आखिल भारतीय समन्वित काजू अनुसंधान परियोजना

ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

वार्षिक प्रतिवेदन २०२३

ANNUAL REPORT 2023

काजू अनुसंधान निदेशालय

(भारतीय कृषि अनुसंधान परिषद्)

पुत्तूर - 574 202, दक्षिण कन्नड, कर्नाटक

DIRECTORATE OF CASHEW RESEARCH

(Indian Council of Agricultural Research)

PUTTUR– 574202, DAKSHINA KANNADA

KARNATAKA

ISSN 0972 – 2645

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परियोजना समन्वयकर्ता

PROJECT COORDINATOR

Dr. J. DINAKARA ADIGA

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Correct citation

Annual Report 2023-24. All India Coordinated Research Project on Cashew
ICAR – Directorate of Cashew Research, Puttur 574202 Pages ….
ISSN 0972 – 2645

Published by

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December 2023

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प्राक्कथन

यह, अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की 39 वीं वार्षिक प्रतिवेदन है। यह प्रतिवेदन में जनवरी – 2023 से दिसम्बर – 2024 तक का शोध परिणाम और अन्य जानकारी को शामिल किया गया है।

परियोजना के अंतर्गत 14 केंद्र हैं, जैसे, भारत के पूर्वी तट में चार; बापट्ला (आंध्र प्रदेश), भुवनेश्वर (उड़ीसा), झारग्राम (प.बंगाल) और वृद्धाचलम् (तमिल नाडु); पश्चिम तट पर तीन केंद्र और एक उपकेंद्र जैसे, माडकत्तरा (केरळ), पिलिकोड उपकेंद्र (केरळ) तथा वेंगुर्ला केंद्र (महाराष्ट्र); नवसारी (गुजरात); मैदानी भाग में तीन केंद्र, एक चिंतामणि (कर्नाटका), दूसरा जगदलपुर (छत्तीसगड) तीसरा दारीसई (झारखण्ड) में स्थित हैं और इस परियोजना का अनुसंधान कार्यसूची को कार्यान्वयन करते हैं।

इस के अतिरिक्त 3 सहयोगी केंद्रों भी परियोजना के अंतर्गत कार्य कर रहे हैं। अरबावी (कर्नाटका), बारापानी (मेघालया) और गोवा में एक – एक केंद्र हैं।

विभिन्न अनुसंधान परियोजनाएँ, प्रमुख विषयानुसार जैसे जनन द्रव्य संग्रहण एवं फसल सुधार, फसल प्रबंधन और फसल संरक्षण जारी हैं। हर एक केन्द्र द्वारा दी गई परिणामों को संकलित कर यह प्रतिवेदन में प्रस्तुत किया गया है। इस प्रतिवेदन में दो प्रमुख अध्याय हैं, एक है, परियोजना और क्षेत्रीय तौर पर प्राप्त प्रायोगिक उपलब्धियों की तकनिकी जानकारी और दूसरा है इतिहास, कर्मचारियों की विवरा, वित्तीय प्रावधान, मौसम की आँकडें, शोध प्रकाशन से संबंधित संस्थानीय जानकारी।

[जे. दिनकर अडिगा]
निदेशक एवं परियोजना समन्वयकर्ता

स्थान : पुत्तूर
दिनांक : **27.12.2023**

ABOUT THIS REPORT

This is the thirty ninth 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 January 2023 to December 2023.

There are a total of 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.

[J DINAKARA ADIGA]
DIRECTOR & PROJECT COORDINATOR

Place : Puttur
Dated : 27.12.2023

INTRODUCTION

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

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

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

The headquarters of the independent cashew project was shifted to National Research Centre for Cashew, Puttur in 1986. Presently, there are ten coordinating Centres and one sub Centre, four in the East Coast viz., Bapatla. Bhubaneswar, Jhargram, Vridhachalam, four in the West Coast viz., Pilicode, Madakkathara, Vengurla, Paria and three Centres, one each in the plain's region at Hogalagere in Karnataka, at Jagdalpur in Chhattisgarh and at Darisai in Jharkhand and three co-operating Centers.

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.

CHAPTER 1 : TECHNICAL

CENTRES OF 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 Hilly Regions, Tura-794 005, West Garo Hills Meghalaya.

EXECUTIVE SUMMARY

The total germplasm accessions conserved at various centers is 1461. A total of 25 new germplasm accessions have been collected by different centers. 92 accessions for yield and yield attributing characters have been evaluated. In the trial on hybridization and selection, a total of 125 F_1 progenies were evaluated at different centers and many promising types are identified.

In the trial on nutrient management for yield maximization in cashew, recommended dose of fertilizers with FYM and foliar spray of major and minor nutrients gave best results in Bhubaneshwar and Hogalagere. In drip irrigation trial, irrigation at 80% cumulative pan evaporation was found to be the best in Hogalagere center.

In the high-density planting – observation trial, it was found that BC ratio goes on decreasing as the years advance in high density (4m x 4 m) and the reverse is true in case of normal planting (8 m x 8m).The intercrop marigold at Bapatla, Tomato at Darisai, Blackgram at Jhargram, China Aster Kanabargi, Arrowroot at Madakkathara, Coriander at Paria, Yardlong bean at Vengurla centers gave highest net returns in the intercropping experiment.

In organic management trial, 100% N as vermicompost and biofertilizers gave highest nut yield in Bapatla center, whereas recommended dose of fertilizer with 10 kg FYM gave highest benefit ratio in Darisai, Vridhachalam and Vengurla.

L-Cyhalothrin (0.6 ml/litre) found to be more effective compared to other insecticides against TMB, Shoot tip caterpillar, Apple and nut borer, leaf miner in Jagdalpur and Vridhachalam. As for as botanicals are concerned, Azadirachtin 1% (1 ml/l) was found effective at Hogalagere and Kanabargi, *Datura metel* decoction @ 5 % at Jagdalpur, Neem seed kernel extract @5% at Pilicode , *Datura* seed extract @ 5 % at Vengurla, spraying of combined Leaf extracts of *Adathoda, Datura, Vitex, Calotropis* and Neem at Vridhachalam were found effective against TMB with least toxicity to non target organisms.

For CSRB management, Chlorpyriphos (10ml/l) was found to be effective in Madakkathara, Vridhachalam, Hogalagere and Jagdalpur. However, Imidachloprid (2ml/l) was effective in Bapatla center. In Vengurla centers, Fipronil gave the best results.

Fifty training programmes were conducted by different centers on different aspect of cashew cultivation and management practices under SCSP, TSP and other programs in which more than 4000 farmers have participated

Production of Planting Material:

A total of 309691 grafts were produced during 2023 and distributed to several government and non-government organizations as well as to cashew farmers. The Center wise production of cashew grafts is given below:

Centre	No. of grafts produced during 2023
Bapatla	40000
Bhubaneswar	15000
Hogalagere	1680
Jagdalpur	7860
Jhargram	6000
Darisai	5000
Kanabargi	8000
Madakkathara	49412
Paria	204
Pilicode	8500
Vengurla	78035
Vridhachalam	90000
TOTAL	3**09691**

REPORT OF THE ANNUAL GROUP MEETING OF SCIENTISTS OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW – 2023

The Annual Group Meeting of the AICRP on cashew was held at Kerala Agricultural University, Thrissur during 17th – 19th January 2024. The inaugural session was presided by B. Ashok, IAS, Vice Chancellor, Kerala Agricultural University, Thrissur. The chief guests included Dr. V.B. Patel, ADG (Horticulture) and Dr. Madhu Subramanian, Director of Research, Kerala Agricultural University. Issues such as development and evaluation of hybrids, evaluation of bold nut and big apple genotypes, pruning response, cropping systems, management of pests and documentation of pollinator complex in cashew eco system were highlighted during the deliberations. Further, publications on cashew germplasm descriptors, package of practices, improved varieties and intercropping and thrips infesting cashew were released.

The technical session on crop improvement was chaired by Dr. G. Jayalekshmi, Former Professor, Kerala Agricultural University. Recommendations pertaining to unique trait germplasms, utilization of bold nut germplasms as parents, recording of accurate flowering duration were suggested during the session. Specific recommendation on various projects were indicated Centre wise. It was suggested that the yield details for variety release proposals need to be checked and confirmed and information about these verities should be registered with NBPGR.

The session on crop management was chaired by Dr. Jose Mathew, Former Associate Director of Extension, KAU. Recommendations pertaining to soil properties and nutrient status, nutrient budgeting, inclusion of shade loving tuber crops, mechanical pruning, and market demand for raw nuts as vegetable were provided.

The technical session on crop protection was chaired by Dr. Madhu Subramanian Director of Research, KAU, Thrissur and co-chaired by Dr. T.N Raviprasad, Prin. Scientist & Scientist-In -charge (PC Cell), ICAR-DCR Puttur. Recommendations on integrated evaluation of pesticides, cost effectiveness of treatments, accurate recording of pollinators were given.

