ISSN 0972 - 2645

अखिल भारतीय समन्वित काजू अनुसंधान परियोजना

ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

वार्षिक प्रतिवेदन
ANNUAL REPORT
2015-16

परियोजना समन्वयकर्ता
प्रो. पी. एल. सरोज

PROJECT COORDINATOR
Prof. P. L. Saroj

भा.कृ.अनु.प. – काजू अनुसंधान निदेशालय
दर्बे पोस्ट, पुत्तूर – 574 202, दक्षिण कन्नड, कर्नाटक

ICAR - DIRECTORATE OF CASHEW RESEARCH
Darbe P.O., Puttur - 574 202
Dakshina Kannada, Karnataka

Correct Citation

Annual Report 2015-16. All India Coordinated Research Project on Cashew
ICAR - Directorate of Cashew Research, Puttur, Page 1-213
ISSN 0972 – 2645

Published by

Prof. P.L. Saroj
Director
Directorate of Cashew Research, Puttur
Phone : (08251) 231530; EPABX : (08251) 230902, 236490
FAX : 08251 – 234350
E-mail : cashewresputr@gmail.com, director.dcr@icar.gov. in, dircajures@gmail.com
Grams : CAJUKENDRA, PUTTUR

DCR Website: http://www.cashew.res.in

July 2016

Compilation and Editing

Dr. Mohana G.S.

Word-processed by

Mrs. Reshma K

Hindi Translation by

A.D. Rajkumar / P.G. Bhat

Printed at

M/s. Codeword Process and Printers, Mangalore – 575 001.
Phone : (0824) 2214618, 9900100818
E-mail: codeword.process@gmail.com

CONTENTS

प्राक्कथन v

ABOUT THIS REPORT vi

CHAPTER- I : TECHNICAL

परियोजना समन्वयकर्ता की रिपोर्ट 1

Project Coordinator's Report 4

AICRP Centres 7

Executive Summary 8

Variety Released during 2015-16 9

Report of AGM - 2015 of AICRP - Cashew 11

EXPERIMENTAL RESULTS

I. CROP IMPROVEMENT

Gen.1. Germplasm collection, conservation, evaluation, characterization and cataloguing 17

Concluded trial 28

Gen.3. Varietal Evaluation Trials

1. Multilocation trial-II 29

Concluded trial 31

2. Multilocation trial-III 32

3. Performance of released varieties (MLT-V) 38

4. Multilocation trial (MLT-VI) 48

Gen.4. Hybridization and Selection 50

Gen.5. Characterization of germplasm for cashew apple 70

Gen.6. Varietal Screening of cashew apple for preparation of RTS and Jam 80

II. CROP MANAGEMENT

Hort.1a. Nutrient Management for yield maximization in cashew 95

Hort.2. Fertilizer application in high density cashew plantations 96

Hort.3. Drip irrigation trial 108

Concluded trial 112

Hort.4. Expt.2. High density planting 115

Hort.6. Intercropping in cashew 118

Hort.7. Organic management of cashew 124

Hort.8. Spacing cum fertilizer trial 133

III. CROP PROTECTION

Ent.1. Chemical control of pest complex in cashew 139
Expt.3. Evaluation of insecticides for control of TMB and other insect pests

Ent.2. Control of cashew stem and root borer 162
Expt.2. Curative control trial

Ent.3. Influence of biotic and abiotic factors on the incidence of pest complex in cashew 172

Ent.4. Screening of germplasm to locate tolerant/ resistant types to major insect pests of the region 185

CHAPTER II : ORGANISATION

1. Introduction 195

2. Transfer of technology 197

3. Publications 199

4. Staff position 202

5. Budgetary provision and actual expenditure during 2015-16 205

6. Meteorological data of different centres 207

7. List of DCR Publications 213

प्राक्कथन

यह, अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की 32वीं वार्षिक प्रतिवेदन है । इस प्रतिवेदन में अप्रैल – 2015 से मार्च – 2016 तक के शोध परिणाम और अन्य जानकारी को शामिल किया गया है।

परियोजना के अंतर्गत 14 केंद्र हैं, जो, भारत के पूर्वी तट में चार; बापट्ला (आंध्र प्रदेश), भुवनेश्वर (उड़ीसा), झारग्राम (पश्चिम बंगाल) और वृद्धाचलम् (तमिल नाडु); पश्चिम तट पर तीन केंद्र और एक उपकेंद्र जैसे, माड़कत्तरा (केरल), पिलिकोड उपकेंद्र (केरल) तथा वेंगुर्ला केंद्र (महाराष्ट्र); नवसारी (गुजरात); मैदानी भाग में तीन केंद्र, एक होगलीगेरा (कर्नाटक), दूसरा जगदलपुर (छत्तीसगढ़), तीसरा दरीसाई (झारखण्ड) में स्थित हैं और इस परियोजना के अनुसंधान कार्यसूची का कार्यान्वयन करते हैं।

इस के अतिरिक्त 3 सहयोगी केंद्र भी परियोजना के अंतर्गत कार्य कर रहे हैं। अरभावी (कर्नाटक), बारापानी (मेघालय) और गोवा में स्थित हैं।

विभिन्न अनुसंधान प्रयोगों में, प्रमुख विषयानुसार जैसे जनन द्रव्य संग्रहण एवं फसल सुधार, फसल प्रबंधन और फसल संरक्षण का कार्य जारी हैं। सभी केंद्रों द्वारा प्राप्त परिणामों को संकलित कर यह प्रतिवेदन प्रस्तुत किया गया हैं। इस प्रतिवेदन में दो प्रमुख अध्याय हैं, प्रथम – परियोजना और क्षेत्रीय तौर पर प्राप्त प्रायोगिक उपलब्धियों की तकनिकी जानकारी और द्वितीय – परियोजना के इतिहास, कर्मचारियों का विवरा, वित्तीय प्रावधान, मौसम के आँकडें, शोध प्रकाशन से संबंधित संस्थानीय जानकारी।

(पि.एल. सरोज)
निदेशक एवं परियोजना समन्वयकर्ता

स्थान : पुत्तूर–574 202
दिनांक : 23.07.2016

ABOUT THIS REPORT

This is the thirty 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 2015 to March 2016.

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

There are various ongoing research projects under major theme areas such as Germplasm Conservation and Crop Improvement, Crop Management and Crop Protection. The results reported by each centre are compiled region-wise and theme-wise and presented in this report. This report consists of two major chapters ie., Technical consisting of project wise and region wise experimental results from different centres and Organisation consisting of history, staff, budgetary provisions, functioning, meteorological data and research publications.

[P. L. SAROJ]
DIRECTOR & PROJECT COORDINATOR

Place : Puttur
Dated : 23.07.2016

CHAPTER I - TECHNICAL

परियोजना समन्वयकर्ता की रिपोर्ट

वर्तमान में काजू के अखिल भारतीय समन्वित अनुसंधान परियोजना के चौदह केंद्र है, जो देश के बारह काजू उगाने वाले विभिन्न राज्यों में स्थित हैं। इन सभी केंद्रों पर विभिन्न राज्य कृषि विश्वविद्यालयों और भारतीय कृषि अनुसंधान परिषद् के संस्थानों का प्रशासनिक नियंत्रण होता है। परियोजना का वर्ष 2015–16 का मूल बजट आबंटन रु.353.25 लाख (भा.कृ.अ.प. का शेयर) था और कुल व्यय रु.360.45 लाख (भा.कृ.अ.प. का शेयर) था ।

निम्नलिखित विधियों से काजू की उत्पादन और उत्पादकता बढ़ाना इस परियोजना का लक्ष्य है :

1. उच्च उत्पादन के साथ रोग एवं कीट सहन / निरोधी, अच्छे गिरी गुणवत्ता वाले और जैविक और अजैविक तनाव को सहने वाले किस्मों का विकास ।
2. विभिन्न कृषि–मौसमी परिस्थितियों में काजू फसल के लिए कृषि प्रौद्योगिकी का मानकीकरण ।
3. लागत प्रभावी, दक्ष पीड़क एवं रोग प्रबंधन विधियों का विकास ।

इन लक्ष्यों को पूरा करने के लिए विभिन्न प्रयोगों से प्राप्त मुख्य परिणामों को प्रतिवेदन में विविध विभागों में प्रस्तुत किया गया है ।

फसल सुधार

इस वर्ष के दौरान, 26 नए जर्मप्लाज्म एक्शेशनों (गोवा–5, झारग्राम–1, मडकतरा–2, वेंगुर्ला–1, दरीसाई–5 और तुरा–12) का विविध केंद्रों ने संचय किया है। भुवनेश्वर केंद्र के अधिक से अधिक 100 जर्मप्लाज्म एक्शेशनों, होगलगेरा से 6, झारग्राम से 31, मडकतरा से 14, पिलीकोड से 11, वेंगुर्ला से 14, वृद्धाचलम् से 9, गोवा से 14 और जगदलपुर से 10 एक्शेशनों का मूल्यांकन कर कुछ आशाजनक प्रकारों की पहचान की गई है। बहुस्थित परिक्षणों के तहत यह पाया गया है की, मडकतरा में H-303 और H-320 का निश्पादन (Performance) दूसरों तुलना में अच्छा और जगदलपुर में H-68 और V-4 का निश्पादन अच्छा पाया गया है। बहुस्थानीय परिक्षण-III में, बापटला केंद्र के 11 जीनोटाइपों के बीच BPP-8 को लगातार उपज स्तर के साथ आशाजनक पाया गया है (वार्षिक नट उत्पादन 8.16 किलो/पेड़ और संचयी उपज 54.32 किलो/पेड़)। भुवनेश्वर केंद्र में BH-85, BH-6 और H-1597 जिनोटाइपों को उनके औसत वार्षिक उपज और संचयी नट उपज के संबंध में अशाजनक पाया गया है। जहाँ तक होगलगेरा केंद्र की बात है, H-32/4 को वार्षिक और संचयी नट उपज के संबंध में आशाजनक पाया गया है अत: इसे विश्वविद्यालय के पैकेज में शामिल करने के लिए अनुमोदित किया गया है। अन्य केंद्रों में भी आशाजनक जीनोटाइपों की पहचान की गई है [मडकतरा–H-1593, H-662, वेंगुर्ला–H-662, BH-6 (सेब के वजन के लिए); वृद्धाचलम्–H-14]।

बहुस्थानीय परिक्षण–V के तहत विमोचित किस्मों / संकरों के मूल्यांकन से यह पता चला है की भुवनेश्वर में V-7 और BPP-8 धना; होगलगेरा में उल्लाल–1, चिंतामणी–1, गोवा–1 और धना (उपज के लिए) और प्रियंका (सेब वजन); पिलिकोड में प्रियंका, BPP-6 (सेब वजन); वृद्धाचलम् में VRI-3, V-4 का अच्छा निश्पादन देखा गया है। दरीसाई में H-14 ने उच्चतम उपज (5.70 किलो/पेड़) दी है, गोवा में V-8 और प्रियंका का प्रदर्शन अच्छा रहा है।

जहाँ तक संकरण और चयन के प्रयोग का प्रश्न है, कई परिक्षणें में किया गया और कुछ आशाजनक प्रकारों की सभी केंद्रों में पहचान की गई। उदाहरण के लिए बापटला में लगाए गए 2006 संकरों के बीच BPP-8 x T.No. 10/19 की संचयी नट उपज में (32.85 किलो/पेड़); BPP-6 x NRCC Sel-2 (21.45 किलो/पेड़) को आशाजनक पाया गया है। भुवनेश्वर में RP-2 x कनकाडी, OC56 x VTH711/4 और OC56 x VTH711/4 संकारों ने 8 वे तुडाई में अच्छा प्रदर्शन किया है। झारग्राम केंद्र के संकर H-37 (स्थानिय x 2/9 डायचेर्ला) में उच्चतम संचयी उपज

(71.48 किलो/पेड़) दर्ज की गई है। वेंगुर्ला केंद्र में, H-778 का 9वें तुड़ाई की संचयी उपज अत्यधिक (59.44 किलो/पेड़) दर्ज की गई है। वेंगुर्ला केंद्र में दो नए संकरों (V-4 x गोव 11/6 और V-3 x H-2/16) का निर्माण किया गया है। वृद्धाचलम् केंद्र में HC-1 (VRI-2 x VRI-3) का 7वें तुडाई की संचयी उपज अधिक (28.25 किलो/पेड़) दर्ज की गई है। गोवा में संकर-31/05 की इपज (12.45 किलो/पेड़) संकर 21/05 से (8.55 किलो/पेड़) अधिक पाई गई है। इसके अलावा विषम गुणधर्मोवाले पेरेंट्स की संकरण कर 28 नए संकर भी निर्माण किए है।

काजू सेब के जननद्रव्य के मूल्यांकन के संबंध में बापटला केंद्र में प्रियांका किस्म का प्रदर्शन काजू सेब का वजन और मिठास के लिए अच्छा पाया गया है। भुवनेश्वर में उल्लाल-4 मुल्य परिवर्धन के सभी मापदंडों के लिए बेहतर पाया गया, जबकि झारग्राम में प्रियंका किस्म रस और मिठास के लिए बेहतर पाई गई । पिलिकोड में BPP-8 और प्रियांका किस्मों को आशाजनक पाया गया, वृद्धाचलम् में VRI-2 (80% उच्चतम रस प्राप्ती) VRI-3 (उच्चतम विटामीन-C) में उपयुक्त पाए गए। जगदलपुर में, CARS-8 में अधिकतम रस प्राप्ती (73.50%) दर्ज की गई।

आर.टी.एस. और जाम तैयार करने के लिए किए गए किस्मों के मूल्यांकन के अंतर्गत बापटला में BPP-8 किस्म के उत्पाद मूल्यांकन में बेहतर पाये गये। होगलगेरा में चिंतामनी-1, जबकि झारग्राम में UN-50 और झारग्राम-1 को सबसे ज्यादा पसंद किया गया। कनबार्गी केंद्र में जाम तैयार करने के लिए V-7 और उल्लाल-4 को अच्छे अंक प्राप्त हुए जबकि आर.टी.एस. के लिए वेंगुर्ला-2 का प्रदर्शन अच्छा रहा। पारिया केंद्र में V-4 को जाम और आर.टी.एस. के लिए बेहतर पाया गया। पिलिकोड केंद्र में PLD-1 के सेब से बनाए गए उत्पादन की कुल स्वीकार्यता अधिक दर्ज की गई। जबकि वेंगुर्ला केंद्र में V-8 जाम के लिए और V-5 आर.टी.एस. के लिए बेहतर पाया गया। जगदलपुर में CARS-6 को जाम तैयार करने के लिए ज्यादा पसंद किया गया ।

फसल प्रबंधन

उच्च घनत्व रोपण प्रणाली में उर्वरक अनुप्रयोग के अंतर्गत बापटला में 10मी x 5मी (200 पेड़/हेक्टेयर) में अधिकतम नट उपज (5.43 किलो/पेड़) दर्ज की गई। रोपड़ दूरी और उर्वरोकों के बीच अंतरव्यवहार गैर महत्वपूर्ण पाया गया। जबकि, तीन साल के आँकड़ों से यह पता चला है की उच्चतम वार्षिक उत्पादन (11.43 किलो/पेड़) 10मी x 5मी की दूरी वाले पेड़ों में था, जहाँ पर उर्वरक अनुप्रयोग 75:25:25 किलो/हेक्टेयर के स्तर पर किया गया था। 6मी x 4मी (400 पेड़/हेक्टेयर) की दूरी में 150:50:50 किलो/हेक्टेयर उर्वरक की मात्रा का अनुप्रयोग ज्यादा लाभदायक पाया गया । भुवनेश्वर में लागत अनुपात 4.18 जबकि मडकतरा में 1.18 थी। झारग्राम में 10मी x 5मी की दूरी में 75:25:25 किलो/हेक्टेयर उर्वरक मात्रा के साथ लाभ : लागत अनुपात उच्चतम (10.77) दर्ज किया गया। पिलिकोड केंद्र में 6मी x 4मी वाली दूरी में (400 पेड़/हेक्टेयर) 75:25:25 किलो/हेक्टेयर के उर्वरक मात्रा के स्तर के साथ अधिकतम लाभ : लागत अनुपात (2.89) दर्ज किया गया। जबकि वेंगुर्ला में 5मी x 4मी की दूरी में 75:25:25 किलो/हेक्टेयर उर्वरक मात्रा के संयोजन से अधिकतम संचयी लाभ प्राप्त हुआ है।

टपक सिंचाई परीक्षणों में, 80 सीपीई की सिंचाई से वेंगुर्ला में अधिकतम संचई उपज 59.41 किलो/पेड़ (12 वी तुड़ाई) और वृद्धाचलम् में 35.96 किलो/पेड़ (7वीं तुड़ाई) उपज प्राप्त हुई है। बापटला केंद्र में उच्च घनत्व रोपण अवलोकन परीक्षण में यह पाया गया है कि लाभ : लागत अनुपात 4मी x 4मी दूरी में 6 फसलों के बाद घटता पाया गया, जबकि यह बापट्ला केंद्र में 8 x 8 में 1से 7वीं फसल तक वृद्धि देखी गई। झारग्राम केंद्र में, बी:सी अनुपात 4मी x 4मी दूरी में 3 फसलों तक अधिक था। अंतर - फसल पर प्रयोग में, बापटला केंद्र में गेंदे के साथ काजू की खेती से अधिक लाभ हुआ है। झारग्राम में भिंडी के साथ लाभ : लागत अनुपात उच्चतम था और पारिया केंद्र में यह अरहर के साथ था। वेंगुर्ला में चौलाई में अधिक (2.68) बी.सी. अनुपात देखा गया। काजू के जैविक प्रबंधन के मामले

में, भुवनेश्वर, वेंगुर्ला और वृद्धाचलम् में सिफारिश की गई उर्वरक की मात्रा और 10 किलो FYM के साथ अधिक उपज प्राप्त हुई जबकि झारग्राम और दरीसाई में FYM के रूप में 100% नाइट्रोजन से सबसे अधिक उपज पाई गई।

फसल संरक्षण:

चाय मच्छर कीट और अन्य कीटों के नियंत्रण के लिए कीटकनाशकों के मुल्यांकन पर प्रयोग में बापटला केंद्र में एल-सैहालौथ्रीन (0.003%) (0.6ml/l) को लिफ ब्लोसम वेबर, शूट टिप कैटरपिलर, सेब और काष्ठ्फल छिद्रक और पत्ती खान कीटों के लिए लगातार प्रभावी पाया गया है। भुवनेश्वर में शूट टिप केटरपिलर और इनफ्लोरसन्स कीटों के लिए एल-सैहालोथ्रीन (0.003%) और प्रोफेनोफॉस का संयोजन बेहतर पाया गया। होगलगेरा में TMB, सेब और काष्ठफल छिद्रक, एफिड और थ्रिप्सों के खिलाफ एल-सैहालोथ्रीन (0.003%) और प्रोफेनोफॉस का संयोजन प्रभावी पाया गया। झारग्राम केंद्र में एल-सैहालोथ्रीन (0.003%) लिफ और ब्लोसम वेबर, पत्ती खाने वाले और सेब और काष्ठफल छिद्रक के लिए प्रभावी पाया गया। कनबर्गी और मडकतरा केंद्र में TMB को नियंत्रीत करने में प्रभावी था। पारिया में एल-सैहालोथ्रीन (0.003%) को प्रभावी पाया गया । जहाँ तक वेंगुर्ला केंद्र का संबंध है, एल-सैहालोथ्रीन (0.003%) TMB के प्रबंधन के लिए बेहतर पाया गया। काजू तना और जड़ छिद्रक के उपचारात्मक नियंत्रण के लिए, बापटला, भुवनेश्वर, होगलगेरा, जगदलपुर, झारग्राम, मडकतरा, वेंगुर्ला और वृद्धाचलम् में क्लोरोपायरीफोस (0.2%) से अधिकतम सुरक्षा मिली है। विभिन्न केंद्रो पर जैसे बापटला और झारग्राम में जांच किए गए जननद्रव्यों के बीच कुछ ऐसे एक्सेशन्स की पहचान की गई है जो पत्ती खाने, पत्ती फोल्डर, शूट टिप केटरपिलर और सेब और काष्ठफल छिद्रक हेतु खुद का बचाव करने में सक्षम हैं।

प्रौद्योगिकी हस्तांतरण:

चालू वर्ष के दौरान काजू के कुल 3,62,894 कलमों का उत्पादन किया है और कई सरकारी और गैर सरकारी संस्थानों और किसानों को वितरित किए गए हैं। भुवनेश्वर केंद्र के वैज्ञानिकों ने ओडिसा राज्य काजू विकास निगम द्वारा आयोजित ''ओडिशा में व्यापक काजू विकास योजना'' में भाग लिया। काजू पर एक राज्य स्तरीय संगोष्ठी में काजू की वैज्ञानिक खेती पर दिनांक 16 और 17 मई 2015 को प्रकाश डाला जिसमें भी वैज्ञानियों ने सहभाग लिया अन्य काजू केंद्रों के वेज्ञानिकों ने भी किसानों के लाभ के लिए काजू उत्पादन तकनीक, फसल प्रबंधन, पौध संरक्षण के उपाय, मूल्य संवर्धन और तुड़ाई पश्चात् प्रबंधन पर प्रदर्शन और प्रशिक्षण कार्यक्रम शुरू किए है। टी.एस.पी. योजना के तहत मडकतरा केंद्र ने काजू में पौध संरक्षण उपायों के अलावा, नर्सरी प्रबंधन और टोप वर्कींग पर प्रशिक्षण, आदिवासी क्षेत्रों में काजू पर जागरूकता सह प्रशिक्षण कार्यक्रमों जैसे गतिविधियों को शुरु किया है। पारिया केंद्र के वैज्ञानिकों ने वैज्ञानिक काजू खेती पर समूह स्तर पर दो प्रशिक्षणों का आयोजन किया था जिसमें 300 किसानों ने भाग लिया। वेंगुर्ला केंद्र के वैज्ञानिकों ने ''काजू के विकास के लिए रणनीति'' पर एक राष्ट्रीय संगोष्ठी का आयोजन किया है और लगभग 100 किसानों के लिए दोडामार्ग तहसिल के आसनी और झारेबांबर गावों में काजू तना और जड़ छिद्रक के प्रबंधन पर दो प्रदर्शनों का आयोजन किया गया। वृद्धाचलम् के वैज्ञानिकों ने काजू उत्पादन प्रौद्योगिकियों पर तीन दिनों का आयोजन किया है और डीसीसीडी कोच्चीन द्वारा वित्त पोषित जिला स्तरीय संगोष्ठी का आयोजन पुदूकोट्टाई और सिवगंगाई के किसानों के लिए गया। वैज्ञानिकों ने काजू नर्सरी और उत्पादन तकनीक पर चार व्यावहारिक प्रशिक्षणों का भी आयोजन किया।

*****

PROJECT CO-ORDINATOR'S REPORT

The AICRP on Cashew has presently fourteen centres, which are located in 12 cashew-growing states of the country and are under the administrative control of different State Agricultural Universities/ ICAR Institutes. The original budget allocation of the project for the year 2015-16 was Rs. 353.25 lakhs (ICAR Share) and the expenditure was Rs. 360.45 lakhs (ICAR Share).

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

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

The salient findings during the period under report, in different projects are presented here.

CROP IMPROVEMENT

During the year, 26 new germplasm accessions (Goa-5, Jhargram-1, Madakkathara-2, Vengurla-1, Darisai-5 and Tura-12) have been collected by different Centres. As many as 100 germplasm accessions at Bhubaneswar Centre, 6 accessions at Hogalgere, 31 accessions at Jhargram, 14 accessions at Madakkathara, 11 accessions at Pilicode, 14 accessions at Vengurle, 9 accessions at Vridhachalam, 14 accessions at Goa, 10 accessions at Jagdalpur have been evaluated and few promising types are identified. Under multilocation trial-II, it was found that H-303, and H-320 performed well compared to others in Madakkathara Centre and H-68 & V-4 at Jagdalpur centre. In multilocation trial –III in Bapatla Centre, out of 11 genotypes, BPP-8 was found to be promising with the consistent yield levels (annual nut yield 8.16 kg/ tree and cumulative nut yield being 54.32 kg/tree). In Bhubaneswar Centre, the genotypes BH-85, BH-6 and H-1597 were promising with respect to mean annual nut yield and cumulative nut yield levels. As far as Hogalagere Centre is concerned. H-32/4 was found to be promising over three years of study with respect to annual and cumulative nut yield and hence has been recommended for inclusion in the pacakage of practices of the University. In other centres also, promising genotypes have been identified [Madakkathara-H-1593, H-662; Vengurla-H662, BH-6 (for apple weight); Vridhachalam-H14].

In multilocation trial-V involving evalution of released varieties/hybrids, it was found that at Bhubaneswar Centre, V-7 and BPP-8, Dhana; at Hogalagere, Ullal-1, Chintamani-1, Goa-1 and Ullal-4 (for apple weight); at Jhargram, V-7 and Bhubaneswar-1 at Madakkathara, Kanaka and Dhana (for yield) and Priyanka (apple weight); at Pilicode, Priyanka, BPP-6 (for apple weight); at Vridhachalam, VRI-3, V-4 performed well for the year. In Darisai, H-14 gave the highest yield (5.70 kg/tree), at Goa Bhaskara, V-8 and Priyanka performed well.

As far as hybridization and selection experiment are concerned, many cross combinations were tested and few promising types were identified in all centres. For instance in Bapatla Centre, the cumulative nut yield of BPP-8 x TNo.10/19 (32.85kg/tree); BPP-6 x NRCC Sel-2 (21.45kg/tree) were found to be promising among the 2006 planted hybrids. In Bhubaneswar Centre, hybrids such as RP2 x Kankady, OC56 x VTH 711/4 and OC56 x VTH 711/4 showed good performance

in the 8th harvest. The hybrids H-37 (Local x 2/9 Dicherla) had recorded highest cumulative nut yield of 71.48 kg/tree at Jhargram Centre. In Vengurla Centre, H-778 recorded highest cumulative yield of 59.44 kg/tree in 9th harvest. Two new cross combinations V-4 x Goa 11/6 and V-3 x H-2/16 have been generated at Vengurla Centre. At Vridhachalam Centre, HC-1 (VRI2 x VRI3) recorded highest cumulative yield of 28.25 kg/tree in the 7th harvest. In Goa, hybrid 31/05 gave highest yield of 12.45 kg/tree followed by hybrid 21/05 (8.55 kg/tree). Further, 28 new hybrids have been produced by crossing parents with contrasting characters.

With respect to evaluation of germplasm accessions for cashew apple, Priyanka variety was found to be performing well at Bapatla Centre for apple weight and TSS. At Bhubaneswar, Ullal-4 was found to be superior for all the parameters of value additions whereas in Jhargram, it was Priyanka with highest juice content and TSS. At Pilicode, BPP-8 and Priyanka were found promising, at Vridhachalam, VRI-2 (highest juice recovery of 80%), VRI 3 (highest Vit.C content) were found suitable. At Jagdalpur, CARS-8 gave the maximum juice recovery (73.50%).

Under varietal evaluation for RTS & Jam preparation, at Bapatla, BPP-8 was found to be superior with respect to organoleptic evaluation and Chintamani-1 was superior at Hogalagere, whereas UN-50 and Jhargram-1 were most accepted at Jhargram Centre. At Kanabargi Centre, V-7 and Ullal-4 were found good for Jam and for RTS it was Vengurle-2. V-4 was found superior at Paria for Jam & RTS preparations. At Pilicode Centre, PLD-1 had high overall accepatability for RTS and PLD-16 for Jam preparation. Whereas in Vengurle Centre, V-8 was found superior for Jam and V-5 for RTS. At Jagdalpur CARS-6 was found superior for Jam preparation.

CROP MANAGEMENT

In the experiment on fertilizer application in high density planting system, at Bapatla Centre, maximum nut yield per tree was recorded (5.43 kg/tree) in spacing of 10m x 5m (200 plants/ha). The interaction between spacings and fertilizers was found to be non-significant. However, the data over three years revealed that highest annual yield (11.43kg/tree) was in 10m x 5m spaced trees applied with fertilizer levels at 75:25:25 kg/ha. It was observed that spacing of 6mx4m (400plants/ha) with fertilizer dosage of 150:50:50kg/ha gave highest benefit:cost ratio of 4.18 at Bhubaneswar and 1.18 at Madakkathara. At Jhargram Centre, B:C ratio was highest (10.77) in 10m x 5m spacing (200 plants/ha) with 75:25:25 kg/ha fertilizer dosage. As far as Pilicode Centre in concerned, spacing of 6m x 4m (400 plants/ha) and fertilizer dosage of 75:25:25 kg/ha gave highest B:C ratio of 2.89. At Vengurle Centre it was the combination of 5mx4m spacing and 75:25:25kg/ha fertilizer level which gave maximum cumulative returns.

In the drip irrigation trials, irrigation at 80% of CPE gave maximum cumulative yield of 59.41kg/tree (12 harvests) at Vengurle and 35.96 kg/tree (7 harvests) at Vridhachalam Centre. With respect to high density planting observational trials, it was seen that B:C ratio started decreasing after 6th harvest in case of 4m x 4m spacing whereas it was increased from 1st to 7th harvest in 8m x 8m at Bapatla Centre. In Jhargram Centre, B:C ratio was more in at 4m x 4m spacing upto 3rd harvest. In the experiment on intercropping, cashew with marigold gave the highest net profit in Bapatla Centre. At Jhargram, it was okra with highest B:C ratio and in paria Centre, it was pigeon pea. In Vengurle Centre, amaranthus gave the highest B:C ratio (2.68). With respect to organic management of cashew, in Bhubaneswar, Vengurle and Vridhachalam Centres,

recommended dose of fertilizer and 10kg FYM gave the highest yield whereas in Jhargram and Darisai, 100% N as FYM gave the highest yield.

CROP PROTECTION

In the experiment on evaluation of insecticides for control of TMB and other insect pests, L-cyhalothrin 0.003% (0.6ml/l) was found to be consistently effective against leaf blossom webber, shoot tip caterpillar, apple and nut borer and leaf miner at Bapatla. Against shoot tip caterpillar and inflorescence thrips, it was L-cyhalothrin (0.003%) and profenophos combination was superior at Bhubaneswar. The L-cyhalothrin (0.003%) was found effective against TMB, apple and nut borers, thrips and aphids in Hogalagere. At Jhargram Centre, L-cyhalothrin (0.003%) was effective against leaf and blossom webber, leaf miner and apple nut borer. L-cyhalothrin (0.003%) was effective in controlling TMB at Kanabargi and Madakkathara centres. At Paria, L-cyhalothrin (0.003%) was effective in controlling TMB damage, leaf miner, apple and nut borer, leaf and blossom webber, shoot tip caterpillar and acetamiprid was effective in controlling thrips and mealy bug.

As far as Vengurle centre is concerned, L-cyhalothrin was found superior for the management of TMB. For curative control of cashew stem and root borer, Chlorpyriphos (0.2%) offered maximum protection at Bapatla, Bhubaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle and Vridhachalam. Among the germplasm accessions screened at different centres, few accessions have been identified in centres such as Bapatla and Jhargram against leaf miner, leaf folder, shoot tip caterpillar and apple and nut borer.

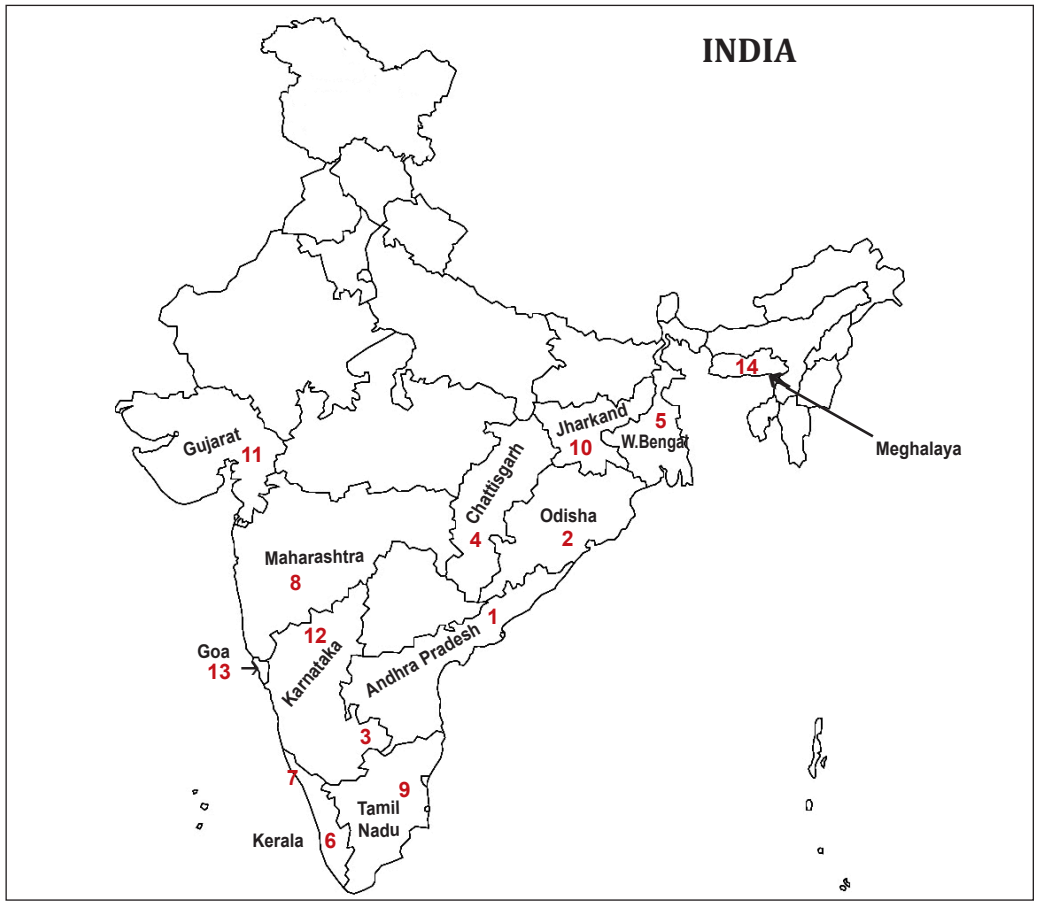
TRANSFER OF TECHNOLOGY :

A total of 3,62,894 grafts were produced during the current year and distributed to several government and non-government organizations as well as to cashew growers. The scientists of Bhubaneswar centre have participated in the "Comprehensive Cashew Development Plan in Odisha", organized by Odisha State Cashew Development Corporation, one state level seminar on cashew highlighting scientific cultivation of cashew was conducted on May 16th and 17th 2015. The scientists of different AICRP-Cashew Centres have taken up demonstration and training programme on cashew production technology, crop management, plant protection measures, value addition and post harvest management for the benefit of the farmers.

Under TSP scheme, the Madakkathara centre has taken up activities on training on nursery management and top working, training cum awareness programme on cashew in tribal areas, besides demonstration of plant protection measures in cashew. The scientists of Paria Centre had organized two farmers trainings on scientific cashew cultivation at cluster level, where 300 farmers were participated. The scientists of Vengurle centre have organized a National Seminar on "Strategies for development of Cashew" and also two demonstrations for about 100 farmers on cashew stem and root borer management at Asni and Zarebambar in Dodamarg Taluk.

The scientists of Vridhachalam have organized three days farmers training programme on Cashew production technologies, district level seminar on cashew cultivation technologies for farmers of Pudukottai and Sivagangai which was funded by DCCD, Cochin. Four practical trainings were also taken up by the scientists on cashew nursery and production technology.

ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW



HEADQUARTERS OF AICRP ON CASHEW

✦ ICAR - Directorate of Cashew Research, Puttur 574 202, Dakshina Kannada, Karnataka

AICRP on cashew Centres:

1. Cashew Research Station, (Dr. YSRHU), Bapatla-522 101, Guntur District, Andhra Pradesh.
2. Cashew Research Station, (OUAT), Bhubaneswar-751 003, Odisha.
3. Zonal Research Station, (BAU), Darisai-832 304, Barakhursi, East Singhbhum Dist., Jharkhand.
4. ICAR - Central Coastal Agricultural Research Institute, Ela, Old Goa, Goa – 403 402.
5. Horticultural Research Station, (UHS), Hogalagere-563 138, Srinivasapura, Kolar Dist., Karnataka.
6. SG College of Agricultural and Research Station, (IGAU), Jagdalpur-494 005, Chattisgarh.
7. Regional Research Station, (BCKV), Jhargram - 721 507, Midnapore West District, West Bengal.
8. Horticultural Research Station, (UHS), Kanabargi – 590 016, Belagavi Dist., Karnataka.
9. Cashew Research Station, (KAU), Madakkathara - 680 651, Thrissur Dist., Kerala.
10. Agricultural Experimental Station (NAU), Paria-396 145, Valsad District, Gujarat.
11. Regional Agricultural Research Station, (KAU), Pilicode - 671 353, Kasaragod District, Kerala.
12. Regional Fruit Research Station, (Dr. BSKKV), Vengurla - 416 516, Sindhudurg Dist., Maharashtra.
13. Regional Research Station, (TNAU), Vridhachalam-606 001, Cuddalore District, Tamil Nadu.
14. ICAR Research Complex for North Eastern Hill Regions, Tura-794 005, West Garo Hills Meghalaya.

EXECUTIVE SUMMARY

* During the year, 26 new germplasm accessions (Goa-5, Jhargram-1, Madakkathara-2, Vengurla-1, Darisai-5 and Tura-12) have been collected by different AICRP-C Centres.

* In multilocation trial –III in Bapatla Centre, out of 11 genotypes, BPP-8 was found to be promising with the consistent yield levels (annual nut yield 8.16 kg/tree and cumulative nut yield being 54.32 kg/tree).

* Under hybridization and selection, at Vridhachalam Centre, HC-1 (VRI2 x VRI3) recorded highest cumulative yield of 28.25 kg/tree in the 7th harvest.

* Under evaluation of germplasm accessions for cashew apple, Priyanka variety was found to be performing well at Bapatla Centre for apple weight and TSS. At Bhubaneswar, Ullal-4 was found to be superior for all the parameters of value additions whereas in Jhargram, it was Priyanka with highest juice content and TSS.

* It was observed that spacing of 6mx4m (400plants/ha) with fertilizer dosage of 150:50:50kg/ha gave highest benefit:cost ratio of 4.18 at Bhubaneswar and 1.18 at Madakkathara.

* In the drip irrigation trials, irrigation at 80% of CPE gave maximum cumulative yield of 59.41kg/tree (12 harvests) at Vengurle and 35.96 kg/tree (7 harvests) at Vridhachalam Centre.

* L-cyhalothrin 0.003% (0.6ml/l) was found to be consistently effective against leaf blossom webber, shoot tip caterpillar, apple and nut borer and leaf miner at most of the centres in the experiment on evalution of insecticides for control of TMB and other insect pests.

* Under curative control of cashew stem and root borer, Chlorpyriphos (0.2%) offered maximum protection at Bapatla, Bhubaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle and Vridhachalam.

Planting Material Produced :

A total of 362894 grafts were produced during 2015-16 and distributed to several government and non-government organizations as well as to cashew farmers. The centre wise production of cashew grafts is given below:

Centre	No. of grafts produced
Bapatla	20000
Bhubaneswar	20000
Jagdalpur	110000
Jhargram	3500
Madakkathara	45344
Pilicode	2500
Vengurle	125550
Vridhachalam	36000
TOTAL	**362894**

VARIETY RELEASED DURING 2015-16

Release of cashew variety "V-9" for cultivation in Maharashtra

Hybridization programme for developing this variety was carried out during 1983 with cashew variety Vengurla-4 as female parent crossed with Vridhachalam -I as male parent. The F1 seedlings raised from those crosses were initially tested for fifteen years and after its evaluation and performance at this centre the F1 hybrid-303 was given for multi-location testing at eight centers of country namely, Bapatla, Bhubaneshwar, Chintamani, Jagdalpur, Jhargram, Maddakathara, Vengurle and Vridhachalam. Excellent performance of this cashew hybrid-303 for its yield contributing characters over consecutively nine years has resulted into development of new variety named as Vengurle-9. Though, the average yield 7.24 kg/ tree/ year looks to be moderate but it is cumulative performance of this hybrid is very good at all the centers of India under all agro-climatic conditions from initiation of yield to full grown tree till date. As the age advances, yield increases proportionately and this has resulted into an average yield of 15.98 kg/plant/year during last five years.

Vengurle-9 is having characters like compact canopy, intensive branching, bunch bearing habit, high yield, bold nut and more shelling percentage. The tree is upright and compact and medium canopy shape, stem smooth, leaves with mango odour, smooth leaf margin, broad leaf size and obovate in shape. The tree starts bearing flowering panicles in the month of November and maximum flowering is observed during December/January. The tree flowers profusely, inflorescence is broadly pyramidal in shape. Harvesting starts from February and it reaches to peak in the month of March-April. On an average 6-8 fruits are harvested per panicle or bunch. Apple is conical obovate in shape. Nut is bold in size with ash-grey to brownish in colour. Nut has a broad base and it bulges on both sides near the stalk and tapering towards the distal end.

Vengurle-9 is moderately affected by Cashew Stem and Root Borer and Tea Mosquito Bug. However, Tea Mosquito Bug can be controlled by recommended spray schedule of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli with three sprays of insecticides, first at flushing, second at flowering and third at fruit set stage of Monocrotophos (0.05%) /Prophenophos (0.05%) / Lamda-cyhalothrin (0.003%) and Carbaryl (0.1%). For the control of Cashew Stem and Root Borer sanitation and regular supervision of the orchard, maintaining cleanliness at the collar region of the tree is essential. Swabbing tree trunk up to 1m height with Chloropyriphos (0.2%) or pour the solution of Chloropyriphos + Kerosene (10ml + 50ml) in the hole and close the hole with mud or DDVP + Kerosene (10ml + 50ml) in the hole and close the hole with mud, removal of grubs from infested trees.

Newly developed cashew variety Vengurle-9 meets all the central released committee requirements because of bold seed nuts (8.9 g) with kernel weight (2.2 g) and shelling per cent (29.35). There are no serious pest and disease problem to this hybrid and its performance is very good under changing climatic conditions. The planting material of Vengurle-9 variety can be had from Regional Fruit Research Station, Vengurle of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Sindhudurg 416 516, Maharashtra.

Salient Feature of Vengurle-9 are as follows:

1. Branching pattern – Intensive
2. Season of flowering – Mid late
3. Flowering duration – 111 days
4. Hermaphrodite flower – 21%
5. Apple colour – Reddish yellow
6. Apple weight – 69.71 g
7. T.S.S.– 13.0 0 Brix
8. Titrable Acidity – 0.21(%)
9. Av. juice content – 76 (%)
10. Nut wt. – 8.9 g
11. Shelling– 29.35 per cent
12. Average kernel weight – 2.2 g
13. Omega fatty acid
    a) Omega 3 fatty acid – 0.1 (g/100g)
    b) Omega 6 fatty acid – 19.4 (g/100g)
    c) Omega 9 fatty acid – 29.8 (g/100g)
14. Average yield – 7.24 (kg/tree)
15. Reaction to insect pest – Medium

REPORT OF THE ANNUAL GROUP MEETING OF SCIENTISTS OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW-2015 HELD AT RFRS, VENGURLE

The Annual Group Meeting of Scientists of All India Coordinated Research Project on Cashew-2015 was held during 2 - 4th November 2015 at Regional Fruit Research Station (Dr. BSKKV), Vengurle, Maharashtra. At the outset, Dr. U.V. Mahadkar, Director of Research welcomed the delegates and mentioned the initiation of research work on cashew in Maharashtra at Vengurla since 1957. He said that cashew fetches a substantial foreign exchange among the horticultural crop exports, and the need to improve the techniques of cashew cultivation to achieve the productivity to fulfill the high demand of the cashew industry. He also mentioned that research should be oriented towards development of high yielding varieties having favourable characteristics like high shelling, tolerant to pest and diseases and adaptability of varieties to changing climatic situations.

The Annual Group Meeting was inaugurated by Hon. Shri. Deepakji Kesarkar, Hon. Minister for Rural Development & Finance, Maharashtra State by lighting the traditional lamp. On this occasion, Dr. K.E. Lawande, Former Vice Chancellor, Dr. BSKKV and Mr. Nagaraja, MD, KCDC were also present as Guest of Honours. Later, Dr. K.E. Lawande, Hon. Ex-Vice Chancellor, Dr. BSKKV in his address as Guest of Honour mentioned that there is wide scope to increase the productivity to compete with the countries like Vietnam and Nigeria for which future line of research should be oriented through Development of compact and dwarf high yielding varieties which will be suited for high density planting; standardization of package of practice to gear up yield potential by intercropping, INM, IPM and IDM techniques; development of value addition chain in cashew products and entrepreneurship development with strong linkages. Prof. P.L. Saroj, Director, DCR and the Project Coordinator (Cashew), spoke about the importance and achievements of AICRP cashew. He informed the audience about the immense role of different centers under AICRP in distributing the quality planting material and dissemination of improved technologies.

The technical session was started with the Action Taken Report on the recommendations of the previous year by Dr. Mohana, G.S., PC Cell In-charge. The research progress and results obtained in various experiments at different AICRP-Cashew centers viz., Bapatla, Bhubaneswar, Chintamani, Darisai, Jagdalpur, Jhargram, Madakkathara, Paria, Pilicode, Vengurle and Vridhachalam as well as, the co-operating centres viz., Arabhavi and Tura were presented by the scientists of the respective disciplines from each centre. The presentations were made in three main sessions viz., Crop Improvement, chaired by Mr. Nagaraja, MD, KCDC, Karnataka, Crop Management chaired by Dr. K. E. Lawande, Former Vice Chancellor Dr. B.S.K.K.V, Dapoli and Crop Protection chaired by Dr. A. Krishnamoorthy, Former Principal Scientist, IIHR, Bangalore.

The Plenary session was chaired by Dr. T. Janakiram, ADG (Hort.I), ICAR, New Delhi

wherein he mentioned for development of hybrids of high density planting systems which can escape the pests and diseases, root stock breeding for dwarfing and salt tolerance, development of varieties with short harvesting space and screening of apples for tannins and other pigments. He further mentioned the need for large scale demonstrations of top technologies to be done at each centres. Dr. U.V. Mahadkar, DR, Dr. BSKKV mentioned that the post harvest processing should be given importance for better utilization of cashew apple.

A session regarding Interaction of development departments and research centres was also held which was chaired by Dr. S.A. Chavan, Associate Dean, College of Agriculture, Dr. BSKKV. Farmers inquired about various issues such as CSRB attack in established cashew orchard and cultivation practices for cashew in changing climate scenario. Dr. Venkatesh Hubbali, Director of DCCD, Kochin, Officers from State Agricultural department, scientists of the university, Dr. B.R. Salvi, ADR, RFRS, Vengurle were present and discussed the issues in crop management, government schemes for promotion of cashew, subsidies and excise policy for cashew wine and fermented products.

Inaugural Session of Annual Group Meeting of AICRP-Cashew 2015 at RFRS, Vengurle, Maharashtra

EXPERIMENTAL RESULTS

I. CROP IMPROVEMENT

I. CROP IMPROVEMENT

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

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

The objectives of the project are:

(a) To evaluate the existing germplasm of cashew in different centres

(b) To collect local germplasm material with desirable characters such as high yield, cluster bearing habit, bold sized nuts, duration of flowering, off season flowering types from different cashew growing regions and,

(c) To establish clonal germplasm conservation blocks in different centres

Germplasm Collection:

During the current year, 26 germplasm accessions have been collected by different centres of AICRP on Cashew and have been planted in the respective Regional Cashew Field Gene Banks (RCFGBs). The total number of accessions conserved so far is 1528 (Table. 1.1)

Table 1.1 : Cashew germplasm accessions conserved in different Centres

Centre	No. of accessions		
	Earlier existing	Collected during 2015-16	Existing
East Coast			
Bapatla	132	--	91
Bhubaneshwar	106	--	106
Jhargram	227	1	228
Vridhachalam	208	--	208
West Coast			
Goa	89	5	94
Madakkathara	140	2	142
Paria	--	--	--
Pilicode	82	--	82
Vengurla	306	1	307
Plains tract/others			
Darisai	17	5	15
Hogalagere *	128	--	128
Kanabargi	--	--	--
Jagdalpur	70	--	70
Tura	--	12	57
Total	**1485**	**26**	**1528**

* Conserved at Chintamani

Germplasm evaluation :

The details of growth and yield parameters of cashew germplasm evaluated during 2015-16 conserved at different centres are given here.

BHUBANESWAR

During the fruiting season, one elite local cashew germplasm having cluster bearing habit (ave. 8-10 nuts/inflorescence) was collected. However, as the centre has 29 numbers of cluster bearing (ave. 8-10 nuts/inflorescence) cashew germplasm, the newly collected germplasm accession was not included to avoid duplication of cluster bearing.

Table 1.2 : Nut yield attributing traits and mean annual nut yield (kg/tree) of cashew germplasm at Bhubaneswar

Sl. No.	Year of planting	Accession No.	Mean annual nut yield (kg/plant)	Cum. nut yield (kg/plant)	Shelling %	Apple Weight (g)	Nut Weight (g)
For 8 harvests							
1	2004	OC 143	2.12	8.786	28.7	60.0	9.60
2		OC 144	3.50	12.32	32.5	70.0	6.60
3		OC 145	2.83	12.68	27.0	40.0	8.00
4		OC 146	6.50	28.50	31.7	61.0	8.20
5		OC 147	8.50	33.22	29.3	50.5	7.20
6		OC 148	15.30	44.24	30.0	52.0	8.00
7		OC 149	1.37	7.03	28.4	34.0	7.40
8		OC 150	2.12	13.33	31.0	33.0	6.60
9		OC 151	1.50	3.60	28.0	20.0	5.00
10		OC 152	2.50	11.50	27.0	34.0	5.80
11		OC 153	1.00	10.37	27.1	57.0	8.60
12		OC 154	1.20	11.95	26.0	17.0	5.80
13		OC 155	0.80	9.734	25.3	39.0	7.25
14		OC 156	4.00	11.88	27.0	34.0	6.60
15		OC 157	2.00	11.86	27.6	58.0	8.44
16		OC 88	1.00	5.08	29.0	108.0	13.14
17		OC 158	0.20	2.70	29.6	44.0	7.00
18		OC 159	0.15	1.65	29.3	100.0	14.00
19		OC 160	0.20	2.85	28.6	82.0	10.80
20		OC 161	0.10	1.10	30.0	66.0	8.00

In the 10th harvest, the highest mean annual nut yield was recorded in OC 36 (11.75kg/tree) followed by OC 31 (9.95 kg/tree). However, the cumulative yield was highest in OC92 (25.86 kg/tree) followed by OC 56 (24.16 kg/tree). As far as apple weight is concerned, highest (116g) was recorded in accession OC 85 followed by OC 50 (115g). Further, the nut weight was highest in OC 85 (18g) followed by OC 114 (12.40g). These may be utilized in the breeding programme to develop improved varieties.

Table 1.3 : Performance of cashew germplasm at Bhubaneswar

Sl. No.	Accessions	Mean annual nut yield (kg tree^{-1})			Cum. nut yield (kg tree^{-1})
		2012-13	2013-14	2014-15	
1.	OC-118	4.50	6.36	8.33	21.61
2.	OC-124	8.00	9.90	10.70	34.24
3.	OC-125	3.20	4.50	16.20	33.42
4.	OC-147	8.50	9.00	8.50	33.22
5.	OC-148	9.50	10.40	15.30	44.24

Regarding the consistency in nut yield, it is revealed that the accessions such as OC-118, OC-124, OC-125, OC-147 and OC-148 were recorded highest mean annual as well as cumulative nut yield (kg tree^{-1}) among the 100 evaluated accessions over the years.

DARISAI

All accessions were identified for bold nut (>8.4gm) except DSI-102, which had medium nut cluster bearing (mean nut weight 7.6gm). Accession no. DSI-102 had maximum nut yield (12.6kg/tree). Apple weight in all accessions ranged from 81.2gm to 101.0gm except accession DSI-102, which recorded only 67.0gm. The flowering duration ranged from 69 to 114 days.

Table 1.4 : Yield parameters of promising cashew germplasm at Darisai

Accession	Year of planting	Nut type	Duration of flowering (days)	No. flowering laterals /m^2	Nut wt. (gm)	Apple wt (gm)	Nut yield (kg/tree)
DSI 101	2012	Bold nut	79	18.75	8.9	85.4	8.4
DSI 102	2012	Medium nut with cluster bearing	69	22.67	7.6	67	12.6
DSI 103	2012	Bold nut	104	24.85	10.2	83.6	7.3
DSI 104	2012	Bold nut	97	26.7	8.6	81.2	4.6
DSI 105	2012	Bold nut	88	28.9	8.4	87	7.4
DSI 106	2012	Bold nut	71	24.5	8.7	88	8.6
DSI 107	2012	Bold nut	69	27.2	9.2	98.5	3.9
DSI 108	2013	Bold nut	110	18.6	8.8	96.4	2.8
DSI 109	2013	Bold nut	101	30.4	10.1	101	7.6
DSI 110	2013	Bold nut	77	23.6	10.4	98.3	4.7
DSI 111	2014	Bold nut	68	24.8	8.8	94.2	2.9
DSI 112	2014	Bold nut	114	26.8	8.2	91.6	1.8
DSI 113	2015	Bold nut	113	17.4	8.5	93.2	3.4
DSI 114	2015	Bold nut	92	21.2	8.6	96.7	2.6
DSI 115	2015	Bold nut	84	23.6	8.4	98.2	5.7

GOA

Four new accessions from Cotigaon (Badde-1, 2, 3 and 4) having bold nut, bigger apple and higher nut yield, and one accession(Adnem-1) having compact canopy type from Adnem village (Quepem zone) were identified & added to Germplasm collection. The characteristic features of mother trees of these accessions are presented in Table 1.5.

Table 1.5 : Cashew accessions collected during 2015-16 at Goa

Sl. No.	Accession name	Spl. feature	Approx. age (yrs)	Av. Nut wt. (g)	Apple wt. (g)	Apple Colour	TSS (°B)
1	Badde-1	Bold nut	About 30	8.2	79.5	Yellow	10.0
2	Badde--2	Bold nut	About 20	8.0	70.6	Yellow	10.6
3	Badde-3	Bold nut	About 25	8.2	68.8	Yellow with reddish tinge	12.2
4	Badde-4	Medium nut, cluster bearing	About 15	8.6	65.0	Red	10.8
5	Adnem-1	Medium nut	About 35	7.1	48.0	Yellow	10.2

New accessions: Badde-1 having bold nut and big apples and Badde-4 having bold nut and big red apples

With addition of these 5 new accessions to the earlier Germplasm of 89 accessions, a total of 94 germplasm accessions of cashew representing the following different groups is being maintained at Goa Centre.

- Jumbo nut types : 14
- old nut types : 40
- Medium nut and high yielders : 13
- High yielders/ cluster bearers irrespective of nut size : 23
- Dwarf canopy types : 3
- Very compact canopy type: 1

Total germplasm collection : 94

Characterization of selected local bold nut cashew genotypes:

Studies on characterization of 14 genotypes namely, Valpoi-1, Valpoi-2, Valpoi-3, Bardez-3, Bardez-9, Tiswadi-7, Tudal-1, Tudal-3, Mayem-1, BKL-1, BKL-2, FMGDI-1, Tiswadi-3 and Balli-1/ Goa-1 (Check) revealed that Bardez 8/98 recorded the highest nut yield of 2.73kg/tree followed by Mayem-1 with 2.31 kg/tree as compared to 1.48kg/ tree of raw nut yield in check. Tiswadi-3, Bardez-9 and Valpoi-2 continued record higher nut weight of >10g. All other accessions excepting Valpoi-3, Bardez 8/98 and BKL-2 recorded the mean nut weight of more than 8g. Among the accessions, apple weight varied from 68.16.g (Bardez 8/98) to 98.39 in Valpoi-2 accession. The significantly differing shelling percentage varied from 27.46 (Bardez-9) to 30.3 as against the highest shelling of 31.1% in Check variety.

All the accessions were affected by tea mosquito bug infestation. One tree each of BKL-1, and Bardez-9 died due to Cashew stem and root borer despite application of Chlorpyriphos.

Table 1.6 : Performance of bold-nut genotypes of cashew at Goa

Sl. No.	Genotype	Height (m)	Girth (cm)	Flowering Year	Nut yield (kg/tree)	Mean nut Wt (g)	Mean apple Wt. (g)	TSS (°B)	Shelling (%)
1	Valpoi-1	3.34	44	2012	0.59	8.13	78.40	11.87	29.30
2	Valpoi-2	4.68	61	2012	0.76	10.93	98.33	10.33	28.20
3	Valpoi-3	4.57	58	2012	1.04	7.52	97.83	10.60	27.73
4	Bardez-8/98	4.32	48	2011	2.73	7.47	68.17	12.07	30.00
5	Bardez-9	3.35	46	2011	1.52	10.53	94.60	11.83	27.47
6	Tiswadi-3	4.03	48	2012	0.98	10.83	92.83	11.20	29.43
7	Tiswadi-7	3.92	41	2011	1.04	8.17	74.67	10.47	30.30
8	Tudal-1	4.40	39	2011	1.15	8.88	84.47	10.97	28.70
9	Tudal-3	4.15	40	2011	1.18	8.73	79.83	10.87	28.37
10	Mayem-1	4.35	44	2011	2.31	8.00	65.80	11.17	32.07
11	BKL-1	3.35	46	2011	0.98	8.17	78.87	11.53	28.53
12	BKL-2	3.79	43	2011	1.02	7.84	75.90	11.67	28.60
13	FMGDI-1	3.32	48	2011	0.79	8.90	80.83	10.97	29.00
14	Goa-1 (Check)	4.23	47	2011	1.48	7.77	72.07	12.33	31.07
	CD (5%)	0.73	3.59		0.41	0.42	7.18	0.59	0.6
	CV (%)	8.04	3.53		19.46	12.8	5.23	3.16	1.23

HOGALAGERE

Among the promising accessions of the germplasm collections, accession 44/1-ARSC (Vengurla-5) recorded highest cumulative nut yield of 424.48 kg/tree (for 26 harvests) followed by 41/3-ARSC (5/37 Manjeri) and 2/6-ARSC (3/108-Gubbi) recorded 396.96 kg/tree (for 26 harvests) and 305.52 kg/tree (for 29 harvests), respectively.

Table 1.7 : Yield performance of promising germplasm accessions at Hogalagere

Accession No.	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree)
3/108 Gubbi (2/6 ARSC)	5.50	39.34	33.57	4.81	305.52 (29 harvests)
Vetore-56 (27/1 ARSC)	7.55	43.50	30.74	7.61	223.95 (28 harvests)
5/23 Kundapur (03/1ARSC)	6.31	46.84	32.74	4.89	227.76 (29 harvests)
5/37 Manjeri (41/3 ARSC)	6.58	48.57	32.77	10.48	396.96 (26 harvests)
Vengurla - 5 (44/1 ARSC)	6.00	48.58	31.54	12.34	424.48 (26 harvests)
K-3-C (56/1 ARSC)	6.37	39.66	31.88	5.52	155.68 (17 harvests)

Documentation of 102 accessions of germplasm collections were made as per the cataloguing developed by NRCC, Puttur.

JAGDALPUR

Ten accessions collected from ICAR-DCR, Puttur were planted during the year 1996-97. It is evident from the data presented in table 1.8 that the mean annual nut yield/tree was highest for NRC-138 (8.20 Kg), followed by NRC–137 (7.80Kg). The cumulative nut yield was highest in NRC-137 (88.95 Kg) with 16 harvests. Mean nut weight was found highest for NRC-138 (8.50g) followed by NRC-140 and NRC-131. Shelling per cent was found highest in NRC- 131 (30.50%).

Table 1.8 : Yield parameters of promising cashew germplasm at Jagdalpur

Accession No.	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (For 16 harvests)
NRC-130	7.60	65.20	27.30	5.30	47.88
NRC-131	7.90	50.60	30.50	4.80	42.93
NRC-136	6.40	56.30	28.30	4.30	40.65
NRC-137	7.80	48.50	29.20	7.80	88.95
NRC-138	8.60	62.40	29.50	8.20	80.28
NRC-140	8.20	94.50	28.60	4.50	47.05
NRC-190	7.50	55.60	26.80	4.20	35.45
NRC-191	7.30	54.20	29.30	7.30	65.56
NRC-192	7.70	60.20	28.40	4.60	40.00
NRC-193	7.20	58.30	29.40	6.50	67.07

JHARGRAM

The yield of accessions varied from 6 Kg to 17.1 Kg/tree. The highest yielder was JGM – 313 followed by JGM – 310, JGM – 285, JGM – 302, JGM – 282 and JGM – 231. Cumulative yield record showed that JGM – 282 was the highest yielder (52 .7kg/tree for 6 harvests) followed by JGM – 231 (51.7kg/tree for 7 harvests) (Table 1.9).

