

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

वार्षिक प्रतिवेदन  
ANNUAL REPORT  
2005-06

परियोजना समन्वयकर्ता  
डा. एम. गोपालकृष्ण भट  
PROJECT COORDINATOR  
Dr. M. Gopalakrishna Bhat



राष्ट्रीय काजू अनुसंधान केंद्र  
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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 में 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 (छत्तीसगढ़) में स्थित है और, इस परियोजना का अनुसंधान कार्यसूची को कार्यान्वयन करते हैं।

प्रतिवेदन में चालू बारह अनुसंधान परियोजनाओं कि उपलब्धियों की क्षेत्रीय स्तर पर विषयानुसार, जैसे फसल सुधार (3), फसल प्रबंध (5), और फसल संरक्षण (4) के विविध विषयों को संबंधित बारह अनुसंधान परियोजनाओं की उपलब्धियों को संकलित करके प्रस्तुत की गई है।

इस प्रतिवेदन में दो अध्याय हैं, जैसे,

1. तकनीकी : जिसमें परियोजना और क्षेत्रीय तौर पर प्राप्त तकनीकी प्रायोगिक उपलब्धियाँ, और
2. संस्थानीय : जिसमें इतिहास, कर्मचारी, वित्तीय प्रावधान, मौसम की आँकड़े और शोध प्रकाशन शामिल हैं।

(एम गोपालकृष्ण भट)  
निदेशक एवं परियोजना समन्वयकर्ता

पुत्तुर - 574 202

दिनांक : 02-02-2007

## **ABOUT THIS REPORT**

This is the twenty second Annual Report of the All India Coordinated Research Project on Cashew. This report covers the research results and other information pertaining to the period from April 2005 to March 2006.

There are eight project centres and one sub centre, four in the East Coast of India, namely, Bapatla (Andhra Pradesh); Bhubaneswar (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 : 02.02.2007

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## **CHAPTER 1 : TECHNICAL**

## परियोजना समन्वयकर्ता की रिपोर्ट

अखिल भारतीय समन्वित मसाला व काजू अनुसंधान पारयोजना 1971 में चौथी पंच वार्षिक योजना में शुरु की गई, जिसका मुख्यालय केंद्रीय रोपण फसल अनुसंधान संस्थान कासरगोड में था। सातवीं पंचवार्षिक योजना में इस परियोजना को दो स्वतंत्र परियोजनाओं - एक काजू व दूसरी मसाले में विभजित किया गया। अखिल भारतीय समन्वित काजू अनुसंधान पारयोजना का मुख्यालय नव निर्मित राष्ट्रीय काजू अनुसंधान केंद्र पुत्रूर 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) माडक्करा (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 छठवीं पंचवार्षिक योजना में दो केन्द्र, एक झारग्राम (बी.सी.के.वि) और दूसरा चिंतामणि (यू.ए.एस) को सम्मिलित किया गया। आठवीं योजना में एक केंद्र - जगदलपुर (आई.जी.ए.यू) और एक उपकेंद्र पिलिकोड (के.ए.यू.) प्रारंभ किया गया। अखिल भारतीय समन्वित काजू अनुसंधान परियोजना के यह केंद्र 8 काजू उगानेवाला राज्यों में स्थित है और यह विभिन्न राज्य कृषि विश्वविद्यालयों के प्रशासनिक नियंत्रण में है।

परियोजना का 2005-06 में बजट आबंटन रु. 120.00 लाख (रु. 90.00 लाख भा.कृ.अ.प. का अंश) था और व्यय रु. 124.14 लाख (रु. 93.11 लाख भा.कृ.अ.प. का अंश) था।

निम्न लिखित विधियों से काजू की उत्पाद और उत्पादन क्षमता बढ़ाना 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) में संरक्षण करने से खुल 1261 काजू जननद्रव्य संरक्षित है। जननद्रव्य परीक्षण प्रयोगों में सन् 2005 में BBSR-1 बापट्ला में 3.00 कि ग्रां की अत्यधिक गुटली उपज दिया। भुवनेश्वर में छः एक्सशनो ने 8.00 ग्रां से अधिक औसत गुटली वजन दिखाया। चिंतामणि केंद्र में 14 फसलों में 44/1 ARSC (Vengurla-5) ने 246.93 कि ग्रां की अत्यधिक संचयी उपज दिया। जगदलपुर केंद्र में स्थानिक संग्रहण CARS-10, टंड (2-25 c) की छोटी अवधि को बरदास्त कर सका, जिसमें दूसरे संग्रहणों जैसे पत्ता नहीं गिरा। झारग्राम केंद्र में JGM-34/3 ने 13 फसलों में 158.36 कि ग्रां की संचयी उपज दिया, जहाँ पर हो 7 आशाजनक जननद्रव्य एक्सेशनो में 29 से अधिक छिलकन प्रतिशतता पाया गया। माडकत्तरा केंद्र में H-8-10 तथा उल्लाळ-4 में अत्यधिक गुटली वजन रहा। तटीय महाराष्ट्र का हरकुल, कुम्भारमट और शेनोली बुद्रक से संग्रहित तीन एक्सशनो में 10.0 ग्रां से अधिक वजन दार 'जुम्बो' गुटली मिला। सुनामी बाधित कडलूर और नागपट्टीणं स्थित काजू बगानों से चार काजू पेड़ों को पहचाना गया, जो क्षारपानी आप्लवन को सहने का संभवता दिखाई।

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

छिलकन प्रतिशतता दिखाई। वृद्धाचलम मे H-320, अधिकतम गुटली वजन (7.80 ग्रं) दिखाया।

बापट्ला मे कुब्ज प्रकार KGN-1 का कायकी गुण स्थानिक तुलना प्रकार के समानरूप रहा, लेखिन चिंतामणि, झारग्राम, वेगुर्ला 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 ग्रं से अधिक गुटली वजन दिखाई। भुवनेश्वर मे पाया गया हैब्रिडो में A6 अत्यंत आशाजनक रहा, जिसमे अधिकतम गुटली उपज (9.00 कि.ग्रं/पेड), तथा 9.0 ग्रं की गुटली वजन और 34.00 तक की छिलकन प्रतिशतता मिला। मडकतरा 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. ग्रं./पेड) दिया।

**फसल प्रबंधन :**

बापट्ला के NPK प्रयोगों मे 500 ग्रं N का प्रमाण, 7.29 कि. ग्रं. 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 गरिष्ठ 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) गरिष्ठ रहा।

भुवनेश्वर मे उच्च 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 उच्च 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, उच्च 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 (रु 4,166 / हेक्टर) मिला और मुख्य व अन्तराल फसल की आय क्रमशः काजू + कोलोकेशिया (रु 17,000 / हेक्टर), काजू + लोबिया (रु 15,263 / हेक्टर) और काजू + बैंगन (रु 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,  $\lambda$ -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%),  $\lambda$ -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 शिफरित फुहार सूची मे मिला जिसके बाद प्रोफीनोफास (6.60 कि ग्रां/पेड) रहा। मडकतरा और वेंगुर्ला मे,  $\lambda$ -सैहालोथ्रीन निशाने कीटो का नियंत्रण मे अत्यंत प्रभावी उपचार पाया गया। वृद्धाचलम मे शिफरित फुहार सूची मे 7.0 कि ग्रां/पेड का औसत वार्षिक 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 कार्बारिल 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, अधिकतम 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 पुष्पगुच्छ थ्रिप्स का क्रिया पर ऋणात्मक प्रभाव (क्रमशः  $r = -0.26$  व  $r = -0.31$ ) दिखाई। भुवनेश्वर मे हल्दी थ्रिप्स पर प्रकाशमान सौर्य घंटा घनात्मक सार्थक प्रभाव दिखाया जब शाम का RH ऋणात्मक प्रभाव दिखाई, काला थ्रिप्स पर प्रकाशमान सौर्य 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 प्रवणता 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 एक्सशनो ने चाय मच्छर, पत्ता सुरंग कीट, पत्ता और पुष्पगुच्छ जालकीट, सेब और गुटली छेदक तथा पुष्पगुच्छ थ्रिप्स को विविध स्तर की प्रवणता 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 शामिल थे। सस्य संरक्षण, जल और मिट्टी संरक्षण, रोपण तकनिकी तथा पोषकांश प्रबंधन, वैसे ही काजू संस्करण संबंधी विचारो पर, स्थानीय कृषको, विविध जनजातियो और अन्य टेकेदारो 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 budget allocation of the project for the year 2005-2006 was Rs.120.00 lakhs (Rs.90.00 lakhs ICAR Share) and the expenditure was Rs.124.14 lakhs (Rs. 93.11 lakhs ICAR Share).

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

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

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

### CROP IMPROVEMENT

Cashew germplasm collections were identified, collected and conserved in respective Regional Cashew Field Gene Banks (RCFGB) thereby enhancing the total germplasm conserved to 1261. The germplasm evaluation trial indicated that BBSR-1 yielded the highest annual nut yield of 3.00kg at Bapatla during 2005. At Bhubaneswar, six accessions had a mean nut weight of more than 8.00g. The highest cumulative yield of 246.93kg for 14 harvests was recorded for 44/1 ARSC (Vengurla-5) at Chintamani Centre. A local collection, CARS-10 was found to be tolerant to short spells of low temperature (2–2.5°C) at Jagdalpur Centre, which had no leaf shedding as in other

collections. JGM 34/3 yielded 158.36kg/tree in 13 harvests at Jhargram Centre, wherein 7 promising germplasm accessions had a shelling percentage exceeding 29 percentage. At Madakkathara Centre, highest nut weight of 8.50g was recorded by H-8-10 and Ullal-4. Three accessions collected from Harkul, Kumbharmat and Sonoli Budruk in Coastal Maharashtra had jumbo nuts of more than 10.00g. Four cashew trees indicating possible tolerance to salt water inundation have been identified from Tsunami affected plantations at Cuddalore and Nagapattinam.

In Multilocation Trial II, a maximum annual nut yield was noticed in T.No. 10/19 at Bapatla which yielded 12.02kg during 2005 and had the maximum cumulative nut yield of 48.24kg for 10 harvests. Similarly, at Bhubaneswar H-320 and H-303 had maximum cumulative nut yield of 65.30kg and 61.00kg up to the 10<sup>th</sup> harvest. The varietal evaluation at Chintamani indicated that H-320 and NRCC-Sel-2 exhibited consistency in annual nut yield and recorded maximum yield of 19.50kg/tree and 17.20kg/tree respectively during 2005. At Madakkathara Centre, highest annual nut yield was recorded by H-303 (5.21kg/tree) followed by H 1608 (5.19kg/tree). Highest shelling percentage of 32.50 was recorded in M 44/3 which was closely followed by 3/28 and 3/33 which had shelling percentage of 32.00 at Vengurla Centre. At Vridhachalam, H-320 recorded the maximum mean nut weight of 7.80g.

The growth parameters of the precocious dwarf KGN-1 were similar to the local check at Bapatla Centre whereas at Chintamani, Jhargram, Vengurla and Vridhachalam KGN-1 had higher growth compared to respective local check. However, dwarfness was displayed by KGN-1 at Bhubaneswar and Pilicode Centres.

Among the released varieties, Vengurla-4 recorded the maximum plant height (8.40m) followed by Vengurla-5 (4.50m) at Bapatla Centre. Maximum number of bisexual flowers were recorded in BBSR-1 (289.50) followed by Kanaka (217.50). At Jhargram, Jhargram-1 had the highest plant height of 3.08m and highest mean canopy spread of 3.14m and highest stem girth was recorded for Vengurla-4 (29.67cm).

Under hybridization trial, at Bapatla the hybrids H-36 and H-65 recorded a nut weight of more than 7.0g. At Bhubaneswar, A6 was the most promising hybrid, which



recorded the highest nut yield of 9.00 kg/plant, having nut weight of 9.00g and shelling percentage of 34.00. All the high yielding hybrids at Madakkathara had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4. Out of the eight promising hybrids evaluated at Vridhachalam, the hybrid H 10 (M 10/4 x M 26/1) had the highest nut yield of 7.58 kg/tree.

## **CROP MANAGEMENT**

In NPK trials, at Bapatla application of 500g level of N gave significantly higher yield of 7.29 kg per tree, however influence of P and K levels were not significant. Interaction effect of N,P,K on cumulative yield of Jhargram-1 upto 6<sup>th</sup> harvest indicated 500:250:250 of NPK/tree leading to a maximum cumulative yield (33.32kg/tree). At Madakkathara, increasing levels of all the three nutrients led to progressive increase in yield with a maximum yield (5.40 kg/tree) in 500:250:250 of NPK/tree. The maximum canopy diameter (6.95m) and maximum annual nut yield (6.82kg/tree) were recorded in T<sub>24</sub> with 1000:125:250g NPK/plant at Vridhachalam.

In fertilizer application in high density planting, at Bhubaneswar flowering was advanced by 15 days ahead with higher doses of fertilizer, and the number of flowering laterals/m<sup>2</sup> (16.22) and the number of nuts per panicle was maximum in highest doses of fertilizer M<sub>3</sub> (8.10). The vegetative characters were significantly influenced by spacing and fertilizer dosage at Chintamani, Jagdalpur, Madakkathara, Vengurla and at Vridhachalam.

At Bapatla, the growth parameters did not vary significantly during the initial stage of crop under normal and high density planting. The yield per tree was marginally high under normal density as compared to high density planting system during the 6<sup>th</sup> harvest at Madakkathara.

In intercropping trials, maximum C:B ratio was observed in F<sub>1</sub> level of fertilizers for both green gram (1:1.10) and black gram (1:1.10) at Bapatla. The return of intercrop was highest in colocasia (Rs.5,880/ha) followed by brinjal (Rs.4,166/ha) at Bhubaneswar and the total return from main and intercrop was highest in T<sub>6</sub> (Cashew + colocasia) (Rs.17,000/ha) followed by T<sub>3</sub> (Cashew + cowpea) (Rs. 15,263/ha) and T<sub>1</sub> (Cashew + brinjal) (Rs.14,666/ha). At Jhargram, the intercrops which yielded maximum in cashew were cluster bean (47.69q/ha), groundnut (2.42q/ha) and pigeon pea (7.05q/ha) under 50

per cent of recommended fertilizer doses and black gram yielded maximum (4.87q/ha) with full dose of fertilizers. Black gram led to the highest C:B ratio of 1:2.1 followed by groundnut (1:1.19) at Vridhachalam, however groundnut resulted in maximum net profit of Rs.16,187/ha.

## **CROP PROTECTION**

All the insecticidal treatments were on-par, but superior over the untreated control after second and third sprays in respect of shoot tip caterpillar as well as, leaf and blossom webber at Bapatla. All the new insecticides viz., Hostathion,  $\lambda$ -cyhalothrin and profenophos were at par with the recommended spray schedule at Bhubaneswar. The mean number of thrips per panicle was 4.35 in Boron treated trees whereas it was 5.34 per panicle in control trees at Bhubaneswar. Carbaryl (0.1%),  $\lambda$ -cyhalothrin (0.003%) and Profenophos (0.05%) were most effective against TMB infestation resulting in higher yields of 5.50, 4.78 and 4.65kg nuts per tree, respectively at Chintamani. The highest nut yield (142.37 kg/ha) was obtained in Triazophos treatment which was at par with Profenophos (116.64 kg/ha) at Jagdalpur, while at Jhargram, the highest nut yield of 6.90kg/tree was recorded in recommended spray schedule followed by profenophos (6.60kg/tree). At Madakkathara and Vengurla,  $\lambda$ -cyhalothrin (T-4) was the most effective treatment in controlling the target pests. The mean annual nut yield was also the highest in the recommended spray schedule (7.0kg/tree) followed by Profenophos (6.60kg/tree) at Vridhachalam.

In curative control trial for the control of Cashew Stem and Root Borer (CSRB), at Bapatla, lindane 0.2% was efficient having 54.54 to 75.00 percent trees without re-infestation followed by carbaryl 1.0% with 45.45 to 66.67 percent trees without re-infestation. Chlorpyriphos (0.2%) led to maximum recovery (85%) and only extraction of grub could also lead to 40 per cent of treated trees without reinfestation at Bhubaneswar. Chlorpyriphos (0.2%) led to different percentages of treated trees without re-infestation; at Jagdalpur (66.66), Jhargram (100.0), Madakkathara (94.90), Vengurla (93.33), while monocrotophos (0.2%) led to 87.50 per cent of treated trees without re-infestation.

In the bioecology of pests of regional importance, at Bapatla both the maximum temperature ( $r = -0.31$ ) and minimum temperature ( $r = -0.30$ ) were found to influence the activity of the shoot tip caterpillar, while rainfall and rainy days displayed significant negative influence ( $r = -0.26$  &  $r = -0.31$ ) on the activity of inflorescence thrips. The yellow thrips were significantly positively correlated with bright sunshine hours and negatively correlated with evening RH, whereas the black thrips were significantly correlated with bright sunshine hours at Bhubaneswar. At Madakkathara, maximum and minimum temperatures, morning and afternoon RH, sunshine hours, rainfall and rainy days; only mean and minimum temperature, and rainfall was found negatively and significantly correlated with the TMB population. TMB infestation at Vengurla was negatively and significantly correlated with relative humidity and minimum temperature; thrips infestation had negative significant correlation with minimum temperature and RH. Rainfall, RH and maximum temperature had significant negative influence on leaf webber populations at Vridhachalam.

While screening the germplasm for locating tolerant/ resistant, ten accessions were found to be on-par with each other having least damage of shoot tip caterpillar from 0.76-0.77 per cent at Bapatla. All the MLT-2 entries indicated susceptibility to shoot tip caterpillar and inflorescence thrips, which ranged between 24 to 50 per 10 panicles at Bhubaneswar. The minimum inflorescence thrips was seen in CARS-5 followed by CARS-3 and T-30/1 at Jagdalpur. All the germplasm accessions at Madakkathara and Vridhachalam had varying levels of susceptibility to TMB, leaf miner, leaf and blossom webber, apple and nut borer as well as inflorescence thrips.

## **TRANSFER OF TECHNOLOGY**

During the year a total of over 4,00,000 grafts have been produced at different centres of AICRP on Cashew and distributed to various Government and Non-Government agencies apart from cashew cultivators. Trainings have been organised on different aspects of cashew cultivation, utilization of cashew apple, value addition and other related aspects by different centres. Scientists of different centres have given radio talks and recorded televised programmes on cashew cultivation. Theme based campaigns on plant protection, soil and water conservation, planting techniques and nutrient management as well as, processing aspects have been organised for the benefit of local cultivators, tribals and other entrepreneurs.

**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, Bhubaneswar, Jhargram and Vridhachalam. This zone receives low to medium rainfall ranging from 800 mm to 2000 mm annually and is distributed over a period of 7-8 months from June to January. The soil is mainly sandy, red sandy loam, red loam and laterite. Bapatla centre is situated at an elevation of 54.9 m from mean sea level (MSL) with 40° 54' latitude and 80° 28' longitude. At Bapatla the annual average rainfall is 1167 mm and the temperature ranges from 17.3 to 37.8° C; the soil is sandy soil with low organic matter, medium N, low P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O. Average water holding capacity (AWC) of soil is 100 mm and the climate is sub humid (dry). At Bhubaneswar average rainfall is 1167 mm and the temperature ranges from 14.3 to 37.1° C. The soil is red soil, red loamy and laterite. The climate is sub humid (dry), AWC 100 mm. The Jhargram centre is located 87° longitude and 78.8° latitude. At Jhargram average rainfall is 1622 mm and the temperature ranges from 11.3 to 39.4° C. The soil is red, laterite, shallow depth gravels, low in organic matter, N and high in P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O. The climate is sub humid (dry), AWC 200 mm. At Vridhachalam average rainfall is 1215 mm and the temperature ranges from 18.7 to 35.7° C, the soil is red laterite, low in organic matter and N, medium in P<sub>2</sub>O<sub>5</sub> and high in K<sub>2</sub>O. The climate is semi arid (dry), AWC 125 mm.

The centres in the West Coast are located at Madakkathara, Pilicode 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<sub>2</sub>O<sub>5</sub> and high in K<sub>2</sub>O. The climate is semi arid (dry), AWC is 150mm. Jagdalpur is located at 17° 45' to 20° 34' N and 80° 15'to 82° 15' E longitude with altitude ranging from 550 m to 850 m above MSL with average annual rainfall ranging from 1200-1400mm. The maximum and minimum temperatures are 41° C and 6° C, respectively. Texturally soils are sandy loam to silty loam, with very poor moisture retaining capacity having shallow depth with poor organic matter (0.05%) and pH value (5.5 - 6.5) about normal.

## **EXPERIMENTAL RESULTS**

# **I. CROP IMPROVEMENT**

## I. CROP IMPROVEMENT

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

#### *Centres: East Coast*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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#### *West Coast*

Madakkathara, Pilicode and Vengurla

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#### *Plains / others*

Chintamani and Jagdalpur

The objectives of the project are:

- (a) To evaluate the existing germplasm of cashew in different centres
  - (b) To collect local germplasm material with desirable characters such as high yield, cluster bearing habit, bold sized nuts, duration of flowering, off season flowering types from different cashew growing regions and,
  - (c) To establish clonal germplasm conservation blocks in different centres
- 

#### **SUMMARY:**

Cashew germplasm collections were identified, collected and conserved in respective Regional Cashew Field Gene Banks (RCFGB) thereby enhancing the total germplasm conserved to 1261. The germplasm evaluation trial indicated that BBSR-1 yielded the highest annual nut yield of 3.00kg at Bapatla during 2005. At Bhubaneswar, six accessions had a mean nut weight of more than 8.00g. The highest cumulative yield of 246.93kg for 14 harvests was recorded for 44/1 ARSC (Vengurla-5) at Chintamani Centre. A local collection – CARS-10 was found to be tolerant to short spells of low temperature (2 – 2.5°C) at Jagdalpur Centre, which had no leaf shedding as in other collections. JGM 34/3 yielded 158.36kg/tree in 13 harvests at Jhargram Centre, wherein 7 promising germplasm accessions had a shelling percentage exceeding 29 percentage. At Madakkathara Centre, highest nut weight of 8.50g was recorded by H-8-10 and Ullal-4. Three accessions collected from Harkul, Kumbharmat and Sonoli Budruk in Coastal Maharashtra had jumbo nuts of more than 10.00g. Four cashew trees indicating possible tolerance to salt water inundation have been identified from Tsunami affected plantations at Cuddalore and Nagapattinam.

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#### **Germplasm Collection:**

During the current year 27 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 1261 (Table 1.1).



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

Centre	No. of accessions		
	Existing	Collected during 2005	Total existing 2005-06
<b>East Coast</b>			
Bapatla	131	1	132
Bhubaneshwar	89	6	95
Jhargram	125	1	106*
Vridhachalam	264	5	269
<b>West Coast</b>			
Madakkathara	148	--	148
Pilicode	65	--	45*
Vengurla	265	12	277
<b>Maidan tract/others</b>			
Chintamani	126	2	128
Jagdapur	61	--	61
<b>TOTAL</b>	<b>1274</b>	<b>27</b>	<b>1261</b>

**Note:** \* = Some germplasm lost due to excess temperature or drought

#### **Germplasm Evaluation :**

Cashew germplasm available at different AICRP-Cashew Centres have been evaluated for growth and yield parameters during 2005 and relevant particulars are mentioned centrewise.

#### **BAPATLA**

Among the accessions evaluated, Hy-95-4 had the highest plant height (5.90m) and maximum mean spread of canopy was recorded in the T.No. 40/1 (7.50m). The maximum number of bisexual flowers per panicle was observed in T.No. 275 (134.75) which is an indicator of fruit set potential. BBSR-1 gave the maximum annual nut yield per tree (3.00kg) followed by 9/8 L (2.08kg), while the cumulative nut yield was highest in T.No.268 as 5.69kg per tree for 5 harvests (Table 1.2).

**Table 1.2 : Growth parameters and nut yield of promising cashew accessions / varieties at Bapatla**

Accession Number	Mean plant height (m)	Mean canopy spread	Mean no. of bisexual flowers/ panicle	Mean annual nut yield/tree (Kg) (2004-05)
T.No.228	3.62	5.21	128.50	0.98
T.No.268	4.48	6.75	55.75	2.02
T.No.275	3.10	4.06	134.75	1.13
4/5	4.98	5.91	106.00	1.47
9/8 L	3.40	5.60	93.50	2.08
15/4	4.10	4.05	130.75	1.95
40/1	4.97	7.50	42.50	0.91
Hy-94-3	4.28	4.53	106.75	0.58
Hy-94-4	5.67	5.56	72.75	1.41
Hy-95-4	5.90	5.70	70.25	0.95
Hy-95-5	5.15	7.00	53.00	1.50
BBSR-1	3.20	3.30	92.50	3.00

## BHUBANESWAR

The highest nut yield during the first harvest was recorded in OC66 (0.50kg/tree) and OC71 (0.50kg/tree). Highest nut weight was observed in OC 57 (15.50g) followed by OC 85 (15.00g), OC 114 (12.00g) and OC 69 (11.50g) which could yield jumbonuts. Six other accessions showed nut weight of more than 8.00g as indicated in Table 1.3.

**Table 1.3 : Yield attributes of cashew germplasm accessions at Bhubaneswar.**

Accession No.	Nut weight (g)	Nut yield (kg)
OC53	9.00	0.10
OC56	4.50	0.40
OC57	15.50	0.10
OC66	10.00	0.50
OC67	8.10	0.30
OC69	11.50	0.40
OC71	9.30	0.50
OC84	8.00	0.10
OC85	15.00	0.10
OC113	10.00	0.30
OC114	12.00	0.20

## CHINTAMANI

In 17 to 21<sup>st</sup> year of planting, 74/6 ARSC (V-2) recorded 38.00kg/tree, 35/3ARSC (ME-4/4) and 70/6ARSC (V-4) each recorded 30.00kg/tree, where as 57/1ARSC (T-40), 58/8ARSC (T-129), 69/1ARSC (V-3), 72/6ARSC (H-19) and 73/1ARSC (V-1) registered more than 20 kg /tree, as annual nut yield.

Highest cumulative yield of 246.93kg/tree was recorded by 44/1ARSC(V-5) followed by 35/3ARSC(ME-4/4) and 41/3ARSC(5/37Manjeri) each of which recorded 237.80kg/tree and 215.67kg/tree was recorded by 2/6ARSC(3/108Gubbi). All these varieties had shelling percentage of more than 27.0 per cent (Table 1.4).

**Table 1.4 : Yield attributes of promising germplasm accessions at Chintamani**

Accession number	Mean cumulative yield (kg)	Mean annual yield (kg)	Mean nut yield (kg/Tree)	Mean nut weight (g)	Mean shelling (%)
2/6 ARSC (3/108 Gubbi)	215.67 (21 yrs)	15.00	10.27	4.10	28.0
35/3 ARSC (ME 4/4)	237.80 (17 yrs)	30.00	13.98	6.30	30.0
41/3 ARSC (5/37 Manjeri)	237.59 (17 yrs)	24.00	13.97	7.18	29.5
44/1 ARSC (Vengurla -5)	246.93 (17 yrs)	32.00	14.52	4.08	27.4

## JAGDALPUR

The locally collected cashew accession, CARS -10 was found tolerant to low temperature of about 2.0 to 2.5 °C, as no leaf shedding occurred in this accession as in case of other varieties.

The plant height was maximum in NRC-192 (3.89 m) followed by NRC-138. Highest nut weight (8.80 g) and apple weight (98.00g) was recorded in NRC-140. The nut yield/tree was highest for NRC-137 (6.63 Kg), followed by NRC-138 (4.91 Kg). The cumulative nut yield was highest in NRC- 137 (16.70 Kg) for 7 harvests. Shelling percentage was found highest in NRC- 137 (32.61) (Table 1.5).

**Table 1.5 : Yield attributes of promising germplasm at Jagdalpur**

Accession	Mean annual nut yield (Kg)	Mean cum. yield Kg/Plant	Mean weight/nut (g)	Mean shelling (%)
NRC- 130	2.23	6.70	7.80	29.57
NRC- 131	1.95	9.14	8.00	29.62
NRC- 136	2.65	6.42	7.40	31.47
NRC- 137	6.63	16.70	7.20	32.61
NRC- 138	4.91	11.01	8.00	32.35
NRC- 140	2.23	6.19	8.80	27.16
NRC- 190	2.60	4.37	6.20	32.03
NRC- 191	3.12	13.52	6.60	28.21
NRC- 192	1.26	2.44	7.40	28.77
NRC- 193	2.39	10.34	6.80	27.19

## **JHARGRAM**

Two of the germplasm viz., JGM-40 & JGM-18/2 had only 5-6g nut weight but their shelling percentage and yield was higher. Nut weight was maximum in case of JGM-34/3 (9.42g) which had shelling percentage and yield of 30.48 and 10.57 kg/tree respectively. The cumulative yield for 16 years was also the highest in JGM-34/3 (158.36 kg/tree) (Table 1.6).