Subsequently, a session on interaction between development departments and research centers was conducted which was Sri Dadasaheb Desai, Deputy Director, DCCD, Kochi. Dr. T.N. Raviprasad, Principal Scientist, and Scientist-in- Charge PC Cell and Dr. James Jacob, MD, PCK Ltd. acted as the Co-chairmen. It was suggested that action should be initiated for better implementation of development schemes, easing out problems faced by farmers for marketing raw cashew nuts, minimizing input costs and product diversification should be dealt on priority.

A special session on discussion on progress of SCSP, TSP, NEH programmes was chaired by Dr. Vikramaditya Pandey, Principal Scientist (Hort), Div. of Hort. Sciences, ICAR, New Delhi. The main points which emerged were identification of regional constraints for cashew production, showcasing yield potential and conducting economic impact analysis.

The plenary session was chaired by Dr. V.B. Patel, ADG (Fruits and Plantation crops) and the recommendations of each session were presented by the rapporteurs. Project specific recommendations and suggestions for altering certain ambiguous recommendations were given by the Chairman. The session was concluded with the vote of thanks from Dr. Jalaja Menon, Head of Station, CRS, Madakkathara.

EXPERIMENTAL RESULTS

I. CROP IMPROVEMENT

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

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

The objectives of the project are:

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

Table 1.01: Cashew germplasm holding in different Centers

Centre	No. of accessions		
	Earlier existing	**Collected during 2023**	**Total**
East Coast			
Bapatla	116	Nil	**116**
Bhubaneshwar	117	6	**123**
Jhargram	187	4	**191**
Vridhachalam	110	-	**110**
West Coast			
Goa	88	-	**88**
Madakkathara	152	-	**152**
Paria	13	1	**14**
Pilicode	105	2	**107**
Vengurla	323	2	**325**
Plains tract/others			
Darisai	28	**4**	**32**
Hogalagere	87	-	**87**
Jagdalpur	76	**2**	**78**
Kanabargi	4	0	**4**
Tura	9	**14**	**23**
Total	**1417**	**35**	**1450**

BAPATLA

Table 1.02: Cashew germplasm accessions maintained at Bapatla Centre during the year 2022-23

No. of accessions till 2020-21		**Accessions collected during 2021-22**	**Total number of accessions**
Local germplasm collections	**43**	**5** **Under i*n situ* evaluation**	**48**
Germplasm obtained from other Centers	**49**	**--**	**49**
Hybrids developed at the Centre	**19**	**--**	**19**
Total	**111**	**5**	**116**

BAPATLA

Germplasm collection: NIL

Germplasm characterization and evaluation:

Year of Planting : September, 2018

Design : Observational Trial

Results:

Among the accessions, Gangavaram-3 recorded highest mean plant height (2.43m) and mean stem girth (38.33 cm). Gangavaram -2 recorded maximum mean canopy spread (E-W) (4.75 m) and canopy spread (N-S) (5.60m) and also the canopy surface area (24.50 m^2) (Table 1.03)

Table-1.03: Growth parameters of cashew germplasm accessions during the year 2023 (YOP: 2018)

Sl. No.	**Accession**	**Mean plant height (m)**	**Canopy height (m)**	**Stem girth (cm)**	**Canopy spread (m)**		**Canopy surface area (m^2)**
					E-W	**N-S**	
1.	Gangavaram -1	1.93	1.65	37.10	2.90	3.66	13.43
2.	Gangavaram-2	2.36	1.96	35.10	4.75	5.60	24.50
3.	Gangavaram-3	2.43	2.03	38.33	4.30	5.28	17.52

Among the three accessions, the duration of flowering ranged from 74.00 days to 76.0 days. The shortest flowering duration was recorded in Gangavaram-2 (74.0 days). The flowering intensity per square meter was highest in Gangavaram -2 (14.6) followed by Gangavaram -3 (13.0) and Gangavaram -1 (Table 1.04)

Table-1.04: Reproductive parameters of cashew germplasm accessions during the year 2023 (YOP: 2018)

Sl. No.	Variety/ Genotype	Date of first Flowering	Date of last Flowering	Duration of days	Flowering Intensity/ Sqmt.)	Mean no of nuts/m^2	Mean no of nuts/ panicle
1.	Gangavaram -1	15.02.2023	01.05.2023	76	11.0	23.0	2.23
2.	Gangavaram-2	03.03.2023	10.05. 2023	74	14.6	24.0	2.87
3.	Gangavaram-3	25.02.2023	10.05. 2023	75	13.0	17.0	2.10

Among the three genotypes, the mean nut weight was found maximum in Gangavaram-1 (9.60 g). The maximum mean annual nut yield per tree during the year was recorded in gangavaram-3 (2.30). With regard to the mean apple weight, the highest was recorded in Gangavaram -2 (67.3 g). The shelling percentage was recorded highest in Gangavaram-1 (30.01). The cumulative nut yield per tree during the year was recorded highest in Gangavaram-2 (4.24 Kg/tree). (Table 1.05)

T**able-1.05: Yield parameters of cashew genotypes in cashew germplasm at Bapatla Centre**

Sl.No.	Variety	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut Yield /tree (kg) (Harvest No.2)2023	CNY (Kg/tree) 2022-23 (for two Harvests)
1.	Gangavarm -1	9.60	56.30	30.10	2.10	4.07
2.	Gangavaram-2	9.30	67.30	29.86	2.00	4.24
3.	Gangavaram-3	8.80	60.40	29.40	2.30	3.93

BHUBANESWAR

During the fruiting season 2023, six germplasms were collected from four cashew growing districts of Odisha *viz*., Jagatsinghpur, Ganjam, Nayagarh and Khorda. The number of germplasm accessions conserved at the center are presented in Table 1.01.

Table 1.06: Details of cashew germplasm accessions maintained at Bhubaneswar Centre, 2023

Details of Germplasm	No. of accessions till 2022	Accessions collected during 2023	Total number of accessions
Local germplasm collections of the centre	43	6 *(in-situ)*	49
Germplasm obtained from other Centers	71	-	71
Hybrids developed at the Centre and included in germplasm block	03	-	03
Total number of accessions	117	6	123

DARISAI

Four germplasms were collected and at present 20 germplasm have been identified details, its multiplication is under progress**.**

GOA

A field Germplasm-bank having 88 germplasm accessions representing the following groups is being maintained

- Jumbo nut types : 10 accessions
- Bold nut types: 40 accessions
- Medium nut and high yielders : 13 accessions
- High yielders/cluster bearers : 23 accessions
- Dwarf canopy types : 2 accessions
- Total Germplasm : 88 accessions

Ten bold nut accessions identified from the Field Germplasm bank were evaluated under a replicated trial along with two checks (Goa cashew -1 and 2) for 8 harvesting seasons (2017 to 2023). The mean nut weight varied from 7.63g (Bardez-8/98) to 11.71g (Tiswadi -3) with higher shelling percentage (>28%) and bigger apple size and higher TSS in most of the accessions.

Table.1.07: Growth parameters of bold nut accessions during 2023

Sl. No	Accession	Year of Planting	tree height (m)	Stem Girth (m)	Canopy spread (m)	
					E-W	N-S
1	Tudal-1	2010	3.52	0.79	8.47	6.71
2	Bardez-8/98	2010	5.41	0.91	9.41	9.26
3	Bardez-9	2010	5.12	0.97	10.47	9.61
4	Tudal-3	2010	7.17	1.19	14.97	13.36
5	Tiswadi-7	2010	6.41	1.12	11.07	10.93
6	Mayem-1	2010	4.14	1.13	6.47	6.03
7	Valpoi-2	2010	4.5	0.62	4.7	4.86
8	Valpoi-3	2010	2.31	1.62	3.14	4.37
9	Valpoi-1	2010	4.61	0.65	4.41	4.41
10	FMGDI-1	2010	5.57	0.67	6.71	6.21
11	Goa-1 (C)	2010	5.6	1.23	9.47	9.2
12	Tis-3 (Goa Cashew-2)	2010	7.14	1.37	12.81	12.16
Mean			5.13	1.02	8.51	8.09
SD			1.43	0.31	3.57	3.09
SEm			0.38	0.08	0.95	0.82
CV%			27.92	30.42	41.92	38.14
CD			0.76	0.17	1.91	1.65

Table.1.08: Flowering and yield parameters of bold nut accessions during 2023 [YOP - 2010]