Table 1.9 : Yield parameters of promising cashew germplasm at Jhargram

Accession No. planting	Year of nut wt (g)	Mean wt. (g)	Mean apple %	Shelling yield	Mean annual nut (kg/tree)	Cum. yield (kg/tree)
JGM-251	2005	7.6	54.0	26.8	10.9	43.9
JGM-302	2006	7.5	63.0	31.4	13.1	24.2
JGM-290	2006	7.3	80.0	29.9	10.2	46.6
JGM-291	2006	7.3	54.0	25.3	6.5	28.6
JGM-231	2005	7.1	59.6	35.2	12.9	51.7
JGM-289	2006	7.0	60.0	33.1	6.0	34.6
JGM-310	2006	6.9	55.0	34.0	13.7	45.8
JGM-221	2005	6.0	38.0	37.8	10.3	16.8
JGM-292	2006	5.7	59.2	32.4	8.2	32.9
JGM-234	2005	5.6	61.0	29.5	6.9	31.8
JGM-320	2006	5.5	67.0	25.5	6.7	30.8
JGM-313	2006	5.5	74.0	28.8	17.1	27.7
JGM-242	2005	5.4	60.0	30.7	6.8	33.9
JGM-299	2006	5.2	78.0	29.5	10.4	50.1
JGM-219	2005	5.2	46.0	32.6	10.2	37.6
JGM-238	2005	5.2	55.0	31.9	10.7	20.1
JGM-282	2006	5.0	32.4	36.2	13.0	52.7
JGM-296	2006	5.0	70.0	35.2	9.5	39.0
JGM-280	2006	5.0	66.4	20.6	6.4	25.0
JGM-293	2006	5.0	32.0	31.1	8.6	28.4
JGM-220	2005	5.0	60.0	32.5	10.6	48.9
JGM-217	2005	5.0	73.0	27.7	7.2	22.0
JGM-285	2006	4.7	66.0	32.8	13.4	43.7
JGM-232	2005	4.4	44.0	36.3	10.5	33.5
JGM-326	2006	4.4	48.0	30.3	7.1	26.5
JGM-319	2006	4.1	36.4	31.7	9.5	32.7
JGM-295	2006	4.0	46.0	38.0	7.4	21.6
JGM-324	2006	3.8	72.0	33.4	9.9	28.5
JGM-227	2005	3.8	50.0	30.3	7.6	39.3
JGM-230	2005	3.4	56.4	31.5	8.8	29.5
JGM-286	2006	3.3	60.0	32.7	6.6	23.2

Significant variation was observed among the varieties with respect to nuts/m^2, nut weight, nuts/panicle, kernel weight, shelling%, yield/tree, apple weight and cumulative yield/tree. JGM-148 had highest value with respect to nuts/m^2 (25.5), nuts/panicle (11), kernel weight (2 g), yield/tree (10.01Kg), and cumulative yield/tree (56.72 Kg) (Table 1.10).

Table 1.10 : Yield parameters of promising cashew primary germplasm at Jhargram

Treatment	Nuts/ m^2	Nut Weight (g)	Nuts/ panicle	Kernel Weight (g)	Shelling %	Yield (kg/tree)	Apple Weight (g)	Cum. Yield (For 9 years (kg/tree)
JGM – 147	11.2	5.70	4.5	1.68	29.53	3.06	59.0	26.24
JGM – 148	25.5	5.81	11.0	2.00	34.43	10.01	75.0	56.72
JGM – 149	24.2	5.22	7.6	1.80	34.52	4.81	49.0	25.74
JGM – 150	5.7	5.32	2.3	1.78	33.50	1.04	99.3	6.79
JGM – 151	3.8	5.74	1.6	1.62	28.29	0.63	64.3	14.08
JGM – 152	5.4	8.75	2.7	1.80	20.63	2.03	120.7	11.55
SEM ±	3.03	0.12	1.13	0.08	1.49	1.17	10.19	3.13
C.D. 5%	6.74	0.28	2.53	0.18	3.33	2.61	22.70	6.96
CV%	9.39	2.49	8.15	5.61	6.07	9.99	6.02	6.28

MADAKKATHARA

The yield and yield attributes of accessions planted during 2002-2003 are presented in Tables. Accession Kainur recorded highest annual yield (6.75 Kg/tree) followed by ARL-1 (4.26 Kg/tree). Highest cumulative yield was recorded by kainur (30.17kg/tree) followed by Kunjithai (28.70kg/tree) during the current season.

Table 1.11 : Yield parameters of promising cashew germplasm at Madakkathra

S.No.	Accession No.	Mean nut wt (g)	Mean apple wt . (g)	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (7 years)
1.	KTR-1	7.13	40.33	3.90	22.72
2.	KTR-3	7.81	38.03	3.50	18.81
3.	Kiralur	8.45	42.50	3.80	20.08
4.	Mannur	8.15	35.85	4.10	20.47
5.	Kainur	6.90	37.00	6.75	30.17
6.	Ummanoor	8.26	40.43	3.90	24.91
7.	Kottukkal	7.75	36.70	3.29	17.41
8.	Peechi	9.53	47.96	3.70	19.15
9.	Kunjithai	9.07	40.65	3.95	28.70
10.	Pathanoor	8.82	39.50	2.70	28.20
11.	ARL-1	8.20	31.00	4.26	21.06
12.	KTR-2	8.24	41.00	3.80	19.96
13.	ARL-2	7.15	44.50	3.60	22.65
14.	ODR	8.03	42.50	4.10	25.32

PILICODE

Highest mean nut weight of 13.03g was recorded in PLD 20 while the lowest of 3.08g was recorded in PLD 57. Highest shelling percentage of 33.40% was recorded in PLD 1, whereas the lowest shelling percentage of 19.43% was recorded in PLD 20 with highest nut weight indicating the inverse relationship of nut weight and shelling percentage. Mean annual nut yield and cumulative yield were highest in PLD 4 (Table 1.12).

Table 1.12 : Yield parameters of promising cashew germplasm at Pilicode

Accession No.	Mean nut wt (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 11 harvests)
PLD1	7.60	33.40	6.38	46.15
PLD 3	8.48	29.13	5.88	33.69
PLD 4	6.90	31.93	7.68	54.60
PLD 12	9.64	25.65	6.63	47.71
PLD 15	8.10	27.75	3.88	20.43
PLD 16	8.38	25.88	5.28	35.02
PLD 17	8.65	27.10	3.67	19.03
PLD 18	9.08	29.20	4.43	18.50
PLD 19	8.54	28.53	3.13	17.80
PLD 20	13.03	19.43	2.83	19.55
PLD 57	3.08	29.28	2.15	6.37

Table 1.13 : Yield parameters of promising cashew germplasm at Pilicode

Accession No.	Mean no. of panicles/ m^2	Ratio of male : bisexual flowers	Mean no. of nuts/ m^2
PLD 75	0.88	0.13	0.00
PLD 54	5.13	0.13	2.13
PLD 44	3.00	0.12	2.00
PLD 64	6.25	0.11	3.25
PLD 62	4.04	0.13	5.58
PLD 40	4.00	0.19	5.75
PLD 48	5.04	0.15	3.50
PLD 67	0.96	0.10	1.25
PLD 66	0.00	0.00	0.00
PLD 45	0.13	0.03	0.00
PLD 82	2.00	0.13	1.25

TURA

Among the 57 accessions, one early high yielding, early bold nut size, fruiting twice a year and dwarf high yielding was identified.

VENGURLA

The yield observations of 14 types collected from Thane, Raigad, Kolhapur and Sindhudurg districts are presented in Table 1.14.

Table 1.14 : Mean yield attribution characters of the germplasm collected during 2001-02 at Vengurle

Name of the type	Apple wt. (g)	Nut wt. (g)	Flow. duration (days)	Yield (kg/plant)	Shelling (%)	TMB (%)
RFRS 171	50.0	8.0	108.0	1.85	26.0	L
RFRS 172	57.0	5.8	109.0	2.68	28.0	M
RFRS 173	60.0	5.0	100.0	1.40	26.0	L
RFRS 174	42.0	4.9	90.0	0.45	28.0	L
RFRS 175	40.0	6.1	106.0	0.73	28.0	L
RFRS 176	36.0	4.8	109.0	1.47	26.0	M
RFRS 177	50.0	6.4	109.0	0.72	31.0	L
RFRS 178	40.0	7.8	115.0	1.32	22.0	L
RFRS 179	60.0	6.6	112.0	3.11	25.8	M
RFRS 180	30.0	6.1	107.0	0.64	28.0	L
RFRS 181	40.0	7.1	99.0	0.65	33.3	L
RFRS 182	69.0	5.0	112.0	0.86	27.5	M
RFRS 183	62.0	5.3	113.0	0.63	27.0	M
RFRS 184	39.0	6.3	110.0	0.97	26.6	L

The yield was highest in case of RFRS 179 (3.11 kg/tree) followed by RFRS 172 (2.68g). The nut weight was highest in RFRS 171 (8.0g) followed by RFRS 178 (7.8gm).

Table 1.15 : Mean yield attribution characters of the germplasm collected during 2003-04 at Vengurle

Type	Apple wt. (g)	Nut wt. (g)	Flow. duration (kg/ plant)	Yield (%)	Shelling (%)	TMB
RFRS 185	53.0	5.5	113.0	1.00	30.5	L
RFRS 186	32.0	7.6	105.0	0.85	28.0	L
RFRS 187	49.0	5.2	111.0	0.63	27.0	L
RFRS 188	54.0	7.3	107.0	1.00	28.0	L
RFRS 189	45.0	8.0	110.0	1.68	27.5	M
RFRS 190	55.0	7.0	111.0	1.62	30.5	L
RFRS 191	43.0	5.0	108.0	0.99	31.0	L
RFRS 192	30.0	6.6	114.0	2.45	30.0	M
RFRS 193	40.0	5.7	108.0	0.85	29.5	M
RFRS 194	45.0	5.9	115.0	0.77	29.5	L

Maximum yield (2.45kg/tree) was recorded in RFRS 192 followed by RFRS 189 (1.68kg/tree).

VRIDHACHALAM

The accession 302361 recorded the highest values for mean nut weight (7.6 g), apple weight (65.4 g), nut yield (8.95 kg/ tree) and overall cumulative nut yield of 70.96 kg/tree in 13 harvests (Table 1.16).

IC 302361 (TK 1)

Table 1.16 : Yield parameters of promising cashew germplasm at Vridhachalam

Accession No.	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 13 harvests)
302360	7.36	57.2	30.0	8.0	58.08
302361	7.58	65.4	29.2	8.95	70.96
302362	6.37	56.5	28.0	6.88	55.62
302363	6.76	53.42	28.4	7.52	57.62
302364	7.02	57.0	29.8	7.80	65.69
302365	6.82	63.5	28.2	8.52	68.83
302366	7.04	61.9	28.8	6.98 2nd Harv.	59.69 Two harvests
PKP 3	7.2	55.8	29.2	2.42	3.64
PKP 4	7.2	60.5	29.8	2.20	3.18

CONCLUDED TRIAL

GERMPLASM COLLECTION, CONSERVATION, EVALUATION, CHARACTERIZATION AND CATALOGUING

MADAKKATHARA

A total of 142 accessions collected till 2014-15, were planted for evaluation in the clonal germplasm conservation block.

Table : Cashew germplasm accessions maintained at Madakkathara Centre

No. of accessions	Total number of accessions
Local Germplasm Collection	25
Germplasm Obtained from other centers	82
Hybrid developed at the centre	35

Results

Accession Kainur recorded highest annual yield (6.75 Kg/tree) followed by ARL-1 (4.26 Kg/tree). Highest cumulative yield was recorded by Kainur (30.17kg/tree) followed by Kunjithai (28.70 kg/tree) during the current season.

The experiment was concluded including data of 2014-2015. The data was subjected to stability analysis. Wrickes model for ecovalance was coopted to assess the stability of accessions as regards to nut weight and nut yield. Accession kottukkal was found to be highly stable for nut weight and accession pathanoor the least stable for nut weight. Accession kainur was found to be highly stable for nut yield and accession peechi the least stable for nut yield.

Table : Yield parameters of promising cashew germplasm at Madakkathara centre during the year 2014-2015

Sl. No.	Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (7^{th} year)
1	KTR-1	7.13	40.33	3.90	22.72
2	KTR-3	7.81	38.03	3.50	18.81
3	Kiralur	8.45	42.50	3.80	20.08
4	Mannur	8.15	35.85	4.10	20.47
5	Kainur	6.90	37.00	6.75	30.17
6	Ummanoor	8.26	40.43	3.90	24.91
7	Kottukkal	7.75	36.70	3.29	17.41
8	Peechi	9.53	47.96	3.70	19.15
9	Kunjithai	9.07	40.65	3.95	28.70
10	Pathanoor	8.82	39.50	2.70	28.20
11	ARL-1	8.20	31.00	4.26	21.06
12	KTR-2	8.24	41.00	3.80	19.96
13	ARL-2	7.15	44.50	3.60	22.65
14	ODR	8.03	42.50	4.10	25.32

Gen.3. Varietal Evaluation Trials

1. Multilocation Trial – II

Centres: *East Coast* : Bapatla
West Coast : Madakkathara and Vengurla
Plains / others : Jagdalpur

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

Experimental Details:

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

JAGDALPUR

At Jagdalpur, the multilocation trial was laid out in RBD with three replications during 2000 consisting of 14 genotypes. The data on morphological and yield characters were collected from the experimental plants are presented in the Tables. Nut yield (Kg/tree) was highest for H-68 (6.37kg) followed by V-4 & H-367. The maximum nut weight (10.27g) was recorded in H-255 followed by H-367. Whereas the maximum apple weight (77.37g) was recorded in H-367 followed by H-255. The shelling percent was recorded maximum for V-4 (30.83 %) followed by NRCC Sel-1 & H-68 (Table 1.17).

Table 1.17 : Yield parameters of cashew genotypes in MLT-II at Jagdalpur centre

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 12 harvests)
T.No. 30/1	6.37	48.03	27.57	3.83	24.07
T.No. 3/33	6.80	54.10	29.83	3.57	22.91
T.No. 10/19	5.80	54.30	28.27	3.56	24.96
T.No. 3/28	7.20	51.70	29.37	3.23	21.32
H- 68	8.70	63.63	30.13	6.37	43.70
H- 255	10.27	70.67	29.07	4.89	29.66
H- 303	7.63	57.70	29.50	5.10	38.06
H- 320	8.37	63.30	29.87	5.03	31.56
H- 367	9.87	77.37	29.40	5.53	35.1
M- 15/4	6.53	49.47	29.93	2.72	17.75
M- 44/3	5.90	49.23	28.60	3.57	23.01
NRCC-Sel-1	7.80	56.70	30.20	3.83	20.60
NRCC-Sel-2	8.80	62.40	29.50	4.57	29.93
V-4	8.20	64.13	30.83	6.00	41.08
Mean	7.73	58.77	29.43	4.41	28.84
SEM ±	0.22	2.14	0.47	0.35	-
CD at 5%	0.65	6.24	1.38	1.03	
CV%	5.02	6.33	2.81	13.98	

MADAKKATHARA

The data revealed that there was significant difference among genotypes and the maximum height was recorded by H 68 (9.23m) followed by H 320 (9.20m). There was significant difference among genotypes and highest sex ratio was recorded by T40/1 (0.581) followed by T30/1 (0.429). Analysis of data revealed that there was significant difference among genotypes and the variety recorded T40/1 highest apple weight (96.91 g) followed by H 1608 (81.50 g). There was significant difference among genotypes and the highest nut weight was recorded by variety H 320 (8.98 g) followed by H 255 (8.96 g). The variety M-15/4 recorded the highest annual yield (8.90 kg/tree) followed by H 320 and T3/28 (7.80kg/tree). The highest cumulative yield was recorded by H 303 (88.45 kg/tree) followed by H 320 (82.78 kg/tree). Based on the previous two years data genotypes H 303 and H 320 performed well compared to other genotypes (Table 1.18).

Table 1.18 : Yield parameters of cashew genotypes in MLT II at Madakkathara

Accession	Nut wt (g)	Apple wt. (g)	Shelling %	Nut Yield during 14-15 (kg/tree)	Cum. nut Yield (18 years) (kg/tree)
T 30/1	6.50	49.45	24.20	5.30	42.89
T 3/33	7.86	45.88	22.90	7.30	43.40
T 10/19	6.20	50.90	23.67	6.50	35.70
T3/28	4.35	71.50	24.50	7.80	54.30
H 68	8.29	56.98	26.30	5.80	42.21
H255	8.96	78.69	24.10	5.60	42.44
H 303	8.82	68.88	22.40	5.10	88.45
H 320	8.98	71.42	21.30	7.80	82.78
H 367	8.87	71.70	22.87	6.30	45.67
M 15/4	5.23	60.40	24.10	8.90	62.98
M-44/3	3.60	55.27	24.20	6.50	55.22
T 107/3	7.30	76.91	23.40	6.80	42.56
T 40/1	6.45	96.91	24.70	6.90	49.85
H 1608	8.50	81.50	23.16	6.80	70.82
Mean	7.14	66.89	23.70	6.67	54.23
SEM±	0.327	5.98		0.560	
CD@0.05	0.962	17.60		1.669	
CV%	6.48	15.68		14.80	

VENGURLA

On the basis of 14 years studies of different hybrids/varieties under MLT-II at AICRP-Cashew Vengurle centre, H-303 is performing best at Vengurle centre as well as other AICRP Cashew centers. Hence, H-303 released as Vengurle-9 for Konkan region of Maharashtra and was also recommended by the house during AGM-2015 on AICRP Cashew held at R.F.R.S., Vengurle during 2-4 November, 2015.

Vengurle-9 (H-303) has medium tree with compact canopy, bold size nut, bunch bearing habit, high yield, more shelling percentage and export grade kernel.

CONCLUDED TRIAL

MULTILOCATION TRIAL II (MLT 1992)

MADAKKATHARA

Experimental Details :

Design	:	RBD
Replications	:	Three
No. of varieties	:	14
Bapatla genotypes	:	T 30/1, T 3/33, T 10/19 and T 3/28
Vengurla genotypes	:	H 68, H 367, H303, H 255 and H 320
Vridhachalam genotypes	:	M 44/3 and M 15/4
DCR genotypes	:	T 107/3 and T 40/1
KAU variety	:	H 1608 (Dhana)
Year of planting	:	1992

Results

Analysis of data revealed that there was significant difference among genotypes during 2014-15. Variety recorded T40/1 highest apple weight (96.91 g) followed by H 1608 (81.50 g). Further, there was significant difference among genotypes with respect to annual yield during 2014-15. Variety M-15/4 recorded the highest annual yield (8.90 kg/tree) followed by H320 and T3/28 (7.80kg/tree). The highest cumulative yield was recorded by H 303 (88.45 kg/tree) followed by H 320 (82.78 kg/tree).

Table : Yield parameters of cashew genotypes in MLT-II at Madakkathara centre during the year 2014-15

Accession	Nut wt (g)	Apple wt. (g)	Shelling %	Nut Yield during 14-15 (kg/tree)	Cum. nut Yield (18 years) (kg/tree)
T 30/1	6.50	49.45	24.20	5.30	42.89
T 3/33	7.86	45.88	22.90	7.30	43.40
T 10/19	6.20	50.90	23.67	6.50	35.70
T3/28	4.35	71.50	24.50	7.80	54.30
H 68	8.29	56.98	26.30	5.80	42.21
H255	8.96	78.69	24.10	5.60	42.44
H 303	8.82	68.88	22.40	5.10	88.45
H 320	8.98	71.42	21.30	7.80	82.78
H 367	8.87	71.70	22.87	6.30	45.67
M 15/4	5.23	60.40	24.10	8.90	62.98

Based on the previous two years data genotypes H-303 and H-320 performed well compared to other genotypes. The experiment was concluded including data of 2014-2015. The data was subjected to stability analysis. Wi values of nut weight indicated that genotype H-303 was found to be highly stable for nut weight and genotype M-44/3 the least stable for nut weight. Genotype H-303 was found to be highly stable for nut yield and genotype T10/19 the least stable for nut yield.

2. Multilocation Trial – III

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

The objectives of the project are to evaluate promising hybrids and TMB tolerant accessions obtained from different sponsoring centres for their performance in different agro-ecological conditions.

Experimental Details :

Starting year: 2003, No. of entries: 10 + 1(Local check)

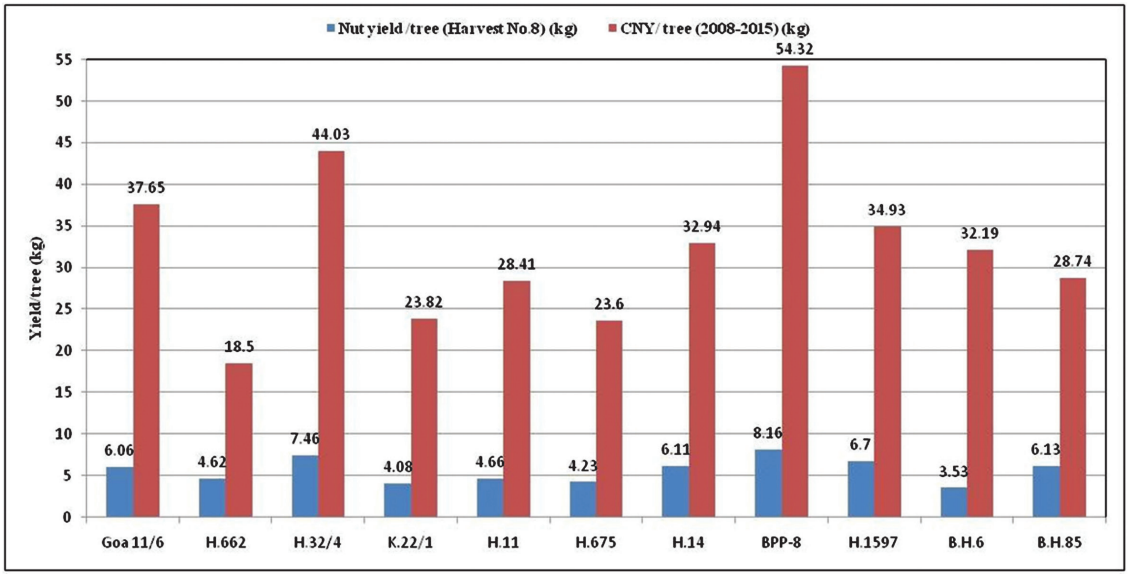
Sponsoring centre	Promising hybrids	TMB tolerant type
CRS, Bhubaneswar	BH 6, BH 85	--
CRS, Madakkathara	H 1597	K 22-1
RFRS, Vengurla	H 662, H 675	--
RRS, Vridhachalam	--	H 11 & H 14
DCR, Puttur	H 32/4	Goa 11/6
Total	6	4
Replications – Three	Spacing 7.5 x 7.5 m	Plot size - 4 plants per plot

BAPATLA

The maximum mean annual nut yield per tree during the year was recorded in BPP-8 (8.16kg) followed by H.32/4 (7.46kg) and cumulative nut yield per tree was also recorded in BPP-8 (54.32kg/tree) followed by H-32/4 (44.03 kg/tree) in 8 annual harvests. However, the mean apple weight was recorded maximum in BH-6 (73.53g) followed by H-662 (57.33g) (Table 1.19).

Table 1.19 : Yield parameters of cashew genotypes in MLT-III at Bapatla Centre

Sl. No.	Variety/ Genotype	Nut yield /tree (8th harvest) (kg)	CNY/tree (2008-2015) (kg)	Nut weight (g)	Apple weight (g)	Shelling (%)
1.	Goa 11/6	6.06	37.65	5.83	57.00	30.59
2.	H.662	4.62	18.5	5.83	57.33	30.03
3.	H.32/4	7.46	44.03	6.75	55.33	32.20
4.	K.22/1	4.08	23.82	5.94	54.00	31.73
5.	H.11	4.66	28.41	4.87	38.42	31.00
6.	H.675	4.23	23.60	3.96	27.66	28.86
7.	H.14	6.11	32.94	4.37	30.33	29.93
8.	BPP-8	8.16	54.32	6.93	55.33	29.27
9.	H.1597	6.70	34.93	5.68	56.00	28.38
10.	B.H.6	3.53	32.19	7.00	73.53	28.37
11.	B.H.85	6.13	28.74	4.62	31.00	29.75
	Mean	5.61	32.65	5.62	48.72	30.01
	SEM±	1.77	-	0.184	14.70	9.02
	CD@5%	NS	-	0.547	NS	NS



Among the 11 genotypes evaluated BPP-8 has recorded highest vegetative growth parameters, maximum canopy height, canopy spread, and canopy surface area during the three consecutive years. With regard to annual nut yield (8.16 kg/tree) and cumulative nut yield (54.32 kg/tree) BPP – 8 is performing well consistently in all the three years for 8 annual harvests.

BHUBANESWAR

The data revealed significant variations for mean nut weight (g), mean apple weight (g), shelling % and mean annual nut yield (kg/tree) among the tested cashew genotypes. Significantly maximum nut weight was recorded in genotype H-1597 (7.80 g) followed by BH-6 (7.57 g) and H-662 (7.57 g) which were statistically at par. The minimum nut weight was recorded in genotype H-675 (4.66g). Mean apple weight (g) ranged from maximum 88.84 g (H-662) to minimum 38.81g (H-675) among the tested genotypes. Significantly maximum shelling was recorded in genotype BH- 6 (31.10%) followed by H-1597 (31.00%) and H-675 (30.40%) where statistical parity was observed. The lowest shelling was recorded in genotype H-32/4 (28.07%). The mean annual nut yield varied from minimum 5.47kg tree^{-1} (H- 675) to maximum 14.82 kg tree^{-1} (H-1597) during the fruiting season 2014-15. The genotype H-1597 recorded significantly maximum mean annual nut yield (14.82kg tree^{-1}) then rest of the genotypes except BH-85 (14.68 kg tree^{-1}) which were statistically at par. However, cumulative nut yield for 9 harvests recorded maximum for genotype BH 85 (54.17 kg tree^{-1}) and minimum for genotype H-675 (15.48kg tree^{-1}) (Table 1.20).

Overall results revealed that genotype H-1597, BH-85, and BH-6 recorded promising performance with respect to mean annual nut yield (kg tree^{-1}) during the fruiting season.

From the Table 1.21, it is revealed that the genotypes BH-85, BH-6, H-1597, Goa-11/6 (Bhaskara) and BPP-8 (Local check) are showing consistency with respect to their mean annual nut yield (kg tree^{-1}) over the years compared to other tested genotypes of MLT-III. All the mentioned genotypes are recorded to be bold nut type (nut wt.> 7.0) with minimum shelling of 28.0%.

Table 1.20 : Yield parameters of cashew genotypes in MLT-III at Bhubaneswar Centre (Year of Planting 2003)

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (9 harvests)
BH-6	7.57	61.94	31.10	13.40	47.81
BH-85	7.13	60.20	28.70	14.68	54.17
H-1597	7.80	63.24	31.00	14.82	37.09
K-22-1	5.64	46.46	29.70	5.87	17.43
H-662	7.57	88.84	29.23	6.33	18.84
H-675	4.66	38.81	30.40	5.47	15.48
H-11	5.31	46.73	28.93	11.48	36.06
H-14	5.40	45.42	29.43	7.20	26.69
H-32/4	6.45	61.94	28.07	6.99	31.07
Goa -11/6	6.58	55.47	28.70	8.81	37.79
BPP-8 (Local Check)	6.73	58.57	28.33	9.74	36.87
Mean	6.44	57.06	29.42	9.53	32.66
SEM ±	0.15	2.84	0.41	0.28	-
CD at 5%	0.44	8.38	1.20	0.82	-

Table 1.21 : Performance of cashew types in MLT-III at Bhubaneswar centre

Accession No.	Annual nut yield (kg tree^{-1})			Cum. yield (kg tree^{-1}) (for 9 harvests)
	2012-13	2013-14	2014-15	
BH 6	9.0	6.06	13.40	47.81
BH 85	10.3	7.97	14.68	54.17
H 1597	5.7	7.11	14.82	37.09
Goa 11/6	6.8	6.20	8.81	37.79
BPP 8 (Local Check)	8.1	7.33	9.74	36.87

HOGALAGERE

The highest nut weight was recorded in H-1597 (5.97g) followed by BH-6 (5.6 g) and lowest was recorded by H-675 (3.31 g). The significantly highest apple weight was recorded in Goa11/6 (76.15 g) followed by BH-6 (69.34g) and H-1597 (62.45g) and the lowest apple weight was observed in H-14 (29.02g) and H-662 & H-11 (39.07g). The shelling percentage of different cashew genotypes ranged from 24.85 to 29.58 per cent. The highest shelling per cent was recorded in accession H-1597 (29.58) followed by H-675 (29.24) and H-32/4 (28.49). The lowest apple weight was observed in H-14 (24.17g) and K 22-1 (24.85g) (Table 1.22).

Table 1.22 : Yield parameters of cashew genotypes in MLT-III at Hogalagere

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (9 harvests)
BH 6	5.60	69.34	27.68	5.21	42.27
BH 85	5.53	32.21	24.76	4.30	37.20
H 1597	5.97	62.45	29.58	6.38	49.97
K 22-1	5.07	61.79	24.85	5.63	43.36
H 662	4.03	39.07	26.30	6.58	45.44
H 675	3.31	36.10	29.24	3.66	26.76
H 11	4.23	39.07	25.00	5.01	35.38
H 14	3.49	29.02	24.17	1.87	18.13
H 32/4	6.12	37.50	28.49	7.57	55.67
Goa 11/6	5.52	76.15	28.20	4.19	37.29
Chintamani-1	5.31	39.28	28.31	6.29	46.25
Mean	4.93	47.45	26.96	5.15	39.79
SEM ±	0.15	1.28	0.82	0.15	0.86
CD at 5%	0.43	3.79	2.41	0.45	2.54
CV%	15.13	13.77	15.82	14.58	11.01

Significantly highest nut yield was recorded by H–32/4 (7.57 kg/tree) followed by H-662 (6.58 kg/tree) and H-1597 (6.38 kg/tree) and lowest nut yield was recorded by H–675 (3.66 kg/tree). The cumulative yield of nine years recorded highest in H-32/4 (55.67 kg /plant) followed by H-1597 (49.97 kg/plant) and Chintamani-1 (46.25 kg/plant). The lowest was in H-14 (18.13 kg/plant).

Observations of present year in comparison to the previous two years on performance of cashew varieties showed that the variety H-32/4 is performing better with respect to nut yield and cumulative nut yield.

MADAKKATHARA

Among the varieties evaluated Goa 11/6 had the maximum annual nut yield of 9.98kg/tree and the lowest was in H11 5.96kg/tree. The cumulative yield was found in H1593 (40.63 kg/tree) for 8 harvests and was lowest in BH 85 (30.00kg/tree) (Table 1.23).

Table 1.23 : Yield parameters of cashew genotypes in MLT III at Madakkathara

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (8 year)
BH 6	8.09	74.23	8.20	30.43
BH 85	6.72	70.66	8.50	30.00
H 1593	7.83	68.91	8.85	40.63
K22-1	6.51	63.87	7.80	30.69
H 662	7.65	47.91	7.59	37.86

Table 1.23 continued

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (8 year)
H 675	6.80	60.00	6.80	30.49
H 11	5.00	62.33	5.96	31.39
H 14	6.50	74.33	9.07	33.06
H 32/4	6.94	72.16	8.77	32.62
Goa 11/6	7.52	70.58	9.98	36.75
Dhana (Local Check)	8.30	62.12	9.90	36.05
Mean	7.08	66.1	8.31	33.63
SEM±	0.229		0.135	
CD@0.05	1.108	NS	0.398	
CV%	7.56		2.83	

VENGURLA

The data revealed that, no significant variation was observed in concern with growth and yield parameters. However, apple weight, nut weight and shelling percentage significantly varies with varieties/types.

The mean apple weight was found significantly maximum in B.H.6 with 77.20 g while, mean nut weight found significantly maximum in H-662 with 8.60 g and at par with V-7 (7.96 g) and B.H.6 (7.76 g), respectively (Table 1.24).

The maximum cumulative yield for third harvests (13.53 kg/tree) was recorded in H-662 (Table1.25).

Table 1.24 : Growth observations of MLT-III at Vengurle

Sr. No.	Variety /Type	Yield (kg/tree)	Yield (t/ha)	No. of nuts/ panicle	Apple wt. (g)	Nut wt. (g)	Shelling (%)	TMB (%)
1	Goa - 11/6	4.71	0.96	12.00	54.33	6.63	31.66	L
2	Hy. 11	1.48	0.30	14.00	33.86	4.96	30.00	M
3	B.H.6	6.11	1.24	14.08	77.20	7.76	33.33	L
4	Hy. 14	5.56	1.13	12.43	33.60	5.33	31.00	L
5	Hy. 1593	3.71	0.75	13.13	71.50	6.90	29.66	M
6	K-22/1	3.97	0.81	13.53	63.86	5.90	28.16	L
7	V-7	4.48	0.91	12.70	51.66	7.96	31.00	L
8	Hy. 662	8.60	1.75	11.76	59.16	8.40	30.00	L
9	32/4	4.23	0.86	12.83	56.00	6.73	26.66	L
10	B.H.-85	2.20	0.45	11.00	50.00	6.13	31.16	M
11	Hy. 675	3.79	0.77	15.40	42.66	4.73	31.00	M
	Mean	4.44	0.90	12.99	53.98	6.49	30.33	
	SEM ±	1.27	0.259	0.97	4.79	0.36	0.60	-
	CD at 5%	NS	NS	NS	1.14	1.07	1.79	-

Table 1.25 : Yield data of MLT-III at Vengurle

Sr. No.	Variety/ type	2012-13 (kg/tree)	2013-14 (kg/tree)	2014-15 (kg/tree)	Cum. yield kg/tree (3 harvests)
1	Goa - 11/6	0.89	2.03	4.71	7.63
2	H-11	1.81	2.40	1.48	5.69
3	B.H.6	1.64	1.58	6.11	9.33
4	H-14	1.54	3.01	5.56	10.11
5	H-1593	2.05	2.49	3.71	8.25
6	K-22/1	1.54	1.57	3.97	7.08
7	V-7	1.82	3.3	4.48	9.60
8	H-662	1.37	3.56	8.60	13.53
9	32/14	1.94	2.57	4.23	8.74
10	B.H.-85	0.73	2.64	2.20	5.87
11	H-675	1.13	2.42	3.79	7.34

VRIDHACHALAM

The accessions, H11, H32/4, Goa 11/6 and VRI 3 recorded nut weight more than 7.2g. Significant variation was observed for mean annual nut yield. The accession H14 of Vridhachalam centre recorded highest nut yield (5.25kg/tree) and cumulative yield (11.89kg/tree) (Table 1.26).

Table 1.26 : Yield parameters of cashew genotypes in MLT-III at Vridhachalam

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 3 harvests)
BH 6	7.1	62.2	30.0	2.85	7.41
BH 85	6.9	50.6	29.6	3.90	9.58
H 1597	7.0	54.2	29.2	3.80	8.84
K 22-1	7.1	54.6	28.0	2.75	6.51
H 662	6.6	64.8	30.0	3.45	8.99
H 675	7.1	58.4	30.2	4.25	9.99
H 11	7.2	63.2	29.2	4.05	10.23
H 14	7.0	59.4	29.8	5.25	11.89
H 32/4	7.2	59.8	29.0	4.10	9.28
Goa 11/6	7.4	68.2	29.6	3.75	9.01
VRI 3 (Local Check)	7.2	55.0	29.0	3.84	9.56
Mean	7.07	59.13	29.42	3.82	9.21
SEM ±		1.2		0.10	
CD at 5%	NS	3.5	NS	0.52	

3. Performance of Released Varieties
(Multilocation Trial – V)

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

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

Treatments :

Year of Initiation : 2006
No. of varieties : 25

Sl. No.	Varieties	Sl. No.	Varieties	Sl. No.	Varieties
1	BPP-4	10	Dhana	19	NRCC Sel-2
2	BPP-6	11	Kanaka	20	Ullal-1
3	BPP-8	12	Priyanka	21	Ullal-3
4	Bhubaneswar-1	13	Amrutha	22	Ullal-4
5	Chintamani-1	14	Vengurla-1	23	UN-5
6	Jhargram-1	15	Vengurla-4	24	Goa-1
7	Madakkathara-1	16	Vengurla-6	25	Bhaskara
8	Madakkathara-2	17	Vengurla-7		
9	K-22-1	18	VRI-3		

BAPATLA

The trial was laid out during 2014. The details are given below.

Date of Planting : 30.09.2014
Design : RBD
No of Replications : 3
No of Plants per replication : 4

State	No.	Released varieties
Andhra Pradesh	3	BPP-4, BPP-6 and BPP-8
Maharashtra	4	Vengurle-1, Vengurle-4, Vengurle-6 and Vengurle-7
Karnataka	5	Chintamani-1,Ullal-1, Ullal-3,Ullal-4, UN-50
Kerala	7	Madakkathara-1, Madakkathara-2, Priyanka, Dhana, Kanaka, Amrutha and K-22-1.
West Bengal	1	Jhargram-1
Orissa	1	Bhubaneswar-1
NRCC Puttur	1	NRCC Sel-2
Tamilnadu	1	VRI-3
GOA	2	Goa-1, Bhaskara
Total	**25**	

BHUBANESWAR

From the vegetative parameters, it is revealed that Vengurla-7 and BPP-8 exhibited vigorous growth while VRI-3 exhibited semi tall growth habit under Bhubaneswar condition.

The mean annual nut yield ranged from minimum 1.25 kg tree^{-1} (Jhargram-1) to maximum 7.79 kg tree^{-1} (Vengurle-7) during the fruiting season 2014-15. However, the cashew type Vengurla-7 (7.79kg tree^{-1}) and BPP-8 (7.71kg tree^{-1}) recorded significantly highest mean annual nut yield then rest of the tested cashew types . The result also revealed that the cashew types such as Bhubaneswar-1 (6.00), Dhana (6.43), Vengurla-6 (6.62) and Bhaskara (6.63) recorded mean annual nut yield of ≥ 6.0kg tree^{-1} during the fruiting season. The cashew type BPP-8 recorded the maximum cumulative nut yield (19.57kg tree^{-1}) while the lowest was recorded in cashew type Jhargram-1 (4.50 kg tree^{-1}) for 5 harvest. Other cashew types which have recorded cumulative nut yield of > 11.0 kg tree^{-1} for 5 harvest are Vengurla-7 (18.11), Bhaskara (16.48), NRCC Sel.-2 (14.13), Dhana (13.71), Vengurla-4 (13.14), Bhubaneswar-1 (13.12), Kanaka (12.66), Madakkathara-1 (12.08), VRI-3 (12.05), Vengurla-6 (11.82) and Ullal-3 (11.14) (Table 1.27).

Table 1.27 : Yield parameters of cashew genotypes in MLT-V at Bhubaneswar (Year of Planting 2008)

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 5 harvests)
BPP-4	6.0	36.5	26.05	5.31	10.54
BPP-6	5.8	42.0	26.75	3.75	7.78
BPP-8	7.5	66.5	28.78	7.71	19.57
Bhubaneswar-1	6.3	38.5	30.80	6.00	13.12
Chintamani-1	6.9	43.5	30.56	5.17	9.84
Jhargram-1	6.0	63.0	28.65	1.25	4.50
Madakkathara-1	5.7	52.5	28.90	5.60	12.08
Madakkathara-2	7.0	58.0	28.81	4.40	7.43
K-22-1	5.2	43.5	29.75	3.12	7.12
Dhana	8.2	54.0	29.71	6.43	13.71
Kanaka	6.1	59.0	30.59	5.50	12.66
Priyanka	10.2	105.0	28.75	3.65	7.80
Amrutha	7.7	53.5	30.71	2.85	5.92
Vengurla-1	7.4	36.5	29.82	5.80	9.76
Vengurla-4	7.0	43.5	29.82	5.46	13.14
Vengurla-6	8.2	61.5	30.15	6.62	11.82
Vengurla-7	10.4	61.0	30.80	7.79	18.11
VRI-3	6.2	34.0	29.15	4.25	12.05
NRCC Sel-2	8.0	58.0	30.75	5.32	14.13
Ullal-1	6.6	47.0	29.80	5.00	9.22
Ullal-3	8.1	69.0	29.33	3.10	11.14
Ullal-4	7.3	59.0	30.72	3.00	6.73
UN-50	7.9	83.5	29.91	2.50	6.53
Goa-1	7.3	66.5	29.87	5.53	10.78
Bhaskara	6.5	62.5	28.98	6.63	16.48
Mean	7.18	55.9	29.52	4.87	10.88
SEM ±	0.25	2.90	0.31	0.30	-
CD at 5%	0.72	8.46	0.90	0.88	-

The results revealed that among the twenty five tested cashew types, BPP-8 (4.03, 6.00 & 7.71), Dhana (1.67, 4.60 & 6.43), Vengurla-7 (3.47, 6.05 & 7.79) and Bhaskara (2.43, 5.25 & 6.63) recorded promising performance except Jhargram-1 (0.73, 1.96 and 1.25) with respect to their mean annual nut yield (kg tree^{-1}) during the fruiting season 2013, 2014 and 2015 respectively. However, it is to be noted that all the above mentioned cashew types are at their initial stages of evaluation (Table 1.28).

Table 1.28 : Performance of cashew types in MLT-V at Bhubaneswar

Accession No.	Mean annual nut yield (kg tree^{-1})			Cum. nut yield (kg tree^{-1}) (for 5 harvests)
	2012-13	2013-14	2014-15	
BPP-4	1.00	3.33	5.31	10.54
BPP-6	0.80	2.76	3.75	7.78
BPP-8	4.03	6.00	7.71	19.57
Bhubaneswar-1	1.68	3.97	6.00	13.12
Chintamani-1	1.48	2.60	5.17	9.84
Jhargram-1	0.73	1.96	1.25	4.50
Madakkathara-1	1.37	4.10	5.60	12.08
Madakkathara-2	1.11	1.46	4.40	7.43
K-22-1	0.95	2.27	3.12	7.12
Dhana	1.67	4.60	6.43	13.71
Kanaka	1.80	3.80	5.50	12.66
Priyanka	1.55	1.51	3.65	7.80
Amrutha	0.92	1.30	2.85	5.92
Vengurla-1	1.33	1.71	5.80	9.76
Vengurla-4	1.68	4.30	5.46	13.14
Vengurla-6	1.35	2.68	6.62	11.82
Vengurla-7	3.47	6.05	7.79	18.11
VRI-3	1.32	4.60	4.25	12.05
NRCC Sel-2	2.10	5.15	5.32	14.13
Ullal-1	1.13	2.44	5.00	9.22
Ullal-3	3.17	4.00	3.10	11.14
Ullal-4	0.70	2.13	3.00	6.73
UN-50	1.10	2.18	2.50	6.53
Goa-1	1.38	2.43	5.53	10.78
Bhaskara	2.43	5.25	6.63	16.48
Mean	1.61	3.30	4.87	10.88
SEM ±	0.42	0.32	0.30	-
CD at 5%	1.25	0.94	0.88	-

DARISAI

The maximum nut weight was recorded in Vengurla -1 followed by Madakkathara-2 (7.30 gm) and H-1597 (7.20gm). The minimum nut weight was recorded in H14 (4.80gm). The apple weight was found minimum in VRI-3 (43.20gm) and maximum in H1597 (89.6gm). In the first year of fruiting the maximum nut yield/tree was found to be in H14 (5.70kg/tree) followed by H11 (5.20 kg/tree) (Table 1.29).

HOGALAGERE

The trial was planted during June 2007 with a spacing of 8 x 8 m. The accession Chintamani-1 and Ullal-1 recorded highest mean nut yield with 2.74 kg/tree and 2.71 kg/tree, respectively followed by Goa-1 (2.56 kg/tree). The least mean nut yield was noticed in the accession Madakkathara-1 (0.88 kg/tree) and VRI (M-26/2) (0.91 kg/tree).

Table 1.29 : Yield parameters of cashew genotypes in MLT-V at Darisai

Accession	Year of planting	Nut wt. (g)	Apple wt. (g)	Yield (kg/tree)
BH6	2011	7.3	97.8	3.3
BH85	2011	5.6	87.4	4.1
H1597	2011	7.2	89.6	4.6
H662	2011	6.4	67.7	5.8
H675	2011	4.5	53.4	4.7
H11	2011	5.3	43.7	5.2
H14	2011	4.8	39.3	5.7
H32/4	2011	6.1	73.6	4.9
GOA 11/6	2011	5.63	45.8	4.8
BPP-4	2011	5.9	33.6	1.6
BPP-6	2012	4.7	40.2	2.4
BPP-8	2012	5.2	65.4	2.3
DHANA	2012	5.7	43.6	1.8
MADAKKATHARA-1	2012	4.2	37.2	0.9
MADAKKATHARA -2	2012	7.3	62.5	1.2
KANAKA	2012	5.4	24.6	1.8
VENGURLA-1	2012	8.3	40.4	2.2
PRIYANKA	2012	5.9	33.7	0.7
ULLAL-1	2013	6.7	63.7	2.1
GOA-1	2013	6.2	48.2	2.4
BHASKAR	2013	5.9	44.9	2.75
VRI-3	2013	5.65	37.4	2.1
K22-1	2013	6.2	43.2	1.8
JHARGRAM-2	2014	5.1	47.8	1.4

The highest cumulative nut yield for two years was showed in accession Ullal-1 (10.22 kg/tree) followed by Chintamani-1 and Goa-1 with 10.19 kg/tree and 9.47 kg/tree, respectively. The least cumulative nut yield was noticed in the accession Madakkathara-1 (3.31 kg/tree) and VRI-3 (3.45 kg/tree).

The accession Dhana recorded highest mean apple weight with (37.25) followed by Goa-1 and Ullal-4 with 35.07 and 34.11, respectively. The least mean apple weight was noticed in the accession BPP-6 (17.33) and Vengurla-1 (18.18). The highest shelling per cent was showed in accession NRCC-Sel-2 (33.35) followed by UN-50 and BPP-4 with 32.91 and 30.54, respectively. The least shelling per cent was noticed in the accession Madakkathara-1 (21.28) and Chintamani-1 (23.42) (Table 1.30).

Table 1.30 : Yield parameters of cashew genotypes in MLT-V at Hogalagere

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 5 harvests)
BPP-4	4.83	26.16	30.54	1.88	7.06
BPP-6	3.25	17.33	28.70	2.13	7.85
BPP-8	4.80	29.11	24.53	1.56	5.93
Bhubaneswar-1	3.99	25.25	26.18	1.41	5.35
Chintamani-1	6.20	21.61	23.42	2.74	10.19
Jhargram-1	4.04	28.89	28.58	1.14	4.33
Madakkathara-1	3.52	23.53	21.28	0.88	3.31
Madakkathara-2	4.83	27.87	24.14	1.57	5.94
K-22-1	4.65	32.74	27.87	2.07	7.79
Dhana	4.84	37.25	26.79	2.42	9.01
Kanaka	4.16	23.02	27.62	1.42	5.25
Priyanka	4.75	33.68	23.74	1.42	5.42
Amrutha	5.45	30.61	29.23	1.63	6.11
Vengurla-1	4.38	18.18	25.93	1.60	6.03
Vengurla-4	4.25	20.50	25.01	2.07	7.74
Vengurla-6	5.15	20.37	24.69	1.60	5.97
Vengurla-7	5.76	29.64	25.93	1.29	4.80
VRI-3	5.05	20.98	25.12	0.91	3.45
NRCC Sel-2	3.88	19.13	33.35	0.96	3.61
Ullal-1	5.89	26.75	29.31	2.71	10.22
Ullal-3	5.67	19.80	29.99	1.19	4.48
Ullal-4	5.83	34.11	30.79	2.11	8.05
UN-50	5.81	30.70	32.91	2.18	8.23
Goa-1	5.30	35.07	27.62	2.56	9.47
Bhaskara	4.96	26.61	28.93	2.32	8.58
Mean	4.85	26.36	27.29	1.75	6.57
SEM±	0.37	2.01	2.18	0.16	0.56
CV (%)	12.51	12.71	12.79	15.12	14.43
CD (0.05%)	1.05	5.72	6.20	0.46	1.60

The accession UN-50 recorded highest number of nuts/m^2 (24.09) followed by Ullal-1 and Ullal-4 with 22.74 and 21.59, respectively. The least number of nuts/m^2 was noticed in the accession VRI-3 (15.22) and Bhubaneshwar-1 (15.99). The highest mean nut weight was showed in accession Ullal-1 (5.89) followed by Ullal-4 and UN-50 with 5.83 and 5.81 respectively. The least mean nut weight was noticed in the accession BPP-6 (3.25) and NRCC Sel-2 (3.88).

Among 25 different cashew varieties evaluated for their suitability and yield potentiality in this experiment, Chintamani-1 is performing well with medium sized nuts. The consistency in its performance is evident from the previous year's observations as well.

JHARGRAM

The varieties could be grouped into three different groups based on the nut weight i.e. bold nut having weight between (7-8)g, medium nut weight between (5-6)g and small nut <5g. among the 24 varieties, varieties like Vengurla-7, UN- 50, Priyanka, BPP – 8, Dhana and Ullal - 3 had bold nuts. Most of the varieties had produced medium sized nuts. Shelling % varied from (7.3 to 45.1)%. Except Priyanka and Dhana all other varieties had more than 28% shelling recovery and maximum was in Kanaka. At the age of 4 years the yield of the varieties were recorded in the range of (1.3-7.6 kg/tree). Maximum yield was with Vengurla - 7 (7.6 kg/tree). The second harvest data revealed that Cumulative yield was maximum in Vengurla-7 (12.2 kg/tree) followed by Bhubaneswar – I (9.2 kg/tree) and Vengurla – 4 (8.8 kg/tree) (Table 1.31).

Table 1.31 : Yield parameters of cashew genotypes in MLT-V at Jhargram (Year of Planting: 2010)

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 3 harvests)
Bhaskara	7.7	46.9	36.0	3.9	7.6
Madakathara II	6.7	30.8	32.7	2.4	4.9
Bhubneswar 1	6.2	25.8	35.4	4.8	9.2
K-22-1	6.2	42.0	35.4	2.6	5.5
Chintamani 1	6.6	29.5	31.0	2.0	4.6
Ullal 4	6.9	54.8	30.5	4.5	8.2
Vengurla 7	8.7	49.3	34.4	7.6	12.2
VRI – 3	5.7	39.5	35.1	3.6	7.1
BPP-6	5.2	40.5	31.4	2.1	4.7
Amrutha	6.8	31.8	29.8	2.0	7.8
Vengurla 4	6.2	32.9	32.1	4.9	8.8
Goa 1	6.7	47.2	33.0	2.1	5.6
Madakathara I	5.6	27.8	34.2	1.3	2.4
Priyanka	8.1	33.7	27.3	3.2	4.3
BPP-8	7.9	62.0	29.3	4.0	7.5
Kanaka	5.3	35.1	45.1	2.7	5.6
Vengurla 1	5.5	57.2	31.0	1.7	4.7
Vengurla 6	5.9	43.8	28.8	2.6	5.4
Ullal 3	7.3	62.5	30.4	4.2	6.8
Dhana	7.4	43.9	27.9	2.2	4.4
BPP 4	4.7	32.5	32.4	1.6	3.6

Table 1.31 continued.....

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 3 harvests)
UN-50	8.1	36.7	31.8	1.8	5.8
Jhargram1	5.8	43.8	29.8	2.0	5.3
NRCC-2	6.0	51.9	35.2	1.5	5.1
Mean	6055	41.75	32.5	2.97	6.13
SEM ±	0.100	1.580	1.927	0.679	1.017
C.D. at 5%	0.200	3.153	3.846	3.15	2.029
CV%	1.6	4.0	6.2	24.3	17.6

MADAKKATHARA

Analysis of data revealed that there was significant difference among genotypes for apple weight, nut weight and nut yield for the current season.The highest apple weight was recorded by priyanka (65.20g) followed by Anagha (58.30g). The highest nut weight was recorded by Priyanka(10.42g) followed by Akshaya(10.09g). The maximum nut yield was recorded genotype kanaka (2.98kg/tree) followed by Dhana (2.69kg/tree). The highest cumulative yield was recorded by Dhana (8.33kg/tree) followed by kanaka (8.32kg/tree) (Table 1.32).

Table 1.32 : Yield parameters of cashew genotypes in MLT-V at Madakkathara (planted 2006)

Sl. No.	Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (17 year)
1	BPP-4	6.51	52.52	1.90	6.09
2	Akshaya	10.09	34.28	2.10	7.12
3	Anagha	10.00	58.30	1.91	6.56
4	Raghav	8.92	48.94	2.28	6.92
5	Chinthamani-1	7.00	45.28	2.03	6.39
6	Jhargram-1	5.10	48.70	2.42	7.94
7	Madakkathra-1	6.50	53.85	2.62	7.60
8	Madakkathra-2	7.00	49.13	2.15	6.68
9	K-22-1	5.84	48.38	2.00	6.18
10	Dhana	8.10	43.29	2.69	8.33
11	Kanaka	5.82	45.76	2.98	8.32
12	Priyanka	10.42	65.20	2.19	7.59
13	Amrutha	7.15	50.47	2.23	7.21
14	Vengurla-1	6.23	47.40	2.07	6.91
15	Vengurla-4	6.82	46.44	1.76	5.93
16	Vengurla-6	7.91	42.17	2.20	7.08
17	Sulabha	9.83	43.85	2.73	7.85
18	VRI-3	7.00	47.64	2.36	7.12

Table 1.32 continued.....

Sl. No.	Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (17 year)
19	NRCC Sel-1	7.52	36.01	1.90	6.74
20	Ullal-1	6.54	43.01	1.48	5.20
21	Ullal-3	7.24	46.59	1.99	5.73
22	Ullal-4	7.00	40.00	1.59	6.75
23	UN-50	9.10	41.41	1.98	6.82
24	Damodar	8.30	47.60	2.12	6.46
25	Bhaskara	7.50	45.45	1.63	6.95
	Mean	7.58	46.87	2.13	6.90
	SEM ±	0.664	2.73	0.154	-
	CD@0.05	1.337	7.762	0.440	-
	CV%	0.470	10.27	11.93	-

PILICODE

The experiment was laid out during 2007-08. Twenty five varieties have been allotted for the experiment and 20 released varieties with 10 plants each were planted during June 2008. The varieties differed among themselves for all the biometric characters studied.

Highest nut weight was recorded in Priyanka and Amrutha, followed by NRCC sel-2, UN 50 and BPP 8. Heaviest apples were found in BPP 6 followed by BPP 8. Priyanka had the highest annual nut yield and cumulative yield.

Table 1.33 : Yield parameters of cashew genotypes in MLT-V at Pilicode (2008 planted)

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 2 harvests)
BPP-6	5.75	101.00	0.48	0.81
BPP-8	10.35	92.50	0.34	0.34
Bhubaneswar-1	5.25	73.50	0.46	0.76
Madakkathara-1	7.32	47.50	0.56	4.01
Madakkathara-2	7.15	63.50	2.00	4.45
K-22-1	7.80	52.00	0.77	2.07
Dhana	8.00	61.50	0.52	1.21
Kanaka	9.90	60.00	1.79	3.72
Priyanka	11.40	62.25	3.88	10.90
Amrutha	11.35	63.00	2.15	4.00
Vengurla-4	7.43	53.00	0.19	0.79
Vengurla-7	9.00	48.75	0.53	1.48
VRI-3	6.13	52.00	0.82	1.27

Table 1.33 continued.....

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 2 harvests)
NRCC Sel-2	10.95	85.50	0.32	1.99
Ullal-1	7.10	50.00	0.58	1.58
Ullal-3	7.33	53.00	0.93	2.21
UN-50	10.28	62.50	0.43	1.43
Goa-1	6.75	57.50	0.22	0.60
Bhaskara	7.65	54.00	0.28	3.98
Mean	8.26	62.79	0.91	2.51
CD at 5%	0.34	6.23	0.09	0.314
CV%	1.93	4.72	4.83	5.97

VRIDHACHALAM

The following released varieties were planted during January 2008.

S. No.	Varieties	S. No.	Varieties	S. No.	Varieties
1	BPP-4	10	Dhana	19	NRCC Sel-2
2	BPP-6	11	Kanaka	20	Ullal-1
3	BPP-8 (H 2/16)	12	Priyanka	21	Ullal-3
4	Bhubaneshwar-1	13	Amrutha	22	Ullal-4
5	Chintamani-1	14	Vengurla-1	23	UN-50
6	Jhargram-1	15	Vengurla-4	24	Goa-1
7	Madakkathara-1	16	Vengurla-6	25	Bhaskara
8	Madakkathara-2	17	Vengurla-7		
9	K-22-1	18	VRI-3		

The varieties were evaluated for morphological characters like plant height, girth, canopy spread etc. and yield characters.

The average nut weight, nuts/ panicle^{1} and nuts/m^{2} showed significant variations among the cashew varieties. The average nut weight varies from 5.8g to 7.8g. Maximum nut weight of 7.8g was recorded by Priyanka. The varieties BPP4, BPP-8, Madakkathara-2, Amrutha, Vengurla-4, Vengurla-7, VRI-3 and Ullal-4 recorded nut weight of 7.2g. Apple weight varies from minimum of 51.2g in BPP 6 to maximum of 70.0 in Priyanka. Shelling ranged from 26.2 % (BPP.-4) to 30.2 % (Vengurla-4). Nut yield/ tree recorded significant differences among the varieties. The mean annual nut yield plant^{-1}(kg) varies from 2.75 (Bhubaneswar 1) to 4.65 (VRI-3) with cumulative nut yield of 6.73 (Bhubaneswar 1) to 10.57 (VRI 3) at fourth harvest (Table 1.34).

Table 1.34 : Yield parameters of cashew genotypes in MLT-V at Vridhachalam (Year of Planting- 2008)

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 4 harvests)
BPP-4	7.2	63.3	26.2	4.20	9.38
BPP-6	5.0	51.2	27.4	4.22	9.74
BPP-8	7.2	66.2	28.0	4.32	10.2
Bhubaneswar-1	6.6	56.7	26.8	2.75	6.73
Chintamani-1	6.0	66.6	27.0	2.95	7.49
Jhargram-1	5.8	53.3	28.2	2.95	7.37
Madakkathara-1	6.2	52.7	28.0	3.80	9.52
Madakkathara-2	7.2	60.4	29.2	3.60	8.72
K-22-1	6.6	59.4	30.0	3.80	9.22
Dhana	7.0	59.5	28.6	3.60	8.68
Kanaka	6.6	56.7	27.8	4.10	9.66
Priyanka	7.8	68.1	29.4	3.80	9.36
Amrutha	7.2	61.2	29.8	3.80	8.94
Vengurla-1	6.6	60.7	29.0	4.20	9.78
Vengurla-4	7.2	70.0	30.2	4.40	10.14
Vengurla-6	6.8	58.4	28.4	3.20	8.14
Vengurla-7	7.2	67.6	29.2	3.70	9.56
VRI-3	7.2	59.0	27.4	4.65	10.57
NRCC Sel-2	7.0	60.2	28.6	3.40	8.04
Ullal-1	6.8	53.0	29.2	3.30	8.34
Ullal-3	7.0	51.8	28.2	3.42	8.30
Ullal-4	7.2	59.0	28.0	3.62	8.87
UN-50	7.0	56.2	29.2	3.42	8.62
Goa-1	7.0	61.6	30.0	3.20	8.50
Bhaskara	6.8	62.5	28.6	3.42	9.14
Mean	6.81	59.81	28.50	3.67	8.92
SEM ±	0.07	1.35	0.16	0.07	
CD at 5%	0.22	2.92	0.40	0.22	

4. Multilocation Trial – (MLT – VI)

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

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

Experimental details:

Two rows each, of the cashew varieties (listed below) comprising of six plants per row.

Varieties :

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

*** Local Check for New Centres :**

BAU Centre	:	BPP-8
Paria, Arabhavi & Tura	:	V-4
Goa	:	Goa-1 or Goa 2

DARISAI

The flowering duration ranged from 59 days (var BPP3/33) to 101.24 days (Var NRCC SEL-2). The apple weight (94.20gm) and the mean weight (9.4gm)was maximum in H367, whereas the maximum nut yield (5.8kg/tree) was found to be in NRCC selection-1 (Table 1.35).

Table 1.35 : Yield parameters of cashew genotypes in MLT-VI at Darisai

Accession	Year of planting	Flowering duration (Days)	Apple wt. (g.)	Nut wt (g.)	Nut yield (kg/tree)
NRCC sel-1	2010	98.36	65.7	7.6	5.8
NRCC sel-2	2010	101.24	67.8	8.8	4.6
M44/3	2010	67.2	29.24	5.1	3.8
M15/4	2010	63.8	58.6	7.2	3.9
BPP3/33	2012	59.0	53.6	6.3	2.6
BPP10/19	2012	67.4	51.7	6.1	1.8
BPP30/1	2012	87.6	38.7	6.6	0.9
BPPP3/28	2012	98.7	62.67	7.6	2.7
H303	2012	100.6	57.84	8.2	5.6
H255	2013	97.4	67.7	9.3	4.9
H367	2013	97.76	94.2	9.4	3.4
H68	2013	63.0	61.7	8.1	4.7
Mean		83.51	59.12	7.52	3.72

GOA

Evaluation of new hybrids / varieties introduced from other cashew research stations.

Though growth of all the varieties was observed to be satisfactory in the evaluation trial comprising of 7 cashew varieties, there was severe incidence of Tea Mosquito Bug and Cashew Stem and Root Borer. Bhaskara, Vengurla-8 and Priyanka recorded better performance with 4.88 kg and 4.24 kg of raw nut yield respectively. Nut and apple size were observed to be stable over seasons. All the varieties recorded higher shelling percentage in the range of 28.4% (Priyanka) to 29.8% (Vengurla-8) except Raghava variety.

Table 1.36 : Initial trends of growth and yield on different introduced varieties of cashew at Goa

Sl. No.	Variety	Height (m)	Canopy Spread (2015)		Nut yield (Kg/tree)			Nut weight (g)			Apple weight (g)	Shelling (%)
			N x S	E x W	2013	2014	2015	2013	2014	2015	2015	2015
1.	Vengurla-8	3.8	2.5	3.2	3.76	3.88	4.24	8.28	8.17	8.8	79.5	29.8
2.	Dhana	3.0	2.6	2.9	1.86	1.68	2.21	7.72	7.52	7.85	62.8	28.6
3.	Raghava	3.1	2.2	2.4	1.96	2.01	2.56	7.90	7.25	7.68	65.6	27.5
4.	Priyanka	3.7	2.3	2.1	1.95	2.3	3.2	7.95	8.02	8.69	68.8	28.4
5.	Bhaskara	3.6	2.8	2.6	3.48	3.33	4.88	7.45	7.33	7.68	52.3	28.8
6.	Ullal-3	3.2	2.4	2.5	2.04	1.89	2.88	8.11	8.10	8.0	62.6	29.4
7.	Tiswadi-3	3.2	2.8	2.3	1.91	1.65	2.85	10.1	9.95	10.2	92.5	28.8
8.	NRCC Sel.2	2.4	1.1	1.2	-	-	-	-	-			
9.	VRI-3	2.1	1.2	1.3	-	-	-	-	-			
	SEM ±	0.26			-	0.27	0.21	0.19	0.14	0.13	2.12	-
	CD (5%)	0.69	NS	NS	-	0.73	0.68	0.72	0.58	0.49	6.64	NS

TURA

Table 1.37 : Performance of Cashew Varieties under Special Multilocation trial at Tura

No.	Variety	Year of planting	Height (m)	Stem Girth (cm)	Canopy spread (m)		Remarks
					E-W	N-S	
1	Dhanna	2010	2	9	2.30	1.9	Fruiting started in 2016-17
2	VRI(CW)H1	2011	1.5	7	1.5	1.6	- Do -

The varieties Bhaskara, H-303, BPP-8, Vengurla-4, VRI-3 and NRCC Sel.-2 were planted in the year 2015.