**Table 1.6 : Yield and yield attributes of promising germplasm accessions at Jhargram**

Accession No.	Mean annual nut yield (Kg/tree)	Mean cumulative yield (Kg/tree)	Mean nut wt (g)	Mean shelling %
JGM –6/5	15.41	1200.82	7.51	29.79
JGM – 18/2	9.35	115.81	6.94	27.97
JGM- 38/6	22.38	132.44	5.04	29.26
JGM – 70	15.02	125.39	7.46	29.41
JGM – 94	17.92	93.39	6.91	30.10
JGM – 34/3	10.57	158.36	9.42	30.48
JGM – 40	23.51	163.84	5.39	31.87
JGM – 45	10.63	116.21	6.08	29.16

## MADAKKATHARA

A total of 148 accessions, collected till 2004-05, were planted for evaluation in the clonal germplasm conservation block. Fresh grafts have been prepared from the old germplasm collections and the mother trees will be removed subsequently

Highest yield was given by *A. microcarpum* (16.10 kg) followed by Ullal-1 (12.90 kg), Indonesia (11.60kg) and Ullal-2 (11.20kg). The highest nut weight was recorded by H-8-10 (8.50g) and Ullal-4 (8.50 g). Cumulative nut yield was maximum in A-1 (41.77kg/tree) followed by *A. microcarpum* (22.04kg/tree) and H-8-10 (19.00kg/tree) (Table 1.7).

**Table 1.7 : Yield and yield attributes of promising germplasm accessions at Madakkathara**

Accession	Cumulative yield (kg/tree/ year) (12 years)	Annual nut yield (kg/tree)	Mean nut weight (g)
A-1	41.77	6.70	6.90
H-3-4	12.72	5.90	8.00
H-8-10	19.00	9.60	8.50
Indonesia	12.10	11.60	5.30
Anakkara	14.74	6.00	7.00
Anandapilly	11.05	6.60	7.60
Ulikkal-6	15.40	10.40	7.00
Peravoor-2	13.25	12.10	3.50
UN-50	10.10	7.90	7.50
Ullal-2	12.70	11.20	6.50
Ullal-1	14.85	12.90	5.00
<i>A.microcarpum</i>	22.04	16.10	7.50
V-5	13.05	5.60	4.40

Among the cashew accessions collected from Panama, the highest nut yield was recorded by P9 (15.20 kg/tree) followed by P13 (12.60 kg/tree). The highest nut weight was recorded by P14 (9.60g).

## PILICODE

So far 78 types were identified from Northern Kerala and 43 types were planted in the germplasm block for evaluation. Among the accessions planted in 1998, PCKC-4, PCKC-9 followed by BLM 1 had better yield and biometric parameters. The percentage of bisexual flowers ranged between 2.44 and 8.76 in the different germplasm collections.

The dwarf type TPB-1 was used for hybridization programme with MDK-1 and ANK-1 (Table 1.8).

**Table 1.8 : Growth and yield parameters of promising cashew germplasm accessions at Pilicode**

Accession No./Variety	Plant height (m)	Canopy spread(m)		Bisexual flowers (%)	Yield of nuts/plant (Kg)	Cum. nut yield /plant (Kg)
		E-W	N-S			
PCKC-4	7.27	6.95	8.25	6.84	4.66	10.66
PCKC-8	8.22	5.84	6.56	6.86	1.25	3.58
PCKC-9	7.84	7.88	7.76	6.06	4.21	11.01
BLM-1	7.02	7.02	7.63	6.08	3.94	9.3
OCT-2	6.94	6.94	6.25	7.60	1.95	3.75
BLM 3	7.40	7.40	7.61	2.44	0.82	1.58
BLM 2	8.52	8.52	7.75	3.49	0.40	0.75
Elappara	4.90	4.90	5.15	8.76	0.13	0.53
KM-1	7.30	7.30	6.35	4.02	0.78	0.78
Kodolipram	6.57	6.57	7.30	6.91	0.92	2.02
TPB-1	1.75	1.75	2.5	7.10	-	-
CD 0.05	0.67	0.67	1.43	NS	3.04	1.50

## VENGURLA

Growth and yield attributes of 14 types collected from Thane, Raigad, Kolhapur and Sindhudurg districts indicated presence of jumbo nut types having more than 10 g nut weight in three accessions (Harkul, Kumbharmat and Shenoli Budruku) (Table 1.9). The growth parameters did not show any significant variation among the germplasm collections.

**Table 1.9 : Growth and yield parameters of promising cashew germplasm accessions at Vengurla**

Accession	Plant height (m)	Stem girth (cm)	Canopy spread (m)		Yield (kg/ tree)	Nut weight (g)
			E.W	N.S.		
Harkul	3.00	32.50	3.12	3.20	0.23	12.50
Kumbharmutt	3.23	33.00	4.13	3.87	0.37	12.30
Masoli	3.76	41.00	4.23	4.27	0.28	5.80
Vetore Gogate	3.82	23.00	4.30	4.35	0.03	6.50
Shenoli Budruku	2.90	37.00	5.10	6.00	0.25	12.50

## VRIDHACHALAM

Survey was conducted in the Tsunami affected cashew plantations of Cuddalore and Nagapattinam Districts by team of scientists from NRCC and RRS, Vridhachalam. Four cashew trees having possibility of salt tolerance were identified by the team. Grafts prepared from these trees will be included in the Gene Bank. Eighteen lines were found to be promising in terms of nut weight (> 6.0g) and shelling percentage (> 26.0%) (Table 1.10).

**Table 1.10 : Yield of promising cashew germplasm accessions at Vridhachalam**

Accession No.	Nut yield / plant (Kg)	Cumulative nut yield / plant(Kg)	Mean weight/ nut (g)	Shelling %
<b>13 harvests</b>				
M 44/3	2.12	25.30	6.90	26.70
NF 40	2.06	25.44	6.70	26.80
M 26/2	1.98	28.73	7.00	27.20
NF 64	2.10	20.81	7.20	28.20
M 4/3	2.04	24.13	6.50	26.50
<b>8 harvests</b>				
M 71/4	3.12	12.85	7.00	26.40
TAF 13	3.24	13.01	6.50	27.10
M 56/1	3.10	14.13	7.10	27.60
M 87/3	2.98	17.83	6.50	27.10
TAF 12	2.12	17.85	6.30	27.80
<b>4 harvests</b>				
VSK 1	2.92	7.56	6.60	27.60
VSK 2	3.10	7.82	7.20	27.80
SL 1	3.22	8.03	7.00	27.40
TK 1	3.71	8.62	6.20	27.70
NK 1	3.12	7.64	6.40	28.10
KK 1	2.86	7.10	7.80	28.50
PV 1	2.92	7.55	6.40	27.70
AM	2.72	7.06	6.20	26.40

## Gen.3. Varietal Evaluation Trials

### 1. Multi Location Trial - II

*Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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*West Coast :*

Madakkathara and Vengurla

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*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.

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#### **SUMMARY :**

A consistent maximum annual nut yield was noticed in T.No. 10/19 at Bapatla which yielded 12.02kg during 2005 and had the maximum cumulative nut yield of 48.24kg for 10 harvests. Similarly, at Bhubaneswar H-320 and H-303 had consistent maximum cumulative nut yield of 65.30kg and 61.00kg during the 10<sup>th</sup> harvest. The varietal evaluation at Chintamani indicated that H-320 and NRCC-Sel-2 exhibited consistency in annual nut yield and recorded maximum yield of 19.50kg/tree and 17.20kg/tree during 2005. At Madakkathara Centre, highest annual nut yield was recorded by H-303 (5.21kg/tree) followed by H 1608 (5.19kg/tree). Highest shelling percentage of 32.50 was recorded in M 44/3 which was closely followed by 3/28 and 3/33 which had shelling percentage of 32.00 at Vengurla Centre. At Vridhachalam, H-320 recorded the maximum mean nut weight of 7.80g.

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#### **Experimental Details:**

Design	:	RBD
Replications	:	Three
Varieties	:	No. of entries – 13
Bapatla	:	3/28, 3/33, 10/19, 30/1
Vengurla	:	H 68, H 255, H 303, H 320, H 367
Vridhachalam	:	M 15/4, M 44/3
Puttur	:	VTH 107/3, VTH 40/1
Year of Planting	:	1992 (1993 at Bapatla, 2002 at Jhargram, 1994 at Vridhachalam)



## BAPATLA

The plant height was highest in T.No 3/33 (5.51m) followed by H-3/28 (4.61m) and maximum stem girth was observed in T.No 3/33 (89.20cm) followed by H-320 (88.0cm). H-320 had the maximum canopy spread of 9.29m. Maximum number of panicles per square meter was noticed in H-68 and T.No. 40/1 (28.88). However, the growth parameters were not significantly different (Table 1.11).

**Table-1.11 : Growth characters of different cashew varieties at Bapatla**

Variety/ Genotype	Plant height (m)	Stem girth (cm)	Mean canopy spread (m)	Number of flowering laterals / m <sup>2</sup>
Hy-3/28	4.61	80.26	7.94	26.50
T.No.3/33	5.51	89.20	8.72	28.12
T.No.10/19	4.98	82.46	8.62	25.00
T.No.30/1	4.20	70.96	6.98	23.00
H-68	4.37	86.40	7.74	28.88
H-367	4.40	80.36	7.48	25.00
H-303	4.48	87.06	7.63	24.87
H-255	3.83	71.83	6.74	20.25
H-320	4.92	88.00	9.29	27.12
M-44/3	3.94	68.40	6.85	28.26
M-15/4	4.54	68.43	5.83	24.38
T.No.107/3	4.67	79.36	6.34	28.38
T.No. 40/1	3.97	79.40	6.20	28.88

The maximum mean annual nut yield per tree was recorded in the T.No.10/19 (12.02kg) followed by M-44/3 (10.23 kg). The cumulative nut yield per tree was highest in T.No.10/19 (48.24kg) followed by T.No.30/1(42.68kg) in ten annual harvests. H-367 (8.96) had the highest nut weight followed by H-255 (8.93g) (Table 1.12).

**Table 1.12 : Yield performance of different varieties at Bapatla**

Variety/ Genotype	Annual yield (kg/tree)	Cum. yield (kg/tree) (10 <sup>th</sup> harvest)	Nut weight (g)	Number of nuts/ Panicle	Shelling (%)
Hy-3/28	4.97	29.35	7.31	4.20	28.10
T.No.3/33	7.17	31.50	7.11	5.55	27.00
T.No.10/19	12.02	48.24	7.91	5.35	33.80
T.No.30/1	7.29	42.68	8.01	5.15	28.50
H-68	8.16	26.58	6.34	2.05	32.70
H-367	6.61	24.55	8.96	3.90	29.20
H-303	6.72	21.39	7.15	3.33	34.00
H-255	6.52	18.91	8.93	3.25	28.50
H-320	6.26	24.78	8.42	5.25	30.80
M-44/3	10.23	41.62	4.61	7.11	31.00
M-15/4	7.04	34.29	7.16	4.85	31.20
T.No.107/3	6.89	27.40	7.18	4.25	28.20
T.No. 40/1	6.96	27.97	6.35	4.00	27.30

**BHUBANESWAR**

The plant height was highest in H 255 (6.10m) followed by BPP 30/1 (5.20m). In H 255, maximum stem girth of 109.30cm was recorded followed by BPP 3/28 (99.30cm). The number of flowering laterals/m<sup>2</sup> was maximum in H 367 (29) followed by H 303 (26) and M 44/3 (26), and was minimum in BPP 3/28 (17) (Table 1.13).

**Table 1.13 : Vegetative & flowering characters of cashew varieties at Bhubaneswar**

Cashew types	Plant height (m)	Stem girth (cm)	No. of flowering laterals/m <sup>2</sup>
NRCC-1	4.90	79.50	24
NRCC-2	4.90	79.00	20
M 44/3	2.90	50.00	26
M 15/4	4.70	92.70	23
BPP 3/33	5.40	97.00	20
BPP 10/19	5.60	96.30	21
BPP 30/1	5.20	84.30	21
BPP 3/28	5.50	99.30	17
H 303	5.00	89.00	26
H 320	5.40	92.00	19
H 255	6.10	109.30	25
H 367	4.80	87.70	29
H 68	5.40	88.70	24

Highest cumulative yield (kg/tee) for 10 harvests was in H 320 (65.30) followed by H 303 (61.00), NRCC Sel-2 (52.60) and H 68 (52.30); which were all were bold nut types having nut weight more than 7.00g and shelling percentage exceeding 28% (Table 1.14).

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

Cashew types	No of nuts/pa nicle	Nut weight (g)	Shelling (%)	Nut yield (kg/plant)	Cum. nut yield (kg/plant) (10 harvests)
NRCC Sel-1	2.50	8.70	33	6.90	24.60
NRCC Sel-2	3.00	9.00	29	10.50	52.60
M 44/3	4.00	5.20	28	3.90	24.50
M 15/4	2.00	7.70	29	3.70	25.00
BPP 3/33	3.00	6.70	34	4.70	38.20
BPP 10/19	3.00	6.80	29	2.90	29.20
BPP 30/1	3.00	6.90	30	3.20	49.90
BPP 3/28	3.00	7.00	29	2.30	35.50
H 303	3.70	8.30	28	10.00	61.00
H 320	3.00	8.50	28	9.70	65.30
H 255	1.00	10.40	30	4.40	32.10
H 367	2.00	9.70	29	8.50	47.70
H 68	3.00	8.20	34	9.50	52.30

## CHINTAMANI

There was no significant difference in plant height which ranged between 4.36 to 5.72m among the entries. The maximum stem girth was observed in Ullal-1(96.86cm) followed by Hy-255 (95.44cm) which were at par. The mean canopy spread was maximum Hy-255 (9.38m). The highest number of flowering laterals/m<sup>2</sup> were observed in M-44/3(15.00) followed by TN-3/33(14.80) and Hy-320 (14.00) (Table 1.15).

**Table 1.15 : Growth parameters of varieties evaluated at Chintamani**

Cashew entries	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread (m)	No. of flowering laterals/m <sup>2</sup>
Hy – 68	5.16	92.23	8.93	7.00
Hy – 367	4.65	85.98	8.36	12.00
Hy – 303	4.58	94.28	8.95	5.00
Hy – 255	5.43	95.44	9.38	8.00
Hy – 320	5.30	86.21	9.16	14.00
M 44/3	4.36	73.04	7.25	15.00
M 15/4	5.20	90.16	9.06	10.25
NRCC -1	5.72	90.68	9.27	8.50
NRCC -2	5.23	68.92	7.84	12.00
TN 30/1	4.49	80.06	8.13	9.50
TN 3/33	5.20	91.63	8.98	14.80
TN 10/19	5.16	86.24	8.58	8.25
TN 3/28	5.10	86.66	8.69	11.00
Ullal – 1	5.12	96.86	8.35	10.50

The annual nut yield did not differ significantly however, highest nut yield was obtained in Hy-320 (19.50kg/plant) followed by NRCC Sel-2 (17.20kg/plant). Over a period of 11 harvests, Hy-320 recorded highest cumulative yield of 75.68kg/tree followed by NRCC Sel-2(71.99kg/tree) and Hy-303 (58.11kg/tree).

The variety Hy-255 recorded highest nut weight of 8.27g followed by Hy-320 (7.98g), Hy-367 (7.96g) and Hy-303 (7.34g). The shelling percentage ranged between 25.20 and 30.70 percent was highest in NRCC-1 (30.70) as mentioned in Table 1.16.

**Table 1.16 : Yield and yield attributing characters of cashew entries at Chintamani**

Cashew entries	Mean no. of nuts/panicle	Mean nut weight (g)	Mean shelling (%)	Mean annual nut yield (Kg/plant)	Cum. Yield(Kg/plant) 11 <sup>th</sup> harvest
Hy - 68	6.00	7.51	25.20	7.30	24.87
Hy - 367	4.50	7.96	29.60	6.58	48.63
Hy - 303	3.50	7.34	27.70	10.50	58.11
Hy - 255	5.20	8.27	29.80	12.76	44.08
Hy - 320	8.00	7.98	27.80	19.50	75.68
M 44/3	5.00	5.01	28.60	15.25	55.00
M 15/4	4.00	5.87	28.00	16.72	56.25
NRCC Sel -1	6.00	6.64	30.70	10.16	50.60
NRCC Sel-2	5.80	5.33	27.00	17.20	71.99
TN 30/1	3.60	4.69	29.00	10.62	54.07
TN 3/33	5.00	6.25	27.40	11.80	38.15
TN 10/19	4.81	4.81	30.00	12.50	34.92
TN 3/28	6.56	6.56	28.20	15.66	44.34
Ullal – 1	6.06	6.06	29.30	14.66	43.12

## JAGDALPUR

The variety H-68 was found superior for plant height (2.90 m) and stem girth (34.75 cm). The mean canopy spread was maximum in H-367 (2.89m). The varieties H-303, 3/33 & 30/1 flowered earlier, while 3/28, 10/19, H-68, H-255, H-367, H-320, VRI-1, VRI-2 & V-4 flowered in mid season. NRCC Sel-2 was the only late flowering variety with shortest flowering duration of 23 days. The number of fruits/ panicle was maximum for H-68 (6.13) (Table 1.17) and the yield (Kg/tree) was also significantly highest (1.48kg). The cumulative yield (Kg/tree) was highest for H-303 (4.02 kg) and the nut weight was highest for H-255 (9.67g) (Table 1.18).

**Table 1.17 : Performance of different varieties at Jagdalpur**

Varieties/ Genotype	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread (m)	No. of fruits / panicle
3/28	2.28	31.08	2.20	2.75
3/33	2.47	29.08	2.50	3.10
30/1	1.94	24.97	2.18	2.62
10/19	2.35	28.58	2.18	3.42
VRI-1	1.52	19.31	1.63	2.68
VRI-2	1.12	16.00	1.11	2.62
H-68	2.90	34.75	2.87	6.13
H-255	2.05	28.33	2.46	3.01
H-367	2.24	32.08	2.89	2.43
H-320	2.01	29.42	2.67	3.66
H-303	1.75	31.25	2.31	5.53
Sel-1	2.30	26.33	2.28	2.36
Sel-2	1.57	18.17	1.35	1.55
V-4	2.52	30.42	2.70	4.87
CD 5%	0.88	8.10		1.29

**Table 1.18 : Performance of different varieties at Jagdalpur**

Varieties/ Genotype	Nut yield (Kg/tree)	Cum. Nut yield (3 harvests)	Nut weight (g)	Shelling %
3/28	0.63	1.47	6.70	30.10
3/33	0.51	1.39	6.20	31.43
30/1	0.76	2.28	6.40	27.16
10/19	0.55	2.31	5.58	30.83
VRI-1	0.25	0.86	5.80	33.37
VRI-2	0.18	0.72	5.50	31.35
H-68	1.48	3.94	9.00	29.87
H-255	0.61	1.85	9.67	31.80
H-367	0.53	1.72	9.41	29.12
H-320	0.48	2.16	8.65	27.17
H-303	1.24	4.02	9.00	29.97
Sel-1	0.54	1.13	8.20	34.19
Sel-2	0.35	1.47	9.03	31.93
V-4	1.24	3.01	9.37	32.43
CD at 5%	0.75	-	0.83	1.94

## JHARGRAM

The growth parameters viz., plant height, trunk girth and canopy spread did not differ significantly among the varieties evaluated. The mean plant height ranged between 1.45 to 2.13m, the stem girth ranged between 13.33 to 19.00cm and canopy spread ranged between 1.68 to 2.43m (Table 1.19).

**Table 1.19 : Growth parameters of different cashew varieties at Jhargram**

Variety	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread (m)
T No. 30/1	1.70	17.00	1.94
T No. 3/33	1.82	13.33	1.98
T No. 10/19	2.13	18.00	2.43
T No. 3/28	1.63	14.00	1.63
H – 68	1.80	15.33	1.86
H-367	1.87	16.67	2.14
H – 303	1.90	14.33	1.68
H – 255	2.05	17.33	2.30
H – 320	1.72	17.33	2.40
M – 44/3	1.73	17.33	2.42
M – 15/4	1.45	13.33	1.73
NRCC Sel– 1	1.85	19.00	2.13
NRCC Sel– 2	1.53	13.33	2.02

## MADAKKATHARA

No significant differences were observed for tree height among the different genotypes evaluated. There was significant difference among genotypes for nut yield. The highest yield was recorded by H 303 (5.21 kg) followed by H 1608 (5.19 kg). Duration of flowering was maximum for T 3/33 (127 days) and minimum for T 3/28 (88 days) (Table 1.20).

**Table 1.20 : Performance of different cashew varieties at Madakkathara**

Variety	Mean annual nut yield (kg/tree)	Cum. Yield (kg/tree)	Mean nut weight (g)	Flowering period (days)
T 30/1	0.87	17.78	8.13	102
T 3/33	1.05	9.81	8.32	127
T 10/19	0.30	8.26	7.50	109
M 44/3	1.69	14.05	5.90	111
M 15/4	1.96	22.73	5.60	115
H 367	0.76	4.92	9.10	118
H 68	1.31	15.78	9.90	104
T 3/28	3.26	21.85	8.20	88
T 40/1	3.83	17.33	12.30	105
T 107/3	1.70	13.38	5.30	73
H 303	5.21	27.63	10.60	97
H 255	2.85	11.84	8.20	114
H 1608	5.19	26.37	9.00	109
H 320	3.19	22.03	10.00	119
<b>CD at 5%</b>	<b>3.13</b>	<b>NS</b>	<b>0.15</b>	<b>12.29</b>

## VENGURLA

The variety 30/1 had maximum height (5.65m) and maximum stem girth (74.58cm). Hy-255 recorded the maximum annual nut yield of 3.10kg/tree, and also the maximum cumulative nut yield (2<sup>nd</sup> harvest) (4.33 kg). H-367 recorded significantly maximum nut weight (10.59 g) while the maximum shelling percentage of 32.50 percent was observed in M 44/3. The number of nuts per panicle did not differ significantly among the varieties (Table 1.21).



**Table 1.21 : Growth and yield observations at Vengurla**

<b>Variety /type</b>	<b>Mean plant height (m)</b>	<b>Mean Stem girth (cm)</b>	<b>Mean canopy spread (m)</b>	<b>Mean annual nut yield (kg/tree)</b>	<b>Mean cum. yield for kg/tree (2<sup>nd</sup> harvest)</b>	<b>Mean nut weight (g)</b>	<b>Shelling (%)</b>
Hy.No. 255	4.79	66.75	8.27	3.10	4.33	9.47	30.00
Hy.No. 303	4.31	53.39	5.28	2.70	4.60	9.21	30.00
Hy.No. 320	5.16	66.00	6.40	0.62	1.25	8.57	30.00
Hy.No.367	3.63	51.86	6.34	1.87	3.37	10.59	27.00
NRCC Sel-1	5.27	67.08	7.43	2.27	2.84	7.44	30.00
NRCC Sel-2	4.24	53.25	6.35	1.22	1.99	6.22	30.00
M-44/3	3.66	47.16	5.00	1.10	2.29	5.76	32.50
M-15/4	4.39	52.50	6.00	1.21	2.21	6.75	30.50
10/19	5.21	67.75	7.63	0.76	1.23	6.17	28.00
3/28	5.60	63.61	6.27	0.28	0.69	6.14	32.00
3/33	5.18	61.83	6.87	1.44	2.14	6.81	32.00
30/1	5.65	74.58	7.42	2.04	2.83	5.56	30.00

## VRIDHACHALAM

The maximum plant height was recorded by T 10/19 (5.22m) and the maximum stem girth was recorded in M 107/3 (68.42cm) and M 15/4 had the maximum canopy spread (6.80m). Maximum annual nut yield (3.71kg/tree) and the highest cumulative yield (9 harvests) (21.64 kg/tree) was recorded by M-44/3 and followed by M 15/4 and H 303 which had annual nut yields and cumulative yields of (3.36 kg and 18.62 kg) and (2.91 kg and 15.60 kg) respectively. Maximum nut weight of 7.80g was recorded in H-320 which also had the highest shelling percentage of 27.80 (Table 1.22).

**Table 1.22 : Performance of cashew varieties/ genotypes at Vridhachalam**

Variety/ Genotypes	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread	Yield (Kg/tree) 2005	Cum. Yield (kg/tree) (9 harvests)	Nut weight (g)	Shelling (%)
T. 30/1	4.72	54.44	4.90	2.82	11.58	6.60	24.70
T. 3/33	3.96	50.46	5.00	3.12	11.60	6.60	24.60
T. 10/19	5.22	62.24	6.60	3.01	10.72	7.00	24.80
T. 3/28	4.36	58.16	6.20	3.22	11.87	6.00	25.80
H 68	4.22	54.46	6.30	3.14	12.75	5.80	26.40
H 367	4.16	59.22	6.20	2.98	12.50	6.50	25.90
H 303	5.10	64.64	6.40	2.91	15.60	5.20	26.40
H 255	4.62	58.62	5.30	3.12	10.29	7.00	27.40
H 320	4.46	49.84	6.30	3.15	13.60	7.80	27.80
M 44/3	4.68	52.46	6.00	3.71	21.64	6.80	26.80
M 15/4	4.88	66.24	6.80	3.36	18.62	6.90	26.20
M 107/3	5.14	68.42	6.40	3.12	9.96	6.90	27.00
M 40/1	4.44	58.16	6.00	3.68	13.58	6.80	26.30

## 2. Multi Location Trial – III

### *Centres: East Coast*

Bapatla, Bhubaneswar and Vridhachalam

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### *West Coast*

Madakkathara and Vengurla

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### *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.

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### **Experimental Details :**

The trial has been initiated in 2003. The trial comprises of 10 test varieties and 1 local check variety.

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

Replications – Three

Spacing 7.5 x 7.5 m

Plot size 4 plants per plot

### **BAPATLA**

The crop is in the initial stage of the growth, and the growth parameters are being recorded.

## BHUBANESWAR

There was significant difference in height and girth of the plants, and maximum plant height was observed in Goa 11/6 (2.13m). The stem girth of plants varied from 14.83cm in H 662 to 20.6cm in Goa 11/6. The maximum canopy spread of 2.29m was recorded in BH 85 (Table 1.23).

**Table 1.23 : Vegetative character of cashew varieties at Bhubaneswar**

Varieties	Mean plant height (m) 2005	Mean stem girth (cm) 2005	Mean canopy spread (m)
BH 6	1.53	17.40	1.88
BH 85	1.90	20.30	2.29
H 1597	1.63	17.70	1.95
K 22-1	1.77	20.43	1.92
H 662	1.63	14.83	1.57
H 625	1.70	18.20	1.90
H 11	1.70	18.83	2.17
H 14	1.60	17.50	1.70
H 3/2	1.70	18.60	2.05
Goa 11/6	2.13	20.60	2.35
H 2/16	1.93	19.60	2.00
<b>CD 5%</b>	<b>0.317</b>	<b>3.16</b>	<b>2.38</b>

## CHINTAMANI

There was no significant difference among the entries for the growth parameters recorded. However, Goa-11/6 recorded highest plant height of 2.10m followed by H-32/4(2.09m). Stem girth did not differ significantly among the entries. However, Goa-11/6 recorded highest stem girth of 27.50cm followed by K-22-1 (26.58cm) (Table 1.24).

**Table 1.24 : Growth observations of cashew varieties at Chintamani**

Varieties	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread (m)
BH-6	1.72	22.25	2.44
BH-85	1.78	25.67	2.37
H-1593	1.72	25.92	2.61
H-662	1.60	21.58	2.10
H-675	1.67	23.33	2.06
H-32/4	2.09	26.37	2.73
K-22/1	1.83	26.58	2.44
H-11	1.91	22.75	2.38
H-14	1.64	23.78	2.08
Goa-11/6	2.10	27.50	2.52
Chintamani-1	1.64	23.64	2.52
S Em	NS 0.11	NS 1.38	NS 0.22

## MADAKKATHARA :

Maximum plant height was recorded in BH-85 (2.56 m) and H-675 had the maximum stem girth of 34.78 cm. Maximum mean canopy spread was recorded in the genotype H-11 (2.85 m) (Table 1.25).

**Table 1.25 : Growth parameters of cashew varieties at Madakkathara**

<b>Variety</b>	<b>Mean plant height (m)</b>	<b>Mean stem girth (cm)</b>	<b>Mean canopy spread (m)</b>
Dhana	1.96	28.08	2.43
H-11	2.40	32.83	2.85
H-32/4	2.08	28.17	2.28
H-1593	2.17	29.58	2.61
BH-6	1.96	29.92	2.21
H-662	2.44	34.58	2.44
H-675	2.44	34.78	2.64
BH-85	2.56	33.75	2.75
H-22-1	2.04	29.50	2.58
Goa 11/6	2.40	33.92	2.81
H-14	2.27	30.92	2.68

## **VENGURLA**

The grafts are in initial stage of growth. The growth observations were recorded and statistical analysis indicated no significant difference amongst the varieties.