Sl. No	Accession	Flowering Time	Duration of Flowering	Nut weight (g)	apple weight (g)	Shelling Percentage (%)	Nut Yield (kg/tree)	Cumu. nut yield (kg) (10 harvests)
1	Tudal-1	Dec (late)	medium	9.34	86.24	28.69	14.78	60.56
2	Bardez-8/98	Nov (Early)	short	7.46	65.44	28.77	9.32	49.12
3	Bardez-9	Dec (Early)	short	9.78	96.85	27.21	11.17	46.89
4	Tudal-3	Jan (Late)	medium	9.55	77.64	28.44	7.12	39.48
5	Tiswadi-7	Dec (late)	medium	7.66	71.64	29.24	7.14	37.85
6	Mayem-1	Jan (Jan)	short	8.16	68.62	30.24	7.07	36.63
7	Valpoi-2	Dec (Late)	medium	11.56	92.66	28.86	7.21	35.48
8	Valpoi-3	Dec (Late)	medium	8.18	82.54	28.02	8.71	32.25
9	Valpoi-1	Dec (late)	medium	8.28	76.55	29.22	6.75	31.91
10	FMGDI-1	Jan (Early)	medium	10.24	82.64	28.8	6.37	29.49
11	Goa-1 (C)	Dec (late)	medium	7.74	72.58	29.54	11.51	52.94
12	Tis-3 (Goa Cashew-2)	Nov (Early)	medium	11.86	98.46	28.18	9.21	44.36
			Mean	9.15	80.99	28.77	8.86	41.41
			SD	1.50	10.91	0.78	2.53	9.48
			SEm	0.40	2.92	0.21	0.68	2.53
			CV%	16.37	13.47	2.70	28.53	22.89
			CD	0.80	5.83	0.42	1.35	5.07

Salient Features: -

Goa Cashew -5 (Tudal-1) selected for State (Goa) Varietal Release
Av. Nut yield/Tree : 6.88kg
Mean nut wt : 9.22 g
Mid-season : March- May

HOGALAGERE

The experimental plot was established at HREC, Hogalagere by adopting augmented block design. The germplasm accessions were established by propagating the then existing germplasm at ARS, Chintamani using in-situ grafting method. The list of germplasm accessions

and their source material is given below. Planting was taken up in two stages, viz., September 2014 and December 2016. [Table no. 1.09]

Table 1.09: List of germplasm accessions established at HREC, Hogalagere germplasm block

Sl. No.	Accession No.	Source	Month of planting
1	HREC-01	13/5 Kadur	September 2014
2	HREC-02	V-2	September 2014
3	HREC-03	4/63 Guntur	September 2014
4	HREC-04	2/97 Kottarakara	September 2014
5	HREC-05	9/66 Chirala	September 2014
6	HREC-06	Tr. No. 274	September 2014
7	HREC-07	5/61 Alangudi	September 2014
8	HREC-08	3 C	September 2014
9	HREC-09	K4 B	September 2014
10	HREC-10	K6 B	September 2014
11	HREC-11	9/8 EPM	September 2014
12	HREC-12	1/64 Madhurantakam	September 2014
13	HREC-13	1/11 Dicherla	September 2014
14	HREC-14	5/37 Manjeri	September 2014
15	HREC-15	M 54/4	September 2014
16	HREC-16	17624	September 2014
17	HREC-17	31564	September 2014
18	HREC-18	Hy 2/16	September 2014
19	HREC-20	32387	September 2014
20	HREC-21	14611	September 2014
21	HREC-22	1/61 Alangudi	September 2014
22	HREC-23	Tr. No. 40	September 2014
23	HREC-24	4/62 Alangudi	September 2014
24	HREC-25	Hy 2/15	September 2014
25	HREC-26	1/63 Chrompet	September 2014
26	HREC-27	VRI-2	September 2014
27	HREC-28	Tr. No. 274	September 2014
28	HREC-29	BPP-6	September 2014
29	HREC-30	V-1	September 2014
30	HREC-31	H.19	September 2014
31	HREC-32	M 16/4	September 2014
32	HREC-33	3/3 Simhachalam	September 2014
33	HREC-35	2/64 Madhurantakam	September 2014
34	HREC-36	M 6-1	September 2014
35	HREC-38	CKD-4	September 2014
36	HREC-39	6/21 Mudabidari	September 2014
37	HREC-40	13/5 Kadur	September 2014
38	HREC-41	CKD-2	September 2014
39	HREC-42	K1	September 2014
40	HREC-43	Hy. 2/3	September 2014
41	HREC-44	9/2 Ullal	September 2014
42	HREC-45	2/9 Dicherla	September 2014
43	HREC 46	V-4	September 2014
44	HREC-49	Vetore-56	September 2014

45	HREC-50	Tree No.1	September 2014
46	HREC-51	V-5	September 2014
47	HREC-52	Hy.2/16	December2016
48	HREC-53	V-5	December2016
49	HREC-54	UN-50	December2016
50	HREC-55	5/23-Coondapur	December2016
51	HREC-56	BLA-139-4	December2016
52	HREC-57	1/26-Nileshwar	December2016
53	HREC-58	A-18-4	December2016
54	HREC-59	2/77-Tuni	December2016
55	HREC-60	T-56	December2016
56	HREC-61	M-1/3	December2016
57	HREC-63	K-25-2	December2016
58	HREC-64	BLA-139-1	December2016
59	HREC-65	ME-4/4	December2016
60	HREC-66	KA-22-1	December2016
61	HREC-67	8/46-Taliparamba	December2016
62	HREC-68	V-4	December2016
63	HREC-69	6/91-Kannangad	December2016
64	HREC-70	8/1-Kadur	December2016
65	HREC-71	39/14	December2016
66	HREC-72	CKD-3	December2016
67	HREC-73	G1-C	December2016
68	HREC-74	K5-B	December2016
69	HREC-75	N-44/2	December2016
70	HREC-76	Kankadi	December2016
71	HREC-77	BPP-2	December2016
72	HREC-78	CKD-1	December2016
73	HREC-79	BPP-4	December2016
74	HREC-80	K7-B	December2016
75	HREC-82	K3-B	December2016
76	HREC-83	K1-B	December2016
77	HREC-84	2/61-Alangudi	December2016
78	HREC-85	BLA-273-1	December2016
79	HREC-86	V-1	December2016
80	HREC-88	2/4-Aruva	December2016
81	HREC-89	V-2	December2016
82	HREC-90	VTH-711/4	December2016
83	HREC-91	3/108-Gubbi	December2016
84	HREC-92	ME-5/3	December2016
85	HREC-93	BPP-3	December2016
86	HREC-94	V-3	December2016
87	HREC-95	BPP-1	December2016
88	HREC-96	ME-6/1	December 2016

The observations on these accessions were recorded from 3rd year onwards considering the first three years as juvenile period. The trees were maintained as per the standard package and regular maintenance pruning. The results are presented separately for both the phases.

Table.1.10: Height of trees in germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Tree height (m)				
		2018	2019	2020	2021	2022
September 2014 planting						
1	HREC-01	3.10	2.90	3.80	4.20	3.97
2	HREC-02	3.30	3.40	3.60	3.90	3.93
3	HREC-03	3.80	3.70	4.00	4.30	4.00
4	HREC-04	3.20	3.50	3.90	4.30	4.30
5	HREC-05		3.10	3.60	3.90	4.00
6	HREC-06	3.50	3.60	3.80	4.10	4.00
7	HREC-07	3.70	3.40	4.10	4.40	4.57
8	HREC-08	2.90	3.00	3.10	3.70	3.40
9	HREC-09	3.80	3.40	3.70	4.10	3.93
10	HREC-10	2.80	2.70	3.30	3.50	3.80
11	HREC-11	4.30	3.80	4.20	4.80	4.17
12	HREC-12	3.30	3.20	3.80	4.10	3.80
13	HREC-13	3.60	3.40	3.80	4.20	4.03
14	HREC-14	3.90	3.30	3.60	3.60	3.70
15	HREC-15	4.10	3.60	4.00	3.20	4.20
16	HREC-16	3.50	3.00	3.60	3.90	3.90
17	HREC-17	3.20	2.80	3.50	3.80	
18	HREC-18	3.40	3.10	3.70	3.90	3.50
19	HREC-20	3.70	3.30	3.80	4.30	3.87
20	HREC-21	3.50	3.40	3.90	4.30	4.05
21	HREC-22	3.40	3.30	3.50	4.00	3.75
22	HREC-23	3.90	3.80	4.10	4.80	4.10
23	HREC-24	3.30	3.10	3.20	3.40	3.47
24	HREC-25	3.20	3.00	3.00	3.20	3.15
25	HREC-26	3.20	3.20	3.50	3.90	3.75
26	HREC-27	2.40	2.30	2.80	3.20	2.80
27	HREC-28	2.80	2.70	2.90	3.30	3.03
28	HREC-29	2.70	2.80	3.10	3.40	3.23
29	HREC-30	2.80	2.50	2.80	3.10	2.87
30	HREC-31	2.80	2.80	3.20	3.70	3.00
31	HREC-32	3.20	3.00	3.30	3.40	3.13
32	HREC-33	3.50	3.20	3.70	3.90	3.55
33	HREC-35	2.60	3.10	3.10	3.40	3.00
34	HREC-36	3.00	3.00	3.50	3.60	4.10
35	HREC-38	4.20	4.00	4.00	4.00	4.20
36	HREC-39	4.10	3.70	4.30	4.40	3.50
37	HREC-40	4.10	3.20	4.10	4.40	4.10
38	HREC-41	4.10	3.90	4.20	4.40	4.40
39	HREC-42	4.10	3.90	4.20	4.50	4.70
40	HREC-43	4.10	3.60	4.00	4.40	4.33
41	HREC-44	3.90	3.50	3.70	4.20	3.90