Gen.4. Hybridization and Selection

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

West Coast : Goa, Madakkathara, Pilicode and Vengurla

Plains / others : Hogalagere

The project aims at utilizing the accessions with high yield and other desirable traits selected from the germplasm conserved at various AICRP centres as parents, to combine the desirable traits such as high yield, bold nut, cluster bearing habit, compact canopy, short flowering period, late synchronized flowering and high shelling percentage in single genotype.

BAPATLA

As a result of continuous crossing programme and systematic evaluation the BPP-1, BPP-2, BPP-8 and BPP-9 were released as hybrid varieties and T.No.10/19 and T.No. 30/1 is proposed for release as BPP-10 and BPP-11. Existing F1 progenies have been evaluated for the duration of flowering, yield, nut weights etc.

The mean nut weight was found highest in H-330 (7.69g) followed by H-355 (7.55g). The shelling percentage was highest in H-371 (34.05) followed by H-350 (33.76) and H-360 (33.32). The mean annual nut yield per tree was recorded highest in H-319 (6.0 kg/tree) followed by H- 365 (4.25kg/tree). The cumulative nut yield was found highest in H-355 (31.85 kg) followed by H- 365 (30.95 kg/tree) for 4 annual harvests (Table 1.38).

Table 1.38 : Yield parameters of different cashew hybrids at Bapatla

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree) 4th harvest (2015)	Cum. nut yield (kg/tree) (for 4 harvests) 2012-2015
H292	BPP6xULLAL-3	5.71	26.0	26.4	1.6	7.15
H293	BPP6xULLAL-3	4.66	30.0	26.8	1.3	6.27
H294	BPP6xULLAL-3	5.71	30.0	28.14	0.4	5.25
H295	BPP6xULLAL-3	3.47	40.0	27.34	0.85	8.06
H297	BPP6xNRCC SEL2	6.13	35.0	31.00	1.9	8.95
H298	BPP6xNRCC SEL2	6.07	30.0	32.51	2.7	13.25
H299	BPP6xNRCC SEL2	6.15	75.0	28.61	2.6	12.95
H300	BPP6xNRCC SEL2	5.71	62.0	30.15	2.35	11.21
H301	BPP6xNRCC SEL2	5.40	39.0	30.00	0.90	6.47
H302	BPP6xNRCC SEL2	5.00	46	28.00	0.95	6.35
H303	BPP6xNRCC SEL1	5.24	60.0	31.23	1.6	6.40
H304	BPP6xNRCC SEL1	6.82	75.0	29.84	2.5	11.30

Table 1.38 continued....

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree) 4th harvest (2015)	Cum. nut yield (kg/tree) (for 4 harvests) 2012-2015
H305	BPP6xNRCC SEL1	5.62	31.0	29.88	0.6	5.20
H306	BPP6xULLAL 4	5.3	51.0	23.40	2.35	9.75
H307	BPP6xULLAL 4	5.77	65.0	25.90	3.6	5.40
H308	BPP6xULLAL 4	5.0	54.0	26.90	0.25	2.80
H309	BPP6xULLAL 4	5.50	53.0	27.80	0.3	3.85
H310	BPP6xULLAL 4	5.10	50.0	29.9	1.5	7.80
H311	BPP6xULLAL 4	6.00	56.0	29.18	2.1	7.6
H312	BPP6xULLAL 4	6.40	54.5	27.20	2.0	8.15
H313	BPP8xNRCC Sel 2	5.63	62.0	27.35	1.3	6.1
H314	BPP8xNRCC Sel 2	6.40	64.0	27.36	2.8	12.7
H315	BPP8xNRCC Sel 2	4.80	51.0	26.30	3.45	13.5
H316	BPP8xNRCC Sel 2	6.94	35.0	13.06	2.3	11.5
H317	BPP8xNRCC Sel 2	6.22	50.0	22.71	4.0	21.95
H318	BPP8xNRCC Sel 2	5.82	50.0	29.85	3.2	10.80
H319	BPP6xNRCC Sel 2	5.96	40.0	25.79	6.0	21.45
H320	BPP6xNRCC Sel 2	5.95	50.0	27.41	1.3	6.25
H321	BPP6xNRCC Sel 2	6.90	49.0	27.40	3.1	11.80
H322	BPP6xNRCC Sel 2	6.50	49.0	28.40	0.3	2.80
H323	BPP6xNRCC Sel 2	5.60	53.0	26.40	2.5	9.95
H324	BPP6xNRCC Sel 2	5.35	25.0	27.94	2.2	9.0
H325	BPP6xNRCC Sel 2	6.77	50.0	26.10	2.8	10.8
H326	BPP6xNRCC Sel 2	5.89	50.0	26.10	2.4	5.75
H327	BPP6xNRCC Sel 2	5.60	51.0	27.10	2.65	10.10
H328	BPP-8xULLAL-4	4.94	62.0	27.305	1.4	6.15
H329	BPP-8xULLAL-4	3.56	85.0	22.95	1.1	6.25
H330	BPP-8xULLAL-4	7.69	46.0	22.30	0.35	2.45
H331	BPP-8xULLAL-4	6.52	61.0	24.40	2.1	9.85
H332	BPP-8xULLAL-4	5.87	75.0	28.42	0.65	5.15
H333	BPP-8xULLAL-4	7.00	51.0	29.30	0.55	3.60
H334	BPP8xBPP4	6.92	41.0	26.30	0.50	7.22
H335	BPP8xBPP4	4.41	54.0	30.09	1.80	5.70
H336	BPP8xBPP4	4.19	35.0	29.0	3.10	12.85
H337	BPP8xBPP4	6.18	50.0	24.63	2.3	9.83
H338	BPP8xT NO 228	6.80	37.5	24.90	1.3	7.55
H339	BPP8xT NO 228	5.69	35.0	32.81	0.9	6.32

Table 1.38 continued....

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree) 4th harvest (2015)	Cum nut yield (kg/tree) (for 4 harvests) 2012-2015
H340	BPP8xT NO 228	7.20	40.0	27.63	2.1	17.20
H341	T NO 228 x BPP8	5.60	40.0	17.88	2.45	10.97
H342	T NO 228 x BPP8	3.24	20.0	28.50	2.2	10.45
H343	T NO 228 x BPP8	3.88	25.0	32.92	1.75	9.45
H344	T NO 228 x BPP8	4.13	20.0	31.42	2.8	16.9
H345	T NO 228 x BPP8	5.69	25.0	30.00	2.3	10.65
H346	T NO 228 x BPP8	4.62	22.5	30.84	1.5	5.73
H347	T NO 228 x BPP8	4.45	33.0	31.56	3.4	12.04
H348	T NO 228 x BPP8	5.81	48.0	30.20	2.2	7.8
H349	T NO 228 x BPP8	2.93	23.0	29.27	2.0	11.75
H350	T NO 228 x BPP8	3.37	35.0	33.76	2.8	14.30
H351	BPP6xNRC SEL 2	3.56	30.0	29.00	2.0	9.35
H352	BPP8xT NO 10/19	4.63	46.0	28.22	2.1	9.47
H353	BPP8xT NO 10/19	6.24	50.0	21.65	1.3	9.70
H354	BPP8xT NO 10/19	6.40	60.0	23.40	1.0	5.40
H355	BPP8xT NO 10/19	4.28	30.0	31.16	1.9	32.85
H356	BPP8xT NO 10/19	2.92	25.0	27.48	4.0	23.70
H357	BPP8xT NO 10/19	3.92	35.0	27.18	0.85	6.5
H358	BPP8xT NO 10/19	7.55	40.0	24.86	2.50	12.88
H359	BPP8xBPP3	6.24	56.0	24.23	0.60	3.75
H360	BPP8xBPP3	3.00	25.0	33.32	0.80	5.58
H361	BPP8xBPP3	4.73	40.0	25.43	1.9	12.60
H362	BPP8xBPP3	6.62	45.0	22.64	2.45	12.28
H363	BPP8xBPP3	3.76	25.0	28.95	0.80	5.87
H364	BPP8xBPP3	5.22	50.0	15.49	2.10	13.41
H365	BPP8xBPP3	3.95	50.0	28.63	4.25	31.85
H366	BPP8xBPP3	3.82	30.0	20.93	2.2	11.58
H368	T NO 228xBPP-8	5.90	41.0	23.23	4.2	18.93
H369	T NO 228xBPP-8	6.26	45.0	26.24	1.0	4.58
H370	T NO 228xBPP-8	5.93	50.0	24.20	3.0	16.45
H371	T NO 228xBPP-8	6.71	55.0	34.05	2.6	10.70
H372	T NO 228xBPP-8	2.61	20.0	17.05	0.4	3.21
H373	T NO 228xBPP-8	6.34	31.0	18.80	1.2	7.34
H374	T NO 228xBPP-8	6.10	41.0	27.40	0.5	8.38
H375	T NO 228xBPP-8	4.31	20.0	28.08	1.0	5.43
H376	T NO 228xBPP-8	4.65	40.0	32.50	0.7	2.60

The mean nut weight was recorded highest in H-420 (11.0g) which was followed by H-389 (8.09g). The shelling percentage was found highest in H-386 (34.85) followed by H-384 (33.42). The mean annual nut yield was found highest in H-410 (5.05kg / tree) followed by H-381 (3.30 kg / tree). The cumulative nut yield was found highest in H-410 (18.35 kg / tree) followed by H-415 (16.30 kg / tree). For 3 annual harvests (Table 1.39).

Table 1.39 : Yield parameters of different cashew hybrids at Bapatla

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%) 3rd harvest (2015)	Mean annual nut yield (kg/tree) (for 3 harvests) 2013-15	Cum. nut yield (kg/tree)
H377	BPP8xT NO 10/19	5.99	76	24.3	2.00	6.60
H378	BPP8xT NO 10/19	6.26	80	26.25	2.60	8.35
H379	BPP8x320	8.00	66	27.20	0.85	11.00
H380	BPP8xH 320	5.51	45	26.40	2.00	6.75
H381	BPP8xH 320	5.63	20	25.35	3.30	13.05
H382	BPP8xH 320	9.00	46	25.35	3.10	11.95
H383	BPP8xH 320	6.69	45	23.40	1.60	5.90
H384	T NO 228xT NO 30/1	4.42	45	33.42	0.70	3.00
H385	T NO 228xT NO 30/1	5.6	55	31.20	1.10	4.95
H386	BPP-8xH 255	4.6	46	34.85	1.60	5.95
H387	BPP-8xH 255	5.62	50	31.47	3.15	11.80
H388	BPP-8xH 255	6.29	41	30.00	0.85	5.45
H389	BPP-8xH 255	8.09	45	29.45	0.80	3.34
H390	BPP-8xH 255	6.66	46	27.35	1.10	5.65
H391	BPP-8xTNO 30/1	4.73	60	30.33	1.05	3.55
H392	BPP-8xTNO 30/1	6.69	40	26.30	1.60	6.25
H393	BPP-8xTNO 30/1	6.71	50	24.85	1.95	8.70
H394	BPP-6xT NO 10/19	5.91	49	25.00	0.30	3.20
H395	BPP-6xT NO 10/19	6.05	44	26.0	1.75	7.30
H396	BPP-6xT NO 10/19	6.21	45	30.00	1.45	6.45
H397	BPP-6xT NO 10/19	5.83	30	28.64	2.00	6.70
H398	BPP-6xT NO 10/19	5.90	40	27.00	1.05	4.25
H399	PRIYANKAxBPP-8	4.27	30	31.60	1.60	5.90
H400	PRIYANKAxBPP-8	6.94	63	29.80	1.20	6.60
H401	PRIYANKAxBPP-8	4.84	56	27.40	1.30	5.00
H402	PRIYANKAxBPP-8	5.14	45	29.79	1.25	4.40
H403	PRIYANKA xTNO 228	6.40	50	24.98	1.45	6.10
H404	BPP 8xM 15/4	6.82	50	28.45	1.65	6.60
H405	BPP 8xM 15/4	6.19	30	26.40	0.70	5.00

Table 1.39 continued .....

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%) 3rd harvest (2015)	Mean annual nut yield (kg/tree) (for 3 harvests) 2013-15	Cum nut yield (kg/tree)
H406	M 15/4xBPP 8	7.87	53	22.51	0.84	5.04
H407	PRIYANKAxBPP-4	6.36	60	31.69	3.00	11.50
H408	T NO 228xBPP-8	5.11	26	30.00	2.55	11.30
H409	T NO 228xBPP-8	4.21	45	28.98	3.10	6.80
H410	T NO 228xBPP-8	4.15	40	27.20	5.05	18.35
H411	T NO 228xBPP-8	5.14	70	29.17	1.90	9.55
H412	T NO 228xBPP-8	4.91	50	28.52	3.05	10.55
H413	T NO 228xBPP-8	6.50	45	26.52	1.1	6.10
H414	BPP-6xT N0 30/1	5.00	50	27.40	1.60	6.10
H415	BPP-6xT N0 30/1	6.91	40	26.30	4.65	16.30
H416	BPP-6xT N0 30/1	4.11	20	26.71	0.70	3.15
H417	T NO 228xT NO 10/19	5.11	45	24.30	0.40	2.30
H418	T NO 228xT NO 10/19	5.08	33	31.08	0.50	4.30
H419	BPP-8xH-367	5.51	75	30.64	1.00	5.40
H420	BPP8xPRIYANKA	11.00	100	29.30	0.50	2.45
H421	PRIYANKAxTNO 10/19	6.0	71	26.20	1.15	4.90

The mean nut weight was recorded highest in H-438 (6.71 g) followed by H-433 (6.25 g). The mean apple weight was found highest in H-437 (74.0 g) followed by H-437 (65.0 g) and H-428 (64.0g). The shelling percentage was recorded maximum in H-426 (31.93) followed by H-431 (31.00). The mean annual nut yield per tree at 2nd harvest was found maximum in H-431 (1.0 kg/tree) followed by H-438 (0.7kg/tree). The cumulative nut yield was found maximum in H-433 (3.90 kg/tree followed by H-431 (3.10 kg/tree) for 2 annual harvests (Table 1.40).

Table 1.40 : Yield parameters of different cashew hybrids at Bapatla

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) (2nd harvest) 2015	Cum nut yield (kg/tree) (for 2 harvests) 2015
H 422	T.NO.228xBPP-8	5.6	54.00	30.50	0.25	0.85
H 423	T.NO.228xBPP-8	5.4	31.00	27.54	0.50	1.80
H 424	T.NO.228xBPP-8	6.0	30.0	26.20	0.60	1.90
H 425	T.NO.228xBPP-8	3.86	25.00	30.31	0.65	2.10
H 426	T.NO.228xBPP-8	4.08	20.00	31.93	0.60	1.80
H 427	TNO.10/19xBPP9	5.51	51.00	28.20	0.10	0.30
H 428	TNO.10/19xBPP9	4.9	64.00	27.54	0.65	2.05

Table 1.40 continued .....

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) (2nd harvest) 2015	Cum nut yield (kg/tree) (for 2 harvests) 2015
H 429	H-303xBPP-5	6.1	45.00	26.54	0.40	1.30
H 430	H-303xBPP-5	5.8	50.00	29.30	0.55	1.70
H 431	H-303xBPP-5	6.0	50.00	31.00	1.00	3.10
H 432	T.NO.228xT.NO.10/19	3.31	22.00	30.17	0.30	0.375
H 433	T.NO.228xT.NO.10/19	6.25	36.00	22.36	0.30	3.90
H434	T.NO.228xT.NO.10/19	5.38	50.00	29.89	0.35	1.65
H 435	T.NO.10/19xT.NO.228	4.60	55.00	29.74	0.40	1.40
H436	T.NO.228xT.NO.10/19	5.36	63.00	28.76	0.45	1.25
H 437	T.NO.228xT.NO.10/19	5.36	74.00	28.36	0.40	1.20
H 438	T.NO.228xPRIYANKA	6.71	41.00	26.78	0.70	1.90

The mean nut weight was recorded highest in H-440 (8.90 g) followed by H-467 (8.83 g). The mean apple weight was found highest in H-470 (65.0 g) followed by H-475 (60.0 g). The shelling percentage was recorded maximum in H-468 (36.04) followed by H-459 (35.23). The mean annual nut yield was found highest in H-474 (2.00 kg/tree) followed by H-461 (1.50 kg/tree). The cumulative nut yield was maximum in H-474 (5.90 kg/tree) followed by H-461 (4.70 kg/tree) for 2 annual harvests (Table 1.41).

Table 1.41 : Yield parameters of different cashew hybrids at Bapatla

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) (2nd harvest) 2015	Cum nut yield (kg/tree) (for 2 harvests) 2015
H 439	M15/4xT.N.30/1	4.85	30.0	31.41	0.7	2.2
H 440	M15/4xT.No.30/1	8.9	45.0	30.20	0.35	0.95
H 441	M15/4xT.No.30/1	3.9	49.00	28.64	0.20	0.70
H 442	M15/4xT.No.30/1	3.9	40.0	27.30	0.30	0.87
H 443	M15/4xT.No.30/1	8.81	55.0	26.30	0.35	1.0
H 444	M15/4xT.No.30/1	6.11	50.0	22.42	0.50	1.5
H 445	M15/4xT.No.30/1	6.30	38.0	28.55	0.40	1.7
H 446	M15/4xT.No.30/1	7.39	50.0	25.12	0.85	2.75
H 447	M15/4xT.No.30/1	6.38	30.0	25.20	0.55	1.65
H 448	M15/4xT.No.30/1	6.0	48.0	23.73	0.60	1.75
H 449	M15/4xT.No.30/1	6.7	58.0	23.43	0.15	0.33
H 450	BPP-5xH-320	7.01	56.0	21.43	0.50	1.57
H 451	BPP-5xH-320	5.86	48.0	26.73	0.10	0.20
H 452	BPP-5xH-320	4.5	41.0	27.42	0.10	0.20

Table 1.41 continued....

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) (2nd harvest) 2015	Cum nut yield (kg/tree) (for 2 harvests) 2015
H 453	BPP-5x H-320	3.8	40.0	29.02	0.50	1.1
H 454	BPP-5x H-320	5.5	56.0	29.00	0.20	0.40
H 455	BPP-5x H-320	5.9	54.0	27.00	0.25	0.55
H 456	BPP-5x H-320	0	0	0	0	0
H 457	BPP-5x H-320	6.0	59.0	36.00	0.10	0.20
H 458	PRIYANKAxBPP-2	6.39	60.0	27.00	0.10	0.20
H 459	H-36xVRI-3	6.50	40.0	35.23	0.20	0.50
H 460	VRI-3 x BPP-9	6.25	55.0	32.37	1.20	3.35
H 461	VRI-3 x BPP-9	7.51	50.0	31.30	1.50	4.70
H 462	BPP-3xPRIYANKA	8.06	54.0	29.60	0.10	0.20
H 463	BPP-3xPRIYANKA	7.05	0	28.60	0.10	0.20
H 464	BPP-3xPRIYANKA	6.63	45.0	45.21	1.00	2.90
H 465	BPP-3xPRIYANKA	5.06	60.0	34.53	0.10	0.30
H 466	BPP-3xPRIYANKA	6.06	39.0	26.60	0.20	0.60
H 467	BPP-3xPRIYANKA	8.83	75.0	28.57	1.50	4.50
H 468	BPP-3xPRIYANKA	5.54	40.0	36.04	0.30	0.90
H 469	BPP-3xPRIYANKA	7.9	44.0	32.00	0.9	1.09
H 470	BPP-3xPRIYANKA	4.7	65.0	31.24	0.10	0.30
H 471	BPP-3xPRIYANKA	6.79	50.0	21.54	0.10	0.32
H 472	VRI-3xBPP-8	6.03	55.0	28.61	1.05	3.05
H 473	VRI-3xBPP-8	6.64	55.0	38.29	0.80	2.50
H 474	VRI-3xBPP-8	7.84	55.0	28.29	2.00	5.90
H 475	VRI-3xBPP-8	6.6	60.0	29.66	0.60	0.67
H 476	BPP-5xM15/4	6.2	13.0	29.84	0.20	0.50
H 477	BPP-5xM15/4	6.51	45.0	23.50	0.25	0.70
H 478	BPP-5xM15/4	6.81	60.0	26.56	0.25	0.50
H 479	BPP-5xM15/4	5.69	40.0	28.16	0.10	0.30
H 480	BPP-5xM15/4	6.28	45.0	34.66	0.10	0.30
H 481	BPP-5xM15/4	5.39	45.0	29.72	0.70	0.85
H 482	BPP-5xM15/4	6.29	60.0	32.08	0.65	2.10
H 483	M15/4 x TNO.228	5.39	35.0	27.87	1.50	4.30
H 484	M15/4 x TNO.228	6.06	28.0	27.84	0.30	1.0
H 485	M15/4 x TNO.228	6.04	48.0	28.93	0.55	1.55
H 486	VRI-2 x BPP-8	5.86	55.0	34.92	0.60	2.10

Table 1.41 continued....

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) (2nd harvest) 2015	Cum nut yield (kg/tree) (for 2 harvests) 2015
H 487	VRI-2 x BPP-8	5.70	40.0	34.00	0.55	1.75
H 488	VRI-2 x BPP-8	6.03	25.0	21.86	0.70	2.10
H 489	VRI-2 x BPP-8	5.35	48.0	29.89	0.45	1.35
H 490	VRI-2 x BPP-8	6.01	55.0	29.61	0.10	0.30
H 491	VRI-2 x BPP-8	6.31	25.0	30.87	0.50	1.70
H 492	VRI-2 x BPP-8	5.68	30.0	32.06	0.75	0.90
H 493	VRI-2 x BPP-8	6.67	35.0	21.20	0.05	0.20
H 494	VRI-2 x BPP-8	4.11	40.0	13.59	0.20	0.55
H 495	VRI-2 x BPP-8	5.07	40.0	24.29	0.50	1.50
H 496	VRI-2 x BPP-8	7.95	45.0	27.46	0.60	1.80
H 497	VRI-2 X BPP-8	6.57	30.0	28.48	1.25	3.65

The mean nut weight was recorded highest in H-556 (8.81 g) followed by H-557 (7.20 g). The mean apple weight was found highest in H-556 (75.0 g) followed by H-557 (68.0 g). The shelling percentage was recorded maximum in H-545 (36.26) followed by H-511 (35.24). The mean annual nut yield was found highest in H-556 (2.56 kg) followed by H-554 (2.40 kg) (Table 1.42).

Table 1.42 : Yield parameters of different cashew hybrids at Bapatla

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) 1st harvest (2015)
H 498	T.No.30/1 x M15/4	4.91	40.0	30.20	0.80
H 499	T.No.30/1 x M15/4	5.31	36.0	29.64	0.68
H 500	T.No.30/1 x M15/4	5.41	35.0	31.46	0.79
H 501	T.No.30/1 x M15/4	4.84	37.6	28.33	0.94
H 502	T.No.30/1 x M15/4	5.60	35.4	29.64	1.24
H 503	T.No.30/1 x M15/4	5.70	65.4	24.98	1.11
H504	T.No.30/1 x M15/4	6.28	45.3	27.08	1.26
H505	M15/4xT.No.228	6.15	48.6	29.63	1.20
H 506	M15/4xT.No.228	5.90	55.0	30.50	1.00
H 507	M15/4xT.No.228	4.30	60.0	33.87	0.96
H 508	M15/4xT.No.228	6.28	56.6	32.20	0.89
H 509	M15/4xT.No.228	4.28	36.0	28.29	1.20
H 510	M15/4xT.No.228	3.59	30	34.39	1.30
H 511	M15/4xT.No.228	3.40	25	35.24	1.26
H 512	M15/4xT.No.228	5.58	38	32.84	2.00

Table 1.42 continued .....

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) 1st harvest (2015)
H 513	M15/4xT.No.228	2.43	20	29.33	0.46
H 514	M15/4xT.No.228	2.80	20	33.08	0.56
H 515	M15/4xT.No.228	4.60	25.0	31.00	1.20
H 516	BPP-5x BPP-8	4.46	30	31.61	1.30
H 517	BPP-5x BPP-8	4.26	36.0	29.20	1.40
H 518	BPP-5x BPP-8	4.16	38.0	28.16	1.36
H 519	BPP-5x BPP-8	5.20	46.0	28.0	1.60
H 520	BPP-5x BPP-8	5.20	46.0	26.0	1.70
H 521	BPP-5x BPP-8	5.40	45.3	27.0	1.20
H 522	BPP-5x BPP-8	6.00	51.6	29.3	1.86
H 523	BPP-5x BPP-8	4.90	50.0	30.10	1.46
H 524	BPP-5x BPP-8	4.20	48.6	29.16	0.80
H 525	BPP-5x BPP-8	4.24	47.6	28.12	0.86
H 526	T.No. 30/1xPriyanka	6.70	49.0	29.20	1.20
H 527	T.No. 30/1xPriyanka	7.10	48.0	24.30	2.10
H 528	T.No. 30/1xPriyanka	6.71	50.0	25.30	2.00
H 529	T.No. 30/1xPriyanka	6.02	40.0	30.58	1.86
H 530	T.No. 30/1xPriyanka	6.02	36.0	29.24	1.80
H 531	T.No. 30/1xPriyanka	7.17	63.0	30.36	2.10
H 532	T.No. 30/1xPriyanka	6.87	60.0	30.82	2.00
H 533	T.No. 30/1xPriyanka	6.36	60.4	29.26	2.00
H 534	T.No. 30/1xPriyanka	6.36	56.8	28.60	1.86
H 535	BPP-5xM15/4	6.30	54.6	26.40	1.80
H 536	BPP-5xM15/4	5.23	54.2	27.40	1.56
H 537	BPP-5xM15/4	5.16	54.3	29.30	1.50
H 538	BPP-5xM15/4	5.23	60.0	31.96	1.50
H 539	BPP-5xM15/4	6.25	56.6	30.16	1.76
H 540	BPP-5xM15/4	6.20	54.8	30.10	1.76
H 541	BPP-5xM15/4	6.16	30.0	28.60	1.18
H 542	BPP-5xM15/4	6.20	46.0	29.60	1.25
H 543	BPP-5 x H-320	5.66	50.0	31.0	1.00
H 544	BPP-5 x H-320	5.66	42.0	33.0	1.20
H 545	BPP-5 x H-320	5.39	45.0	36.26	1.21
H 546	BPP-5 x H-320	4.55	63.0	32.96	1.06
H 547	BPP-5 x H-320	6.01	55.0	34.30	1.56
H 548	BPP-5 x H-320	5.99	36.0	30.0	1.40
H 549	BPP-5 x H-320	4.86	38.6	26.0	1.36
H 550	BPP-5 x H-320	6.29	50.0	27.4	1.28
H 551	BPP-5 x H-320	5.56	51.2	26.8	1.36

Table 1.42 continued .....

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) 1st harvest (2015)
H 552	BPP-5 x H-320	6.20	52.3	29.95	1.42
H 553	BPP-3 x Priyanka	6.18	50.4	27.06	2.00
H 554	BPP-3 x Priyanka	7.14	40.6	28.03	2.40
H 555	BPP-3 x Priyanka	7.20	41.7	29.06	2.20
H 556	BPP-3 x Priyanka	8.81	75.0	30.84	2.56
H 557	BPP-3 x Priyanka	7.20	68.0	30.16	2.10
H 558	BPP-3 x Priyanka	4.60	35.0	30.63	1.80
H 559	BPP-3 x Priyanka	5.42	75.0	33.09	1.96
H 560	BPP-3 x Priyanka	5.86	66.0	30.90	1.90
H 561	BPP-3 x Priyanka	6.20	64.0	27.4	1.56
H 562	Priyanka x BPP-2	6.45	58.0	28.32	1.28
H 563	Priyanka x BPP-2	5.29	56.0	28.70	1.40
H 564	Priyanka x BPP-2	5.67	54.6	28.19	1.76
H 565	Priyanka x BPP-2	3.74	36.4	29.70	0.70
H 566	Priyanka x BPP-2	6.80	38.2	28.40	1.10
H 567	Priyanka x BPP-2	6.26	46.0	28.02	1.25
H 568	Priyanka x BPP-2	6.10	54.0	29.02	1.15
H 569	VRI-2 x BPP-8	4.45	53.0	29.17	0.86
H 570	VRI-2 x BPP-8	4.35	52.0	26.16	0.92
H 571	VRI-2 x BPP-8	4.25	53.0	29.40	0.96
H 572	VRI-2 x BPP-8	6.19	46.0	29.54	1.25
H 573	VRI-2 x BPP-8	4.68	44.6	27.59	1.90
H 574	VRI-2 x BPP-8	5.20	52.0	27.20	2.10
H 575	VRI-2 x BPP-8	4.37	53.0	29.71	1.60
H 576	VRI-2 x BPP-8	4.74	50.0	28.20	1.45
H 577	VRI-2 x BPP-8	3.91	54.0	29.64	1.36
H 578	VRI-2 x BPP-8	4.62	46.0	31.78	1.45
H 579	VRI-3 x BPP-8	4.80	47.6	29.30	1.70
H 580	VRI-3 x BPP-8	5.20	51.6	29.60	1.80
H 581	VRI-3 x BPP-8	4.43	48.6	29.62	1.80
H 582	VRI-3 x BPP-8	4.26	40.3	31.72	1.67
H 583	VRI-3 x BPP-8	4.48	38.6	30.68	1.66
H 584	VRI-3 x BPP-9	4.56	39.4	28.00	1.76
H 585	H-36 x VRI-3	4.36	44.0	26.00	1.66
H 586	H-36 x VRI-3	5.26	53.0	29.16	1.82
H 587	H-36 x VRI-3	5.16	52.4	28.88	1.60
H 588	H-36 x VRI-3	5.20	52.0	29.00	1.60

BHUBANESWAR

In the hybrids of year 2002 planting, five hybrids recorded superior performance during the fruiting season. Hybrid B6-27 recorded maximum mean annual nut yield (3.5kg tree^{-1}), cum. nut yield (19.5kg tree^{-1}) and shelling % (32.1) for 9 harvest. Hybrid C6-30 recorded the maximum nut (10.2g) as well as apple weight (65.0g) among the promising hybrids of 2002 planting.

Hybrids namely C2-6, E7-2 and E7-6 exhibited promising performance among the hybrids of 2003 planting. Hybrid C2-6 recorded maximum shelling (30.7%), mean annual nut yield (8.6kg tree^{-1}) and cumulative nut yield (24.2 kg tree^{-1}) for 8 harvest. Hybrid E7-2 was the second best hybrid with respect to mean annual nut yield (2.5 kg tree^{-1}) and cumulative nut yield (14.3kg tree^{-1}). Hybrid E7-6 recorded the maximum nut weight (10.0g) while apple weight was maximum in hybrid E7-2 (60.0g).

Table 1.43 : Yield parameters of different cashew hybrids at Bhubaneswar

Hybrid No.	Cross combination	Year of planting	Mean nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg tree^{-1})	Cum. yield (kg tree^{-1})
							14th harvest
A1-105	Bhubaneswar-1 x H2/16	1997	7.8	57.2	30.0	11.6	82.5
							13th harvest
B2-32	H 2/16 x M 44/3	1998	7.0	36.0	29.2	12.8	65.3
							12th harvest
F4-24	M 44/3 x H 2/15	2000	9.0	48.0	28.3	12.2	54.5
							10th harvest
E5-20	BPP 30/1 x H 2/16	2001	7.0	44.0	28.5	8.0	40.0
J5-13	Bhubaneswar -1 x VTH 711/4		8.0	76.0	28.3	9.1	41.4
							9th harvest
B6-27	RP-1 x VTH 711/4	2002	8.8	75.0	32.1	3.5	19.5
C6-30	RP2 x Kankady		10.2	65.0	31.0	2.2	18.5
C6-41	RP2 x Kankady		9.0	64.0	30.8	2.5	18.2
D6-19	M44/3 x VTH 711/4		9.5	50.0	30.4	3.2	19.6
H6-6	M44/3 x Kalyanpur bold nut		7.0	40.0	28.3	2.5	17.3
							8th harvest
C2-6	RP 2 x Kankady	2003	8.0	55.0	30.7	8.6	24.2
E7-2	OC 56 x VTH 711/4		8.3	60.0	28.6	2.5	14.3
E7-6	OC 56 x VTH 711/4		10.0	55.3	28.2	2.4	13.1

GOA

(a) Performance of 1st set of Hybrids (5th harvest)

Hybrids H-31/05, H-22/05 and H21/05 continued to record vigorous growth habit recording the higher tree height and canopy spread (Table). The highest tree height of 5.8 m was recorded in H-31/05 followed by H-22/05 (5.1m) and H-21/05 (4.8m). Similar trend was also observed with respect to collar girth and canopy spread. Three hybrids, H-11/05, 31/05 and H-21/05 showed precocious bearing while H-27/05 was the last to flower. Trees of H-31/05 and H-11/05, H23/05, H-27/05and 29/05 had higher incidence of TMB and leaf webber.

With respect to nut yield trend, the hybrid 31/05 continued to record the highest yield of 12.45kg per tree followed by the hybrid 21/05 (8.557kg/tree), though former hybrid was severely affected by the TMB. Other hybrids namely, HB-12/05, HB-22/05, HB27/05 also showed better trend at a later stage compared to the former two precocious hybrids (Table 1.44).

Table 1.44 : Trend of yield and nut characteristics of first set of hybrids (5th harvest) at Goa

Sl. No.	Hybrid	Av. Nut Wt. (g)			Nut yield (kg/tree)			Shelling (%)		
		2013	2014	2015	2013	2014	2015	2013	2014	2015
1	H- 5/05	7.6	7.8	7.35	0.88	1.65	1.45	28.63	28.22	28.00
2	H- 14/05	8.25	8.12	8.2	0.65	1.81	3.28	27.45	28.00	27.55
3	H- 11/05	7.86	7.80	7.21	2.10	4.41	4.90	29.05	28.86	28.35
4	H- 12/05	7.56	7.82	8.0	1.85	5.85	8.25	29.65	29.45	29.80
5	H- 13/05	7.88	7.91	7.55	0.32	0.89	1.85	28.33	27.92	27.50
6	H- 21/05	8.26	8.6	8.2	3.12	6.7	8.55	29.20	29.15	28.86
7	H- 22/05	8.88	9.02	9.65	1.95	2.87	5.68	29.33	29.21	28.76
8	H- 23/05	7.66	7.9	7.85	0.78	2.02	4.05	28.80	28.86	28.24
9	H- 27/05	7.35	7.56	7.90	0.75	3.35	5.35	28.10	28.55	28.42
10	H- 29/05	7.68	7.60	7.85	0.90	1.55	2.85	28.68	28.00	28.22
11	H- 30/05	7.55	7.62	7.85	0.35	1.01	2.35	27.80	27.68	27.22
12	H- 31/05	7.11	7.22	6.85	4.80	14.56	12.45	28.14	29.02	29.24

Bearing of H-21/05

Apples with nuts of H-27/05

Apple size was observed to vary from 45g in H-31/05 to 90.35g in H-22/05 with juice contents 59.3% and 72.4% having total soluble solids of 12.4 °B and12.8 °B respectively.

Table 1.45 : Apple characteristics of cashew hybrids (5th harvest) at Goa

S. No.	Hybrid	Mean apple Wt. (g)		Juice %		TSS (°B)		Apple colour
		2014	2015	2014	2015	2014	2015	
1	H- 5/05	60.55	64.56	68.5	62.4	11.2	12.6	Yellow
2	H- 14/05	65.40	62.50	65.3	69.4	10.6	11.0	Orange
3	H- 11/05	80.50	72.50	69.4	70.5	11.0	10.8	Red
4	H- 12/05	85.50	81.50	65.6	67.6	10.8	11.0	yellow
5	H- 13/05	79.55	73.45	70.0	68.5	11.2	10.8	Yellow
6	H- 21/05	90.55	82.58	70.3	72.4	11.8	12.8	Yellow
7	H- 22/05	100.40	90.35	69.7	68.5	12.4	12.8	yellow
8	H- 23/05	75.25	71.35	63.9	66.8	11.2	10.8	Red
9	H- 27/05	70.65	68.00	65.5	69.5	10.8	11.0	Yellow
10	H- 29/05	68.33	69.45	66.6	72.5	10.6	11.6	Yellow
11	H- 30/05	65.68	60.80	60.2	62.5	11.2	10.8	Yellow
12	H- 31/05	55.65	45.50	60.8	59.3	12.0	12.4	Yellow

(b) Performance of second set of 34 hybrids

The seedlings of the following parental combinations is also planted in the field for evaluation which is under juvenile stage.

Table 1.46 : Second set of hybrids at Goa

S .No.	Parental combination	No. Hyb. seedlings
1	KN 2/98 x Goa-1	3
2	Goa-1 x Tis-3	2
3	Tis-3 x Red loca-1	3
4	Red loca-1 x Tis-3	5
5	Tis-3 x Ganj-2	1
6	Ganj-2 x Tis-3	5
7	V-4 x Tis-3	8
8	Gnj 2 x Valpoi-3	5
9	Valpoi-3 x R L	2
	Total	**34**

(c) Performance of third set of 53 hybrids

The seedlings of the following parental combinations were planted in the main field.

Table 1.47 : Third set of hybrids at Goa

S. No.	Parental combination	No. Hyb. Seedlings
A	**Bold nut size Vs High yielding**	
1	Tis-3 x Red Local	8
2	Bardez-9 x GNJ-2	17
3	Tis-3 x Vengurla-4	4
B	**High yielding Vs Bold nut size**	
1	Red Local x Tis-3	6
2	GNJ-2 x Bardez-9	14
3	Vengurla-4 x Tis-3	4
	Total	**53**

A 4th set of 81 hybrid seedlings is ready for planting in the main field for further evaluation.

During fruiting season 2015, hybridization work was continued for producing the 5th set of hybrid progeny of parents involving contrast characters like bold nut and high yielding accessions and cluster bearing accessions. A total of 28 new hybrid seeds were collected from the crosses.

Among the promising cashew hybrids evaluated, the hybrid H-216 (2/77-Tuni x Vetore-56) recorded highest mean nut weight with 8.62g, followed by H-191 (Ullal-3 x Vetore-56) (7.18g) and H-81 (Ullal-3 x Vetore-56) (6.40 g). The least mean nut weight was noticed in H-01 (Ullal-3 x Kankady 7/6) with 5.55g. The highest mean apple weight was recorded in H-216 (2/77-Tuni x Vetore-56) with 53.74g followed by H-01 (Ullal-3 x Kankady 7/6) and H-81 (Ullal-3 x Vetore-56) with 45.97g and 39.41g respectively. The lowest mean apple weight was observed in H-151 (NRCC-2 x Vetore-56) (27.27g). The highest shelling per cent was recorded in H-81 (Ullal-3 x Vetore-56) with 26.87, followed by H-216 (2/77-Tuni x Vetore-56) and H-01 (Ullal-3 x Kankady 7/6) with 25.10 and 24.50, respectively. The lowest shelling per cent was observed in H-191 (Ullal-3 x Vetore-56) (21.70). The hybrid H-216 (2/77-Tuni x Vetore-56) recorded highest number of nuts/m^2 (12.84) followed by H-81 (Ullal-3 x Vetore-56) and H-01 (Ullal-3 x Kankady 7/6) with 10.82 and 10.47, respectively. The least number of nuts/m^2 was noticed in the hybrid H-151 (NRCC-2 x Vetore-56)

HOGALAGERE

Table 1.48 : Growth and yield parameters of different cashew hybrids at Hogalagere

Hybrid No.		H-01	H-81	H-151	H-188	H-191	H-216
Cross Combinations		(Ullal-3 x Kankady 7/6)	(Ullal-3 x Vetore-56)	(NRCC-2 x Vetore-56)	(V-5 x Vetore-56)	(Ullal-3 x Vetore-56)	(2/77-Tuni x Vetore-56)
Mean tree ht. (m)		6.44	6.86	4.60	6.10	5.51	7.46
Mean stem girth (cm)		109.30	119.80	38.25	71.23	75.74	101.25
Mean canopy spread (m)	E-W	5.43	7.01	3.04	4.86	4.95	7.39
	N-S	5.68	4.07	2.69	5.28	4.80	5.50
Mean canopy area (m^2)		24.24	24.10	6.46	20.15	18.68	32.58
Flowering duration (days)	Range	48-84	57-88	43-91	45-86	46-106	65-96
	Mean	63.51	66.94	59.31	70.62	70.61	76.46
No. of flowering laterals / m^2		4.06	4.82	5.06	3.62	5.53	5.16
Ratio of male : bisexual flowers		0.15	0.15	0.14	0.17	0.18	0.27
Nuts/ m^2		10.47	10.82	5.76	8.69	9.81	12.84
Mean no. of nuts/ panicle		3.65	3.42	2.08	3.15	2.84	4.11
Mean nut wt (g)		5.55	6.40	5.71	6.01	7.18	8.62
Mean apple wt. (g)		45.97	39.47	27.27	29.20	32.91	53.74
Shelling %		24.50	26.87	22.88	24.25	21.70	25.10
Mean annual nut yield (kg/tree)		6.00	5.55	0.99	5.47	5.11	5.52
Cum. yield (kg/tree) (9 Hrvst.)		29.20	26.75	4.83	26.67	24.95	26.48

(5.76). The hybrid H-01 (Ullal-3 x Kankady 7/6) recorded highest mean nut yield with (6.00 kg/tree) followed by H-81 (Ullal-3 x Vetore-56) and H-216 (2/77-Tuni x Vetore-56) with 5.55 kg/tree and 5.52 kg/tree, respectively. The least mean nut yield was noticed in the hybrid H-151 (NRCC-2 x Vetore-56) (0.99 kg/tree). The highest cumulative nut yield for nine harvests was showed in H-01 (Ullal-3 x Kankady 7/6) with 29.20 kg/tree, followed by H-191 (Ullal-3 x Vetore-56) and H-81 (Ullal-3 x Vetore-56) with 24.95 kg/tree and 26.75 kg/tree, respectively. The least cumulative nut yield was noticed in the hybrid H-151 (NRCC-2 x Vetore-56) (4.83 kg/tree). Among the hybrids of cashew, the variation with respect to yield potentiality doesn't seem to be varying significantly, except for H-151 which yields drastically low compared to other hybrids. This trend is consistent over recent years of observation (Table 1.48).

JHARGRAM

H - 39, H – 58 and H – 119 produced bold nuts i.e. more than 7g weight Except H - 58 all other hybrids had more than 30% shelling recovery. Highest was H- 28 (48.4%) followed by H - 179 (41.9%) and H - 30 (41.8%). H- 119 had 7.7g nut weight and also had high shelling% (36%). Yield was highest in H- 37 (14.2 kg/tree) followed by H-65 (12.4 kg/tree), H- 119 (12.2 kg/tree) and H- 39 (11.7 kg/tree).Cumulative yield records depicted that H-119 had maximum cumulative yield for 7 harvests (73.75 Kg/tree) followed by H-37 (71.48 Kg/tree) and H – 41 (68.31Kg/tree) (Table 1.49).

Table 1.49 : Yield parameters of different cashew hybrids at Jhargram

Hybrid No.	Cross combination	Mean nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree)
H - 37	Local x 2/9 Dicherla	5.4	35.6	34.5	14.2	71.48
H - 65	WBDC – V x Red Hazari	5.1	60.0	36.0	12.4	54.48
H -119	JGM– 216 x Yellow Hazari	7.7	66.7	36.0	12.2	73.75
H - 39	Local x 2/9 Dicherla	7.0	62.8	30.7	11.7	51.47
H - 58	BLA 39-4 x DC – 8	7.2	35.0	23.5	9.8	16.00
H - 87	BLA – 39-4 x Red Hazari	4.7	22.0	35.0	9.1	17.63
H - 146	JGM– 216 x BLA	6.5	60.0	35.2	8.9	34.93
H - 162	JGM– 216 x Yellow Hazari	6.9	60.0	32.5	8.6	23.47
H - 30	Local x 2/9 Dicherla	6.1	65.2	41.8	8.1	52.39
H - 147	JGM– 216 x BLA	5.6	47.0	35.5	8.1	10.53
H - 28	Local x 2/9 Dicherla	5.0	40.0	48.4	8.0	57.55
H - 98	BPP - 8 x Vengurla - 4	6.4	74.4	35.9	7.8	57.20
H - 174	JGM– 216 x Yellow Hazari	5.8	56.0	31.7	7.6	7.59
H - 126	JGM– 216 x Yellow Hazari	6.1	54.0	31.6	7.4	51.50
H - 121	JGM– 216 x Yellow Hazari	5.7	70.0	35.1	7.3	13.28
H - 124	JGM– 216 x Yellow Hazari	6.0	50.0	34.8	7.2	8.98
H - 33	Local x 2/9 Dicherla	6.7	47.0	36.8	6.9	59.66
H - 123	JGM– 216 x Yellow Hazari	5.8	40.0	34.8	6.9	40.49

Table 1.49 continued .....

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree)
H - 154	JGM– 216 x Yellow Hazari	6.2	62.0	35.6	6.8	21.39
H - 109	JGM– 216 x Yellow Hazari	4.5	27.0	34.7	6.8	46.77
H - 49	WBDC – V x Jhargram -1	3.9	50.0	35.8	6.7	36.28
H - 113	JGM– 216 x Yellow Hazari	6.2	72.0	37.6	6.7	10.60
H - 132	JGM– 216 x Yellow Hazari	5.9	60.0	32.0	6.7	20.40
H - 41	Local x 2/9 Dicherla	5.7	51.0	35.8	6.6	68.31
H - 173	JGM– 216 x Yellow Hazari	5.8	61.0	31.1	6.4	28.75
H - 179	JGM– 216 x Yellow Hazari	5.0	73.0	41.9	6.3	25.15
H - 140	JGM– 216 x BLA	5.4	39.0	36.0	6.3	31.52
H - 134	JGM– 216 x Yellow Hazari	5.5	75.0	39.8	6.2	34.46
H - 69	WBDC – V x Red Hazari	6.2	86.0	32.4	6.0	44.63

MADAKKATHARA

The yield parameters of different cashew hybrids evolved during different years were recorded and presented in table 1.50 to 1.52.

Table 1.50 : Yield parameters of different cashew hybrid at Madakkathara

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (18 years)
21	BLA-39-4 x P-3-2	7.88	73.58	27.40	18.90	174.85
22	BLA-39-4 x P-3-2	7.60	103.90	25.86	9.00	96.50
35	V-5 x H-1591	8.99	113.00	26.38	8.00	118.00
36	V-5 x H-1591	11.99	132.95	25.30	10.80	126.67
44	V-5 x H-1591	8.98	67.00	26.30	13.60	99.18
49	V-5 x H-1591	9.90	106.00	27.80	10.60	104.90
50	V-5 x H-1591	10.10	53.10	29.60	12.00	109.77
51	V-5 x H-1591	9.96	56.03	28.40	11.20	82.55
69	BLA-39-4 x P-3-2	10.52	46.03	29.70	9.60	64.60
70	BLA-39-4 x P-3-2	9.03	68.99	27.20	10.30	90.25
72	BLA-39-4 x P-3-2	9.92	70.02	26.50	8.80	72.90
73	BLA-39-4 x P-3-2	7.05	105.06	24.30	10.10	97.80
91	V-5 x H-1591	8.06	88.96	27.90	9.30	62.45
95	BLA-39-4 x P-3-2	8.70	123.00	27.21	10.10	72.35
107	BLA-139-1 x P-3-2	9.78	84.90	21.98	9.60	59.15

Table 1.51 : Yield and yield attributes of promising hybrids (2007-2015) at Madakkathara

Cross Combination	2007	2008	2009	2010	2011	2012	2013	2014	2015	Mean
Hybrid No. 21	**BLA-39-4 x P-3-2**									
Yield kg/tree	22.50	4.60	4.00	2.00	22.53	17.00	22.53	18.20	18.90	14.69
Apple colour	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
Apple shape	Conical	Conical	Conical	Conical	Conical	Conical	Conical	Conical	Conical	Conical
Apple wt.(g)	42.00	40.00	35.00	33.00	85.40	85.40	86.10	73.60	73.58	61.56
Nut wt (g)	10.00	10.10	10.00	10.10	8.60	8.60	8.70	7.90	7.88	9.09

Table 1.52 : Yield and yield attributes of promising hybrids (2007-2015) at Madakkathara

Cross Combination	2007	2008	2009	2010	2011	2012	2013	2014	2015	Mean
Hybrid No. 36	**V-5xH-1591**									
Yield kg/tree	9.27	13.30	10.00	6.00	9.00	10.00	9.00	10.20	10.80	9.73
Apple colour	Orange red	Orange red	Orange red	Orange red	Orange red	Orange red	Orange red	Orange red	Orange red	Orange red
Apple shape	Conical	Conical	Conical	Conical	Conical	Conical	Conical	Conical	Conical	Conical
Apple wt.(g)	75.00	80.00	40.00	42.00	50.00	50.00	58.00	133.00	132.95	73.43
Nut wt (g)	8.00	9.80	9.18	9.50	9.00	9.00	8.90	12.00	11.99	9.70

PILICODE

The dwarf type PLD-57 was used for hybridization with ANK-1 and MDK-1 with the objective of obtaining hybrid progenies having dwarf stature, higher percentage of bisexual flowers, nut setting and high nut yield.

Table 1.53 : Yield parameters of different cashew hybrids at Pilicode

Cross combination	No. of flowering laterals / m^2	Ratio of bisexual : male flowers	Nuts/ m^2	Mean annual nut yield (kg/tree)
PLD 57 graft	16.18	0.13	3.50	0.60
PLD 57 (OP)	7.90	0.14	1.97	0.55
PLD 57 x ANK 1	4.48	0.22	2.25	2.00
ANK 1 x PLD 57	5.13	0.15	6.74	1.60
MDK 1 x PLD 57	3.41	0.17	4.03	6.35
MDK 1	3.33	0.14	2.96	2.90

VENGURLA

On the basis of standard criteria viz., compact canopy, cluster bearing habit, nut weight (more than 8 g), shelling percentage (more than 28%) and high yield, 44 F1 hybrid seedlings during the year were screened initially as promising hybrids. H-3083 recorded maximum nut weight (16.2 g), while, highest apple weight (127.0 g) observed in H-3084 followed by H-3083 (125.0 g) whereas, maximum shelling percentage (33.0%) was recorded in H-1017. Mean annual nut yield recorded maximum in H-1135 (11.74 kg/tree) while, cumulative yield for 9th harvests was highest in H-778 i.e. 59.44 kg/tree (Table 1.54).

Table 1.54 : Yield performance of new promising hybrids at Vengurle

Sr. No.	Hybrid No.	Year of planting	Yield (kg/ plant)	Cum. yield kg/tree	Av. nut wt. (g)	Apple wt. (g)	Shelling (%)	Tol. of TMB (L/M/H)
1	735	1999	5.665	34.59**	12.5	75	28.0	L
2	777	2001	3.190	32.13*	7.7	77	32.0	M
3	778	2001	7.360	59.44*	9.3	40	29.0	L
4	868	2001	3.525	20.24*	14.6	82	28.5	L
5	883	2001	2.660	27.10**	13.7	80	29.0	M
6	891	2001	5.200	19.57*	8.9	75	32.0	L
7	899	2001	2.380	15.88**	9.5	60	29.0	L
8	908	2001	1.985	17.97*	8.9	78	28.5	M
9	921	2001	2.700	13.58*	12.3	65	28.5	L
10	929	2001	3.965	13.58*	10.2	67	29.0	L
11	938	2001	3.590	20.11*	10.1	65	29.0	M
12	939	2001	3.455	28.36*	9.7	72	31.0	L
13	940	2001	4.435	24.66*	8.6	80	31.7	M
14	945	2001	1.990	15.41*	10.6	60	31.0	L
15	948	2001	2.000	14.89*	10.8	70	26.0	L
16	956	2001	0.755	10.54*	8.6	75	28.5	L
17	958	2001	7.035	31.63*	10.9	55	30.0	M
18	969	2001	5.475	40.12*	10.7	60	30.0	L
19	991		4.850	37.20*	10.6	65	31.0	M
20	992		4.390	30.62*	9.9	80	31.5	L
21	998		1.400	14.62*	9.6	65	30.0	M
22	1002		2.100	19.82*	9.7	55	31.0	M
23	1003		2.990	21.42**	10.1	40	32.0	M
24	1015		3.105	22.96*	10.3	55	31.5	L
25	1016		5.635	28.48*	11	60	31.5	L

Table 1.54 continued ....

Sr. No.	Hybrid No.	Year of planting	Yield (kg/plant)	Cum. yield kg/tree	Av. nut wt. (g)	Apple wt. (g)	Shelling (%)	Tol. of TMB (L/M/H)
26	1017	2001	2.010	17.84*	10.1	65	33.0	L
27	1025		1.245	13.65***	9.9	63	31.5	M
28	1039		5.105	27.88*	9.1	70	30.5	L
29	1135		11.74	25.52*	9.0	40	29.0	M
30	1174		10.39	52.66*	8.9	45	32.0	L
31	1187		8.305	46.72*	12.7	65	31.0	L
32	1210		1.440	11.09**	11.0	65	28.0	L
33	1298		3.550	23.03*	11.2	60	28.0	M
34	1675	2003	3.430	13.01***	8.6	65	28.0	L
35	2874		5.330	14.91*****	8.7	60	32.0	L
36	2917	2004	6.420	18.94*****	9.8	60	31.0	L
37	3043		4.825	19.39****	15.2	100	26.0	L
38	3083		1.300	5.68****	16.2	125	27.0	L
39	3084		5.680	9.73*****	13.0	127	26.0	L
40	3090		4.235	9.67*****	10.7	60	29.0	L
41	3096		4.310	13.29****	14.0	75	27.0	L
42	3103		2.590	9.29****	9.7	50	30.0	L
43	3113		3.935	8.84****	9.7	87	32.5	L
44	3139		4.210	10.90****	10.3	85	32.0	L

10^{th} harvest, ** 8^{th} harvest, *** 7^{th} harvest, **** 6^{th} harvest and ***** 5^{th} harvest

The details of cashew breeding programme are given in Table.

Table 1.55 : Cashew breeding programme at Vengurle

Sr. No.	Cross combination	Objective of breeding	Total No. of flowers crossed	No. of fruit set	No. of fruits harvest	Fruit retention (%)
1	V-4 x Goa 11/6	Nut size improvement	84	58	40	69.0
2	V-3 x Hy. 2/16	Nut size improvement	65	43	27	62.8
		Total	**149**	**101**	**67**	**66.3**

In all, 149 hermaphrodite flowers were crossed and from these crossed flowers 101 fruits were set. Out of 101 fruit set, finally 67 fruits were retained. Thus, the fruit retention percentage was 66.3 per cent. The nuts were sown in polybags for germination.

VRIDHACHALAM

The hybrids planted during 2005, 2006 and 2008 were evaluated for characteristics namely high yield, cluster bearing, good fruit set, high % of bisexual flowers, bold nuts, dwarfness and easy peeling testa. Many promising hybrids were identified and data recorded. HC 1 resembled VRI 2 in terms of high yield but had an important advantageous character of easy peeling testa. HC 24 recorded good fruit set, high yield, bold nut (7.6 gms) along with easy peeling testa. HC 10, HC 25, HC 27 and HC 30 were cluster bearing with bold nuts. HC 10 was observed to have the typical characteristic of high yield even under water stress conditions. HC 23 and HC 25 had compact canopy, cluster bearing and bold nuts. HC 17 and HC 23 showed a different type of intensive branching pattern occupying less space of spread.

Table 1.56 : Yield parameters of different cashew hybrids at Vridhachalam

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 4/5/6 harvests)	Total Number of harvests
HC1	VRI2 x VRI 3	6.04	26.5	27.5	5.5	28.25	7
HC2	VRI 3 x VSK 2	6.54	32.4	26.5	3.5	22.10	7
HC3	VRI 3 x TK 1	6.82	38.5	24.5	3.0	14.65	7
HC 5	VRI 3 x VRI 2	7.15	43.2	27.5	6.5	24.25	7
HC6	VRI 3 x KGN 1	6.10	55.4	26.0	6.0	15.60	7
HC8	VRI 3 x PKP 1	6.80	50.4	26.0	5.5	16.10	7
HC9	VRI 3 x PKP 2	6.24	38.5	26.4	8.5	15.00	7
HC10	VRI 3 x KK 1	7.50	30.5	28.5	11.0	29.60	6
HC 17	VRI 3 x AM 1	6.40	32.5	27.0	5.25	22.00	6
HC 22	VRI 3 x TK 1	7.50	55.0	28.5	5.00	17.75	5
HC 23	VRI 3 x AM 1	7.30	30.4	27.6	3.5	13.85	5
HC 24	VRI3 x M 33/3	7.10	32.5	26.0	6.5	18.40	5
HC 25	VRI3 x M 33/3	7.60	50.5	30.0	8.5	22.65	5
HC 27	VRI 3 x SL 1	8.00	52.5	31.5	7.0	23.05	5
HC 30	VRI 3 x PV 1	8.10	53.5	26.8	8.5	24.65	5

Gen.5: Characterization of germplasm for cashew apple

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

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

BAPATLA

Experimental details

Design: CRD

Treatments : 13

Germplasm accessions

Priyanka, T.No: 2/14, T.No: 17/5, T.No: 5/1, BLA: 139/1, BLA: 39/4, T.No: 3/4, T.No: 8/7, T.No: 18/3, Hy95-T4, T.No. 12/1, T.No. 228, BPP-8

Duration : 3 years

Among the 13 genotypes evaluated, the maximum mean annual nut yield per tree recorded in BLA – 39/4 (6.20 kg) followed by BPP- (5.20 kg). The maximum apple weight was recorded in Priyanka (123.0 g) followed by BPP-8 (54.6g). The maximum nut weight was recorded in Priyanka (9.21 g) followed by BPP-8 (6.95 g). The apple nut ratio was highest in Priyanka (13.35) followed by T.No. 17/5 (12.23).The juice recovery percentage was found maximum in BLA-39/4 (74.6%) followed by T.No.228 (71.4 %) (Table 1.57).

Table 1.57 : Physical parameters of cashew germplasm for cashew apple at Bapatla

S. No.	Germplasm	Yield /tree (kg)	Apple wt. (gm)	Nut wt. (gm)	Apple nut ratio	Juice recovery (%)	Colour of the apple
1.	Priyanka	4.83	123.0	9.21	13.35	64.0	Red yellow
2.	T.No: 2/14	3.45	46.0	4.36	10.55	66.8	Yellow
3.	T.No.17/5	4.34	48.2	3.94	12.23	61.4	Yellow
4.	T.No. 5/1	4.60	27.5	4.87	5.64	61.6	Yellow
5.	BLA. 139/1	3.40	27.5	4.96	5.54	56.2	Yellow
6.	BLA. 39/4	6.20	32.5	3.98	8.16	74.6	Yellow
7.	T.No. 3/4	3.20	48.6	4.46	10.89	64.8	Yellow
8.	T.No. 8/7	3.30	44.3	3.73	11.87	54.2	Yellow
9.	T.No. 18/3	2.00	40.5	4.32	9.37	58.0	Yellow
10.	Hy 95-T4	4.86	37.5	5.05	7.42	67.0	Yellow
11.	T.No. 12/1	3.23	34.0	4.24	8.01	63.3	Yellow
12.	T.No. 228	4.96	38.8	4.35	8.91	71.4	Red yellow
13.	BPP-8	5.20	54.6	6.95	7.85	66.0	yellow
	Mean	4.12	46.38	4.96	9.21	63.79	
	SEM±	0.18	1.79	0.269	0.63	2.72	
	CD at (5%)	0.53	5.27	0.79	1.85	7.99	

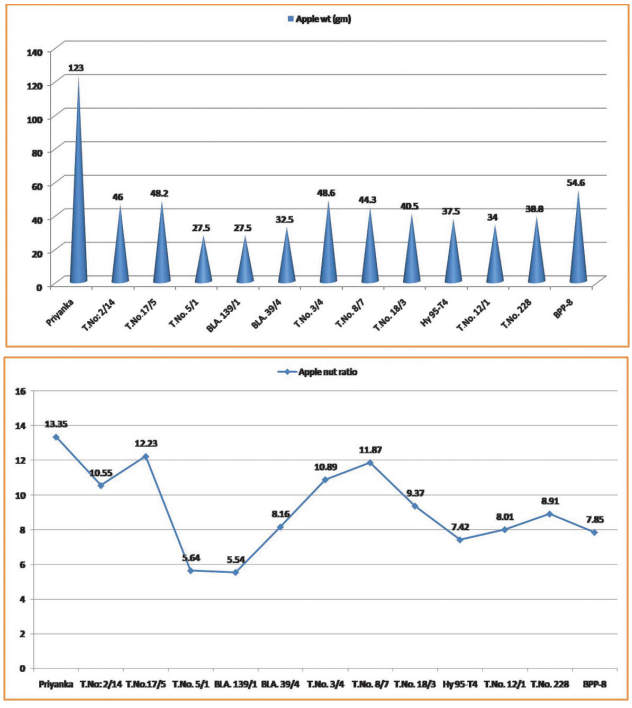


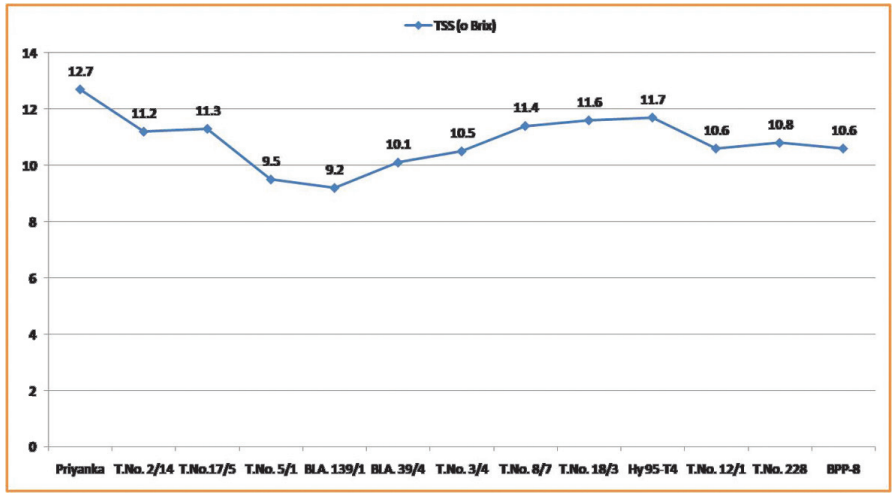
Fig. Physical parameters of cashew germplasm for cashew apple.