## **VRIDHACHALAM :**

The entry H 675 recorded the maximum plant height (1.85m) while H 14 recorded maximum stem girth of 11.80 cm. H 662 recorded the maximum canopy spread of 1.90m (Table 1.26).

**Table 1.26 : Performance of cashew varieties at Vridhachalam**

<b>Variety/ Genotypes</b>	<b>Mean plant height (m)</b>	<b>Mean stem girth (cm)</b>	<b>Mean canopy spread (m)</b>
BH 6	1.32	10.90	0.80
BH 85	1.70	11.40	1.65
H 1597	1.83	11.40	1.67
K 22-1	1.47	10.40	1.58
H 662	1.88	11.60	1.90
H 675	1.85	12.20	1.84
H 11	1.07	7.60	1.78
H 14	1.62	11.80	1.82
H 32/4	1.53	9.60	1.88
Goa 11/6	1.28	9.80	1.76
VRI 2	1.12	10.60	1.74
VRI 3	1.19	8.20	1.80

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

*Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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*West Coast :*

Pilicode and Vengurla

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*Plains / others :*

Chintamani and Jagdalpur

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

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#### **SUMMARY :**

The growth parameters of the precocious dwarf KGN-1 were similar to the local check at Bapatla Centre, whereas, at Chintamani, Jhargram, Vengurla and Vridhachalam KGN-1 had higher growth compared to respective local check. However, dwarfness was displayed by KGN-1 at Bhubaneswar and Pilicode Centre.

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#### **Experimental Details :**

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

Planting year : 2002

#### **BAPATLA**

The vegetative characters viz., plant height, stem girth and canopy spread did not vary significantly in KGN-1 as compared to local check (BPP-5). However, the average internodal length and duration of flowering were lesser in KGN-1 (Table 1.27).

#### **BHUBANESWAR**

KGN-1 had comparatively shorter internodal length (1.60 cm) whereas plant height (2.00 m) and trunk girth (18.80 cm) were higher than the check variety H 2 / 16.



The nut yield (0.10kg/plant) at first harvest, number of nuts/ panicle (1.70) and nut weight (7.20g.) were comparatively lower in KGN-1 (Table 1.27).

### CHINTAMANI

The vegetative parameters and flowering intensity were higher in KGN-1 compared to Chintamani-1 indicating that KGN-1 may not retain its dwarfness under varied agro-ecological conditions (Table 1.27).

### JHARGRAM:

Average height, girth, canopy spread (E-W) and inter nodal length were higher in KGN-1 than the check variety (BLA 39-4) indicating that KGN-1 did not exhibit dwarfness under Jhargram conditions. Trunk girth, canopy spread (N-S) and number of laterals/m<sup>2</sup> was more in check variety. KGN-1 variety was found to be precocious in flowering than BLA-39-4 (18.67/m<sup>2</sup>) (Table 1.27).

**Table 1.27 : Vegetative & yield characters of KGN-1 and local check**

Growth parameters	Bapatla		Bhubaneswar		Chintamani		Jhargram	
	KGN-1	BPP-5	KGN-1	H 2/16	KGN-1	Chint-1	KGN-1	BLA-39-4
Plant height (m)	1.66	1.41	2.00	1.70	1.50	1.40	3.81	2.20
Stem girth (cm)	20.00	16.66	18.80	17.70	18.00	15.83	32.20	38.67
Canopy spread (E-W) (m)	1.96	1.51	2.20	2.30	1.49	1.15	4.07	3.85
Canopy spread (N-S) (m)	1.78	1.43	2.30	2.30	1.51	1.26	3.85	4.73
Mean canopy spread								
Average internodal length (cm)	16.66	19.33	1.60	2.20	3.46	3.26	2.40	2.31
No. of laterals/m <sup>2</sup>	80-90	85-90	14.80	18.00	--	--	18.67	22.67
Flowering intensity/m <sup>2</sup>	--	--	9.80	8.00	15.17	7.88	14.10	18.67
Number of nuts /panicle	--	--	1.70	3.00	6.40	4.44	2.15	2.00
Male: Bisexual flowers	--	--	--	--	17.13	21.05	9.86	10.96
Nut weight (g)			7.20	8.00	--	--	--	--
Nut yield (kg/tree)			0.10	0.20	--	--	1.20	3.61

## PILICODE

The vegetative parameters of variety KGN-1 were comparatively lesser than that of the MDK-1 (Table 1.28).

## VENGURLA

The internodal length and plant height of KGN-1 were higher than Vengurla-7. The nut weight of V-7 was higher (9.83g) in comparison to KGN-1 (5.50g). Based on the growth parameters KGN-1 did not exhibit dwarfness under Vengurla conditions (Table 1.28).

## VRIDHACHALAM

The local check, VRI 2 recorded lower plant height, stem girth, and canopy spread in comparison to KGN-1 indicating that the precocious dwarf may not exhibit dwarfness under varied conditions (1.28).

**Table 1.28 : Vegetative & yield characters of KGN-1 and local check**

Growth parameters	Pilicode		Vengurla		Vridhachalam	
	KGN-1	MDK-1	KGN-1	V-7	KGN-1	VRI-2
Plant height (m)	2.56	2.00	2.52	2.12	4.43	3.21
Stem girth (cm)	12.17	18.17	21.00	22.20	32.20	28.20
Canopy spread (E-W) (m)	2.47	1.97	2.50	2.54	5.32	3.98
(N-S) (m)	2.37	1.81	2.50	2.90	5.65	4.28
Mean canopy spread						
Average internodal length (cm)	1.04	1.65	34.14	31.38	--	--
No. of laterals/m <sup>2</sup>	--	--	--	--	7.60	5.00
Flowering intensity/m <sup>2</sup>	--	--	--	--	--	--
Number of nuts /panicle	--	--	--	--	--	--
Male : Bisexual flowers	--	--	--	--	--	--
Nut weight (g)	--	--	5.50	9.83	--	--
Nut yield (kg/tree)	--	--	0.11	0.04	--	--

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

*Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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*West Coast :*

Madakkathara and Vengurla

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*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.

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#### **SUMMARY:**

At Bapatla Centre, Vengurla-4 recorded the maximum plant height (8.40m) followed by Vengurla-5 (4.50m). Maximum number of bisexual flowers were recorded in BBSR-1 (289.50) followed by Kanaka (217.50). At Jhargram, Jhargram-1 had the highest plant height of 3.08m and highest mean canopy spread of 3.14m and highest stem girth was recorded for Vengurla-4 (29.67cm).

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#### **BAPATLA**

During the year 2005-06, the variety Vengurla-4 recorded the maximum plant height (8.40m) followed by Vengurla-5 (4.50m). Maximum stem girth was recorded in Vengurla-5 (78.0 cm). The varieties BPP-4 (7.09m) followed by BPP-8 (7.08 m) recorded the maximum mean canopy spread. Maximum number of bisexual flowers were recorded in BBSR-1 (289.50) followed by Kanaka (217.50). The highest mean nut yield per tree of 2.73kg was recorded in BPP-8 variety which also recorded highest cumulative yield of 8.32kg for 5 harvests (Table 1.29).

**Table 1.29: Growth and yield performance of released varieties at Bapatla**

Variety	Plant height (m)	Stem Girth (cm)	Canopy Spread (m)		Bi-Sexual flowers	Nut weight (g)	Nut yield /tree (kg) (5 <sup>th</sup> harvest)	Cumul ative nut yield/ tree (kg)
			E-W	N-S			2005	2001-05
BPP-1	3.50	56.80	5.75	5.60	124.50	5.85	2.30	5.60
BPP-2	4.12	62.80	6.68	8.18	150.70	4.85	2.42	6.97
BPP-3	3.43	58.00	6.06	6.53	125.50	6.51	1.68	4.67
BPP-4	3.80	67.00	7.17	7.02	102.50	6.22	2.07	7.64
BPP-5	3.43	51.00	5.08	5.23	201.30	6.14	1.94	6.49
BPP-6	2.37	39.00	3.50	3.67	175.30	5.35	0.53	1.86
BPP-8	3.36	59.40	7.02	7.16	93.50	7.20	2.73	8.32
BPP-9	2.32	38.20	3.55	3.82	70.80	6.82	1.46	3.56
Kanaka	2.76	42.80	4.56	4.18	217.50	5.05	1.60	5.88
Dhana	2.65	39.20	4.10	4.37	152.00	7.65	1.45	4.35
Priyanka	2.75	46.80	4.93	5.06	130.30	9.69	1.30	3.68
Vengurla-1	2.00	54.00	3.33	4.00	126.80	5.36	0.70	2.35
Vengurla-2	2.90	46.30	3.86	3.93	153.80	4.11	1.00	2.84
Vengurla-3	4.25	65.00	6.30	6.55	146.80	6.75	1.02	3.00
Vengurla-4	8.40	64.00	6.66	5.72	205.50	6.31	0.87	3.42
Vengurla-5	4.50	78.00	5.86	5.80	108.30	4.65	2.46	7.40
BBSR-1	3.15	42.00	4.44	4.60	289.50	4.78	1.22	3.80
VRI-2	3.61	47.60	6.26	6.50	110.00	4.35	1.93	7.17
Chintamani1	1.85	28.50	2.60	2.75	115.00	4.50	0.25	0.55
Ullal-1	1.95	35.50	3.85	3.20	26.00	5.21	0.47	1.07
Ullal-4	2.50	35.50	4.80	4.30	32.50	5.30	0.40	1.05
Ullal-5	3.40	37.50	3.67	4.52	54.30	7.61	0.93	1.94
Jhargram	2.450	42.00	4.47	4.50	115.50	5.91	0.50	1.25

## JHARGRAM

Jhargram-1 had the highest plant height of 3.08m and highest mean canopy spread of 3.14m and highest stem girth was recorded for Vengurla-4 (29.67cm) (Table 1.30).

**Table 1.30 : Evaluation of released varieties at Jhargram.**

Variety	Plant height (cm)	Stem girth (cm)	Canopy spread (m)	
			E-W	N-S
BPP – 1	1.07	4.50	1.17	1.17
BPP – 3	1.43	11.00	1.63	1.63
BPP – 4	1.36	12.25	1.27	1.35
BPP –5	0.65	4.68	0.72	0.65
BPP – 8	1.56	8.65	1.82	1.85
Ullal – 3	1.34	10.50	1.50	1.37
Vengurla – 6	1.41	11.20	1.20	1.30
Vengurla – 4	1.25	29.67	1.13	1.20
Jhargram – 1	3.08	23.55	3.19	3.09
Dhana	1.44	11.20	1.51	1.46
Kanaka	1.48	12.33	1.75	1.42
MDK-1	1.07	9.50	1.28	1.19
VTH – 711/4	1.15	8.60	1.40	1.60
NRCC – Sel- 2	1.53	13.33	1.00	1.25
NRCC – Sel-1	1.85	19.00	2.05	1.65

## Gen.4. Hybridization and Selection

### *Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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### *West Coast :*

Madakkathara and Vengurla

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### *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.

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### **SUMMARY:**

At Bapatla, the hybrids H-36 and H-65 recorded a nut weight of more than 7.0g. At Bhubaneswar, A6 was the most promising hybrid, which recorded the highest nut yield of 9.00 kg/plant, having nut weight of 9.00g and shelling percentage of 34.00. All the high yielding hybrids at Madakkathara had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4. Out of the eight promising hybrids evaluated at Vridhachalam, the hybrid H 10 (M 10/4 x M 26/1) had the highest nut yield of 7.58 kg/tree.

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### **BAPATLA**

A total of 97 F1 hybrid nuts were obtained from the 10 cross combinations during 2005.

**Table 1.31 : Details of cross combinations at Bapatla**

T-228 x BPP-8	BPP-6 x NRCC-Sel-2
BPP-8 x T-228	BPP-8 x Ullal-3
BPP-6 x Ullal-4	BPP-8 x BPP-4
BPP-8 x BPP-3	BPP-8 x Ullal-4
BPP-6 x NRCC-Sel-1	BPP-6 x Ullal-3

The existing F1 trees were evaluated and H-10 (T.No.273 x T 71) recorded highest cumulative yield of 7.65 Kg / tree followed by H-25 (F.No.3 x T.228) gave 7.25 kg/tree (Table 1.32). The hybrids H-36 and H-65 recorded a nut weight of more than 7.0g.

**Table 1.32 : Evaluation of F1 Hybrids (1997 planted) at Bapatla**

Hybrid No	Cross combination	Yield/tree(kg) (3rd harvest) (2005)	Cumulative yield/tree (kg) (2003-05)	Mean nut weight (g)
H-9	T 273 x T 71	2.50	6.85	5.00
H-10	T 273 x T 71	2.00	7.65	6.00
H-14	T 228 x T2/22	1.25	4.95	6.50
H-25	F.No.3 x T 228	1.25	7.25	6.00
H-34	BPP-5 x T2/22	1.50	5.60	6.00
H-36	F.No.3 x T30/1	2.40	6.90	8.00
H-64	T 71 x T 273	2.50	7.00	6.00
H-65	T 71 x T 273	2.00	7.15	7.00
H-76	T 71 x T 273	2.00	4.75	6.00

## **BHUBANESWAR**

Among the hybrids planted in 1995, A6 was the most promising hybrid, which recorded the highest nut yield of 9.00 kg/plant, with a nut weight of 9.00g and shelling percentage of 34.00. Highest nut yield (kg/plant) as well as highest shelling percentage were recorded in A1-85 (9.50; 34%) followed by A1-105 (7.00; 32%) among the hybrids planted in 1997. The nut yield (kg/plant) was highest in B2-32 (2.00) followed by F2-8 (1.80) among the 1998 planted hybrids. The nut weight (g), shelling percentage (%) and number of nuts per panicle of these two hybrids were (7.70g & 9.20g), (32% & 29%) and (4.00 & 3.00) respectively (Table 1.33).

In the 1999 planted hybrids highest nut yield (kg/plant) was observed in D3-11 (2.60) followed by D3-18 (2.50). Higher nut weight (g) and shelling percentage (%) were recorded in D3-11 & D3-18 (10.00g & 8.60g) and (32% & 33%) respectively. All the 6 hybrids planted in 2000 were bold nut types, and had cluster bearing habit (Table 1.33).

Amongst the hybrids planted during 2001, at 2<sup>nd</sup> harvest, the nut yield (kg/plant), nut weight (g) and shelling percentage (%) respectively in the hybrids J5-13 (1.80, 8.80 & 33.00), E5-19 (1.40, 10.40 & 26.00) in and D5-40 (1.20, 9.20, 31.00) were the highest (Table 1.33).

**Table 1.33 : Performances of cashew hybrids at Bhubaneswar**

Year of planting	Hybrid No.	Cross combinations	No. of fruits/panicle	Yield (kg/plant)	Cumulative yield (kg/plant)	Nut weight (g)	Shelling (%)
1995 8 <sup>th</sup> harvest	A 6	Bhubaneswar C-2 x VTH 711/4	4	9.00	30.60	9.00	34
1997 6 <sup>th</sup> harvest	A 1-85	Bhubaneswar-1 x H2/16	3	9.50	30.00	7.80	34
	A 1-105	Bhubaneswar-1 x H2/16	4	7.00	23.00	8.20	32
1998 4 <sup>th</sup> harvest	B 2-32	H 2/16 x M44/3	4	2.00	5.20	7.70	32
	F 2-8	Bhubaneswar-1 x Kankanadi	3	1.80	4.30	9.20	29
1999 3 <sup>rd</sup> harvest	D 3-11	M 44/3 x H 2/15	3	2.60	3.90	10.00	32
	D 3-18	M 44/3 x H 2/15	4	2.50	3.70	8.60	33
2000 2 <sup>nd</sup> harvest	C 4-2	M 44/3 x H 2/16	3	1.20	2.10	8.00	33
	C 4-30	M 44/3 x H 2/16	2	1.00	2.00	10.00	35
	D 4-6	H 2/16 x M 44/3	3	1.00	2.40	8.00	31
	F 4-3	M 44/3 x H 2/15	2	1.30	1.90	8.40	32
	F 4-28	M 44/3 x H 2/15	2	1.20	2.00	12.00	31
	G 4-6	M 44/3 x VTH 711/4	5	1.00	2.20	9.40	23
2001 2 <sup>nd</sup> harvest	D 5-40	M 44/3 x H 2/15	2	1.20	1.90	9.20	31
	E 5-19	BPP 30/1 x H 2/16	3	1.40	2.40	10.40	26
	J 5-13	Bhubaneswar-1 x VTH 711/4	3	1.80	2.00	8.80	33

**R- Red****Y- Yellow****YR-Yellowish Red**



## CHINTAMANI

A total of 165 nuts have been obtained from 13 cross combinations and 63 F<sub>1</sub> plants have been raised for further evaluation during 2005 (Table 1.34).

**Table 1.34 : Details of cross combinations at Chintamani**

NRCC-2 x Vetore56/2	ME-4/4 x Vetore56/2
8/46 Taliparamba x Vetore56/2	Chrompet x Vetore56/2
1/64 Madhurantakam x Vetore56/2	Chintamani-1 x NRCC-2
V-5 x Vetore-56/2	Chintamani-1 x NRCC-1
9/88 x Vetore56/2	Kankanadi x 2/6 Gubbi
Ullal-3 x Vetore56/2	Chintamani-1 x NDR-2-1
2/77 Tuni x Vetore56/2	

## JHARGRAM

Hybridization programme during 2005 was done with H-2/15 as the male parent and Yellow Hazari as the female plant. Out of F<sub>1</sub> hybrids planted during 2002 the plant height was maximum in H-64 (4.65m) followed by H-45 (4.50m) and H-42 (4.45m). Hybrids H-37, H-41, H-28 and H-9 were the early flowering types and the shortest duration of flowering was noticed in H-31 & H-70 (44 days) while longer durations were recorded in H-9 (90 days) and H-42 (87 days).

The highest nut weight of 8.02g was recorded in H-6 with a shelling percentage of 27.74 while, H-41 had a nut weight of 6.87g and shelling percentage of 29.86 (Table 1.35).

**Table 1.35 : Performance of promising hybrids at Jhargram**

Hybrid No.	Cross combination	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread (m)	Mean nut weight (g)	Mean shelling (%)
H-6	KC-1 x BLA-39-4	3.90	30.00	3.53	8.02	27.74
H-9	KC-1 x BLA-39-4	3.70	25.00	3.20	6.30	27.60
H-42	Red Hazari x WBDCV	4.45	32.00	3.93	5.81	27.02
H-45	Red Hazari x WBDCV	4.50	35.00	4.30	5.34	31.50
H-28	Local x Dicherla-2/9	3.75	43.00	5.45	5.13	30.66
H-31	Local x Dicherla-2/9	3.55	40.00	4.90	6.23	29.28
H-37	Local x Dicherla-2/9	3.95	40.00	4.18	5.07	33.41
H-41	Local x Dicherla-2/9	3.65	41.00	5.13	6.87	29.86
H-64	WBDC-V x Red Hazari	4.65	42.00	5.15	5.05	33.43
H-70	JGM-1 x Red Hazari	3.65	39.00	4.83	4.97	27.37

## MADAKKATHARA

Out of the 56 hybrids planted in 1993, the highest yield was recorded by H-30 and H-44 (18.70 kg/tree) followed by H-7 (18.40 kg/tree). Highest cumulative yield was given by H-7 (76.44

kg), H-17 (71.35 kg) (Table 1.36). All the high yielders had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4.

**Table 1.36 : Performance of hybrids planted during 1993 at Madakkathara**

Hy. No.	Mean annual nut yield (kg/tree) 2005	Mean cum. yield (kg/tree)	Mean nut wt.(g)
7	18.40	76.44	8.25
14	9.90	30.85	7.10
17	17.80	71.35	6.50
21	10.50	47.70	8.67
24	17.40	54.15	8.19
30	18.70	31.70	7.40
31	8.70	17.28	7.23
36	9.00	30.06	10.28
42	8.20	24.24	5.30
44	18.70	20.23	

Out of 26 hybrids planted in 1994, the highest annual yield/ tree was recorded by H-71 (7.20 kg/tree) with a cumulative yield of 25.90 kg and H-73 with an annual yield of (5.40 kg) and cumulative yield of 29.75 kg (Table 1.37). All the high yielders were progenies of BLA 39-4 and P-3-2 showing that these two genotypes are genetically divergent.

**Table 1.37: Performance of hybrids planted during 1994 at Madakkathara**

Hybrid No.	Mean annual nut yield (kg/tree) 2005	Mean cum. Yield (kg/tree)	Mean nut wt.(g)
56	1.30	2.30	-
64	1.80	2.70	8.20
70	1.40	13.90	8.80
71	7.20	25.90	7.50
73	5.40	29.75	6.60
74	3.70	25.30	7.50
77	4.20	6.70	-
79	3.20	3.20	-
82	1.60	12.60	5.70

Maximum annual nut yield of 4.30 kg/tree was recorded in H-91 followed by 4.20kg/tree in H-92. The cumulative yield (kg/tree) was highest in case of H-101 (23.10) followed by H-85 (21.75). H-97 and H-98 had a nut weight of more than 10g (Table 1.38).

**Table 1.38 : Performance of hybrids planted during 1995 at Madakkathara**

Hybrid No.	Yield (kg/tree/annum)	Cum. yield (kg/tree)	Nut wt. (g)
84	2.30	6.05	4.50
85	3.00	21.75	6.50
91	4.30	7.20	8.00
92	4.20	11.27	7.80
93	2.10	7.30	6.50
95	1.40	6.60	7.30
97	2.90	10.08	10.10
98	1.70	8.82	10.00
100	1.40	10.23	7.50
101	1.50	23.10	6.80
105	1.30	10.48	7.00
110	2.20	7.53	7.60

During 2001, 124 hybrid seedlings were planted from 15 cross combinations. The parents identified for the crosses were A1, V-56, Kilianthara, K-30-1, V5, K 22-1, Sulabha, MDK-1 and M 44/3. During 2002, 135 hybrid seedlings were field planted from 20 cross combinations. The parents identified were Amrutha, Ullal-3, UN-50, Kanaka, Ullal-4, K 22-1, Anakkayam-1, KGN, VTH 711/4, NRCC Sel-2, Dhana, MDK-1, Priyanka and Sulabha. During 2003, 626 hybrids obtained from 126 cross combinations were planted at SCRS, Konni and 220 hybrids at Madakkathara.

### **PILICODE**

The dwarf type TPB1 was used for hybridization with ANK-1 and MDK-1 with the objective of obtaining hybrid progenies having dwarf stature, higher percentage of bisexual flowers, nut setting and nut yield. The hybrid seed nuts were sown in nursery for raising seedlings.

Three seedlings of MDK1 x TPB1, 3 ANK1 x TPB1, 2 TPB1 x ANK1 and seven open pollinated seedlings of TPB-1 were obtained during 2001-2002 and field planted. The performance of the three year old hybrids are given in Table 1.39.

**Table 1.39 : Growth characteristics of different hybrids planted in 2001 at Pilicode**

Hybrid	Mean plant height(m)	Mean stem girth(cm)	Mean canopy spread(m)	Internodal length (cm)
MDK-1 x TPB-1	1.87	14.50	1.62	0.96
ANK-1 x TPB-1	2.80	30.00	3.35	1.19
TPB-1 x ANK-1	2.5	20.67	2.13	1.75
TPB-1 (OP)	0.62	14.00	1.53	0.66

## VENGURLA

Based on standard yield criteria, 23 F<sub>1</sub> hybrid seedlings were initially screened as promising hybrids and yield parameters are mentioned in Table 1.40.

**Table 1.40 : Yield parameters of promising hybrids planted during 2001 at Vengurla.**

Cross combination	Mean no. of nut/ panicle	Mean nut weight (g)	Yield (kg/tree)	Shelling percentage (%)
M 44/3 x B.T.-22	6.50	8.30	1.87	29
M 44/3 x B.T.-22	3.20	10.00	1.60	32
M 44/3 x B.T.-22	10.50	8.90	1.59	30
M 44/3 x B.T.-22	6.00	8.50	1.80	28
V-5 x B.T.1	9.50	8.00	1.52	30
M 26/2 x B.T.-22	3.00	10.60	1.32	29
M 44/3 x B.T.-65	4.70	8.00	1.97	28
M 44/3 x B.T.65	4.00	8.00	1.50	29
M 44/3 x B.T.-65	3.00	8.00	1.50	29
M 44/3 x B.T.-65	3.00	10.00	1.25	29
V-4 x Hy 2/16	6.20	11.00	1.16	28
V-4 x Hy 2/16	4.00	10.00	1.65	30
V-4 x Hy 2/16	7.00	8.00	1.74	28

The progenies of M44/3 x B.T. 22, M26/2 x B.T. 22, V-4 x Hy 2/16 cross combinations had nut weight exceeding 10.00g. All the promising hybrids had shelling percentage of more than 28 per cent. The average yield of these F<sub>1</sub> hybrids ranged from 1.25 to 1.97Kg/tree.

## VRIDHACHALAM

Out of the eight promising hybrids evaluated, H-10 (M 10/4 x M 26/1) performed better in terms of nut yield (7.58 kg/tree) followed by H-13 (6.32kg/tree). The cumulative yield for 12 years

was the highest for H 10 (65.10 kg/tree), while shelling percentage was highest (28.12) for H-12 (Table 1.41).

**Table 1.41 : Performance of Selected F<sub>1</sub> Hybrids at Vridhachalam**

<b>Hybrid Number</b>	<b>Cross combination</b>	<b>Mean yield (kg/tree)</b>	<b>Cumulative yield (Kg/tree) for 12 years</b>	<b>Mean nut weight (g)</b>	<b>Mean shelling %</b>
H 10	M 10/4 x M 26/1	7.58	65.10	6.98	27.30
H 11	M 10/4/ x M 45/4	6.20	43.38	6.70	26.52
H 12	M 10/4 x M 75/3	6.10	45.54	6.75	28.12
H 13	M 26/2 x M 26/1	6.32	57.47	6.72	27.55
H 14	M 26/2 x M 45/4	5.60	45.50	6.65	27.52
H 15	M 26/2 x M 75/3	5.55	43.97	6.85	27.10
H 16	M 44/3 x M 26/1	5.63	53.89	6.54	27.25
H 17	M 44/3 x M 45/1	6.15	50.35	7.20	26.30
CD(0.05)		0.4100**		0.4046**	0.2997**

## **II. CROP MANAGEMENT**

## II. CROP MANAGEMENT

### Agr.1: NPK Fertilizer Experiment

*Centres : East Coast :*

Bapatla, Jhargram and Vridhachalam

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*West Coast :*

Madakkathara

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*Plains / others :*

Chintamani

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

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#### **SUMMARY:**

At Bapatla, application of 500g level of N gave significantly higher yield of 7.29 kg per tree. However, influence of P and K levels were not significant. Interaction effect of N,P,K on cumulative yield of Jhargram-1 upto 6<sup>th</sup> harvest indicated 500:250:250 of NPK/tree leading to a maximum cumulative yield (33.32kg/tree for 6 harvests). At Madakkathara, increasing levels of all the three nutrients led to progressive increase in yield with a maximum yield (5.40 kg/tree) in 500:250:250 of NPK/tree. The maximum canopy diameter (6.95m) and maximum annual nut yield (6.82kg/tree) were recorded in treatment with 1000:125:250g NPK/plant at Vridhachalam.

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#### **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 the 500g level of N gave significantly higher yield of 7.29 kg per tree, however influence of P and K levels were not significant. The mean annual nut yield per tree was highest in the treatment N<sub>2</sub>P<sub>2</sub> (6.35 kg per tree) followed by N<sub>2</sub>P<sub>1</sub> (5.78kg per tree) in comparison to control (3.73kg per tree) (Table 2.1).