42	HREC-45	2.80	2.80	3.90	4.30	3.95
43	HREC-46		2.90	3.30	3.60	4.00
44	HREC-49	4.10	3.20	4.00	4.20	4.20
45	HREC-50	3.20	3.30			
46	HREC-51		2.40	2.70	2.80	3.50
Minimum		2.40	2.30	2.70	2.80	2.80
Maximum		4.30	4.00	4.30	4.80	4.70
Average		3.44	3.21	3.62	3.91	3.79
SD±		0.51	0.40	0.42	0.47	0.46
December 2016 Planting						
46	HREC-52		2.80	3.30	3.60	3.43
47	HREC-53		2.30	2.90	3.40	3.50
48	HREC-54		2.20	2.80	3.00	3.35
49	HREC-55		2.40	3.00	3.20	3.25
50	HREC-56		2.20	2.70	2.90	2.95
51	HREC-57		2.30	2.50	2.80	2.70
52	HREC-58		2.20	2.60	2.90	2.90
53	HREC-59		2.40	2.60	2.50	2.90
54	HREC-60		2.80	3.20	3.60	3.80
55	HREC-61		2.10	2.40	2.60	2.55
56	HREC-63		2.10	2.50	2.70	3.17
57	HREC-64		2.10	2.70	3.10	3.15
58	HREC-65		2.40	2.90	3.10	3.73
59	HREC-66		2.50	2.90	3.20	3.35
60	HREC-67		2.30	2.80	3.00	3.30
61	HREC-68		2.10	2.70	2.90	3.40
62	HREC-69		1.90	2.40	2.60	2.93
63	HREC-70		2.40	3.10	3.30	3.27
64	HREC-71		2.20	2.80	3.00	2.77
65	HREC-72		2.30	3.00	3.40	3.57
66	HREC-73		2.30	2.80	3.20	3.30
67	HREC-74		2.20	2.70	2.90	3.03
68	HREC-75		2.30	3.00	3.30	3.47
69	HREC-76		2.40	2.90	3.20	3.30
70	HREC-77		2.30	2.70	3.10	3.00
71	HREC-78		2.60	3.00	3.60	3.40
72	HREC-79		2.30	3.10	3.20	3.73
73	HREC-80		2.00	2.50	2.80	3.30
74	HREC-82		2.20	2.80	3.20	3.20
75	HREC-83		2.40	2.60	2.90	3.17
76	HREC-84		2.30	2.70	2.90	3.37
77	HREC-85		2.50	2.80	3.30	3.37
78	HREC-86		2.80	3.10	3.40	4.07
79	HREC-88		2.50	2.90	3.40	3.47
80	HREC-89		2.10	2.60	2.80	3.53
81	HREC-90		2.40	2.90	3.20	3.77

82	HREC-91		2.70	3.20	3.50	3.60
83	HREC-92		2.70	3.10	3.50	3.47
84	HREC-93		2.40	2.90	3.20	3.50
85	HREC-94		2.20	2.90	3.00	3.55
86	HREC-95		2.40	3.00	3.30	3.95
87	HREC-96		2.30	3.00	3.20	3.40
Minimum			1.90	2.40	2.50	2.55
Maximum			2.80	3.30	3.60	4.07
Average			2.34	2.83	3.12	3.33
SD			0.21	0.22	0.28	0.33

The tree height in the first phase trees ranged from 2.80m (HREC-27) to 4.70m (HREC-42) in 2023. However, among the promising accessions tree No. 274 (HREC 28) was small (3.03m). Among the second phase planting, the tree height ranged from 2.55m to 4.07m. Among the promising accessions HREC-57(2.70m) was the smallest.

Table.1.11: Spread of trees in germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Tree spread (m)				
		2018	2019	2020	2021	2022
September 2014 planting						
1	HREC-01	4.30	4.45	4.90	4.80	5.05
2	HREC-02	3.70	3.35	4.45	4.55	4.33
3	HREC-03	3.80	3.50	4.85	4.90	4.95
4	HREC-04	4.20	3.70	4.85	5.05	5.52
5	HREC-05		4.30	4.80	5.00	5.70
6	HREC-06	6.10	3.95	4.95	5.05	5.50
7	HREC-07	5.30	4.95	6.10	6.10	6.62
8	HREC-08	4.10	4.10	5.00	4.90	4.00
9	HREC-09	5.70	4.60	6.10	6.30	6.90
10	HREC-10	4.50	4.05	4.30	4.30	5.08
11	HREC-11	5.70	4.65	6.15	6.20	6.58
12	HREC-12	6.10	4.25	4.75	4.70	5.70
13	HREC-13	6.00	4.30	5.05	5.15	5.82
14	HREC-14	7.10	4.45	6.05	6.45	5.85
15	HREC-15	5.80	4.35	4.85	5.00	4.20
16	HREC-16	6.00	4.55	5.05	5.10	5.47
17	HREC-17	4.90	3.60	3.90	4.05	
18	HREC-18	5.30	3.95	4.90	4.90	5.08
19	HREC-20	4.50	3.95	4.60	4.65	4.83
20	HREC-21	5.90	4.00	4.45	4.55	5.20
21	HREC-22	4.80	3.70	4.80	4.85	4.83
22	HREC-23	6.00	4.80	6.70	6.90	6.75
23	HREC-24	5.20	3.75	4.20	4.35	4.83
24	HREC-25	4.80	3.05	4.10	4.20	4.08
25	HREC-26	4.90	3.90	4.70	4.75	4.73
26	HREC-27	4.20	2.80	3.20	3.30	3.70
27	HREC-28	4.90	3.85	4.10	4.30	3.90
28	HREC-29	4.70	3.80	4.25	4.30	3.97

29	HREC-30	5.10	3.50	3.80	3.80	3.97
30	HREC-31	3.80	3.90	4.10	4.20	4.15
31	HREC-32	5.20	3.65	4.30	4.45	4.13
32	HREC-33	6.50	4.30	4.80	4.95	4.83
33	HREC-35	3.80	3.80	3.80	3.85	4.05
34	HREC-36	4.80	4.40	4.90	4.95	4.85
35	HREC-38	6.70	4.85	6.45	6.65	6.45
36	HREC-39	7.80	4.70	6.45	6.60	6.60
37	HREC-40	6.70	4.50	6.35	6.80	6.35
38	HREC-41	6.20	4.25	6.10	6.10	6.03
39	HREC-42	5.60	4.40	6.00	6.10	6.35
40	HREC-43	5.30	4.05	5.75	6.00	5.42
41	HREC-44	5.20	4.30	4.30	4.25	4.50
42	HREC-45	4.90	4.50	5.00	5.10	5.53
43	HREC-46		4.05	4.55	4.75	6.45
44	HREC-49	5.80	4.40	6.85	6.75	6.60
45	HREC-50	4.50	4.00			
46	HREC-51		3.80	3.50	3.45	4.05
Minimum		3.70	2.80	3.20	3.30	3.70
Maximum		7.80	4.95	6.85	6.90	6.90
Average		5.27	4.09	4.96	5.05	5.22
SD±		0.95	0.46	0.90	0.94	0.95
December 2016 Planting						
47	HREC-52		3.10	3.20	3.30	3.50
48	HREC-53		3.25	2.95	2.90	3.90
49	HREC-54		3.20	3.90	3.95	3.98
50	HREC-55		3.70	3.85	3.90	3.93
51	HREC-56		3.50	3.05	3.05	3.63
52	HREC-57		2.95	2.40	2.50	3.03
53	HREC-58		2.90	3.15	3.20	3.62
54	HREC-59		3.15	2.75	2.80	3.45
55	HREC-60		3.35	4.00	4.05	4.25
56	HREC-61		3.55	2.10	2.10	2.63
57	HREC-63		3.55	2.70	2.70	3.48
58	HREC-64		3.35	3.20	3.30	3.83
59	HREC-65		3.25	3.30	3.45	3.95
60	HREC-66		3.40	3.65	3.70	4.35
61	HREC-67		2.90	3.20	3.35	3.93
62	HREC-68		2.50	3.15	3.20	3.53
63	HREC-69		3.15	3.35	3.55	4.18
64	HREC-70		3.35	3.55	3.50	4.33
65	HREC-71		3.00	3.60	3.65	3.50
66	HREC-72		3.15	3.80	3.95	3.83
67	HREC-73		2.65	3.05	3.10	3.82
68	HREC-74		3.70	3.65	3.70	4.00
69	HREC-75		3.05	3.45	3.50	4.53