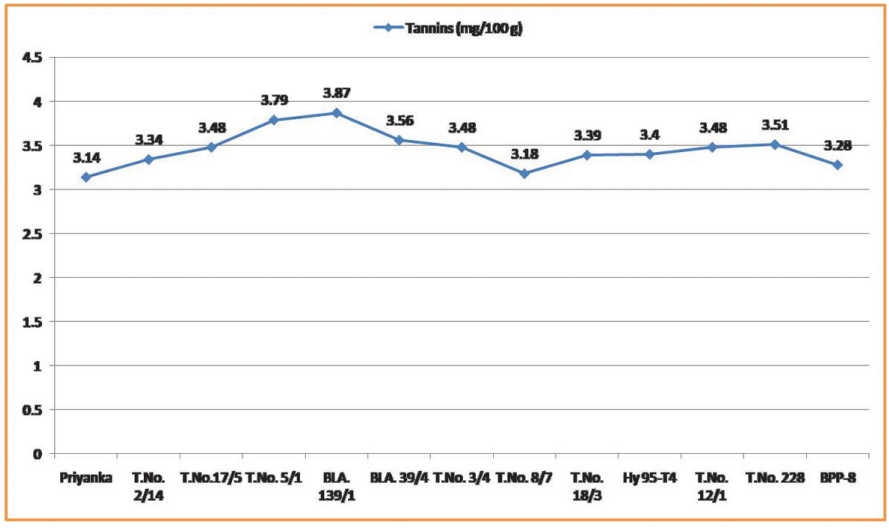
Among the 13 genotypes the total Soluble Solids was ranged from 9.2 Brix to 12.7 Brix. However, the highest TSS was recorded in Priyanka (12.7). The lowest vitamin C content was recorded in T.No. 12/1 (124.8mg/100gm) followed by T. No. 228 (132.8mg/100gm). With regard to the tannin content the lowest was recorded in T.No. 8/7 (3.18mg/100g) followed by BPP-8 (3.28mg/100gm). The acidity content was lowest in T.No. 18/3 (0.47%) followed by BPP-8 and Priyanka (0.48%) (Table 1.58).

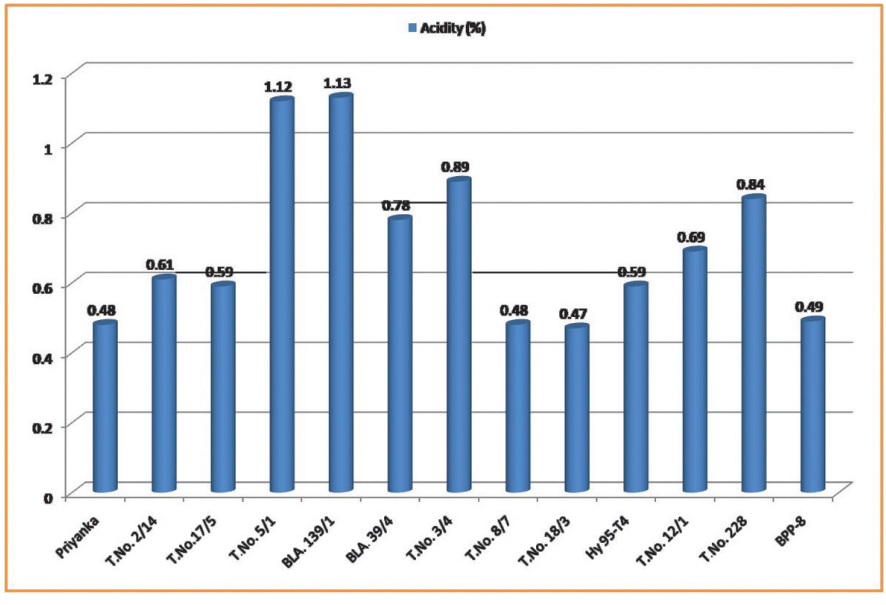
Table 1.58 : Chemical parameters of cashew germplasm for cashew apple at Bapatla

S.No.	Germplasm	TSS (° Brix)	Vitamin-C (mg/100 g)	Tannins (mg/100 g)	Acidity (%)
1.	Priyanka	12.7	136.0	3.14	0.48
2.	T.No. 2/14	11.2	141.2	3.34	0.61
3.	T.No.17/5	11.3	152.3	3.48	0.59
4.	T.No. 5/1	9.5	140.2	3.79	1.12
5.	BLA. 139/1	9.2	156.4	3.87	1.13
6.	BLA. 39/4	10.1	153.3	3.56	0.78
7.	T.No. 3/4	10.5	178.4	3.48	0.89
8.	T.No. 8/7	11.4	180.8	3.18	0.48
9.	T.No. 18/3	11.6	174.4	3.39	0.47
10.	Hy 95-T4	11.7	163.4	3.40	0.59
11.	T.No. 12/1	10.6	124.8	3.48	0.69
12.	T.No. 228	10.8	132.8	3.51	0.84
13.	BPP-8	10.6	143.6	3.28	0.49
	Mean	10.86	152.12	3.45	0.70
	SEM±	0.69	6.80	0.08	0.07
	CD at (5%)	NS	16.6	0.25	0.21

Chemical parameters of cashew germplasm for cashew apple







BHUBANESWAR

During the fruiting season, 15 numbers of cashew germplasm was evaluated to test their suitability for value addition. The details of physical and bio-chemical parameters recorded are presented in Table.

Table 1.59 : Physical Characters of cashew apple in different germplasm at Bhubaneswar

Sl. No.	Germplasm details	Mean nut yield/ tree (kg)	Apple wt. (g)	Apple to nut ratio(ANR)	Mature cashew apple colour	Juice recovery (%)
1.	Dutiyanuapalli (OC-90)	3.75	44.44	6.02	Yellow	76.61
2.	RP-4 (OC-88)	1.0	88.88	6.88	Yellow	83.06
3.	H367 (OC 132)	3.12	78.20	9.03	Orange	82.49
4.	BT-56 (OC -115)	1.4	55.20	5.19	Yellow	74.21
5.	Tapanga-1 (OC 109)	4.0	47.99	7.58	Yellow	72.15
6.	BBSR Cluster-2 (OC 144)	3.5	55.53	7.15	Red	73.58
7.	BH 105 (OC 145)	15.0	51.33	6.73	Yellow	71.46
8.	Ullal-4 (OC 100)	2.12	51.99	7.09	Yellow	83.97
9.	BBSR Cluster-1 (OC 145)	2.83	38.66	5.66	Yellow	83.61
10.	BT-4 (OC 114)	1.5	82.44	7.73	Red	82.56
11.	Lahanga (OC 83)	4.6	48.55	7.57	Orange	74.47
12.	OS-25 (OC 101)	2.25	42.42	7.06	Yellow	75.00
13.	Banjhakusuma (OC 110)	2.25	50.87	10.32	Red	68.83
14.	OS-20 (OC 104)	2.81	40.21	7.76	Yellow	72.69
	Mean	3.58	55.48	7.27	66.33	76.76
	SEM±	-	1.69	0.38	-	1.24
	CD (0.05%)	-	4.89	1.10	-	3.60

Table 1.60 : Bio-chemical characters of apple in different germplasm at Bhubaneswar

Sl. No.	Germplasm details	TSS (%)	Acidity (%)	Total sugar (%)	Ascorbic acid (mg)
1.	Dutiyanuapalli (OC 90)	11.93	0.28	6.46	173.14
2.	RP-4 (OC 88)	15.97	0.34	9.18	212.88
3.	H367 (OC 132)	13.50	0.36	7.11	213.09
4.	BT-56 (OC 115)	13.33	0.27	7.22	199.85
5.	Tapanga-1 (OC 109)	11.70	0.13	7.28	132.96
6.	BBSR Cluster-2 (OC 144)	14.40	0.19	6.10	159.53
7.	BH 105 (OC 145)	12.30	0.27	8.11	199.23
8.	Ullal-4 (OC 100)	16.53	0.40	10.27	229.48
9.	BBSR Cluster-1 (OC 145)	15.63	0.37	9.04	229.28
10.	BT-4 (OC 114)	12.13	0.19	8.65	173.26
11.	Lahanga (OC 83)	10.97	0.19	6.11	120.08
12.	OS-25 (OC 101)	13.63	0.19	7.66	173.21
13.	Banjhakusuma (OC 110)	13.53	0.28	8.87	186.02
14.	OS-20 (OC 104)	13.23	0.20	8.65	173.26
	Mean	13.48	0.26	7.91	183.95
	SEM±	0.29	0.01	0.37	0.48
	CD (0.05%)	0.83	0.04	1.06	1.40

It data revealed significant variations for cashew apple weight(g) among the fourteen cashew genotypes. The average weight of cashew apple varied from minimum 38.66g (Bhubaneswar Cluster-1) to maximum

of 88.88g (RP-4). Significantly maximum apple weight was recorded in RP-4 (88.88g) followed by BT-4 (82.44g), H-367 (78.20g), BT-65 (55.20g) and Bhubaneswar Cluster-2 (55.53g). Significantly highest apple to nut ratio (ANR) was observed in Banjhakusuma (10.32) followed by H-367 (9.03) where statistical parity was recorded. BT-65 exhibited the lowest ANR(5.19) among the tested genotypes. Among the genotypes evaluated, only Bhubaneswar Cluster- 2 and Banjhakusuma had red colour , H-367, BT-4 and Lahanga had orange colour apple, while rest of the genotypes had yellow colour apple. Ullal- 4 recorded significantly maximum % of juice recovery (83.97) followed by Bhubeneswar Cluster-1 (83.61), RP- 4 (83.06), H-367 (82.49) and BT-4 (82.56) which were statistically at par with each other. The genotype, Banjhakusuma recorded significantly minimum % of juice recovery (68.83) among the tested genotypes (Table 1.59).

The results in the table 1.60 revealed that the TSS recorded in the genotypes ranged from minimum 10.97° brix (Lahanga) to maximum 16.53° brix (Ullal- 4). Other tested genotypes which were statistical at par with Ullal -4 are H- 367 (15.97°brix) and Bhubaneswar Cluster-1 (15.63° brix). Significantly minimum TSS was recorded in the genotype Lahanga (10.97° brix). Significantly highest acidity was recorded in genotype Ullal-4 (0.40%) than rest of the genotypes except Bhubaneswar cluster 1 (0.37%) and BT- 65 (0.36%) where statistical parity was observed. The minimum acidity was recorded in Tapanga-1 (0.13%). The % of total sugar varied from minimum 5.73 (Bhubaneswar Cluster-2) to maximum 10.27 (Ullal-4). However, the genotype Bhubaneswar cluster-1 (9.22%) exhibited statistical parity with the highest value. Significantly highest ascorbic acid content was recorded in Ullal-4 (229.48mg) which was statistically at par with genotype Bhubaneswar Cluster-1 (229.48mg). Other genotypes which exhibited appreciable quantity of ascorbic acid were H-367 (213.09mg $100g^{-1}$), RP-4 (212.88mg $100g^{-1}$) and BT-65 (199.85mg $100g^{-1}$).

Overall performance of cashew germplasm revealed that Ullal-4 recorded maximum for all the biochemical parameters and was found suitable for preparation of value added products.

JAGDALPUR

Locally collected 10 genotypes were characterized for cashew apple. Apple weight ranged between 43.50g to 102.80g. The maximum juice recovery was recorded in CARS-8 (73.50%). The vit C content varies between 205.4 to 260.5 mg/100 ml juice. TSS (°Brix) ranged from 10.20 to 16.22.

Table 1.61 : Physical observations of germplasm at Jagdalpur

Germplasm	Age of tree (Years)	Yield/ tree (kg)	Apple wt. (g)	Nut wt. (g)	Apple nut ratio	Juice recovery (%)	Colour of apple
CARS-1	32	10.80	56.80	6.50	8.73	56.50	Red
CARS-2	32	9.50	62.30	7.10	8.77	63.40	Yellow
CARS-3	19	6.40	64.50	7.40	8.71	67.50	Red
CARS-4	19	5.30	43.50	6.80	6.39	61.50	Yellow
CARS-5	19	5.75	71.40	7.40	9.64	65.80	Yellow
CARS-6	19	6.20	68.20	7.20	9.47	68.20	Red
CARS-8	19	6.50	102.80	12.70	8.09	73.50	Yellow
CARS-9	19	5.60	75.10	9.20	8.16	66.50	Red
CARS-10	19	8.70	78.50	10.40	7.54	70.20	Yellow
CARS-11	19	7.50	84.20	8.50	9.90	68.50	Red

Table 1.62 : Quality parameters

Germplasm	TSS (°Brix)	Acidity	Vitamin C (mg/100ml)	Total sugar (mg/ml)
CARS-1	12.76	0.31	230.50	13.20
CARS-2	13.56	0.24	255.40	12.50
CARS-3	16.22	0.29	260.50	15.40
CARS-4	14.60	0.40	228.40	8.50
CARS-5	11.40	0.37	224.60	12.60
CARS-6	11.66	0.48	235.50	10.60
CARS-8	12.60	0.42	245.60	12.30
CARS-9	10.20	0.58	205.40	8.10
CARS-10	11.16	0.35	248.20	12.40
CARS-11	13.66	0.45	215.50	9.40

JHARGRAM

The weight of cashew apple varied from (27.8 – 64.8) g. The apple weight was maximum in Bidhan Jhargram-2 and lowest was in Madakkathara-I. Juice content of cashew apple ranged between (35.6– 85.0)%. Maximum juice content was recorded in Priyanka and minimum in NRCC- 2. The TSS value was highest in UN - 50 and Priyanka (15.0 °Brix) followed by Vengurla - 1 (14.8 °Brix) and Bidhan Jhargram-2 and Vengurla-4 (13.8°Brix) and minimum TSS was with Bhubaneswar-1 (10.4°Brix). Acidity was highest in Goa - 1 (0.42 %) and minimum in Bhubaneswar-1 and Chintamani -1 (0.12 %). Total sugar content was maximum in Goa-1 (12.3%), while minimum in Vengurla- 4, Amrutha and NRCC - 2 (7.7%). Among the 20 varieties characterised 10 were yellow, 9 were red and 1 was pink. According to the shapes 5 were conical, 8 were cylindrical, 1 was elongated and 6 were obovate. Apple production was maximum with Vengurla – 7 (42.96 Kg/tree) followed by Ullal - 3 (35.76 Kg/tree) and Bhubaneswar - 1 (32.73 Kg/tree) (Table 1.63 & 1.64).

Table 1.63 : Cashew apple characteristics of released varieties of cashew at Jhargram

Sl. No	Varieties	Cashew Apple length (cm)	Cashew Apple breadth (cm)	Juice Content %	Cashew Apple weight (g)	Apple yield (Kg/tree)	Cashew Apple Colour	Cashew Apple Shape
1	Bhaskara	7.10	15.6	45.4	46.9	22.71	Red	Cylindrical
2	Madakkathara - II	6.50	11.3	80.0	30.8	10.76	Red	Cylindrical
3	Bhubaneswar - 1	4.87	16.4	37.5	42.0	32.73	Red	Elongated
4	Chintamani - 1	5.50	13.7	54.1	29.5	9.12	Yellow	Conicle
5	Vengurla - 7	6.80	13.3	50.9	49.3	42.96	Yellow	Obovate
6	VRI - 3	5.43	12.2	43.9	39.5	24.75	Red	Obovate
7	BPP - 6	5.13	13.9	78.0	40.5	16.44	Yellow	Cylindrical
8	Amrutha	6.60	11.9	54.4	31.8	9.23	Red	Conicle
9	Vengurla - 4	5.10	11.0	70.0	32.9	26.19	Red	Cylindrical
10	Goa 1	6.43	10.3	66.5	47.2	15.00	Yellow	Obovate

Table 1.63 continued .....

Sl. No	Varieties	Cashew Apple length (cm)	Cashew Apple breadth (cm)	Juice Content %	Cashew Apple weight (g)	Apple yield (Kg/tree)	Cashew Apple Colour	Cashew Apple Shape
11	Madakkathara - I	5.40	12.6	57.8	27.8	6.22	Yellow	Conicle
12	Priyanka	6.60	16.0	85.0	33.7	13.62	Pink	Conicle
13	Vengurla 1	7.70	11.4	57.8	57.2	17.95	Yellow	Cylindrical
14	Vengurla - 6	5.80	13.2	60.0	43.8	19.47	Yellow	Cylindrical
15	Ullal - 3	6.50	12.0	72.0	62.2	35.76	Red	Conicle
16	Dhana	5.20	13.0	51.4	60.5	18.20	Yellow	Obovate
17	UN - 50	8.40	9.0	66.0	59.1	13.47	Red	Cylindrical
18	Jhargram - 1	5.27	11.5	51.6	43.8	14.73	Yellow	Cylindrical
19	NRCC Sel - 2	2.97	10.5	35.6	51.9	13.19	Red	Obovate
20	Bidhan Jhargram - 2	6.00	14.0	55.9	64.8	22.71	Yellow	Obovate

Table 1.64 : Cashew apple characteristics of released varieties of cashew at Jhargram

Sl. No.	Varieties	TSS (° Brix)	Acidity (%)	Total Sugar %	Reducing Sugar %
1	Bhaskara	11.2	0.26	8.3	9.1
2	Madakkathara - II	13.4	0.32	10.3	9.1
3	Bhubaneswar – 1	10.4	0.12	10.4	10.5
4	Chintamani - 1	12.2	0.12	10.0	8.7
5	Vengurla - 7	12.6	0.22	9.1	8.7
6	VRI - 3	12.7	0.26	8.3	5.1
7	BPP - 6	11.8	0.41	9.1	9.5
8	Amrutha	13.6	0.20	7.7	9.1
9	Vengurla - 4	13.8	0.21	7.7	6.1
10	Goa 1	12.6	0.42	12.3	9.1
11	Madakkathara - 2	11.8	0.38	10.0	10.0
12	Priyanka	15.0	0.18	8.3	6.7
13	Vengurla 1	14.8	0.28	11.1	10.5
14	Vengurla 6	11.9	0.24	11.8	9.5
15	Ullal - 3	13.0	0.20	9.1	8.0
16	Dhana	10.8	0.22	10.5	11.8
17	UN - 50	15.0	0.40	10.5	9.1
18	Jhargram - 1	13.7	0.23	10.0	5.3
19	NRCC Sel - 2	12.5	0.29	7.7	11.1
20	Bidhan Jhargram - 2	13.8	0.22	8.3	4.9

PILICODE

Highest apple weight was recorded in variety BPP8. Apple to nut ratio was highest in Bhuvaneswar-1. Highest juice recovery in volume was obtained from BPP 8. Acidity was highest in Priyanka. Tannin Content was lowest in Madakkathara-1. Tannin content was found to be very high in K-22-1.

Table 1.65 : Physical characters of apple in different germplasm at Pilicode

Germplasm details	Apple weight (g)	Apple nut ratio	Colour of apple	Juice recovery %
NRCC Sel - 2	55.68	5.53	Reddish yellow	77.23
Madakkathara-1	45.06	7.23	Yellow	68.80
V4	57.43	7.77	Red	78.36
VRI3	29.23	3.21	Red	54.74
Goa-1	43.94	6.23	Yellow	66.00
Dhana	34.88	5.70	Yellow	71.67
Priyanka	74.95	7.59	Yellow	69.38
Kanaka	57.42	7.11	Yellow	78.37
Amritha	57.18	6.43	Yellow	71.70
K-22-1	45.48	6.59	Yellow	74.76
Bhubaneswar-1	75.12	8.08	Yellow	77.21
BPP 8	103.5	9.36	Yellow	77.29
PLD-57	53.77	7.42	Pinkish Yellow	74.39

Table 1.66 : Biochemical characters of apple in different germplasm at Pilicode

Germplasm details	Acidity (Citric Acid) g/100ml	Tannin content (%)
NRCC Sel - 2	0.46	0.53
Madakkathara-1	0.23	0.31
V4	0.32	0.53
VRI3	0.36	0.44
Goa-1	0.48	0.57
Dhana	0.53	0.52
Priyanka	0.70	0.71
Kanaka	0.57	0.68
Amritha	0.53	0.51
K-22-1	0.39	1.05
Bhubaneswar-1	0.55	0.70
BPP 8	0.56	0.68
PLD-57	0.54	0.85

VRIDHACHALAM

The characterization of germplasm for cashew apple was done in 20 germplasm types along with the three released varieties at Vridhachalam. The juice recovery of the accessions evaluated ranged from 49% to 80%. VRI 2 recorded the highest juice recovery of 80%. Vitamin C content was more in VRI 3 and M103/7. The germplasm accessions NF 69, VRI2, VRI3, VRI (Cw) H1 recorded highest total sugars. TSS was highest in K 10/1, M 30/1 and A 5/3. Tannin content ranged between 0.05 – 0.1 g/ 100g.

Table 1.67 : Physical characters of apple in different germplasm at Vridhachalam

Germplasm details	Mean nut weight	Apple Wt.	Apple nut ratio	Colour of apple	Juice recovery (%)
K 10/1	4.6	35.2	7.7	Yellow orange	60
M 30/1	5.7	40.1	7.0	Yellow orange	55
M 76/2	6.8	58.4	8.6	Yellow	65
TAF 11	6.7	44.5	6.6	Orange	63
105/4	6.8	57.2	8.4	Yellow	49
ME 3/2	6.4	62.4	9.8	Yellow orange	54
S10	6.2	37.2	6.0	Orange	65
M45/7	7.2	54.4	7.6	Yellow	67
NF 57	5.4	32.2	6.0	Yellow	64
M103/7	4.8	45.4	9.5	Yellow	51
NF 40	5.4	41.2	7.6	Yellow orange	59
M31/1	4.8	43.4	9.0	Red	65
NF 63	5.4	42.0	7.8	Yellow	57
M33/2	7.1	58.1	8.2	Orange	61
A 5/3	6.4	64.5	10.1	Yellow	56
M10/4	5.8	61.0	10.5	Yellow	60
NF 60	5.0	34.1	6.8	Yellow orange	60
M8/1	5.2	53.2	10.2	Orange yellow	62
NF 69	7.5	58.2	7.8	Orange	55
88/4	5.2	58.0	11.2	Orange	60
VRI 2	5.9	53.4	9.1	Yellow	80
VRI3	7.2	57.2	7.9	Orange	75
VRI (Cw) H1	7.2	54.0	7.5	Pink with yellow	77

Table 1.68 : Bio-chemical characters of Cashew apple in different germplasm at Vridhachalam

Germplasm details	Total Sugars (%)	TSS (° brix)	Acidity	Tannin Content (g/100g)	Vitamin C (mg/100g)
K 10/1	3.52	13.80	0.33	0.10	292.15
M 30/1	3.10	13.20	0.13	0.08	290.20
M 76/2	3.33	12.25	0.08	0.08	237.25
TAF 11	3.82	11.40	0.10	0.06	154.90
105/4	4.98	11.00	0.15	0.08	288.23
ME 3/2	3.84	12.10	0.20	0.08	290.20
S 10	4.01	11.90	0.18	0.06	282.35
M 45/7	3.82	11.30	0.23	0.06	213.72
NF 57	3.51	12.70	0.15	0.06	243.14
M 103/7	3.50	11.80	0.38	0.06	303.92
NF 40	3.61	11.20	0.15	0.07	268.63
31/1	3.69	11.30	0.18	0.07	211.76
NF 63	3.87	12.40	0.23	0.09	252.94
M 33/2	3.82	11.80	0.18	0.07	152.94
A 5/3	4.10	12.90	0.23	0.05	245.09
M 10/4	3.39	10.60	0.23	0.08	211.76
NF 60	3.81	10.20	0.15	0.07	241.17
M8/1	3.82	11.80	0.15	0.08	176.47
NF 69	8.01	9.00	0.28	0.08	274.51
88/4	3.42	11.20	0.26	0.08	235.29
VRI 2	10.02	11.90	0.23	0.07	245.20
VRI 3	11.80	11.40	0.21	0.08	312.00
VRI (Cw)H1	9.02	10.40	0.20	0.08	274.00

Gen. 6 : Varietal Screening of cashew apple for preparation of RTS and Jam

Centres: *East Coast* : Bapatla, Jhargram and Vridhachalam
West Coast : Pilicode, Vengurla and Paria
Plains / others : Jagdalpur, Kanabargi and Hogalagere

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

BAPATLA

Experimental details

Design : CRD

Treatments : 10

Varieties : BPP-1; BPP-2 ; BPP-3; BPP-4; BPP-5; BPP-6; BPP-8; BPP-9; BPP-10; BPP-11

Organoleptic Evaluation: a) Taste b) Colour c) Flavour and Total Acceptability
d) Nutritive value e) Shelf life

During the year, the organoleptic evaluation of RTS for different varieties of cashew apple showed higher scores were recorded in cashew variety BPP-8 with respect to colour, flavour, appearance, sweetness and overall acceptability. Regarding shelf life, all RTS the are shown to be in good condition at room temperature (Table 1.69).

Table 1.69 : Evaluation of organoleptic score of RTS for cashew apple at Bapatla

S.No.	Variety	Taste	Colour	Flavour	Overall acceptability	Shelf life
1.	BPP-1	3.0	3.00	2.75	2.75	Good
2.	BPP-2	3.25	3.25	2.50	2.50	Good
3.	BPP-3	2.75	2.75	2.25	2.00	Good
4.	BPP-4	2.50	2.50	2.00	3.00	Good
5.	BPP-5	3.0	3.00	2.25	2.50	Good
6.	BPP-6	2.50	2.50	3.00	3.00	Good
7.	BPP-8	3.25	3.25	3.50	3.75	Good
8.	BPP-9	3.25	3.25	3.25	3.00	Good
9.	BPP-10	2.75	2.75	2.75	2.75	Good
10.	BPP-11	3.00	3.00	2.00	2.00	Good
	SEM±	0.524	0.313	0.406	0.34	Good
	CD (5%)	NS	NS	NS	1.0	

(1=Poor, 2= Fair, 3=Good, 4= very good 5= Excellent)

Table 1.70 : Evaluation of organoleptic score of jam for cashew apple at Bapatla

S.No.	Variety	Taste	Colour	Flavour	Overall Acceptability	Shelf Life
1.	BPP-1	3.50	2.50	3.50	2.50	Good
2.	BPP-2	2.75	2.25	2.75	2.50	Good
3.	BPP-3	3.00	2.50	3.00	2.75	Good
4.	BPP-4	2.25	2.75	2.50	3.00	Good
5.	BPP-5	2.00	3.00	2.75	2.50	Good
6.	BPP-6	2.75	3.25	3.00	3.25	Good
7.	BPP-8	3.50	3.25	2.50	3.25	Good
8.	BPP-9	3.00	2.25	3.00	2.75	Good
9.	BPP-10	2.50	2.50	2.75	3.00	Good
10.	BPP-11	2.25	2.50	2.50	2.25	Good
	SEM±	0.408	0.498	0.41	0.435	
	CD (5%)	NS	NS	NS	NS	

(1=Poor, 2= Fair, 3=Good, 4= very good 5= Excellent)

During the year, the organoleptic evaluation of Jam for different varieties of cashew apple showed higher scores in cashew variety BPP-8 with respect to colour, flavour, appearance, sweetness and overall acceptability. Regarding shelf life, the jam of all the varieties are shown to be in good condition at room temperature (Table 1.70).

Compilation of three years data

Ten varieties screened for cashew apple for preparation of RTS and jam. Among the 10 varieties for organoleptic evaluation of RTS and jam, BPP-8 variety showed highest scores with respect to colour, flavour, appearance and overall acceptability in all the three consecutive years.

HOGALAGERE

The cashew apples of six different varieties were collected during fruiting season of the year and subjected for screening for preparation of RTS and Jam at Post Harvest Technology laboratory, College of Horticulture, Kolar. The sensory evaluation or organoleptic analysis was done by the technical faculty of the college by using sensory score scale. The data on sensory evaluation of six different cashew varieties were presented below (Table 1.71 & 1.72). The results indicated that the cashew variety Chintamani-1 found to be superior, followed by Vengurla-4 with respect to sensory evaluation parameters. The results are consistent with our earlier observations.

Table 1.71 : Sensory evaluation of different cashew varieties apple for preparation of RTS at Hogalagere

Variety	Appearance	Colour	Flavour	Taste	Texture	Sweetness /Saltiness	Overall acceptability	TSS (°Brix)	Shelf life (Months)	Mean score	Overall Grade
UN-50	2.9	2.9	2.9	3.3	2.8	3.8	3.1	12.1	5	3.10	Good
V-3	3.0	3.6	3.6	3.4	3.1	4.1	4.0	11.8	5	3.54	Good
V-7	3.4	3.6	3.6	3.4	3.0	3.6	3.3	12.0	5	3.41	Good

Table 1.71 continued .....

Variety	Appearance	Colour	Flavour	Taste	Texture	Sweetness /Saltiness	Overall acceptability	TSS (°Brix)	Shelf life (Months)	Mean score	Overall Grade
V-2	3.7	3.9	3.6	3.6	3.3	4.1	3.6	13.6	5	3.69	Very Good
V-4	4.3	4.6	3.6	3.9	3.6	4.1	3.5	13.0	5	3.94	Very good
C-1	3.9	3.9	4.1	4.1	3.6	4.1	4.4	14.0	5	4.01	Very good

Note: Scale for scoring, Excellent-5, Very good-4, Good-3, Fair-2, Poor-1.

Table 1.72 : Sensory evaluation of different cashew varieties apple for preparation of Jam at Hogalagere

Variety	Appearance	Colour	Flavour	Taste	Texture	Sweetness/ Saltiness	Overall acceptability	TSS (°Brix)	Shelf life (Months)	Mean score	Overall Grade
UN-50	3.2	3.0	3.2	3.4	3.0	3.6	3.2	67.9	5	3.23	Good
V-3	3.2	3.4	3.4	3.6	3.4	3.8	3.8	67.7	5	3.51	Good
V-7	3.2	3.4	3.4	3.2	3.0	3.4	3.4	68.0	5	3.29	Good
V-2	4.0	4.0	3.6	3.6	3.4	3.8	3.8	68.1	5	3.74	Very Good
V-4	4.2	4.2	3.6	4.0	3.6	3.8	3.8	67.9	5	3.89	Very good
C-1	3.8	4.2	3.8	4.2	4.0	4.0	4.2	68.3	5	4.03	Very good

Note: Scale for scoring, Excellent-5, Very good-4, Good-3, Fair-2, Poor-1.

JAGDALPUR

Among the 10 cashew genotypes tested for preparation of jam, CARS-6 had the maximum score with respect to colour, flavor and total acceptability. However the maximum score for taste was 3.8 in CARS-8.

Table 1.73 : Organoleptic evaluation of jam prepared from different genotypes of cashew at Jagdalpur

Genotypes	Taste	Colour	Flavour	Total acceptability
CARS-1	3.4	2.9	3.3	3.1
CARS-2	3.2	3.1	2.5	3.3
CARS-3	3.5	3.5	3.1	3.2
CARS-4	3.0	3.2	2.7	3.1
CARS-5	3.3	3.2	3.0	2.9
CARS-6	3.6	**3.9**	**3.8**	3.7
CARS-8	**3.8**	3.2	3.1	3.5
CARS-9	3.1	3.1	3.3	3.1
CARS-10	3.5	3.6	3.3	3.3
CARS-11	3.0	3.2	3.3	3.0

JHARGRAM

The most accepted varieties for RTS and Jam were and UN- 50, Jhargram - 1 due to less astringency and more sweetness.

Table 1.74 : Quality parameters of RTS from different varieties at Jhargram

Sl.No	Variety	Taste	Flavour	Acceptability	Shelf Life (months)
1	Vengurla- 6	6	5	6	2
2	BPP - 8	6	5	6	2
3	Priyanka	6	5	5	2
4	Dhana	7	5	6	2
5	BPP – 4	7	5	6	2
6	Jhargram - 1	8	5	8	2
7	Ullal – 3	7	5	5	2
8	Kanaka	7	5	5	2
9	UN – 50	8	5	8	2
10	Vengurla- 1	6	5	5	2

Table 1.75 : Quality parameters of Jam from different varieties at Jhargram

Sl. No.	Variety	Taste	Colour	Flavour	Acceptability	Shelf Life
1	Vengurla- 6	7	Brown	5	6	3
2	BPP -8	7	Brown	5	6	3
3	Priyanka	7	Brown	5	6	3
4	Dhana	7	Brown	5	6	3
5	BPP – 4	7	Brown	5	6	3
6	Jhargram - 1	8	Brown	5	6	3
7	Ullal – 3	7	Brown	5	6	3
8	Kanaka	7	Brown	5	6	3
9	UN – 50	8	Brown	5	6	3
10	Vengurla- 1	7	Brown	5	6	3

Scoring has been done as given below:

Score

Like extremely	- 9	Like very much	- 8	Like moderately	- 7
Like slightly	- 6	Neither like or dislike	- 5	Dislike slightly	- 4
Dislike moderately	- 3	Dislike very much	- 2	Dislike extremely	- 1

KANABARGI

Experiment was carried out to identify suitable variety for preparation of Jam and RTS. Table shows quality parameters of cashew apple of different varieties under study.

Among all varieties studied for preparation of Jam, variety Vengurla-7 and Ullal-4 recorded higher scores for colour and appearance, flavor, taste, texture and overall acceptability. Over storage period, reduction in scores of all sensory parameters for all varieties was noticed. Jam prepared from Vengurla-6 variety was having lowest scores for all quality parameters (Table 1.77).

Among all varieties studied for preparation of RTS, Vengurla-2, 3, 4 and 7 recorded higher scores for colour and appearance, flavor, taste and overall acceptability. Over storage period, reduction in scores of all sensory parameters for all varieties was noticed. Among the varieties studied for preparation of RTS Ullal-2 recorded lowest scores for all sensory parameters (Table 1.78.)

Table 1.76 : Quality parameters of Cashew apple as influenced by different varieties at Kanabargi

Sl. No.	Variety	TSS (^{0}Brix)	PH RTS (%)	Juice recovery for for Jam (%)	Pulp recovery
1	Vengurla 1	12.2	2.7	49.3	64.5
2	Vengurla 2	14.4	3.1	45.8	63.2
3	Vengurla 3	12.6	3.3	51.5	59.7
4	Vengurla 4	12.1	4.2	40.1	61.1
5	Vengurla 5	14.3	2.3	55.6	57.9
6	Vengurla 6	13.5	3.5	55.8	56.5
7	Vengurla 7	14.4	3.0	43.9	61.6
8	Ullal 1	11.1	2.9	44.1	68.8
9	Ullal 2	14.2	3.6	54.0	67.6
10	Ullal 4	15.7	3.1	50.9	64.7

Table 1.77: Sensory evaluation of cashew apple jam as influenced by varieties and storage period at Kanabargi

Treatment	Colour and appearance				Flavor				Taste				Texture				Overall acceptability			
	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS
Vengurla-1	4.13	4.04	3.86	3.84	4.08	3.54	3.22	3.18	4.04	3.29	3.15	3.03	4.11	3.80	2.67	2.63	2.95	2.62	2.47	2.19
Vengurla-2	4.52	4.14	3.93	3.94	3.93	3.81	3.64	3.50	4.25	3.56	3.49	3.45	4.26	3.75	3.58	3.45	4.38	3.89	3.71	3.45
Vengurla-3	3.92	3.62	3.47	3.28	3.44	3.32	3.20	3.25	3.38	3.11	2.98	2.92	3.07	2.45	2.49	2.36	3.49	3.12	3.05	2.68
Vengurla-4	4.20	4.04	3.47	3.49	3.37	3.47	3.40	3.19	3.41	3.02	2.81	2.71	3.20	2.69	2.33	2.18	3.22	3.26	3.02	2.93
Vengurla -5	4.27	4.02	4.09	3.57	3.53	3.05	2.68	2.68	3.33	3.18	3.02	2.03	3.97	3.62	3.53	3.34	3.78	3.61	3.35	3.24
Vengurla -6	3.69	3.54	3.44	3.27	3.58	3.47	3.42	3.18	3.57	3.50	3.39	3.22	3.51	3.50	3.44	3.23	3.81	3.53	3.42	3.17
Vengurla -7	4.23	4.14	4.02	3.90	3.71	3.57	3.47	3.40	3.90	3.85	3.76	3.70	4.01	3.76	3.67	3.45	4.14	3.65	3.54	3.39
Ullal-1	4.33	3.71	3.47	3.27	3.50	3.47	3.29	3.20	3.68	3.50	3.36	3.18	3.94	3.68	3.55	3.27	4.22	3.40	3.38	3.24
Ullal-2	4.16	4.08	3.75	3.54	3.95	3.65	3.36	3.39	3.99	3.69	3.53	3.33	3.94	3.71	3.56	3.54	3.95	3.66	3.52	3.23
Ullal-4	4.31	3.14	3.50	4.04	3.65	3.35	3.43	3.26	3.94	3.67	3.58	3.57	4.20	4.19	3.94	3.73	4.10	3.96	3.94	3.67
SEM±	0.11	0.09	0.15	0.14	0.13	0.11	0.11	0.10	0.11	0.09	0.10	0.09	0.12	0.10	0.14	0.11	0.10	0.11	0.14	0.12
CD (0.01)	0.32	0.27	0.46	0.42	0.39	0.32	0.33	0.29	0.33	0.28	0.29	0.26	0.35	0.31	0.42	0.33	0.29	0.32	0.42	0.36

Table 1.78 : Sensory evaluation of cashew apple RTS as influenced by varieties and storage period at Kanabargi

Treatment	Colour and appearance				Flavor				Taste				Overall acceptability			
	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS	Initial	1MAS	2MAS	3MAS
Vengurla-1	3.70	3.12	2.84	2.82	3.30	3.12	2.90	2.69	3.36	2.82	2.36	2.16	3.29	2.92	2.64	2.39
Vengurla-2	3.77	3.44	3.39	3.22	4.21	3.85	3.47	3.42	3.80	3.49	3.27	3.17	3.79	3.59	3.38	3.18
Vengurla-3	4.28	3.65	3.36	3.21	3.91	3.27	3.17	2.82	4.08	3.70	3.51	3.18	3.91	3.72	3.33	3.19
Vengurla-4	4.15	3.61	3.39	3.14	4.02	3.70	3.53	3.32	3.67	3.49	3.29	3.14	3.73	3.55	3.30	3.09
Vengurla -5	3.72	3.42	3.15	2.96	3.71	3.58	3.43	2.22	3.68	3.27	3.15	2.87	3.65	3.46	3.18	2.91
Vengurla -6	3.83	3.32	3.15	2.71	3.42	3.04	2.97	2.73	3.19	2.94	2.71	2.39	3.27	2.66	2.62	2.32
Vengurla -7	3.72	3.45	3.32	3.08	3.64	3.28	3.22	2.92	3.54	3.23	2.98	2.71	3.26	3.23	3.01	2.88
Ullal-1	3.13	2.84	2.63	2.72	3.22	3.21	3.12	2.97	3.28	3.05	2.69	2.55	3.40	3.19	2.95	2.81
Ullal-2	2.92	2.33	2.19	2.13	2.92	2.43	2.13	2.01	3.84	3.53	3.22	3.09	2.60	2.25	2.04	2.02
Ullal-4	3.27	2.80	2.51	2.32	3.28	3.06	2.54	2.56	3.97	3.60	3.61	3.38	3.41	3.16	2.92	2.60
SEM±	0.17	0.14	0.13	0.17	0.13	0.10	0.15	0.13	0.13	0.09	0.11	0.10	0.13	0.12	0.12	0.09
CD (0.01)	0.52	0.41	0.38	0.52	0.40	0.30	0.45	0.40	0.39	0.27	0.33	0.31	0.40	0.35	0.36	0.28

PARIA

Decreasing orders of the results were observed for all the sensory parameters and ascorbic acid under biochemical parameters. Among the seven varieties of cashew, V-4 and V-1 gave the maximum scores in biochemical as well as sensory parameters. So under South Gujarat, V-4 and V-1 i.e. Vengurla-4 and Vengurla-1 varieties of cashew are suitable for RTS and Jam Preparation. In view of storage period of Jam, there was some fungal infection and enzymatic browning was observed in Jam after four month of storage. Both the products were observed acceptable near about three months of storage at an ambient temperature.

Table 1.79 : Biochemical and sensory changes of cashew apple RTS prepared from different varieties during the storage at ambient temperature at Paria

INITIAL											
Treatments	**Biochemical Parameters**					**Sensory Parameters (5 Point hedonic scale)**					
	TSS	**Acidity**	**AA**	**TS**	**RS**	**APP**	**Colour**	**Flavour**	**Taste**	**OA**	**Sweetness**
V1	12.30	0.34	74.68	17.34	13.43	4.96	4.89	4.96	4.96	4.94	4.62
V2	12.29	0.37	92.58	16.77	13.05	4.92	4.94	4.76	4.76	4.90	4.59
V3	12.18	0.33	51.62	13.50	10.87	4.83	4.75	4.46	4.25	4.62	4.52
V4	12.34	0.30	97.16	17.59	13.60	5.00	5.00	4.92	5.00	4.97	4.66
V5	12.22	0.34	71.79	15.36	12.11	4.92	4.82	4.64	4.42	4.70	4.59
V6	12.25	0.36	73.45	16.60	12.94	4.88	4.85	4.67	4.54	4.74	4.56
V7	12.19	0.35	62.66	14.37	11.45	4.85	4.80	4.50	4.38	4.65	4.54
SEM ±	0.01	0.01	0.86	0.19	0.13	0.06	0.05	0.05	0.06	0.02	0.05
CD @ 5%	0.04	0.02	2.61	0.57	0.39	NS	NS	0.14	0.17	0.07	NS
CV %	0.18	3.45	1.99	2.06	1.80	1.95	1.96	1.67	2.10	0.80	1.73
3 MONTH STORAGE											
Treatments	**TSS**	**Acidity**	**AA**	**TS**	**RS**	**APP**	**Colour**	**Flavour**	**Taste**	**OA**	**Sweetness**
V1	13.28	0.44	38.12	22.90	17.59	4.02	3.97	4.20	4.01	4.05	3.74
V2	13.19	0.47	53.04	22.05	17.02	3.99	4.04	3.89	3.96	3.97	3.71
V3	13.04	0.42	19.58	17.14	13.75	3.55	3.88	3.58	3.45	3.62	3.52
V4	13.30	0.40	56.86	23.28	17.84	4.11	4.09	4.10	4.16	4.12	3.77
V5	13.11	0.43	35.71	19.93	15.61	3.96	3.91	3.77	3.62	3.82	3.72
V6	13.13	0.46	37.10	21.79	16.85	3.87	3.97	3.80	3.74	3.84	3.66
V7	13.07	0.45	28.11	18.45	14.62	3.78	3.89	3.63	3.58	3.72	3.57
SEM ±	0.02	0.01	0.67	0.16	0.19	0.11	0.05	0.04	0.05	0.04	0.08
CD @ 5%	0.05	0.02	2.02	0.50	0.58	NS	NS	0.12	0.16	0.12	NS
CV %	0.22	2.59	3.01	1.37	2.05	4.98	2.17	1.74	2.37	1.80	3.67

TSS (%), AA- Ascorbic acid (mg/100g), TS- Total Sugar (%), RS- Reducing Sugar (%), APP- Appearance, OA- Overall Acceptability.

Table 1.80 : Biochemical and sensory changes of cashew apple Jam prepared from different varieties during the storage at ambient temperature at Paria

INITIAL												
Treatments	**Biochemical Parameters**					**Sensory Parameters (5 Point hedonic scale)**						
	TSS	**Acidity**	**AA**	**TS**	**RS**	**APP**	**Col.**	**Fla.**	**Taste**	**Text.**	**OA**	**Swe.**
V1	68.60	0.42	268.67	34.58	13.64	4.80	5.00	5.00	4.82	5.00	4.92	5.00
V2	68.53	0.46	290.15	45.30	17.67	4.76	4.85	4.76	4.76	4.80	4.79	4.95
V3	68.51	0.36	241.00	33.40	12.95	4.10	4.30	4.40	4.15	4.37	4.26	4.85
V4	68.63	0.32	295.65	44.46	17.22	5.00	4.96	4.95	5.00	4.95	4.97	5.00
V5	68.55	0.35	265.20	38.00	14.60	4.35	4.50	4.62	4.35	4.50	4.46	4.95
V6	68.56	0.44	267.18	36.10	14.15	4.50	4.65	4.65	4.50	4.66	4.59	4.90
V7	68.53	0.43	254.25	34.00	13.42	4.32	4.45	4.45	4.31	4.44	4.39	4.85
SEM±	0.01	0.01	1.04	0.44	0.15	0.08	0.09	0.05	0.07	0.06	0.04	0.07
CD @ 5%	0.03	0.02	3.16	1.34	0.46	0.24	0.28	0.16	0.20	0.17	0.13	NS
CV %	0.02	2.45	0.67	2.02	1.77	3.00	3.41	1.99	2.56	2.08	1.63	2.55
3 MONTH STORAGE												
Treatments	**TSS**	**Acidity**	**AA**	**TS**	**RS**	**APP.**	**Col.**	**Fla.**	**Taste**	**Text.**	**OA**	**Swe.**
V1	69.95	0.55	118.32	40.58	18.84	4.35	4.55	4.49	4.55	4.50	4.44	4.00
V2	69.69	0.59	142.00	52.45	24.18	4.29	4.45	4.35	4.45	4.00	4.34	3.94
V3	68.62	0.56	94.50	37.65	17.56	3.00	3.15	3.35	3.20	3.25	3.18	3.84
V4	70.30	0.53	145.40	51.13	23.42	4.50	4.46	4.45	4.68	4.30	4.48	4.50
V5	69.56	0.55	112.90	44.50	20.20	4.15	4.30	4.40	4.30	4.20	4.26	3.93
V6	69.60	0.57	113.98	42.24	19.56	4.20	4.35	4.35	4.35	4.35	4.32	3.91
V7	69.56	0.54	103.65	39.50	18.43	4.00	4.15	4.08	4.15	3.30	3.94	3.85
SEM±	0.14	0.01	0.97	0.41	0.35	0.07	0.06	0.03	0.06	0.07	0.02	0.17
CD @ 5%	0.41	0.02	2.95	1.26	1.05	0.22	0.18	0.09	0.17	0.22	0.07	NS
CV %	0.34	1.62	1.42	1.63	2.96	3.07	2.47	1.27	2.28	3.13	0.98	7.15

TSS (%), AA- Ascorbic acid (mg/100g), TS- Total Sugar (%), RS- Reducing Sugar (%), APP- Appearance, OA- Overall Acceptability.

PILICODE

Among the varieties tried, PLD 1 had high overall acceptability when processed in to cashew apple RTS. This was followed by PLD 15, PLD 16, PLD 20 and PLD 18. RTS prepared from PLD 16 had the highest score for appearance. Regarding colour, RTS prepared from PLD 16 had the highest score (Table 1.81).

Table 1.81: Organoleptic Scoring- Cashew Apple RTS at Pilicode

Variety/ Germplasm	Appearance	Colour	Flavour	Taste	Texture	Sweetness/ Saltiness	Overall acceptability
PLD1	2.68	2.56	2.68	2.98	2.80	2.80	2.98
PLD 3	2.56	2.32	2.68	2.52	2.68	2.84	2.64
PLD 4	2.57	2.67	2.98	2.96	2.66	2.80	2.82
PLD 12	2.68	2.68	2.68	2.84	2.76	2.90	2.72
PLD 15	2.80	2.60	3.00	2.96	2.80	2.90	2.95
PLD 16	2.92	2.96	2.92	2.78	2.80	2.98	2.96
PLD 17	2.76	2.68	2.68	2.80	2.76	2.98	2.84
PLD 18	2.60	2.64	2.80	2.92	2.88	2.98	2.88
PLD 19	2.68	2.68	2.82	2.72	2.76	2.96	2.85
PLD 20	2.76	2.76	2.80	2.92	2.86	2.86	2.90

Among varieties tried, PLD 16 had the highest overall acceptability. The score was highest for PLD 16 for appearance of the product (Jam). PLD 16 had the highest score for colour, whereas PLD 18 had the highest score for flavour. Highest score for taste was obtained for the variety, PLD 18 and PLD 16 (Table 1.82).

Table 1.82 : Organoleptic Scoring- Cashew Apple Jam at Pilicode

Variety/ Germplasm	Appearance	Colour	Flavour	Taste	Texture	Sweetness/ Saltiness	Overall acceptability
PLD1	2.60	2.68	2.48	2.60	2.56	2.56	2.72
PLD 3	2.40	2.48	2.72	2.54	2.76	2.60	2.88
PLD 4	2.50	2.48	2.50	2.48	2.88	2.64	2.64
PLD 12	2.56	2.66	2.80	2.68	2.80	2.68	2.74
PLD 15	2.52	2.36	2.32	2.52	2.48	2.64	2.60
PLD 16	2.88	2.96	2.84	2.92	2.96	2.85	2.96
PLD 17	2.68	2.64	2.88	2.68	2.84	3.00	2.84
PLD 18	2.68	2.58	2.96	2.92	2.68	2.85	2.66
PLD 19	2.56	3.52	2.46	2.68	2.88	2.85	2.68
PLD 20	2.56	2.32	2.54	2.54	2.65	2.56	2.48

VENGURLA

The data with respect to organoleptic evaluation of RTS of different cashew varieties (Table 1.83) shows that the highest score for organoleptic evaluation of RTS in different cashew varieties was observed maximum score in variety Vengurla-5 with respect to taste (4), colour (4), total acceptability (4) while, the score recorded for flavour in all the varieties was same (3) except Vengurla-2 (2). Shelf life of RTS in days was found higher (122 days) in Vengurla-5.

The data presented in Table revealed that organoleptic evaluation score of jam was found maximum in cashew Vengurla-8 variety in respect of colour (4) and total acceptability (4). While, the score for taste (3) and flavour (3) remain same in all the varieties. The maximum shelf life (142 days) was observed in Vengurla-4.

Table 1.83 : Organoleptic evaluation of products viz., RTS and jam in different varieties at Vengurle

a. RTS

Variety	Taste	Colour	Flavour	Total acceptability	Shelf life in days
V-1	3	3	3	3	117
V-2	2	3	2	3	113
V-3	3	3	3	3	120
V-4	3	3	3	3	113
V-5	4	4	3	4	122
V-6	3	3	3	3	114
V-7	3	3	3	3	120
V-8	2	3	3	3	116

b. Jam

Variety	Taste	Colour	Flavour	Total acceptability	Shelf life in days
V-1	3	3	3	3	115
V-2	3	3	3	3	111
V-3	3	3	3	3	118
V-4	3	3	3	3	142
V-5	3	3	3	3	120
V-6	3	3	3	3	126
V-7	3	4	3	3	118
V-8	3	4	3	4	114

VRIDHACHALAM

RTS and Jam were prepared from eight varieties and organoleptic evaluation was done.

Table 1.84 : Organoleptic evaluation of products viz., RTS and jam in different varieties at Vridhachalam

a. RTS

Variety	Taste	Colour	Flavour	Total acceptability	pH	Shelf life (days)
VRI2	4	5	5	6	4.8	90
VRI3	7	7	5	6	4.6	
VRI(Cw)H1	8	7	5	8	4.2	
Vengurla 4	7	5	5	6	4.8	
Bhaskara	7	5	5	6	4.5	
Priyanka	7	7	5	6	4.8	
Madak- 2	7	7	5	6	4.6	
BPP 8	7	7	5	6	4.2	

b. Jam

Variety	Taste	Colour	Flavour	Total acceptability	Shelf life (days)
VRI2	7	5	8	7	180 days
VRI3	7	7	7	7	
VRI(Cw)H1	7	7	7	7	
Vengurla 4	5	7	7	7	
Bhaskara	5	7	7	7	
Priyanka	7	5	7	7	
Madak- 2	7	5	7	7	
BPP 8	7	7	7	7	

II. CROP MANAGEMENT

II. CROP MANAGEMENT

Hort.1a : Nutrient Management for yield maximization in cashew

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

To investigate the effect of nutrient management approaches on growth, yield and soil properties.

Experimental Design : Randomized Block Design

No. of replications : 3

Treatments:

T_1 - 100% RDF (500:250:250g NPK/Plant)
T_2 - 100% RDF + FYM @10kg/Plant/Year
T_3 - T_2 + Foliar Spray of major nutrients (3% urea + 0.5% H_3PO_4 +1% K_2SO_4)
T_4 - T_2 + Foliar Spray of Secondary and micro-nutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% $MgSO_4$)
T_5 - T_3 + Foliar Spray of Secondary and micro-nutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% $MgSO_4$)
T_6 - Control

BHUBANESWAR

The experiment was laid out during the year 2014. Cashew variety, Balabhadra was planted at a spacing of 7m x 7m. The crop is at initial stage of vegetative growth.

Table 2.1 : Initial soil status of the Experimental plot at Bhubaneswar

Sl. No.	Parameters	Status
01	Soil pH	5.59
02	EC (dSm^{-1})	0.07
03	Organic carbon (%)	0.24 (very low)
04	Available N (kg/ ha)	162.50 (Low)
05	Available P_2O_5 (kg/ ha)	9.57 (Low)
06	Available K_2O (kg/ ha)	90.04 (Low)
07	S (mg/ kg)	5.01
08	Fe (mg/ kg)	11.10
09	Mn (mg/ kg)	0.98
10	Cu (mg/ kg)	0.33
11	Zn (mg/ kg)	0.13
12	B (mg/ kg)	0.07

Hort.2 : Fertilizer application in high density cashew plantations

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

This trial envisages identification of optimum population density for cashew and suitable fertilizer doses at different high density plantings for specific regional variety.

Experiment Details :

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

BAPATLA

It is evident that trees planted at closer densities i.e. 5m x 4m apart have given higher plant heights, trunk girth, canopy diameter and canopy height. Annual nut yield per tree was highest 6.1 kg per tree in 10 x 5m spaced trees applied with fertilizer levels at 150:50:50 kg/ha [S1M2] which is followed by treatment S1M3 [5.29 kg/tree]. Cumulative nut yields are also highest in the same treatments i.e. S1M2 [57.88kg/tree] and S1M1 [56.26 kg/tree]. Results have indicated that at closer densities vegetative parameters are at higher values and at wider densities yields are higher.

Table 2.2 : Effect of tree density and fertilizer levels on growth parameters of cashew at Bapatla

	Plant Height (m)				Canopy Height (m)			
	S1	S2	S3	Mean	S1	S2	S3	Mean
M1	5.66	5.12	5.87	5.55	5.17	4.67	5.38	5.07
M2	5.30	4.93	5.41	5.21	4.89	4.50	4.81	4.74
M3	4.87	4.84	4.67	4.79	4.47	4.41	4.31	4.39
Mean	5.28	4.96	5.31	5.18	4.84	4.52	4.83	4.73
	CD(0.05)		SEM±		CD(0.05)		SEM±	
Spacing	NS		0.16		NS		0.16	
Fertilizers	0.31		0.10		0.34		0.11	
Spacing x Fertilizers	NS		0.18		NS		0.19	

Table 2.3 : Effect of tree density and fertilizer levels on growth parameters of cashew at Bapatla

	Stem Girth (cm)				Canopy Diameter (m)			
	S1	S2	S3	Mean	S1	S2	S3	Mean
M1	100.62	82.28	96.25	93.05	8.16	7.20	6.14	7.16
M2	100.75	100.77	95.56	99.02	7.84	7.89	6.63	7.47
M3	77.41	72.84	70.04	73.43	7.73	6.26	6.28	6.76
Mean	92.93	85.30	87.28	88.50	7.93	7.11	6.35	7.11
	CD(0.05)		SEM±		CD(0.05)		SEM±	
Spacings	NS		4.24		1.09		0.33	
Fertilizers	7.65		2.58		NS		0.238	
Spacings x Fertilizers	NS		4.47		NS		0.412	

Table 2.4 : Effect of tree density and fertilizer levels on yield parameters of Cashew at Bapatla

	Nuts/Panicle				Nut Wt. (g)			
	S1	S2	S3	Mean	S1	S2	S3	Mean
M1	1.68	1.68	1.62	1.66	6.14	5.32	5.26	5.57
M2	3.40	2.18	2.75	2.77	6.27	5.59	5.95	5.93
M3	2.25	2.06	2.37	2.22	5.10	4.95	6.15	5.40
Mean	2.44	1.97	2.24	2.22	5.84	5.29	5.78	5.64
	CD(0.05)		SEM±		CD(0.05)		SEM±	
Spacings	NS		0.22		0.39		0.114	
Fertilizers	0.35		0.118		0.26		0.087	
Spacings x Fertilizers	NS		0.20		0.45		0.152	

Table 2.5 : Effect of tree density and fertilizer levels on yield parameters of Cashew at Bapatla

	Apple Wt. (g)				Nut Yield/tree (kg)			
	S1	S2	S3	Mean	S1	S2	S3	Mean
M1	53.62	47.30	48.90	49.94	4.90	3.49	2.53	3.64
M2	52.75	47.87	46.00	48.87	6.10	3.67	3.02	4.26
M3	48.62	47.12	52.92	49.55	5.29	2.48	3.10	3.62
Mean	51.66	47.43	49.27	49.45	5.43	3.22	2.88	3.84
	CD(0.05)		SEM±		CD(0.05)		SEM±	
Spacings	NS		1.13		1.15		0.335	
Fertilizers	NS		2.21		NS		0.37	
Spacings x Fertilizers	NS		3.83		NS		0.65	

The nut weight was found to be significant at different levels of spacings and fertilizers. The maximum nut weight (5.84) was recorded in S1 (10x5m) followed by S3 (5.78) and S2 (5.29) among the different levels of spacings. The highest nut weight was recorded in M2 (5.93) followed by M1 (5.57) and M3 (5.40). The interaction between spacings and fertilizers was found to be significant. The highest nut weight was recorded in S1M2 (6.27) followed by S3M3 (6.15) (Table 2.4).

The apple weight was found to be non significant at different levels of spacings and fertilizers. The interaction between spacings and fertilizers was found to be non significant. However the highest was recorded in S1M1 (53.62g) followed by S3M3 (52.92g). The annual nut yield per tree was found to be significant at different levels of spacings and non significant at different levels of fertilizers. The maximum nut yield per tree was recorded in S1 (5.43kg/tree) followed by S2 (3.22kg/tree). The interaction between spacings and fertilizers was found to be non significant. However the highest was recorded in S1M2 (6.10kg/tree) (Table 2.5).

Compilation of three years data

The results obtained from planting densities cum fertilizer trial showed that trees planted at closer densities i.e. 5m x 4m had higher plant heights, trunk girth, canopy diameter and canopy height. Annual nut yield per tree was highest (11.43 kg/tree) in 10 x 5m spaced trees applied with fertilizer levels at 75:25:25 kg/ha [S1M1], Cumulative nut yields was also highest in the same treatments i.e. S1M1 [43.45kg/tree] during 2012-13 and annual nut yield per tree was highest (10.69 kg/tree) in 10 x 5m spaced trees applied with fertilizer levels at 150:50:50 kg/ha [S1M2]. Cumulative nut yields were also highest in the same treatments i.e. S1M2 [51.78kg/tree] during 2013-14. The results indicated that at closer densities vegetative parameters are at higher values and at wider densities yields are higher.

BHUBANESWAR

Experiment was laid out during August 2000. The results presented in Table revealed significant effect on stem girth, canopy diameter and canopy surface area due to tree density. The tree density S_1 (10m x5m) was significantly superior to both S_2 (6mx4m) and S_3 (5mx4m) in respect of plant height (6.92m), trunk girth (87.73cm), canopy diameter (9.31m) as well as canopy surface area (68.09m^2) but no significant difference was observed in respect of ground area coverage by canopy (%).

Significantly higher plant height (6.69m), canopy diameter (7.49m), canopy surface area (45.56m^2) as well as ground coverage by canopy (149.31%) was observed in M_3. M_2 ($N_{150}P_{50}K_{50}$) recorded statistical parity with M_3 for plant height, trunk girth and canopy surface area.

The results presented in the Table revealed that no significant differences on plant height, stem girth, canopy diameter, canopy surface area and ground coverage by canopy were recorded due to interaction effect of tree density and levels of fertilizers. However, S_1M_3 treatment recorded maximum plant height (7.05m), canopy diameter (9.34m), canopy surface area (68.54m^2) and ground area coverage by canopy (137.07%).

The data indicated significant variations for all the yield parameters due to tree density and levels of fertilizers. On the other hand, all the parameters were statistically non-significant due to interaction effect of tree density and levels of fertilizers. The tree density S_1(10m x5m) was significantly superior to both S_2 (6m x4m) and S_3 (5m x4m) in respect of average nut weight (8.26g), apple weight (68.00g) as well as nut yield/tree (5.46kg). However, highest number of panicles/m^2 (19.72) was observed with tree density S_2 (6m x 4m). Highest mean annual nut yield was recorded in S_3 (1522.92kg/ha) than S_1 and S_2. Similarly, nut yield over 13th harvest indicated highest nut yield of 56.60kg/tree in highest tree

density of S_1 than S_2 and S_3. Significantly higher number of panicles/m^2 (18.49 to 18.70g), average nut weight (8.01 to 8.08g), apple weight (64.35 to 66.14g) as well as annual nut yield (1432.84 to 1445.51kg/ha) was recorded with application of higher levels of fertilizers either M_2($N_{150}P_{50}K_{50}$ kg/ha) or M_3 ($N_{225}P_{75}K_{75}$ kg/ha). Overall, application of M_2($N_{150}P_{50}K_{50}$ kg/ha) in cashew recorded maximum nut yield and yield attributing parameters including highest cumulative nut yield 46.35kg/ha after 13th harvest (Table 2.6 & 2.7).