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

	<b>P<sub>0</sub></b>	<b>P<sub>1</sub></b>	<b>P<sub>2</sub></b>	<b>Mean</b>	<b>K<sub>0</sub></b>	<b>K<sub>1</sub></b>	<b>K<sub>2</sub></b>
<b>N<sub>0</sub></b>	3.73	3.77	4.27	<b>3.92</b>	3.61	3.90	4.27
<b>N<sub>1</sub></b>	5.88	5.85	7.32	<b>6.35</b>	5.55	6.96	6.53
<b>N<sub>2</sub></b>	6.70	7.73	7.45	<b>7.29</b>	5.72	8.13	8.03
<b>Mean</b>	<b>5.43</b>	<b>5.78</b>	<b>6.35</b>		<b>4.96</b>	<b>6.33</b>	<b>6.28</b>
<b>K<sub>0</sub></b>	4.31	5.23	6.76				
<b>K<sub>1</sub></b>	5.17	6.63	5.55				
<b>K<sub>2</sub></b>	5.39	7.13	6.52				
F-Test		<b>N</b>	<b>P</b>	<b>K</b>	<b>NP</b>	<b>NK</b>	<b>PK</b>
<b>Significance</b>		*	NS	NS	NS	NS	NS
<b>CD 5%</b>		1.62			2.80		

Cumulative nut yield of 7 harvests indicated significant differences for NPK and NPK interactions. The highest cumulative nut yield was obtained in the N<sub>2</sub> level (17.62 kg/tree). The N<sub>2</sub>P<sub>2</sub> gave highest cumulative yield of 19.66 kg/tree followed by N<sub>2</sub>P<sub>1</sub> (19.46 kg/tree) which were on par with each other and superior over control (9.88 kg/tree) (Table 2.2). The treatment N<sub>2</sub>P<sub>1</sub>K<sub>1</sub> (500:125:125g NPK) recorded significantly highest cumulative nut yield of 24.07 kg/tree.

**Table 2.2 : Cumulative mean nut yield (kg/tree) of the N, P and K interactions (Pooled analysis) at Bapatla**

	<b>P<sub>0</sub></b>	<b>P<sub>1</sub></b>	<b>P<sub>2</sub></b>	<b>Mean</b>	<b>K<sub>0</sub></b>	<b>K<sub>1</sub></b>	<b>K<sub>2</sub></b>
<b>N<sub>0</sub></b>	9.88	9.22	10.54	<b>9.88</b>	10.70	8.72	10.22
<b>N<sub>1</sub></b>	18.06	15.32	16.63	<b>16.67</b>	15.26	17.65	17.09
<b>N<sub>2</sub></b>	13.76	19.46	19.66*	<b>17.62*</b>	15.84	20.50	16.53
<b>Mean</b>	<b>13.90</b>	<b>14.67</b>	<b>15.61</b>		<b>13.94</b>	<b>15.62</b>	<b>14.62</b>
<b>K<sub>0</sub></b>	12.84	14.85	14.00				
<b>K<sub>1</sub></b>	13.50	16.72	13.78				
<b>K<sub>2</sub></b>	15.47	15.30	16.06				
<b>CD 5%</b>		<b>1.12</b>			<b>1.93</b>		



### On-farm trial with higher dose of fertilizers:

The highest dose of NPK recorded the highest nut yield of 11.75 kg /tree which was on par with T2 treatment (10.50 kg/tree). Highest number of panicle (21.5/m<sup>2</sup>) was observed in T3 treatment (Table 2.3).

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

Treatment	N <sub>2</sub> g/tree	P <sub>2</sub> O <sub>5</sub> g/tree	K <sub>2</sub> O g/tree	Number of panicles/m <sup>2</sup>	Nut yield/tree (kg)
Recommended dose (T1)	500	125	125	14.00	6.50
Higher dose (T2)	1000	250	250	20.50	10.50
Highest dose (T3)	1500	375	375	21.50	11.75

## CHINTAMANI

The grafts of Ullal-1 were non-bearing hence, limb pruning of 10 border row plants was suggested on trial basis. Based on the positive response of limb pruned trees, the entire NPK trial plot was limb pruned.

The number of primary branches per tree in the plot varied from 3 to 9 and the stem girth varied from 64.00 to 130.00 cm. The nut yield of ten previously limb pruned trees varied from 0.75 to 5.94kg/tree.

## JHARGRAM

The growth and yield parameters differed significantly in terms of their response to different doses of fertilizers. The treatment N<sub>1</sub>P<sub>2</sub>K<sub>2</sub> led to the maximum tree height (7.20m) while stem girth was maximum with the treatment N<sub>2</sub>P<sub>1</sub>K<sub>2</sub> (113.75cm). Maximum fertilizer dose supported the maximum flowering duration (75days) (Table 2.4)

Interaction effect of nitrogen and phosphorus on yield indicated maximization of yield (12.38kg/tree) for highest dose of phosphorus in combination with highest dose of nitrogen. A different trend on interaction effect of phosphorus and potassium on yield of cashew was observed wherein highest dose of potassium when combined with lower dose of phosphorus led to maximum yield (11.22kg/tree).

Interaction effect of N,P,K on cumulative yield for 6 harvests indicated that N<sub>1</sub>P<sub>2</sub>K<sub>2</sub> i.e., 500g N, 250g P<sub>2</sub>O<sub>5</sub> and 250g K<sub>2</sub>O was identified as a better combination for maximum cumulative yield (33.32kg/tree) from Jhargram-1 (Table 2.5 and Table 2.6)

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

<b>Treatment</b>	<b>Plant height (m)</b>	<b>Stem girth (cm)</b>	<b>Mean canopy diameter (m)</b>	<b>Duration of flowering (days)</b>	<b>Mean nut wt. (g)</b>	<b>Mean apple wt. (g)</b>
N <sub>0</sub> P <sub>0</sub> K <sub>0</sub>	6.30	90.50	7.86	64	4.39	41.50
N <sub>0</sub> P <sub>0</sub> K <sub>1</sub>	5.68	91.00	6.58	70	5.72	30.50
N <sub>0</sub> P <sub>0</sub> K <sub>2</sub>	5.88	86.50	6.04	52	5.72	30.50
N <sub>0</sub> P <sub>1</sub> K <sub>0</sub>	6.02	91.00	6.84	46	4.15	40.30
N <sub>0</sub> P <sub>1</sub> K <sub>1</sub>	6.08	100.25	7.85	69	4.85	51.25
N <sub>0</sub> P <sub>1</sub> K <sub>2</sub>	5.92	109.25	8.14	70	5.24	42.50
N <sub>0</sub> P <sub>2</sub> K <sub>0</sub>	6.72	99.05	7.67	52	5.15	36.50
N <sub>0</sub> P <sub>2</sub> K <sub>1</sub>	6.33	85.50	7.99	61	5.20	38.50
N <sub>0</sub> P <sub>2</sub> K <sub>2</sub>	6.66	86.85	6.80	66	4.94	42.00
N <sub>1</sub> P <sub>0</sub> K <sub>0</sub>	6.79	95.50	8.36	56	4.78	31.50
N <sub>1</sub> P <sub>0</sub> K <sub>1</sub>	6.99	86.25	7.37	64	5.16	39.75
N <sub>1</sub> P <sub>0</sub> K <sub>2</sub>	6.59	80.75	7.06	70	4.62	26.00
N <sub>1</sub> P <sub>1</sub> K <sub>0</sub>	6.55	90.00	7.55	70	4.38	45.25
N <sub>1</sub> P <sub>1</sub> K <sub>1</sub>	6.50	80.00	7.21	55	5.40	27.60
N <sub>1</sub> P <sub>1</sub> K <sub>2</sub>	5.88	88.85	7.10	60	4.78	34.25
N <sub>1</sub> P <sub>2</sub> K <sub>0</sub>	5.88	89.00	6.93	75	4.80	31.25
N <sub>1</sub> P <sub>2</sub> K <sub>1</sub>	6.43	91.75	8.10	72	4.02	49.75
N <sub>1</sub> P <sub>2</sub> K <sub>2</sub>	7.20	90.75	7.24	66	5.79	37.75
N <sub>2</sub> P <sub>0</sub> K <sub>0</sub>	6.35	90.00	7.05	64	4.29	36.75
N <sub>2</sub> P <sub>0</sub> K <sub>1</sub>	5.95	95.25	7.16	59	5.17	32.38
N <sub>2</sub> P <sub>0</sub> K <sub>2</sub>	5.13	89.75	6.87	62	5.08	38.75
N <sub>2</sub> P <sub>1</sub> K <sub>0</sub>	5.63	101.00	8.00	66	5.10	39.88
N <sub>2</sub> P <sub>1</sub> K <sub>1</sub>	6.98	93.75	7.93	50	4.70	53.38
N <sub>2</sub> P <sub>1</sub> K <sub>2</sub>	5.87	113.75	7.68	66	4.33	35.25
N <sub>2</sub> P <sub>2</sub> K <sub>0</sub>	5.80	99.50	8.45	65	4.63	51.25
N <sub>2</sub> P <sub>2</sub> K <sub>1</sub>	5.10	92.50	8.28	70	4.97	37.50
N <sub>2</sub> P <sub>2</sub> K <sub>2</sub>	6.63	105.00	7.84	75	4.33	36.00
C.D at 5%	1.262	21.271	1.40		1.398	14.558

**Table 2.5 : Effect of interaction of NPK on annual yield of cashew (kg/tree) at Jhargram**

	<b>P<sub>0</sub></b>	<b>P<sub>1</sub></b>	<b>P<sub>2</sub></b>	<b>Mean</b>	<b>K<sub>0</sub></b>	<b>K<sub>1</sub></b>	<b>K<sub>2</sub></b>
<b>N<sub>0</sub></b>	7.29	9.45	8.20	8.31	9.96	7.08	7.89
<b>N<sub>1</sub></b>	9.14	9.94	9.59	9.55	11.37	8.97	8.32
<b>N<sub>2</sub></b>	9.13	9.66	12.38	10.39	10.33	10.75	10.10
<b>Mean</b>	8.52	9.68	10.05		10.55	8.92	8.77
<b>K<sub>0</sub></b>	10.77	7.55	7.25	8.52			
<b>K<sub>1</sub></b>	9.68	8.81	10.56	9.68			
<b>K<sub>2</sub></b>	11.22	10.44	8.56	10.05			

SEm± for N,P,K = 1.02

C.D. at 5% for NP, PK and NK = 3.65

**Table 2.6 : Effect of interaction of NPK on cumulative yield of cashew for 6 harvests (kg/tree) at Jhargram**

	<b>P<sub>0</sub></b>	<b>P<sub>1</sub></b>	<b>P<sub>2</sub></b>	<b>Mean</b>	<b>K<sub>0</sub></b>	<b>K<sub>1</sub></b>	<b>K<sub>2</sub></b>
<b>N<sub>0</sub></b>	22.94	27.47	26.18	25.53	25.06	23.13	28.41
<b>N<sub>1</sub></b>	26.72	31.95	32.12	30.26	30.64	28.09	32.05
<b>N<sub>2</sub></b>	27.23	29.10	35.63	30.65	29.13	31.18	31.65
<b>Mean</b>	25.63	26.51	31.30		28.27	27.46	30.70
<b>K<sub>0</sub></b>	25.58	24.83	26.49	25.63			
<b>K<sub>1</sub></b>	29.41	29.41	26.67	32.39			
<b>K<sub>2</sub></b>	29.79	30.89	33.32	31.30			

SEm± for N,P,K = 1.02

C.D. at 5% for NP, PK and NK = 3.65

### **On farm trial**

This experiment is at initial stage wherein fertilizer doses are evaluated to maximise yields using BPP-8 variety.

### **MADAKKATHARA**

The growth and yield characters were not significantly influenced by the application of graded levels of N, P or K or their interactions. Girth of trees increased progressively, with increasing levels of nitrogen and phosphorous. However a declining trend was observed in girth with increasing levels of potash. Increasing levels of nitrogen led to increased canopy spread both in E-W and N-S directions, though not statistically significant.

Application of nutrients showed a positive trend on nut weight only in case of phosphorous wherein application of 500g N, 125g P<sub>2</sub>O<sub>5</sub>/ tree/ year, 250g K<sub>2</sub>O/tree recorded the maximum nut weight (6.10g). Increasing levels of all the three nutrients led to progressive increase in yield leading to a maximum yield (5.40 kg/tree) in 500g N/ tree, 250g P<sub>2</sub>O<sub>5</sub>/ tree and 250g K<sub>2</sub>O/ tree (Table 2.7).

It was found that increasing levels of P<sub>2</sub>O<sub>5</sub> increased the yield marginally at 0gN/tree (2.64kg/tree), 500g N/tree (2.71kg/tree) and 1000g N/tree (3.04kg/tree). Likewise, increasing levels of N increased the yield at 0g P<sub>2</sub>O<sub>5</sub>/tree (2.34kg/tree) and 125g P<sub>2</sub>O<sub>5</sub>/ tree (2.73kg/tree) and 250g P<sub>2</sub>O<sub>5</sub>/ tree (3.23kg/tree).

**Table 2.7 : Effect of N, P and K on growth and yield characters at Madakkathara**

Treatment	Plant height (m)	Stem girth (cm)	Canopy spread-EW (m)	Canopy spread-NS (m)	Weight of nut (g)	Yield (kg/tree/annum)	Cumulative yield (kg/tree) (for 6 harvests)
N <sub>0</sub> P <sub>0</sub> K <sub>0</sub>	5.13	87.17	7.82	7.98	6.03	1.74	18.10
N <sub>0</sub> P <sub>0</sub> K <sub>1</sub>	5.84	94.67	8.81	8.33	5.63	3.29	17.97
N <sub>0</sub> P <sub>0</sub> K <sub>2</sub>	5.43	103.75	7.77	7.20	5.55	0.30	14.82
N <sub>0</sub> P <sub>1</sub> K <sub>0</sub>	6.15	104.33	8.33	9.28	5.91	2.99	16.03
N <sub>0</sub> P <sub>1</sub> K <sub>1</sub>	5.40	101.42	7.90	8.03	5.95	1.56	15.48
N <sub>0</sub> P <sub>1</sub> K <sub>2</sub>	6.02	87.00	7.82	7.60	5.73	3.90	17.24
N <sub>0</sub> P <sub>2</sub> K <sub>0</sub>	5.98	113.50	8.09	7.58	5.57	4.35	25.12
N <sub>0</sub> P <sub>2</sub> K <sub>1</sub>	6.17	100.17	8.72	8.77	5.40	3.25	32.59
N <sub>0</sub> P <sub>2</sub> K <sub>2</sub>	5.88	58.75	6.68	3.68	5.85	2.39	19.12
N <sub>1</sub> P <sub>0</sub> K <sub>0</sub>	7.97	90.67	10.60	9.07	5.73	2.67	19.40
N <sub>1</sub> P <sub>0</sub> K <sub>1</sub>	4.88	111.67	5.93	7.90	3.02	1.46	16.51
N <sub>1</sub> P <sub>0</sub> K <sub>2</sub>	5.28	56.25	6.38	4.17	2.51	2.06	20.44
N <sub>1</sub> P <sub>1</sub> K <sub>0</sub>	5.63	103.50	8.03	7.63	5.79	0.83	20.88
N <sub>1</sub> P <sub>1</sub> K <sub>1</sub>	5.85	90.00	7.85	7.60	5.32	3.90	16.02
N <sub>1</sub> P <sub>1</sub> K <sub>2</sub>	6.58	105.83	8.60	9.00	6.10	2.42	24.86
N <sub>1</sub> P <sub>2</sub> K <sub>0</sub>	6.05	144.00	8.22	7.57	5.43	3.44	18.63
N <sub>1</sub> P <sub>2</sub> K <sub>1</sub>	6.40	91.25	8.17	7.95	5.88	2.20	22.89
N <sub>1</sub> P <sub>2</sub> K <sub>2</sub>	6.63	98.92	8.35	8.78	5.56	5.40	29.26
N <sub>2</sub> P <sub>0</sub> K <sub>0</sub>	6.33	99.75	8.65	9.35	5.55	2.25	27.59
N <sub>2</sub> P <sub>0</sub> K <sub>1</sub>	6.55	107.67	8.13	8.89	6.04	3.04	23.42
N <sub>2</sub> P <sub>0</sub> K <sub>2</sub>	6.86	108.83	10.08	8.68	5.85	4.21	25.22
N <sub>2</sub> P <sub>1</sub> K <sub>0</sub>	6.13	97.25	9.30	8.68	5.61	2.83	23.35
N <sub>2</sub> P <sub>1</sub> K <sub>1</sub>	6.18	104.17	8.63	7.40	5.96	2.86	23.97
N <sub>2</sub> P <sub>1</sub> K <sub>2</sub>	6.28	88.75	8.63	7.76	5.67	3.30	20.76
N <sub>2</sub> P <sub>2</sub> K <sub>0</sub>	6.15	104.67	8.53	7.37	5.11	2.28	16.26
N <sub>2</sub> P <sub>2</sub> K <sub>1</sub>	5.40	99.67	7.63	7.90	5.83	3.97	22.41
N <sub>2</sub> P <sub>2</sub> K <sub>2</sub>	6.23	90.00	8.63	8.33	5.70	2.59	23.78
CD (0.05)	NS	NS	NS	NS	NS	NS	NS

### **On-farm fertilizer trial in cashew**

These trials were conducted Pazhayannur and Kadavallur panchayats. It was observed that treatment with 1000:250:250g NPK/tree (200% of NRCC recommendation) led to the highest yield (587g/tree) at one location whereas treatment with 750:325:750g NPK/tree (KAU recommendation) resulted in highest yield of 3950g/tree at the second location (Table 2.8).

**Table 2.8 : Effect of fertilizer doses on nut yield of cashew at Madakkathara**

<b>Fertilizer doses ( g NPK/tree)</b>	<b>Nut yield (g/tree/annum)</b>	
	<b>Location 1</b>	<b>Location 2</b>
T <sub>1</sub> - 500:125:125	2500	520
T <sub>2</sub> - 750:187.5: 187.5	2738	567
T <sub>3</sub> - 1000: 250: 250	2806	587
T <sub>4</sub> - 750: 325: 750	3950	535
T <sub>5</sub> - fully organic	2450	528

### **VRIDHACHALAM**

The maximum canopy diameter (6.95m) and maximum annual nut yield (6.82kg/tree) were recorded in treatment with 1000:125:250g NPK/plant (Table 2.9).

**Table 2.9 : Vegetative & yield characters in Cashew NPK fertilizer trials at Vridhachalam**

Treatment details		Mean plant height (m)	Mean stem girth (cm)	Mean canopy diameter (m)	Mean annual nut yield (Kg/tree.)	Cum yield kg/tree for 5 years
T <sub>1</sub>	N <sub>0</sub> P <sub>0</sub> K <sub>0</sub>	4.10	45.60	6.02	3.50	7.53
T <sub>2</sub>	N <sub>0</sub> P <sub>0</sub> K <sub>1</sub>	3.52	48.82	6.25	3.15	7.33
T <sub>3</sub>	N <sub>0</sub> P <sub>0</sub> K <sub>2</sub>	3.57	44.05	5.58	3.45	8.41
T <sub>4</sub>	N <sub>0</sub> P <sub>1</sub> K <sub>0</sub>	3.71	44.50	5.62	4.56	11.50
T <sub>5</sub>	N <sub>0</sub> P <sub>1</sub> K <sub>1</sub>	3.33	42.00	5.70	4.00	9.51
T <sub>6</sub>	N <sub>0</sub> P <sub>1</sub> K <sub>2</sub>	3.64	38.62	5.55	4.90	12.41
T <sub>7</sub>	N <sub>0</sub> P <sub>2</sub> K <sub>0</sub>	3.53	39.60	5.62	3.80	8.55
T <sub>8</sub>	N <sub>0</sub> P <sub>2</sub> K <sub>1</sub>	4.12	44.52	5.45	4.50	10.48
T <sub>9</sub>	N <sub>0</sub> P <sub>2</sub> K <sub>2</sub>	3.55	48.10	5.62	4.73	10.63
T <sub>10</sub>	N <sub>1</sub> P <sub>0</sub> K <sub>0</sub>	3.90	30.20	4.73	4.95	12.45
T <sub>11</sub>	N <sub>1</sub> P <sub>0</sub> K <sub>1</sub>	3.95	30.72	5.43	5.50	13.38
T <sub>12</sub>	N <sub>1</sub> P <sub>0</sub> K <sub>2</sub>	4.30	37.62	5.55	5.10	12.70
T <sub>13</sub>	N <sub>1</sub> P <sub>1</sub> K <sub>0</sub>	3.62	31.62	5.92	5.50	13.16
T <sub>14</sub>	N <sub>1</sub> P <sub>1</sub> K <sub>1</sub>	4.41	40.25	5.82	5.25	12.80
T <sub>15</sub>	N <sub>1</sub> P <sub>1</sub> K <sub>2</sub>	4.50	31.62	5.83	5.32	13.03
T <sub>16</sub>	N <sub>1</sub> P <sub>2</sub> K <sub>0</sub>	4.26	41.50	5.80	5.70	14.38
T <sub>17</sub>	N <sub>1</sub> P <sub>2</sub> K <sub>1</sub>	4.52	41.72	5.85	5.73	14.40
T <sub>18</sub>	N <sub>1</sub> P <sub>2</sub> K <sub>2</sub>	4.26	42.52	5.96	5.65	14.28
T <sub>19</sub>	N <sub>2</sub> P <sub>0</sub> K <sub>0</sub>	4.65	41.20	6.20	5.73	14.77
T <sub>20</sub>	N <sub>2</sub> P <sub>0</sub> K <sub>1</sub>	4.66	42.20	6.25	6.00	14.97
T <sub>21</sub>	N <sub>2</sub> P <sub>0</sub> K <sub>2</sub>	4.65	43.50	6.35	5.85	14.83
T <sub>22</sub>	N <sub>2</sub> P <sub>1</sub> K <sub>0</sub>	4.65	49.35	6.43	5.30	13.84
T <sub>23</sub>	N <sub>2</sub> P <sub>1</sub> K <sub>1</sub>	4.68	49.52	6.62	5.52	14.73
T <sub>24</sub>	N <sub>2</sub> P <sub>1</sub> K <sub>2</sub>	4.80	50.50	6.95	6.82	16.48
T <sub>25</sub>	N <sub>2</sub> P <sub>2</sub> K <sub>0</sub>	4.80	48.50	6.72	6.20	14.70
T <sub>26</sub>	N <sub>2</sub> P <sub>2</sub> K <sub>1</sub>	4.85	46.20	6.80	6.56	15.54
T <sub>27</sub>	N <sub>2</sub> P <sub>2</sub> K <sub>2</sub>	4.88	58.01	6.65	6.65	15.78
CD (0.05)		0.0967**	0.2217**	0.0812**	0.1797**	0.1737**

## **Agr.2: Fertilizer application in high density cashew plantations**

### ***Centres : East Coast :***

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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### ***West Coast :***

Madakkathara, Pilicode and Vengurla

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### ***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.

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### **SUMMARY:**

At Bhubaneswar, flowering was advanced by 15 days ahead with higher doses of fertilizer, and the number of flowering panicles/m<sup>2</sup> (16.22) and the number of nuts per panicle was maximum in highest doses of fertilizer M<sub>3</sub> (8.10). The vegetative characters were significantly influenced by spacing on fertilizer dosage at Chintamani, Jagdalpur and Madakkathara, Vengurla and at Vridhachalam.

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### **Experiment Details :**

Design	:	Split plot
Main plot : Plant density	:	S <sub>1</sub> 200 plants/ha (10m x 5m) S <sub>2</sub> 400 plants/ha (6m x 4m) S <sub>3</sub> 600 plants/ha (5m x 4m)
Sub-plot : Fertilizer dose/ha	:	M <sub>1</sub> 75kg N, 25kg P <sub>2</sub> O <sub>5</sub> , 25kg K <sub>2</sub> O M <sub>2</sub> 150kg N, 50kg P <sub>2</sub> O <sub>5</sub> , 50kg K <sub>2</sub> O M <sub>3</sub> 225kg N, 75kg P <sub>2</sub> O <sub>5</sub> , 75kg K <sub>2</sub> O
Total area	:	2.5 ha
Fertilizers application level	:	1 <sup>st</sup> year : 1/5 <sup>th</sup> 2 <sup>nd</sup> year : 2/5 <sup>th</sup> 3 <sup>rd</sup> year : 3/5 <sup>th</sup> 4 <sup>th</sup> year : 4/5 <sup>th</sup> 5 <sup>th</sup> year : Full dose

## BAPATLA

The plant height was maximum with 75kg N, 25kg P and 25kg K with 600pl/ha (2.47m) and the stem girth was also maximum (30.77m) in this treatment (Table 2.10).

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

Treatment	Plant height (m)	Stem girth (cm)	Canopy spread (m)	
			E-W	N-S
M <sub>1</sub> S <sub>1</sub>	1.59	28.43	2.55	2.46
M <sub>1</sub> S <sub>2</sub>	1.81	29.90	2.94	2.76
M <sub>1</sub> S <sub>3</sub>	2.47	30.77	3.10	3.10
M <sub>2</sub> S <sub>1</sub>	1.31	21.03	1.68	1.80
M <sub>2</sub> S <sub>2</sub>	1.86	25.10	2.28	2.36
M <sub>2</sub> S <sub>3</sub>	0.65	7.31	0.79	0.82
M <sub>3</sub> S <sub>1</sub>	1.45	24.73	2.11	2.13
M <sub>3</sub> S <sub>2</sub>	1.84	27.50	2.61	2.56
M <sub>3</sub> S <sub>3</sub>	1.56	19.04	1.95	1.96

## BHUBANESWAR

Maximum plant height was recorded in S<sub>2</sub> (400trees/ha) followed by S<sub>3</sub> (600trees/ha). Girth was maximum in S<sub>1</sub> (200trees/ha) followed by S<sub>2</sub>. The mean canopy spread was non significant among the treatments.

Significant variation was observed in plant height wherein M<sub>3</sub> recorded maximum plant height (3.93m) which was statistically on par with M<sub>2</sub> but significantly superior to M<sub>1</sub>. There was no significant variation in the plant height, stem girth and canopy spread of the plant due to interaction effect of spacing and doses of fertilizer (Table 2.11 a & b).

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

**a). Effect of spacing (Main plot)**

Treatment	Plant height (m)	Stem girth (cm)	Canopy spread (m)
	2005	2005	2005
S <sub>1</sub>	3.72	44.97	4.72
S <sub>2</sub>	3.98	43.44	4.65
S <sub>3</sub>	3.79	42.58	4.71
F 'test'	NS	NS	NS
SE (m) ± CD 5%	0.1	0.9	0.09



**b) Effect of doses of fertilizer (sub plot) at Bhubaneswar**

Treatment	Plant height (m)	Stem girth (cm)	Mean canopy Spread (m)
	2005	2005	2005
M <sub>1</sub>	3.72	43.44	4.59
M <sub>2</sub>	3.84	44.27	4.74
M <sub>3</sub>	3.93	43.28	4.76
F 'test'	*	NS	NS
SE (m) ±	0.06	0.66	
CD5%	0.13	-	

The no. of flowering panicles was significantly more in S<sub>1</sub> (16.44) compared to S<sub>3</sub>, S<sub>1</sub> and S<sub>2</sub> were found statistically at par. The no. of nuts per panicle was maximum in S<sub>3</sub> (7.20) and minimum in S<sub>1</sub> (6.40). The cumulative yield for 3 years was found maximum in S<sub>1</sub> (6.63 kg) followed by S<sub>2</sub> (6.50) indicating that increase in the plant population led to significant variation in nut yield/ha.

Flowering was advanced by 15 days ahead with higher doses of fertilizer. The no. of flowering panicles/m<sup>2</sup> and the no. of nuts per panicle was maximum in highest doses of fertilizer M<sub>3</sub> (8.10). The yield of nut per plant did not significantly vary due to varying doses of fertilizer application.

M<sub>2</sub> was significantly superior to M<sub>3</sub> but M<sub>2</sub> and M<sub>1</sub> were statistically at par with respect to cumulative yield which was highest in M<sub>2</sub> (6.74kg) and minimum in M<sub>1</sub> (6.28 kg). M<sub>2</sub> was significantly superior to M<sub>3</sub>. The cumulative yield was highest in M<sub>2</sub> (24.68) followed by M<sub>3</sub> and M<sub>1</sub> (Table 2.12 a & b).

No significant variation was observed among the treatments with respect to flowering and yield attributes. The yield per plant was found highest (3.98kg) in S<sub>2</sub>M<sub>2</sub>.

**Table 2.12 : 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 <sup>2</sup>	No. of nuts /panicle	Nut weight (g)	Yield/plant (kg) (2005)	Cumulative yield (3 years)	Yield Kg/ha (2005)
S <sub>1</sub>	16.44	6.40	7.70	3.77	6.63	753.00
S <sub>2</sub>	15.97	6.90	7.70	3.72	6.50	1489.00
S <sub>3</sub>	14.11	7.20	7.50	3.45	6.32	1729.00
F 'test'	*			NS		*

**b) Effect of doses of fertilizer (Subplot) at Bhubaneswar**

Treatments	No. of flowering panicles/m <sup>2</sup>	No. of nuts/panicle	Nut weight (g)	Yield/plant (kg) (2005)	Cumulative yield (3 years)	Yield Kg/ha (2005)
S <sub>1</sub>	15.35	6.00	8.13	3.74	6.28	1353.00
S <sub>2</sub>	16.22	6.80	7.70	3.85	6.74	1406.00
S <sub>3</sub>	14.95	8.10	7.07	3.55	6.64	1212.00
F 'test'	*			*		*

Leaf nutrient analysis indicated that the leaf nitrogen percentage was maximum in S<sub>1</sub> (2.13%) followed by S<sub>2</sub> (1.96%). M<sub>3</sub> led to maximum leaf Nitrogen 2.18% followed by M<sub>2</sub> (2.05%) while the combination S<sub>1</sub>M<sub>3</sub> recorded maximum leaf N (2.27%) and minimum in S<sub>3</sub>M<sub>1</sub> (1.62%) (Table 2.13 a).