70	HREC-76		2.90	2.85	2.95	3.88
71	HREC-77		2.90	3.30	3.40	4.20
72	HREC-78		3.20	3.25	3.25	3.73
73	HREC-79		3.05	3.30	3.40	4.12
74	HREC-80		3.30	3.65	3.80	4.20
75	HREC-82		2.05	2.45	2.50	3.85
76	HREC-83		2.95	3.00	3.05	3.85
77	HREC-84		3.30	2.85	2.85	4.12
78	HREC-85		3.45	3.25	3.35	4.80
79	HREC-86		2.95	3.80	3.85	4.32
80	HREC-88		2.50	3.25	3.40	4.60
81	HREC-89		2.70	3.15	3.25	4.85
82	HREC-90		3.65	3.55	3.65	5.08
83	HREC-91		3.50	3.90	4.05	4.68
84	HREC-92		2.75	3.35	3.45	4.13
85	HREC-93		2.85	3.55	3.70	5.62
86	HREC-94		2.90	3.90	4.00	4.45
87	HREC-95		2.80	3.10	3.15	4.63
88	HREC-96		2.75	3.35	3.45	4.90
	Minimum		2.05	2.10	2.10	2.63
	Maximum		3.70	4.00	4.05	5.62
	Average		3.10	3.28	3.35	4.08
	SD		0.35	0.43	0.45	0.55

The tree spread ranged from 3.70m in HREC 27 (VRI-2) to 6.90m in HREC 09 (K4B) in first phase of planting. Among the promising accessions, tree no. 374 had less spread. Similarly, in the second phase of planting, the tree spread ranged from 2.63m in HREC 61(M1/3) to 5.62m in HREC 93 (BPP-3). Among the promising accessions, 1/26 Neeleshwar (HREC-57) was a low spreading tree (3.03m).

Table.1.12: Girth of tree trunks in germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Tree girth (cm)				
		2018	2019	2020	2021	2022
September 2014 planting						
1	HREC-01	46.20	56.00	73.00	75.20	72.00
2	HREC-02	46.50	51.30	52.00	59.50	65.33
3	HREC-03	55.30	56.70	67.00	75.20	79.33
4	HREC-04	54.00	55.30	58.70	65.20	77.33
5	HREC-05		49.70	54.00	57.70	69.33
6	HREC-06	54.00	53.30	57.70	64.80	67.67
7	HREC-07	60.30	59.70	81.30	85.40	92.67
8	HREC-08	47.00	58.00	57.00	62.30	45.00
9	HREC-09	54.50	55.00	63.30	67.50	76.33
10	HREC-10	42.50	47.50	55.50	64.60	58.50
11	HREC-11	54.30	54.30	67.30	70.60	80.00
12	HREC-12	51.50	55.00	65.50	72.10	75.00
13	HREC-13	53.70	55.30	64.70	68.90	80.00

14	HREC-14	47.00	46.00	57.00	57.80	66.00
15	HREC-15	51.00	58.50	66.00	77.50	74.50
16	HREC-16	55.00	58.30	67.00	71.80	79.67
17	HREC-17	45.00	48.00	53.00	59.10	
18	HREC-18	50.80	58.70	61.00	66.50	71.33
19	HREC-20	46.80	57.30	67.00	72.90	80.00
20	HREC-21	40.60	45.50	57.00	64.50	67.00
21	HREC-22	41.10	46.00	55.30	56.70	64.00
22	HREC-23	56.40	69.50	76.50	88.70	89.00
23	HREC-24	42.20	44.70	52.70	57.70	62.67
24	HREC-25	45.30	45.50	51.00	57.10	59.00
25	HREC-26	41.90	47.50	58.00	59.30	67.50
26	HREC-27	38.10	40.00	42.00	45.20	47.00
27	HREC-28	43.70	45.30	53.70	57.20	61.00
28	HREC-29	36.70	38.00	49.30	56.40	56.67
29	HREC-30	41.80	38.70	46.00	48.80	54.67
30	HREC-31	41.50	48.00	68.00	76.10	69.00
31	HREC-32	46.00	46.70	59.00	64.50	67.67
32	HREC-33	51.00	50.00	68.00	71.10	80.50
33	HREC-35	32.50	40.00	50.00	54.70	60.00
34	HREC-36	39.50	42.00	56.00	63.80	69.00
35	HREC-38	48.30	55.00	72.00	86.00	90.00
36	HREC-39	40.20	58.00	62.00	72.10	87.00
37	HREC-40	48.70	59.00	68.00	72.00	76.00
38	HREC-41	50.50	57.00	70.50	78.10	84.00
39	HREC-42	46.00	53.00	71.00	75.90	91.00
40	HREC-43	47.10	51.70	61.00	70.10	78.67
41	HREC-44	43.70	52.50	62.50	68.80	78.50
42	HREC-45	44.80	55.00	67.00	71.40	79.00
43	HREC-46		40.00	53.00	54.90	72.00
44	HREC-49	37.90	60.00	67.00	70.00	81.00
45	HREC-50	49.90	55.00			
46	HREC-51		38.00	39.00	39.00	48.00
	Minimum	32.50	38.00	39.00	39.00	45.00
	Maximum	60.30	69.50	81.30	88.70	92.67
	Average	46.76	51.21	60.52	66.10	71.59
	SD±	6.09	7.12	8.92	10.30	11.67

December 2016 Planting						
47	HREC-52		31.00	39.30	42.70	49.00
48	HREC-53		40.00	48.00	49.90	59.00
49	HREC-54		32.50	38.00	44.80	49.50
50	HREC-55		44.00	52.50	60.30	67.50
51	HREC-56		37.00	40.50	42.20	49.50
52	HREC-57		36.00	38.50	40.80	45.00
53	HREC-58		38.70	38.30	42.20	54.67
54	HREC-59		39.50	45.50	53.60	56.50
55	HREC-60		44.00	51.00	55.70	68.00
56	HREC-61		34.50	38.00	40.30	46.50
57	HREC-63		34.00	41.00	43.90	52.00
58	HREC-64		37.00	46.50	51.70	68.50
59	HREC-65		38.70	44.70	49.40	56.00
60	HREC-66		39.00	43.50	46.20	54.00
61	HREC-67		35.00	40.00	43.10	51.67
62	HREC-68		31.00	36.70	40.00	46.67
63	HREC-69		35.70	41.70	47.20	56.33
64	HREC-70		36.00	41.30	47.60	55.67
65	HREC-71		36.00	46.70	50.60	52.67
66	HREC-72		36.70	48.00	52.70	63.33
67	HREC-73		33.30	40.00	43.30	53.33
68	HREC-74		33.70	51.70	57.00	58.00
69	HREC-75		35.30	41.30	47.50	54.67
70	HREC-76		32.70	41.30	47.30	52.00
71	HREC-77		39.00	38.50	40.30	52.50
72	HREC-78		39.70	47.70	53.30	54.00
73	HREC-79		38.00	43.00	48.30	59.00
74	HREC-80		41.00	46.00	54.90	61.00
75	HREC-82		29.00	38.00	43.50	49.00
76	HREC-83		34.00	39.30	42.00	50.00
77	HREC-84		36.30	43.70	50.30	51.67
78	HREC-85		36.70	42.70	44.00	54.67
79	HREC-86		36.30	48.70	52.40	63.33
80	HREC-88		32.30	39.00	40.40	50.33
81	HREC-89		33.70	41.70	47.00	53.00
82	HREC-90		38.70	52.30	59.00	63.67
83	HREC-91		36.00	44.70	50.90	55.67
84	HREC-92		34.30	41.30	45.20	50.67
85	HREC-93		33.30	40.70	46.10	54.00
86	HREC-94		33.00	36.50	39.90	50.00
87	HREC-95		36.00	44.50	50.40	59.00
88	HREC-96		36.30	43.00	46.60	58.00
	Minimum		29.00	36.50	39.90	45.00
	Maximum		44.00	52.50	60.30	68.50
	Average		36.07	42.98	47.49	54.99
	SD		3.23	4.37	5.44	5.75

The tree girth was maximum in HREC 12 (75cm) in 2023 in first phase of planting while it was more in HREC 57(45cm) in second phase planting.