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

Treatment	No. of panicles/ m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (kg/tree) (for 13th hvts)
				(kg/tree)	(kg/ha)	
S_1	18.41	8.26	68.00	5.46	1092.56	56.60
S_2	19.72	7.94	62.75	3.71	1483.78	37.05
S_3	15.35	7.78	61.19	3.05	1522.92	32.02
SEM+	0.88	0.06	1.41	0.28	74.22	-
CD@5%	3.04	0.20	4.87	0.96	256.83	-
M_1	16.29	7.89	61.45	3.60	1220.90	36.59
M_2	18.70	8.08	64.35	4.32	1445.51	46.35
M_3	18.49	8.01	66.14	4.30	1432.84	42.72
Mean	13.86	6.03	48.77	3.21	1903.79	15.71
SEM±	0.63	0.04	1.15	0.14	41.14	-
CD@5%	1.88	0.13	3.41	0.41	122.32	-

Table 2.7 : Effect of tree density and fertilizer levels on yield parameters of cashew at Bhubaneswar

Treatment	No. of panicles/ m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (kg/tree) (for 13th hvts)
				(kg/tree)	(kg/ha)	
S_1M_1	17.85	8.18	63.52	4.64	927.92	47.46
S_1M_2	18.64	8.31	68.77	5.82	1163.53	64.38
S_1M_3	18.75	8.28	71.72	5.93	1186.23	57.96
S_2M_1	16.74	7.87	61.02	3.49	1394.17	33.01
S_2M_2	21.63	8.08	64.10	3.97	1589.67	40.09
S_2M_3	20.80	7.88	63.13	3.67	1467.50	38.04
S_3M_1	14.28	7.62	59.82	2.68	1340.63	29.32
S_3M_2	15.84	7.85	60.18	3.17	1583.33	34.58
S_3M_3	15.91	7.89	63.57	3.29	1644.79	32.15
Mean	17.83	8.00	63.98	4.07	1366.42	41.89
SEM ±	1.09	0.74	1.99	0.24	71.30	
CD @ 5%	NS	NS	NS	NS	NS	

The results on economics presented in the Table revealed wide variations for cumulative cost of cultivation, total returns and benefit cost ration due to different tree density as well as fertilizer levels. The cumulative cost of cultivation over 13th harvest ranged from Rs.179166.00 (S_1M_1) to Rs. 211053.00 (S_2M_3), while cumulative net returns varied from Rs. 4,84,101.00 (S_1M_1) to Rs. 9,00,779.00 (S_3M_2). Similar trend was also observed for BCR, maximum of 4.53 was recorded in the treatment of S_3M_2 (Table 2.8).

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

Spacing (Density)	Fertilizer Dose NPK (kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 13th no. of years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : Cost Ratio
S_1: 10m x 5m (200plant/ha)	M_1: 75-25-25	179166	484101	304935	2.70
	M_2: 150-50-50	193180	658850	465670	3.41
	M_3: 225-75-75	207201	591727	384526	2.86
S_2: 6m x 4m (400plant/ha)	M_1: 75-25-25	183018	678792	495774	3.71
	M_2: 150-50-50	197032	824432	627400	4.18
	M_3: 225-75-75	211053	795538	584485	3.77
S_3: 5m x 4m (500plant/ha)	M_1: 75-25-25	184944	769187	584243	4.16
	M_2: 150-50-50	198958	900779	701821	4.53
	M_3: 225-75-75	212979	837545	624566	3.93

DARISAI

S1: 10mx5m, S2:6mx4m, S3: 5mx5m.
M1: 75 Kg N, 25 Kg P_2O_5, 25Kg K_2O,
M2: 150 Kg N, 50 Kg P_2O_5, 50Kg K_2O
M3: 225 Kg N, 75 Kg P_2O_5, 75Kg K_2O
Var.: BPP-8

The flowering laterals /m^2 (7.23), nut weight (9.26 gm), apple weight (67.30 gm) and nut yield (5.20 kg/tree) was maximum in S_1M_2 (200 plants/ha with 150 kg N, 50 kg P_2O_5, 50 kg K_2O.

Table 2.9 : Yield parameters of cashew under spacing cum fertilizer trial at Darisai

Treatment	Flowering lateral/m^2	Nut wt. (gm)	Apple wt. (gm)	Nut yield (kg/tree)
S1M1	6.86	9.14	65.2	4.25
S1M2	7.23	9.26	67.3	5.2
S1M3	7.01	9.18	64.1	4.3
S2M1	5.84	8.13	54.7	3.6
S2M2	6.1	8.34	60.7	3.75
S2M3	6.34	8.45	63.9	3.45
S3M1	5.15	7.2	50.56	2.52
S3M2	5.65	7.4	58.74	2.74
S3M3	5.4	8.1	59.64	2.84

JHARGRAM

The plants under 6m x 4m spacing and 5m x 4m spacing were pruned during 2013 August. As there was enough space under 10m x 5m spacing, the plants were not pruned. Therefore, the mean tree height was highest with plants under 10m x 5m spacing. The treatments were on par with respect to stem girth. Generally, irrespective of plant density, a decrease in stem girth was noticed with an increase in fertilizer dose. Significant variation was notices among the treatments with respect to canopy spread. The narrowly spaced plants i.e. under 6m x 4m spacing and 5m x 4m spacing, were on par with respect to canopy spread, but the plants with maximum spread were under 10m x 5m spacing. The canopy area and ground coverage were highest under 10m x 5m spacing. With wider spacing, canopy surface area increased with an increase in fertilizer dose. On the other hand canopy surface area decreased with 5m x 4m spacing, when fertilizer dose increased. After pruning, within 2 years time the branches of plants under 6m x 4m and 5m x 4m spacing had regenerated and 90% space covered with the canopy.

Significant difference was noticed among the plants under wider spacing and narrow spacing with respect to no. of panicles /m^2, nuts/m^2 and yield/ tree. A higher fertilizer dose had positive effect on production of flower bearing laterals /m^2, but had negative relation with nuts/m^2. The treatments were on par with respect to nut weight and apple weight. In case of 10m x 5m spacing yield /tree had increased with an increase in fertilizer dose. While after pruning the narrow spacing treatments were on par with respect to yield /tree. Significant variation was observed among the treatments when yield /unit area was compared and it was highest with 10m x 5m spacing + application of 225- 75 -75 kg NPK/ha/year and lowest with 6m x 4m spacing + 150 – 50- 50 kg NPK/ha/year. Significant variation was also observed among the treatments when cumulative yield /unit area was compared and it was highest under 6m x 4m spacing i.e. a plant density of 400 plants /ha.

Table 2.10 : Effect of tree density and fertilizer levels on yield parameters of cashew at Jhargram

Treatment	Duration of flowering (days)	No. of panicles / m^2	No. of nuts / m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (q/ha) (for 9 hvts)
						(Kg/ tree)	(Q/ha)	
S1M1	82	12.0	43.5	4.6	44.5	14.4	68.95	80.19
S1M2	80	11.4	45.0	4.6	42.7	14.8	74.22	75.94
S1M3	79	13.4	47.2	4.4	51.0	16.4	81.94	78.42
S2M1	80	7.4	27.4	5.3	52.8	4.4	17.46	154.95
S2M2	81	5.6	21.7	4.5	49.1	3.4	13.51	160.66
S2M3	80	7.7	22.9	5.2	51.9	3.9	15.69	172.62
S3M1	77	5.4	25.3	6.4	54.7	4.4	21.84	103.65
S3M2	79	5.6	24.5	4.4	45.9	3.1	15.44	107.58
S3M3	78	5.9	23.0	4.6	54.7	2.8	13.99	104.29
Mean	79.56	8.27	31.17	4.89	49.7	7.51	35.89	115.37
SEM ±	81	1.020	5.140	0.398	3.107	1.503	1.51	10.71
CD @ 5%	NS	2.22	11.20	0.90	6.77	3.28	3.30	23.35
CV %		30.3	40.4	19.9	15.3	49.1	10.33	11.37

Table 2.11 : Economics of high density planting based on cumulative yield at Jhargram

Spacing (Density)	Fertilizer Dose NPK (Kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 12 years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	B:C Ratio
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	88,481	10,41,061	9,52,580	10.77
	M2: 150-50-50	1,04,736	11,08,560	10,03,824	9.58
	M3: 225-75-75	1,25,893	11,76,783	10,50,890	8.35
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	1,04,856	6,03,605	4,98,749	4.76
	M2: 150-50-50	1,36,947	5,47,400	4,10,453	3.00
	M3: 225-75-75	1,53,807	5,87,130	4,33,323	2.82
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	1,47,801	5,92,648	4,44,847	3.01
	M2: 150-50-50	1,64,420	5,83,105	4,18,685	2.55
	M3: 225-75-75	1,80,393	5,70,620	3,90,227	2.16

Benefit cost ratio was highest with 10m x 5m spacing + 75-25-25 kg NPK/ha/year (10.77) followed by 10m x 5m spacing + 150-50-50 kg NPK/ha/year (9.58).

MADAKKATHARA

The analysis of the previous years data have shown that the tree density did not influence the per tree yield (year wise as well as cumulative) significantly. There was significant increase in per hectare nut yield with increase in tree density from 200 to 500 trees/hectare. The increase in nut yields both per tree and per hectare with increase in fertilizer levels were recorded. Maximum yield was recorded by the treatment receiving highest fertilizer dose. The result on cumulative yield was also same.

Considering the interaction effect of spacing and fertilizer doses highest per tree yield both year wise and cumulative was recorded in S1 M3. Cumulative yield per hectre (year wise as well as cumulative) was high under S3 M3.

The data on the growth characters as influenced by different tree densities and fertilizer doses are presented in Tables. The plants under observations are 13 year old. Statistical analysis of the data showed that the interaction effect of tree densities and fertilizer dose influence the growth parameters other than tree height and stem girth significantly.

The flowering duration, mean flowering laterals/ panicle and sex ratio did not differ significantly in response to density of planting and different doses of fertilizers. The mean nut weight apple weight and yield differed significantly in response to different treatments. Maximum nut weight (6.45 to 6.72 g) and apple weight (62.50 to 64.00g) was recorded in S1 plots (Table 2.12).

Table 2.12 : Effect of tree density and fertilizer levels on yield parameters of cashew at Madakkathara

Treatment	Duration of flowering (days)		Flowering laterals/ panicles m^2	Bisexual Male flowers ratio	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (kg/tree)
	Range	Mean					(Kg/tree)	(kg/ha)	
S1M1	41-53	63.87	4.00	0.28	6.45	63.80	7.04	1408.50	33.08
S1M2	40-57	63.12	3.25	0.29	6.62	62.50	5.10	1020.50	30.83
S1M3	41-56	62.00	5.00	0.26	6.72	64.00	5.47	1094.00	31.16
S2M1	46-53	61.50	4.25	0.22	6.10	60.50	3.35	1341.50	26.27
S2M2	44-53	64.62	3.75	0.24	6.22	56.50	3.97	1591.00	30.25
S2M3	50-62	61.62	4.25	0.19	6.15	60.50	2.95	1181.50	27.36
S3M1	43-60	62.87	4.00	0.18	6.15	55.75	3.81	1908.00	24.79
S3M2	45-61	63.37	4.00	0.16	6.07	54.25	3.15	1576.25	25.38
S3M3	40-54	62.50	4.00	0.15	6.07	55.50	3.63	1818.75	27.32
Mean		62.83	4.06	0.22	6.28	59.26	4.27	1437.78	28.49
CD @ 5%	-	NS	NS	NS	0.15	4.31	1.02	328.46	2.15

Economics of high density planting :

The economic analysis of the data on cost of cultivation and returns revealed that the lower density planting with different doses of fertilizer is comparatively less economical. However the next two higher densities i.e. 400 plants/ha and 500 plants /ha at different levels of fertilizer are economical. The highest density with lowest doses of fertilizer was found more economical than the other treatments. In general the application of highest dose of fertilizer increase the cost of cultivation and reduce the net return.

Table 2.13 : Economics of high density planting based on cumulative yield at Madakkathara

Spacing (Density)	Fertilizer Dose NPK (Kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 11 years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : Cost Ratio
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	320000	655000	335000	1.05
	M2: 150-50-50	330000	639000	309000	0.94
	M3: 225-75-75	335000	652000	317000	0.95
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	350000	748000	398000	1.14
	M2: 150-50-50	360000	783000	423000	1.18
	M3: 225-75-75	375000	750000	375000	1.00
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	390000	845000	455000	1.17
	M2: 150-50-50	410000	823000	413000	1.01
	M3: 225-75-75	420000	835000	415000	0.99

PILICODE

The experiment was started during 2000 with the variety, MDK 1 in three replications with 3 x 3 in split plot design. The fertilizers were applied as per the treatment schedule. The observations recorded during the period under report is furnished in the tables.

Effect of spacing on vegetative characters and yield of Cashew variety MDK-1

Spacing could not influence biometric characters except the percentage ground cover by the canopy. Highest percentage of canopy coverage was noted with closer spacing (S3: 600 plants / ha (5m x 4 m). Canopy coverage increased with increasing density levels. Among the yield related characteristics, the number of nuts retained per panicle, Nuts per sq.m and fruit set per sq.m was found to be influenced by the levels of spacing. Nut /panicle was highest with medium plant density (S2: 400 Plants / ha (6 m x 4 m). Nuts per sq.m found to increase with increasing plant density levels. Highest nuts per unit area was reported with closer spacing (S3: 600 plants / ha (5m x 4 m). Fruit set/sq.m also showed the similar trend. Flowering duration was found to be unaffected by the spacing levels.

The mean apple weight was found to be influenced by levels of density. Heaviest apples were seen in medium density level (S2: 400 Plants / ha (6 m x 4 m). The mean nut weight did not found to be influenced by different levels of plant density. The yield per plant and yield per ha was found to be affected by the change in plant density levels. Highest yield per plant was observed with closer spacing (S3: 600 plants / ha (5m x 4 m). Yield per ha also was maximum for this level of spacing.

Table 2.14 : Effect of spacing on vegetative characters and yield of Cashew variety MDK-1 at Pilicode

Characters		S1	S2	S3	Mean	CD@5%	CV%
Plant Height (m)		4.53	4.97	4.67	4.72	NS	6.44
Girth (m)		0.64	0.56	0.63	0.61	NS	17.75
Spread of the plant (m)	E-W	5.05	4.35	5.45	4.95	NS	13.26
	N-S	5.04	4.50	5.54	5.03	NS	14.61
Canopy area (m^2)		19.97	19.27	21.45	20.23	NS	13.84
% Ground cover by canopy		43.30^{c}	67.50^{b}	122.00^{a}	77.60	6.23	23.65
Panicle per m^2		10.52	9.82	11.01	10.45	NS	21.14
No. of branches not flowered		8.17	7.59	9.35	8.37	NS	18.90
Bisexual: Male flowers ratio		0.18	0.18	0.16	0.17	NS	29.03
Nuts /Panicle		4.88^{c}	8.39^{a}	6.38^{b}	6.55	0.17	6.13
Nuts/ m^2		16.57^{c}	19.20^{b}	21.28^{a}	19.02	1.11	11.29
Fruit set/ m^2		13.61^{c}	14.93^{b}	16.79^{a}	15.11	0.71	11.72
Flowering duration (Days)		120.78	108.89	110.11	113.26	NS	13.70
Apple weight		49.11	52.44	49.89	50.48	0.52	2.25
Nut weight		6.92	6.99	6.99	6.97	NS	1.35
Mean annual nut yield	(Kg/tree)	4.40	3.36	4.83	4.20	0.90	4.11
	(Kg/ha)	880.23	1342.63	2897.21	1706.69	91.68	14.24

Effect of Fertilizer on vegetative characters and yield of Cashew variety MDK-1

Different doses of fertilizer could not influence the vegetative growth parameters of the variety MDK 1 except percentage ground coverage by the canopy. Highest percentage of canopy coverage was reported in medium fertilizer dose (M2: 150 kg N : 50 Kg P_2O_5: 50 kg K_2O). The trend was similar in previous years also.

Among the yield related characteristics, the number of nuts retained per panicle, nuts per sq.m and fruit set per sq.m was found to be influenced by the doses of fertilizer. Nut /panicle was highest with medium dose of fertilizer (M2: 150 kg N : 50 Kg P_2O_5: 50 kg K_2O). Nuts per sq.m found to increase with increasing fertilizer dose. Highest nuts per unit area was reported with higher fertilizer dose (M3: 225 kg N: 75 Kg P_2O_5: 75 kg K_2O). Fruit set/ sq.m also showed the similar trend.

Regarding yield related characters, fertilizer doses alone could influence the apple weight and the mean nut weight. Highest apple weight and mean nut nut was recorded with higher dose of fertilizer (M3: 225 kg N: 75 Kg P_2O_5: 75 kg K_2O). Annual nut yield and yield per ha was found to be significantly influenced by the fertilizer doses. Annual yield was highest with medium fertilizer dose (M2: 150 kg N : 50 Kg P_2O_5: 50 kg K_2O). Yield per ha also showed the similar trend.

The doses of fertilizers and the plant density were not found to interact significantly in influencing growth characteristics of variety MDK-1 except for the percentage ground cover by the canopy. Higher percentage ground coverage was observed with S2 M3 higher fertilizer dose and wider spacing (S2: 400plants / ha (6 m X 4m), M3: 225 kg N: 75 Kg P_2O_5: 75 kg K_2O).

The doses of fertilizers and the plant density were did not found to interact significantly in influencing reproductive characteristics of variety MDK-1 except for the number of nuts per panicle, nuts per sq.m and the fruit set per sq.m. The nuts per panicle was highest with S2M2 (S2: 400plants/ ha (6 m x 4m), M2: 150 kg N : 50 Kg P_2O_5: 50 kg K_2O), Number of fruits /sq.m was also highest with this combination, though it was statistically on par with S3 M1 (S3: 600 plants / ha (5m x 4 m), M1: 75 kg N : 25 Kg P_2O_5: 25 kg K_2O) and S3 M3 (S3: 600 plants / ha (5m x 4 m), M3: 225 kg N : 75 Kg P_2O_5: 75 kg K_2O).

The mean apple weight and the mean nut weight were not influenced by the interaction of the spacing levels and the fertilizer levels. Mean annual nut yield both in terms of per plant yield and per hectare yield was found to be significantly influenced by the interaction of the plant density levels and fertilizer doses. Mean annual nut yield per plant was the highest in S3M2 (S3: 600 plants / ha (5m x 4 m), M2: 150 kg N: 50 Kg P_2O_5: 50 kg K_2O) (6.99 Kg/tree). Yield per hectare was also highest in this combination (4193.5kg/ha). But the cumulative yield did not have any significant interaction effect (Table 2.15).

Benefit cost ratio was highest in S2M1 (S2: 400plants/ ha (6m x 4m), (M1: 75 kg N : 25 Kg P_2O_5: 25 kg K_2O), followed by S3M1 (S3: 600 plants / ha (5m x 4 m), (M1: 75 kg N : 25 Kg P_2O_5: 25 kg K_2O).

Table 2.15 : Effect of tree density and fertilizer levels on yield parameters of cashew at Pilicode

Treatment	Mean Duration of flowering (days)	No. of fl. panicles/ m^2	Bisexual : male flowers ratio	Apple wt. (g)	Nut weight (g)	Annual nut yield		Cum. nut yield (Kg/ tree) (for 11 harvests)
						(Kg/tree)	(kg/ha)	
S1M1	132.00	8.78	0.17	46.00	6.80	4.56	912.11	51.01
S1M2	126.00	10.61	0.20	49.00	6.92	3.40	679.44	39.16
S1M3	104.33	12.19	0.18	52.33	7.06	5.25	1049.14	54.25
S2M1	118.33	9.30	0.21	50.33	6.83	2.15	861.62	47.17
S2M2	99.33	10.61	0.20	52.00	7.01	6.12	2446.27	43.66
S2M3	109.00	10.08	0.16	55.00	7.13	1.80	720.00	47.94
S3M1	112.67	12.24	0.19	48.67	6.90	4.69	2814.00	45.41
S3M2	113.67	11.37	0.15	50.00	6.98	6.99	4193.50	39.94
S3M3	104.00	9.41	0.15	51.00	7.08	2.81	1684.13	44.59
Mean	113.26	10.51	0.18	50.48	6.97	4.20	1706.69	45.90
CD @ 5%	NS	NS	NS	NS	NS	0.22	301.46	NS
CV%	13.70	21.14	29.03	2.25	1.35	4.11	14.24	20.40

Table 2.16 : Leaf Nitrogen content (%) and leaf potassium content (%) in cashew in different spacing and fertilizer levels at Pilicode

Leaf Nitrogen content (%)				
	M1	**M2**	**M3**	**Mean**
S1	2.27	2.34	2.24	2.28
S2	2.32	2.14	2.09	2.18
S3	2.20	2.00	2.18	2.13
Mean	2.26	2.16	2.17	2.20
Leaf potassium content (%)				
	M1	**M2**	**M3**	**Mean**
S1	0.92	0.83	0.93	0.89
S2	1.06	0.98	0.92	0.97
S3	0.98	0.80	0.88	0.89
Mean	0.99	0.87	0.91	0.92

Table 2.17 : Economics of high density planting based on cumulative yield at Pilicode

Spacing (Density)	Fertilizer Dose NPK (kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 14 of years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : Cost Ratio
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	234138.69	527093.11	292954.42	2.25
	M2: 150-50-50	268248.69	441895.97	173647.28	1.65
	M3: 225-75-75	302559.49	591933.18	289373.68	1.96
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	406942.98	1174291.03	767348.05	2.89
	M2: 150-50-50	440467.95	962131.88	521663.93	2.18
	M3: 225-75-75	474700.75	995171.83	520471.08	2.10
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	547526.54	1243950.89	696424.34	2.27
	M2: 150-50-50	577538.50	1150639.14	573100.64	1.99
	M3: 225-75-75	634682.90	1310232.09	675549.19	2.06

VENGURLA

The trial is concluded and on the basis of results of 14 years of experimental study, the data on individual effect of tree density, individual effect of fertilizer levels and interaction effect of both recorded during 2003-2013 showed continues non-significant results with respect to most of the growth, flowering, fruiting and yield attributes with few exception of individual effect of spacing and individual effect of fertilizer levels which showed the significant results for few years but pooled studies also showed the non-significant results.

Therefore it is very difficult to draw the precise conclusion of the experiment. However, data of economics of the trial on the basis of cumulative yield, it can be concluded that 5m x 4m spacing with 75:25:25kg NPK/ha levels of fertilizers i.e. S3M1 gave the maximum cumulative total return of Rs. 398,350/- per ha and maximum net returns of Rs. 2,11,460/- per ha with higher B:C ratio of 2:13 as compared to rest of the interactions.

During experimentation it was observed that, the cashew variety Vengurla-7, which is most vigorous growing variety and does not give good response to limb pruning and hence not suitable for high density planting.

Hort.3: Drip irrigation trial

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

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

Experimental Details :

Treatments : 5

T1 : No Irrigation

T2 : Irrigation 20% of Cumulative Pan Evaporation (CPE).

T3 : Irrigation 40% of Cumulative Pan Evaporation (CPE).

T4 : Irrigation 60% of Cumulative Pan Evaporation (CPE).

T5 : Irrigation 80% of Cumulative Pan Evaporation (CPE).

Spacing	=	7 x 7m		
Variety	=	Chintamani	:	Chintamani-1
		Vengurla	:	Vengurla-7
		Vridhachalam	:	VRI-3

HOGALAGERE

This experiment laid out in HREC, Hogalagere in existing cashew block (with 250 grafts) of Chintamani-1 variety of four years old during 2014. The treatments of different levels of irrigation were imposed during August 2015 and the observations will be made in the ensuing years.

VENGURLA

During the year except for shelling percentage, the growth and yield attributing characters were found to be significant. The plant height was recorded minimum (7.43 m) in T_5 (Irrigation 80% of CPE) while irrigation at 20% of CPE (T_2) recorded maximum (97.68 m) mean stem girth. However, said treatments were at par with rest of the treatments with respect of plant height and girth. Similarly, maximum canopy spread (8.68 m), canopy area (59.35 m^2) and canopy surface area (110.80 m^2) recorded in T_2 (irrigation at 20% of CPE) and was found at par with rest of the treatments.

Application of irrigation at 80% of CPE (T_5) recorded significantly the maximum number of flowering panicles (20.02 m^2), fruit set (69.1/m^2), nuts per panicle (9.0), nut weight (9.0 g), apple weight (72.10 g) and yield (13.49 kg/tree and 1.92 t/ha) and is found superior over rest of the treatments. The maximum cumulative yields for 12^{th} harvests recorded in T_5 - irrigation at 80% of CPE (59.41 kg/tree).

It is seen from the data that, as the irrigation level increased, the yield levels also increased. The present results may be due to maximum availability of water to the tree particularly during critical stage that also increased the availability of nutrient to the tree.

Table 2.18 : Effect of drip irrigation on growth and yield attributing characters of cashew at Vengurle

Treatment	Plant ht. (m)	Stem girth (cm)	No. of nut /pncl	Yield (kg/tree)	Yield (t/ha)	Mean apple wt. (g)	Mean nut Wt. (g)	Shelling (%)
T_1 : No Irrigation	7.60	89.70	8.2	5.90	0.84	61.0	8.2	31.25
T_2 : Irrigation 20% CPE	7.53	97.68	8.4	7.12	1.00	64.5	8.4	31.38
T_3 : Irrigation 40% CPE	7.85	96.93	8.5	8.84	1.25	65.1	8.5	31.13
T_4 : Irrigation 60% CPE	7.78	90.08	8.6	10.53	1.50	66.2	8.6	31.00
T_5 : Irrigation 80% CPE	7.43	97.10	9.0	13.49	1.92	72.1	9.0	30.88
Mean	7.64	94.30	8.54	9.18	1.30	65.78	8.54	31.13
SEM±	0.26	4.85	0.09	0.64	0.09	1.60	0.09	0.32
CD at 5%	0.82	14.96	0.28	1.99	0.28	4.93	0.28	NS

Table 2.19 : Yield data of drip irrigation trial in cashew at Vengurle

Treatments	Yield kg nut/tree												Cum. yield for kg/tree 12th hvst kg/tree
	*2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	
T_1: No Irrigation	1.31	1.36	1.88	7.02	4.66	2.85	0.41	0.45	6.87	5.05	4.77	5.90	42.53
T_2 : Irrigation 20% CPE	1.38	1.14	2.13	6.57	4.75	3.32	0.34	0.45	8.22	8.41	3.92	7.12	47.75
T_3 : Irrigation 40% CPE	1.65	1.55	1.87	7.14	6.17	2.64	0.39	1.15	7.28	5.84	3.75	8.84	48.12
T_4 : Irrigation 60% CPE	1.36	1.50	1.61	8.36	4.48	2.54	0.34	0.60	5.67	5.07	2.85	10.53	44.91
T_5 : Irrigation 80% CPE	1.79	1.70	1.78	7.34	4.14	3.29	0.41	1.00	7.29	9.08	8.10	13.49	59.41
*Yield started from 2003-04													

VRIDHACHALAM

The treatments were imposed during 2007 once in three days based on Cumulative Pan Evaporation value. Among the different levels of irrigation, irrigating the crop at 80% CPE recorded significantly highest plant height, girth and canopy surface area.

Treatments with irrigation at 80% CPE recorded maximum number of panicles/ m^2 and higher male: bisexual flower ratio. Nut yield vary significantly among the treatments. The highest nut yield of 8.92 Kg/tree with a nut weight of 7.2 g, shelling percent of 30.2 and mean cumulative yield of 35.96 kg per tree in 7 harvests was observed in the treatment with irrigation at 80% CPE.

Table 2.20 : Effect of drip irrigation levels on yield parameters of cashew at Vridhachalam

Treatments	No. of panicles / m^2	Male: Bisexual flowers ratio	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/ tree)	Cum. yield (kg/ tree) (for 7 harvests)	Shelling (%)
T1 : No irrigation	12.2	0.14	6.2	49.6	6.20	24.54	28.0
T2 : Irrigation at 20% CPE	14.4	0.17	6.5	55.4	6.75	27.13	28.4
T3 : Irrigation at 40% CPE	16.4	0.18	6.6	58.8	7.72	30.64	29.0
T4 : Irrigation at 60% CPE	20.2	0.20	7.2	59.4	7.85	31.63	29.6
T5: Irrigation at 80% CPE	22.8	0.23	7.2	65.2	8.92	35.96	30.2
Mean	17.2	0.18	6.74	57.68	7.49	29.98	29.04
SEM±	0.7			2.6	0.2		
CD at 5%	2.0		NS	5.2	0.6		NS

CONCLUDED TRIAL
DRIP IRRIGATION TRIAL

VENGURLE

Treatments	:	5
		T_1 No irrigation
		T_2 Irrigation 20% of CPE
		T_3 Irrigation 40% of CPE
		T_4 Irrigation 60% of CPE
		T_5 Irrigation 80% of CPE
Replications	:	Four
Variety	:	Vengurle-7
Spacing	:	5m x 5m
Year of planting	:	1999
Starting year of irrigation	:	2000

Results :

An experiment initially planted at the spacing of 5m x 5m with cashew variety Vengurla-7 during the year 1999 and application of irrigation treatments started in the year 2000. Due to overcrowding of branches and reduction in yield at the age of 10th years (2010-11), the experimental trees were diagonally thinned as per the decision taken in Annual Group Meeting of Scientists of AICRP-Cashew held at TNAU, Coimbatore during the year 2011.

The various growth and yield attributing observations of the trial during the period of investigation (2003-04 to 2014-15) were recorded and the results are as below.

a) Various drip irrigation levels did not significantly influenced height (m) and trunk girth (cm) of the tree during the year 2003-04 to 2013-14. However, irrigation treatments significantly influenced the plant height and girth during the year 2014-15.

b) Irrigation at 40% CPE (T3) recorded significantly maximum EW spread of 7.57m and 8.12m during the year 2008-09 and 2009-10, respectively and at par with T3 - irrigation at 40%CPE (7.14m) during 2008-09. Whereas, significantly maximum EW spread (9.00m) recorded in treatment T2 (Irrigation at 20%CPE) and on par with rest of the treatments during 2014-15. Various irrigation levels did not significantly influence the NS spread and mean canopy spread of cashew during the period of 2001-02 to 2013-14.

c) No significant variation observed among the different irrigation levels with respect of canopy height (m), canopy area (m^2) of cashew during the investigation period of 2004-05 to 2013-14. However, irrigation levels showed significant variation for the year 2014-15 for said growth attributes.

d) Different drip irrigation levels did not

significantly influence the mean canopy surface area (m^2) from the age of 9 to 13 years (2009-2013); the results might be due to conducting of drip irrigation trial under high density plantation up to age of 10^{th} year. The diagonal thinning of trees was done during 2010-11, which provided plenty space for further growth however the results were non-significant after diagonal thinning (2011-12 to 2013-14) might due long term effect of HDP planted with V-7 cashew variety.

e) Drip irrigation treatments did not significantly affect the production of laterals/m^2, panicles/m^2, flowering duration (days), fruit set/m^2 and number of nuts/panicle during the period under reporting (2003-04 to 2014-15) except for the year 2014-15.

f) Various drip irrigation levels significantly affected the nut weight of cashew particularly during the year 2013-14 and 2014-15 and apple weight during 2014-15.

g) Application of drip irrigation at 80% CPE recorded significantly maximum yield of 8.10 kg/tree and 13.54 kg/tree during the year 2013-14 and 2014-15 respectively and it is superior over rest of the treatments including control during both the years.

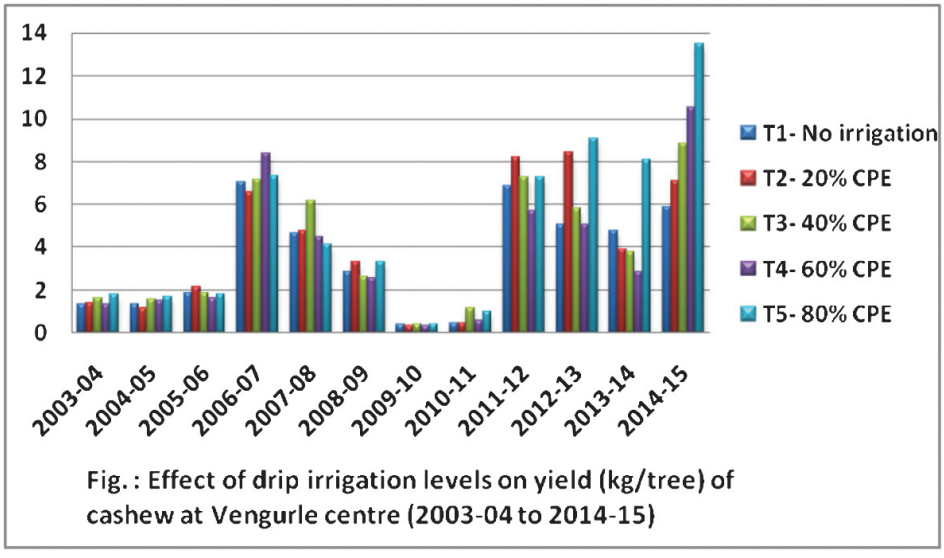


Fig. : Effect of drip irrigation levels on yield (kg/tree) of cashew at Vengurle centre (2003-04 to 2014-15)

Table : Effect of drip irrigation levels on yield (kg/tree) of cashew at Vengurle centre (2003-04 to 2014-15)

Treatments	Yield (kg/tree)												Mean pooled yield (kg /tree) for 12 years
	2003 -04	2004 -05	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	
T1 : No irrigation	1.31	1.36	1.88	7.02	4.66	2.85	0.41	0.45	6.87	5.05	4.77	5.90	3.54
T2 : Irrigation at 20% CPE	1.38	1.14	2.13	6.57	4.75	3.32	0.34	0.46	8.22	8.41	3.92	7.12	3.98
T3 : Irrigation at 40% CPE	1.65	1.55	1.87	7.15	6.17	2.64	0.40	1.15	7.28	5.84	3.75	8.84	4.02
T4 : Irrigation at 60% CPE	1.36	1.50	1.61	8.36	4.48	2.54	0.35	0.60	5.67	5.07	2.85	10.53	3.74
T5: Irrigation at 80% CPE	1.79	1.70	1.78	7.34	4.14	3.29	0.41	1.00	7.29	9.07	8.10	13.49	4.95
SEM±	0.23	0.29	0.25	0.40	0.63	0.20	0.08	0.28	1.53	1.78	0.95	0.64	2.37
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2.91	1.99	NS

h) Drip irrigation at 20 % CPE (T2) recorded maximum shelling percentage (31.38%) and it was on par with rest of the treatments including control during 2014-15.

i) Data on economic with respect to cashew drip irrigation trial over 14 years based on cumulative yield revealed that application of irrigation at 80% CPE (T5) gave the maximum cum. total returns of Rs. 11,72,640/- per ha and cumulative net returns of Rs. 8,19,146/- with higher B:C ratio (2.32:1).

Conclusion:

On the basis of results of 14 years of experimental study, the data on effect of different irrigation levels on various vegetative growth, flowering, fruiting and yield attributed recorded during 2003-2014 showed continues non-significant results with few exception to EW canopy spread, flowering panicles/m^2, fruit set/m^2, number of nuts/panicle, nut and apple weight (g) and yield (kg/tree & t/ha) which showed the significant results for one to two years but pooled studies also showed the non-significant results. This might be due to long term conducting of experiment under HDP (5m x 5m) with most vigorous growing variety like Vengurle-7 during initial 10 years experimentation (2000-01 to 2010-11). Therefore it is very difficult to draw the precise conclusion of the experiment. However, data of economics of the trial on the basis of cumulative yield, it can be conducted that application of irrigation at 80% CPE (T5) gave the maximum cum. total returns of Rs. 11,72,640/- per ha and cumulative net returns of Rs. 8,19,146/- with higher B:C ratio (2.32:1) as compared to rest of the treatments.

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

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

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

Experimental Details :

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

BAPATLA

Table 2.21 : Growth and Yield parameters of cashew in normal and high density planting at Bapatla

	4m x 4m	8m x 8m
Plant height (m)	4.65	3.90
Canopy Height (m)	4.25	3.54
Trunk Girth (cm)	64.77	67.94
Canopy spread (m)	4.82	5.75
Canopy surface area (m^2)	36.92	41.00
Ground area coverage by canopy (%)	114.25	40.41
Date of first Flowering	25.02.2015	06.03.2015
Date of last Flowering	15.05.2015	31.05.2015
Duration of Flowering (days)	80.0	87.0
Mean Flowering laterals/Sqmt	16.60	19.34
Mean no nut/m^2	12.05	14.18
Mean no nuts/panicle	1.36	1.37
Mean Nut yield kg/tree (Harvest No.7)	1.62	3.12
Nut yield (Kg/ha)	1012.5	486.7
CNY kg/tree (2008-2015)	12.13	17.12
Mean Nut weight [g]	5.10	5.21
Mean Apple weight (g)	51.14	57.00

The mean nut yield was recorded highest in 8x8 m spacing (3.12 kg/tree) and cumulative nut yield was also recorded highest in 8x8 m spacing (17.12kg/tree) for eight annual harvests.

Table 2.22: Yield and B:C ratio in high density trials at Bapatla

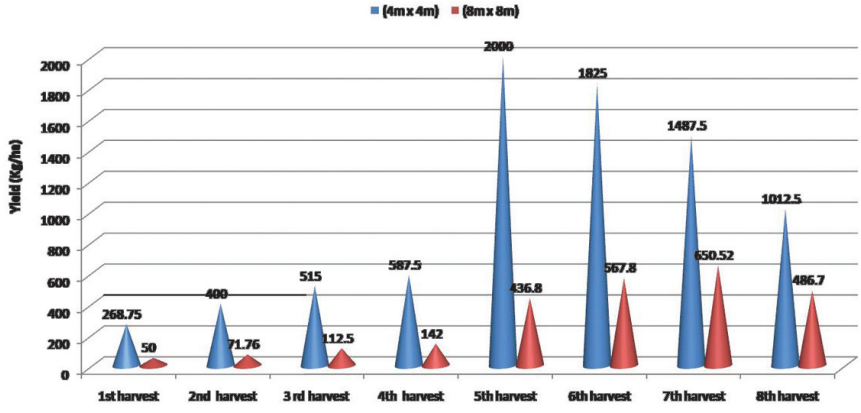
Harvest	Yeild (kg/ha.)		Net returns (Rs/ha.)		B:C ratio	
	(4m x 4m)	(8m x 8m)	(4m x 4m)	(8m x 8m)	(4m x 4m)	(8m x 8m)
1st harvest	268.75	50.00	-8875.00	-3240.00	-0.35	-0.51
2nd harvest	400.00	71.76	-1000.00	-1934.4	-0.04	-0.31
3rd harvest	515.00	112.5	5350.00	-292.5	0.19	-0.04
4th harvest	587.5	142.0	10062.50	2210.0	0.35	0.31
5th harvest	2000.00	436.8	111875.00	23556.0	3.97	3.35
6th harvest	1825	567.8	96500.00	31946.0	3.08	4.09
7th harvest	1487.5	650.52	80312.5	40987.5	2.57	5.25
8th harvest	1012.5	486.7	51000.00	18936.0	1.76	2.05

Compilation of three years data

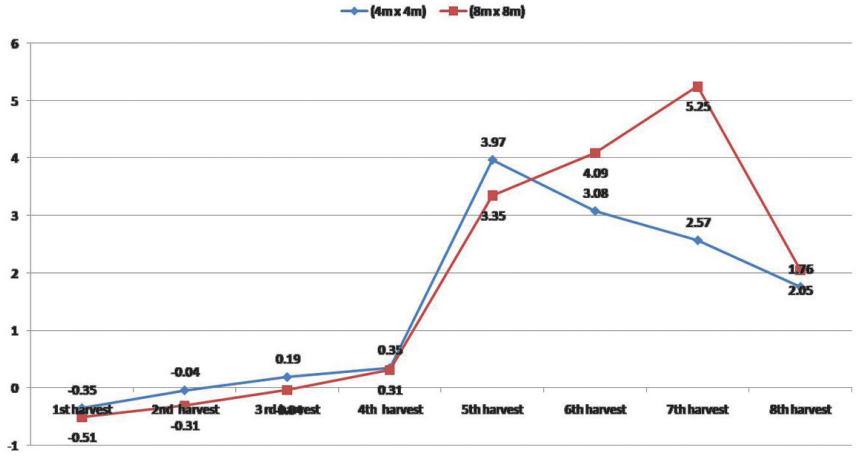
With respect to the benefit cost ratio in case of 4x4 m spacing, B:C ratio increased up to 5th harvest (-0.35 to 3.97) and 6th harvest onwards B: C ratio started decreasing rate. Whereas B:C ratio for 8x8 m spacing increased from 1st harvest to 7th harvest (-0.51 to 5.25).

Yield and B:C ratio in high density trials at Bapatla Centre

A. YIELD



B. B.C RATIO



JHARGRAM

Table 2.23 : Growth parameters of cashew in normal and high density planting at Jhargram

Spacing	Mean tree Height (m)	Mean stem girth (cm)	Mean canopy diameter (m)	Mean canopy surface area (m^2)	Ground coverage by canopy (%)
4m x 4m	3.1	33.6	3.7	17.9	67.17
8m x 8m	3.4	37	3.8	20.8	17.71

Table 2.24 : Yield parameters of cashew in normal and high density planting at Jhargram

Spacing	Duration of flowering (days)	Mean no. of panicles/m^2	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield		Cum. nut yield (for 3 hvts)
					(Kg/tree)	(Kg/ha)	
4m x 4m	80	3.1	8.1	62.2	1.2	750.0	1909.1
8m x 8m	88	4.9	8.2	62.5	3.19	498.3	1098.24

Table 2.25 : Yield and B:C ratio in high density trials at Jhargram

Harvest	Yield (Q/ha.)		Net returns (Rs/ha.)		B:C ratio	
	(4m x 4m)	(8m x 8 m)	(4m x 4 m)	(8m x 8 m)	(4m x 4 m)	(8m x8 m)
1st harvest	10.55	4.16	25552	14214	0.43	0.75
2nd harvest	6.93	1.84	32143	9247	1.38	1.69
3rd harvest	7.50	4.98	60000	39800	4.00	3.98

It was very clear that when plants were spaced at 8m x 8m, then Nuts/m^2, yield/tree were higher than the trees spaced at 4m x 4m. But yield per unit area (Yield/ha) was more in case of trees spaced at 4m x 4m (750 kg/ha). Cost benefit ratio was more in 4m x 4m .

VENGURLE

The mean yield obtained from high density plot at 9th harvest was 1096.88 kg/ha and net returns was Rs.1,09,688/- per ha with B:C ratio of 2.31:1. During the entire period of investigation the year-wise yield obtained from high density plot was found very low and hence it is not economically feasible. The low yield due to most vigorous growing cashew variety Vengurla-7 did not give good response to limb pruning.

Hort.6: Intercropping in Cashew

Centres: *East Coast* : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam
West Coast : Madakkathara, Paria and Vengurla
Plains / others : Kanabargi and Darisai

The objectives of this trial are to identify compatible intercrops with cashew in the initial stages of orchard development, to study the economic benefits of inter-cropping system, and to work out a soil fertility management strategy for the intercropping system.

Experimental Details :

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

BAPATLA

Among the different intercrops studied during the initial years of cashew the treatment T_3 (Cashew + Gogu) recorded maximum yield of 5733 kg/ha and was superior over rest of the treatments and this was followed by T_4 (Cashew + Amaranthus) of 4680 kg/ha and Cashew + Cluster Bean recorded the lowest yield (2808 kg/ha).

Further the economics of growing intercrops, it is seen from the data presented in table that growing marigold as inter crop in cashew orchard give the higher net profit of Rs.76265/- with B:C ratio of 1.62 followed by Hibiscus Rs.43319-00 and B:C ratio of 1.23 and the lowest net profit was obtained in growing cashew alone of Rs. 29920.00.

Hence it is seen that growing one of the inter crop in cashew in initial years is profitable.

Table 2.26 : Yield and economics of cashew and inter crops at Bapatla

Treatment details	Yield of intercrop		Yield of cashew		Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha	Cashew	Inter crop	Cashew + inter crop	Cashew	Inter crop	Total	Net	
T1 Cashew + Marigold	26.25	40.95	4.8	7.48	20000	25000	45000	59840	61425	121265	76265	1.62
T2 Cashew + Cluster bean	18.0	28.08	4.8	7.48	20000	20000	40000	59840	28080	87920	47920	1.19
T3 Cashew + Gogu	36.75	57.33	4.9	7.64	20000	15000	35000	61120	17199	78319	43319	1.23

Table 2.26 continued..

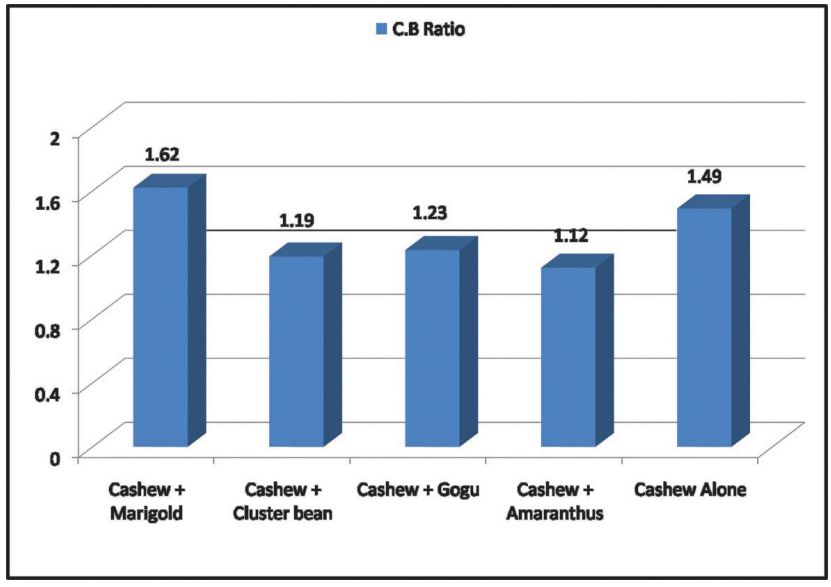
Treatment details	Yield of intercrop		Yield of cashew		Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha	Cashew	Inter crop	Cashew + inter crop	Cashew	Inter crop	Total	Net	
T4 Cashew + Amaranthus	30.00	46.80	5.2	8.11	20000	15000	35000	64880	9360	74240	39240	1.12
T5 Cashew Alone	------	-----	4.0	6.24	20000	------	20000	49920	------	49920	29920	1.49
C.D.@5%	3.45	0.697										
SEM ±	1.06	0.224										

Sale Price (Rs/Kg)

Raw Cashew Nuts	: 80.00	Cluster bean	: 10.00
Marigold	: 15.00	Amaranthus	: 3.00
Gogu	: 2.00		

At Cashew Research Station the intercrop trail was conducted with Marigold, cluster bean, Hibiscus, Amaranthus. Among that cashew + Marigold were found as best intercrop under sandy soils situation of cashew plantations. The intercrop Cashew + Marigold has recorded maximum yield and consistent results for 5 years and gave the highest B:C ratio of 2.09.

Economics of cashew and inter crops in intercropping trail at Bapatla



Compilation of three years data (Cashew Based Cropping Systems)

Different intercrops grown in initial years of cashew at Bapatla centre with Marigold, Cluster bean, Gogu (Hibiscus cannabinus), Amaranthus, Hibiscus. Among all the intercrops Marigold has recorded maximum yield and B:C ratio (3.81, 2.09 & 1.62) compared to other intercrops in all the three years. It has performed consistently in all three years 2012-13, 2013-14 & 2014-15 respectively.

DARISAI

Table 2.27 : Yield and economics of cashew and intercrops in intercropping trial at Darisai

Yield of intercrop (Q/ha)	Yield of cashew (Q/ha)	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
		Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net Profit	
113.7	0	47,200	87,300	1,34,500	0	1,70,490	1,70,490	35,590	0.78
213.3	0	47,200	64,140	1,11,340	0	2,13,330	2,13,330	1,01,909	0.52
402.7	0	47,200	2,14,285	2,61,485	0	4,02,660	4,02,660	1,41,175	0.64
162.7	0	47,200	3,42,180	3,89,380	0	6,50,640	6,50,640	2,61,260	0.59
196.3	0	47,200	4,07,115	4,54,315	0	5,88,990	5,88,990	1,34,675	0.77
0	0	47,200	-	0	0	0	0	0	0

Selling Price:

Colocasia: Rs.15/Kg, Sweet potato: Rs.10/Kg, Amorphophallus: Rs.10/Kg, Ginger: Rs.40/Kg & Turmeric: Rs.30/Kg

JHARGRAM

Cashew Variety BPP - 8 spaced at 6m x 6m and cowpea, Tapioca, okra and bottle gourd were grown as intercrops under the 3 year old plantation leaving 1.5m space from the base of the cashew plants.

During the year, four different crops namely tapioca, okra, cowpea and bottle gourd were grown as intercrop under 3 year old cashew plantation spaced at 6m x 6m. The available space for intercrops was 83.33%. Cost benefit ratio revealed that bottle gourd was the most profitable crop under cashew orchard followed by okra and cowpea.

Table 2.28 : Yield and economics of cashew and intercrops in intercropping trial at Jhargram

Treatment details	Yield of intercrop (Q/ha)	Yield of cashew (Q/ha)	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
			Cashew	Intercrop	Cashew + Intercrop	Cashew	Inter-crop	Cashew + Intercrop	Net	
Cashew + Cowpea	33.3	5.3	18158	14500	32658	47495	33333	80829	48171	8.0:1.4
Cashew + Tapioca	166.7	5.4		20000	38158	55369	33333	88702	50544	2.0:1.3
Cashew + Bottle gourd	62.0	5.5		6000	24158	59613	62037	121650	97492	4.0:4.0

Table 2.28 continued

Treatment details	Yield of intercrop (Q/ha)	Yield of cashew (Q/ha)	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
			Cashew	Intercrop	Cashew + Intercrop	Cashew	Inter-crop	Cashew + Intercrop	Net	
Cashew + Okra	45.4	5.2		11000	29158	53379	45370	98749	69591	9.0:2.3

Available area for intercropping (Age 3 years) : 83.33%
% Ground Coverage by canopy of cashew trees : 25.5%

Price of intercrop
Cowpea : Rs. 10/Kg
Tapioca : Rs. 2/Kg
Okra : Rs. 10/Kg
Bottle Gourd : Rs. 10/Kg

MADAKKATHARA

The influence of intercropping on the growth and yield of main crop (cashew) is being monitored. The cashew plants are at early stage of bearing. The intercrops are at the stage of 10 months after planting and yet to harvest stage.

PARIA

The yield and economics of intercropping in cashew is presented in table. The highest inter crop yield/ha (25.00 q/ha) was recorded in treatment cashew + okra (T2) which was followed by treatment cashew + pigeon pea (T1) and treatment cashew + indian bean (T4) in gaining higher yield of intercrops. Highest net return of Rs. 50,280 ha^{-1} was observed under the inter crop of okra (T2); while highest benefit:cost ratio (1.86) was observed under inter crop of pigeon pea (T1). The yield of cashew was found non-significant in all the treatments. However as compared to all other treatments, low yield was observed under treatment cashew alone (T6). That might be resulted due to non-irrigating the control trees (Table 2.29).

Looking to previous results for three years, the intercrop treatment T2 (cashew with okra) gives consistant second position wherein it ranked first position during the second year.

Table 2.29: Yield and economics of cashew and intercrops in intercropping trial at Paria

Treat.	Yield of IC (Q/ha)	Yield of cashew (Q/ha)	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
			Cashew	IC	Cashew + IC	Cashew	IC	Total	Net	
T1: C + Pigeon pea	13.90	0.63	8000	10800	18800	5040	48650	53690	34890	1.86
T2: C + Okra	25.00	0.51	8000	20800	28800	4080	75000	79080	50280	1.75
T3: C + Indian bean (GW-2)	9.01	0.41	8000	8000	16000	3280	31535	34815	18815	1.18

Table 2.29 continued

Treat.	Yield of IC	Yield of cashew	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	q/ha	q/ha	Cashew	IC	Cashew + IC	Cashew	IC	Total	Net	
T4: C+ Indian bean (NPS-1)	10.80	0.47	8000	8000	16000	3760	37800	41560	25560	1.60
T5: C+ Cowpea (GC-4)	5.20	0.68	8000	7200	15200	5440	15600	21040	5840	0.38
T6: Cashew alone	0	0.18	8000	0	8000	1440	0	1440	-6560	-0.82
C.D.@ 5%		NS								
SEM±		0.17								
CV%		59.90								

MADAKKATHARA

The influence of intercropping on the growth and yield cashew is being monitored. The cashew plants are at early stage of bearing. The intercrops are at the stage of 10 months after planting and yet to harvest stage.

VENGURLA

It can be seen that out of five different tuber crops, elephant foot yam recorded significantly higher yield (37.25 kg/plot and 4.917 t/ha) which was at par with greater yam (28.50 kg/plot & 3.762 t/ha). In addition to this, the main crop cashew recorded the average yield of 8.77 kg/tree and 1.368 t/ha (Table 2.30)

Table 2.30 : Yield observations of intercrops in cashew at Vengurle

Treat.	Inter Crops	Spacing (cm)	Plot size sq.m.	Yield (kg/plot)	Yield (t/ha)	Local market rate (Rs/kg)	Income (Rs/ha)
T_1	Lesser Yam (Kangar)	60 x 60	24	10.75	1.42	40/-	56,760/-
T_2	Greater Yam (Ghorkand)	60 x 75	24	28.50	3.76	20/-	75,240/-
T_3	Aerial Yam (Karanda)	100 x 60	24	14.83	1.96	15/-	29,370/-
T_4	Elephant foot Yam (Suran)	75 x 75	24	37.25	4.92	15/-	73,755/-
T_5	Tapioca	100 x 60	24	11.75	1.55	4/-	6,204/-
			SEM±	3.37			
			CD at 5%	10.38			
	Yield of cashew (V-1)	8m x 8m		8.77	1.368	100/-	1,36,800/-

VRIDHACHALAM

Vegetable crops namely cluster bean (Pusa Navbahar), bhendi (CoBh H1) , radish (Pusa Chetki), amaranthus (CO-1) were sown as intercrops in cashew VRI-3 plot (year of planting 2013) in an area of 20 cents each. Sowing was done during the second week of July 2014. The results are as follows.

Table 2.31 : Yield and economics of cashew and intercrops in intercropping trial at Vridhachalam

Treatment details	Yield of inter crop	Yield of cashew	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	Q/ha	Q/ha	Cashew	Inter-Crop	Cashew + Inter crop	Cashew	Inter-crop	Total	Net returns	
Cashew+ cluster bean	42.50	1	12000	18000	30000	10000	51000	61000	31000	2.03
Cashew+ bhendi	55.75	1	12000	15000	27000	10000	55750	65750	38750	2.44
Cashew + Radish	45.50	1	12000	10000	22000	10000	45500	55500	33500	2.52
Cashew+ amaranthus	35.50	1	12000	5000	17000	10000	35500	45500	28500	2.68

Price: Cluster bean Rs. 12/Kg : Bhendi: Rs. 10/Kg : Radish: Rs. 10/Kg
Amaranthus: Rs. 10/Kg : Cashewnuts: Rs. 100/Kg

The net return is higher in Cashew + Bhendi (Rs.38,750/ha) while the BC ratio is higher (2.68) in Cashew + Amaranthus due to less duration as well as less cost of cultivation. All the vegetable intercrops are giving high returns (B:C>2) in the initial cashew establishment periods (Table 2.31).

Hort.7: Organic Management of Cashew

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

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

Treatments:

T_1 - 100 % N as FYM
T_2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g
T_3 - 50 % N as FYM + Bio-fertilizers (200 g)
T_4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)
T_5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)
T_6 - In situ green manuring / green leaf manuring to meet 100 % N
T_7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)
T_8 - Recommended doses of fertilizer + 10 kg FYM (Control)

BHUBANESWAR

The experiment was laid out during the year 2007 in Randomized Block Design with three replications. Cashew variety H 2/16 (BPP-8) was planted at a spacing of 7m x 7m. Only farmyard manure was applied to all the plants during planting.

The results of vegetative growth parameters presented in Table indicated that there were significant variations among different treatments for different vegetative growth parameters under organic management at Bhubaneswar.

Significant variations were observed among different treatments for nut yield and yield attributing parameters. Recommended doses of fertilizer + 10kg FYM (Control) T_8 recorded significantly highest number of panicles/m^2 (24.90) and nut yield of 1944.67kg/ha. Maximum average nut weight (8.60g) was observed in treatment T_2 whereas treatment T_4 showed highest average apple weight of 62.8g.

The results of cumulative nut yield/tree at 6th harvest indicated highest nut yield in T_8 (17.09Kg/tree) followed by T_2(11.91kg/tree) and T_3(10.81kg/tree). The overall results during the year revealed the superiority of both T_8 and T_2 among the different organic sources towards cashew production.

Table 2.32 : Yield parameters of cashew under organic management at Bhubaneswar

Treatment	No. of panicles/ m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (Kg/tree) (6^{th} No. of hvts)
T_1 - 100 % N as FYM	22.17	7.88	58.58	1078.23	9.57
T_2 - 100 % N as FYM + Bio-fertilizers Consortium(BFC) 200 g	25.00	8.60	60.92	1345.80	11.91
T_3 - 50 % N as FYM + BFC (200 g)	22.46	7.89	56.97	1042.18	10.81
T_4 - 100 % N as Vermicompost + BFC (200 g)	24.50	8.55	62.8	1248.75	9.81
T_5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	21.54	8.04	53.87	995.24	9.49
T_6 - In situ green manuring / green leaf manuring to meet 100 % N	20.97	7.89	51.75	901.36	7.88
T_7 - 25 % N as FYM + Recycling of organic residue + *In situ* green manuring / green leaf manuring + BFC (200 g)	24.11	8.27	57.95	1359.18	12.84
T_8 - Recommended doses of fertilizer + 10 kg FYM (Control)	24.90	8.53	61.5	1944.67	17.09
SEM ±	0.94	0.17	1.91	59.99	
CD at 5%	2.86	0.51	5.81	181.99	

DARISAI

The maximum nut weight (7.1gm) as well as annual nut yield (8.3 kg/tree) was found to be in T_1 (100%N as FYM) where as the maximum apple weight (63.70 gm) was found to be in T_8 (recommended dose of fertilizer+10kg FYM) (Table 2.33).

Table 2.33 : Yield parameters of cashew under organic management at Darisai

Treatment	Flowering laterals/m^2	Nut wt. (gm)	Apple wt. (gm)	Annual nut yield kg/tree
T1 - 100 % N as FYM	16.84	7.1	58.4	8.3
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	18.76	6.8	60.3	7.2
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	20.56	6.56	54.6	6.3
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	17.54	6.45	52.45	5.1
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	19.76	6.76	59.76	4.9
T6 - *In situ* green manuring / green leaf manuring to meet 100 % N	19.96	6.34	62.4	5.3
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	19.85	6.57	59.8	5.6
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	16.9	6.2	63.7	5.1

HOGALAGERE

This experiment was laid out in HREC, Hogalagere with eight treatments of different organic sources on Ullal-1 cashew variety. The experimental block is under establishment stage and the results from this experiment will be analyzed and interpreted.

JHARGRAM

There was no significant difference observed among the treatments in terms of their response on tree height and stem girth. The treatments were on par with respect to all the growth parameters studied.

Table 2.34 : Yield parameters of cashew under organic management at Jhargram

Treatment	Duration of flowering (days)	No. of panicles/ m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (kg/tree) (5 harvests)
T1 - 100 % N as FYM	80	7.25	7.36	53.33	6.82	23.40
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	82	5.92	7.93	59.17	5.33	19.84

Table 2.34 continued.

Treatment	Duration of flowering (days)	No. of panicles/ m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (kg/tree) (5 harvests)
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	81	3.00	7.78	70.50	5.49	18.41
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	79	4.25	8.00	69.44	2.33	12.51
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	88	5.25	7.93	62.22	3.27	13.59
T6 - In situ green manuring / green leaf manuring to meet 100 % N	77	5.67	7.57	59.00	3.59	15.55
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	87	3.92	7.52	59.17	3.31	15.10
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	81	6.50	7.79	63.22	3.72	14.31
SEM ±	NS	2.11	0.20	9.43	1.87	4.61
CD at 5%		4.48	0.43	20.00	3.96	9.77
CV%		49.61	3.20	18.63	54.09	34.04

KANABARGI

Among eight treatments, no significant difference with growth parameters was observed.

General View of Organic management of cashew in Kanabargi Centre

Table 2.35 : Effect of different organic manures on growth of cashew at Kanabargi

Sl. No.	Treatments	Plant height (m)	Trunk girth (cm)	Canopy diameter (m)	Canopy height (m)	Canopy surface area (m^2)	Yield (kg)	
							Kg/plant	Q/ha
1	100 % N from FYM	1.54	8.05	2.04	1.91	25.68	1.72	4.79
2	100 % N as above+ bio-fertilizer consortium (BFC) (200g/tree/Yr)	1.70	7.13	2.08	1.69	22.34	1.77	4.91
3	50 % N as above + BFC (200g/tree/Yr) + Rock Phosphate	1.60	7.25	1.93	1.77	20.76	1.58	4.40
4	100 % N as vermicompost + BFC (200g/tree/Yr)	1.52	6.64	1.84	1.54	17.24	1.60	4.44
5	Recycling of organic residue with the addition of 20 % cow dung slurry (on weight basis-20% weight of organic residue as cow dung slurry)	1.74	7.76	1.98	1.60	21.27	1.57	4.35
6	*In situ* green manuring (Retain litter + planting cowpea)	1.58	6.78	1.84	1.55	16.25	1.76	4.90
7	25% N as FYM + recycling of organic residue + *in situ* green manuring /green leaf manuring + BFC (200 g/tree/Yr)	1.78	7.81	1.94	1.74	21.24	1.57	4.35
8	Recommended dose of fertilizer + 10 Kg FYM	1.83	7.64	1.99	1.66	20.93	1.54	4.28

MADAKKATHARA

The experiment was planted during 2008. Treatments were imposed and observations on biometric characters were recorded.