The P levels increased with increased doses of P<sub>2</sub>O<sub>5</sub> and was maximum in M<sub>3</sub> (0.045%). The leaf K content showed similar trend as P. Maximum K was recorded in S<sub>3</sub> (0.41%), followed S<sub>2</sub> (0.37%) (Table 2.13 b & c).

**Table 2.13 (a) : Leaf Nitrogen content under fertilizer & spacing trials at Bhubaneswar.**

	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	Average
S <sub>1</sub>	1.96	2.16	2.27	2.13
S <sub>2</sub>	1.68	2.05	2.15	1.96
S <sub>3</sub>	1.62	1.95	2.12	1.90
Average	1.75	2.05	2.18	

**Table 2.13 (b) : Leaf phosphorous content under fertilizer and spacing trials at Bhubaneswar.**

	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	Average
S <sub>1</sub>	0.034	0.038	0.043	0.038
S <sub>2</sub>	0.043	0.039	0.046	0.043
S <sub>3</sub>	0.039	0.043	0.046	0.043
Average	0.038	0.040	0.045	

**Table 2.13 (c) : Leaf Potassium content (%) under fertilizer & spacing trials at Bhubaneswar.**

	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	Average
S <sub>1</sub>	0.21	0.44	0.35	0.33
S <sub>2</sub>	0.27	0.46	0.38	0.37
S <sub>3</sub>	0.31	0.48	0.44	0.41
Average	0.26	0.46	0.39	

## CHINTAMANI

No significant effect was observed in plant height and stem girth due to different levels of spacing. During first year of harvest, the yield of nuts varied significantly among the levels of spacing. The highest yield per plant was recorded in S<sub>1</sub> (200pl/ha) (0.97kg) and the least was recorded in S<sub>3</sub> (600pl/ha) (0.36kg).

The varying levels of fertilizers showed non-significant variation in plant height and stem girth, canopy spread, canopy height, canopy area and yield per plant. The interaction effect of varying levels of spacing and doses of fertilizers showed no significant variation in plant height, stem girth, canopy spread, canopy height, canopy area and yield per plant (Table 2.14).

**Table 2.14 : Effect of spacing fertilizer application on growth and yield at Chintamani**

Treatments	Plant height (m)	Stem girth (cm)	Mean canopy spread (m)	Yield (kg/plant)	Yield (kg/ha)
S <sub>1</sub>	2.82	38.93	4.20	0.97	194.83
S <sub>2</sub>	2.68	36.56	3.65	0.43	170.33
S <sub>3</sub>	2.62	36.41	3.71	0.36	190.41
CD (0.05)	NS -	NS -	NS -	** 0.14	NS -
M <sub>1</sub>	2.69	37.84	3.83	0.67	209.50
M <sub>2</sub>	2.74	38.94	3.90	0.51	168.00
M <sub>3</sub>	2.69	35.12	3.81	0.58	178.08
S Em	NS 0.13	NS 2.79	NS	NS 0.11	NS 29.28

## JAGDALPUR

The plant height, stem girth, canopy spread, nut weight and yield/ tree were found non significant for all the treatments. Higher nut weight (6.79 g) was found under treatment S<sub>3</sub>M<sub>3</sub> and it was at par S<sub>1</sub>M<sub>3</sub> (6.79g) and S<sub>2</sub>M<sub>3</sub> (6.63g). The yield /tree (g) was recorded to be highest for S<sub>3</sub>M<sub>3</sub> (513.49) (Table 2.15).

**Table 2.15 : Effect of spacing and fertilizer application in high-density cashew plantations at Jagdalpur**

Treatment	Plant height (m)	Stem girth (cm)	Canopy Spread		Nut weight (g)	Yield/ tree (g)	Yield/ha (Kg)	
			E - W	N - S				
S <sub>1</sub> M <sub>1</sub>	1.31	23.00	168.33	133.00	6.36	110.63	22.13	
S <sub>1</sub> M <sub>2</sub>	1.26	19.50	177.03	191.67	6.47	183.04	36.61	
S <sub>1</sub> M <sub>3</sub>	1.76	26.91	198.33	206.89	6.79	437.99	87.60	
S <sub>2</sub> M <sub>1</sub>	1.20	21.78	183.00	173.00	6.36	121.89	50.71	
S <sub>2</sub> M <sub>2</sub>	1.63	23.72	177.03	177.03	6.46	228.52	95.07	
S <sub>2</sub> M <sub>3</sub>	1.77	23.00	185.60	185.60	6.63	384.54	159.97	
S <sub>3</sub> M <sub>1</sub>	1.31	20.33	136.00	158.50	6.36	111.30	55.65	
S <sub>3</sub> M <sub>2</sub>	1.54	21.33	137.03	190.00	6.46	191.54	95.77	
S <sub>3</sub> M <sub>3</sub>	1.57	22.67	186.00	191.00	6.79	513.49	256.47	
CD @ 5%	S	NS	NS	Ns	NS	NS	NS	52.96
	M	24.27	2.28	21.06	16.18	0.05	104.61	49.21
	S x M	NS	NS	NS	*	NS	NS	NS

## JHARGRAM

The plant height was maximum (3.24m) with moderate spacing (400trees/ha) and highest dose of fertilizer (225:75:75 – NPK) and the stem girth was maximum with highest density of planting (600trees/ha) and minimum dose of fertilizer (75:25:25 – NPK) (27.78cm). The mean canopy spread was however not significantly different between the spacings and was maximum at the lowest as well as highest density of planting (3.19m) (Table 2.16).

**Table 2.16 : Effect of spacing and fertilizer application in high-density cashew plantations at Jhargram**

Treatment	Plant height (m)	Stem girth (cm)	Mean canopy spread (m)
S <sub>1</sub> M <sub>1</sub>	3.08	23.55	3.19
S <sub>1</sub> M <sub>2</sub>	3.09	24.89	3.09
S <sub>1</sub> M <sub>3</sub>	3.05	23.67	2.96
S <sub>2</sub> M <sub>1</sub>	2.93	22.78	2.92
S <sub>2</sub> M <sub>2</sub>	3.13	22.89	2.79
S <sub>2</sub> M <sub>3</sub>	3.24	22.45	3.23
S <sub>3</sub> M <sub>1</sub>	3.01	27.78	3.19
S <sub>3</sub> M <sub>2</sub>	3.26	25.45	3.14
S <sub>3</sub> M <sub>3</sub>	3.03	24.44	2.99

### MADAKKATHARA

Tree densities, fertilizer doses or their interaction did not significantly influence any of the growth parameters (Table 2.17).

Lower density of planting at 200 trees/ ha lead to maximum spread (E-W 4.46m; N-S 4.34m). The cumulative nut yield per tree (2004-05) (kg/tree) showed a decreasing trend with increasing density of planting (0.30 at 200tree/ha, 0.29 at 400tree/ha and 0.26 at 600tree/ha) and the per hectare yield showed an increasing trend (61.0 at 200tree/ha, 117.0 at 400tree/ha and 132.0 at 500tree/ha) which is due to the higher number of trees available per unit area.

The data on tree height did not show any definite trend with the variation in fertilizer doses. Canopy spread (both N-S and E-W) and stem girth, however, increased marginally with increasing levels of fertilizer. The maximum cumulative nut yield (113.0kg/ha) was recorded at a fertilizer dose of 75:25:25kg NPK/ha

**Table 2.17 : Interaction effect between plant density and fertilizer doses on growth and yield of cashew at Madakkathara**

Treatments	Plant height (m)	Stem girth (cm)	Canopy spread – NS (m)	Canopy spread – EW (m)	Annual yield (kg/ tree/ year) (2004-05)
S <sub>1</sub> M <sub>1</sub>	4.02	52.63	4.16	4.58	0.28
S <sub>1</sub> M <sub>2</sub>	4.20	55.94	4.37	4.27	0.25
S <sub>1</sub> M <sub>3</sub>	4.07	57.14	4.50	4.54	0.36
S <sub>2</sub> M <sub>1</sub>	4.14	51.54	3.71	3.63	0.36
S <sub>2</sub> M <sub>2</sub>	3.97	51.78	4.06	4.30	0.25
S <sub>2</sub> M <sub>3</sub>	4.27	57.64	4.20	4.40	0.26
S <sub>3</sub> M <sub>1</sub>	4.26	54.55	4.04	4.20	0.27
S <sub>3</sub> M <sub>2</sub>	4.39	58.99	4.17	4.55	0.29
S <sub>3</sub> M <sub>3</sub>	4.12	52.33	4.05	4.30	0.22
CD (0.05)	NS	NS	NS	NS	NS
SEm	0.17	2.51	0.20	0.25	0.06

## PILICODE

The trials were laid out during 2000, the results indicated that canopy spread was comparatively more in N-S direction (2.68 to 3.35m) rather than the E-W direction (2.62 to 3.13m). Even though at wider spacing ( $S_1$ ) vigorous vegetative growth was noticed the yield per ha was significantly higher in  $S_3$  (519kg/ha), because of the more number of plants per unit area (Table 2.18). The effect of fertilizers on biometric characters indicated an increased vigour in growth and yield in  $M_1$  (Table 2.19). The interaction effect of fertilizers and spacings also showed an increased vegetative growth and significantly higher yield of cashew nut per hectare in the treatment of  $S_3M_1$  (667kg/ha) and in other closer spacing treatments ( $S_3$  and  $S_2$ ) irrespective of fertilizer combinations during the initial years of establishment of the plantations. The yield was lowest (193kg/ha) in  $S_1M_2$  (the treatment with wider spaced plants and receiving moderate dose of fertilizers) (Table 2.20).

**Table 2.18 : Effect of spacing on biometric characters of cashew in high density planting at Pilicode**

Treatment	Plant height (m)	Stem girth (cm)	Mean canopy spread(m)		Yield (Kg/ha)
			E-W	N-S	
$S_1$	2.46	31.03	2.89	3.14	219.00
$S_2$	2.84	30.47	2.96	3.05	477.00*
$S_3$	2.85	30.77	2.95	3.00	519.00*
CD 0.05	0.22	NS	NS	NS	

**Table 2.19: Effect of Fertilizers on biometric characters of cashew in high density planting at Pilicode**

Treatment	Plant height (m)	Stem girth (cm)	Mean canopy spread(m)		Yield (Kg/ha)
			E-W	N-S	
$M_1$	2.88	31.77	3.03	3.23	465.00
$M_2$	2.59	30.02	2.82	2.96	363.00
$M_3$	2.68	30.48	2.95	2.99	387.00
CD 0.05	NS	NS	NS	NS	NS

**Table 2.20 : Mean of growth characteristics of cashew under fertilizer application in high density planting at Pilicode**

Treatment	Plant height (m)	Stem girth (cm)	Mean canopy spread(m)		Yield (kg) per plot	Yield (Kg/ha)
			E-W	N-S		
S <sub>1</sub> M <sub>1</sub>	2.47	31.32	3.02	3.07	6.80	227.00
S <sub>1</sub> M <sub>2</sub>	2.42	29.33	2.62	2.76	5.78	193.00
S <sub>1</sub> M <sub>3</sub>	2.90	32.43	3.04	3.29	6.57	237.00
S <sub>2</sub> M <sub>1</sub>	3.00	30.65	2.95	3.08	6.70	501.00
S <sub>2</sub> M <sub>2</sub>	2.76	30.78	3.02	3.13	6.77	447.00
S <sub>2</sub> M <sub>3</sub>	2.74	29.98	2.92	2.93	6.33	484.00
S <sub>3</sub> M <sub>1</sub>	3.17	33.32	3.13	3.35	7.73	667.00
S <sub>3</sub> M <sub>2</sub>	2.58	29.94	2.82	2.99	4.80	450.00
S <sub>3</sub> M <sub>3</sub>	2.80	29.04	2.89	2.68	5.30	442.00
CD 0.05	NS	NS	NS	NS	NS	

## VENGURLA

The trial is in initial stage. The results indicated non significant variation for all the growth and yield parameters. The maximum yield per hectare was found in the treatment S<sub>2</sub>M<sub>2</sub> (124.00 kg/ha) whereas cumulative yield of 413.00kg/ha was recorded in S<sub>3</sub>M<sub>3</sub> (Table 2.21).

**Table 2.21 : Effect of spacing and fertilizer on growth and yield of cashew at Vengurla**

Treatment	Mean plant height (m)	Mean stem girth (cm)	Mean canopy spread (m)	Mean no. of panicle/ m <sup>2</sup>	Nut wt. (g)	Yield kg/tree	Yield kg/ha	Cum. yield for 2 harvests (kg/ha)
S <sub>1</sub> M <sub>1</sub>	3.80	48.13	5.37	23.02	8.76	0.27	55.00	113.20
S <sub>1</sub> M <sub>2</sub>	4.02	5.26	5.62	21.84	9.00	0.18	37.80	149.60
S <sub>1</sub> M <sub>3</sub>	3.72	50.41	5.54	21.51	9.41	0.23	46.40	229.20
S <sub>2</sub> M <sub>1</sub>	3.57	46.27	4.16	25.86	9.27	0.29	119.60	165.20
S <sub>2</sub> M <sub>2</sub>	4.07	47.97	8.87	22.12	9.08	0.31	124.00	187.20
S <sub>2</sub> M <sub>3</sub>	3.69	47.08	4.58	18.94	9.56	0.16	66.40	126.40
S <sub>3</sub> M <sub>1</sub>	4.53	54.34	4.99	21.63	9.53	0.22	113.00	342.50
S <sub>3</sub> M <sub>2</sub>	4.02	52.50	4.76	23.72	9.38	0.23	118.50	355.00
S <sub>3</sub> M <sub>3</sub>	4.35	48.38	4.86	20.61	9.54	0.18	92.00	413.00
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	-	-

## VRIDHACHALAM

The treatment M<sub>3</sub>S<sub>3</sub> (5 x 4m spacing with 225:75:75 kg NPK/ha) recorded the highest per unit area yield of 1625 kg/ha however the yields were not statistically significant (Table 2.22).

**Table 2.22 : Effect of spacing and fertilizer application on growth and yield of cashew at Vridhachalam**

<b>Treatment</b>	<b>Plant height (m)</b>	<b>Stem girth (cm)</b>	<b>Canopy spread (m)</b>	<b>Nut weight (g)</b>	<b>Yield/ tree (kg)</b>	<b>Yield (kg/ ha)</b>
M <sub>1</sub> S <sub>1</sub>	4.25	23.21	3.85	5.80	2.55	510
M <sub>1</sub> S <sub>2</sub>	3.90	33.62	3.80	5.90	2.61	522
M <sub>1</sub> S <sub>3</sub>	3.30	21.53	3.78	5.90	2.85	570
M <sub>2</sub> S <sub>1</sub>	3.66	28.43	3.96	6.10	2.80	1120
M <sub>2</sub> S <sub>2</sub>	3.79	27.00	4.15	5.92	2.95	1180
M <sub>2</sub> S <sub>3</sub>	3.86	22.52	3.66	6.12	2.95	1180
M <sub>3</sub> S <sub>1</sub>	3.80	31.40	4.40	6.12	3.00	1500
M <sub>3</sub> S <sub>2</sub>	3.70	23.30	3.75	5.80	3.23	1615
M <sub>3</sub> S <sub>3</sub>	4.15	28.25	4.35	5.90	3.25	1625
CV% (S)	3.17	1.52	2.53	1.99	7.85	2.55
CV% (M x S)	6.32	0.72	3.51	0.65	4.71	1.00



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

### *Centres : East Coast :*

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

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### *West Coast :*

Madakkathara and Vengurla

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### *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.

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### **SUMMARY:**

At Bapatla, the growth parameters did not vary significantly during the initial stage of crop under normal and high density planting. The yield per tree was marginally high under normal density as compared to high density planting system during the 6<sup>th</sup> harvest at Madakkathara.

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### **Experimental Details :**

Planting of cashew at 4m x 4m with control plot at 8m x 8m spacing with recommended fertilizer dosage

### **BAPATLA**

The crop is in the initial stage of vegetative growth. Growth parameters were recorded and presented in Table 2.23. The plant height was marginally higher in high density planting (1.00m) as compared to normal density planting (0.85m).

**Table 2.23: Growth parameters in observational trial on high density planting in cashew at Bapatla**

<b>Mean Growth Parameters</b>	<b>Normal Density Planting ( 8x8m )</b>	<b>High Density Planting ( 4x4m )</b>
Pl. Height (m)	0.85	1.00
Stem girth (cm)	15.50	19.50
Canopy spread E-W (m)	1.50	1.62
Canopy spread N-S (m)	1.50	2.00

## BHUBANESWAR

The trial was laid out with H 2/16 with a spacing of 4 x 4m during 1996 with recommended fertilizers. The plants had a maximum height of 5.20m and hence were pruned at 3.00m during 2004. The yield (tons/ha) recorded was 1.60 in 2004 and 2.40 tons in 2005.

In the farmers' field, under high-density spacing with Vengurla-4 at 4<sup>th</sup> harvest 1.75tons/ha of annual nut yield was realized during 2004, and at 5<sup>th</sup> harvest the yield was 2.50 tons/ha during 2005.

## CHINTAMANI

The plants were pruned to an height of 3.00m during 2005. The nut yield per tree from five harvests ranged from 0.65 to 5.80kg. The yield per hectare ranged from 406 to 1250kg (828.00kg/ha) and the cumulative yield of 5 harvests ranged from 1031 to 3625kg/ha (2328.00kg/ha) (Table 2.24).

**Table 2.24 : Growth parameters and yield in observational trial on high density planting in cashew at Chintamani.**

Parameter		Mean
Pl. height (m)		4.00
Stem girth (cm)		41.00
Canopy spread (m)	E-W	3.40
	N-S	3.65
Yield (kg/tree)		1.33
Yield (kg/ha)		828.00
Cumulative Yield (5 harvests)	Kg/tree	3.73
	Kg/ha	2328.00

## JHARGRAM

### On farm trials on high density planting

The cashew varieties, BPP-8 & BLA-39-4 were evaluated in farmers' plots under high density planting system. The growth parameters of these varieties are presented in Table 2.25.

**Table 2.25 : Growth parameters in observational trial on high density planting in cashew at Jhargram**

Treatment	Plant Height (m)	Stem Girth (cm)	Mean canopy diameter (m)	Canopy height (m)	Canopy area (m <sup>2</sup> )
BPP-8	1.42	10.50	1.26	1.28	2.82
BLA 39-4	1.37	10.22	1.21	1.27	2.67

## MADAKKATHARA

The yield per tree was marginally high under normal density as compared to high density planting system during the 6<sup>th</sup> harvest. The comparable growth of trees under high density and normal density planting systems in the initial growth period led to comparable yield per tree. Tree height, tree girth and canopy spread were marginally high in normal density planting (Table 2.26).

**Table 2.26 : Effect of high density planting on growth and yield attributes and cumulative yield of cashew for 6 harvests at Madakkathara**

<b>Parameters</b>	<b>High density planting</b>	<b>Normal planting</b>
Mean plant height (m)	6.72	6.81
Mean stem girth (cm)	78.6	82.00
Mean canopy spread - NS (m)	7.45	7.60
Mean canopy spread - EW (m)	7.30	7.55
Mean yield (kg/tree/annum)	3.52	3.66
Mean yield (kg/ha/annum)	2197.0	572
Mean cumulative yield (kg/ tree)	18.95	19.43
Mean cumulative yield (kg/ha)	11841.0	3036

## VENGURLA

The plant height under high density trials ranged between 5.46 to 6.70m and the mean stem girth was 59.00cm and mean canopy area was 119.91m<sup>2</sup> which ranged between 92.48 to 218.56m<sup>2</sup>.

### **Agr.3: Drip irrigation trial**

*Centres : East Coast :*

Vridhachalam

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*West Coast :*

Vengurla

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*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.

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#### **Experimental Details :**

**Treatments :** 5

T1 : No Irrigation

T2 : Irrigation 20% of cumulative pan evaporation.

T3 : Irrigation 40% of cumulative pan evaporation.

T4 : Irrigation 60% of cumulative pan evaporation.

T5 : Irrigation 80% of cumulative pan evaporation.

Spacing = 7 x 7m

Planting material = Softwood grafts

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

#### **CHINTAMANI**

Grafts were planted in the year 1997. Treatments were re-imposed during March-2006. The vegetative characteristics recorded during 2005 were mean plant height of 4.58m, stem girth of 65.70cm, canopy spread of 7.25m in E-W and canopy spread of 7.88m in N-S with an average yield of 5.45 kg/plant.

#### **VENGURLA**

Grafts were planted in the year 1999 in 5 x 5m spacing and the treatments were first imposed during the year 2000. The plant growth and yield observations recorded are presented in Table. 2.27. The different treatments did not differ significantly for plant growth characters and yield, in the same way as seen in the previous year, probably due to overlapping of canopy. The closer spacing coupled with irrigation treatments have resulted in faster overlapping of canopy. Hence it is felt that some remedial measures need to be taken to contain the canopy so that adverse effect of overlapping of canopy on treatmental differences is removed.

**Table 2.27 : Effect of drip irrigation on growth and yield parameters of cashew at Vengurla**

<b>Treatment</b>	<b>Mean plant height (m)</b>	<b>Mean stem girth (cm)</b>	<b>Mean canopy spread (m)</b>	<b>Mean flowering duration (days)</b>	<b>No. of nuts per panicle</b>	<b>Mean nut weight (g)</b>	<b>Nut yield during the reporting year (kg/plant) (2<sup>nd</sup> harvest)</b>	<b>Cumulative yield (kg/plant) for two harvests</b>
T <sub>1</sub> : No Irrigation	4.67	60.16	6.66	87.38	3.00	9.85	1.36	2.67
T <sub>2</sub> : Irrigation 20% CPE	4.59	63.70	6.66	89.63	3.13	9.87	1.14	2.52
T <sub>3</sub> : Irrigation 40% CPE	4.57	61.49	6.65	88.07	3.05	9.90	1.55	3.20
T <sub>4</sub> : Irrigation 60% CPE	4.53	62.91	6.60	90.91	2.95	9.75	1.50	2.86
T <sub>5</sub> : Irrigation 80% CPE	4.33	61.24	6.62	87.57	2.83	9.90	1.69	3.48
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	

## **Agr.6: Intercropping in Cashew**

*Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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*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.

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### **SUMMARY:**

Maximum C:B ratio was observed in F<sub>1</sub> level for both green gram (1:1.1) and black gram (1:1.10) at Bapatla. The return of intercrop was highest in colocasia (Rs.5,880/ha) followed by brinjal (Rs.4,166/ha) at Bhubaneswar and the total return from main and intercrop was highest in Cashew + colocasia (Rs.17,000/ha) followed by Cashew + cowpea (Rs. 15,263/ha) and T<sub>1</sub> (Cashew + brinjal) (Rs.14,666/ha). At Jhargram, the intercrops which yielded maximum in cashew were cluster bean (47.69q/ha), groundnut (2.42q/ha) and pigeon pea (7.05q/ha) under 50 per cent of recommended fertilizer doses and black gram yielded maximum (4.87q/ha) with full dose of fertilizers. Black gram led to the highest C:B ratio of 1:2.1 followed by groundnut (1:1.19) at Vridhachalam, however groundnut resulted in maximum net profit of Rs.16,187/ha.

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### **Experimental Details :**

Main plot : 4  
Sub plots : 3  
F<sub>0</sub> = No additional fertilizer to the intercrop  
F<sub>1</sub> = Additional fertilizer to the intercrop as per the state recommendation  
F<sub>2</sub> = 50% of additional fertilizer applied to the intercrop  
No. of replications : 3  
Design : Split plot

### **BAPATLA**

The growth performance of main crop indicated a mean plant height of 3.51m, mean stem girth of 55.40cm, mean canopy spread (6.57m).

Green gram and black gram were grown as inter crops as late kharif during the season. In green gram, the treatments F<sub>1</sub>, F<sub>2</sub> and F<sub>0</sub> recorded the mean grain yield of 150.0, 97.0 and 75.0 kg/ha respectively and in black gram, the mean grain yield was 165.0, 108.0 and 75.0kg/ha respectively. Maximum C:B ratio was observed in F<sub>1</sub> level for both green gram(1:1.11) and black gram (1:1.10) (Table 2.28).

**Table 2.28 : Yield and returns of inter crop trial at Bapatla**

Treatments	Mean Yield from intercrops	Total cost of intercrops/ha (Rs)	Total returns from intercrops/ha (Rs)	Net profits/ha (Rs)	C:B ratio
	Per ha (kg)				
T1 Cashew+Green gram + F <sub>0</sub>	75.0	3200.00	2100.00	6700.00	1:0.63
T2 Cashew+Green gram + F <sub>1</sub>	150.0	4200.00	3400.00	13000.00	1:1.11
T3 Cashew+Green gram + F <sub>2</sub>	97.0	3600.00	2800.00	9500.00	1:0.84
T4 Cashew+Black gram + F <sub>0</sub>	75.0	3400.00	2400.00	6600.00	1:0.61
T5 Cashew+Black gram + F <sub>1</sub>	165.0	4800.00	4800.00	13650.00	1:1.10
T6 Cashew+Black gram + F <sub>2</sub>	108.0	3800.00	3200.00	10050.00	1:0.89
T7 Cashew alone	--	--	--	6600.00	1:0.88

## **BHUBANESWAR**

Vegetable crops such as brinjal, cowpea, chilli, bhindi, pumpkin, colocasia were evaluated for their economic suitability as intercrops with different doses of fertilizer.

The height of the plant was maximum in T3 and T6 (3.80m) each. The stem girth varied between 18cm in T7 to maximum of 26cm in T3. The mean canopy spread of the plant was maximum in T3 (4.40m) and it is ranged from 2.35m to 4.40m. The mean nut yield per plant was maximum in T3 (1.80kg per tree).

The return of intercrop was highest from the intercrop in T<sub>6</sub> colocasia (Rs.5,880/ha) followed by T1 brinjal (Rs.4,166/ha). The total return from main and intercrop was highest in T6 (Cashew + colocasia) (Rs.17,000/ha) followed by T3 (Cashew + cowpea) (Rs. 15,263/ha) and T1 (Cashew + brinjal) (Rs.14,666/ha) (Table 2.29).

**Table 2.29 : Vegetative character and yield per plant and per ha. of cashew at Bhubaneswar**

Treatment		Mean plant height (m)	Mean stem girth (m)	Mean canopy spread (m)	Yield (kg/plant) 1 <sup>st</sup> harvest	Mean nut yield (kg/ha)	Net return (Intercrops) (Rs/ ha)	Net return (Rs/ha) (Main crop + inter-crop)
T1	Cashew + brinjal (Blue Star)	3.50	22	4.35	1.50	300	4166	14666
T2	Cashew + chilli (Sindhur)	3.70	25	4.20	1.40	280	3004	12804
T3	Cashew + cowpea (SEB-2)	3.80	26	4.40	1.80	360	2663	15263
T4	Cashew + bhindi (BO-2)	3.70	24	3.70	1.60	320	2550	13750
T5	Cashew + pumpkin (Baidyabati)	3.40	23	3.90	1.40	280	3950	13750
T6	Cashew + colocasia (Local)	3.80	25	4.10	1.60	320	5880	17000
T7	Cashew alone	2.50	18	2.35	0.80	160	Nil	5600

## JHARGRAM

The intercrops occupied 80.40 per cent area of which maximum yield was obtained in cluster bean (47.69q/ha), groundnut (2.42q/ha) and pigeon pea (7.05q/ha) under 50 per cent of recommended fertilizer doses and black gram yielded maximum (4.87q/ha) with full dose of fertilizers. Cost-benefit ratio indicated that pigeon pea was the most remunerative intercrop (1:4.15) under cashew plantation followed by cluster bean (1:3.89) and black gram (1:2.98). Highest return was from cashew with pigeon pea (F<sub>1</sub>) (Rs.17,885/ha) followed by cashew with cluster bean (F<sub>0</sub>) (Rs.17,227/ha).