Table.1.13: Flowering duration in germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Flowering duration (days)					Mean (days)
		2018	2019	2020	2021	2022	
September 2014 planting							
1	HREC-01	59	70	54	63.7	37	56.74
2	HREC-02	68	72	61	66.7	42	61.94
3	HREC-03	58	84	59	49.7	50	60.14
4	HREC-04	100	71	54	34.3	43	60.46
5	HREC-05		75	77	34.3	48	58.58
6	HREC-06	65	85	71	41.7	51	62.74
7	HREC-07	70	71	58	40	42	56.20
8	HREC-08	41	72	52	60	42	53.40
9	HREC-09	52	86	55	38.3	50	56.26
10	HREC-10	54	71	78	41	45	57.80
11	HREC-11	75	71	80	43.7	48	63.54
12	HREC-12	80	88	59	40	51	63.60
13	HREC-13	66	86	67	53	47	63.80
14	HREC-14	66	56	62	55	25	52.80
15	HREC-15	83	72	66	47	50	63.60
16	HREC-16	70	71	61	33	42	55.40
17	HREC-17	76	89	53	25		60.75
18	HREC-18	71	85	66	68.3	46	67.26
19	HREC-20	66	78	68	65	46	64.60
20	HREC-21	85	83	68	48.5	36	64.10
21	HREC-22	73	79	56	32	48	57.60
22	HREC-23	55	85	59	43.5	52	58.90
23	HREC-24	69	70	61	42.3	38	56.06
24	HREC-25	70	71	49	45	49	56.80
25	HREC-26	70	86	62	44	45	61.40
26	HREC-27	68	76	72	39	36	58.20
27	HREC-28	60	83	64	36.7	44	57.54
28	HREC-29	78	85	61	55.7	44	64.74
29	HREC-30	61	73	58	33.7	48	54.74
30	HREC-31	70	85	73	51	55	66.80
31	HREC-32	75	86	87	67.7	42	71.54
32	HREC-33	67	72	50	30	27	49.20
33	HREC-35	72	88	60	48	56	64.80
34	HREC-36	58	83	53	59	27	56.00
35	HREC-38	35	77	59	52	35	51.60
36	HREC-39	58	74	48	60	37	55.40
37	HREC-40	55	91	59	40	33	55.60
38	HREC-41	26	84	66	70.5	41	57.50
39	HREC-42	64	70	56	53	64	61.40

40	HREC-43	63	80	55	64	53	63.00
41	HREC-44	68	74	59	33	63	59.40
42	HREC-45	26	86	71	43	34	52.00
43	HREC-46		73	48	23	29	43.25
44	HREC-49	58	80	69	46	42	59.00
45	HREC-50	52	72				62.00
46	HREC-51		76	81	53	43	63.25
	Minimum	26.00	56.00	48.00	23.00	25.00	43.25
	Maximum	100.00	91.00	87.00	70.50	64.00	71.54
	Average	64.09	78.15	62.33	46.96	43.77	59.16
	SD±	14.15	7.39	9.20	12.15	8.69	5.17
December 2016 Planting							
47	HREC-52		82	58	29.3	54	55.83
48	HREC-53		72	63	38	27	50.00
49	HREC-54		80	65	68.5	52	66.38
50	HREC-55		86	65	51	57	64.75
51	HREC-56		79	60	34	27	50.00
52	HREC-57		76	45	27.5	58	51.63
53	HREC-58		81	61	70.7	48	65.18
54	HREC-59		79	67	63	38	61.75
55	HREC-60		55	92	60	29	59.00
56	HREC-61		76	69	48.5	54	61.88
57	HREC-63		82	64	39	41	56.50
58	HREC-64		79	72	45.5	52	62.13
59	HREC-65		73	61	42.3	31	51.83
60	HREC-66		74	74	65.5	40	63.38
61	HREC-67		74	66	58.7	45	60.93
62	HREC-68		73	65	54.7	49	60.43
63	HREC-69		78	60	36	37	52.75
64	HREC-70		70	65	54	49	59.50
65	HREC-71		72	48	34.7	53	51.93
66	HREC-72		82	56	31.7	42	52.93
67	HREC-73		74	70	48.7	47	59.93
68	HREC-74		82	57	34.7	44	54.43
69	HREC-75		85	64	58.7	50	64.43
70	HREC-76		72	56	42.7	42	53.18
71	HREC-77		80	55	31	44	52.50
72	HREC-78		85	70	53	39	61.75
73	HREC-79		70	66	62	48	61.50
74	HREC-80		71	61	45	32	52.25
75	HREC-82		76	62	34	37	52.25
76	HREC-83		58	58	60.3	45	55.33
77	HREC-84		70	65	75.7	31	60.43
78	HREC-85		70	77	66	48	65.25
79	HREC-86		82	69	57	50	64.50
80	HREC-88		72	59	38.3	54	55.83

81	HREC-89		74	61	38.7	54	56.93
82	HREC-90		76	62	33.3	40	52.83
83	HREC-91		76	61	38.7	36	52.93
84	HREC-92		91	62	35	50	59.50
85	HREC-93		72	57	35.3	46	52.58
86	HREC-94		75	61	42.5	34	53.13
87	HREC-95		87	55	31	50	55.75
88	HREC-96		79	59	51	40	57.25
	Minimum		55.00	45.00	27.50	27.00	50.00
	Maximum		91.00	92.00	75.70	58.00	66.38
	Average		76.19	62.93	46.79	43.90	57.45
	SD		6.87	7.71	13.09	8.42	4.89

The mean flowering duration ranged from 43.25 days to 71.54 days among the germ plasm accessions. It was short for tree No 274 (57.54 days) and 1/26 Neeleshwar (51.63 days) among the two planting phases.

Table.1.14: Cashew nut weight of germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Nut weight (g)					Average nut weight (g)
		2018	2019	2020	2021	2022	
September 2014 planting							
1	HREC-01	4.9	6.2	6	6.2	6.1	5.88
2	HREC-02	5.1	5.8	6.6	6.8	5.1	5.88
3	HREC-03	7.1	7.9	6.3	7.9	5.8	7.00
4	HREC-04	6.4	5.8	6.2	6.4	6.1	6.18
5	HREC-05		5.3	7.9	6.6	6.7	6.63
6	HREC-06	6.8	5	7.4	6.1	5.1	6.08
7	HREC-07	5	6	6.3	6	5.2	5.70
8	HREC-08	5.2	5.7	6	6.9	5.6	5.88
9	HREC-09	4.8	6.7	6.2	6.7	5.0	5.88
10	HREC-10	6.8	5	8.9	7.7	7.7	7.22
11	HREC-11	11.3	10.3	10.3	10.3	11.4	10.72
12	HREC-12	4.9	6.3	6.5	6.3	7.1	6.22
13	HREC-13	7.1	7.8	7.2	7.8	8.6	7.70
14	HREC-14	7.8	5.5	6.5	6.2	9.4	7.08
15	HREC-15	5.2	6.7	7.7	6.1	8.6	6.86
16	HREC-16	6.4	5.9	6.6	6.4	7.1	6.48
17	HREC-17	5.5	6.9	6	6.9		6.33
18	HREC-18	6.3	7.1	7	7.1	6.0	6.70
19	HREC-20	6.4	5.5	7.2	6.2	6.1	6.28
20	HREC-21	5.1	5.8	7.2	6.8	7.5	6.48
21	HREC-22	5.3	5.2	6.2	6.3	5.7	5.74
22	HREC-23	5.4	5.8	6.4	6.8	7.2	6.32
23	HREC-24	4.7	5.4	6.7	8.1	5.6	6.10
24	HREC-25	5.8	7.4	5.8	7.4	5.6	6.40
25	HREC-26	6.1	5.2	6.8	7.2	6.0	6.26