Table 2.36 : Effect of tree density and fertilizer levels on yield parameters of cashew at Madakkathara

Treatment	Duration of flowering (days)		Flowering laterals/ panicles m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (kg/tree) (2 harvests)
	Range	Mean					
T1 - 100 % N as FYM	41-55	50.67	5.66	7.60	83.00	3.96	6.56
T2 - 100 % N as FYM+ Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	38-46	49.33	8.00	7.16	73.66	3.54	7.03

Table 2.36 Continued.

Treatment	Duration of flowering (days)		Flowering laterals/ panicles m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (kg/tree) (2 harvests)
	Range	Mean					
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	40-59	49.33	5.66	7.33	71.00	4.45	7.51
T4 - 100 % N as Vermicompost + Bio- fertilizers (200 g)	46-58	51.33	6.00	7.83	84.00	3.41	7.05
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	48-58	47.33	6.00	7.73	72.33	3.65	6.39
T6 – In situ green manuring / green leaf manuring to meet 100 % N	46-66	50.00	4.33	6.20	85.66	3.88	7.80
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	40-61	49.00	6.33	8.13	80.33	3.86	6.91
T8 – Recommended doses of fertilizer + 10 kg FYM (Control)	39-63	51.33	6.33	8.06	73.00	3.39	6.55

Statistical analysis of the data did not record significant variation among the treatments with respect to different parameters analyzed. The experimental trees are at early stage of bearing hence influence of treatments may not be evident.

VENGURLE

The trial is planted during November, 2007 as per the guidelines. Data on growth and yield parameters during the period under reporting was recorded and presented in the Tables. There was no significant difference among the treatments with respect to vegetative growth parameters. The various organic treatments had significantly influenced the number of flowering duration however, showed non-significant results for rest of the yield attributes. Treatment T_2 (100% N as FYM + Biofertilizers consortium) recorded significantly the maximum flowering duration (110.33 days) and was at par with treatments T_1 (109.66 days), T_8 (108.66 days), T_4 (108.0 days), T_5 (107.33 days) and T_3 (105.66 days) while, minimum flowering duration was observed in T_7 (102.33 days) (Table 2.37).

Table 2.37 : Yield attributing characters of organic farming trial in Cashew at Vengurle

Sr. No.	Treatments	Flow. duration (days)	Yield (kg/tree)	Yield (t/ ha)	Nut wt. (g)	Apple wt. (g)	Shelling (%)
1	T_1 - 100% N as FYM	109.66	3.10	0.63	8.83	90.83	29.00
2	T_2 - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	110.33	2.79	0.57	9.10	92.50	29.00
3	T_3 - 50% N as FYM + BCF (200g/tree) + Rock phosphate	105.66	4.32	0.88	8.83	90.00	29.50
4	T_4 - 100% N as Vermicompost + BCF (200g/tree)	108.00	4.06	0.83	9.13	101.67	29.66
5	T_5 - Recycling of organic residues with addition of 20% cow dung slurry	107.33	3.16	0.64	9.06	93.33	29.16
6	T_6 - In situ green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	102.66	3.57	0.72	9.10	86.66	28.50
7	T_7 - 25% N as FYM + Recycling of organic residues + In situ green manuring /green leaf manuring + BCF (200g/tree)	102.33	4.73	0.96	8.86	98.33	29.33
8	T_8 - RDF + 10 kg FYM (control)	108.66	6.91	1.41	9.30	101.66	29.66
	SEM±	1.76	0.83	0.17	0.17	7.76	0.57
	CD at 5%	5.34	NS	NS	N.S	N.S	NS

Table 2.38: Yield data of organic farming trial in cashew at Vengurle

Treatments	Yield kg nut /tree				Cum. yield for 4th harvest kg/tree
	2011-12	2012-13	2013-14	2014-15	
T_1 - 100% N as FYM	3.24	2.92	2.06	3.10	11.32
T_2 - 100% N as FYM + Biofertilizers (Azatobacter + Azospirillum + PSB*)	4.69	3.86	2.66	2.79	14.00
T_3 - 50% N as FYM + Biofertilizers	3.53	2.76	2.10	4.32	12.71
T_4 - 100% N as Vermicompost + Biofertilizers	2.89	2.61	1.55	4.06	11.11
T_5 - Recycling of organic residues with addition of 20% cow dung slurry	2.06	2.06	1.15	3.16	8.43
T_6 - In situ green manuring/green leaf manuring to meet 100% N	4.11	2.92	2.25	3.57	12.85

Table 2.38 Continued.

Treatments	Yield kg nut /tree				Cum. yield for 4th harvest (kg/tree)
	2011-12	2012-13	2013-14	2014-15	
T_7 - 25% N as FYM + Recycling of organic residues + In situ green manuring/green leaf manuring + Biofertilizers	2.82	3.70	1.55	4.73	12.80
T_8 - RDF + 10 kg FYM (Control)	4.91	5.16	2.32	6.91	19.30
SEM±	0.69	0.78	0.45	6.91	-
CD at 5%	NS	NS	NS	0.83	-
***Yield started from 2003-04**					

VRIDHACHALAM

Revised Treatments

T1 - 100 % N as Locally available source (FYM)

T2 - 100 % N as FYM + Bio-fertilizers consortium(200 g/tree/year)

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

T4 - 100 % N as Vermicompost + Bio-fertilizers consortium(200 g/tree/year)

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

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

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

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

Table 2.39 : Yield parameters of cashew under organic management at Vridhachalam

Treatment	Duration of flowering (days)		Flowering laterals/ panicles per m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (kg/tree) (6 hvts)
	Range	Mean					
T1 - 100 % N as FYM	60-70	65	22.0	6.9	56.5	1020	21.90
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	59-71	65	19.0	6.8	54.0	960	21.90
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	63-69	66	18.5	6.8	53.5	880	20.70

Table 2.39 Continued

Treatment	Duration of flowering (days)		Flowering laterals/ panicles per m^2	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (kg/tree) (6 hvts)
	Range	Mean					
T4 - 100 % N as Vermi-compost + Bio-fertilizers (200 g)	61-71	66	18.5	6.8	54.5	1040	24.30
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	61-69	65	17.0	6.9	56.0	980	23.10
T6 – In situ green manuring / green leaf manuring to meet 100 % N	62-70	66	21.0	6.9	53.0	980	21.80
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	60-70	65	21.0	6.9	55.5	1100	25.50
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	64-72	68	24.0	7.1	57.5	1360	28.40
CD @ 5%		3.85	1.062	0.415	3.504	0.314	0.824
SEM±		1.819	0.521	0.192	1.421	0.145	0.373
CV %		3.30	3.44	3.45	3.51	3.42	3.41

Inorganic fertilizer treatment (T8) recorded the highest values for mean canopy diameter, mean surface area, mean flowering laterals per m^2, nut yield and cumulative yield followed by T7 with 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers consortium (200 g).

Hort.8 : Spacing cum fertilizer trial

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

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

PARIA

The results on effect of different levels of spacing and fertilizers on growth and yield of cashew at Paria are presented in table. The growth parameters like trunk girth, plant height and mean canopy area were observed to be non-significant at individual as well as interaction level. Looking to character number of nuts per plant, individual effects were observed to be non-significant while the interaction effect of spacing and fertilizer was found to be significant. Significantly the highest numbers of nuts (92.50) were observed in the treatment combination of S1F1 which was followed by the treatment S2F1 with 70.00 numbers of nuts. Looking to yield (q/ha) parameter, spacing gave non-significant results while fertilizer levels shows significant results. In the interaction effect, highest nut yield (2.78 q/ha) was observed in the treatment combination of S1F1 which was followed by the treatment S2F1 with 1.26 q/ha nut yield.

Looking to previous year, it was first year of yield and the results were found to be non significant for individual as well as interaction effect of spacings and fertilizer levels.

Table 2.40 : Effect of different levels of spacing and fertilizers on growth and yield of cashew at Paria

Treatments	Mean canopy area (m)			Mean of Spacing	SEM / CD	No. of nuts/plant			Mean of Spacing	SEM/ CD
	F1	F2	F3			F1	F2	F3		
S1	2.51	2.62	2.54	2.56	0.30/ NS	92.50	29.50	32.83	51.61	20.70/ NS
S2	3.33	4.16	2.76	3.42		70.00	1.17	20.50	30.56	
S3	3.09	3.24	3.00	3.11		10.00	32.00	68.83	36.94	
Mean of Ferti.	2.98	3.34	2.77			57.50	20.89	40.72		
SEM±	0.42					9.82				
CD at 5%	NS					NS				
Interaction effect:						Interaction effect:				
SEM±	0.72					17.00				
CD at 5%	NS					52.39				
CV%	41.35					74.17				

KANABARGI

Year of planting : 2012
Design : Split plot
Replication : Three
Spacing : S1- 8m x 8m
S2- 10m x 5m
S3- 6.5m x 6.5 m

Fertilizer: F1- 52:13:13 g NPK/plant /year
F2- 78: 20:20 g NPK/plant/year
F3- 117: 29: 29g NPK/plant/year

Number of plant per replication : 5

The effects of different levels of spacing were showed significant difference on vegetative and yield parameters. The highest yield was found in S2 (1.64 kg/plant) and lowest found in S3 (1.44 kg/plant). Highest yield per hectare was recorded in S3 (1.14 Q) followed by S1 (0.85Q) (Table 2.41).

Table 2.41 : Effect of different levels of spacing on growth of cashew at Kanabargi

Treatments	Plant height (m)	Trunk girth (cm)	Canopy diameter (m)	Percent ground cover area	Canopy height (m)	Canopy surface area (m^2)	Yield (kg)	
							Kg/ plant	Q/ha
S1-8m x 8 m	2.47	8.05	1.53	12.03	2.35	23.72	0.54	0.85
S2- 10m x 5 m	2.34	8.12	1.60	8.09	1.92	19.69	0.55	0.55
S3- 6.5m x 6.5 m	2.43	8.32	1.67	11.08	2.24	24.35	0.48	1.14
SEM±	0.13	0.28	0.14	0.89	0.09	2.33	0.04	0.005
CD (P=0.05)	0.40	0.85	0.41	2.68	0.28	6.99	0.12	0.014

The effect of different levels of fertilizer applications were showed significant difference on vegetative and yield parameters (Table). The highest yield was found in F2 (1.74 kg/plant) and lowest in F1 (1.42 kg/plant). Yield per hectare was highest in F2 (0.87Q) followed by F1 (0.84Q) (Table 2.42).

Table 2.42 : Effect of different levels of fertilizer on growth of cashew at Kanabargi

Treatments	Plant height (m)	Trunk girth (cm)	Canopy diameter (m)	Percent ground cover area	Canopy height (m)	Canopy surface area (m^2)	Yield (kg)	
							Kg/ plant	Q/ha
F1-52:13:13 g NPK/ plant /year	2.34	7.58	1.46	9.52	2.08	19.74	0.47	0.84
F2- 78: 20:20 g NPK/ plant/year	2.43	8.57	1.69	10.57	2.19	23.83	0.58	0.87
F3-117: 29: 29gNPK/ plant/year	2.47	8.34	1.65	11.12	2.24	24.19	0.52	0.82
SEM±	0.06	0.12	0.08	0.40	0.04	1.41	0.03	0.004
CD (P=0.05)	0.18	0.37	0.24	1.21	0.13	4.23	0.08	0.011

The interaction effect of different levels of spacing and fertilizer applications were showed significant difference on vegetative and yield parameters (Table). The highest yield was found in S1F2 (1.74 kg/plant) and lowest in S1F1 (1.42 kg/plant) (Table 2.43).

Table 2.43 : Interaction effect of different spacing and fertilizer levels on growth of cashew at Kanabargi

Sl. No.	Treatments	Plant height (m)	Trunk girth (cm)	Canopy diameter (m)	Percent ground cover area	Canopy height (m)	Canopy surface area (m^2)	Yield	
								Kg/plant	Q/ha
1	S1F1	2.52	7.27	1.42	11.22	2.26	21.44	0.32	0.50
2	S1F2	2.42	8.40	1.65	13.18	2.46	26.57	0.81	1.27
3	S1F3	2.47	8.46	1.52	11.69	2.32	23.14	0.50	0.78
4	S2F1	2.10	7.29	1.37	7.26	1.82	16.07	0.44	0.44
5	S2F2	2.39	8.37	1.67	8.69	1.99	21.20	0.61	0.61
6	S2F3	2.53	8.70	1.75	8.33	1.95	21.79	0.59	0.59
7	S3F1	2.40	8.18	1.57	10.07	2.15	21.71	0.66	1.58
8	S3F2	2.49	8.94	1.76	9.84	2.12	23.71	0.31	0.74
9	S3F3	2.40	7.85	1.67	13.34	2.47	27.63	0.46	1.09
	SEM±	0.10	0.22	0.14	0.70	0.07	2.44	0.05	0.063
	CD (P=0.05)	0.31	0.65	0.41	2.09	0.22	7.33	0.14	0.189

III. CROP PROTECTION

III. CROP PROTECTION

Ent. 1: Chemical Control of pest complex in cashew

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

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

Treatment details:

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

BAPATLA

Three sprays were imposed at 30-35 days interval at flushing, flowering and at fruit & nut development stages.

No. of replications : 4
No. of trees per replication : 2
Design : RBD

The data on pest incidence from 8 trees per each treatment was recorded from 52 leader shoots of each tree from all the four sides in respect of leaf and blossom webber and shoot tip caterpillar at one day before spray and 30 days after each spray. In the case of apple and nut borer total nuts in 52 panicles and the nuts damaged by the borer were counted at 30 days after 3rd spray. Thrips damage on nut surface was graded on 100 nuts per tree following 0 to 4 scale. Counts of spiders and ants were recorded at 30 days after 3rd spray by tapping 52 panicles per tree on 1 sq. foot card board.

Table 3.1 : Efficacy of different insecticides against pest complex in Cashew at Bapatla

Treatment		Leaf and blossom webber damaged shoots (%)		Shoot tip caterpillar damaged shoots (%)	
		Before spray	30 days after 3rd spray	Before spray	30 days after 3rd spray
T_1	Neem oil soap(4%) at flushing, L- Cyhalothrin (0.6ml/l) at flowering and Neem oil soap(4%) at fruit and nut development stage	23.6 (27.4)	6.87 (16.6)b	44.10 (41.44)	12.55 (21.8) c
T_2	Imidacloprid (0.6ml/lt) at all the three sprays	24.20 (29.0)	15.25 (24.8)c	42.92 (39.79)	14.23 (23.8)cd
T_3	Acetamiprid 20SP (0.5 g/l) at all the three sprays	23.25 (29.4)	12.45 (24.2)c	44.24 (43.17)	16.25 (24.6)d
T_4	L-Cyhalothrin 0.003% at all the three sprays	24.3 (29.1)	2.12 (10.9)a	45.21 (44.59)	0.00 (0.0)a
T_5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage.	24.2 (29.4)	7.85 (18.9)b	44.25 (44.85)	7.90 (17.1)b
T_6	Un treated Control	27.5 (32.0)	19.23 (28.2)d	46.25 (44.48)	33.25 (36.5)e
	CD (0.05)	2.51	2.38	0.92	0.80
	SEM±	0.674	0.78	2.79	2.41

Figures in parentheses are arc sin transformed values

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

During the year, the activity of different important foliage, flower and nut feeding pests of cashew was medium during the season. Treatment T_4 (L-Cyhalothrin 0.003%) was found to be effective in controlling the Leaf and Blossom Webbler and the treatments T_1 & T_5 are found to be on par to each other against Leaf and Blossom Webbler. With regard to Shoot tip caterpillar, T_4 (L-Cyhalothrin 0.003%) was found to be more effective compared to rest of the treatments followed by the treatment T_5 (Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage) (Table 3.1).

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

Sl. No.	Treatment	Apple and nut borer damage (%)		Leaf miner (%)	
		Before spray	30 days after 3rd spray	Before spray	30 days after 3rd spray
T_1	Neem oil soap(4%) followed by L-Cyhalothrin (0.6ml/l) followed by Neem oil soap	12.25 (21.37)	11.25 (22.0)c	28.46 (35.3)	5.50 (15.0)b

Table 3.2 continued...

Sl. No.	Treatment	Apple and nut borer damage (%)		Leaf miner (%)	
		Before spray	30 days after 3rd spray	Before spray	30 days after 3rd spray
T_2	Imidacloprid (0.6ml/lt)	18.67 (26.51)	14.32 (24.1)d	26.30 (32.3)	9.50 (19.9)c
T_3	Acetamiprid 20SP(0.5 g/l)	15.25 (24.73)	12.32 (21.4)c	35.26 (37.7)	13.70 (22.6) d
T_4	L-Cyhalothrin 0.003%	23.12 (28.74)	5.62 (14.4)a	25.45 (35.4)	0.42 (1.6)
T_5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering development stage.	21.36 (28.93)	10.50 (19.8)b	26.52 (32.4)	12.52 (22.6)d
T_6	Un treated control	24.25 (30.57)	28.25 (33.2)c	28.52 (33.2)	31.20 (34.0)e
	SEM±	0.686	1.06	0.96	0.651
	CD (0.05)	2.08	3.24	2.92	1.98

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

The treatment T_4 (L-Cyhalothrin 0.003%) offered better control against Apple and nut borer damage followed by T_5 (Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage). With regard to leaf miner the treatment T_4 (L-Cyhalothrin 0.003%) was found to be effective in reducing the pest population and damage on leaf followed by the treatment T_1 Neem oil soap (4%) followed by L-Cyhalothrin (0.6ml/l) followed by Neem oil soap (4%) (Table 3.2).

None of the chemicals evaluated are found to be safe to the natural enemies i.e. spiders and ants. However the treatment T_5 (Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at Flowering & nut development stage) was recorded maximum number of spiders ants population at 30 days after 3rd spray (Table 3.3).

Table 3.3 : Influence of different insecticides on natural enemies and pollinators in cashew at Bapatla centre

Sl. No.	Treatment	Mean No. per 52 inflorescence at 30 days after 3rd spray	
		Ants	Spiders
T_1	Neem oil soap (4%) followed by L-Cyhalothrin (0.6ml/l) followed by Neem oil soap	0.53 (3.6)d	0.32 (3.0)c
T_2	Imidacloprid (0.6ml/lt)	0.25 (3.6)d	0.28 (4.8)c

Table 3.3 continued...

Sl. No.	Treatment	Mean No. per 52 inflorescence at 30 days after 3rd spray	
		Ants	Spiders
T3	Acetamiprid 20SP(0.5 g/l)	0.24 (5.3)c	0.72s (3.8)c
T4	L-Cyhalothrin 0.003%	0.11 (1.1)e	0.00 (0.0)d
T5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage	1.24 (7.2)b	1.44 (6.9)b
T6	Un treated control	11.14 (19.3)a	10.30 (21.3)a
	SEM±	0.201	0.185
	CD (0.05)	0.611	0.57

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

During the consecutive three years, the activity of different important foliage, flower and nut feeding pests of cashew was medium. Among all the treatments, the treatment T_4 (L-Cyhalothrin 0.003%) was found to be effective in controlling the Leaf and Blossom Webber with a shoot damage percent of 3.67, 3.42 and 2.12% respectively in all the three years. With regard to Shoot tip caterpillar in all the three years the same treatment T_4 (L-Cyhalothrin 0.003%) was found to be more effective with 0.0 % shoot damage. In case Apple and nut borer less percent nut damage was observed in the treatment T_4 (L-Cyhalothrin 0.003%) with a percent damage of 6.40 6.30 & 5.62% respectively in all the three years. With regard to leaf miner the same treatment T_4 (L-Cyhalothrin 0.003%) was found to be effective and recorded a percent damage of 0.4, 0.39 & 0.42% respectively.

During all the three years, the treatment T_4 L-Cyhalothrin 0.003% (0.6 ml/l) was consistently effective against the cashew pest complex (Leaf and Blossom Webber, Shoot tip caterpillar, Apple and nut borer & leaf miner).

BHUBANESWAR

Shoot Tip caterpillar (STC) and Inflorescence Thrips (IT) (yellow and black thrips) were the two dominant pests observed during flushing, flowering and fruit setting in cashew. There was no incidence of TMB during the period under report. Significant reduction of both STC and IT was observed in the insecticidal treatment as compared to untreated control.

The incidence of shoot tip caterpillar varied from 4.12 to 5.11% damaged shoot before insecticide application. The pest incidence was lowest in T_5 (1.6%) followed by T_4 and T_2 while untreated control recorded 5.29% damaged shoot.

Population of IT varied from 3.06- 4.78 per inflorescence before the insecticidal treatment and was non significant. Lowest population of IT was observed in both T_4 and T_5 (0.53-0.88 per inflorescence) after spraying as compared to 5.84 per inflorescence in case of untreated control. With respect to intensity of damage on the cashew fruits it varied from 0.27 - 0.49 among the insecticidal treatments the lowest being observed in T_1 followed T_4 and T_5 as compared to 1.53 in untreated control.

Cashew nut yield per tree varied from 1.95 – 2.17kg/ tree in the treated plot as compared to 1.94kg/tree in the untreated control. There was no significant difference in nut yield per tree among the treatments including untreated control. Spider population varied from 0.7-1.6 among the treatments and were significantly different. Highest population was recorded in untreated control (1.6 per inflorescence) closely followed by T_2 and T_3 while lowest population was noticed in T_5 (Table 3.4).

Table 3.4 : Efficacy of insecticides against pest complex in cashew at Bhubaneswar

Treatment	STC (5 damaged shoot)		Thrips (No./ rache)		Damage by IT (0-4 scale)	Nut Yield (kg/tree)	Spiders (No/rache)
	Before spray	After spray	Before spray	After spray	30 days after 3rd spray		
T-1 Neem oil soap (4%)-L-Cyhalothrin-(0.003%) after 15 D- neem oil soap (4%)	4.34 (2.19)	2.98 (1.86)	3.72 (1.95)	1.00 (1.22)	0.27 (0.89)	1.95	1.1 (1.23)
T-2 Imidacloprid 17.8 SL (0.6 ml/l) all 3 sprays	4.12 (2.14)	1.92 (1.55)	3.65 (2.03)	1.41 (1.38)	0.40 (0.95)	2.17	1.5 (1.38)
T-3 Acetamiprid 20 SP (0.5G/l) all 3 sprays	5.11 (2.37)	2.06 (1.60)	3.06 (1.87)	1.38 (1.37)	0.49 (0.99)	1.95	1.4 (1.37)
T-4 L-cyhalothrin (0.003%) all 3 sprays	4.18 (2.15)	1.88 (1.54)	3.26 (1.92)	0.88 (1.17)	0.31 (0.90)	2.14	1.2 (1.25)
T-5 L-cyhalothrin (0.003%)-Prophenophos -L-Cyhalothrin	4.84 (2.30)	1.60 (1.45)	4.34 (2.19)	0.53 (1.01)	0.35 (0.92)	2.04	0.7 (1.07)
T-6 Untreated control	4.66 (2.27)	5.29 (2.40)	4.78 (2.30)	5.18 (2.38)	1.53 (1.43)	1.94	1.6 (1.45)
CD (0.05)	NS	0.15	NS	0.16	0.08	NS	0.12
CV %		5.94		7.51	0.5		6.3

HOGALAGERE

The population of tea mosquito bug (TMB) on shoots and panicles ranged between 1.01 to 1.75 and 1.22 to 1.61, respectively before spraying the insecticides. The damage on shoots and panicles at 7 days and 15 days after each spray was significantly reduced in the treatment sprayed with Lambda cyhalothrin 0.003% in all the sprays. This was followed by Acetamiprid 20 SP @ 0.5g/l and recommended spray for the region (Dimethoate @ 1.7ml/l) in all the three sprays. Whereas, the neem oil soap (4%) followed by Lambda cyhalothrin 0.003% (0.6ml/l) and neem oil treatment and Imidacloprid 17.8 SL (0.3ml/l) were found least effective in controlling the TMB and are on par with unsprayed check. The maximum nut yield was recorded in the treatment Lambda cyhalothrin 0.003% (8.49 kg/tree) followed by Acetamiprid 20SP (6.21 kg/tree) and recommended spray for the region (6.12 kg/tree). Comparison of results with previous observations indicate similar trend among the treatment effects on TMB damage and nut yield (Table 3.5).

Table 3.5 : Efficacy of different insecticides against tea mosquito bug incidence at Hogalagere

	Treatments	Tea mosquito bug incidence on 52 leader shoots/panicles (1-4 scale)						Nut yield (Kg/tree)
		On shoots			On panicles			
		BS	7 DAS	15 DAS	BS	7 DAS	15 DAS	
T1	First spray with neem oil soap (4%) followed by L-Cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	1.21	0.79	0.61	1.33	1.61	**1.37**	5.98
T2	Imidacloprid 17.8 SL (0.6ml/l) all the three sprays	1.71	0.76	0.74	1.61	0.76	0.73	5.43
T3	Acetamiprid 20 SP (0.5g/l) all the three sprays	1.01	0.65	0.42	1.55	1.31	0.65	6.21
T4	L - Cyhalothrin (0.003% @ 0.6ml/l) all three sprays	1.75	0.73	0.13	1.25	0.41	0.17	8.49
T5	Rec. spray schedule for the region (Dimethoate @1.7ml/l)	1.31	0.76	0.43	1.34	0.88	0.83	6.12
T6	Untreated control	1.36	1.47	1.65	1.22	1.61	1.42	4.86
	Mean	1.39	0.86	0.66	1.38	1.10	0.86	6.18
	SEM±	0.14	0.08	0.07	0.10	0.12	0.06	0.06
	CD (0.05)	0.42	0.23	0.21	0.29	0.37	0.17	0.18
	CV %	19.83	17.52	20.82	13.85	17.89	13.00	18.26

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

The results pertaining to insect damage on cashew by different insect species showed that minimum damage of apple and nut borer, thrips on nuts as well as on apple and aphids was recorded in Lambda cyhalothrin 0.003% and Acetamiprid 20SP The maximum damage was noticed in Imidacloprid 17.8 SL (0.3ml/l) and neem oil soap (4%) treatments (Table 3.6). The maximum numbers of spider and coccinellids population were observed in neem oil soap (4%) and Acetamiprid 20 SP (0.5gl/l) treatments compared to rest of the treatments (Table 3.7). These observations are consistent with the previous observations of this experiment.

Table 3.6 : Efficacy of different insecticides against pest complex in cashew at Hogalagere

	Treatment	Incidence of diff. pests on 52 leader shoots/ panicles (1-4 scale)					
		Apple and nut borer	Thrips	Treat ment	Apple and nut borer	Thrips	Treat ment
		30 DAS		BS	30 DAS		BS
T1	First spray with neem oil soap (4%) followed by L-Cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	2.46	2.11	1.84	0.86	1.52	0.32

Table 3.6 continued...

Treatment		Incidence of diff. pests on 52 leader shoots/ panicles (1-4 scale)					
		Apple and nut borer	Thrips	Treat ment	Apple and nut borer	Thrips	Treat ment
		30 DAS		BS	30 DAS		BS
T2	Imidacloprid 17.8 SL (0.6ml/l) all the three sprays	2.28	1.62	1.41	0.71	1.87	0.37
T3	Acetamiprid 20 SP (0.5g/l) all the three sprays	2.32	1.71	1.06	0.62	1.94	0.31
T4	L - Cyhalothrin (0.003% @ 0.6ml/l) all three sprays	2.86	1.08	1.75	0.32	1.33	0.1
T5	Rec. spray schedule for the region (Dimethoate @1.7ml/l)	2.16	1.41	1.18	0.64	1.02	0.34
T6	Untreated control	2.34	1.32	1.77	1.84	1.32	1.55
	Mean	2.40	1.54	1.50	0.83	1.50	0.50
	SEM±	0.22	0.13	0.11	0.10	0.12	0.07
	CD (0.05)	0.67	0.39	0.34	0.30	0.36	0.22
	CV %	18.59	16.98	14.61	18.69	14.18	18.01

Table 3.7 : Efficacy of different insecticides against pest complex in cashew at Hogalagere

Treatment		Spiders (*Oxypes sweta*)		Lady bird beetles (*Menochilus sexmaculatus & Scymnus sp.*)	
		BS	30 DAS	BS	30 DAS
T1	First spray with neem oil soap (4%) followed by L-Cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	2.07	2.31	2.13	2.32
T2	Imidacloprid 17.8 SL (0.6ml/l) all the three sprays	2.31	1.56	2.06	1.26
T3	Acetamiprid 20 SP (0.5g/l) all the three sprays	2.83	1.43	2.51	1.64
T4	L-Cyhalothrin (0.003% @ 0.6ml/l) all three sprays	2.34	1.95	2.32	1.13
T5	Rec. spray schedule for the region (Dimethoate @1.7ml/l)	2.11	2.12	2.44	1.23
T6	Untreated control	2.14	2.27	2.38	2.55
	Mean	2.3	1.94	2.31	1.69
	SEM±	0.22	0.15	0.13	0.14
	CD (0.05)	0.67	0.45	0.39	0.41
	CV %	19.30	15.31	11.10	16.24

JAGDALPUR

This trial was laid out in 13 year old cashew plantation of Vengurle-4. The damage incidence of TMB and other minor pest were recorded at flushing, flowering, and fruiting stages in different treatments are presented in Tables. Pretreatment infestation of TMB was less or negligible in all the treatments at shoot stage and this trend was similar at 30 days after first and second sprays due to low incidence of TMB. After that, the population increased gradually causing damage to the plant. At 30 days after 3rd spray, all treatments were at par and significantly superior over control.

At panicle stage, maximum damage score of TMB before spray was recorded in treatment T_3 followed by T_1, T_5 and T_6. Treatment T_4 (L-cyhalothrin @ 0.003%) gave the better response and was at par with T_5 (Profenophos @ 0.05%) and both were superior over all the treatments at 30 days after 1st and 2nd sprays. While, at 30 days after 3rd spray, treatment T_4 ,T_5 and T_3 received minimum damage score with 0.23, 0.27 and 0.42 respectively.

The incidences of different minor pests are shown in Tables. Pretreatment population of minor insect pests was similar over all the treatments. For leaf caterpillar damage, significantly minimum damage of 19.81 per cent was recorded in treatment T_4 which was significantly superior over all the treatment at 30 days after 1st spray. This treatment was again superior and gave minimum damage of 9.89 and 8.66 per cent at 30 days after 2nd and 3rd spray, respectively which were at par with treatment T_5 with 13.28 and 9.86 per cent, respectively at both sprays.

As far as leaf folder damage is concerned, significantly minimum percent incidence recorded in T_3 with 9.96 per cent which was on par with T_5 and T_4 with 10.30 and 11.95 per cent, respectively at 30 days after 1st spray. Similar trend was recorded at 30 days after 2nd spray. While, at 30 days after 3rd spray, all treatments were significantly superior over control. In case of leaf miner damage, treatment T_5 gave minimum damage with 10.76 per cent and was at par with T_4 and T_2 with 11.52 and 13.30 per cent, respectively at 30 days after 1st spray. While, 30 days after 2nd and 3rd spray, T_4 and T_5 both were superior over all the treatment. In nut thrips damage, significantly minimum damage was observed in treatment T_4 with 0.98 nut thrips damage score at 30 days after 3rd spray followed by treatment T_5 with 1.19 score.

The population of natural enemies was also recorded at 30 days after 3rd spray . Population of all natural enemies was maximum in untreated tree. However, Population of ant within the treated tree recorded maximum with 0.56 numbers in T_2 treated tree followed by T_1 (0.50 numbers). Maximum population of Brumus was recorded in T_4 (0.07 number) treated tree followed by T_2 (0.06 number). Spider found maximum in number in T4 followed by T_2 and T_3 treated trees. The mirid bug population was observed maximum (0.49 numbers) in T_1 and T_3 followed by T_4 (Table 3.8, 3.9, 3.10 & 3.11).

Table 3.8 : Efficacy of different insecticides against major pest of cashew at Jagdalpur

TMB (Tea mosquito bug) Mean Damage Score 0-4 scale on 52 leader shoots								
Treatment	Shoot				Panicle			
	Pre-Treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray	Pre-Treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray
T-1: Neem oil soap (4%) followed by L- Cyhalothrin (0.6ml/l) followed by Neem oil soap	0.00 (1.00)	0.00 (1.00)	0.06 (1.03)	0.14 (1.06)^{a}	0.46 (1.20)^{bc}	0.79 (1.33)^{c}	1.03 (1.42)^{b}	0.67 (1.28)^{c}

Table 3. continued...

Treatment	Shoot				Panicle			
	Pre-Treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray	Pre-Treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray
T-2 : Imidacloprid 17.8 SL (0.6ml/l)	0.25 (1.10)	0.00 (1.00)	0.06 (1.04)	0.07 (1.03)^{a}	0.17 (1.07)^{a}	0.62 (1.27)^{c}	0.88 (1.37)^{b}	0.78 (1.33)^{c}
T-3: Acetamiprid 20 SP (0.5g/l)	0.03 (1.10)	0.00 (1.00)	0.00 (1.00)	0.05 (1.02)^{a}	0.69 (1.28)^{c}	0.43 (1.19)^{b}	0.94 (1.39)^{b}	0.42 (1.18)^{a}
T-4: L-Cyhalothrin 0.003%	0.13 (1.05)	0.00 (1.00)	0.00 (1.00)	0.03 (1.01)^{a}	0.23 (1.10)^{ab}	0.14 (1.06)^{a}	0.39 (1.17)^{a}	0.23 (1.10)^{a}
T-5 : Profenophos 0.05%	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.07 (1.03)^{a}	0.41 (1.19)^{abc}	0.16 (1.07)^{a}	0.25 (1.11)^{a}	0.27 (1.12)^{a}
T-6 : Unsprayed check	0.00 (1.00)	0.09 (1.04)	0.28 (1.12)	0.71 (1.30)^{b}	0.39 (1.15)^{ab}	1.11 (1.45)^{d}	1.26 (1.50)^{d}	1.07 (1.43)^{d}
CD at 5%	NS	NS	NS	0.05	0.12	0.07	0.06	0.08
SEM±	0.047	0.018	0.046	0.01	0.04	0.03	0.02	0.02
CV	9.14	3.54	8.84	5.48	6.79	7.81	5.50	8.39

*Figure in parentheses are square root transformed values

Table 3.9 : Efficacy of different insecticides against pest complex in cashew at Jagdalpur

Treatment	Percent incidence of minor pest of Cashew							
	% Leaf Caterpillar damage				% Leaf Folder damage			
	Pre-treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray	Pre-treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray
T-1: Neem oil soap (4%) followed by L-Cyhalothrin (0.6ml/l) followed by Neem oil soap	35.16 (36.29)	32.55 (35.76)^{c}	17.54 (24.48)b^{c}	16.18 (23.68)^{c}	25.44 (30.17)	15.79 (23.27)b^{c}	20.92 (27.03)b	13.10 (21.03)a
T-2 : Imidacloprid 17.8 SL (0.6ml/l)	38.39 (38.21)	30.68 (33.42)^{b}	21.02 (27.16)^{c}	15.57 (23.00)^{c}	27.29 (31.46)	16.02 (23.41)^{bc}	21.79 (27.79)^{bc}	14.07 (21.97)^{a}
T-3 : Acetamaprid 20 SP (0.5g/l)	30.27 (33.31)	29.84 (33.09)^{bc}	19.28 (25.98)^{c}	13.82 (21.67)^{b}	29.48 (32.77)	9.96 (18.30)^{a}	13.90 (21.85)^{a}	11.97 (19.86)^{a}
T-4:L-Cyhalothrin 0.003%	30.94 (33.75)	19.81 (26.36)^{a}	9.89 (18.30)^{a}	8.66 (17.01)^{a}	20.84 (26.62)	11.95 (20.07)^{ab}	14.52 (22.31)^{a}	10.01 (18.34)^{a}
T-5:Profenophos0.05%	32.65 (34.80)	26.52 (30.97)^{b}	13.28 (21.34)^{ab}	9.86 (17.87)^{ab}	22.60 (27.71)	10.30 (18.69)^{a}	11.84 (20.11)^{a}	13.18 (21.02)^{a}
T-6: Unsprayed check	35.30 (36.38)	34.58 (35.98)^{c}	28.69 (32.31)^{d}	20.15 (26.62)^{c}	18.06 (24.75)	20.13 (27.54)^{d}	25.71 (31.09)^{c}	20.98 (27.24)^{b}
CD at 5%	NS	4.24	3.97	4.27	NS	4.29	4.43	4.00
SEM±	1.69	1.39	1.30	1.43	2.75	1.41	1.48	1.31
CV (%)	9.52	12.60	10.48	16.02	19.04	13.14	14.38	12.19

*Figure in parentheses are angular transformed values

Table 3.10 : Efficacy of different insecticides against pest complex in cashew at Jagdalpur

Treatment	Percent incidence of minor pest of Cashew				
	% Leaf Miner damage				NUT Thrips Mean damage (30 days after 3rd spray (0-4 scale)
	Pre-treat	30 days after Ist spray	30 days after IInd spray	30 days after IIIrd spray	
T-1 : Neem oil soap (4%) followed by L- Cyhalothrin (0.6ml/l) followed by Neem oil soap	11.23 (17.03)	19.12 (25.87)^{d}	16.50 (23.92)^{b}	12.51 (20.69)^{b}	1.38 (1.54)^{bc}
T-2 : Imidacloprid 17.8 SL (0.6ml/l)	11.86 (17.20)	13.30 (21.23)^{abc}	19.74 (26.32)^{cd}	13.54 (21.56)^{c}	1.28 (1.51)^{bc}
T-3 : Acetamaprid 20 SP (0.5g/l)	12.56 (20.46)	16.33 (23.75)^{bcd}	15.08 (22.87)^{b}	12.61 (20.78)^{bc}	1.51 (1.58)^{c}
T-4 : L-Cyhalothrin 0.003%	12.24 (20.34)	11.52 (19.47)^{ab}	11.86 (20.11)^{a}	4.29 (11.91)^{a}	0.98 (1.40)^{a}
T-5 : Profenophos 0.05%	12.78 (16.79)	10.76 (19.09)^{a}	11.01 (19.34)^{a}	5.33 (13.33)^{a}	1.19 (1.47)^{ab}
T-6 : Unsprayed check	14.57 (22.21)	20.88 (27.09)^{d}	19.96 (26.51)^{d}	17.18 (24.46)^{d}	2.14 (1.77)^{d}
CD at 5%	NS	4.63	2.115	1.50	0.08
SEM±	4.65	2.15	0.983	0.494	0.04
CV (%)	18.93	13.38	6.000	10.26	7.06

Table 3.11 : Efficacy of insecticides against different natural enemies of insect pest of cashew at Jagdalpur

Treatments	Mean number of natural enemies of insect pest of cashew at 30 days after IIIrd spray			
	Ant	Brumus	Spider	Mirid bug
T-1 : Neem oil soap (4%) followed by L-Cyhalothrin (0.6ml/l) followed by Neem oil soap	0.50(1.25)	0.04 (1.02)	0.22(1.10)	0.49 (1.22)
T-2 : Imidacloprid 17.8 SL (0.6ml/l)	0.56 (1.25)	0.06 (1.03)	0.30 (1.14)	0.38(1.17)
T-3 : Acetamaprid 20 SP (0.5g/l)	0.48(1.21)	0.04 (1.01)	0.29 (1.13)	0.49(1.22)
T-4 : L- Cyhalothrin 0.003%	0.44(1.19)	0.07 (1.03)	0.31 (1.42)	0.45 (1.20)
T-5 : Profenophos 0.05%	0.35(1.16)	0.03 (1.01)	0.24 (1.11)	0.43 (1.19)
T-6 : Unsprayed check	0.59(1.26)	0.08 (1.03)	0.36 (1.16)	0.53 (1.23)
CD (0.05)	NS	0.008	0.03	0.02
SEM±	0.03	0.003	0.01	0.08
CV (%)	4.25	3.25	5.52	5.50

JHARGRAM

All the insecticidal treatments were found to be superior to the untreated check. L-cyhalothrin @ 0.003%, acetamiprid @ 0.5g/l and 0.05% profenophos were most effective treatment to control leaf and blossom webber. Again L-cyhalothrin was proved to be best treatment to reduce leaf miner and apple and nut borer populations followed by acetamiprid. However the treatment Neem oil soap (4%) – L-cyhalothrin (0.003%) - Neem oil soap (4%) was found to be most effective treatment to reduce thrips damage in nut and apple followed by acetamiprid. The result revealed that L-cyhalothrin and acetamiprid were the most effective treatment to reduce the pest population (Table 3.12).

Table 3.12 : Efficacy of insecticides against pest complex in cashew at Jhargram

Treatment	Before spray		After spray (1st)		After spray (2nd)				
	LBW	LM	LBW	LM	LBW	LM	ANB	Thrips	
								Nut	Apple
Neem oil soap (4%) – L-cyhalothrin (0.003%)	13.77 (21.76)	13.79 (21.76)	4.32 (11.95)	5.26 (13.23)	2.01 (8.11)	2.16 (8.32)	1.92 (7.95)	0.78 (5.06)	0.71 (4.83)
Imidacloprid 17.8 SL (0.6ml/l)	21.56 (27.65)	15.53 (23.18)	5.68 (13.77)	6.24 (14.44)	2.52 (9.12)	2.69 (9.30)	15.38 (23.07)	1.29 (6.52)	1.13 (6.08)
Acetamiprid 20 SP (0.5G/l)	17.36 (24.59)	16.52 (23.96)	3.49 (10.75)	4.32 (11.91)	0 (0.00)	1.60 (7.22)	0.00 (0.00)	1.05 (5.86)	0.60 (4.41)
L-cyhalothrin (0.003%)	15.84 (23.39)	13.86 (21.82)	3.41 (10.62)	2.28 (8.67)	0 (0.00)	1.39 (6.73)	0.00 (0.00)	1.14 (6.12)	0.96 (5.60)
Prophenophos (0.05%)	17.84 (24.90)	16.63 (24.05)	4.08 (11.64)	4.56 (12.29)	1.26 (6.43)	1.99 (8.09)	11.54 (19.83)	1.18 (6.22)	0.88 (5.35)
Untreated check	18.43 (25.38)	15.23 (22.92)	34.47 (35.93)	17.97 (25.06)	19.96 (26.49)	15.97 (23.52)	34.61 (36.02)	1.51 (7.00)	1.04 (5.86)
SEM±	1.17	0.84	0.57	0.74	0.63	0.94	0.55	0.32	0.30
CD(5%)	2.55	1.83	1.24	1.61	1.37	2.05	1.20	0.70	0.65

Figure in the parentheses are arc sin transformed values.

* TMB – Tea Mosquito Bug, LM – Leaf Miner, LBW – Leaf and Blossom Webber, ANB – Apple and Nut Borer

KANABARGI

Design : RBD

No. of trees/ treatment : 2

No. of Replications : 4

Three sprays were given, the first at fresh vegetative flush stage, while the second and third at flowering and pea nut stage of the crop. The results indicated that out of six treatments selected, the treatment of L-cyhalothrin 0.003% was recorded the least percent infestation of TMB (0.67 mean number/ 52 lateral shoots) followed by acitamaprid 30 EC (0.73 mean number / 52 lateral shoots) that was also significantly superior over rest of the

treatments in controlling TMB. L-cyhalothrin recorded highest yield of 4.78kg/tree followed by acetamaprid 20SP (4.67kg/ha) (Table 3.13).

Table 3.13 : Evaluation of insecticides for the control of TMB on cashew at Kanabargi

Treatment	Pre-treatment count		Post treatment count at 30 Days after each spray**						Yield (Kg/ plant)
			1st Spray		2nd spray		3rd spray		
	1	2	1	2	1	2	1	2	
First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	1.19	8.85	0.56	4.60	0.46	3.29	0.44	1.06	3.19
Imidacloprid 17.8 SL (0.6 ml/l) all the three sprays	1.38	9.29	0.60	4.85	0.48	3.12	0.38	0.94	4.67
Acetamaprid 20 SP (0.5 g/l) all the three sprays	1.35	8.79	0.62	3.31	0.46	2.92	0.31	0.73	4.42
L-cyhalothrin (0.003%) all the three sprays	1.29	8.15	0.37	4.15	0.44	2.88	0.23	0.67	4.78
Dimethoate 30EC @ 1.70 ml/l all the three sprays	1.19	7.83	0.42	4.44	0.52	3.54	0.31	0.71	4.10
Untreated control	1.33	8.87	1.10	5.23	1.21	3.98	1.10	2.48	3.10
Mean	1.45	8.96	0.78	4.76	0.76	3.62	0.63	1.43	4.04
SEM±	0.03	0.18	0.08	0.15	0.07	0.10	0.07	0.10	0.67
CD at 5%	0.08	0.54	0.25	0.46	0.20	0.29	0.20	0.30	0.22

1: TMB mean damage score (0-4 scale) 2 : TMB population/52 lateral shoots

** Three sprays: First at flushing, second at flowering and third at fruit and nut development stage

MADAKKATHARA

Experimental detail :

Design : RBD

Replications : 4

No. of trees/ treatment : 2 (Age – 18 yrs, 1996 planted)

Variety : Priyanka (Mid season)

As per the technical programme, three-round spray-schedule of above insecticides was to be followed at flushing, flowering and nut-initiation stages. The first spray was skipped due to low pest load during the flushing stage. POP (Package of Practices, Kerala Agricultural University) recommendation comprised of spraying of L-cyhalothrin (0.003%), quinalphos (0.1%) and carbaryl (0.1%) at flushing, flowering

and nut-initiation stages respectively. Due to the unavailability of carbaryl, quinalphos (0.1%) itself was sprayed at third stage.

Fifty-two leader shoots were selected on any directional quadrant, tagged and observations on pre-treatment and three post-treatments at 7, 15 and 30-days after each spray on pest-infestations were taken. Even though the first spray was skipped, in order to execute the treatment T1 (Neem oil- L-cyhalothrin (15 days after) – Neem oil), L-cyhalothrin was sprayed in advance in T1 trees before starting second round spray. Observations were taken on infestation of TMB (damage in 0-4 scale) on flushes and panicles, TMB population (adults + nymphs), leaf miner (% infestation), inflorescence thrips (damage score on 0-4 scale and apple and nut-damage (% infestation). Natural enemy (mainly ants and spiders) population was also recorded.

Table 3.14 : Effect of different insecticides against Tea Mosquito Bug in Cashew at Madakkathara

Treatments	Damage score due to incidence of TMB (Tea Mosquito Bug) in Second spray Mean of 52 leader shoots (0-4 scale)							
	Shoot				Panicle			
	days after spray							
	Pre treat ment	7 days	15 days	30 days	Pre treat ment	7 days	15 days	30 days
T-1 Neem oil L-cyhalothrin-Neem oil	0.014 (0.717)	0.000 (0.707)	0.004 (0.710)	0.000 (0.707)	0.017 (0.719)	0.007 (0.712)	0.000	0.000 (0.707)
T-2 Imidachloprid	0.062 (0.749)	0.018 (0.719)	0.000 (0.707)	0.019 (0.720)	0.073 (0.757)	0.043 (0.735)	0.000	0.000 (0.707)
T-3 Acetamaprid	0.002 (0.709)	0.000 (0.707)	0.000 (0.707)	0.003 (0.709)	0.067 (0.752)	0.057 (0.743)	0.000	0.000 (0.707)
T-4 L-cyhalothrin	0.043 (0.736)	0.000 (0.707)	0.000 (0.707)	0.000 (0.707)	0.035 (0.731)	0.000 (0.707)	0.000	0.013 (0.716)
T-5 POP	0.028 (0.726)	0.005 (0.711)	0.000 (0.707)	0.000 (0.707)	0.010 (0.713)	0.074 (0.756)	0.000	0.000 (0.707)
T-6 Control	0.006 (0.711)	0.000 (0.707)	0.008 (0.713)	0.090 (0.713)	0.030 (0.727)	0.045 (0.737)	0.000	0.000 (0.707)
CV %	2.97	1.36	0.76	1.72	4.72	5.87	-	1.01
CD (0.05)	NS	NS	NS	NS	NS	NS	-	NS

Values are adjusted mean of four replicates.

Values in parenthesis are square root transformed values

Table 3.15 : Effect of different insecticides against Tea Mosquito Bug in Cashew at Madakkathara

Treatments	Incidence of TMB(Tea Mosquito Bug) in Third spray Mean of 52 leader shoots (0-4 scale)						
	Shoot			Panicle			* Nut yield (kg/tree)
	days after spray						
	7 days	15 days	30 days	7 days	15 days	30 days	2014-15
T-1 Neem oil L-cyhalothrin-Neem oil	0.028 (0.726)	0.006 (0.711)	0.022 (0.722)	0.138 (0.796)	0.000 (0.707)	0.000 (0.707)	2.630 (1.761)
T-2 Imidachloprid	0.040 (0.734)	0.013 (0.716)	0.008 (0.712)	0.345 (0.888)	0.000 (0.707)	0.000 (0.707)	2.831 (1.815)
T-3 Acetamaprid	0.025 (0.725)	0.010 (0.714)	0.002 (0.709)	0.047 (0.739)	0.113 (0.775)	0.000 (0.707)	3.622 (2.008)
T-4 L-cyhalothrin	0.007 (0.712)	0.004 (0.735)	0.000 (0.707)	0.032 (0.729)	0.000 (0.707)	0.000 (0.707)	4.194 (2.100)
T-5 POP	0.000 (0.707)	0.019 (0.720)	0.008 (0.713)	0.000 (0.707)	0.000 (0.707)	0.006 (0.711)	2.433 (1.711)
T-6 Control	0.013 (0.716)	0.000 (0.707)	0.000 (0.707)	0.086 (0.760)	0.000 (0.707)	0.000 (0.707)	2.518 (1.710)
CV%	3.50	3.26	1.87	14.47	7.67	0.46	18.99
CD	NS	NS	NS	NS	NS	NS	NS

Values are adjusted mean of four replicates

Values in parenthesis are square root transformed values

Tea mosquito bug damage

The effect of insecticide treatments on damage to shoots and panicles due to TMB incidence is given in Tables. A reliable conclusion could not be made due to the low pest intensity. During the second spray, practically, no fresh damage was observed on shoots and panicle in any of the treatments. Almost same trend was recorded in third spray also.

Table 3.16 : Efficacy of different chemicals against minor pests of cashew at Madakkathara

Treatments	Leaf miner (LM)				Thrips				Apple and Nut borer (ANB)			
	Pre-treat ment	30 days after spray			Pre- treat ment	30 days after spray			Pre- treat ment	30 days after spray		
		1st	2nd	3rd		1st	2nd	3rd		1st	2nd	3rd
T-1 : Neem oil – L-cyhalothrin-Neem oil	7.45 (2.311)^{ab}	The first spray is skipped	0.000	3.78 (1.518)	0.000	The first spray is skipped	0.064 (0.750)^{b}	0.104 (0.776)^{ab}	0.000	The first spray is skipped	0.93 (1.043)	5.55 (2.204)
T-2 : Imidacloprid	0.75 (0.998)^{b}		0.000	4.00 (1.547)	0.000		0.025 (0.724)^{b}	0.111 (0.781)^{b}	0.000		1.00 (1.061)	5.12 (1.962)
T-3 : Acetamaprid	1.85 (1.233)^{b}		0.000	0.000 (0.707)	0.000		0.058 (0.746)^{b}	0.095` (0.769)^{b}	0.000		0.37 (0.884)	5.12 (1.993)
T-4 : L-cyhalothrin	5.21 (1.970)^{ab}		0.000	0.000 (0.707)	0.000		0.032 (0.729)^{b}	0.000 (0.707)^{c}	0.000		0.87 (1.030)	2.60 (1.356)
T-5 : POP	6.00 (2.121)^{ab}		0.000	0.000 (0.707)	0.000		0.040 (0.735)^{b}	0.000 (0.707)^{c}	0.000		3.77 (1.718)	3.00 (1.582)
T-6 : Control	12.92 (3.628)^{a}		0.000	4.88 (1.648)	0.000		0.237 (0.858)^{a}	0.18 (0.824)^{a}	0.000		4.22 (1.836)	12.85 (3.341)
CV %	69.21		-	0	-		5.15	5.22	-		79.19	67.57
CD	2.132		-	NS	-		0.067	0.048	-		NS	NS

Values are adjusted mean of four replicates

Values in parenthesis are square root transformed values

Table 3.17 : Effect of different chemicals on natural enemies (ants and Spiders) at Madakkathara

Treatment	Mean no. of natural enemies in 52 inflorescence 30 days after each spray											
	Black ant				Red ant				Spider			
	Pre treatment	1st	2nd	3rd	Pre treatment	1st	2nd	3rd	Pre treatment	1st	2nd	3rd
T-1 Neem oil – L–cyhalothrin-Neem oil	1.000 (1.140)	First spray is skipped	0.000	0.250 (1.131)^{ab}	7.750 (2.622)	First spray is skipped	1.500 (1.246)	2.875 (1.683)	0.000 (0.707)^{b}	First spray is skipped	0.000	0.000
T-2 Imidachloprid	0.750 (1.037)		0.000	0.120 (0.780)^{ab}	4.370 (2.142)		1.875 (1.370)	2.500 (1.587)	0.125 (0.780)^{ab}		0.000	0.000
T-3 Acetamaprid	2.250 (1.414)		0.000	0.000 (0.707)^{b}	4.750 (1.935)		2.500 (1.588)	1.500 (1.246)	0.125 (0.780)^{ab}		0.000	0.000
T-4 L-cyhalothrin	0.750 (1.270)		0.000	0.370 (0.884)^{ab}	5.000 (2.097)		2.125 (1.512)	3.125 (1.784)	0.000 (0.707)		0.000	0.000
T-5 POP	0.000 (0.707)		0.000	0.250 (0.854)^{b}	3.900 (1.882)		2.250 (1.570)	3.750 (2.006)	0.125 (0.780)^{ab}		0.000	0.000
T-6 Control	3.250 (1.926)		0.000	1.250 (1.248)^{a}	5.500 (2.270)		3.500 (1.917)	4.125 (2.130)	0.500 (0.983)^{a}		0.000	0.000
CV%	39.32		-	37.55	49.04		38.35	40.74	17.62		-	-
CD	0.739		-	0.528	NS		NS	NS	0.207		-	-

Not analysed due to insufficient data points

Values are adjusted mean of four replicates

Values in parenthesis are square root transformed values

Insect pests other than tea mosquito bug

Observation on insect pests other than TMB was taken before treatment imposition and 30 days after second and third spray. The leaf miner infestation was observed during flushing stage and there was significant difference among treatments during the pretreatment observations. At 30th day after second spray, the leaf miner infestation was not at all observed in any of the treatments including control. At 30th day after third spray, the infestation was not observed in acetamaprid, L-cyhalothrin and POP. However no statistical significance was observed among treatments including control.

In case of thrips, infestation recorded at 30th day after second spray showed that all the treatments were statistically on par among each other but significantly different from control. At 30th day after third spray, the infestation was not observed in L-cyhalothrin and POP. Imidachloprid and acetamaprid recorded comparatively less and significantly different score values compared to control. In case of apple and nut borer infestation, at 30th day after second and third spray, there was no significant difference among treatments including control.

Influence on natural enemies

The data on the influence of insecticides on natural enemies given in Table indicated variation in population of black ant in all the trees that received insecticide treatments. At 30th day after second spray, the population was nil in the experimental plot. The population was significantly less in acetamaprid and POP. Other treatments were on par with control at 30th day after third spray. In general, spider population was scanty in the experimental plot during the reporting year.

PARIA

All the treatments were siginficantely superior over the control for reducing the Tea Mosquito Bug (TMB) population on shoots and panicles after 7 and 15 days interval. The least damage grade caused by TMB (0.36%) on shoots was recorded in the treatment of L-cyhalothrin followed by Acetamiprid (0.38%), thiamethoxam (0.49%) and Polytrin-C (0.51%). These treatments were significanterly at with each other in the terms of efficacy. Other hand on panicles the lowest TMB population was recorded in the treatment Acetamiprid (0.57%) followed by L-cyhalothrin and Thiamethoxam.

The lowest damage grade caused by Thrips (0.18%) was recorded in the treatment of Acetamiprid and it was significantely at par with thiamethoxam, L-cyhalothrin and Polytrin-C. The least damage grade (0.22 %) was recorded in the treatment of Acetamiprid against mealy bug and it was significantely at par with L-cyhalothrin, thiamethoxam and Polytrin-C. The lowest infestation (8.61 % & 6.76 %, respectively for LM and ANB) was found in the treatment of L-cyhalothrin and it was statistically at par with Polytrin-C. Similarly the lowest infestation (10.07% & 6.89%, respectively for LBW and STC) were recorded in the treatment of L-cyhalothrin and it was statistically at par with treatments of Acetamiprid and Polytrin-C.

All the insecticidal treatments were found significantly superior over control in the gaining higher raw nut yield of cashew. The highest raw nut yield was recorded in the treatment of L-cyhalothrin (1113 kg/ha) followed by Acetamiprid (1079 kg/ha). These were significantly at par with each other. The activities of beneficials viz; spiders, ants and parasitoids were recorded high in untreated control.

Table 3.18 : Efficacy of different insecticides against tea mosquito bug incidence in cashew at Paria

Sr. No.	Treatments	On shoots (%)			On panicles (%)		
		Before spray	7 days after spray	15 days after spray	Before spray	7 days after spray	15 days after spray
T1	Neem oil soap (4%) followed by L- cyhalothrin 5 EC @ 0.003% followed by neem oil soap	1.57 (1.96)	1.45 (1.60)	1.33 (1.27)	1.82 (2.80)	1.63 (2.17)	1.38 (1.40)
T2	Acetamiprid 20 SP @ 0.004% (2 g/10 lit. water)	1.50 (1.76)	1.21 (0.96)	0.94 (0.38)	1.74 (2.53)	1.40 (1.47)	1.03 (0.57)
T3	Thiomethoxam 25% WG @0.0075% (3 g / 10 lit. water)	1.54 (1.87)	1.24 (1.04)	0.99 (0.49)	1.77 (2.67)	1.43 (1.57)	1.12 (0.77)
T4	L-cyhalothrin 5 EC @ 0.003% (6 ml/ 10 lit. water)	1.52 (1.80)	1.20 (0.93)	0.92 (0.36)	1.81 (2.77)	1.40 (1.47)	1.09 (0.70)
T5	Polytrin-C 44% @ 0.044 % (10 ml/ 10 lit. water)	1.50 (1.76)	1.22 (0.98)	1.01 (0.51)	1.81 (2.77)	1.48 (1.70)	1.18 (0.90)
T6	Profenophos 50 EC @ 0.05% (10 ml/ 10 lit. water)	1.55 (1.91)	1.29 (1.16)	1.09 (0.69)	1.82 (2.83)	1.51 (1.80)	1.21 (0.97)
T7	Triazophos 40 EC @ 0.04 % (10ml/ 10 lit.water)	1.55 (1.91)	1.35 (1.33)	1.18 (0.91)	1.87 (3.00)	1.64 (2.20)	1.39 (1.43)
T8	Untreated control	1.57 (1.98)	1.69 (2.36)	1.72 (2.47)	1.84 (2.90)	1.93 (3.23)	1.94 (3.27)
	SEM ±	0.04	0.04	0.03	0.05	0.04	0.03
	CD at 5%	NS	0.13	0.11	NS	0.13	0.11
	CV%	4.41	5.41	5.25	5	4.73	4.64

Figures in the parenthesis are original values and outside are square root transformation values

Table 3.19 : Efficacy of different insecticides against sucking pest in cashew at Paria

Sr. No	Treatments	Damaging score (0-4)					
		Thrips			Mealybugs		
		BS	AS7	AS15	BS	AS7	AS15
T_1	Neem oil soap (4%) followed by L- cyhalothrin 5 EC @ 0.003% followed by neem oil soap	1.21 (0.96)	1.11 (0.73)	1.07 (0.64)	1.21 (0.96)	1.15 (0.82)	1.13 (0.78)
T_2	Acetamiprid 20 SP @ 0.004% (2 g/10 lit. water)	1.18 (0.91)	0.95 (0.40)	0.82 (0.18)	1.18 (0.89)	0.98 (0.47)	0.85 (0.22)
T_3	Thiomethoxam 25 % WG @0.0075% (3 g / 10 lit. water)	1.14 (0.80)	0.97 (0.44)	0.88 (0.27)	1.15 (0.82)	1.02 (0.53)	0.90 (0.31)
T_4	L-cyhalothrin 5 EC @ 0.003% (6 ml/10 lit. water)	1.12 (0.76)	0.95 (0.40)	0.88 (0.27)	1.15 (0.82)	1.02 (0.53)	0.89 (0.29)
T_5	Polytrin-C 44% @ 0.044 % (10 ml/ 10 lit. water)	1.10 (0.71)	0.98 (0.47)	0.90 (0.31)	1.15 (0.82)	1.04 (0.58)	0.95 (0.40)
T_6	Profenophos 50 EC @ 0.05% (10 ml/ 10 lit. water)	1.12 (0.76)	1.01 (0.53)	0.95 (0.40)	1.16 (0.84)	1.06 (0.62)	0.97 (0.44)

Table 3.19 continued...