**Table 2.30 : Performance of inter crops in between cashew plants at Jhargram.**

Treatment Details			Cashew yield (Q/ha)	Inter crop yield Q/ha	Net Return (Rs.)	Cost : Benefit Ratio
T1	Cashew + cluster bean	(F <sub>0</sub> )	1.38	26.85	17227.35	1:3.89
T2	Cashew + cluster bean	(F <sub>1</sub> )	1.43	47.69	13946.55	1:3.03
T3	Cashew + cluster bean	(F <sub>2</sub> )	1.78	37.40	10690.35	1:1.64
T4	Cashew +Groundnut	( F <sub>0</sub> )	1.18	2.12	2684.41	1:0.30
T5	Cashew +Groundnut	(F <sub>1</sub> )	1.00	2.42	1382.35	1:0.13
T6	Cashew +Groundnut	( F <sub>2</sub> )	0.86	2.42	-558.85	-----
T7	Cashew +Pigeon pea	( F <sub>0</sub> )	1.60	5.70	16658.35	1:4.15
T8	Cashew + Pigeon pea	(F <sub>1</sub> )	1.20	7.05	17885.35	1:3.92
T9	Cashew + Pigeon Pea	( F <sub>2</sub> )	0.99	6.25	14504.85	1:2.83
T10	Cashew + Black Gram	( F <sub>0</sub> )	1.15	1.71	6667.96	1:2.17
T11	Cashew + Black Gram	( F <sub>1</sub> )	1.20	2.49	8695.87	1:2.41
T12	Cashew + Black Gram	(F <sub>2</sub> )	1.46	4.87	15347.35	1:2.98

**MADAKKATHARA :**

Tapioca recorded the highest total return (Rs.66,374/ha), highest net profit (Rs.41,049/ha) and C:B ratio (1:2.62), among the various tuber crops raised as intercrop in the young cashew plantation.. Amorphophallus recorded the highest total return next to tapioca (Rs.66,181/ha); but in terms of net profit and C:B ratio it was inferior to coleus and colocasia. This was largely due to the higher cost of production of amorphophallus, owing mainly due to the high cost of planting material. Coleus and colocasia ranked second and third, respectively, in the net profit and C:B ratio as indicated in the Table 2.31.

**Table 2.31 : Economics of intercropping in cashew at Madakkathara**

Intercrop	Mean yield of intercrop		Total return from intercrop (Rs./ha)	Cost of cultivation (Rs/ ha)	Net profit (Rs./ha)	C: B ratio
	(Kg/ plot)	t / ha *				
Coleus	28.20	10.87	65,220	29,725	35,495	1:2.19
Colocasia	33.00	12.72	63,600	29,800	33,800	1:2.13
Tapioca	49.20	18.96	66,374	25,325	41,049	1:2.62
Sweet potato	21.40	8.24	49,494	26,315	23,179	1:1.88
Amorphophallus	40.00	15.57	66,181	39,600	26,581	1:1.67

Plot size 22.68 m<sup>2</sup> \* Area planted with inter crops/ha : 8742 m<sup>2</sup>

## VRIDHACHALAM

Black gram led to the highest C:B ratio of 1:2.1 followed by groundnut (1:1.19). However, groundnut resulted in maximum net profit of Rs.16,187/ha (Table 2.32). Medicinal plants namely, *Ocimum sanctum*, *Phyllanthus niruri*, *Catharanthus roseus* have been established in the interspaces of cashew.

**Table 2.32 : Performance of different intercrops in cashew at Vridhachalam**

Treatments		Yield (Intercrops) (kg/ha)	Net profit (Rs./ha)	C:B ratio
T <sub>1</sub>	Cashew + Black gram	1000.50	12150.00	1:2.1
T <sub>2</sub>	Cashew + Gingelly	281.25	1143.75	1:0.27
T <sub>3</sub>	Cashew + Green gram	500.00	2550.00	1:0.46
T <sub>4</sub>	Cashew + Groundnut	1562.50	16187.50	1:1.19

### **III. CROP PROTECTION**

### III. CROP PROTECTION

#### Ent. 1: Chemical Control of pest complex in cashew

#### Expt. 3. Evaluation of insecticides for control of TMB and other insect pests

*Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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*West Coast :*

Madakkathara and Vengurla

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*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.

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#### SUMMARY:

All the insecticidal treatments were on-par, but superior over the untreated control after second and third sprays in respect of shoot tip caterpillar as well as leaf and blossom webber at Bapatla. All the new insecticides viz., hostathion,  $\lambda$ -cyhalothrin and profenophos were at par with the recommended spray schedule at Bhubaneswar. The mean number of thrips per panicle was 4.35 in boron treated trees whereas it was 5.34 per panicle in control trees at Bhubaneswar. Carbaryl (0.1%),  $\lambda$ -cyhalothrin (0.003%) and profenophos (0.05%) were most effective against TMB infestation resulting in higher yields of 5.50, 4.78 and 4.65kg nuts per tree, respectively at Chintamani. The highest nut yield (142.37 kg/ha) was obtained in triazophos treatment which was at par with profenophos (116.64 kg/ha) at Jagdalpur, while at Jhargram, the highest nut yield of 6.90kg/tree was recorded in recommended spray schedule followed by profenophos (6.60kg/tree). At Madakkathara and Vengurla,  $\lambda$ -cyhalothrin (T4) was the most effective treatment in controlling the target pests. The mean annual nut yield was also the highest in the recommended spray schedule (7.0kg/tree) followed by profenophos (6.60kg/tree) at Vridhachalam.

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#### Experimental details:

T1 = Recommended sprays for the region      T4 =  $\lambda$ -cyhalothrin 0.003%

T2 = Chlorpyrifos 0.05%                              T5 = Profenophos 0.05%

T3 = Triazophos 0.1%                                T6 = Control

## BAPATLA

Due to the negligible incidence of insect pests, the first spray was not given and only second and third sprays were imposed. Among the foliage and flower feeders the damage by shoot tip caterpillar, ranged between 0.32 to 0.41 per cent at 30 days after second spray and 0.22 to 0.52 per cent at 30 days after third spray. The leaf and blossom webber damage was reduced to 0.21 to 0.33 per cent and 0.21 to 0.44 per cent at 30 days after second and third spray, respectively. All the insecticidal treatments were on-par but superior over the untreated control both at 30 days after second and third sprays in respect of both pests.

With respect to thrips damage triazophos 0.1% and profenophos 0.05% were superior and on-par with a damage score of 0.41 and 0.47, respectively. The yield varied from 3.95 to 4.07kg/tree in different treatments without any statistical significance due to very low pest load during the season (Table 3.1).

**Table 3.1: Efficacy of certain new insecticides against pest complex in cashew at Bapatla during 2005-06 season**

Treatment	Shoot tip caterpillar damaged shoots (%)			Leaf and blossom damaged shoots (%)			Thrips damage grade at 30 days after 3 <sup>rd</sup> spray (0-4 scale)	Yield /tree (kg.)
	Before spraying	30 days after 2 <sup>nd</sup> spray	30 days after 3 <sup>rd</sup> spray	Before spraying	30 days after 2 <sup>nd</sup> spray	30 days after 3 <sup>rd</sup> spray		
Endosulfan 0.05% at flowering and carbaryl 0.1% at nut development stage	1.68	0.32a	0.43a	1.44	0.32a	0.22a	0.61b	4.07
Chlorpyriphos 0.05% (2 sprays)	1.31	0.33a	0.22a	0.98	0.33a	0.44 a	0.64bc	4.05
Triazophos 0.1% (2 sprays)	0.94	0.32a	0.31a	1.04	0.21a	0.21 a	0.41a	3.96
λ-cyhalothrin 0.003% (2 sprays)	0.93	0.41a	0.52a	0.93	0.21a	0.41a	0.74cd	3.95
Profenophos 0.05% (2 sprays)	1.16	0.32a	0.22a	1.27	0.32a	0.32a	0.47a	3.97
Un treated control	0.94	1.16b	0.94b	1.06	1.27b	0.74b	0.80d	4.06
CD (0.05)	---	0.32	0.38	---	0.37	0.34	0.10	NS

Figures in parentheses are square root (x+0.5) transformed values

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

## BHUBANESWAR

Infestation by shoot tip caterpillar and inflorescence thrips was noticed, whereas, the tea mosquito bug infestation was not observed during the report period.

After 1<sup>st</sup> spray, the per cent infestation of shoot tip caterpillar (*Hypatima haligramma* L.) was reduced to 1.00 to 1.95, which was significantly lower compared to control (7.26%). All the new insecticides viz., hostathion, λ-cyhalothrin and profenophos were at par with the recommended spray schedule (T1). However, λ-cyhalothrin reduced the pest infestation to lowest. (1.0% & 0.57%) both after 1<sup>st</sup> and 2<sup>nd</sup> spray respectively.

The new chemicals were at par with the recommended spray schedule in checking the infestation by inflorescence thrips, of which  $\lambda$ -cyhalothrin was the most effective (Table 3.2).

**Table 3.2 : Effect of new chemicals on different insect pests of cashew at Bhubaneswar**

Treatments	Mean no. of shoots damaged (%) due to shoot tip caterpillar			Mean nut damaged (score value) due to thrips 30 days after 3 <sup>rd</sup> spray	Nut yield (kg/tree)
	Before spray	30 days after 1 <sup>st</sup> spray	30 days after 2 <sup>nd</sup> spray		
T <sub>1</sub>	8.05 (2.92)	1.68 (1.46)	1.05 (1.24)	0.13 (0.79)	3.45
T <sub>2</sub>	8.98 (3.08)	1.95 (1.56)	1.34 (1.34)	0.17 (0.82)	3.15
T <sub>3</sub>	8.48 (3.00)	1.29 (1.32)	0.74 (1.09)	0.14 (0.80)	3.52
T <sub>4</sub>	9.55 (3.17)	1.00 (1.22)	0.57 (1.02)	0.09 (0.77)	3.71
T <sub>5</sub>	9.38 (3.14)	1.67 (1.45)	0.94 (1.16)	0.16 (0.81)	2.92
T <sub>6</sub>	8.40 (2.98)	7.26 (2.78)	4.30 (2.19)	0.33 (0.92)	3.13
CD at 5%	NS	0.30	0.33	0.07	

### Estimation of thrips damage

Borax @ 100gm/tree was applied separately after application of recommended fertilizer in 10 trees and another trees were kept as untreated check i.e. only fertilizer application and no borax. An average of 5.25 kg of nuts was harvested from boron treated trees, which was 8.10 per cent higher than control. The mean number of thrips per panicle was 4.35 in boron treated trees whereas it was 5.34 per panicle in control trees (Table 3.3).

**Table 3.3 : Effect of boron application on thrips population and yield**

Mean no. of thrips per panicle		Mean yield (kg/tree)	
Treated trees	Control trees	Treated trees	Control trees
4.35 ± 1.60	5.34 ± 1.50	5.25 ± 0.86	4.95 ± 1.05

In an observational trial, a mean of 17.20 nuts per panicle were harvested from monocrotophos treated panicles whereas 16.40 nuts harvested from control panicle. An

increase of 19.0 per cent was noticed in case of nuts harvested from insecticide treated panicles as compared to control panicles.

### Natural enemies and pollinators

The population of the natural enemies viz., spiders (*Acropes* sp., *Oxyopes* sp) lady bird beetle (*Vigna cinta*, *Menochilus sexmaculata*), mirid bug (unidentified) and pollinators viz., black ant (*Camponotus* sp) and honeybees (*Apis cerana indica*) were significantly reduced by application of insecticides.

### CHINTAMANI

At 30 days after the third spray carbaryl (0.1%), triazphos (0.1%),  $\lambda$ -cyhalothrin (0.003%) and chlorpyriphos (0.05%) were found effective with 1.06, 1.68, 2.02 and 2.08 percent infestation by TMB, respectively. Carbaryl (0.1%),  $\lambda$ -cyhalothrin (0.003%) and profenophos (0.05%) were most effective in preventing TMB infestation resulting in higher yields of 5.50, 4.78 and 4.65kg nuts per tree, respectively (Table 3.4).

**Table 3.4 : Effect of different insecticidal treatments on TMB infestation and yield in Cashew at Chintamani**

Treatment	Percent incidence of TMB on shoot and inflorescence		Yield Kg/tree
	Pre-Treatment	30 days after III spray	
T1.Monocrotophos (0.05%) and Carbaryl (0.1%)	28.48	1.06a	5.50
T2.Chloropyriphos (0.05%)	21.36	2.08a	3.06
T3.Triazphos (0.1%)	24.86	1.68a	2.98
T4. $\lambda$ -cyhalothrin (0.003%)	23.88	2.02a	4.65
T5.Profenofos (0.05%)	30.06	2.46b	4.78
T6.Control	28.02	6.68	1.22
CD@ 5%	3.05	1.34	0.99

### JAGDALPUR

The incidence of TMB damage was very low during entire period of experiment leading to non-significant damage levels on shoot and panicle, among different treatments. Treatment with  $\lambda$ -cyhalothrin resulted in least leaf caterpillar damage (31.63% in 3<sup>rd</sup> spray) while leaf folder damage was minimum (1.80).

The thrips mean damage grade at 30 days after 3<sup>rd</sup> spray was lowest in chlorpyriphos treatment on both nut and apple (0.66 and 0.30 respectively) whereas leaf miner damage was

nil in triazophos treatment. The highest yield (142.37 kg/ha) was obtained in triazophos treatment which was at par with profenophos (116.64 kg/ha) (Table 3.5).

**Table 3.5 : Efficacy of insecticides against minor insect pests of cashew at Jagdalpur**

Treatments	Percent incidence of minor pest of Cashew					Yield Kg/ha
	% Leaf caterpillar damage 30 DAS after III <sup>rd</sup> spray	% Leaf folder damage 30 DAS after III <sup>rd</sup> spray	Thrips mean damage grade at 30 days after 3 <sup>rd</sup> spray (0-4 scale)		% Leaf miner damage 30 DAS after 3 <sup>rd</sup> spray	
			On nut	On apple		
T1	29.03 (32.15)	2.74 (9.19)	0.84 (1.13)*	0.70 (1.09)	5.33 (13.31)	84.08
T2	43.66 (41.33)	4.69 (12.12)	0.66 (1.06)	0.30 (0.88)	4.07 (11.45)	100.89
T3	44.71 (41.86)	7.71 (15.79)	0.66 (1.06)	0.65 (1.06)	0.00 (0.00)	142.37
T4	31.63 (33.50)	1.80 (7.36)	0.42 (0.94)	0.67 (1.06)	5.99 (13.86)	79.76
T5	44.43 (41.50)	3.59 (10.82)	0.71 (1.09)	0.67 (1.04)	6.11 (14.17)	116.64
T6	53.17 (46.85)	8.00 (16.30)	1.44 (1.37)	1.06 (1.24)	7.20 (14.94)	68.59
<b>CD at 5%</b>	<b>(12.26)</b>	<b>(4.94)</b>	<b>(0.38)</b>	<b>(0.35)</b>	<b>(4.58)</b>	<b>45.08</b>

Figures in parentheses are square root (x+0.5) transformed values

## JHARGRAM

Profenophos was the most effective insecticide for managing leaf miner and leaf & blossom webber recording 2.90 and 2.40 percent damage of leaves and panicles respectively. The lowest apple and nut borer damage (0.80%) was recorded, in recommended spray schedule while in T5 (Profenophos) it was 0.90%. The highest yield of 6.90kg/tree was recorded in recommended spray schedule followed by profenophos (6.60kg/tree).

## MADAKKATHARA

The damage score on shoots as well as panicles varied between 0.00 (nil) to 4.00 (complete damage). The TMB population ranged between 5.00 to 9.75 after second spray (Table 3.6).



**Table 3.6 : Efficacy of different insecticides against damage by tea mosquito bug in cashew at Madakkathara**

Treatments	Incidence of TMB on						Nut yield (kg/tree /yr)
	Shoot			Panicle			
	Pre-treatment	30 days after		Pre-treatment	30 days after		
		2 <sup>nd</sup> spray	3 <sup>rd</sup> spray		2 <sup>nd</sup> spray	3 <sup>rd</sup> spray	
T1	0.01	0.54a	0.02	0.02	1.61a	3.57a	0.61a
T2	0.02	0.63a	---	0	1.07b	3.48a	1.43b
T3	0.00	0.45b	---	0	0.87b	3.78a	1.21b
T4	0.01	0.30b	---	0	0.66b	2.77b	3.45c
T5	0.04	0.35b	---	0.04	0.88b	4.00a	1.74b
T6	0	0.45b	---	0.20	0.99b	4.00a	1.30b
<i>DMRT</i>	ND	*	ND	ND	*	*	*

Means followed by common alphabets are not significantly different among themselves by DMRT. ND – Not done due to insufficient data-points

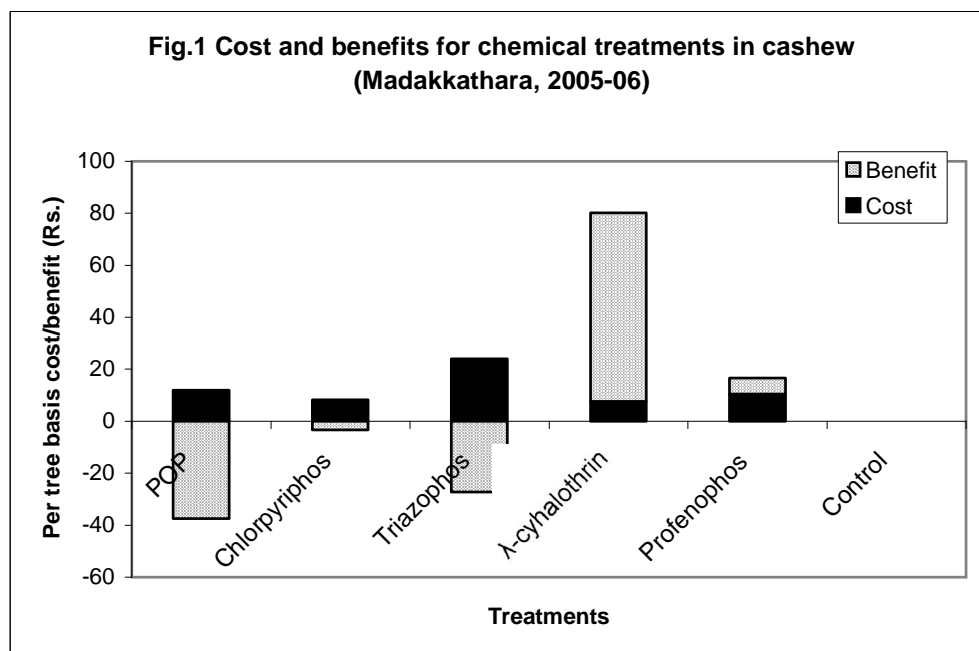
Ist spray not done due to less pest load

Amongst all treatments viz., recommended spray schedule (T1), chlorpyriphos (T2), triazophos (T3),  $\lambda$ -cyhalothrin (T4) and profenophos (T5); the treatment with  $\lambda$ -cyhalothrin was found effective in reducing panicle infestation during second and third spray.

$\lambda$ -cyhalothrin (T4) was effective in controlling the target pests and the annual yield data showed a trend of better yield in treatments (T4, 3.45 kg/tree), which was statistically significant. The yield in untreated control was low (1.30 kg/tree) and the least yield (0.61 kg/tree) was obtained in T1 (Table 3.6), which had a higher population of 9.75 TMB adults/nymphs per 52 shoots.

Infestation of leaf miner, leaf and blossom webber as well as apple and nut borer revealed no significant variations among the treatments. Thrips population ranged between 1.23 to 2.17 in different treatments and was 1.63 in untreated trees. The nut weight in different treatments varied between 8.70 to 10.30g. In all treatments, ants and spiders were observed to be unaffected by spraying schedule.

Spraying with  $\lambda$ -cyhalothrin (T4) was most cost-effective, when calculated per tree basis, as well as profitable offering an income of Rs.72.50 per tree. Treatments T1 (Recommended spray schedule), T2 (Chlorpyriphos) and T3 (Triazophos) resulted in loss during the current year (Fig.1).



## VENGURLA

All insecticidal treatments significantly reduced TMB incidence over control in cashew (11.54 per cent) of which ( $\lambda$ -cyhalothrin 0.003%) was significantly superior (3.85 per cent), over rest of the treatments.  $\lambda$ -cyhalothrin 0.003% was also found to be significantly superior over rest of the treatments in reducing thrips damage; 3.25 on apple and 4.25 on nuts.  $\lambda$ -cyhalothrin recorded lowest incidence of apple and nut borer (9.50) while shoot tip caterpillar infestation was significantly lowest (Nil) in  $\lambda$ -cyhalothrin treatment.

$\lambda$ -cyhalothrin 0.003% was found to be significantly superior over rest of the treatments which yielded a maximum of 6.81 kg/tree followed by triazophos 0.01% (5.61 kg/tree) (Table 3.7).

**Table 3.7 : Incidence of tea-mosquito bug and other minor pests at 30 days after 3<sup>rd</sup> spray in various treatments at Vengurla**

Sl. No.	Treatment details	TMB	Thrips population		Apple and nut borer	Yield (Kg/tree)
			Apple	Nut		
T1	Recommended spray schedule	9.85 (18.05)	12.81 (20.94)	12.33 (20.68)	11.63 (19.91)	4.47
T2	Chlorpyrifos 0.05%	6.97 (15.22)	8.56 (16.96)	7.88 (16.35)	14.00 (21.97)	4.62
T3	Triazophos 0.01%	5.53 (13.39)	5.67 (13.69)	5.67 (13.76)	10.99 (19.28)	5.61
T4	$\lambda$ -cyhalothrin 0.003%	3.85 (10.96)	3.25 (10.29)	4.25 (11.87)	9.50 (17.95)	6.81
T5	Profenophos 0.05%	7.57 (15.54)	7.13 (15.32)	9.50 (14.05)	11.57 (19.82)	4.87
T6	Untreated control	11.54 (19.70)	19.50 (26.41)	19.44 (26.14)	15.19 (22.87)	4.00
C.D. at 5%		3.18	3.18	3.01	2.76	0.56

\* Figures in parenthesis are arc sine transformed values

## VRIDHACHALAM

The least damage score (Nil) by TMB was noticed in T1 followed by T5 (Profenophos) (1.60) followed by T4 ( $\lambda$ -cyhalothrin) (2.20). Least damage by leaf miner (3.00% damaged leaves), leaf and blossom webber (5.90% damaged shoots) and apple and nut (0.60% damaged fruits) was noticed in T1 (recommended spray schedule) which also lead to the highest yield of 7.00kg/tree which was found par with T5 (Profenophos) which resulted in nut yield of 6.60kg/tree (Table 3.8).

**Table 3.8 : Evaluation of insecticides for control of tea mosquito bug and other minor pests at Vridhachalam**

Treatment		TMB score	Leaf miner damaged leaves (%)	Leaf and blossom damaged shoots (%)	Apple and nut borer damaged fruits (%)	Yield (kg/tree)
T1	Recommended spray schedule	0.00	3.00	5.90	0.60	7.00
T2	Chlorpyriphos 0.05%	3.00	3.60	7.75	0.95	6.20
T3	Triazophos 0.01%	3.00	4.20	8.90	1.10	5.70
T4	$\lambda$ -cyhalothrin 0.003%	2.20	4.40	8.75	1.00	5.60
T5	Profenophos 0.05%	1.60	3.33	6.38	0.80	6.60
T6	Untreated control	2.60	8.33	10.40	1.60	1.80

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

### Expt. 2. Curative control trial

#### *Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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#### *West Coast :*

Madakkathara and Vengurla

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#### *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.

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#### **SUMMARY:**

At Bapatla, lindane 0.2% was efficient having 54.54 to 75.00 percent trees without re-infestation followed by carbaryl 0.1% with 45.45 to 66.67 percent trees without re-infestation. Chlorpyrifos (0.2%) led to maximum recovery (85%) and only extraction of grub could also lead to 40 per cent of treated trees without reinfestation at Bhubaneswar. Chlorpyrifos (0.2%) led to different percentages of treated trees without re-infestations; at Jagdalpur (66.66), Jhargram (100.0), Madakkathara (94.90), Vengurla (93.33), while monocrotophos (0.3%) led to 87.50 per cent of treated trees without re-infestation.

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#### **Treatments :**

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

#### **BAPATLA**

Among the curative treatments, lindane 0.2% was better with 75.00 percent of treated trees without re-infestation followed by carbaryl 1.0% with 66.67 percent of treated trees without re-infestation, other treatments were on par with the control (Table 3.9).

**Table 3.9 : Efficacy of certain insecticides as curative treatment against cashew stem and root borer at Bapatla**

Treatment	% trees without reinfestation/ persistent attack
Carbaryl 1.0%	66.67
Chlorpyrifos 0.2%	58.33
Monocrotophos 0.2%	41.67
Lindane 0.2%	75.00
Untreated check	33.33

Recovery of treated trees was influenced by percentage of bark circumference damage wherein more than 60.60% of the trees which recovered had 25 to 50 per cent of bark circumference damaged while 70.30% of trees which had more than 75% of the bark circumference damaged could not recover. All the trees with yellowing of canopy succumbed to CSRB infestation (Table 3.10).

**Table 3.10 : Physical parameters of treated cashew trees reinfested / without reinfestation at Bapatla under curative control trials**

Parameters		No. of trees in each category	
		Without re-infestation	With re-infestation / persistent infestation
Stem girth (cm.)	< 60	11	---
	60-80	14	9
	80-100	5	11
	> 100	3	7
Age (Years)	< 5	---	---
	5-10	---	---
	10-15	33	27
	> 15	---	---
% Bark circumference damaged	< 25	6	2
	25-50	20	6
	50-75	7	7
	> 75	---	12
Zone	C+R	14	11
	C+S	8	7
	R	---	---
	S	11	---
	C+R+S	---	9
Canopy yellowing	Yellowed	3	30
	Not yellowed	27	---
	Total	30	30

## BHUBANESWAR

Maximum recovery (78.0%) was noticed in treatment with chlorpyrifos (0.2%) followed by monocrotophos (0.2%) (70.0%) whereas only 32.0% of treated trees could recover with extraction of grubs alone. Maximum recovery of treated trees was noticed when less than 25% of bark circumference was damaged and incidence was restricted to collar and stem zone (Table 3.11 and 3.12).

**Table 3.11 : Percentage infestation of CSRB under curative control trial at Bhubaneswar**

Treatments	No. of trees without reinfestation	% of trees without reinfestation
T1 Carbaryl 1.0%	26	52
T2 Chlorpyrifos 0.2%	39	78
T3 Monocrotophos 0.2%	35	70
T4 Lindane 0.2%	32	64
T5 <i>Metarrhizium anisopliae</i> fungus spawn 250gm/tree + 500gm neem cake	21	42
T6 Treated check	16	32

**Table 3.12 : Physical parameters of trees observed under curative trial of CSRB at Bhubaneswar**

Physical parameters of trees observed		No. of trees in each category	
		Without reinfestation	With reinfestation
1	2	3	4
Stem girth (in cm)	<60	128	12
	60-80	41	99
	80-100	-	10
	>100	-	-
Age (years)	5-10	-	-
	10-15	142	89
	>15	27	32
% Bark circumference damaged	<25	130	7
	25-50	39	112
	50-75	-	2
Zone of attack	C+R	3	20
	C+S	121	2
	R	-	3
	S	5	-
	C+R+S	40	96
Canopy yellowing	Yellowed	-	30
	No yellowing	-	270

## JAGDALPUR :

Chlorpyrifos (0.2%) (T2) led to maximum recovery of 66.66 per cent of treated trees without re-infestation. Cashew trees having stem girth of 100 cm and aged 15 years and above were observed to be susceptible to incidence of this pest. Preferential zone of attack of re-infestations by stem and root bores in cashew tree was collar and stem zone. Most of the cashew trees infested by CSRB did not show canopy yellowing. Reinfestation was maximum in trees which had bark circumference damage of 50 per cent or more (Table 3.13 and 3.14).

**Table 3.13 : Efficacy of certain insecticides as curative control against CSRB at Jagdalpur**

Treatment	% of trees without reinfestation/persistent attack
T1 : Carbaryl (1.0%)	50.00
T2 : Chlorpyrifos (0.2%)	66.66
T3 : Monocrotophos (0.2%)	60.00
T4 : Lindane (0.2%)	60.00
T5 : Untreated check (only removal of CSRB grubs followed)	20.00

**Table 3.14 : Physical parameters of trees observed under curative control against CSRB at Jagdalpur**

Physical parameters		Percentage of trees re-infested	Percentage of trees not reinfested
Stem girth	<60 cm		
	60-100 cm	19.23	15.38
	>100 cm	26.92	38.46
<b>Total</b>	<b>52</b>	<b>46.15</b>	<b>53.85</b>
Age of tree	<10 years		
	10-15 years		3.85
	>15 years	46.15	50.00
<b>Total</b>	<b>52</b>	<b>46.15</b>	<b>53.85</b>
Zone of attack	C+R	15.38	5.57
	C+S	19.23	44.23
	C+R+S	11.11	3.85
<b>Total</b>	<b>52</b>	<b>46.15</b>	<b>53.85</b>
Canopy yellowing	a) Canopy Yellowed	5.77	5.57
	b) Canopy Not yellowed	48.08	40.38
<b>Total</b>	<b>52</b>	<b>53.85</b>	<b>46.15</b>
% of bark circumference damaged	<25	17.31	25.00
	25-50	36.54	21.15
	50-75		
	>75		
<b>Total</b>	<b>52</b>	<b>53.85</b>	<b>46.15</b>

## JHARGRAM

Carbaryl (1.0%) and chlorpyrifos (0.2%) were the most effective treatments which were on par having nil reinfestation. In treated check, wherein only grub removal was done, 50% of the trees showed reinfestation (Table 3.15).