26	HREC-27	7.3	5.6	7.7	6.6	5.8	6.60
27	HREC-28	5.2	6.2	6.8	6.2	6.5	6.18
28	HREC-29	5.8	6.3	7.3	6.3	5.9	6.32
29	HREC-30	5.5	6.3	6.3	6.3	5.8	6.04
30	HREC-31	5.2	5.6	7.8	6.6	6.2	6.28
31	HREC-32	5.8	6.2	6	6.2	5.9	6.02
32	HREC-33	5.3	5.3	5.9	6.6	6.0	5.82
33	HREC-35	5.3	6.2	6.5	6.2	4.3	5.70
34	HREC-36	4.3	5.2	6	7.2	5.7	5.68
35	HREC-38	4.5	5	6.5	6.1	5.0	5.42
36	HREC-39	6.8	5	5.7	6	5.4	5.78
37	HREC-40	4.5	6.5	6.3	6.5	5.9	5.94
38	HREC-41	5.6	6.2	7.2	6.2	6.9	6.42
39	HREC-42	4.9	5.9	5.9	6.9	5.1	5.74
40	HREC-43	5.3	4.5	6.2	6.2	7.5	5.94
41	HREC-44	6.5	4.7	5.7	6.7	6.2	5.96
42	HREC-45	5.6	4.8	7.3	6.3	8.9	6.58
43	HREC-46		5.3	5.5	6.5	5.8	5.78
44	HREC-49	5.5	5.4	7.3	9.8	6.0	6.80
45	HREC-50	4.4	5.1				4.75
46	HREC-51		5	9.8	6.1	5.6	6.63
	Minimum	4.30	4.50	5.50	6.00	4.30	4.75
	Maximum	11.30	10.30	10.30	10.30	11.40	10.72
	Average	5.78	5.92	6.79	6.77	6.38	6.31
	SD±	1.21	1.02	1.00	0.89	1.35	0.84
December 2016 Planting							
47	HREC-52		6.6	7.6	6.6	6.0	6.70
48	HREC-53		9.4	9.4	9.4	4.8	8.25
49	HREC-54		4.4	5.4	6.9	5.9	5.65
50	HREC-55		6.7	7.7	6.7	6.2	6.83
51	HREC-56		7.8	8.8	7.8	5.1	7.38
52	HREC-57		5.1	6.1	6.6	5.9	5.93
53	HREC-58		7.1	7.1	7.1	5.9	6.80
54	HREC-59		5.4	6.4	6.4	7.9	6.53
55	HREC-60		6.6	7.6	6.6	6.4	6.80
56	HREC-61		7.6	7.6	7.6	7.7	7.63
57	HREC-63		4.9	5.9	6.5	6.2	5.88
58	HREC-64		6.4	6.4	6.4	5.8	6.25
59	HREC-65		4.6	5.6	6.6	4.0	5.20
60	HREC-66		6.3	7.3	6.3	6.0	6.48
61	HREC-67		6	7.1	6	6.6	6.43
62	HREC-68		7.9	7.9	7.9	6.7	7.60
63	HREC-69		5.3	6.3	6	8.6	6.55
64	HREC-70		5.9	6.9	6.9	7.8	6.88
65	HREC-71		5.5	6.5	6.8	10.3	7.28
66	HREC-72		6.3	7.3	6.7	11.4	7.93

67	HREC-73		5.9	6.9	6.3	9.7	7.20
68	HREC-74		5.2	6.2	6.5	6.2	6.03
69	HREC-75		5.5	10.2	9.9	7.2	8.20
70	HREC-76		5.6	6.6	6.6	6.5	6.33
71	HREC-77		5.5	6.5	6.5	6.1	6.15
72	HREC-78		7	7	7	6.6	6.90
73	HREC-79		5.3	6.3	6.3	7.5	6.35
74	HREC-80		5.5	6.5	6.5	6.8	6.33
75	HREC-82		6	6	6	6.3	6.08
76	HREC-83		6.8	6.8	6.8	8.8	7.30
77	HREC-84		6.1	6.1	6.1	10.8	7.28
78	HREC-85		5.7	6.7	6.7	7.1	6.55
79	HREC-86		5.1	7.3	6.4	8.6	6.85
80	HREC-88		6.8	6.8	6.8	7.8	7.05
81	HREC-89		5.4	6.4	6.4	7.1	6.33
82	HREC-90		6.1	7.1	6.1	6.7	6.50
83	HREC-91		5	6	7.4	8.5	6.73
84	HREC-92		5.1	6.1	6.1	7.6	6.23
85	HREC-93		6.2	7.2	6.2	7.4	6.75
86	HREC-94		5.5	6.5	6.5	6.5	6.25
87	HREC-95		5.4	6.4	6.4	6.5	6.18
88	HREC-96		6	6	6	6.7	6.18
	Minimum		4.40	5.40	6.00	4.00	5.20
	Maximum		9.40	10.20	9.90	11.40	8.25
	Average		6.01	6.87	6.75	7.10	6.68
	SD		0.98	0.95	0.80	1.52	0.65

The overall average nut weight ranged between 4.75g to 10.72 g. However, among the promising accessions, nuts of K6B (HREC 10) were 7.22g and N44/2 (HREC 75) were 8.20g respectively among the two phases of planting.

Table.1.15: Cashew apple weight of germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Apple weight (g)					Average apple weight (g)
		2018	2019	2020	2021	2022	
September 2014 planting							
1	HREC-01			36	37.1	37.0	36.70
2	HREC-02			51.2	47.8	57.3	52.10
3	HREC-03			35.1	48.1	48.0	43.73
4	HREC-04			30.2	51.4	42.7	41.43
5	HREC-05			34.8	46.5	28.3	36.53
6	HREC-06			28.7	37.7	38.0	34.80
7	HREC-07			35.5	42.5	46.2	41.40
8	HREC-08			37.1	41	42.5	40.20
9	HREC-09			42.6	45.1	32.5	40.07
10	HREC-10			28.8	47.2	40.0	38.67
11	HREC-11			56.2	52.6	53.0	53.93

12	HREC-12			52.9	38.1	39.0	43.33
13	HREC-13			33.7	42.6	43.0	39.77
14	HREC-14			58.4	44.3	56.5	53.07
15	HREC-15			40.4	44.5	45.0	43.30
16	HREC-16			28.7	45.1	28.3	34.03
17	HREC-17			37	49.8		43.40
18	HREC-18			42.3	40.6	41.0	41.30
19	HREC-20			32.5	45.3	45.0	40.93
20	HREC-21			39	46.7	25.3	37.00
21	HREC-22			61.6	45.3	19.5	42.13
22	HREC-23			32.8	51.1	29.5	37.80
23	HREC-24			36	43.2	43.0	40.73
24	HREC-25			36.2	35.9	36.0	36.03
25	HREC-26			32.2	44.1	27.0	34.43
26	HREC-27			43.4	43	20.0	35.47
27	HREC-28			56.1	51.8	21.0	42.97
28	HREC-29			32.4	47.9	48.0	42.77
29	HREC-30			65.3	38.5	39.0	47.60
30	HREC-31			42.7	36	36.0	38.23
31	HREC-32			33.3	46.9	47.0	42.40
32	HREC-33			40.4	51.4	26.5	39.43
33	HREC-35			42.8	51.7	33.0	42.50
34	HREC-36			37.4	36	36.0	36.47
35	HREC-38			33.8	47.6	40.0	40.47
36	HREC-39			40.1	43.8	45.0	42.97
37	HREC-40			35.6	44.4	44.0	41.33
38	HREC-41			30.2	46.4	46.0	40.87
39	HREC-42			42.9	40.2	30.5	37.87
40	HREC-43			35.1	37.4	37.0	36.50
41	HREC-44			31.9	47.1	47.0	42.00
42	HREC-45			31	48.3	30.0	36.43
43	HREC-46			61	48.8	35.0	48.27
44	HREC-49			38.9	38.7	45.0	40.87
45	HREC-50						
46	HREC-51			42.3	40.9	30.5	37.90
	Minimum			28.70	35.90	19.50	34.03
	Maximum			65.30	52.60	57.30	53.93
	Average			39.92	44.45	38.18	40.89
	SD±			9.55	4.77	9.23	4.58
December 2016 Planting							
47	HREC-52			32.1	45.9	40.5	39.50
48	HREC-53			34.6	53	19.9	35.83
49	HREC-54			33.1	40.1	24.5	32.57
50	HREC-55			44.4	36.8	37.0	39.40
51	HREC-56			35.9	45.5	46.0	42.47
52	HREC-57			29.6	47.6	20.0	32.40

53	HREC-58			40.9	47.5	21.3	36.57
54	HREC-59			41.3	44.1	44.0	43.13
55	HREC-60			34.9	39.6	40.0	38.17
56	HREC-61			43.9	39.8	39.0	40.90
57	HREC-63			43.7	49.9	50.0	47.87
58	HREC-64			42.9	46.4	46.0	45.10
59	HREC-65			30.8	44.8	26.8	34.13
60	HREC-66			39.9	43.1	29.9	37.63
61	HREC-67			32.2	39	39.0	36.73
62	HREC-68			39.2	39.2	40.0	39.47
63	HREC-69			34.7	47.4	31.8	37.97
64	HREC-70			41.6	50.8	36.8	43.07
65	HREC-71			38.7	46.5	47.0	44.07
66	HREC-72			30.9	40.7	37.7	36.43
67	HREC-73			45	41	41.0	42.33
68	HREC-74			32.1	44.5	45.0	40.53
69	HREC-75			44	49.6	33.0	42.20
70	HREC-76			33.7	50	50.0	44.57
71	HREC-77			37.8	52.4	52.0	47.40
72	HREC-78			29.2	35.8	36.0	33.67
73	HREC-79			36.3	36.4	27.8	33.50
74	HREC-80			35.4	41.2	24.9	33.83
75	HREC-82			38	52.6	53.0	47.87
76	HREC-83			42.2	49.4	27.1	39.57
77	HREC-84			28.5	36.2	36.0	33.57
78	HREC-85			32.6	37.7	29.6	33.30
79	HREC-86			35.7	45.3	31.0	37.33
80	HREC-88			38.8	48	29.8	38.87
81	HREC-89			30.6	53.3	25.0	36.30
82	HREC-90			34	41.6	26.3	33.97
83	HREC-91			40.6	40.9	30.2	37.23
84	HREC-92			38.7	43.9	44.0	42.20
85	HREC-93			33.4	43.4	28.6	35.13
86	HREC-94			44.8	51.6	52.0	49.47
87	HREC-95			36.5	45.4	45.0	42.30
88	HREC-96			39.8	40.8	41.0	40.53
	Minimum			28.50	35.80	19.90	32.40
	Maximum			45.00	53.30	53.00	49.47
	Average			36.98	44.49	36.32	39.26
	SD±			4.81	5.05	9.39	4.60

The apple weight ranged between 32.40g to 53.93g.