Sr. No	Treatments	Damaging score (0-4)					
		Thrips			Mealybugs		
		BS	AS7	AS15	BS	AS7	AS15
T_7	Triazophos 40 EC @ 0.04 % (10ml/ 10 lit.water)	1.14 (0.80)	1.05 (0.60)	0.98 (0.47)	1.17 (0.87)	1.11 (0.73)	1.06 (0.62)
T_8	Untreated control	1.17 (0.87)	1.30 (1.20)	1.34 (1.29)	1.18 (0.89)	1.28 (1.13)	1.37 (1.38)
	SEM ±	0.04	0.04	0.04	0.04	0.03	0.03
	C.D. (0.05)	NS	0.13	0.11	NS	0.10	0.10
	CV%	5.31	7.27	6.24	6.41	5.25	5.74

Figures in the parenthesis are original values and outside are square root transformation values

Table 3.20 : Efficacy of different insecticides against pest complex in cashew at Paria

Sr. No.	Treatments	Per cent damage due to								Yield (kg/ ha)
		LM		LBW		STC		ANB		
		BS	AS	BS	AS	BS	AS	BS	AS	
T_1	Neem oil soap (4%) followed by L- cyhalothrin 5 EC @ 0.003% followed by neem oil soap	21.14 (13.01)	19.49 (11.14)	24.64 (17.38)	23.23 (15.56)	19.71 (11.37)	18.38 (9.94)	19.29 (10.91)	18.52 (10.09)	572
T_2	Acetamiprid 20 SP @ 0.004% (2 g/10 lit. water)	20.75 (12.55)	17.48 (9.02)	23.99 (16.53)	19.89 (11.57)	19.16 (10.78)	16.15 (7.74)	18.54 (10.11)	15.64 (7.27)	1079
T_3	Thiomethoxam 25 % WG @0.0075% (3 g / 10 lit.water)	21.30 (13.19)	19.22 (10.83)	23.74 (16.20)	20.34 (12.08)	18.67 (10.24)	16.97 (8.52)	19.32 (10.95)	17.51 (9.06)	936
T_4	L-Cyhalothrin 5EC @ 0.003% (6 ml/ 10 lit. water)	21.27 (13.15)	17.06 (8.61)	23.43 (15.81)	18.50 (10.07)	18.79 (10.38)	15.22 (6.89)	18.95 (10.55)	15.06 (6.76)	1113
T_5	Polytrin-C 44% @ 0.044% (10 ml/ 10 lit. water)	20.76 (12.56)	17.42 (8.97)	23.95 (16.48)	19.85 (11.52)	18.97 (10.57)	16.55 (8.12)	19.02 (10.62)	16.45 (8.01)	931
T_6	Profenophos 50 EC @0.05% (10 ml/ 10 lit. water)	21.40 (13.31)	18.02 (9.57)	24.57 (17.29)	20.76 (12.56)	18.27 (9.83)	16.37 (7.94)	19.64 (11.30)	17.26 (8.81)	884
T_7	Triazophos 40EC @ 0.04% (10ml/ 10 lit.water)	21.56 (13.50)	19.39 (11.03)	24.03 (16.58)	21.08 (12.94)	18.96 (10.56)	17.82 (9.37)	19.04 (10.64)	17.54 (9.09)	712
T_8	Untreated control	22.09 (14.14)	24.44 (17.12)	24.30 (16.94)	25.61 (18.69)	19.31 (10.94)	21.37 (13.28)	19.87 (11.56)	21.38 (13.28)	465
	SEM ±	0.85	0.80	0.71	0.55	0.54	0.53	0.73	0.65	34.75
	CD (0.05)	NS	2.42	NS	1.68	NS	1.60	NS	1.97	105.41
	CV%	6.89	7.25	5.09	4.52	4.93	5.26	6.60	6.46	7.2

Values in the parenthesis are original values and outside are arc sign transformed values.

Table 3.21 : Influence of different insecticides on natural enemies and pollinators in cashew at Paria

Sr. No.	Treatments	Population of beneficial insects			
		Predators		Parasitoids	
		BS	AS	BS	AS
T_1	Neem oil soap (4%) followed by L- cyhalothrin 5 EC @ 0.003% followed by neem oil soap	5.00	4.67	4.00	3.67
T_2	Acetamiprid 20 SP @ 0.004% (2 g/10 lit. water)	5.67	3.33	3.33	2.00
T_3	Thiomethoxam 25 % WG @0.0075% (3g/10 lit.water)	5.00	3.00	3.33	2.33
T_4	L-Cyhalothrin 5 EC @ 0.003% (6 ml/ 10 lit. water)	5.67	4.00	3.67	3.33
T_5	Polytrin-C 44% @ 0.044 % (10 ml/ 10 lit. water)	6.00	4.67	3.67	3.33
T_6	Profenophos 50 EC @ 0.05% (10 ml/ 10 lit. water)	4.67	2.33	3.00	2.00
T_7	Triazophos 40 EC @ 0.04 % (10ml/ 10 lit.water)	5.33	2.67	3.00	2.33
T_8	Untreated control	7.00	7.33	4.67	5.00
	Mean	5.54	5.33	3.58	3.00
	SEM ±	0.90	0.64	0.55	0.57
	CD (0.05)	NS	1.94	NS	1.73
	CV%	28.36	27.75	26.63	32.83

VENGURLA

It is revealed from the data presented in Table that, all the insecticidal treatments significantly reduced the incidence of TMB over control in cashew. Among the insecticidal treatments, treatment (T4) L-cyhalothrin (0.003%) was observed significantly superior for the management of tea mosquito bug on panicle and shoot.

Table 3.22 : Incidence of TMB in various treatments at Vengurla

Treatments		On shoots (%)		On panicles (%)	
		Before spray	15 days after spray	Before spray	15 days after spray
T1	Neem oil soap(4%) followed by L-cyhalothrin (0.6ml/l) followed by Neem oil soap	0.127	0.151	0.266	0.084
T2	Imidacloprid (0.6ml/lt)	0.129	0.107	0.194	0.096
T3	Acetamiprid 20SP(0.5 g/l)	0.141	0.098	0.169	0.122
T4	L-cyhalothrin 0.003%	0.139	0.051	0.180	0.038
T5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at lowering and carbaryl 0.1% at fruit & nut development stage.	0.163	0.134	0.158	0.132

Table 3.22 continued...

Treatments		On shoots (%)		On panicles (%)	
		Before spray	15 days after spray	Before spray	15 days after spray
T6	Untreated control	0.067	0.194	0.094	0.209
	Mean	0.128	0.122	0.177	0.113
	SEM ±	0.020	0.028	0.033	0.014
	CD at 5%	NS	0.084	NS	0.043

The data in the Table shows that, the treatment (T_4) L-cyhalothrin (0.003%) was observed significantly superior after 30 days of third spray followed by the treatment T_2 Imidacloprid.

Table 3.23 : Incidence of Thrips in various treatments at Vengurla

Treatments		Before spray	30 days after spray
T1	Neem oil soap(4%) followed by L-cyhalothrin (0.6ml/l) followed by Neem oil soap	0.180	0.112
T2	Imidacloprid (0.6ml/lt)	0.163	0.093
T3	Acetamiprid 20SP(0.5 g/l)	0.130	0.122
T4	L-cyhalothrin 0.003%	0.143	0.071
T5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at lowering and carbaryl 0.1% at fruit & nut development stage.	0.166	0.098
T6	Untreated control	0.103	0.187
	Mean	0.147	0.114
	SEM ±	0.025	0.021
	CD at 5%	NS	0.063

VRIDHACHALAM

The results of evaluation of insecticides against TMB revealed that after first, second and third spraying, the efficacy of different insecticides was at par, but statistically superior over untreated control. The pre-treatment damage score of TMB was non-significant in all treatments including the untreated control. Gradual reduction of fresh infestation was observed two weeks after each round of spray. After first spray, the damage score was low (0.62) in T5 and T1 as second spray within 15 days followed by neem oil soap (4%) as third spray followed by T3, T2, and T4 ranging between 0.64 and 0.69 as against 1.40 in the control. After the second spray, the damage score ranged between 0.33 and 0.49 in different treatments as against an increased damage score of 1.43 in untreated control. Thirty days after third spray, the damage score decreased and ranges between 0.30 and 0.36 in various treatments as against an increased score of 1.26 in control. The overall efficacy ranked in the order: T-5 (standard spray) > T-1 (First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray) followed by T3 (Acetamaprid 0.5g/lit), T2 (Imidachloprid 0.6ml/lit)> T-4 (L-cyhalothrin 0.003%). However, all the insecticides were statistically on par to control the pest.

Table 3.24 : Effect of insecticides on the incidence of TMB at Vridhachalam

	Treatment	Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		
			30 days after I spray	30 days after II spray	30 days after III spray
1.	First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	1.2_{a}	0.62_{a}	0.49_{a}	0.30_{a}
2.	Imidachloprid 17.8 SL (0.6ml/lit) all the three sprays	1.0_{a}	0.67_{a}	0.43_{a}	0.33_{a}
3.	Acetamaprid 20 SP (0.5g/lit) all the three sprays	1.0_{a}	0.64_{a}	0.40_{a}	0.36_{a}
4.	L-Cyhalothrin 0.003% all the three sprays	1.2_{a}	0.69_{a}	0.43_{a}	0.30_{a}
5.	Recommended spray for the region	1.2_{a}	0.62_{a}	0.33_{a}	0.30_{a}
6.	Untreated check	1.0_{a}	1.40_{b}	1.43_{b}	1.36_{b}
	CD (0.05)	0.46	0.43	0.36	0.33

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

The population trend of TMB and other foliar feeding insects was recorded. Thirty days after 3rd spray, all the insecticides effective in controlling TMB populations to zero as against 5.8 bugs/ 52 leader shoots observed in untreated control.

Table 3.25 : Efficacy of insecticides on TMB population/52 leader shoot at Vridhachalam

	Treatments	Pre treatment count/52 leader shoots	Post-treatment count (Mean TMB population/52 leader shoots)				
			30 days after I spray	30 days after II spray	30 days after III spray	Yield (Kg/ tree)	Rank
1.	First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	1.0_{a}	0.6_{a}	0.0_{a}	0.0_{a}	5.6_{ab}	2
2.	Imidachloprid 17.8 SL (0.6ml/lit) all the three sprays	1.6_{a}	0.8_{a}	0.0_{a}	0.0_{a}	5.4_{b}	4
3.	Acetamaprid 20 SP (0.5g/lit) all the three sprays	1.3_{a}	0.6_{a}	0.0_{a}	0.0_{a}	5.5_{b}	3
4.	L-Cyhalothrin 0.003% all the three sprays	1.3_{a}	0.6_{a}	0.0_{a}	0.0_{a}	5.0_{c}	5
5.	Recommended spray for the region	1.0_{a}	0.0_{a}	0.0_{a}	0.0_{a}	5.9_{a}	1
6.	Untreated check	1.3_{a}	1.6_{c}	2.0_{c}	1.0_{b}	3.6_{d}	-
	CD (0.05)	0.35	0.22	-	-	-	-

Furthermore, the per cent damage of leaf miner, leaf folder, leaf and blossom webber and nut borer was very low in all insecticides treated trees as compared to untreated trees (Table 3.26).

Table 3.26 : Efficacy of insecticides against foliar pests of cashew at Vridhachalam

Treatment		Mean damage 30 days after 3rd spray					
		TMB damaged (%)	Leaf miner damaged leaves(%)	Leaf folder damage leaves (%)	Leaf and blossom damaged shoots (%)	Apple and nut borer damaged nuts (%)	Yield (kg/ tree)
1.	First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	2.0	1.0	0.0	0.51	0.0	5.6
2.	Imidachloprid 17.8 SL (0.6ml/lit) all the three sprays	2.4	1.2	0.0	0.43	0.0	6.0
3.	Acetamaprid 20SP(0.5g/lit) all the three sprays	2.0	1.1	0.0	0.55	0.0	5.5
4.	L-cyhalothrin 0.003% all the three sprays	2.7	1.2	0.0	0.56	0.0	5.0
5.	Recommended spray for the region	2.7	1.3	0.0	0.53	0.0	5.8
6.	Untreated check	19.3	2.2	1.8	1.52	0.7	3.2
	Mean	5.18	1.33	0.30	0.68	0.12	5.18
	CD (0.05)	1.26	0.47	-	0.25	-	-

The population trends of various natural enemies in respect of all the insecticides treatment gradually decimated the population of spiders, coccinellids, ants and braconid wasp after each round of insecticidal spray. In unprotected trees, the activity of weaver ants and Cotesia wasps were predominant among different forms of natural enemies.

Table 3.27 : Effect of insecticide sprays on natural enemies at Vridhachalam

Treatment		Mean number of natural enemies/ pollinators in 52 inflorescence 30 days after 3rd spray			
		Spiders	Ants	Coccinellids	Cotesia
1.	First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	1.5	4.5	1.0	3.5
2.	Imidachloprid 17.8 SL (0.6ml/lit) all the three sprays	1. 3	3.5	1.2	3.4
3.	Acetamaprid 20 SP (0.5g/lit) all the three sprays	1.3	3.3	1.6	3.5
4.	L-Cyhalothrin 0.003% all the three sprays	1.4	3.0	1.6	3.0
5.	Recommended spray for the region	1.4	3.3	1.3	3.5
6.	Untreated check	3.0	5.5	4.4	6.0
	CD (0.05)	0.88	0.64	0.59	0.44

The mean population of natural enemies was considerably reduced in sprayed trees, but in unsprayed trees higher number of natural enemies were observed throughout the season.

Ent. 2: Control of cashew stem and root borer

Expt. 2. Curative control trial

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

West Coast : Madakkathara and Vengurla

Plains / others : Hogalagere and Jagdalpur

The objective of this trial is to evaluate different pesticides and neem products for their efficacy in curative control of the cashew stem and root borer incidence after extraction of pest stages.

Treatments :

T1 = Carbaryl (1%)

T2 = Chlorpyriphos (0.2%)

T3 = Monocrotophos (0.2%)

T4 = Lindane (0.2%)

T5 = Metarhizium anisopliae fungus spawn 250gm/tree + 500gm neem cake

T6 = Control (only removal of CSRB stages)

BAPATLA

Treatments: 6

T_1 : Carbaryl 1.0%

T_2 : Chlorpyriphos 0.2%

T_3 : Monocrotophos 0.2%

T_4 : Lindane (0.2%)

T_5 : Un treated check (only removal of CSRB grubs)

T_6 : Treated check (Using most effective treatment under prophylactic trails)

Design: CRD

The treatments 1 – 5 indicated above were applied sequentially as and when infested trees are available .The treatments are applied on the tree trunk and exposed roots after removal of the grubs and cocoons from the infested trees to the extent possible and observation on re-infestation and persistent infestation were recorded at monthly intervals.

During the year, among the insecticides evaluated as post extraction prophylaxis, Chloropyriphos 0.2% offered protection to the tune of 89.66 % trees without re-infestation or persistent attack followed by monocrotophos (0.2%) with 74.32 % trees without re-infestation or persistent attack. The other treatments treated check with neem oil has offered 56.23 per cent protection without re-infestation or persistent attack and are

superior over the control treatment which recorded 30.33 % trees without re-infestation or persistent attack.

Preferential zone of attack is collar +root in 30 per cent of trees followed by color+ stem in 25 per cent of trees.

Table 3.28 : Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer at Bapatla

Treatment	% trees without reinfestation/ persistant attack
Chlorpyriphos 0.2%	89.66
Monocrotophos 0.2%	74.32
Un treated check (only removal of CSRB grubs)	30.33
Treated check with most effective treatment under prophylactic trails	56.23

During the three consecutive years, among the insecticides evaluated as post extraction prophylaxis, Chloropyriphos 0.2% consistently performed well in the protection to the tune of 86.3%, 91.66% & 89.66% trees without re-infestation in all the three years.

Table 3.29 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Bapatla

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
Stem girth	< 60 cm	13	0	0.0	13	100.0
	60-80cm	36	12	23.33	24	66.66
	80-100 cm	20	10	50.00	10	50.00
	>100 cm	11	5	45.45	6	54.54
Total		80	27	33.75	53	66.25
Age of the tree	< 10 years	0	0	0.00	0	0.00
	10-15 years	56	13	23.21	43	76.78
	>15years	24	14	58.33	10	41.66
Total		80	27	33.75	53	66.25
Zone of attack	C + R	24	12	50.00	12	50.0
	C + S	20	3	15.0	17	85.0
	R	10	0	0.00	10	100.0
	S	02	0	0.00	2	100.0
	C	10	2	20.0	8	80.0
	C + S + R	14	10	12.50	4	28.57
Total		80	27	33.75	53	66.25

Table 3.29 continued...

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
Yellowing of canopy	Canopy yellowing	05	05	100.0	0	0.00
	Canopy not yellowing	75	22	29.33	53	70.66
Total		80	27	33.75	53	66.25
% of bark circumference damaged	<25	58	20	34.48	38	65.52
	26-50	12	4	33.33	08	66.66
	51-75	10	3	30.00	7	70.00
	>75	0	0	0.00	00	0.00
Total		80	27	33.75	53	66.25

BHUBANESWAR

Maximum recovery (86%) of plant was observed in case chlorpyriphos (0.2%) followed by Neem oil @ (5%). In case control i.e. extraction of CSRB grub, 27 per cent of the plant were recovered from reinfestation. In case of stem girth less than 60cm, reinfestation of treated trees was below 8 per cent. With the increase in stem girth i.e. above 60 cm reinfestation of CSRB was found to be higher. In plants of age group 5-10 percentage reinfestation of CSRB was nil and plants of age group 10-15 years showed 32.4 per cent reinfestation. C+R zone of attack was more prone to attack of CSRB (72% reinfestation) followed by R and C+S. Yellowing of canopy showed 79 per cent reinfestation. With the increase in damage to bark the reinfestation by the pest also increased gradually, highest being observed in >75% damage in bark.

Table 3.30 : Efficacy of post extraction prophylaxis treatment at Bhubaneswar

Treatment	No. of trees treated	No. of trees without reinfestation	Recovery (%)
i. Chlorpyriphos (0.2%)	44	38	86
ii. Untreated check (removal of grub only)	22	6	27
iii. Neem oil (5%)	42	31	74
Total	108	75	69

Table 3.31 : Physical parameter of CSRB treated tree at Bhubaneswar

Parameters		No. of trees treated	No. of trees reinfested	% reinfested	No. of trees not reinfested	% of trees not reinfested
Stem girth (cm)	< 60 cm	39	3	7.7	36	92.30
	60-80 cm	58	23	39.7	35	60.3
	80-100 cm	11	7	63.6	4	46.4
	>100 cm	0	0	0	0	0
	Total	108	33	30.6	75	69.4

Table 3.31 continued...

Parameters		No. of trees treated	No. of trees reinfested	% reinfested	No. of trees not reinfested	% of trees not reinfested
Age of tree (yrs)	<5	0	0	0	0	0
	5-10	6	0	0	6	100
	10-15	102	33	32.4	69	67.6
	>15	0	0	0	0	0
	Total	108	33	30.6	75	69.4
Zone of attack	C+R	36	26	72.2	10	27.8
	C+S	24	13	54.2	11	45.86
	R	6	4	66.7	2	33.3
	S	18	6	33.3	12	66.7
	C+S+R	24	7	29.2	17	70.8
	Total	108	33	30.6	75	69.4
Yellowing of canopy	Yellowed	14	11	78.6	3	21.4
	Not yellowed	94	22	23.4	72	76.6
	Total	108	33	30.6	75	69.4
% bark circumference damage	<25	15	0	0	15	100
	26-50	25	6	24	19	76
	51-75	36	13	36	23	64
	>75	32	14	44	18	56
	Total	108	33	31	75	69

HOGALAGERE

Infestation and reinfestation of the grubs were observed in the trees treated with the insecticides. The treatment with Chlorpyriphos (0.2%) and treated check with most effective treatment under prophylactic trails (Swabbing Neem oil 5% during Oct.-Nov., Jan.-Feb. and April-May) found to be effective against CSRB with 87.50% and 66.67% trees without reinfestation, respectively. In untreated check, where only grubs extraction was adopted, it was observed that 28.57% trees could recover (Table 3.32).

Table 3.32 : Efficacy of insecticides as Post Extraction Prophylaxis (PEP) against cashew stem and root borer (CSRB) at Hogalagere

Sl. No.	Treatment	Total number of trees treated	No. of trees without re-infestation	% Recovery from re-infestation
1	Chlorpyriphos 0.2%	8	7	87.50
2	Dimethoate @ 0.05%	7	3	42.86
3	Carbosulfan @ 0.05%	8	4	50.00
4	Treated check with most effective treatment under prophylactic trails (Swabbing Neem oil 5% during Oct.-Nov., Jan.- Feb. and April - May)	6	4	66.67
5	Untreated check (only removal of CSRB grubs)	7	2	28.57
	Total	36	20	-

The incidence of cashew stem and root borer was monitored randomly at fortnightly interval in neglected cashew gardens. Trees with 60-100 cm stem girth showed maximum damage (51.61%) and with respect to age of trees, more than 15 years old trees were highly prone to CSRB damage (92.86%). The zone of CSRB attack was noticed maximum at collar + stem (70.59%) and canopy yellowing of trees was observed in 27.27 per cent of treated trees.

The per cent bark circumference damage in less than 25 per cent was 51.85 per cent of the infested trees (Table 3.33). The efficacy of PEP treatment is best with chlorpyriphos-0.2% treatment, consistently over years. Physical parameters of treated cashew trees also similar trend over years with respect to infestation by CSRB.

Table 3.33 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Hogalagere

Physical parameters		No. of trees infested after PEP	% of total trees treated	No. of trees not reinfested after PEP	% of total trees treated
Stem girth	< 60 cm	6	19.35	2	12.50
	60-100 cm	16	51.61	11	68.75
	> 100 cm	9	29.03	3	18.75
Total		31		16	
Age of the tree	<10 years	0	0.00	0	0.00
	10-15 years	1	7.14	0	0.00
	>15 years	13	92.86	12	100.00
Total		14		12	
Zone of attack	C + R	1	5.88	03	15.79
	C + S	12	70.59	14	73.68
	C + S + R	4	23.53	02	10.53
Total		17		19	
Yellowing of canopy	Canopy yellowing	3	27.27	2	18.18
	Canopy not yellowing	8	72.73	9	81.82
Total		11		11	
% of bark circumference damaged	< 25	14	51.85	13	65.00
	26-50	7	25.92	04	20.00
	51-75	2	7.40	01	5.00
	>75	4	14.81	02	10.00
Total		27		20	

JAGDALPUR

The result revealed that Chlorpyriphos-0.2% (T2) led to maximum recovery of 77.77 per cent trees without re-infestations (Table 3.34). The physical parameters of different treated trees were also recorded and details are given in Table. The cashew trees have 60-100 cm of stem girth were more prone to attack of CSRB. More than 15-year-old cashew trees were more susceptible to attack of this pest.

Table 3.34 : Percentage infestation of CSRB under curative control trials at Jagdalpur

Treatment	No. of trees treated	No. of trees re-infested	No. of trees without re-infestation/ persistent attack	% of trees without attack out of total trees treated
T1 : Carbaryl (1.0%)	Not available	-	-	-
T2 : Chlorpyriphos (0.2%)	18	5	14	77.77
T3 : Monocrotophos (0.2%)	18	8	10	55.55
T4 : Chlorpyriphos (0.1%)	18	7	11	61.11
T5 : DDVP (10 ml) + Kerosene (50 ml)	18	11	8	44.44
T6 : Untreated check (only removal of CSRB grubs followed)	18	11	5	27.77
Total	90	42	48	-

Preferential zones of attack of re-infestations by cashew stem and root bores in the tree were C + S zone followed by C+S+R, zone with 66.67and 47.06 per cent re-infested trees, respectively. The canopy of cashew trees infested by CSRB was not yellowed. Trees with 25-50 per cent bark circumference damage had maximum re-infestation with 59.57 per cent followed by less than 25 per cent bark circumference damage (45.16% re-infestation) (Table 3.35).

Table 3.35 : Physical parameters of trees observed under curative control against CSRB at Jagdalpur

Physical parameters		Total No. of tree treated	No. of trees re-infested	% of trees re-infested	No. of trees not re-infested	% of trees not re-infested
Stem girth	<60 cm	5	2	40.00	3	60.00
	60-100 cm	48	29	60.42	19	39.58
	>100 cm	49	18	36.73	31	63.27
Total		102	49		53	
Age of tree	<10 years	2	0	0.00	2	100.00
	10-15 years	48	19	39.58	29	60.42
	>15 years	52	30	57.69	22	42.31
Total		102	49		53	
Zone of attack	C	29	13	44.83	16	55.17
	C+R	34	15	44.12	19	55.88
	C+S	18	12	66.67	6	33.33
	R	4	1	25.00	3	75.00
	S	0	0	0.00	0	0.00

Table 3.35 continued...

Physical parameters		Total No. of tree treated	No. of trees re-infested	% of trees re-infested	No. of trees not re-infested	% of trees not re-infested
	S+R	0	0	0.00	0	0.00
	C+S+R	17	8	47.06	9	52.94
Total		102	49		53	
Canopy yellowing	a) Canopy Yellowed	26	10	38.46	16	61.54
	b) Canopy Not yellowed	76	39	51.32	37	48.68
Total		102	49		53	
% of bark circumference damaged	<25	31	14	45.16	17	54.84
	26-50	47	28	59.57	19	40.43
	51-75	21	7	33.33	14	66.67
	>75	3	0	0.00	3	100.00
Total		102	49		53	

Zone of attack:

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

d) S :- Only Stem (e) R : - Only Root

JHARGRAM

Table 3.36 : Efficacy of post extraction prophylaxis (PEP) against CSRB at Jhargram

Treatment	% of trees without reinfestation/ persistant attack
Chlorpyriphos (0.2%)	92.31
Chlorpyriphos (0.1%)	84.62
Untreated check (only removal of CSRB grubs followed)	77.78
Treated check (Neem oil @ 5%)	80.77

Cholorpyriphos (0.2%) was found to be most effective treatment with maximum recovery of 92.31% followed by trees treated with Cholorpyriphos (0.1%). In case of untreated check where only grubs were removed showed 77.78% of recovery.

Trees with stem girth more than 100 cm showed maximum re-infestation (44.44%) followed by the trees having stem girth 60-80 cm. Out of the total trees maximum infestation was observed at stem region followed by collar + stem region. Trees infested at collar + root and root region showed maximum re-infestation at the rate 60% and 50% respectively. Maximum recovery was observed on trees less than 25% and 25-50% bark circumference damage. 100% re-infestation was observed when bark circumference damage 50-75% followed by more than 75% and those trees also showed canopy yellowing (3.81%) (Table 3.37).

Table 3.37 : Physical parameters of treated trees at Jhargram

Physical Parameters		No. of trees in each category			
		Without reinfestation	% of trees	With reinfestation	% of trees
Stem girth (in cm)	<60	12	92.31	1	7.69
	60 – 80	50	81.97	11	18.03
	80 – 100	21	95.45	1	4.55
	>100	5	55.56	4	44.44
In yrs	>5				
	5-10				
	10 – 15	88	83.81	17	16.19
	>15				
% bark circumference damaged	< 25	75	92.59	6	7.41
	25 – 50	9	64.29	5	35.71
	50 – 75	0	0	2	100
	> 75	4	50	4	50
Zone of attack	C + R	2	40	3	60
	C + S	9	75	3	25
	R	1	50	1	50
	S	70	90.91	7	9.09
	C + R + S	7	77.78	2	22.22
Canopy yellowing	a) Yellowed			4	3.81
	b) No yellowing	101	96.19		

MADAKKATHARA

The effect of post-extraction prophylaxis of insecticides is tabulated in Table. Among the insecticides tested for curative control, chlorpyriphos (0.2%) recorded the highest (72%) recovery of treated trees followed with neem oil soap swabbing (67%). In untreated check with grub extraction only the recovery was only 35 per cent (Table 3.38).

Table 3.38 : Efficacy of different insecticides for curative control against CSRB (post prophylaxis treatments) at Madakkathara

Treatments		Percentage trees without re-infestation/persistent attack
T-1	Carbaryl (1%)	Not available
T-2	Chlorpyriphos (0.2%)	72 %
T-3	Monocrotophos (0.2%)	Not included
T-4	Untreated check (grub-extraction only)	35 %
T-5	Most effective prophylactic treatment (swabbing neem oil soap 5%)	67%

Stem girth was found to significantly influence infestation. Out of total trees re-infested, 74 per cent of the trees come under the category with stem girth of more than 100 cm. The infestation was found to have significant relation with age of trees. When the age factor is taken in account, 97.5 per cent of trees re-infested were within the age group of more than 10 years. Out of these, 79 per cent were within the category of more than 15 years. Out of 39 trees re-infested, 33.3 per cent comes under the category of infestation at collar, stem and root region, 25.7 per cent with infestation at collar and stem region. Yellowing was observed in some of the re-infested trees and not at all observed in some re-infested trees (Table 3.39).

Table 3.39 : Physical parameters of tree observed at Madakkathara

Physical parameters		No. of trees treated	No. of trees		Per cent of total
			Without re-infestation	With re-infestation	
Stem girth (cm)	<60	2	1	1	2.5
	60 – 80	7	4	3	7.5
	80 – 100	16	10	6	15..0
	>100	68	39	29	74.0
Total		93	54	39	
Age in years	< 5	0	0	0	0
	5 -10	2	1	1	2.5
	10 – 15	20	13	7	18.0
	>15	71	40	31	79.5
Total		93	54	39	
% of bark circumference damaged	< 25	24	19	5	13.0
	25 – 50	34	19	15	38.5
	50 – 75	8	4	4	10.0
	>75	27	12	15	38.5
Total		93	54	39	
Zone of attack	C + R	19	10	9	23.0
	C + S	21	11	10	25.7
	R	13	10	3	7.7
	C	13	10	3	7.7
	C + R + S	22	9	13	33.3
	S	5	4	1	2.6
Total		93	54	39	
Canopy yellowing	Yellowed	29	10	19	48.7
	Not yellowed	64	44	20	51.3
Total		93	54	39	

VENGURLA

The results indicated that, the treatment T_2 (Chlorpyriphos 0.2%) recorded (90.00 %) without reinfestation followed by Chlorpyriphos (0.1%) T_4 (80.00%) trees without reinfestation. Reinfestation was more (50.00%) in Untreated check (T_5) (Table 3.40).

Table 3.40 : Effect of curative treatments against Cashew Stem and Root Borer (CSRB) at Vengurle

Sr. No.	Treatment	% trees without reinfestation
1	T_1- Carbaryl (0.1%)	-
2	T_2- Chloropyriphos (0.2%)	90.00
3	T_3- Monocrotophos (0.2%)	-
4	T_4- Chloropyriphos (0.1%)	80.00
5	T_5- Effective treatment in prophylactic trail (Swabbing Neem oil 5% during Oct.- Nov., Jan. – Feb. and April - May)	50.00
6	T_6- Mechanical Control	65.00

VRIDHACHALAM

Maximum recovery of 46.15% was noted in chlorpyriphos 50 EC (0.2%) treated trees, which was on par with Triazophos 40EC (0.2%) treated trees with 45.83% recovery. Treatments with profenofos 50 EC (1.0%), and neem oil (5.0%) lead to 40.00, and 35.00% recovery respectively as against mere 5.5% recovery in untreated control. The overall results indicate that chlorpyriphos and Triazophos are at par in reducing the CSRB infestation, with an average cost of protection of Rs.62/- and Rs.63/- respectively. Maximum damage with more than 50% bark circumference resulted in nil recovery of treated trees (Table 3.41).

Table 3.41 : Efficacy of certain insecticides as curative control against CSRB at Vridhachalam

Treatment		No. of trees treated	No. of trees without reinfestation from CSRB	Mean % recovery of trees	Frequency of treatment	Cost of treatment /tree
T_1	Profenofos 50 EC (0.1%)	25	10	40.00_b	3	66.0
T_2	Chlorpyriphos 50 EC (0.2%)	26	12	46.15_a	3	62.0
T_3	Triazophos 40 EC (0.2%)	24	11	45.83^a	3	63.0
T_4	Dichlorvos 76 EC (0.2%)	20	05	25.00_d	3	57.0
T_5	Untreated check (removal of grubs)	18	01	05.85_e	3	30.0
T_6	Treated check (Neem oil 5%)	20	07	35.00_c	3	61.0
	Total	133	46	-	-	-

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

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

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

BAPATLA

Trees were selected randomly in the cashew plantations visited in the surrounding areas of Bapatla and in villages of Prakasam and the different pests occurring and their intensities were recorded. Collection of pest infested samples at weekly intervals and maintaining in the laboratory for observation of emergence of parasitoids was done. The data on pest incidence from 12 selected and unprotected trees in Cashew Research Station, Bapatla was recorded at weekly intervals from 52 leader shoots of each tree from all the four sides.

During the year, the relation between the percent shoot damage by Leaf and Blossom Webber (Y) and weather variables such as Max.Temp (X1), Min.Temp.(X2), Relative Humidity (m) (X3) Relative Humidity (e) (X4) and Rainfall (X5) was worked out by subjecting the data collected over 34 standard weeks.

Relationship of percent Leaf and Blossom Webber damaged shoots with selected weather variables was subjected to multiple regression analysis. Results revealed that all weather variables together accounted for 32.46 percent variation in percent shoot damage by leaf and blossom webber (R^2=0.3246). However none of the variables was found to influence the damage by LBW independently.

With respect to leaf miner, results indicated that all five independent variables have accounted for 66.58% of total variation in percent leaf damage (R^2=0.6658). The data indicated that minimum temperature, rain fall and humidity RH (e) independently exerted significantly negative influence on the pest influence. Which indicates that 10 increases in the minimum temperature is expected to bring down leaf miner incidence by 3.29 percent. Similarly 1mm increase in the rainfall would reduce the population by 4.32 percent when all other variables tested are at their mean level (Ceteris paribus- holding other things constant).

In case of leaf folder, results revealed that all weather variables together in question accounted for 32.46 percent variation in percent leaf damage (R^2=0.3246). Data revealed that no variable seem to independently exert significant influence.

All five independent variables have accounted for 32.46 percent of total variation in percent shoot damage by shoot tip caterpillar (R^2=0.3246). Data revealed that all variables put together could not account for significant variation in percent shoot damage by shoot tip caterpillar incidence. However among the five independent variables, decrease in Relative Humidity (e) was found to exert significant –ve effect on percent shoot damage which means that one percent increase in Relative Humidity (e)

is expected to bring down percent shoot damage by 0.55 times when all other variables tested are at their mean level (Ceteris paribus- holding other things constant).

With regard to Apple and nut borer, all five independent variables have accounted for 32.46% of total variation in percent nut damage (R^2=0.3246). However none of the variables was found to exert any influence on the incidence of Apple and nut borer independently. Decrease in Relative humidity (e) and Minimum temperature was found to exert significant –ve effect on percent of apple and Nut Borer damage which means that one percent increase in Relative humidity (e) is expected to bring down percent shoot damage by 0.51 times when all other variables tested are at their mean level. The infestation of Cashew Stem and Root Borer found to be more (up to 20%) in Vishakapatnam District. The incidence of Mealy bug was also recorded in few pockets of Visakhapatnam District at low levels.

Table 3.42 : Influence of abiotic factors on the activity of pest complex of cashew at Bapatla

Variable	Leaf and blossom webber	Leaf miner	Leaf folder	Shoot tip caterpillar	Apple and nut borer
X1-Maximum Temp	-0.112	0.241	0.331	0.019	0.216
X2-Minimum Temp	0.066	-0.329	-0.46	0.076	0.361
X3-RH (m)	0.051	0.294	0.316	-0.005	-0.317
X4-RH (e)	0.345	-0.065	-0.114	-0.552	-0.516
X5-Rainfall	-0.15	-0.432	-0.48	-0.008	0.087

(R^2= 0.3246)

During 2012-13, 2013-14 and 2014-15 none of the variables was found to influence the damage by LBW independently. During 2013-14 and 2014-15 none of the variables independently exert significant influence on leaf folder damage, however, during 2012-13 RH (m) had shown significant –ve influence on the leaf folder damage. During 2014-15, in case of shoot tip caterpillar Relative humidity (e) has exerted significant –ve effect on percent shoot damage This observation is different from the previous year's findings where RH (m) has –ve influence during 2012-13 and rainfall has –ve influence during 2013-14. In 2014-15, Relative humidity (e) and Minimum temperature has shown significant –ve effect on percent damage of apple and nut borer damage. However during the last two years (2012-13 & 2013-14) none of the variables was found to influence the damage by ANB independently.

BHUBANESWAR

Insect pests incidence was comparatively lower during the year under report. Maximum incidence of pests was observed coinciding with new growth of flush and flowers. Apple and nut borer incidence was positively influenced by temperature (min) while negatively influenced by the RH (morn). Inflorescence thrips incidence was negatively influenced evening RH and positively by RH morning while remaining environmental factors influenced the pests in a negative pattern (Table 3.43).

Table 3.43 : Correlation of weather parameters with the pests of regional importance at Bhubaneswar

	STC	LM	ANB	IT
Temp (max)	0.435254	0.3598	0.296389	-0.30651
Temp (min)	0.333814	0.296321	0.580226*	-0.44393
RH (Morn)	0.225202	0.307185	-0.50145*	0.545555*
RH (Even)	-0.18918	-0.26705	0.462124	-0.6677*
Rainfall	-0.15146	-0.05113	0.221563	-0.4031
BSH	-0.22553	0.076478	-0.29496	-0.09925
R^2 Values	0.65	0.85	0.89	0.81

STC- Shoot tip caterpillar, LM- Leaf miner, IT- Inflorescence thrips, ANB- Apple and nut borer

HOGALAGERE

A total of six species of insect pests infesting and breeding on cashew and two species of their natural enemies were recorded in maidan parts of Chintamani region. Among them tea mosquito bug and cashew stem and root borer were found to be the major insect pests in the region (Table 3.44).

Table 3.44 : Influence of abiotic factors on the activity of pest complex of cashew at Hogalagere

Sl. No.	Insect pests	Month of Occurrence	Intensity
1	Tea mosquito	October – March	Moderate to high
2	Stem and root borer	Throughout the year	Moderate
3	Inflorescence thrips	March - April	Low
4	Fruit and nut borer	April - May	Low to moderate
5	Aphids	November - May	Low
6	Mealy bug	February - May	Moderate to high
	Predators		
7	*Oxypes sweta*	Oct - Mar.	Low to moderate
8	*Menochilus sexmaculatus*	Feb. - May	Low to moderate

The correlation between the pest incidence and weather parameters revealed that maximum temperature (0.113), number of rainy days (0.067) and sunshine hours (0.302) had a positive correlation with the activity of TMB, but negative correlation was established with minimum temperature (-0.017) and rainfall (-0.162) (Table). The activity of CSRB was observed throughout the year but its peak activity was noticed during October to November months. Minimum temperature (0.092), Relative humidity-morning and evening (0.046 & 0.193) had positive correlation with the incidence of the pest. Mealy bug had negative correlation with morning relative humidity (-0.108) and evening relative humidity (-0.031). Positive correlation was observed incidence of mealy bug with maximum temperature (0.070) and minimum temperature (0.016), rainfall (0.274), number of rainy days (0.276) and bright sunshine hours (0.006).

Apple and nut borer had positive correlation with maximum temperature (0.184) and negative correlation with rest of the weather parameters. The infestation of thrips showed negative correlation with minimum temperature (-0.176) and number of rainy days (-0.176) and had a positive correlation with maximum temperature (0.239), morning and evening relative humidity (0.259 & 0.789), rainfall (0.242) and bright sunshine hours (0.261). The aphid infestation had a positive correlation with maximum temperature (0.251), bright sunshine hours (0.098). The negative correlation was obtained with minimum temperature (-0.098), morning & evening relative humidity (-0.310 & -0.131) and rainfall (-0.249) (Table 3.45).

Table 3.45 : Correlation of weather parameters and different insect pests recorded on cashew at Hogalagere

Weather Parameters	TMB	CSRB	MB	ANB	Thrips	Aphids
X1 - Maximum Temp	0.113	-0.403	0.070	0.184	0.239	0.251
X2 - Minimum Temp	-0.017	0.092	0.016	-0.204	-0.176	-0.098
X3 - RH (m)	0.120	0.046	-0.108	-0.172	0.259	-0.310
X4 - RH (e)	0.118	0.193	-0.031	-0.534	0.789	-0.131
X5 - Rain fall	-0.162	-0.162	0.274	-0.162	0.242	-0.249
X6 - No. of rainy days	0.067	-0.225	0.276	-0.531	-0.176	0.093
X7 - Bright sunshine hours	0.302	-0.219	0.006	-0.160	0.261	0.098

* Significant at 0.05 level

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

Variation with respect to pest incidence is evident over years of observations and even with the occurrence of natural enemies of pests. However, correlation of pests with the weather parameters is consistent over years.

JAGDALPUR

To observe influence of biotic and abiotic factors on incidence of pest complex cashew a survey of pest complex were taken in randomly selected trees in cashew plantation visited in the surrounding areas of Districts - Jagdalpur viz. Bakawand, Tokapal, Bastar and Lohandiguda. Different insect pest occurring and their intensities in forest plantation were recorded (Tables). The corresponding meteorological data was also recorded.

The TMB damage in shoot ranged from 0.02-0.21 per cent during second week of November to March with maximum in 4th week of February; in panicle TMB damage varied from 0.09 to 1.21 per cent with maximum damage in the month of March. Relative humidity (evening) was significantly positively influenced (r= 0 .347) the activity of TMB on panicle. The leaf damage by leaf caterpillar was observed through out the year with infestation ranged from 31.77 to 49.70 per cent leaf damage with maximum damage recorded during 2nd week of January. Maximum temperature and rainfall were significantly negatively influence the activity of leaf caterpillar with the correlation coefficient value of -0.449 and -0.408, respectively. While, relative humidity (morning) had positive correlation (r= 0.376) with leaf caterpillar.

The incidence of leaf folder damage was observed through out the year with the leaf damage ranged from 20.73 to 41.52 per cent with relatively

high incidence during first week of February. Effect of abiotic factors on activity of leaf folder was similar as recorded in leaf caterpillar. The incidence of leaf miner damage was noticed almost through out the year with the leaf damage ranged from 1.12 to 32.86 per cent with maximum damage noticed during first week of December. Minimum temperature was significantly negatively influenced (r= -0.342) the activity of leaf miner. Whereas, relative humidity (morning) was significantly positively influenced (r= 0.517) the incidence of leaf miner.

Thrips was active throughout the season with the ranged from 2.45 to 11.90 percent damage with the maximum incidence was recorded during the month of March-April. Maximum temperature significantly positively correlated (r= 0.311) the thrips population. Mealy bug population was active throughout the year with the ranged from 0.02 to 0.15 mealy bug. Among the abiotic factors, rainfall had significant negative relation (r = -0.419) with mealy bug activities. While, relative humidity (morning) having significant positive relationship (r = 0.347).

In case of natural enemies population, population of thrips was significantly positively correlated with black ant (r= 0.472) and lady bird beetle (r = 0.402). Population of leaf caterpillar was significantly positively influence with mirid bug (r= 0.471) and significantly negatively influence with spider (r =- 0.316). Leaf folder population was significantly positively correlated with spider and mirid bug population.

Table 3.46 : Seasonal occurrence of cashew insect pests and their enemies at Jagdalpur

S. No.	Common Name	Scientific Name	Month of occurrence	Range (%)
1.	Stem & Root borer	*Plocaederrus ferrugineus*	Throughout year	1.21 - 12.37%
2.	Leaf caterpillar	*Mentrysia hyrtica*	Throughout year	31.77 - 49.70%
3.	TMB	*Helopeltis antonii*	Dec. - June	0.02 - 0.21% (Shoot) 0.09 - 1.21% (Panicle)
4.	Leaf folder	*Caloptilea tiselea*	Round the year	20.73 - 41.52%
5.	Leaf miner	*Acrocercops syngramma*	Round the year	1.12 - 32.86%
6	leaf thrips	*Rhiphiphorothrips sp*	Throughout season	2.45 - 11.90%
7.	Mealy bug	*Planococcus sp*	Dec-Jan	0.02 - 0.15%

Table 3.47 : Seasonal occurrence of natural enemies of cashew pests at Jagdalpur

Sr. No.	Natural enemies	Host insect	Stage affected	Period of occurrence	Intensity (nos.)
1.	Spider	*Argeopes sp., Oxypes sp. and Plexippuspaykulli*	Thrips & Lepidopterous larvae	Throughout year	0.13 -0.56
2.	Black Ant,	*Componotus spp*	Nymphs and adult of Thrips	Throughout the Season	0.21 - 0.98
3.	Mirid bug		Nymph of Thrips	Throughout the Season	0.02-0.40
4.	Lady Bird Beetle	*Menochilus sexmaculata*	Thrips	Flowering period	0.02 – 0.13

Table 3.48 : Correlation of weather parameters with the pests of regional importance at Jagdalpur

Weather Parameters	Correlation coefficient values (r) of pests of regional importance								
	Max.	Min.	Rainfall	Relative Humidity		Wind Vel.	Evap.	Bright Sunshine	No. of Rainy days
	Temp ^{0}C	Temp ^{0}C	mms	I	II	Kmph	mms	hours	
Shoot TMB	-0.17	-0.10	-0.01	-0.11	-0.15	0.03	-0.06	-0.14	0.01
Panicle TMB	0.00	-0.13	-0.01	-0.21	0.35*	0.00	-0.00	0.03	-0.04
% LC	-0.45*	-0.29	-0.41*	0.38*	-0.28	-0.28	-0.04	0.29	-0.42*
% LF	-0.52*	-0.30	-0.36*	0.36*	-0.23	-0.28	0.15	0.07	-0.17
% LM	-0.30	-0.34*	-0.22	0.52*	-0.15	-0.12	-0.42*	0.12	-0.29
Leaf thrips	0.31*	-0.15	-0.11	0.01	-0.01	-0.13	-0.13	-0.16	-0.12
Mealy bug	-0.30	-0.15	-0.42*	0.35*	-0.17	-0.15	-0.26	0.21	-0.15

Table 3.49 : Correlation of insect pests with associated predators on cashew at Jagdalpur

Natural enemies	Correlation coefficient values (r) of pests of regional importance					
	Thrips (%)	LC (%)	LM (%)	LF (%)	TMB Shoot	TMB Panicle
Spider	-0.24	-0.32*	0.20	0.39*	0.03	-0.19
Black Ant	0.47*	0.12	-0.21	0.04	0.06	0.02
Mirid Bug	-0.21	0.47*	-0.23	0.43*	0.04	-0.30
LBB	0.40*	0.06	-0.25	-0.22	-0.14	0.25

JHARGRAM

Table 3.50 : Correlation of weather parameters with pest complex of cashew at Jhargram

Weather parameter	TMB	LM	LBW	ANB	Thrips
Temp (Max.)	0.839	-0.631	-0.760	0.528	0.359
Temp (Min.)	0.522	-0.821	-0.918	0.796	0.604
RH	0.321	-0.715	-0.468	0.740	0.556
Rainfall	-0.114	-0.501	-0.564	0.526	0.352
No. of rainy days	-0.36	-0.111	-0.328	0.116	0.06

The result revealed temperature and humidity has positive correlation to tea mosquito but negatively correlated with rainfall and number of rainy days. Leaf miner and leaf and blossom webber showed a negative correlation with all the weather parameters. A positive correlation was observed between apple nut borer (ANB) and the weather parameters. Thrips also have a positive correlation with the weather parameters.

KANABARGI

The extent of damage by Tea mosquito bug was graded quantitatively in a scale of 0-4. The data indicated that TMB activity began in January and peaked in the second fortnight of February synchronizing with peak flowering and fruit set. Among the weather parameters, heavy rainfall and minimum temperature were the most negatively correlated factors with TMB population and damage percentage. TMB incidence was highest during end of October month coinciding with new flush.

Table 3.51 : Observations on incidence of TMB on cashew Kanabargi

Sl. No.	Month of observation	TMB mean damage score (0-4 scale) In 52 shoots/tree	Weather data of HRS, Kanabargi					
			Rainfall (mm)	No. of rainy days	Temperature (°C)		Relative Humidity (%)	
					Maximum	Minimum	Morning	Evening
1.	January, 2015	0.48	0	0	27.34	14.77	77.64	32.41
2.	February, 2015	1.21	0	0	30.87	16.62	68.64	18.21
3.	March, 2015	0.56	3.5	0	31.98	19.6	86.9	28.8
4.	April, 2015	0.62	33	2	33.83	20.45	85.66	23.2
5.	May, 2015	0.73	114.5	10	33.2	21.62	92.16	37.67
6.	June, 2015	0.71	141	12	27.19	21.00	94.66	64.73
7.	July, 2015	0.52	40.5	0	26.25	20.96	95.09	68.16
8.	August, 2015	0.36	214	9	30.51	21.41	81.16	71.01
9.	September, 2015	0.23	72	8	30.76	21.53	86.27	56.01
10	October, 2015	1.40	52	6	31.54	21.16	76.35	51.05

MADAKKATHARA

The tables depicts the monthly occurrence record of TMB and other minor pests in cashew at Madakkathara.

The incidence of TMB through the months starting from April to March clearly shows that the pest incidence was noticed during the flushing stage from October onwards with peak damage during January and the population continued up to March. The population build up was noticed coinciding with the penology of crop, that can be clearly observable in the data presented here. The infestation was not there from April to October in all the varieties.

An overview of leaf miner infestation through the months from April to March clearly shows the incidence of pest starting from October in early variety Anakkayam, from November in variety, Madakkathara-1 and from December in mid varieties, Kanaka and Dhana coinciding the flushing stage of crop. Maximum percent infestation was noticed during November December months and thereafter the pest activity was not at all observed.

Inflorescence thrips were active during the months of February and March. Incidence of apple and nut borer was observed during the months from January to March with maximum per cent infestation in February in early varieties and in March in Mid varieties.

The result of correlation studies of pest population on abiotic factors is presented in Table. The correlation analysis with regard to tea mosquito bug and weather factors revealed that the minimum temperature, relative humidity and rainy days had a significant negative correlation, whereas significant positive correlation was established with bright sunshine hours and wind velocity. However during last year, positive significant correlation was established between TMB damage and minimum temperature. Morning relative humidity has shown significant negative correlation with leaf miner damage. This observation is different from the last year finding that none of the abiotic factors was found correlated with leaf miner activity. Thrips activity was positively correlated with maximum temperature and evaporation and significant negative correlation was established with relative humidity. Apple and nut borer incidence had significant positive correlation with sunshine hours, maximum temperature and evaporation and established a negative correlation with relative humidity. During previous year also, same trend was observed.

Table 3.52 : TMB mean damage score (Mean of 52 shoots) at Madakkathara

Variety	Apr 14	May 14	June 14	July 14	Aug 14	Sept 14	Oct 14	Nov 14	Dec 14	Jan'15	Feb'15	Mar'15
Anakkayam-1	0	0	0	0	0	0	0.046	0.124	0.263	0.581	0.129	0.026
Madakkathara-1	0	0	0	0	0	0	0	0	0	0.169	0.058	0.020
Kanaka	0	0	0	0	0	0	0	0.017	0.059	0.111	0.032	0.016
Dhana	0	0	0	0	0	0	0	0	0.007	0.035	0.036	0.022

Table 3.53 : Leaf miner (% of mined leaves of five laterals) at Madakkathara

Variety	Apr 14	May 14	June 14	July 14	Aug 14	Sept 14	Oct 14	Nov 14	Dec 14	Jan'15	Feb'15	Mar'15
Anakkayam-1	0	0	0	0	0	0	15.21	38.7	35.6	0	0	0
Madakkathara-1	0	0	0	0	0	0	0	33.6	19.0	0	0	0
Kanaka	0	0	0	0	0	0	0	0	11.25	0	0	0
Dhana	0	0	0	0	0	0	0	0	21.02	14.8	0	0

Table 3.54 : % Damage by thrips at Madakkathara

Variety	Apr 14	May 14	June 14	July 14	Aug 14	Sept 14	Oct 14	Nov 14	Dec 14	Jan'15	Feb'15	Mar'15
Anakkayam-1	0	0	0	0	0	0	0	0	0	0.03	0.13	0
Madakkathara-1	0	0	0	0	0	0	0	0	0	0	0.04	0.05
Kanaka	0	0	0	0	0	0	0	0	0	0	0.16	0.09
Dhana	0	0	0	0	0	0	0	0	0	0	0.07	0.08

Table 3.55 : Apple and Nut borer (% damaged apples) at Madakkathara

Variety	Apr 14	May 14	June 14	July 14	Aug 14	Sept 14	Oct 14	Nov 14	Dec 14	Jan'15	Feb'15	Mar'15
Anakkayam-1	0	0	0	0	0	0	0	0	0	0	0.042	0
Madakkathara-1	0	0	0	0	0	0	0	0	0	0.045	0.085	0
Kanaka	0	0	0	0	0	0	0	0	0	0	0.042	0.047
Dhana	0	0	0	0	0	0	0	0	0	0	0.010	0.093

Table 3.56 : Influence of abiotic factors on the activity of pest complex of cashew at Madakkathara

Insect pests	Temperature		Relative humidity		BSS	RF	RD	WD	Evaporation
	Max	Min	am	pm					
TMB	-0.008	-0.536**	-0.463*	-0.496**	0.389*	-0.368	-0.416*	0.898**	0.305
Leaf Miner	-0.188	-0.349	-0.458*	-0.229	0.071	-0.350	-0.354	0.093	-0.044
Thrips	0.457*	0.116	-0.192	-0.394*	0.312	-0.251	-0.300	-0.059	0.561**
Apple and Nut borer	0.410*	-0.149	-0.498**	-0.583**	0.468*	-0.335	-0.382	-0.048	0.693**
* Significant at 5 %									

PARIA

Tea Mosquito Bug (TMB) damage ranged from 0.30 to 2.12 recorded during the period of investigation and main activity of TMB was recorded more or less throughout the period. The maximum TMB population was recorded in 6th Standard Meteorological Week (2.12 %) followed by 51th SMW (2.08), 52th and 1st (2.04). The activity of thrips remained quite low throughout the observational period; however, its peak activity was recorded in 39th SMW (0.88). The infestation caused by LBW and LM ranged from (1.55 to 9.96 & 5.64 to 11.95 %, respectively) with their peak infestation was recorded in 12th and 33th SMW. The infestation caused by ANB was in the range of 0 to 13.66 % during the observational period (Table 3.57).

The correlation studies revealed that activity of TMB was quite highly negative significant with minimum temperature (r =-0.722), evening relative humidity (r =-0.585), Rainfall (r =-0.427), Rainy days (r =-0.529) and evaporation (r = -0.316). The thrips damge was found positively significant with minimum temperature (r =0.469). The leaf and blossom webber was significantly positively correlated with maximum temperature (r = 0.307) and evaporation (r = 0.670) and negative significant with evening relative humidity and rainy days (r = -0.344). Similarly, leaf miner damage was significantly positive with evening relative humidity (r =0.468) (Table 3.58).

Apple and Nut Borer (ANB) damage had significant positive correlation with evaporation rate and maximum temperature. While, Mealy bug damage was found significantly positive correlation with minimum temperature (r =0.565) and evening relative humidity (r =0.451). Lastly, Shoot tip caterpillar (STC) damage was recorded positively with maximum temperature and negatively significant with all abiotic factors except evaporation.

The regression equation worked out for predicting the TMB damage was significant and explained 72.59% variation. Against thrips damage was also varied 57.48 % due to abiotic factors. The damage per cent caused by LBW was also varied upto 60.67 % due to weather factors.

Table 3.57 : Insects damage activity at Paria

SMW	TMB	Thrips	LBW	LM	STC	Mealy bug	ANB
27	0.30	0	0.00	6.86	0.00	0	0.00
28	0.58	0	0.00	7.07	0.00	0.10	0.00
29	0.74	0.16	0.00	9.85	0.00	0.18	0.00
30	0.90	0.22	0.00	10.74	0.00	0.38	0.00
31	0.98	0.14	0.00	9.35	0.00	0.24	0.00
32	0.98	0.30	0.00	10.41	0.00	0.42	0.00
33	1.28	0.44	0.00	11.95	2.01	0.58	0.00
34	1.54	0.26	0.00	11.05	3.96	0.48	0.00
35	1.32	0.56	0.00	11.58	7.06	0.72	0.00
36	1.26	0.66	0.00	10.23	7.58	0.76	0.00
37	1.28	0.74	0.00	9.48	8.30	0.84	0.00
38	1.42	0.80	0.00	9.21	8.54	0.66	0.00
39	1.54	0.88	0.00	9.54	8.98	0.56	0.00
40	1.38	0.48	0.00	10.34	9.21	0.5	0.00
41	1.14	0.28	0.00	9.19	10.55	0.22	0.00
42	1.56	0.56	0.00	8.99	10.94	0.46	0.00
43	1.76	0.78	0.00	10.01	10.88	0.74	0.00
44	1.72	0.62	0.00	10.62	11.40	0.54	0.00
45	1.50	0.48	0.00	11.27	11.68	0.64	0.00
46	1.40	0.52	0.00	9.80	10.80	0.42	0.00
47	1.42	0.4	0.00	10.19	10.80	0.36	0.00
48	1.54	0.28	0.00	9.05	10.88	0.34	0.00
49	1.72	0.26	0.00	7.87	9.78	0.32	0.00
50	1.86	0.32	0.00	7.64	9.15	0.22	0.00
51	2.08	0.22	0.00	8.20	9.84	0	0.00
52	2.04	0	0.00	7.43	10.38	0	0.00
1	2.04	0	0.00	8.16	9.19	0	0.00
2	1.80	0	0.00	7.54	9.88	0	0.00
3	1.54	0	1.55	7.45	8.42	0	0.00
4	1.60	0	2.75	6.92	8.88	0	0.00
5	1.74	0	5.21	6.68	8.53	0	0.00
6	2.12	0	5.98	6.65	7.49	0	0.00
7	2.02	0	7.19	7.66	6.73	0	0.00
8	1.86	0	8.08	7.27	6.81	0	0.00
9	1.74	0	8.45	7.16	6.69	0	0.00
10	1.56	0	9.78	7.50	6.26	0	0.00
11	1.56	0	9.78	7.50	6.26	0	0.00
12	1.20	0	9.96	6.98	5.82	0	4.25
13	0.96	0	8.71	7.37	6.01	0	7.66
14	0.82	0	8.23	7.34	6.41	0	9.82
15	0.60	0	6.83	6.06	5.35	0	12.82
16	0.44	0	6.08	5.64	4.64	0	13.66

Table 3.58 : Correlation and regression coefficient analysis of major insects of cashew with abiotic factors at Paria

Abiotic Factors	Correlation coefficient (r)						
	TMB	Thrips	LBW	LM	ANB	Mealy Bug	STC
Max. Tem.	-0.050	0.060	0.307*	-0.124	0.368*	-0.008	0.366*
Min.Tem.	-0.722*	0.469*	-0.298	0.503*	0.123	0.565*	-0.521*
Mor. RH (%)	-0.254	0.079	-0.175	0.281	-0.211	0.219	-0.490*
Eve. RH (%)	-0.585*	0.290	-0.428*	0.468*	-0.127	0.451*	-0.646*
Rainfall	-0.427*	0.0160	-0.274	0.293	-0.147	0.166	-0.627*
RD	-0.529*	0.096	-0.344*	0.367*	-0.194	0.271	-0.733*
Evaporation	-0.316*	-0.247	0.670*	-0.427*	0.602*	-0.345*	-0.046
Abiotic Factors	**Regression coefficient**						
	TMB	Thrips	LBW	LM	ANB	Mealy bug	STC
Max. Tem.	-0.005	-0.025	0.146	-	-0.067	-	0.264
Min.Tem.	-0.012	0.083	-0.498	0.361	0.011	0.066	0.124
Mor. RH (%)	0.013	-	0.204	0.036	-0.111	-	0.027
Eve. RH (%)	-0.012	-0.015	0.057	-0.071	0.052	-	-0.056
Rainfall	-	-	-	-	-	-	-
RD	-0.083	-0.038	0.33	-0.101	-0.123	-0.029	-1.168
Evaporation	-0.197	-0.149	2.348	-0.955	1.696	-0.158	-1.473
R^2	0.7259	0.5748	0.6067	0.5601	0.4156	0.6292	0.7024
% Variation	72.59	57.48	60.67	56.01	41.56	62.92	70.24
R value	0.852	0.758	0.778	0.748	0.644	0.793	0.838

VENGURLA

Major incidence of TMB was observed during November - March with peak in the month of March. The incidence of thrips started from November and reached its peak in the month of February and continued up to march. The incidence of apple and nut borer was noticed in month of January with setting of apples and nuts and it was maximum in the month of February.

The TMB Infestation shows positive correlation with maximum temperature, morning and evening humidity and negative significant correlation with minimum temperature, and negative correlation with rainfall and rainy days. The apple and nut borer shows positive correlation with maximum temperature and morning and evening humidity. Negative significant correlation with minimum temperature and negative correlation rainfall and number of rainy days.

The incidence of thrips shows positive correlation with maximum temperature and negative significant correlation with minimum temperature, negative correlation with rainfall and number of rainy days. The incidence of

leaf miner shows positive relationship with maximum temperature, morning humidity and negative significant correlationship with minimum temperature and negative correlation with relative humidity evening, rainfall and number of rainy days (Table 3.59).