**Table 3.15 : Efficacy of different curative treatments against CSRB at Jhargram.**

Treatment	% trees without reinfestation / persistent attack
T1 Carbaryl 1.0%	100.0
T2 Chlorpyrifos 0.2%	100.0
T3 Monocrotophos 0.2%	50.0
T4 Lindane 0.2%	50.0
T5 Treated check (grub removal only)	50.0
T6 Application of neem oil 5.0% thrice	50.0

## MADAKKATHARA

Chlorpyrifos (0.2%) was found effective, with 94.90% trees without re-infestation however the other treatments also showed a similar trend. The treated check wherein only grub extraction was adopted, 81.8% of treated trees could recover (Table 3.16).

Canopy yellowing was not observed in any of the treated trees which were 33 years of age, the zone of attack was noticed in collar + root + stem. The circumference bark damaged was less than 25 per cent in most of the trees which would have resulted in similar levels of recovery in various treatments.

**Table 3.16 : Efficacy of different insecticides for curative control (post prophylaxis treatments) against CSRB at Madakkathara**

Treatments		Percentage trees without re-infestation/ persistent attack
T1	Carbaryl (1%)	84.80
T2	Chlorpyrifos (0.2%)	94.90
T3	Monocrotophos (0.2%)	85.70
T4	Lindane (0.2%)	91.80
T5	Treated check (grub extraction only)	81.80
T6	Neem oil 5% swabbing + 75g Sevidol 8%/tree	91.30



## VENGURLA

Chlorpyriphos (0.2%) recorded the highest percentage (93.33) of treated trees without reinfestation. Carbaryl (1.0%) (86.66) followed by monocrotophos (0.2%) (80.00) and lindane (0.2%) (80.00) were effective in that order regarding percentage of trees without reinfestation (Table 3.17).

**Table 3.17 : Efficiency of curative treatments against Cashew Stem and Root Borer (CSRB) at Vengurla**

Treatment	% of trees without reinfestation/ persistent attack
T1-Carbaryl (1%)	86.66
T2-Chlorpyriphos (0.2%)	93.33
T3-Monocrotophos (0.2%)	80.00
T4-Lindane (0.2%)	80.00
T5-Treated check (grub removal only)	60.00

Maximum percentage of trees without reinfestation was noticed when percentage bark circumference damage was 25-50 per cent (41.33%), zone of attack was restricted to collar and root (45.33%) and without yellowing of canopy (80.00%) (Table 3.18).

**Table 3.18 : Physical parameters of infested and uninfested cashew trees under curative control of CSRB at Vengurla**

Physical Parameters		Percentage of trees with reinfestation	Percentage of trees without reinfestation
Stem girth (cm)	<60	5.33	24
	60-80	2.67	12
	80-100	1.33	6.67
	>100	10.67	37.33
Age (in yrs)	<5	0.33	40
	5-10	-	
	10-15	-	
	>15	10.67	40
% bark circumference damaged	<25	5.33	29.33
	25-50	12	41.33
	50-75	-	8.00
	>75	2.67	1.33
Zone of attack	C+R	13.33	45.33
	C+S	4	20.00
	C+R+S	2.67	14.67
Canopy yellowing	Yellowed	-	
	Not Yellowed	20	80

## VRIDHACHALAM

Monocrotophos treatment was the most effective in preventing re-infestation of CSRB (87.50). The other promising insecticides having lower re-infestation were chlorpyriphos (T2) (76.92) and lindane (T4) (75.00) (Table 3.19).

**Table 3.19 : Efficacy of certain insecticides as curative control against CSRB at Vridhachalam**

<b>Treatment</b>	<b>No. of trees treated</b>	<b>Trees without re-infestation (%)</b>
T1-Carbaryl (1%)	16	68.75
T2-Chlorpyriphos (0.2%)	13	76.92
T3-Monocrotophos (0.2%)	16	87.50
T4-Lindane (0.2%)	16	75.00
T5-Untreated check (grub removal only)	14	0.00

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

#### *Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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#### *West Coast :*

Madakkathara and Vengurla

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#### *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.

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#### **SUMMARY:**

At Bapatla, both the maximum temperature ( $r = -0.31$ ) and minimum temperature ( $r = -0.30$ ) were found to influence the activity of the shoot tip caterpillar, while rainfall and rainy days displayed significant negative influence ( $r = -0.26$  &  $r = -0.31$ ) on the activity of inflorescence thrips. The yellow thrips were significantly positively correlated with bright sunshine hours and negatively correlated with evening RH, whereas the black thrips were significantly correlated with bright sunshine hours at Bhubaneswar. At Madakkathara, maximum and minimum temperatures, morning and afternoon RH, sunshine hours, rainfall and rainy days; only mean and minimum temperature, and rainfall was found negatively and significantly correlated with the TMB population. TMB infestation at Vengurla was negatively and significantly correlated with relative humidity and minimum temperature; thrips infestation had negative significant correlation with minimum temperature and RH. Rainfall, RH and maximum temperature had significant negative influence on leaf webber populations at Vridhachalam.

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#### **BAPATLA**

None of weather parameters influenced the activity of leaf and blossom webber. The damage by leaf miner had significant negative influence of both maximum ( $r = -0.38$ ) and minimum ( $r = -0.27$ ) temperatures and positive influence of relative humidity. The activity of leaf folder was similar to that of leaf miner with a significant negative influence of maximum temperature ( $r = -0.30$ ) and positive influence of relative humidity. Both the maximum temperature ( $r = -0.31$ ) and minimum temperature ( $r = -0.30$ ) were found to influence the activity of the shoot tip caterpillar. Significant positive influence of temperatures and negative influence of relative humidity was observed on the activity of leaf thrips. The abiotic factors *viz.*, rainfall and rainy days displayed significant negative influence ( $r = -0.26$  &  $r = -0.31$ ) on the activity of inflorescence thrips (Table 3.20).

**Table 3.20 : Correlation coefficients (r) for abiotic factors and insect pests of cashew at Bapatla**

Weather Parameters	LBW	LM	STC	LT	IT	LF
Maximum temperature °C	0.16	-0.38*	-0.31*	0.69*	-0.01	-0.30*
Minimum temperature °C	0.25	-0.27*	-0.30*	0.68*	0.02	-0.13
Relative humidity(m) (%)	-0.22	0.32*	0.20	-0.65*	-0.00	0.28*
Relative humidity (e) (%)	-0.07	0.27*	0.01	-0.41*	0.23	0.38
Rainfall	0.17	0.06	-0.08	-0.07	-0.26*	-0.16
Rainy days	0.20	0.09	0.04	-0.02	-0.31*	0.20

**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.

## **BHUBANESWAR**

Rainfall significantly and positively influenced pest incidence. RH and number of rainy days were positively correlated, while temperature and BSH has negative correlation with incidence of the shoot tip caterpillar. The yellow thrips were significantly positively correlated with Bright Sunshine Hours and negatively correlated with evening RH, whereas the Black thrips were significantly correlated with Bright sunshine hours. None of the weather parameter was significantly correlated towards incidence of apple and nut borer (Table 3.21).

The leaf miner population was significantly, positively correlated with evening RH, rainfall and no. of rainy days. Maximum temperature and BSH had negative correlation towards incidence of the pest. The weather parameter maximum temperature was significantly positively correlated towards incidence of the leaf and blossom webber. RH, rainfall and no. of rainy days has negative correlation towards incidence of the pest. The correlations indicated that RH, rainfall and no. of rainy days had significant positive correlation and BSH had significant negative correlation towards incidence of leaf beetle (Table 3.21).

The CSRB population had significant positive correlation with maximum temperature. Relative humidity, rainfall and number of rainy days had negative correlation with incidence of the pest (Table 3.21).

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

Name of the insect pest	Temperature		Relative Humidity		Rainfall	Rainy days	Bright sunshine hours
	Max.	Min.	AM	PM			
Shoot tip caterpillar (Y <sub>1</sub> )	-0.45	-0.02	0.33	0.54	0.66*	0.52	-0.28
Yellow thrip (Y <sub>2</sub> )	0.22	-0.35	0.27	-0.65*	-0.44	-0.53	0.60*
Black thrips (Y <sub>3</sub> )	0.41	-0.50	0.19	-0.52	-0.42	-0.51	0.60*
Apple and nut borer (Y <sub>4</sub> )	0.48	0.17	0.006	-0.22	0.30	-0.38	0.44
Leaf miner (Y <sub>5</sub> )	-0.11	0.21	0.50	0.71*	0.83*	0.69*	-0.43
Leaf and blossom webber (Y <sub>6</sub> )	0.80*	0.39	-0.38	-0.10	-0.23	-0.29	0.43
Leaf beetle (Y <sub>7</sub> )	-0.21	0.46	0.61*	0.88*	0.94*	0.91*	-0.67*
Cashew Stem and Root Borer (CSRB) (Y <sub>8</sub> )	0.84*	0.43	-0.006	-0.26	-0.38	-0.30	0.45

## JAGDALPUR

The multiple regression analysis indicated that morning RH negatively contributed 63% towards incidence of TMB on panicle. The abiotic factors did not influence the activity of CSRB.

The thrips damage in leaf was found throughout the year but maximum (68.85%) in 2<sup>nd</sup> week of February and minimum (6.53%) in 4<sup>th</sup> week of July. No weather parameters significantly influenced on thrips damage on leaf. The multiple regression analysis indicated that minimum temperature negatively contributed 31% towards incidence of thrips damage on leaf. The influence of weather parameters on the activity of leaf miner, leaf and blossom webber, leaf caterpillar and leaf folder was non significant (Table 3.22).

**Table 3.22 : Correlation of weather parameters with the pests of regional importance at Jagdalpur.**

Weather Parameters	% CSRB infested trees	Thrips affected		TMB		% LBW damaged shoot	% Leaf Caterpillar damaged leaves	% Leaf Folder damaged leaves	% Leaf Miner damaged leaves
		Leaves %	Panicles %	Shoot %	Panicle %				
Max. Temp °C	0.32	-0.01	0.39	0.09	0.10	-0.43	-0.46	-0.52	-0.47
Min. Temp °C	0.06	-0.47	0.37	0.03	0.14	-0.08	-0.18	-0.22	-0.14
R. H. (m) %	-0.14	0.06	-0.69**	-0.08	-0.46	0.26	0.16	0.24	0.21
R. H. (e) %	-0.30	-0.01	-0.69**	-0.17	-0.43	0.35	0.33	0.42	0.51
Rainfall	-0.17	-0.32	-0.07	-0.09	-0.18	0.03	0.16	0.25	0.14
Rainy Days	-0.13	-0.45	-0.10	-0.08	-0.19	0.14	0.10	0.14	0.01

## MADAKKATHARA

TMB damage score was nil for July to Sept and the damaged laterals were maximum in February (2.11 grade, apple & nut borers ranged from 0 to 5.64 (maximum in December). Leaf miner and thrips were present during the flushing period in varying population. Red ant (*Oecophylla smaragdina*) population ranged between 3.9 to 18.98 per 52 shoots. An unidentified ant was found tending the aphids on leaves and nut surfaces. Spiders population was within the range of 0.05 – 4.88.

Amongst the abiotic factors – maximum and minimum temperatures, morning and afternoon RH, sunshine hours, rainfall and rainy days; only mean and minimum temperature, and rainfall was found negatively and significantly correlated with the TMB population (Table 3.23).

**Table 3.23 : Simple linear correlation (r) between TMB population and weather parameters at Madakkathara.**

Max temp (°C)	Min temp (°C)	Mean temp (°C)	RH (morning) (%)	RH (afternoon) (%)	Sunshine hours (h)	Rain (mm)
- 0.27*	- 0.21	- 0.33*	0.11	- 0.01	0.11	- 0.39**

Weekly ant and spider populations were analysed for simple correlation studies. No antagonistic effect was found between ant and spider fauna. Ant nests are found harbouring the scale insects in a symbiotic relationship with *Oecophylla smaragdina*. Trophobionts like aphids, mealy bugs were found associated with the ant fauna in cashew ecosystem. Different life stages of red ant (*O. smaragdina*) were observed and documented.

## VENGURLA

The TMB infestation was negatively and significantly correlated with relative humidity and minimum temperature, while it had positive relationship with maximum temperature. The infestation of thrips had negative significant correlation with minimum temperature and RH, (morning) (Table 3.24).

**Table 3.24 : Correlation between the pest incidence and weather parameters at Vengurla.**

	<b>TMB</b>	<b>Thrips</b>
Maximum Temperature	0.15	0.04
Minimum Temperature	-0.81**	-0.82**
Morning Humidity	-0.13	-0.04
Afternoon Humidity	-0.67*	-0.64*
Rainfall	-0.64	0.62

## **VRIDHACHALAM**

Rainfall, RH and maximum temperature significantly and negatively influenced the leaf webber population, while the other pests viz., apple and nut borer, leaf miner, shoot tip caterpillar and leaf folder had no significant correlation with any abiotic factors (Table 3.25) .

**Table 3.25 : Correlation of weather parameters with the pests of region importance at Vridhachalam**

<b>Weather parameters</b>	<b>Leaf Webber</b>	<b>Nut borer</b>	<b>Leaf miner</b>	<b>Shoot tip caterpillar</b>	<b>Leaf folder</b>
Maximum temperature	-0.82**	-0.53*	-0.21 <sup>NS</sup>	-0.21 <sup>NS</sup>	-0.19 <sup>NS</sup>
Minimum temperature	-0.63*	-0.45 <sup>NS</sup>	0.04 <sup>NS</sup>	0.66 <sup>NS</sup>	0.70 <sup>NS</sup>
Relative Humidity (M)	0.74**	0.76 <sup>NS</sup>	0.12 <sup>NS</sup>	0.13 <sup>NS</sup>	0.12 <sup>NS</sup>
Relative humidity (E)	0.82**	0.53 <sup>NS</sup>	0.70*	0.72*	0.73*
Rainfall	0.76**	0.64 <sup>NS</sup>	0.71*	0.72*	0.72*

Simple correlation studies with regard to TMB revealed that only the mean maximum temperature had a significant positive correlation with *H. antonii* population and panicle infestation (Table 3.26).

**Table 3.26 : Simple correlation between panicle damage and the population of *H. antonii* with various abiotic factors at Vridhachalam**

<b>Biotic factors</b>	<b>Mean Max. Temp. (°C)</b>	<b>Mean Mini. Temp. (°C)</b>	<b>Mean Temp. (°C)</b>	<b>Average RH (%)</b>	<b>Rainfall (mm)</b>	<b>Sunshine hours</b>
Percent panicle infestation	0.66*	0.25	0.67	0.34	-0.27	0.32
TMB Population	0.73*	0.19	0.20	0.26	-0.36	0.33



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

*Centres : East Coast :*

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

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*West Coast :*

Madakkathara and Vengurla

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*Plains / others :*

Chintamani, Jagdalpur

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

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### **SUMMARY:**

Ten accessions were found to be on-par with each other having least damage of shoot tip caterpillar from 0.76-0.77 per cent at Bapatla. All the MLT-2 entries indicated susceptibility to shoot tip caterpillar and inflorescence thrips, which ranged between 24 to 50 per 10 panicles at Bhubaneswar. The minimum inflorescence thrips was seen in CARS-5 followed by CARS-3 and T-30/1 at Jagdalpur. All the germplasm accessions at Madakkathara and Vridhachalam had varying levels of susceptibility to TMB, leaf miner, leaf and blossom webber, apple and nut borer as well as inflorescence thrips.

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### **BAPATLA**

The incidence of leaf and blossom webber varied from a minimum damage of 1.14 per cent to a maximum of 3.27 per cent only in different germplasm entries at the research station. All the 53 entries did not differ statistically in their reaction against leaf and blossom webber. The following 10 entries *viz.*, T.No.40, PTRI-1, T.No.3/4, T.No.17/5, ABT-1, T.No.7/12, T.No.6/20, T.No.9/8, T.No.277 *etc.*, were found on-par with each other recording least damage of shoot tip caterpillar from 0.76 per cent to 0.77 as against the highest damage of 4.94 percent in T.No.30/1 (Table 3.27).

**Table 3.27 : Screening of germplasm against minor pests of cashew nut at Bapatla**

Entry	Leaf and blossom webber damaged shoots (%)	Shoot tip caterpillar damaged shoots (%)
Priyanka	1.56 (7.18)	1.17 (6.13)
T.No.30/1	3.27 (10.42)	4.94 (12.65)
T.No.40	2.30 (8.73)	0.77 (5.03)
PTR1-1	1.15 (6.08)	0.77 (5.03)
T.No.3 /4	1.53 (6.88)	0.77 (5.03)
BLA 139-1	2.30 (8.72)	1.15 (6.06)
T.No.17/5	1.90 (7.89)	0.76 (5.00)
BLA 39/4	1.53 (6.87)	1.15 (6.07)
ABT-1	2.67 (9.38)	0.76 (5.01)
T.No.7/12	2.29 (8.58)	0.76 (5.00)
T.No.277	1.15 (6.07)	0.77 (5.03)
BBSR-1	1.91 (7.91)	1.14 (6.05)
T.No.6/20	1.14 (6.05)	0.76 (5.00)
T.No.9/8	1.89 (7.87)	0.76 (5.00)
CD(0.05)	(NS)	(2.67)

Figures in parentheses are arc sin transformed values.

## **BHUBANESWAR**

The germplasm accessions damaged by super cyclone were replanted and other germplasms were planted during 2002. The leaf and blossom webber & shoot tip caterpillar infestation was noticed in all the accessions. The leaf and blossom webber infestation was within a range of 0 to 18.5% and shoot tip caterpillar infestation was 0 to 20.50%.

Also the MLT-2 entries were screened for shoot tip caterpillar and inflorescence thrips which indicated susceptibility of all germplasm to these pests. The inflorescence thrips population occurred in all the cashew types with a range of 24 to 50 per 10 panicles.

## **JAGDALPUR**

It was observed that the mean TMB damage was nil in NRCC Selection-2, Ullal-2 & Ullal-1, Hy- 1591, Hy-1598, CARS-4, CARS-9 and CARS-6 in shoot, while in panicle TMB mean damage score were nil in majority of entries. The minimum inflorescence thrips was seen in CARS-5 followed by CARS-3 and T-30/1. The Leaf & blossom Webber damage was not seen in VRI-2, Hy-1598, Hy-3/28, Hy-367, T-30/1, Hy-255, CARS-4, CARS-6 and CARS-9 (Table 3.28).

**Table 3.28 :** Screening of germplasm for susceptibility to regional pest incidence at Jagdalpur

Accession No.	TMB mean damage score 0-4 scale in 52 leader shoots		Leaf & blossom webber (% shoots damaged) 52 leader shoots	Inflorescence thrips (mean No. per 10 panicle)
	Shoot	Panicle		
Sel-2	-	-	1.52	2.13
Ullal-2	-	0.05	0.99	3.00
Ullal-1	-	0.08	1.29	1.33
VRI-2	0.04	0.04	-	2.13
Hy-1591	-	-	0.26	1.83
Hy-1598	-	-	-	2.38
H-3/28	0.09	0.03	-	2.50
Hy-367	0.06	-	-	1.33
T-30/1	0.20	0.38	-	0.83
Hy-255	0.25	-	-	1.96
CARS-3	0.10	-	1.21	0.83
CARS-4	-	-	-	1.92
CARS-5	0.28	-	2.39	0.75
CARS-6	-	-	-	1.33
CARS-9	-	-	-	2.00

## **JHARGRAM**

Screening was done for 44 F<sub>1</sub> hybrids planted during 2002. All the accessions were observed to have negligible pest infestation during the current year.

## **MADAKKATHARA**

In the old germplasm block, the TMB damage ranged between 0.03 to 0.51. However, in the local genotype block (2001 planted), the TMB damage score ranged between 1.10 to 1.58. All the germplasm accessions had varying levels of susceptibility to leaf miner, leaf and blossom webber as well as inflorescence thrips.

## VENGURLA

The observation on incidences of TMB on cashew was recorded throughout the year with an interval of 8 days. The variety M-44/3 recorded lowest TMB infestation (2.77%) followed by 3/33 (2.90%) and NRCC Sel-2 (2.99%) whereas the maximum per cent damage was recorded in Hy 303 (6.01%) followed by 30/1 (5.49%) and Hy-320 (5.34%) (Table 3.29).

**Table 3.29 : Screening of germplasm for susceptibility to regional pest incidence at Vengurla**

Varieties	TMB (%)	Varieties	TMB (%)
V-1	4.38	Hy-320	5.34
V-2	3.21	Hy-303	6.01
V-3	3.34	30/1	5.49
V-4	3.50	3/33	2.90
V-5	4.64	10/19	3.47
V-6	4.42	3/28	5.09
V-7	4.43	NRCC Sel-1	3.12
V-8	4.18	NRCC Sel-2	2.99
M-44/3	2.77	15/4	3.94

## VRIDHACHALAM

The 17 MLT entries and eight hybrids were screened for damage intensity by TMB, leaf & blossom webber, leaf miner, apple and nut borer.

The mean damage score due to TMB infestations in various MLT entries ranged from 1.60 - 3.40. The score was low in H 1608 and VTH 59/2 with a mean scoring of 1.60 in both the entries. Amongst the hybrids, the TMB score was low in H 17 (2.00) followed by H11 (2.30) and H 16 (2.40). However none of the entries were found susceptible to any of these pests. The leaf and blossom webber damage ranged between 12.0-20.0 while 6.0 to 8.60 per cent damage occurred due to leaf miner and apple and nut borer ranged between 1.0 and 3.0 per cent (Table 3.30).

**Table 3.30 : Screening of F<sub>1</sub> hybrids for tolerance to cashew pests at Vridhachalam**

Hybrid	Cross Combination	Percent damage			Yield (kg/tree)
		TMB	Shoot webber	Leaf miner	
H 10	M 10/4 x M 26/1	3.20	16.50	12.00	6.50
H 11	M 10/4/ x M 45/4	2.30	11.60	8.80	5.20
H 12	M 10/4 x M 75/3	3.10	15.70	13.00	5.50
H 13	M 26/2 x M 26/1	3.20	15.00	11.20	5.60
H 14	M 26/2 x M 45/4	2.50	13.60	9.50	4.70
H 15	M 26/2 x M 75/3	2.70	15.20	16.70	4.80
H 16	M 44/3 x M 26/1	2.40	13.80	13.00	4.90
H 17	M 44/3 x M 45/1	2.00	11.00	11.50	5.50

## **CHAPTER II : ORGANISATION**

## 1. HISTORY, OBJECTIVES, GROWTH AND SALIENT ACHIEVEMENTS

The All India Coordinated Spices and Cashew nut Improvement Project (AICS & CIP) was started during the fourth five year Plan in 1971. The AIC & CIP had five centres (four University Centres and one ICAR Institute based centres) identified for conducting research on cashew. These centres were located at Bapatla (Andhra Pradesh), Vridhachalam (Tamil Nadu), Anakkayam (Kerala) (Later shifted to Madakkathara), Vengurla (Maharashtra) and CPCRI, Regional Station, Vittal (Karnataka). During the fifth Plan period, one centre at Bhubaneswar (Orissa) and in sixth plan period two centres one at Jhargram (West Bengal) and another at Chintamani (Karnataka) were added. During VIII Plan period one centre at Jagdalpur (Chattisgarh) and a sub Centre at Pilicode (Kerala.) was started.

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

1. All India Coordinated Cashew Improvement Project and
2. All India Coordinated Spices Improvement Project.

The headquarters of the independent cashew project was shifted to National Research Centre for Cashew, Puttur in 1986. Presently, there are eight coordinating Centres and one sub Centre, four in the East Coast viz., Bapatla, Bhubaneswar, Jhargram, Vridhachalam, three in the West Coast viz., Madakkathara, Vengurla, Pilicode and one in the maidan parts of Karnataka – Chintamani and one in the Central India at Jagdalpur.

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

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

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

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

## ACHIEVEMENTS :

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

- Since its inception, a total of 27 high yielding cashew varieties have been developed and released to the farmers by different centres of AICRP Cashew.
- Collected local germplasm materials with desirable characters such as high yield, cluster bearing habit, bold sized nuts, short duration of flowering, off season flowering types from different cashew growing regions and are being vegetatively multiplied and field planted in different centres.
- Number of cashew accessions so far collected and conserved by the Coordinating Centres in Regional Cashew Field Gene Bank comes to 1274.
- 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<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O each per tree per year was found to be suitable.
- Intercropping with ginger, turmeric, cluster bean, black gram, horse gram, ground nut, vegetables and medicinal plants with cashew as main crop during the initial stage of orchard development were evaluated and recommended for the economic upliftment of farmers at different locations.
- Effective spray schedule for the management of tea mosquito bug and other minor pests of cashew has been devised. Monocrotophos (0.05%) at flushing and carbaryl (0.1%) at flowering and fruiting were found effective in controlling these pests.
- For the control of Cashew Stem and Root Borer (CSRB) infestation, swabbing of neem oil (5%) up to one meter height of trunk twice in a year along with soil application of Sevidol (4G) 75g/tree found to be effective in many centres. Phytosanitation was found to reduce the spread of CSRB.
- Screening of germplasm is being carried out to locate tolerant/resistant types or less susceptible to TMB and other major pests of the respective region.
- The centres have also been producing quality-planting materials for the respective regions to meet the requirement of farmers and developmental agencies.
- Developed close linkages of Centres of AICRP Cashew with State Departments of Agriculture and Horticulture, Directorate of Cashewnut & Cocoa Development (DCCD), Krishi Vigyan Kendras (KVKs) and Cashew Corporations for laying out demonstration plots in farmers' fields. Regularly cashew field days and training programmes for the benefit of farmers / development agencies are being conducted by all the Centres.



### **Salient achievements of the Project during 2005-06 :**

- A local collection, CARS-10 was found to be tolerant to short spells of low temperature (2 – 2.5°C) at Jagdalpur Centre, which had no leaf shedding as in other collections.
- Three accessions collected from Harkul, Kumbharmat and Sonoli Budruk in Coastal Maharashtra had jumbo nuts of more than 10.00g.
- Four cashew trees indicating possible tolerance to salt water inundation have been identified from Tsunami affected plantations at Cuddalore and Nagapattinam.
- Under hybridization trials, A6 was the most promising hybrid at Bhubaneswar which recorded the highest nut yield of 9.00 kg/plant, having nut weight of 9.00g and shelling percentage of 34.00. .At Vridhachalam, H 10 (M 10/4 x M 26/1) had the highest nut yield of 7.58 kg/tree out of the eight promising hybrids evaluated.
- Under NPK trials, increasing levels of all the three nutrients led to progressive increase in yield at Madakkathara with a maximum yield (5.40 kg/tree) in 500:250:250 of NPK/tree. Flowering was advanced by 15 days ahead with higher doses of fertilizer at Bhubaneswar, and the number of flowering panicles/m<sup>2</sup> (16.22) and the number of nuts per panicle was maximum (8.10) in highest doses of fertilizer (1000:250:250g NPK/pl).
- Maximum C:B ratio was observed in F1 level for both green gram(1:1.1) and black gram (1:1.10) at Bapatla. Black gram led to the highest C:B ratio of 1:2.1 followed by groundnut (1:1.19) at Vridhachalam, however groundnut resulted in maximum net profit of Rs.16,187/ha. The total returns from main and intercrop at Bhubaneswar was highest in T6 (Cashew + colocasia) (Rs.17,000/ha) followed by T3 (Cashew + cowpea) (Rs. 15,263/ha) and T1 (Cashew + brinjal) (Rs.14,666/ha).
- λ-cyhalothrin was most effective in managing the foliage pests of cashew at Bhubaneswar, Chintamani, Madakkathara and Vengurla.
- Under curative control trials, chlorpyrifos (0.2%) was the most effective treatment at Bhubaneswar, Jagdalpur, Jhargram, Madakkathara and Vengurla.