Table 3.59 : Seasonal incidence of pest at Vengurle

Weather Parameters										
Month	Temperature (^{0}C)		Humidity (%)		Rain fall (mm)	No. of rainy days	TMB *(Helopeltis antonii)* (0-4 scale)	Apple & Nut borer *(Nephopteryx sp.)* (%)	Inflo. Thrips *(Scritothrips dorsalis)* 0-4 scale	Leaf miner
	Max.	Min.	Fore noon	After noon						
April	33.71	26.26	82.13	62.37	0.00	0.00	0	0	0	0
May	33.96	27.60	80.71	65.42	72.80	4.00	0	0	0	0
June	32.65	27.22	85.90	71.23	358.00	17.00	0	0	0	0
July	29.56	24.93	89.26	85.00	1178.00	31.00	0	0	0	0
Aug.	30.23	25.45	89.48	79.03	599.4	26.00	0	0	0	0
Sep.	30.76	25.39	89.50	77.87	252.6	23.00	0	0	0	0
Oct.	32.51	24.72	89.55	72.06	226.8	10.00	0	0	0	0
Nov.	33.63	22.08	89.47	62.23	0.80	2.00	0	0	0	0
Dec.	32.87	20.12	88.10	56.42	0.20	1.00	0.091	0	0.066	0.48
Jan.	31.99	16.29	87.61	64.97	0.00	0.00	0.067	0.56	0.067	0.516
Feb.	33.03	18.49	89.75	66.89	0.00	0.00	0.065	0.641	0.065	0
Mar.	32.63	21.43	87.61	64.68	40.80	1.00	0.134	0	0.134	0

Table 3.60 : Correlation between the pest incidence and weather parameters at Vengurle

Weather Parameters	TMB	Thrips	ABN	Leaf miner
X_1 - Maximum Temp (^{0}C)	0.171	0.159	0.082	0.039
X_2 - Minimum Temp (^{0}C)	-0.713*	0.-707*	-0.756*	-0.671*
X_3 - RH (m)	0.159	0.16	0.203	0.064
X_4 - RH (e)	0.500	-0.450	0.170	-0.461
X_5 - Rain fall	-0.413	-0.403	-0.299	-0.300
X_6 - No. of rainy days	-0.533	-0.525	-0.385	-0.306

* - Significant at 5%

VRIDHACHALAM

The seasonal incidence and correlation coefficient of insect-pests in Cuddalore district are presented in Table 3.61.

Table 3.61 : Correlation coefficient (r) for abiotic factors and insect pests at Vridhachalam

Insect-pests	Temperature		Relative Humidity		Rainfall	Rainy days	Sunshine hours
	Max	Min	AM	PM			
Tea mosquito bug (population) (Y_1)	0.52*	0.24	0.25	*0.22	-0.29	0.40	*0.32
Leaf and blossom webber (Y_2)	0.59*	0.37	-0.31*	-0.27	-0.24	-0.26	0.45
Apple and nut borer (Y_3)	0.48	0.38	0.35	-0.27	-0.22	-0.35	0.26
Leaf miner (Y_4)	0.22	0.25	0.33	0.39	0.52	0.35*	-0.31
Leaf roller (Y_5)	-0.48*	-0.34	-0.38*	-0.25	-0.25	-0.35	0.38
Shoot tip caterpillar (Y_6)	-0.28	0.28	0.38	0.36	0.48	0.45	-0.49
Aphids (Y_7)	-0.29	0.29*	0.37*	0.48*	0.45	0.44*	-0.44
Cashew Stem and Root Borer (Y_8)	0.55*	0.46	-0.24	-0.38	-0.4 2	-0.36	0.48

*= Significant at 5%

The incidence of TMB was confined to flushing through fruiting season. Its activity was observed from first week of February 2015 to third week of April 2015. Maximum TMB damage was observed during the second week of March with mean damage score ranging between 1.9 and 2.6. Nut borer activity during non-bearing periods could not be traced out. Cashew leaf miner was found from August to March with a maximum of 2.2% leaf damage during first fortnight of February 2015. Cashew leaf folder was also observed from August-March 2015 with 1.8% leaf damage observed in young plantations.

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

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

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

West Coast : Madakkathara and Vengurla

Plains / others : Hogalagere and Jagdalpur

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

BAPATLA

Germplasm entries existing in the gene bank of Cashew Research Station, Bapatla were screened for resistance/susceptibility to major pest(s) of cashew viz,.

1) Leaf and blossom webber (*Lamida moncusalis*)
2) Shoot tip caterpillar (*Cheleria haligramma*)
3) Leaf miner (*Acrocercops syngramme*)
4) Apple and nut borer (*Thylocoptila panrosema*)

Observations:

The data on pest incidence from 2 trees per each entry from 52 leader shoots of each tree from all the four sides was recorded under unprotected conditions in respect of Leaf and Blossom Webber and Shoot Tip Caterpillar.

During the year, among the 40 accessions screened to identify the tolerant lines against the pests of cashew, T.No.233 has recorded with highest incidence of leaf and blossom webber (5.64%) and T.No. 129 recorded with the lowest incidence (0.25%). The accession T.No.12/8 has recorded with the highest incidence of leaf miner (15.14%) and Vetapalem has recorded with the lowest incidence (0.83%). With regard to the incidence of leaf folder, the T.No.ABT-2 has recorded with the highest incidence (3.23%) and T NO.129 has recorded with lowest incidence (0.25%). The accession ABT-3 has recorded with the highest incidence of Shoot tip caterpillar (10.12%) and Priyanka recorded with the lowest incidence (0.28%). The accession line BLA.39/4 has recorded with highest incidence of Apple and nut borer (12.47%) and T.No.275 has recorded with the lowest incidence (0.35%).

Table 3.62 : Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Bapatla

Sl. No.	Entry	IC No.	Leaf and blossom webber damaged shoots (%)	Leaf miner damaged leaves (%)	Leaf folder damaged leaves (%)	Shoot tip caterpillar damaged shoots (%)	Apple and nut borer damaged nuts (%)
1.	Priyanka	250140	3.59	12.54	1.26	0.28	1.20
2.	T.No.129	249784	0.25	2.17	0.25	0.86	0.54
3.	T.No.275	249982	3.53	11.54	1.56	5.25	0.35
4.	T.No.274	302488	1.10	2.20	2.51	5.48	3.10
5.	T.No.12/1	---	0.85	5.21	1.33	5.66	4.40
6.	T.No.12/8	---	1.84	15.14	1.40	4.45	1.10

Table 3.62 continued...

Sl. No.	Entry	IC No.	Leaf and blossom webber damaged shoots (%)	Leaf miner damaged leaves (%)	Leaf folder damaged leaves (%)	Shoot tip caterpillar damaged shoots (%)	Apple and nut borer damaged nuts (%)
7.	T.No.18/3	---	3.20	6.67	1.68	4.84	1.13
8.	ABT-3	302391	2.45	13.51	2.58	10.12	1.40
9.	ABT-2	302390	1.81	7.84	3.23	2.54	2.54
10.	T.No.3/7	---	1.60	10.21	2.46	6.24	3.00
11.	T.No.3/4	---	2.41	9.20	2.43	4.68	0.58
12.	T.No.1/1	---	2.54	2.15	3.01	3.23	2.54
13.	T.No.8/7	302437	2.50	4.30	2.20	4.51	1.20
14.	T.No.4/3	302442	1.56	5.20	1.90	2.51	2.77
15.	T.No.4/5	---	1.31	4.70	2.51	5.20	1.25
16.	T.No.30/1	302368	1.37	9.14	2.43	9.54	1.05
17.	T.No.228	302376	1.97	3.14	1.86	5.20	0.52
18.	T.No.233	302374	5.64	2.11	2.56	6.30	2.35
19.	T.No.244	302379	0.64	6.23	1.00	5.10	2.31
20.	T.No.268	302381	3.49	5.03	2.54	8.25	2.60
21.	M 15/4	---	3.74	4.24	3.00	6.80	240
22.	BLA 139-1	---	3.54	3.66	2.00	4.67	1.80
23.	T.No.17/5	---	2.64	4.23	2.14	3.60	1.80
24.	BLA 39/4	---	2.35	4.24	2.04	3.20	12.47
25.	T.No.5/1	250025	1.90	4.12	2.26	4.20	7.54
26.	T.No.2/3	302435	2.50	3.80	1.74	1.70	1.40
27.	T.No.10/2	249911	1.52	2.24	1.84	2.81	0.52
28.	T.No.7/12	302434	1.72	3.24	0.96	4.20	1.10
29.	T.No.71	302370	2.54	4.96	2.06	5.45	2.52
30.	T.No.277	302384	3.25	2.84	1.56	2.00	1.20
31.	T.No.2/14	302446	3.33	13.10	1.23	4.10	1.54
32.	Ch.gudem	302409	5.13	1.68	1.96	2.56	1.86
33.	ASRPT	---	2.64	2.23	1.86	4.10	2.86
34.	T.No.40/1	---	2.45	2.40	2.34	2.00	3.26
35.	T.No.6/14	302432	1.25	2.17	1.10	4.00	1.07
36.	Hy 94-T3	---	2.54	1.40	2.85	1.71	1.97
37.	T.No.2/5	302387	2.11	3.00	2.64	1.4	1.24
38.	Hy 94-T4	---	1.74	1.50	1.54	2.86	1.80
39	Hy 95-T4	---	1.70	1.40	1.36	5.21	2.13
40	Vetapalem	---	2.48	0.83	1.46	2.24	0.85

During the years 2012-13, 2013-14 and 2014-15, among the 40 accessions screened to identify the tolerant lines against the pests of cashew, T.No.233 has recorded with highest incidence of leaf and blossom webber (7.03, 6.45 & 5.64%) and T.No. 129 recorded with the lowest incidence (0.00, 0.00 & 0.25%). The accession line T.No.275 has recorded with the lowest incidence (0.00, 0.00 & 0.35%) during all the three years. T.No.129 is the only accession which performed consistently during the last three years in reducing the incidence of the leaf and blossom webber and T.No.275 performed well against the Apple and nut borer. In case of all the other pests none of the accessions exhibited a consistent response either tolerance/ Susceptibility.

BHUBANESWAR

Extent of damage by Leaf miner ranged between 0.5 and 1.0 per cent damage leaf in all the accessions. Minimum incidence of shoot tip borer (0.5-1% damaged shoot) was observed in 5 accessions and maximum 2-3% damaged shoot in 4 accessions. Leaf and blossom webber ranged from 0.5- 5% in germplasm accessions. Thrips incidence was recorded 1 – 3/panicle among the germplasms during the year under report.

Table 3.63 : Reaction of germplasm accessions against insect pests in Bhubaneswar

Pest	Accessions	Min. damage	Accessions	Max. damage
Leaf Miner	100 Nos (all)	0.5-1.0	--	--
Shoot tip caterpillar	OC 31,OC37, OC133, OC 140, OC 160	0.5-1.5%	OC 104,OC129, OC132,OC149	2-3% damaged shoot
Inflorescence thrips	OC 31, OC 37,OC6, OC21 OC92,OC109, OC117, OC122, OC137	0.5-1/ panicle	OC22 ,OC107, OC110,	3-5/panicle OC124,OC158
Leaf and blossom webber	OC21, OC55 OC77 126, OC135, OC158	0.5-1.0%	OC 47,OC100, OC117, OC149	2-3%

HOGALAGERE

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

JAGDALPUR

Twenty nine germplasm were screened against tea mosquito bug incidence, leaf caterpillar, leaf folder and leaf miner (Table-3.64). It was observed that the incidence of TMB was less during this year. Germplasm NRC-131,NRC-136, NRC-193, CARS-8, and VRI-1 were free from the attack TMB at shoot stage. While the germplasm NRC-130, NRC-190, NRC-191, CARS-9, SEL-1, SEL-2, HY-367, HY-320 and VRI-1 were free from TMB at panicle stage. None of the germplasm was free from the attack of miner insect pest.

Table 3.64 : Screening of germplasm to regional pest incidence at Jagdalpur

Sr. No.	Germplasm	TMB mean damage score 0-4 scale in 52 leader shoots		%LC damage	%LM damage	%LF damage
		Shoot	Panicle			
1	NRC - 130	0.25	0.00	21.91	18.35	14.09
2	NRC - 131	0.00	0.06	21.08	20.44	19.74
3	NRC - 136	0.00	0.12	21.10	24.13	12.00
4	NRC - 137	0.06	0.03	25.17	23.63	13.58
5	NRC - 138	0.06	0.06	27.05	15.88	11.32
6	NRC - 140	0.02	0.01	25.70	13.59	16.52
7	NRC - 190	0.15	0.00	31.24	33.97	21.37
8	NRC - 191	0.38	0.00	27.08	35.90	15.57
9	NRC - 192	0.02	0.12	23.94	27.90	20.38
10	NRC - 193	0.00	0.12	23.81	13.60	11.50
11	AAKHANE	0.02	0.25	26.41	13.74	13.35
12	VTH - 711/4	0.15	0.02	29.13	17.19	13.26
13	CARS - 8	0.00	0.06	29.78	13.57	18.71
14	CARS - 9	0.08	0.00	13.89	24.77	28.45
15	CARS - 10	0.02	0.02	21.26	17.25	10.58
16	HY - 303	0.10	0.18	15.90	18.93	17.62
17	10/19	0.04	0.06	19.32	10.69	129.49
18	SEL - 1	0.10	0.00	13.32	9.14	19.74
19	SEL - 2	0.14	0.00	24.62	33.13	10.72
20	V - 3/33	0.14	0.44	12.87	18.46	11.44
21	HY - 255	0.02	0.02	20.45	11.72	14.83
22	HY - 68	0.32	0.10	23.71	8.45	27.90
23	HY - 367	0.27	0.00	22.64	16.59	8.53
24	HY - 320	0.03	0.00	12.88	19.94	16.43
25	VRI - 1	0.00	0.00	27.34	26.79	3.46
26	VRI - 2	0.13	0.02	33.65	32.32	6.43
27	V - 30/1	0.50	0.32	28.99	30.23	15.71
28	V - 3/28	0.41	0.25	24.14	23.88	11.41
29	V - 4	0.08	0.25	21.07	40.40	17.40

JHARGRAM

Almost all the accessions were infested by leaf miner and thrips. During 2014 there was heavy infestation of leaf and blossom webber. The accessions H-158 and H-170 showed tolerance to leaf and blossom webber and rest of the accessions showed medium to very high infestation (5-79%). Maximum accessions were free from TMB infestation.

Table 3.65 : Screening of cashew germplasm to locate tolerance/resistance to major insect pests in Jhargram

Pest	Accessions	Min. damage	Accessions	Max. damage
Leaf miner	H-10, H-126, H-132, H-144, H- 23, H-159, H-110, H-136, H-68, H-55	0-2%	H-9, H-12, H-126, H-154, H-157, H-115, H-21, H-133, H-161, H-117, H-134, H-150, H-111, H-120, H-146, H-173, H-174, H-121, H-41, H-137, H-178, H-57, H-179, H-180, H-59, H-112, H-122, H-130, H-139, H-147, H-65,H-87, H-28, H-30, H-37, H-39, H-146, H-162, H-58, H-158,H-119, H-170, H-36	2- 63%
Leaf & blossom webber	H – 158, H-170		All the other accessions	5-79%
Thrips	H-9, H-126, H-115, H-21, H-159, H-134, H-111, H-136, H-41, H-137, H-55, H-179, H-59, H-122, H-112, H-139, H-58, H-119, H-36	0-<1	H-10, H-12, H-114, H-132, H-144, H-154, H-157, H-133, H-23, H-161, H-110, H-117, H-150, H-120, H-146, H-173, H-174, H-121, H-178, H-57, H-180, H-130, H-147,H-65, H-87, H-28, H-30, H-37, H-39, H-146, H-162,158, H-170	1-3.2 (0-4 Scale)
TMB	H-9, H-10, H-12, H-114, H-126, H-132, H-144, H-154, H-157, H-115, H-21, H-133, H-23, H-159, H-161, H-110, H-117, H-134, H-150, H-120, H-136, H-146, H-121, H-55, H-57, H-179, H-180, H-112, H-130, H-139, H-147, H-87, H-28, H-30, H-37, H-39, H-146. H-158, H-119, H-170, H-36	0-< 1	H-111, H-173, H-174, H-41, H-137, H-178, H-59, H-122, H-65, H-162, H-58	1-4 (0-4 Scale)

MADAKKATHARA

The insect-pests infestation data on different accessions maintained in the germplasm collection is presented in Table.

Tea mosquito bug infestation was very low during the reporting year and the damage score varied from a minimum of 0.005 in ODR to maximum of 0.312 in Peechi. During the previous year, minimum damage was reported in Kainoor and maximum in Kunjithai. However, the damage in ODR was comparatively less and the accession Peechi recorded damage score of 0.081 as high as that in Kunjithai during last year.

The Leaf miner infestation was low in all the accessions and a maximum of 4.5 per cent was observed in accession, K-1 and minimum in ARL-2 (1.17%). In the previous year, maximum (22.05%) infestation was recorded in accession, Kainoor and minimum (1.25%) was in ODR. The leaf miner infestation was not at all reported in Pathannur, ARL-1 and ARL-2 during last year.

Table 3.66 : Screening of accessions to locate tolerant / resistant types to major insect pests of the region at Madakkathara

Accession score	TMB damage (% infestations)	Leaf miner	Thrips	Apple and Nut borer
K-1	0.02	4.50	0.00	0.30
K-3	0.26	1.20	0.00	1.08
K-5	0.17	2.30	0.00	0.40
Mannar	0.31	1.90	0.00	1.00
Kainoor	0.05	2.20	0.00	0.20
Ummannoor	0.20	1.90	0.00	11.3
Kottukkal	0.13	2.30	0.00	1.28
Peechi	0.31	2.60	0.00	0.53
Kunjithai	0.02	2.10	0.00	1.00
Pathannur	0.01	1.60	0.00	0.40
ARL-1	0.07	1.65	0.00	0.10
K-2	0.04	2.50	0.00	0.20
ARL-2	0.02	1.17	0.00	0.30
ODR	0.01	2.00	0.00	0.30

Mean of April - March values

Thrips infestation was absent in Kottukkal and ARL-2. During last year also, thrips infestation was comparatively in a lower range in these accessions. The maximum score was recorded by Ummannur (0.008). Apple and nut borer incidence was very low in all accessions during the reporting year except in Ummannur, which recorded 11.3 per cent.

VENGURLA

The observations on incidence of TMB on cashew were recorded throughout the year with an interval of 8 days. The variety NRCC Selection 1 recorded lowest thrips infestation. Whereas, it was maximum on Vengurle-5. In case of tea mosquito bug the lowest incidence was observed on 3/33 whereas, it was maximum on variety Vengurle- 8.

Table 3.67 : Screening at AICRP – Cashew, Vengurle (April to Feb.)

Varieties	TMB (0-4 scale)	Thrips (0-4 scale)
Vengurla -1	0.21	0.27
Vengurla -2	0.20	0.31
Vengurla -3	0.17	0.26
Vengurla -4	0.15	0.26
Vengurla -5	0.15	0.16
Vengurla -6	0.16	0.30
Vengurla -7	0.27	0.30
Vengurla -8	0.12	0.28
Hy. 320	0.15	0.20
Hy. 303	0.13	0.29
M- 44/3	0.25	0.20

Table 3.67 continued...

Varieties	TMB (0-4 scale)	Thrips (0-4 scale)
30/1	0.14	0.21
10/19	0.20	0.20
3/28	0.210	0.27
NRCC Sel. 1	0.16	0.06
NRCC Sel. 2	0. 25	0.21
3/33	0.01	0.21
15/4	0.16	0.19
Goa 11	0.23	0.07

VRIDHACHALAM

Screening of the available cashew accessions was made to locate the tolerant against TMB and other foliar feeding insects. The data pertaining to reaction of different accessions indicate that all the MLT entries and hybrids are prone for TMB infestation by varying degree of susceptibility. The damage score for TMB infestations in various MLT entries ranged from 1.2-3.5 (Table 3.68). The score was low in ME 20/1 with mean damage score of 1.2. In other cashew entries, the mean damage score ranged between 1.8 and 3.5. So, none of the cashew entries have shown immune or resistant reactions to TMB infestation under field condition.

Table 3.68 : Screening of MLT entries against major pests of cashew at Vridhachalam

MLT entries	TMB mean damage score 0-4 scale in 52 leader shoots	Leaf & blossom webber % shoot damaged / 52 leader shoots	Leaf roller (% of rolled leaves) on five laterals	Leaf miner (% of mined leaves) on five laterals	Inflorescence caterpillars (% of damaged panicle out of 52 panicles)
H 1598	2.4	2.8	1.2	1.2	0.0
H 1600	2.0	3.2	1.3	1.0	0.0
H 1608	2.3	3.0	2.0	1.3	0.0
H 1610	2.5	3.2	1.3	2.0	0.0
H 129	2.8	3.5	3.0	2.0	0.0
H 40	3.5	1.8	2.0	2.6	0.0
H 2/15	2.8	3.0	1.3	1.0	0.0
H 2/16	3.5	2.3	2.0	2.0	0.0
H 33/3	1.8	2.8	1.2	2.8	0.0
H 44/3	2.0	2.3	1.3	1.3	0.0
M 26/2	2.6	3.0	1.0	3.3	0.0
ME 20/1	1.2	2.2	1.0	1.3	0.0
VTH 30/4	2.8	3.0	2.2	1.3	0.0
VTH 59/2	3.0	3.0	0.0	1.0	0.0
V 2	2.8	2.3	1.0	1.0	0.0
V 3	3.0	2.3	1.0	3.0	0.0
V 4	3.0	2.8	1.0	2.3	0.0
V 5	1.8	3.0	2.3	2.6	0.0

Screening of F1 hybrids revealed that all the cross combinations were susceptible to TMB infestation. However, the damage score was low (2.0) in H 10, H 14 and H 16 followed by H 13 and H 17 with a mean damage score of 2.2 and 2.3 respectively (Table 3.69).

Table 3.69 : Screening of F1 hybrids for tolerance to cashew pests at Vridhachalam

Hybrid Number	Cross combination	TMB mean damage score 0-4 scale in 52 leader shoots	Leaf & blossom webber % shoot damaged /52 leader shoots	Leaf roller (% of rolled leaves) on five laterals	Leaf miner (% of mined leaves) on five laterals	Apple & nut borer (% of apples damaged / 52 panicles)
H 10	M 10/4 x M 26/1	2.0	3.0	2.3	1.6	0.0
H 11	M 10/4 x M 45/4	2.6	3.6	3.0	1.3	0.0
H 12	M 10/4 x M 75/3	2.5	3.6	2.6	0.0	0.0
H 13	M 26/2 x M 26/1	2.2	3.3	2.3	1.0	0.0
H 14	M 26/2 x M 45/4	2.0	4.8	2.6	1.0	0.0
H 15	M 26/2 x M 75/3	2.3	4.6	2.6	1.8	0.0
H 16	M 44/3 x M 26/1	2.0	4.8	2.3	2.3	0.0
H 17	M 44/3 x M 45/1	2.3	4.6	2.6	2.0	0.0

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

CHAPTER II : ORGANISATION

INTRODUCTION

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

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

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

The headquarters of the independent cashew project was shifted to ICAR-DCR, Puttur (then National Research Centre for Cashew, Puttur) in 1986. Presently, there are ten coordinating Centres and one sub Centre, four in the East Coast viz., Bapatla, Bhubaneswar, Jhargram, Vridhachalam, four in the West Coast viz., Pilicode, Madakkathara, Vengurla, Paria and three centres, one each in the plains region at Chintamani in Karnataka, at Jagdalpur in Chhattisgarh and at Darisai in Jharkhand and three co-operating centres - Goa, Kanabargi in Belgaum and Tura in Meghalaya.

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

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

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

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

The centres of the East Coast are located at Bapatla, Bhubaneshwar, Jhargram and Vridhachalam. This zone receives low to medium rainfall ranging from 800 mm to 2000 mm annually and is distributed over a period of 7-8 months from June to January. The soil is mainly sandy, red sandy loam, red loam and laterite. Bapatla centre is situated at an elevation of 54.9 m from mean sea level (MSL) with 40° 54' latitude and 80° 28' longitude. At Bapatla the annual average rainfall is 1167 mm and the temperature ranges from 17.3 to 37.8° C; the soil is sandy soil with low organic matter, medium N, low P_2O_5 and K_2O. Average water

holding capacity (AWC) of soil is 100 mm and the climate is sub humid (dry). At Bhubaneshwar average rainfall is 1550 mm and the temperature ranges from 14.3 to 37.1° C. The soil is red soil, red loamy and laterite. The climate is sub humid (dry), AWC 100 mm. The Jhargram centre is located 87° longitude and 78.8° latitude. At Jhargram average rainfall is 1622 mm and the temperature ranges from 11.3 to 39.4° C. The soil is red, laterite, shallow depth gravels, low in organic matter, N and high in P_2O_5 and K_2O. The climate is sub humid (dry), AWC 200 mm. At Vridhachalam average rainfall is 1215 mm and the temperature ranges from 18.7 to 35.7° C, the soil is red laterite, low in organic matter and N, medium in P_2O_5 and high in K_2O. The climate is semi arid (dry), AWC 125 mm.

The centres in the West Coast are located at Madakkathara, Pilicode, Vengurla and Navasari and a cooperating centre at Goa. This zone receives rainfall ranging from 2800 mm to 3800 mm annually and is distributed over a period of 7-9 months from April/June to December. The soil is typically sandy, sandy loam, sandy clay loam and laterite (oxisol). Madakkathara receives an average rainfall of 3550 mm and the temperature ranges from 22.0 to 36.2° C, the soil is laterite (oxisol), medium in N, low in P and medium in K contents. The climate is per humid and AWC is 150 mm. At Vengurla average rainfall is 2916 mm and the temperature ranges from 17.4 to 32.9° C. Centre is situated at an elevation of 90m above MSL; the soil is sandy loam to sandy clay loam with high organic matter, N, K and low in P. The climate is humid and AWC is 150 mm. Paria centre is characterized by heavy black soils and receives an average annual rainfall of 2200mm and temperature ranged from 18.5°C to 33.0°C with a mean RH of 70.22 percent.

Maidan tract characterized by even land has Chintamani, Darisai, Jagdalpur centres and Co-operating centre at Arabhavi in this region. Chintamani comes under Region III (Southern dry region), Eastern dry zone (zone V) of Karnataka and receives average rainfall of 789mm and the temperature ranges from 13.9 to 34.5° C. Centre is situated at an elevation of 300m above MSL, the soil is red sandy loam, deficient in N, medium in P_2O_5 and high in K_2O. The climate is semi arid (dry), AWC is 150mm. Darisai Centre has well drained loamy soil and receives about 1200 mm of rain during June to October. Jagdalpur is located at 17° 45' to 20° 34' N and 80° 15' to 82° 15' E longitude with altitude ranging from 550 m to 850 m above MSL with average annual rainfall ranging from 1200-1400mm. The maximum and minimum temperatures are 41° C and 6° C, respectively. Texturally soils are sandy loam to silty loam, with very poor moisture retaining capacity having shallow depth with poor organic matter (0.05%) and pH value (5.5 - 6.5) about normal. Arabhavi centre is situated in North transitional zone (zone-8) of Karnataka and soils are texturally red sandy loams and having medium to deep soil depth. The average annual rainfall is 1200 mm. A cooperating centre in Barapani / Tura in Meghalaya region is characterized by hilly terran and has deep black loamy soils. The average rainfall ranges between 2500 – 4000mm spread out durind the months of June to November. The cooperating centre at Goa is characterized by lateritic soils with shallow to medium depth. The centre is situated at altitude of 25-40m above the MSL. This centre receives rainfall ranging from 2800 mm to 3800 mm spread out during June to December.

2. TRANSFER OF TECHNOLOGY :

BAPATLA

The scientists have participated in training programme on production technology, crop management, plant protection measures, value addition and Post harvest management held at Eluru, Jangareddy, Tadepalligudem and Nellore District. They have also participated in the training programme on Cashew Production Technology organized by KVK-Pandirimamidi.

The scientists organized training programme on "Production technology on Cashew and pest and disease management in cashew to the tribal farmers under Tribal Sub plan at BREDS (NGO organization), Pathapatnam, Srikakulam District in which 150 farmers had participated. A district level Seminar program on same aspect was organized at Palasa, Srikakulam district and about 120 farmers had participated.

The centre organized a district level training programme on "Production technology on Cashew and pest and disease management in cashew to the tribal farmers at Narsipatnam Market yard, Visakhapatnam district with the financial assistance from the Directorate of Cashew and Cocoa Development-Kochi and at Gadhabapalem village of Visakhapatnam district with the financial assistance from ICAR - Directorate of Cashew Research, Puttur.

Forest department, Kavali and farmers from different mandals of Srikakulam were given training on "cashew production technology and value addition" and information on "pest and disease management in cashew".

BHUBANESWAR

Scientists of the centre imparted two days training programme on "Cashew apple Utilization" organized by OSCDC, Govt of Odisha, Bhubaneswar. They have also attended the "Comprehensive Cashew Development Plan in Odisha", organized by Odisha State Cashew Development Corporation. Training was also imparted to the cashew growers of Ganjam district of Odisha on" Cashew Cultivation" organized by Paradeep Phosphate Limited, Odisha.

HOGALAGERE

As resource persons, the scientists of the centre delivered 11 lectures in the cashew programmes organized by State Department of Agriculture and Horticulture, Chikkaballapur and Kolar districts, College of Horticulture, Kolar and SKDRDP, Srinivasapura.

JAGDALPUR

The scientist of the centre has taken up one day training programme to about 120 participants on 'Production technologies, Plant Protection and Processing of cashew '.

JHARGRAM

The scientist of the centre functioned as resource person in the farmers training programme on cashew cultivation technology organized by Gramin Vikas Trust, KRIBHCO at Kuilapal, Purulia Dist., West Bengal.

MADAKKATHARA

The scientists of the centre had organized twelve training programmes of one day duration on high yielding varieties of cashew, pest management in cashew, cashew apple processing and important cashew apple products for the farmers of Karnataka and Tamil Nadu. Two training programmes of 3 days were also conducted for women group on cashew apple processing. The scientists had attended "National Seminar on Cashew" and "National level training on cashew" held at RFRS, Vengurle. The

scientists have conducted training on cashew apple utilization for unemployed women funded by DCCD. A state level seminar on cashew funded by DCCD was organized during May 2015. The exposure visit of farmers was conducted from 6th to 12th April 2015 regarding cashew cultivation and processing in Vengurla and Goa. One state level seminar on cashew highlighting scientific cultivation of cashew was conducted on May 16th and 17th 2015.

During the year, 5 exhibitions were arranged to depict the research achievements of the station as well as for the sale and display of cashew apple products and cashew grafts. Field visits were made to progressive cashew farmers plot at Marakkal, Thrissur with the farmer's team from Tamil Nadu and conducted diagnostic field visit at Mankada, Kootilangadi and Manjeri, Wandoor.

Under tribal sub plan, the centre has taken up activities on training on nursery management and top working, training cum awareness programme on cashew in tribal areas, Small scale nursery on tribal farmers field and demonstration of plant protection measures in cashew. The production forecast of cashew for Kannur and Kasaragod districts is being done by the centre for the benefit of farmers, traders and entrepreneurs of cashew.

PARIA

The scientists of this centre organized two farmers trainings on scientific cashew cultivation at cluster level and about 300 farmers had participated. Farmer Scientist meet was organized at taluk level at Kaparada to know the problems faced by the cashew growers of the area and there were about more than 60 farmers had participated.

PILICODE

The scientist of the centre were involved in conducting 5 trainings in which around 150 women farmers were given practical training in cashew apple processing and training was also conducted on value addition of cashew apple and nut processing in which about 25 farmers had attended. The scientist of the centre participated in the National Seminar on Strategies for developing cashew held at RFRS, Vengurle.

VENGURLA

The Centre had conducted "National training on cashew" sponsored by DCCD in which about 48 participants had attended. A Horticulture fair cum field day on cashew was organized in which 150 farmers attended the programme. National Seminar on "Strategies for development of Cashew" was organized in which 91 participants were present. The scientists also organized 2 demonstrations for about 100 farmers on cashew stem and root borer management at Asni, Dodamarg Taluk, Zarebambar Dodamarg Taluk.

VRIDHACHALAM

The Centre had laid out 13 demonstration on Demonstration plots on High Density Cashew planting of VRI (Cw) H1 variety at Solan Kurichy village, Udayarpalayam Taluk, Ariyalur District. Awareness trainings on cashew cultivation and demonstrations were taken up for 75 tribal farmers of Keeraikadu, velikadu villages, Kolli hills, Namakkal district of Tamilnadu. A district level seminar on Cashew funded by DCCD, Cochin was organised at KVK, Ariyalur and 150 farmers of Ariyalur district were imparted training on Cashew production technology and high yielding varieties in cashew. The AICRP scientists have taken up field visit to Kallamedu, Panruti block TAFCORN cashew plantations and explained about drought management and protection of cashew plantation.

Pruning and foliar spray demonstrations in High density cashew plantations were organized at Vegakollai village, Panruti Taluk by the scientists along with ADH, Panruti funded by DCCD, Cochin. The three days Farmers Training Programme on Cashew production technologies, district level seminar on cashew cultivation technologies for farmers of Pudukottai and Sivagangai were also organized by AICRP scientists which was funded by DCCD, Cochin. Four practical trainings were also taken up by the scientists on cashew nursery and production technology.

3. PUBLICATIONS

RESEARCH PAPERS :

BHUBANESWAR

Mohapatra, A., Dash, D.K., Tripathy, P., Sethi, K. and Dash, A. K. 2015. Impact of organic inputs on growth and yield in cashew. *Trends in Bioscience 8*(4):1086-1090.

Sethi, K., Lenka, P. C., Tripathy, S. K., Muhkerjee, S. K. and Dash, A. K . 2015. Evaluation of cashew *(Anacardium occidentale L.)* hybrids for nut and apple parameters. *Research in Environment and Life Science* 8(4): 549-552.

Tripathy, P., Sethi, K., Patnaik, A. K. and Mukherjee, S. K. 2015. Nutrient Management in High Density Cashew Plantation under Coastal Zones of Odisha. *International Journal of Bio-resource and Stress Management,* 6(1):094-097.

Tripathy, P., Sethi, K. and Mukherjee, S. K. 2015. Evaluation of Released Cashew varieties under Odisha Condition. *International Journal of Bio-resource and Stress Management,* 6(5):566-571.

Tripathy, P., Sethi, K. Patnaik, A. K., Mukherjee, S. K. and Saroj, P. L. 2015. Efficacy of plant density and nutrient management in cashew (*Anacardium occidentale L.*). *Progressive Horticulture,*47(2):213-217.

Sethi, K., Lenka, P.C. and Tripathy, S. K. 2015. Evaluation of Cashew (*Anacardium occidentale L.*) hybrids for vegetative parameters and nut yield. *J. Crop and Weed* 11(1):152-156.

Sethi, K., Mohapatra, K. C., Lenka, P.C. and Pattnaik, A. K. 2015. Evaluation of cashew types under agro-climatic condition of Odisha. *Trends in Biosciences* 8(10):2598-2602.

Sethi, K., Tripathy, P. and Mohapatra, K. C. 2015. Variability and heritability of important quantitative characters in cashew (*Anacardium occidentale L.*). *Environment and Ecology* 34(4B): 1795-1798.

Tripathy, P., Sethi, K. and Mukherjee, S. K. 2015. Screening of cashew (*Anacarduim occidentale L.*) types for RTS Preparation. *Trends in Biosciences* 8(12):3064-3067.

Sethi, K., Mohapatra, K. C., Tripathy, P, and Dash, P. C. 2015. Performance of cashew types under Bhubaneswar condition. *Journal of Plantation Crops,* 43(2): 145-148.

Sethi, K., Lenka, P.C. and Tripathy, S. K. 2016. Evaluation of cashew (*Anacarduim occidentale L.*) hybrids for flowering parameters. *International Journal of Farm Sciences,* 6(1): 49-60.

MADAKKATHARA

Sobhana, A. and Mathew,J. 2015. Novel products from cashew apple- jelly and cake. *Food Science Research Journal.* 6(1): 45-49

Sobhana, A., Mathew,J., Mredhula Raghavan. and Ambili Appukuttan.2015. Development of value added products from cashew apple powder. *International Journal of Tropical Agriculture.* 33(2) part Iv: 1635-1639

Sobhana, A., Mathew, J. , Mini, C., and Pushpalatha P.B . 2015. Technologies for cashew apple utilization on commercial scale - *The cashew and cocoa Journal.* 4(1):21-28.

Sobhana, A. and Mathew, J., 2015. Vinegar production from cashew apple. *International Journal of Processing and Post harvest technology.* 6(2) 150-156

VENGURLA

V.K. Zote, R.C. Gajbhiye, S.P. Salvi and B.R. Salvi, 2015. Population dynamics of tea mosquito bug and thrips of cashew in relation to weather parameters in Konkan region of Maharashtra. Paper published in *J. Pestology* Vol.39(7).

R.C. Gajbhiye, S.N. Pawar, S.P. Salvi and V.K. Zote., 2015. Early performance of Cashew (*Anacardium occidentale* L.) genotypes under Konkan region of Maharashtra. Paper published in J. Indian Society of Coastal Agricultural Research, Vol. 33 (2), 2015

R.C. Gajbhiye, S.N. Pawar, S.P. Salvi and V.K. Zote, 2016. Effect of drip irrigation on growth and yield of cashew (*Anacardium occidentale* L.) under south Konkan region of Maharashtra. Paper published in *International J. Green Farming,* 7(2): 492-494.

VRIDHACHALAM

Jeeva S., Aneesa Rani, M.S., Ambethgar, V. and Vaidyanathan V, 2015. Cashew Germplasm of Tamilnadu: Characterization and Cataloguing. *Acta Hortic.* 1080:151-154

Jeeva S., Aneesa Rani, M.S., Ambethgar, V. and Vaidyanathan V, 2015. Biodiversity and Consevation of Cashew in Tamilnadu. *Acta Hortic.* 1080:14

Murali, K., Prasanna Kumar, P. and M. S. Aneesa Rani 2015. Effect of tertiary shoot pruning and foliar spray of nutrients on flowering and yield of cashew (*Anacardium occidentale* L.) under high density planting system In: *The Bioscan* 10(1): 411-415

Keisar Lourdusamy, D., and Nalina, L, 2015. Text Book on Plantation Crops (for Diploma Agri students in Tamil) published by: Scientific Tamil Society, New Delhi. ISBN No. 978-93-84234-33-1

SEMINAR/SYMPOSIA/PROCEEDINGS :

BHUBANESWAR

Mohapatra, M., Dash, D.K., Tripathy, P., Sethi, K., Mukherjee, S. K. and Dash, A. K. 2015. Performance of certain cashew (*Anacardium occidentale* L.) selections for nut yield. In: National Symposium on Modern Agro-Technologies for Nutritional Security and Health, 21th -23th Apr. Solan, p-212.

Sethi, K., Lenka, P.C. and Tripathy, S. K., Mukherjee, S. K. and Dash, A. K. 2015. Evaluation of Cashew (*Anacardium occidentale* L.) hybrids for flowering parameters. In: National Symposium on Modern Agro-Technologies for Nutritional Security and Health, 21th -23th Apr. Solan, p-212-213.

Sethi, K.; Lenka, P. C., Tripathy, P., Mukherjee, S. K. and Dash, A. K. 2015. Studies of Heterosis in Cashew. In: 2nd International Conference on Boi-resource and Stress Management" organized at PJTSAU, 7th -10th Jan., Hyderabad, p-30.

Tripathy, P., Sethi, K. and Mukherjee, S. K. 2015. Evaluation of Cashew Varieties under Odisha condition. In: 2nd International Conference

on Boi-resource and Stress Management" organized at PJTSAU, 7th -10th Jan., Hyderabad, p-182.

HOGALAGERE

N. Aswathanarayana Reddy, M.K. Honnabyraiah, B. Subramanyam and A. Sreenatha, 2014, Seasonal incidence of cashew apple and nut borer, *Thylecoptila panerosema* in maidan parts of Karnataka (P-177). In: Proceedings of *International Symposium on Plantation Crops* held on 10-12th December 2014 at Indian Institute of Spices Research (IISR), Calicut (Khozikode), Kerala, p-144.

M.K. Honnabyraiah, N. Aswathanarayana Reddy, B. Subramanyam and A. Sreenatha, 2014, Performance of high density planting system for yield maximization in cashew under maidan parts of Karnataka, India (O-65). In: Proceedings of *International Symposium on Plantation Crops* held on 10-12 December 2014 at Indian Institute of Spices Research (IISR), Calicut (Khozikode), Kerala, p-66.

MADAKKATHARA

P.B and Sobhana.A. 2015 cashew apple processing- An over view. In: *Souvenir National Seminar on Cashew* held on 13th and 14th March 2015 at Goa.

Smitha, M.S. and Pushpalatha, P.B. 2015. Alternate management strategies for the cashew stem and root borer Plocaederus ferrugenius L. (Coleoptera:Cerambycidae). In: abstracts of the *National Seminar on strategies for development of cashew* held on 19th and 20th February 2016 at RFRS, Vengurlla p-69.

Smitha, M.S. and Nalini, P.V, Post extraction prophylaxis with insecticides for the management of cashew stem and root borer *Plocaederus ferrugenius* L. (Coleoptera:Cerambycidae). In: abstracts of the National Seminar on strategies for development of cashew held on 19th and 20th February 2016 at RFRS, Vengurle p-65.

POPULAR ARTICLE :

PARIA

Popular article on *'Kaju ni kheti'* in vernacular language in *Ek prayash* Gujarati monthly magazine.

BOOK EDITED :

PILICODE

Meera Manjusha A.V., B. Jayaprakash Naik and P.K. Retheesh, 2014, Cashew based cropping systems: An effective approach for integrated land use planning in hard lateritic regimes of Northern Kerala. Integrated Land Use Planning for Sustaninable Agriculture and Rural Development. Edited by Dr. M.V. Rao, Dr. V. Suresh Babu, Dr. K. Sumanchandra, Dr. G. Ravindrachary, Apple Academic Press Inc.

4. STAFF POSITION

HEADQUARTERS

Directorate of Cashew Research, Darbe PO, PUTTUR-574 202, DK, KARNATAKA

Phone No.: 08251-231530, 233490 (R) and 230992 (R)
EPABX : 08251-230902, 236490 Fax No. : 08251-234350

E-mail : cashewresputr@gmail.com, director.dcr@icar.gov.in, dircajures@yahoo.co.in, dircajures@gmail.com,

Website : http://www.cashew.res.in

Project Coordinator	:	Dr. P.L. Saroj
Scientist-in-charge	:	Dr. Mohan G.S.
Secretarial Assistance	:	Smt. Reshma K.

PROJECT CENTRES

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

Phone No. : 08643 - 225304 Fax No. : 08643 – 225304

E-mail : cashewresbapt@gmail.com, headcrs_bapatla@drysrhu.edu.in

Horticulturist	:	Dr. K.M. Yuvaraj (From 10.12.2014)
Asstt. Horticulturist	:	Mr. K. Uma Maheswara Rao
Asstt. Entomologist	:	Vacant
Sr. Technical Assistant	:	Sri. M. Sambasiva Rao
Jr. Technical Assistant	:	Mr. Samuel
Grafter	:	Mr. V. Kantha Rao

Cashew Research Station, (Orissa University of Agriculture and Technology), Bhubaneswar 751 003, Orissa.
Phone No. : 0674-2397383 Fax No. : 0674-2397780

E-mail : cashewresbhub@gmail.com, aicrpcashew_bbsr@yahoo.co.in

Horticulturist	:	Dr. Pradyumna Tripathy Dr. P.K. Panda (From 11.6.2015)
Jr. Horticulturist	:	Mrs. Kabita Sethi
Jr. Entomologist	:	Dr. S.K. Mukherjee
Sr. Technical Assistant	:	Sri. A. Mansingh
Jr. Technical Assistant	:	Sri. C.R. Das
Grafter	:	Sri. D. Almango

Horticulture Research Station, (University of Horticultural Sciences), Hogalagere-563 125, Srinivaspura Taluk, Kolar District, Karnataka.

Phone No. : 08157 - 245022

E-mail : cashewreshogl@gmail.com, hrshogalagere@gmail.com

Horticulturist	:	Vacant
Jr. Horticulturist	:	Dr. V.A. Ramachandra
Jr. Entomologist	:	Dr. N. Aswathanarayana Reddy
Sr. Technical Assistant	:	Mr. B. Subramanyam
Sr. Technical Assistant	:	Vacant
Grafter	:	On Contractual Basis

Zonal Research Station, (Birsa Agricultural University), Darisai, East Singhbhum Dist., Jharkhand

Phone No. : 0651-2450060 Fax No. : 0651-2450060

E-mail : cashewresdari@gmail.com, drprshntkumar@yahoo.com

Horticulturist	:	Dr. Pawan Kumar Jha

SG College of Agricultural and Research Station, (Indira Gandhi Agricultural University), Jagdalpur - 494 005, Bastar District, Chattisgarh

Phone No. : 07782-229360, 229150 Fax No. : 07782-229360

E-mail : cashewresjagd@gmail.com, zars_igau@rediffmail.com

Jr. Horticulturist	:	Mr. M.S. Paikra
Jr. Entomologist	:	Dr. A.K. Gupta
Jr. Technical Assistant	:	Contractual basis
Grafter	:	Mr. Jagdev

Regional Research Station, (Bidhan Chandra Krishi Vishwa Vidyalaya), Jhargram 721 507, Midnapore West District, West Bengal

Phone No. : 03221-205500

E-mail : cashewresjhar@gmail.com, poduvalmini@gmail.com

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

Cashew Research Station, (Kerala Agricultural University), Madakkathara 680 651, Thrissur District, Kerala

Phone No. : 0487-2370339 Fax No. : 0487-2370019

E-mail : cashewresmadk@gmail.com, crsmadakkathara@kau.in

Horticulturist	:	Dr. P.B. Pushpalatha Dr. P.V. Nalini (From 26.09.2015)
Jr. Breeder	:	Mr. Gregory Zachariah
Jr. Entomologist	:	Dr. M.S. Smitha
Sr. Technical Assistant	:	Dr. A. Sobhana
Jr. Technical Assistant	:	Mr. M.K. Manoj
Grafter	:	Vacant

Agricultural Experimental Station, (Navsari Agricultural University), Paria, Pardi Taluk, Valsad-396 145, Gujarat

Phone No : 0260 2337227 Fax No. : 0260 2337227

E-mail : cashewrespari@gmail.com, aesnau@yahoo.co.in

Horticulturist	:	Dr. J.P. Makati
Jr. Entomologist	:	Mr. S.G. Parmar

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

Phone No. : 0467-2260450 FAX No. : 0467-2260554

E-mail : cashewpili@gmail.com, adrrarspil@rediffmail.com

Jr. Horticulturist	:	Dr. Meera Manjusha A.V.
Jr. Technical Assistant	:	Contractural Basis

Regional Agricultural Research Station, (Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth), Vengurla 416 516, Sindhudurg District, Maharashtra.

Phone No : 02366-262234 Fax No. : 02366-262234

E-mail : cashewresveng@gmail.com, adrrfrsvengurle@yahoo.com

Horticulturist	:	Mr. R.C. Gajbhiye
Jr. Breeder	:	Mr. R.T. Bhingarde
Jr. Entomologist	:	Mrs. V.K. Zote
Sr. Technical Assistant	:	Mr. S.P. Salvi
Jr. Technical Assistant	:	Mr. A.L. Patekar

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

Phone No. : 04143-238231 Fax No. : 04143-238120

E-mail : cashewresvrid@gmail.com, arsvri@tnau.ac.in, rrsvri@tnau.ac.in

Horticulturist	:	Dr. M.S. Aneesa Rani (10.4.2015)
Jr. Horticulturist	:	Dr. D. Keisar Lourdusamy
Jr. Entomologist	:	Dr. S. Jaya Prabhavathi (13.4.2015)
Sr. Technical Assistant	:	Mr. M.K. Sendilnayagam
Jr. Technical Assistant	:	Mr. C. Jayachandran
Grafter	:	Mr. C. Gopalakrishnan

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

Phone : 08332 – 284 502 (O) Fax No. : 08332 – 284684

Email : rudratp@gmail.com, dikrccha@yahoo.co.in

Horticulturist	:	Dr. R.T. Patil

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

Phone : 03651 - 222535

E-mail : shyam_westgaro@rediffmail.com director@icarneh.ernet.in, kvkwestgarohills@rediffmail.com

Horticulturist	:	Dr. A.S. Singh

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

Phone : 0832 – 2284678 / 2284679 (O)

E-mail : director@icargoa.res.in

Horticulturist	:	Dr. A.R. Desai

5. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2015-16

Allocation (₹ in lakhs)

Centre	Details of sanctioned provision					ICAR share
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total	
Bapatla	32.67	0.25	3.80	0	36.72	27.54
Bhubaneshwar	51.94	0.75	5.75	0	58.44	43.83
Hogalagere	30.67	0.60	3.00	0	34.27	25.70
Darisai	14.67	0.30	1.58	0	16.55	12.41
Jagdalpur	14.50	0.50	3.00	0	18.00	13.50
Jhargram	20.42	0.50	5.75	0	26.67	20.00
Madakkathara	55.22	0.50	5.75	0	61.47	46.10
Paria	21.33	0.25	3.00	0	24.58	18.44
Pilicode	8.41	0.25	2.00	0	10.66	8.00
Vengurla	40.60	0.50	5.70	0	46.80	35.10
Vridhachalam	53.64	0.60	5.70	0	59.94	44.95
KRCCH, Arabhavi	0.00	0.16	5.17	0	5.33	4.00
ICAR Res. Compl. For Goa, Goa	0.00	0.35	4.35	0	4.70	4.70
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.35	3.65	0	4.00	4.00
Payment of Pay arrears to Chintamani Centre (ICAR Share)	8.40	0.00	0.0	0	8.40	8.40
Provision for TA for PC Cell	0.00	1.50	0.00	0	1.50	1.50
Provision for RC for PC Cell	0.00	0.00	1.83	0	1.83	1.83
Total	**344.07**	**7.36**	**60.03**	**0**	**411.46**	**320.00**
Provision for NEH						5.00
Provision for TSP						28.25
					GRAND TOTAL	**353.25**

Actual Expenditure (₹ in lakhs)

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	31.44	0.48	4.51	0	36.43	27.32
Bhubaneshwar	50.67	0.75	5.75	0	57.17	42.88
Hogalagere	31.91	0.58	3.00	0	35.49	26.62
Darisai	14.04	0.24	1.46	0	15.74	11.81
Jagdalpur	13.90	0.50	4.65	0	19.05	14.29
Jhargram	15.75	0.43	5.86	0	22.04	16.53
Madakkathara	76.41	0.52	7.26	0	84.19	63.14
Paria	15.18	0.27	4.02	0	19.47	14.60
Pilicode	8.93	0.19	0.67	0	9.79	7.34
Vengurla	39.84	0.36	9.63	0	49.82	37.37
Vridhachalam	50.69	0.67	7.41	0	58.77	44.08
KRCCH, Arabhavi	0.0	0.05	3.25	0	3.30	2.48
ICAR Res. Compl. For Goa, Goa	0.0	0.24	4.34	0	4.58	4.58
ICAR Res. Compl. For NEH Region, Barapani	0.0	0.43	2.00	0	2.43	2.43
Payment of Pay arrears to Chintamani Centre (ICAR Share)	8.40	0.00	0.0	0	8.40	8.40
Provision for TA for PC Cell	0.0	1.50	0.0	0	1.50	1.50
Provision for RC for PC Cell	0.0	0.0	1.83	0	0	1.83
Total	**357.09**	**7.29**	**65.64**	**0**	**428.17**	**327.20**
Provision for NEH						5.00
Provision for TSP						28.25
					GRAND TOTAL	**360.45**

6. METEOROLOGICAL DATA OF DIFFERENT CENTRES

BAPATLA

Month	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
April	34.6	25.2	76	68	1.8	1.0
May	38.0	27.5	68	63	24.2	3.0
June	40.3	29.1	58	46	49.1	3.0
July	36.1	26.5	70	54	132.3	5.0
August	35.3	25.9	72	62	80.8	5.0
September	33.9	25.2	77	70	106.7	7.0
October	33.1	24.0	81	72	163.4	4.0
November	30.6	20.6	87	74	113.0	4.0
December	29.8	18.1	87	69	4.0	2.0
January	30.2	17.1	87	62	0.0	Nil
February	31.2	17.9	88	63	0.6	Nil
March	33.3	22.1	82	66	Nil	Nil

BHUBANESWAR

Months	Temp. (Max)	Temp. (Min)	RH (Max)	RH (Min)	Rainfall (mm)	No. of rainy days	BSH
June	36.6	26.3	87.0	61.0	111.0	10	5.1
July	31.4	24.7	94.0	82.0	410.5	22	2.8
August	33.0	24.7	93.9	78.5	261.2	22	4.7
September	31.6	24.2	95.1	76.6	383.1	20	4.4
October	31.7	22.0	93.3	63.8	163.1	10	6.3
November	30.9	18.0	90.0	44.0	0	0	7.1
December	27.7	13.9	88.0	45.0	0	0	5.8
January	27.8	14.2	91.0	43.0	21.5	2	6.7
February	32.5	17.0	94.0	39.0	18.4	1	8.2
March	35.8	21.5	91.0	40.0	24.8	3	8.0
April	37.1	24.1	88.4	50.3	115.8	6	7.2
May	38.9	27.0	87.8	51.1	27.4	5	7.7

HOGALAGERE

Month	Temp (°C)		R.H %		Sunshine (hrs)	Normal rainfall (mm)	Rainfall received (mm)	No. of rainy (days)
	Max.	Mini.	Morn.	Even.				
April	33.7	22.73	73.80	38.80	3.20	27.40	4.80	1.00
May	33.7	22.75	70.9	44.50	4.00	69.20	150.80	3.00
June	28.87	20.10	67.86	40.90	6.40	60.60	75.10	5.00
July	30.48	12.26	74.47	59.30	5.00	74.70	34.20	2.00
August	29.69	24.77	78.71	64.95	4.40	96.90	168.30	5.00
September	29.85	20.49	77.68	68.76	5.50	150.60	58.40	4.00
October	28.72	21.95	80.28	69.44	4.40	126.20	4.70	1.00
November	27.23	18.81	80.18	61.65	5.40	61.90	0.00	2.00
December	26.66	17.65	73.85	51.75	3.10	16.30	43.60	2.00
January	27.24	17.87	72.50	41.40	4.50	2.10	6.20	1.00
February	29.90	19.47	70.53	33.78	9.50	6.50	0.00	0.00
March	32.54	21.68	71.06	52.43	8.20	11.60	35.20	4.00

JAGDALPUR

Month	Temp ^{0}C		Rainfall	Relative Humidity		Vapour Pressure		Wind	Evap. Vel.	Bright Sunshine
	Max.	Min.	mms	I	II	I	II	Kmph	mms	hours
April	37.4	22.5	26.6	79.3	33.4	21.2	17.2	3.8	5.0	5.6
May	36.9	25.4	73.0	80.0	37.0	28.4	18.0	5.3	5.4	6.6
June	36.0	26.1	151.3	79.7	44.9	23.5	19.7	6.8	7.3	4.1
July	28.8	23.9	336.0	89.4	73.6	22.7	21.7	6.4	2.1	0.9
August	29.4	24.4	338.9	91.8	75.4	23.2	23.4	4.2	3.2	2.4
September	29.2	23.2	301.7	94.0	74.2	22.7	22.9	2.3	2.7	2.7
October	29.4	20.4	112.4	95.1	68.1	20.3	21.3	4.4	2.6	6.1
November	29.3	14.3	0.8	95.1	45.6	14.0	14.9	2.9	2.9	7.0
December	27.1	10.5	0.0	93.7	39.8	9.9	11.0	2.3	2.4	5.7
January	27.3	10.0	7.0	94.7	36.0	9.6	9.7	2.9	2.7	7.8
February	31.7	12.9	3.0	92.2	29.8	12.1	10.6	2.9	4.0	8.1
March	33.9	19.2	13.8	87.5	34.4	17.4	14.6	4.1	7.6	6.2

JHARGRAM

Month	Temperature (^{0}C)		Relative Humidity %	Total Rainfall (cm)	No. of Rainy Days
	Max.	Min.	Average		
April	40.17	23.83	69.60	29.80	0.00
May	39.16	25.35	82.58	43.68	2.42
June	37.77	26.43	85.27	60.93	8.77
July	32.68	26.29	90.87	70.81	8.19
August	32.58	25.74	91.16	70.87	9.81
September	33.30	25.10	89.90	71.77	3.03
October	31.97	21.81	89.69	63.27	5.13
November	30.20	14.30	0.00	0.00	0.00
December	26.61	10.68	87.94	35.74	0.03
January	26.19	11.52	87.19	36.71	0.26
February	31.54	15.07	0.00	0.00	0.00
March	34.26	19.65	75.29	38.00	0.84

MADAKKATHARA

Month	Average Temperature (^{0}C)		Relative Humidity (%)	Total Sunshine hours (h)	Total Rainfall (mm)	Total Rainy days (No.)
	Max.	Min.	Average			
April	35.24	25.50	73.00	217.70	126.50	5
May	32.70	25.13	78.75	159.8	215.10	5
June	30.67	24.27	85.75	79.10	479.10	21
July	29.18	23.12	88.40	7.10	918.40	30
August	32.30	23.20	85.70	84.10	473.40	19
September	31.40	23.30	81.25	24.20	162.00	11
October	31.90	23.60	80.80	23.00	239.00	15
November	31.60	23.10	68.70	20.80	70.90	4
December	31.95	23.30	66.25	25.30	13.80	1
January	32.50	22.30	57.20	44.20	0	0
February	34.60	23.10	57.00	33.70	0	0
March	35.90	25.00	63.20	32.30	47.20	2

PARIA

Month	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)	Rainfall (mm)	No. of rainy days
April	36.27	19.46	67.59	0.0	0
May	36.34	23.83	64.65	0.0	0
June	35.00	26.64	70.53	58.0	5
July	30.76	24.40	89.48	1172.9	26
August	30.83	24.27	87.48	615.4	17
September	31.64	23.59	82.84	229.1	10
October	36.15	20.65	66.92	1.2	0
November	35.20	17.85	60.56	19.1	2
December	33.08	11.24	52.81	0.0	0
January	30.25	10.32	65.07	0.0	0
February	33.62	12.35	62.38	0.0	0
March	35.10	16.10	59.21	8.6	1

PILICODE

Month	Max. Temp. (°C)	Min Temp. (°C)	Mean RH (%) (Avg.)	Rainfall (mm)	BSH
April	34.5	24.6	74.30	50.43	6.46
May	33.0	24.2	77.89	250.24	6.21
June	31.2	23.6	83.85	576.18	2.48
July	29.2	22.9	88.39	1456.38	0.66
August	29.2	22.9	86.51	754.55	2.06
September	31.0	23.3	80.89	144.74	4.44
October	31.5	23.1	79.44	168.58	3.28
November	32.3	21.3	75.82	83.65	4.49
December	32.4	21.7	74.58	0.00	4.37
January	31.7	19.3	73.79	0.00	6.10
February	32.6	20.0	74.77	0.00	6.76
March	32.8	23.2	73.73	0.00	5.26

TURA

Month	Max. Temp.	Min. Temp.	RS (%)		Rainfall (MM)	Rainy days
			(Max)	(Min)		
April	23.45	13.06	89	68	115.4	0
May	23.85	12.89	83	67	337.4	4
June	29.35	15.93	87	64	756.6	2
July	33.20	23.10	88	50	307.4	6
August	29.52	21.70	75	66	585.3	16
September	28.37	21.10	80	59	645	19
October	29.00	22.12	77	59	37.4	20
November	28.10	20.83	78	60	00	24
December	28.90	21.63	80	56	00	17
January	28.17	9.32	97.67	28.73	32	6
February	30.01	13.60	77.96	41.37	10.20	4
March	34.20	17.86	95.69	13.99	62.60	7

VENGURLA

Month	Temperature (^{0}c)		Humidity (%)		Rain fall (mm)	No. of rainy days
	Max.	Min.	Forenoon	Afternoon		
April	33.71	26.26	82.13	62.37	0.00	00.00
May	33.96	27.60	80.71	65.42	72.80	04.00
June	32.65	27.22	85.90	71.23	358.00	17.00
July	29.56	24.93	89.26	85.00	1178.00	31.00
August	30.23	25.45	89.48	79.03	599.4	26.00
September	30.76	25.39	89.50	77.87	252.6	23.00
October	32.51	24.72	89.55	72.06	226.8	10.00
November	33.63	22.08	89.47	62.23	0.80	02.00
December	32.87	20.12	88.10	56.42	0.20	01.00
January	31.99	16.29	87.61	64.97	0.00	00.00
February	33.03	18.49	89.75	66.89	0.00	00.00
March	32.63	21.43	87.61	64.68	40.80	01.00

VRIDHACHALAM

Month	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%) (Avg.)	Rainfall (mm)	No. of rainy days
April	37.4	24.5	74.5	-	-
May	36.7	26.5	76.9	157.6	5
June	37.5	27.2	74.5	61	3
July	36.3	26.5	76.8	54.6	4
August	35.5	25.6	81.3	164.2	9
September	35.6	25.2	80.4	134.8	6
October	33.8	24.9	83.5	162.8	8
November	29.9	23.5	88.7	148.7	10
December	29.9	23.2	86.8	83.2	8
January	31.3	20.8	85.6	7.4	2
February	33.4	20.6	86.5	-	-
March	35.9	22.9	77.5	-	-

7. LIST OF DCR PUBLICATIONS

Sl. No.	Publication	Price (Rs.)
1	Cashew Production Technology (Revised)	60.00
2	Softwood grafting and nursery management in cashew (Revised)	45.00
3	Annotated Bibliography on Cashew (1985-1994)	75.00
4	Catalogue of Minimum Descriptors of Cashew	
	Germplasm accessions – I	165.00
	Germplasm accessions –II	125.00
	Germplasm accessions –III	128.00
	Germplasm accessions –IV	--
	Germplasm accessions –V	--
5	Database on Cashewnut Processing in India (2003)	100.00
6	Directory of Cashewnut Processing Industries in India (2003)	100.00
7	Process Catalogue on Development of economically viable on-farm Cashewnut Processing	45.00
8	Annotated Bibliography on Cashew (1995-2007)	205.00
9	Soil and water management in cashew plantations	30.00
10	Biochemical characterization of released varieties of Cashew	85.00
11	Pruning and canopy architecturing in cashew	40.00
12	Development of dual mode dryer for raw cashewnuts	90.00
13	Alternate energy utilization of cashew shell cake for thermal application	90.00
14	Cashew Cultivation Practices (Pamphlet)	*
15	Status of Cashew Germplasm Collection in India (Booklet)	*
16	Compendium of Concluded Research Projects (1986-2001)	*
17	Cashew nutritive value (Revised) (Brochure)	*
18	Insect pests of cashew	*

* Free of cost

Price indicated above does not include postage.

Address your enquiries to the Director, ICAR-Directorate of Cashew Research (DCR), Puttur – 574 202, Dakshina Kannada, Karnataka.

****