**Report on National Group Meeting of Scientists of AICRP on Cashew held at Kerala Agricultural University, Vellanikkara, Thrissur, Kerala (28<sup>th</sup> to 30<sup>th</sup> Nov. 2005).**

The National Group Meeting of Scientists of All India Coordinated Research Project on Cashew-2005 was held during 28-30<sup>th</sup> November 2005 at Kerala Agricultural University, Vellanikkara, Thrissur. Dr. K.V. Ramana, Asst. Director General (PC), ICAR inaugurated the National Group Meeting in the forenoon of 28-11-2005 in the College of Forestry, KAU. In his inaugural address Dr. K.V. Ramana mentioned that presently cashew is expanding considerably in the non-traditional areas due to profitability of the crop. He also mentioned that, hybrids developed at various centres need to be popularized, cultivation techniques especially drip irrigation needs to be given more impetus. He appreciated the good rapport developed between AICRP-Cashew Centres and their respective State Departments as well as local NGOs. Development of high yielding varieties with field tolerance to biotic and abiotic stresses, physiology of cashew flowering, organic and biodynamic farming approaches, eco-friendly plant protection techniques and development of on-farm processing machinery were some of the important areas which he felt need to be addressed immediately by cashew research workers. Dr. M.G. Bhat, Director, National Research Centre for Cashew and Project Coordinator, AICRP on Cashew, delivered the Project Coordinator's Report regarding the salient achievements under AICRP-Cashew. Dr. D. Alexander, Director of Research, KAU presided this session and mentioned in his presidential address about the possibilities of value addition of cashew kernels and utilization of cashew apples. Dr. M.K. Sheela, Director of Extension, Dr. Luckins C. Babu, Associate Dean, College of Forestry, Dr. G.S.L.H.V. Prasada Rao, Associate Dean, College of Horticulture offered the felicitations and conveyed their best wishes for the success of this National Group Meeting. A technical publication entitled "Experimental Manual on Cashew" brought out by NRCC was released by Dr. K.V. Peter, Vice Chancellor, KAU on 30-11-2005 during the Plenary Session. Other four publications brought out by KAU were also released in the Plenary Session.

The Group Meeting comprised of five technical sessions viz., Crop Improvement, Crop Management, Crop Protection, Interaction between Development Departments & Research Centres and Plenary Session. The research results obtained from different trials at the AICRP centres viz., Bhubaneswar, Chintamani, Jagdalpur, Jhargram, Madakkathara, Pilicode, Vengurla and Vridhachalam for the last 2 years were presented by the scientists of the respective disciplines from each centre. A brief highlight of deliberations during these technical sessions is given below:

The Session on Crop Improvement was chaired by Dr. K.V. Ahmed Bavappa, Former Director, CPCRI & FAO Consultant. During the session, the results from the trials on germplasm collection and maintenance, varietal evaluation and on trials regarding hybridization and selection were presented. The major decisions of this session were :-

- All the 44 released varieties (36 + 8) need to be analyzed for biochemical quality traits.
- Review the biochemistry of cashew nut and cashew apple and prepare a detailed project on in-depth study with a view to develop organic cashew with specific qualitative traits (weather supporting, nutrition) in due course.
- The entire cross combinations done so far may be reviewed in all the centres and yield level and other qualitative traits studied. On the basis of the results, decision to change the parental combinations depending upon genetic distance or any other specific character including biochemical parameters should be thought of.
- The norms fixed for selection of a variety to get qualified for release may be reviewed and the norms upgraded so that future varieties should have better level of performance than the existing ones.
- Cashew genotype Goa 11/6 developed by NRCC was recommended to be released in the name of “Bhaskara”.

The Session on Crop Management was chaired by Dr. G.S.L.H.V. Prasada Rao, Associate Dean, College of Horticulture. During the session, the results from trials on NPK fertilizer experiments, fertilizer requirements in high density planting, cashew based cropping systems and drip irrigation trials were presented. The important decisions taken in this session include :

- A separate experiment can be laid out for technology development in the case of organic farming as organic cashew is priced at high in the international market.
- There was elaborate discussion regarding the pruning and thinning of plant under high density planting. It was decided to do the pruning as a farm operation.
- Wherever, market is ensured, medicinal plants should be grown as intercrop under cashew plantation.
- The Project Coordinator suggested to initiate an experiment on “Organic management of Cashew”. The title and the details of experiment including technical programme need to be finalized by Dr. N. Yadukumar, Principal Scientist, NRCC.

The Session on Crop Protection was chaired by Dr. C.C. Abraham, Former Dean, KAU in which findings from trials on management of pest complex in cashew, evaluation of new

chemicals for control of TMB and management of bio ecology of pests, screening of germplasm to locate tolerant types for major pests were presented. The important decisions taken in Crop Protection session were :-

- In all centres, TMB incidence will invariably be recorded on a 0-4 scale as percentage incidence data for TMB is not dependable. Dosage-transfer to the canopy target areas is critical in TMB and it is therefore essential to evaluate solid cone nozzle with a narrow angle of upto 35°. This study may be taken at the NRCC.
- Prophylactic trial against CSRB may be discontinued hence forth and only curative trial will be continued.
- The data on relative susceptibility will be processed meaningfully by clustering the accession into various tolerant/ susceptibility categories. The protocols for categorization of the entries will be provided by NRCC, Puttur.
- In all centres, germplasm screening has to be done continuously for a period of four years. For this the existing germplasm collection may be utilized. At least 2 trees of each accession in the genebank will be left totally untreated, to record pest incidence.

Goa 11/6 cashew genotype developed by NRCC was recommended for release as a variety under the name “Bhaskara”. Technical programmes for next two years were formulated in Crop Improvement, Crop Management and Crop Protection disciplines.

The IV technical session on “Interaction between Development Departments and Research Centres” was chaired by Mr. P.P Balasubramanian, Director, Directorate of Cashewnut & Cocoa Development, Kochi. The representatives from Directorate of Cashew and Cocoa Development, Cashew Export Promotion Council of India, Officers of Development Department of Kerala and Progressive Farmers from Karnataka also participated. Five speakers delivered talk on different topics. The important decisions taken in this session were :-

- Survey and surveillance of cashew pests in the field is planned to be studied by DCCD, Kochi for which the co-operation from scientists of NRCC and SAU’s is sought.
- Methodology of assessment of impact of transfer of technology (TOT) in cashew cultivation need to be provided to all co-ordinating centres of AICRP on Cashew by NRCC, Puttur, so that the impact of TOT efforts can be assessed and future strategies for effective TOT can be planned.

- A team of scientists from Cashew Research Station, Madakkathara may visit cashew plantations of PCKL to assess the *Loranthus* problem in cashew gardens and suggest remedial measures.
- Processing industry need to take part in cashew development programmes so that the cashew gardens will be motivated to increase the production which in turn helps the cashew industry also.
- State development departments are advised to procure the cashew grafts for their developmental programmes from the regional nurseries of their own state.
- Cashew programmers need to be taken to narrow down the gap between cashew production and the requirement of cashew processing industry. Measures are to be taken to stop the conversion of cashew area into other commercial crops.
- Strategies are to be formulated to augment organic plant protection measures in cashew plantations.

The Plenary Session was chaired by Dr. K.V. Ramana, ADG (PC), ICAR. Dr. K.V. Peter, Vice Chancellor, KAU was the Chief Guest. In the Plenary Session, recommendations ensuing from the deliberations regarding each projects under various technical sessions were presented. The house further deliberated on these decisions which were modified wherever found essential. Dr. K.V. Ramana, ADG (PC) in his concluding remarks emphasized that the coordinating centres should be more dedicated in achieving the targets specified for their respective centres. He also mentioned that the scientific staff posted under AICRP should be retained in the same place for sufficient duration to ensure continuity of research activities. Dr. K.V. Peter, Vice Chancellor in his address mentioned the need of accelerating cashew research in Kerala. Mr. P.P. Balasubramanian, Director, Directorate of Cashewnut and Cocoa Development (Govt. of India), Kochi was felicitated in the Plenary Session for the significant contributions made by him in implementing the developmental programmes and TOT efforts in cashew during his long tenure as Director of DCCD from 1984 to 2005 and a Certificate of Appreciation was presented to him.

## 2. TRANSFER OF TECHNOLOGY :

A total of 4,43,320 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:

<b>Centre</b>	<b>No. of grafts produced</b>
Bapatla	11,060
Bhubaneswar	43,000
Chintamani	17,259
Jagdalpur	44,300
Jhargram	4,000
Madakkathara	19,223
Pilicode	9,200
Vengurla	1,05,491
Vridhachalam	1,89,787
<b>TOTAL</b>	<b>4,43,320</b>

### **BAPATLA**

Scientists of this centre imparted 15 trainings to farmers and students of Agricultural and Agri-polytechnic colleges on various aspects of cashew cultivation. Tribal farmers of Bhadrachalam were imparted training on crop production and crop protection in cashew. Nallamothuvaripalem was adopted under village adoption scheme wherein regular field visits and technical advice on various crops including cashew has been disseminated. Also technical know how on cashew production was broadcast through two radio talks from AIR, Vijayawada.

### **BHUBANESWAR**

Scientists of this centre have conducted 8 plant protection campaigns and 2 seminars on cashew production technology in tribal cashew tracts of Orissa. Three demonstration plots with high density planting have been laid out for inclusion under National Horticulture Mission. Scientists of this centre participated in radio talks and televised discussion on various aspects of cashew cultivation as well as several seminars and training programme organised by various state owned or non-government agencies.

### **CHINTAMANI**

Scientists of this centre have undertaken field visits and technical advice on cashew cultivation aspects to the cultivators of demonstration/model cashew orchards.

## **JAGDALPUR**

A total of five training programmes were conducted to impart training on cashew production technology to farmers and field staff of Horticulture/Agriculture Department. A Cashew Day was organised during March 2006 in which 900 farmers from Bastar region participated and got acquainted with cashew production technology.

## **JHARGRAM**

The centre has been monitoring six demonstration plots on the theme of high density planting in West Midnapur district. Four campaigns on vegetative propagation and agro-technics (4 nos.) and plant protection (4 nos.) were also conducted apart from three trainings on cashew cultivation in collaboration with Department of Agricultural Marketing/Horticulture. Scientists of this centre participated in Eastern Region Agricultural Fair during February 2006.

## **MADAKKATHARA**

Scientists of this centre participated in various seminars, zonal meeting and state level workshops on different aspects of cashew cultivation and related aspects. Trainings were imparted to farm officials of various state owned farms and cashew farmers on cashew production. Scientists of this centre had put up stalls depicting scientific technologies for cashew production and cashew apple products in various exhibitions. Two radio talks on cashew apple utilization, promising cashew varieties and planting techniques and a TV programme on scientific cashew cultivation have been broadcast by involving scientists of this centre.

## **PILICODE**

A total of 5 cashew demonstration plots have been monitored by the scientists of this centre. A total of 16 training programmes on cashew production and processing techniques have been conducted for the benefit of farmers and agricultural officers. Scientists of this centre recorded two radio talks on softwood grafting and nutrient management in cashew, which were broadcast from AIR, Kannur.

## **VENGURLA**

This centre had organised 5 trainings on cashew apple nut processing, cashew nursery management and integrated pest management in cashew. Method demonstration on softwood

grafting were also conducted for the benefit of local cultivators in 24 different locations. Under DCCD funding demonstration plots for high density planting have been laid out by this centre using cashew grafts of improved varieties.

### **VRIDHACHALAM**

This centre has been monitoring 85 demonstration plots in Cuddalore and Ariyaloor districts under DCCD funding. Seven trainings on cashew production technology have been organised by the scientists of this centre.

### **3. STAFF POSITION**

#### **HEADQUARTERS**

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

#### **PROJECT CENTRES**

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

Horticulturist : Dr. P. Shesha Reddy  
Asstt. Horticulturist : Dr. B. Prasanna Kumar (Upto 19.11.2005)  
Asstt. Entomologist : Dr. Gouse Mohammed  
Sr. Technical Assistant : Mr. B. Krishna Murthy (Upto 22.03.2006)  
Jr. Technical Assistant : Mr. K. Ranga Rao  
Grafter : Mr. V. Kantha Rao

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

Horticulturist : Dr. P.C. Lenka  
Jr. Horticulturist : Dr. K.C. Mohapatra  
Jr. Entomologist : Mr. R. N. Mohapatra  
Sr. Technical Assistant : Mr. P.C. Swain  
Jr. Technical Assistant : Mr. K.B. Pani  
Grafter : Mr. Laxman Biswal (From 1.10.2005)

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

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



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

Jr. Horticulturist : Mr. Dhananjaya Sharma  
Jr. Entomologist : Mr. Khoobhi Ram Sahu  
Sr. Technical Assistant : Vacant  
Grafter : Mr. Jagdev

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

Horticulturist : Vacant  
Jr. Horticulturist : Dr. Mini Poduval  
Jr. Entomologist : Dr. S. Chakraborti  
Sr. Technical Assistant : Mr. S. Sirkar  
Jr. Technical Assistant : Mrs. K. Bose  
Grafter : Mr. Jagannath Shaw

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

Horticulturist : Dr. Jose Mathew  
Jr. Breeder : Dr. Mareen Abraham  
Jr. Entomologist : Dr. G.K. Mohapatro  
Sr. Technical Assistant : Dr. Mini C  
Jr. Technical Assistant : Mr. M.K. Manoj  
Grafter : Vacant

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

Jr. Horticulturist : Dr. B. Jayaprakasha Naik  
Jr. Technical Assistant : Smt .Reshma .K. P.  
From 01.08.05 to 30.11.05

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

Horticulturist	: Dr. B.B. Sapkal (Upto 30.6.2005) Vacant since 1.7.2005
Jr. Breeder	: Mr. R.C. Gajbhiye
Jr. Entomologist	: Mr. V.N. Jalgaonkar
Sr. Technical Assistant	: Mr. R.D. Sawale
Jr. Technical Assistant	: Mr. R.L. Mayekar

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

Horticulturist	: Dr. S. Jeeva
Jr. Horticulturist	: Dr. M. S. Aneesa Rani
Jr. Entomologist	: Dr. V. Ambethgar
Sr. Technical Assistant	: Mr. S. Manickam
Jr. Technical Assistant	: Mr. S. Alagarsamy
Jr. Technical Assistant	: Mr. C. Nallaperumal (From 16.8.2005)
Grafter	: Mr. C. Gopalakrishnan

#### 4. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2005-06

##### 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	11.00	0.45	2.40	2.00	15.85	11.89	3.96
Bhubaneshwar	12.00	0.45	2.40	5.40	20.25	15.19	5.06
Chintamani	13.00	0.45	2.40	1.33	17.18	12.89	4.30
Jagdalpur	4.03	0.30	1.60	0.0	5.93	4.45	1.48
Jhargram	5.90	0.45	2.40	0.0	8.75	6.56	2.19
Madakkathara	12.00	0.45	2.40	1.20	16.05	12.04	4.01
Pilicode	3.50	0.15	0.80	2.00	6.45	4.84	1.61
Vengurla	8.50	0.45	2.40	2.67	14.02	10.50	3.51
Vridhachalam	12.00	0.45	2.40	0.67	15.52	11.64	3.88
<b>Total</b>	<b>81.93</b>	<b>3.60</b>	<b>19.20</b>	<b>15.27</b>	<b>120.00</b>	<b>90.00</b>	<b>30.00</b>

##### Actual Expenditure

(Rs. in lakhs)

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	12.87	0.09	2.39	2.00	17.35	13.01
Bhubaneshwar	13.21	0.28	2.40	5.29	21.18	15.89
Chintamani	16.83	0.08	2.40	1.33	20.64	15.48
Jagdalpur	4.45	0.13	1.58	0.00	6.16	4.62
Jhargram	5.50	0.19	2.40	0.00	8.09	6.07
Madakkathara	13.73	0.09	2.14	1.19	17.15	12.86
Pilicode	4.15	0.07	0.58	2.00	6.80	5.10
Vengurla	8.41	0.38	2.35	0.38	11.52	8.64
Vridhachalam	11.73	0.45	2.40	0.67	15.25	11.44
<b>Total</b>	<b>90.88</b>	<b>1.76</b>	<b>18.64</b>	<b>12.86</b>	<b>124.14</b>	<b>93.11</b>

## 5. MONITORING OF PROJECT BY PROJECT COORDINATOR

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

<b>Date</b>	<b>Place</b>
27 – 30 Nov. 2005	KAU, Thrissur and CRS, Madakkathara
15 Feb. 2006	SG CA&RS, Jagdalpur
16 & 17 Feb. 2006	CRS, Bhubaneswar
18 Feb. 2006	College of Agriculture, Srikakulam, Andhra Pradesh
7 Mar. 2006	RRS, Jhargram
9 – 10 Mar. 2006	ARS, Chintamani
20 Mar. 2006	RARS, Pilicode

During the visit to these centres the technical programmes allotted to each of the above centres and progress made were reviewed. Inspected the field experiments of on-going projects and gave suggestions and guidelines, wherever found necessary. University authorities were met and impediments in implementing some of the programmes were also discussed. Met Associate Dean, College of Agriculture (ANGRAU), Srikakulam on 18.02.2006 and discussed matters related to the availability of land and facilities, inspected the same for consideration of shifting AICRP-Cashew Centre from CRS, Bapatla to Srikakulam as per the recommendation of QRT (1997-2001). Progress of other centres of AICRP on Cashew was monitored by regular correspondence and telephonic conversation.

## 6. FUNCTIONING OF EACH CENTRE

### **BAPATLA**

The centre has been established during 1971. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently three projects in Crop Improvement; five in Crop Management and four in Crop Protection are being carried out. Scientists of this centre participated in Zonal Research and Extension Advisory Council Meeting for kharif and Rabi seasons 2005-06 at Eluru and Vijayawada respectively. They also participated in the State Level Technical Programme of Entomology and Horticulture at ANGRAU, Hyderabad. They participated in Kishan Mela at LAM, Guntur by arranging an exhibition on cultivation aspects of cashew and in interactive session of farmers and researchers organised by Govt. of Andhra Pradesh.

## **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; five in Crop Management and four in Crop Protection are being carried out. Scientists of this centre participated as Resource Persons in training programmes on cashew production technology, cashew, citrus and banana workshop as well as ICAR training programme on softwood grafting in cashew. They also participated in State Level Exhibitions cum Seminar organised by Dept. of Horticulture, Govt. of Orissa and training programmes organised by M/s. Nagarjuna Fertilizers Ltd.

## **CHINTAMANI**

The centre has been established in 1980. At present there are three scientists working under the project in the posts of Horticulturist, Jr. Horticulturist and Jr. Entomologist. Presently three projects in Crop Improvement, five in Crop Management and four in Crop Protection are being carried out. Scientists of this Centre are also involved in Revolving Fund Scheme for production of elite cashew grafts and training of farmers in Cashew Production Technology. Scientists of this Centre are involved in maintenance of Model Clonal Cashew Orchards funded by Directorate of Cashew and Cocoa Development, Kochi.

## **JAGDALPUR**

The centre has been established in 1993. At present there are two scientists working under the posts of Jr. Horticulturist and Jr. Entomologist under the project. Presently there are three projects in Crop Improvement, two in Crop Management and four in Crop Protection, which are allotted to the centre. The Scientists of this Centre are associated with Zilla Parishad for watershed programmes for cashew plantations and drought prone area programme on community and private lands. During the current the Cashew Day was organised to acquaint tribal farmers about cashew production technology and maintenance of trees during fruiting.

## **JHARGRAM**

The centre has been established in 1982. At present there are two scientists working under the project in the posts of Junior Horticulturist and Junior Entomologist. One post of Horticulturist is lying vacant. Presently three projects in Crop Improvement; five in Crop Management and four in Crop Protection are being carried out. Scientists of this Centre have participated in winter school on 'Trade oriented exploitation of horticulture in humid tropics – opportunity and challenges' organised at KAU, Vellayani, Kerala. The scientists of this centre participated in Eastern Region Agricultural Fair at Mohanpur by setting up a stall depicting various aspects of cashew cultivation.

## **MADAKKATHARA**

The centre has been established in 1972. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; five in Crop Management and four in Crop Protection are being carried out. This centre is involved in imparting training on different aspects of cashew cultivation with emphasis on cashew apple procession. Scientists of this Centre participated in different seminars/summer-winter schools on plant genetics, economic entomology and breeding for special attributes organised by ICAR. Stalls displaying various aspects of cashew cultivation along with sale of grafts of high yielding cashew varieties and cashew apple products were organised during Thrissur Pooram and State Level Agricultural Exhibition.

## **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 two projects, one 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 16 training programmes on cashew production and processing techniques have been conducted for the benefit of farmers and agricultural officers. Scientists of this centre recorded two radio talks on softwood grafting and nutrient management in cashew, which were broadcast from AIR, Kannur.

## **VENGURLA**

The centre has been established in 1970. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. The scientists participated in Cashew Festival at Goa. This centre had organised 5 trainings on cashew apple nut processing, cashew nursery management and integrated pest management in cashew. Method demonstration on softwood grafting were also conducted for the benefit of local cultivators in 24 different locations.

## **VRIDHACHALAM**

The centre has been established in 1971. At present three scientists are working as Horticulturist, Junior Horticulturist and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. This centre has been monitoring 85 demonstration plots in Cuddalore and Ariyaloor districts under DCCD funding. Seven trainings on cashew production technology have been organised by the scientists of this centre, in which 750 farmers from different districts have been trained.

## **7. METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2005**

### **BAPATLA**

<b>Month &amp; Year</b>	<b>Mean Max. Temp. (°C)</b>	<b>Mean Min Temp. (°C)</b>	<b>Mean RH (%)</b>		<b>Total rainfall (mm)</b>	<b>Total rainy days (No)</b>
			<b>(m)</b>	<b>(e)</b>		
Jan-05	30.30	18.60	91	70	5.40	2
Feb-05	31.70	19.30	87	67	3.00	1
Mar-05	33.00	22.80	81	74	0.00	--
Apr-05	34.90	26.20	76	72	0.00	--
May-05	37.40	27.60	73	68	14.30	3
Jun-05	40.10	28.70	64	53	16.00	3
Jul-05	34.90	25.60	75	66	127.00	9
Aug-05	35.50	25.90	76	65	82.10	7
Sept-05	32.20	24.80	84	78	352.60	11
Oct-05	31.20	23.80	89	84	377.70	15
Nov-05	30.20	19.80	86	71	31.90	3
Dec-05	29.60	18.40	87	68	7.40	1



## BHUBHANESWAR

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)
			(m)	(e)	
Apr-05	36.88	25.48	90	52	45.20
May-05	37.68	26.74	86	50	55.01
Jun-05	38.15	27.55	88	51	101.40
Jul-05	32.50	25.93	93	73	147.00
Aug-05	32.00	25.62	92	75	143.60
Sept-05	31.65	25.48	93	81	527.30
Oct-05	30.68	24.10	93	79	328.70
Nov-05	30.50	16.0	87	40	0.00
Dec-05	27.40	14.25	85	41	0.00
Jan-06	29.78	14.03	90	36	0.00
Feb-06	34.52	18.38	93	28	0.00
Mar-06	35.38	21.78	91	41	2.50

## CHINTAMANI

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)	Total rainy days (No)
			(m)	(e)		
Apr-05	32.95	19.65	79	38	46.80	7
May-05	34.12	20.20	80	42	54.80	6
Jun-05	31.36	19.08	80	50	32.70	5
Jul-05	29.35	19.62	84	57	87.60	7
Aug-05	28.80	19.30	83	58	100.80	6
Sept-05	28.40	18.95	84	57	73.20	6
Oct-05	27.10	19.34	87	69	159.00	11
Nov-05	24.62	16.45	87	68	116.00	8
Dec-05	24.67	14.60	87	60	7.40	1
Jan-06	27.30	12.54	81	41	-	-
Feb-06	30.25	12.35	67	27	-	-
Mar-06	31.65	16.90	74	39	-	-

## JAGDALPUR

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)
			(m)	(e)	
Apr-05	35.58	19.78	77	21	49.40
May-05	37.55	20.73	76	30	41.80
Jun-05	33.98	22.00	75	57	302.80
Jul-05	27.88	20.33	92	81	220.20
Aug-05	27.05	19.95	91	80	228.20
Sept-05	28.90	20.10	93	85	314.80
Oct-05	29.00	18.35	92	81	159.2
Nov-05	27.46	10.38	88	83	104.90
Dec-05	26.58	7.18	92	76	0.00
Jan-06	28.55	7.10	93	76	0.00
Feb-06	31.90	10.05	96	74	0.00
Mar-06	32.88	17.78	92	75	55.60

## JHARGRAM

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)	Total rainy days (No)
			(m)	(e)		
Apr-05	35.20	23.70	75	55	37.60	6
May-05	38.20	22.80	76	47	41.50	4
Jun-05	39.10	26.20	81	50	60.30	8
Jul-05	34.70	24.30	88	70	310.30	20
Aug-05	33.20	24.10	95	72	446.20	23
Sept-05	34.70	25.30	85	70	302.50	18
Oct-05	29.30	21.40	92	73	420.70	11
Nov-05	29.80	18.30	78	47	10.30	2
Dec-05	25.30	11.30	75	42	10.20	1
Jan-06	23.60	12.10	76	46	4.20	1
Feb-06	22.30	12.80	74	45	--	--
Mar-06	26.40	21.60	71	51	--	--

\* Unusual heavy rain in October 2005 due to depression

## MADAKKATHARA

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)	Total rainy days (No)
			(m)	(e)		
Apr-05	33.70	24.80	88	60	171.40	10
May-05	33.60	25.00	86	58	89.20	5
Jun-05	30.00	23.50	94	78	711.40	23
Jul-05	28.70	23.00	94	82	727.50	28
Aug-05	29.90	23.30	92	72	346.50	16
Sept-05	29.40	23.30	92	78	416.10	16
Oct-05	31.00	23.20	91	68	178.40	9
Nov-05	30.70	22.90	81	63	11.60	1
Dec-05	31.50	22.10	81	51	3.20	0
Jan-06	32.50	22.60	94	41	0.00	0
Feb-06	34.30	22.30	71	31	0.00	0
Mar-06	34.80	23.80	86	49	95.20	4

## PILICODE

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)	Total rainy days (No)
			(m)	(e)		
Apr-05	33.50	25.00	85	63	42.00	3
May-05	33.90	26.20	80	67	98.00	2
Jun-05	30.60	24.30	92	78	984.60	23
Jul-05	28.90	23.70	94	83	754.40	28
Aug-05	29.60	23.20	95	79	307.80	20
Sept-05	29.20	23.00	94	78	351.70	21
Oct-05	31.10	23.70	93	71	136.20	7
Nov-05	31.40	22.60	89	64	106.30	4
Dec-05	31.60	20.20	92	59	6.80	11
Jan-06	32.20	19.80	92	56	Nil	Nil
Feb-06	32.70	18.80	91	54	Nil	Nil
Mar-06	32.00	23.60	85	56	Nil	Nil

## VENGURLA

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)	Total rainy days (No)
			(m)	(e)		
Apr-05	33.25	25.44	79	66	13.20	2
May-05	34.40	27.21	73	56	52.80	2
Jun-05	31.52	26.16	88	76	745.00	22
Jul-05	29.62	25.09	89	85	1075.00	28
Aug-05	29.42	24.68	91	82	336.80	25
Sept-05	29.82	24.68	91	82	579.60	22
Oct-05	32.30	23.69	89	70	93.60	6
Nov-05	33.58	19.89	83	58	-	-
Dec-05	32.92	18.03	87	58	3.00	1
Jan-06	33.72	17.59	85	55	0.00	-
Feb-06	33.11	18.27	87	58	0.00	-
Mar-06	31.87	21.59	85	64	10.00	1

## VRIDHACHALAM

Month & Year	Mean Max. Temp. (°C)	Mean Min Temp. (°C)	Mean RH (%)		Total rainfall (mm)	Total rainy days (No)
			(m)	(e)		
Apr-05	34.90	35.43	84	69	91.60	4
May-05	37.68	38.14	82	68	146.70	3
Jun-05	37.34	37.90	81	64	53.40	1
Jul-05	37.90	38.50	78	66	35.00	1
Aug-05	38.32	37.60	80	69	273.00	10
Sept-05	36.51	37.11	88	73	231.70	10
Oct-05	35.09	35.25	86	77	188.20	12
Nov-05	29.37	26.37	88	78	525.40	12
Dec-05	29.77	26.52	88	78	548.60	8
Jan-06	30.74	26.42	90	78	9.00	2
Feb-06	34.18	26.70	89	63	-	-
Mar-06	35.33	29.42	89	71	15.40	1

## **8. RESEARCH PUBLICATIONS**

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Mareen Abraham and Jose Mathew. 2005. *Improved Cashew Varieties* (Leaflet in Malayalam). Cashew Research Station, Madakkathara.

#### **VRIDHACHALAM**

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## 10. LIST OF NRCC PUBLICATIONS

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