Table.1.16: Nut yield of germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Nut yield (kg/tree)					Cumulative yield (kg/tree)
		2018	2019	2020	2021	2022	
September 2014 planting							
1	HREC-01	1.47	3.6	4.1	6.3	6.5	21.97
2	HREC-02	0.52	3.8	5.1	7.5	6.6	23.52
3	HREC-03	0.69	4	4.6	6.8	6.9	22.99
4	HREC-04	0.42	2.9	4.2	5.4	5.3	18.22
5	HREC-05		2.8	6.9	4.8	5.0	19.5
6	HREC-06	2.8	2.4	6.4	3.7	4.2	19.5
7	HREC-07	0.29	2.3	4.3	3.6	3.7	14.19
8	HREC-08	0.23	2.1	3.7	3.9	5.2	15.13
9	HREC-09	3.62	2.8	4.3	4.7	5.7	21.12
10	HREC-10	1.36	4.8	7	7.4	10.2	30.76
11	HREC-11	0.53	2.1	8.6	4.1	4.9	20.23
12	HREC-12	0.6	4.5	4.8	7.4	7.7	25
13	HREC-13	0.49	2.9	6	4.5	4.5	18.39
14	HREC-14	1.53	3.7	5.3	6.1	7.0	23.63
15	HREC-15	0.93	3.5	6.1	6.2	6.9	23.63
16	HREC-16	2.72	3.7	5.1	5.2	5.6	22.32
17	HREC-17	0.39	2.5	3.8	4		10.69
18	HREC-18	0.27	3.4	5.8	5.3	6.4	21.17
19	HREC-20	1.18	4	6.1	7.6	8.5	27.38
20	HREC-21	1.17	3.7	6	6.2	5.8	22.87
21	HREC-22	1.22	2.5	4.3	3.6	4.0	15.62
22	HREC-23	0.98	3.6	4.8	5.7	7.5	22.58
23	HREC-24	0.5	3.8	5.2	8.4	6.2	24.1
24	HREC-25	0.13	2.3	3	3.8	3.4	12.63
25	HREC-26	1.64	4.3	5.3	8	7.9	27.14
26	HREC-27	3.6	3.8	6.5	6.2	8.2	28.3
27	HREC-28	1.45	4.5	5.5	8.2	9.3	28.95
28	HREC-29	1.19	4.3	5.9	7.5	7.9	26.79
29	HREC-30	0.26	3.3	4.4	5.9	6.8	20.66
30	HREC-31	1.18	3.8	6.7	5.7	6.2	23.58
31	HREC-32	1.26	2.2	3.5	3.7	5.4	16.06
32	HREC-33	0.91	2.6	3.5	4.3	3.9	15.21
33	HREC-35	0.21	2.6	5.1	3.4	4.2	15.51
34	HREC-36	0.1	2.5	3.8	3.6	3.8	13.8
35	HREC-38	0.48	3	5	5.9	6.3	20.68
36	HREC-39	0.3	2.2	2.9	3.6	5.2	14.2
37	HREC-40	0.57	3.4	4.5	4.7	6.3	19.47
38	HREC-41	0.18	3.1	6	4.9	5.4	19.58
39	HREC-42	0.51	3.9	6.7	5.9	6.7	23.71
40	HREC-43	1.05	2.4	4.3	4.3	4.3	16.35
41	HREC-44	0.52	3.9	6.5	6.3	5.1	22.32

42	HREC-45	1.28	3.8	6.3	5	5.0	21.38
43	HREC-46		1.9	2.7	3.6	4.0	12.2
44	HREC-49	1.64	2.6	6.3	8	6.3	24.84
45	HREC-50	1.07	3.1				4.17
46	HREC-51		2.9	7.2	4.1	3.5	17.7
	Minimum	0.10	1.90	2.70	3.40	3.40	4.17
	Maximum	3.62	4.80	8.60	8.40	10.20	30.76
	Average	1.01	3.21	5.20	5.44	5.90	20.21
	SD±	0.85	0.76	1.29	1.51	1.60	5.32
December 2016 Planting							
47	HREC-52		2.5	4	3.5	4.0	14
48	HREC-53		2.5	4	3.5	4.4	14.4
49	HREC-54		2.8	4.3	5.6	6.6	19.3
50	HREC-55		1.6	2.4	2.4	2.6	9
51	HREC-56		1.8	2.7	3	3.2	10.7
52	HREC-57		2.4	4.2	4.3	3.8	14.7
53	HREC-58		1.8	3.1	2.9	3.3	11.1
54	HREC-59		2	3.8	2.9	3.2	11.9
55	HREC-60		1.8	3.5	2.5	3.3	11.1
56	HREC-61		2.1	3.2	3	3.6	11.9
57	HREC-63		1.6	2.9	2.6	2.7	9.8
58	HREC-64		1.8	3.4	3.3	3.5	12
59	HREC-65		2.3	3.8	4.2	4.2	14.5
60	HREC-66		1.7	3	3.4	3.2	11.3
61	HREC-67		1.7	5.9	2.5	2.6	12.7
62	HREC-68		1.5	2.5	2.9	3.0	9.9
63	HREC-69		2.1	3.9	3.4	3.7	13.1
64	HREC-70		2.1	5.6	4	4.1	15.8
65	HREC-71		2	3.7	4	4.6	14.3
66	HREC-72		1.7	2.7	2.7	3.0	10.1
67	HREC-73		2.1	2.9	3.6	2.8	11.4
68	HREC-74		1.5	2.9	2.6	2.6	9.6
69	HREC-75		2.3	3.9	4.3	4.7	15.2
70	HREC-76		2	3.5	3.9	4.4	13.8
71	HREC-77		1.8	3.1	2.8	3.7	11.4
72	HREC-78		1.7	3	2.9	3.3	10.9
73	HREC-79		1.6	3.1	2.9	3.1	10.7
74	HREC-80		2.1	3.5	4.1	4.5	14.2
75	HREC-82		2	3.7	3.2	3.5	12.4
76	HREC-83		2.1	3.3	4	4.2	13.6
77	HREC-84		1.8	3.5	2.4	2.7	10.4
78	HREC-85		2	2.9	3.7	3.9	12.5
79	HREC-86		2.2	6.1	3	3.4	14.7
80	HREC-88		1.8	3.1	3.1	3.2	11.2
81	HREC-89		1.9	3.1	3.1	3.6	11.7
82	HREC-90		1.9	3.3	3.3	3.7	12.2

83	HREC-91		1.7	2.8	2.8	2.7	10
84	HREC-92		2.1	4.1	3.4	3.9	13.5
85	HREC-93		1.9	3.8	3.4	3.5	12.6
86	HREC-94		2	3.4	2.9	2.7	11
87	HREC-95		1.9	3	2.5	2.5	9.9
88	HREC-96		1.6	3.1	2.9	2.7	10.3
	Minimum		1.50	2.40	2.40	2.50	9.00
	Maximum		2.80	6.10	5.60	6.60	19.30
	Average		1.95	3.52	3.27	3.52	12.26
	SD±		0.29	0.81	0.66	0.79	2.08

Among the trees planted in first phase, HREC-10 (K6 B) with 30.76 kg, HREC-28 (Tr. No. 274) with 28.95kg, HREC-20 (32387) with 27.38kg, HREC-26 (1/63 Chrompet) with 27.14kg and HREC-12 (1/64-Madhurantakam) with 25.00kg are the promising accessions. Similarly, among the trees of December 2016 planting, HREC-70 (8/1-Kadur) with 15.8kg, HREC-75 (N-44/2) with 15.2kg, HREC-57 (1/26-Nileshwar) with 14.7kg, HREC-65 (ME-4/4) with 14.5 kg and HREC-71 (39/14) with 14.3kg/tree are promising.

Table .1.17: Shelling percentage in germplasm accessions during 2018 to 2022

Sl. No.	Accession No.	Shelling (%)					Mean
		2018	2019	2020	2021	2022	
September 2014 planting							
1	HREC-01	29.8	28.7	27.0	29.2	29.6	28.86
2	HREC-02	29.8	29.5	28.5	30.2	27.7	29.14
3	HREC-03	25.4	25.4	27.5	23.2	24.0	25.10
4	HREC-04	26.0	25.6	27.2	23.7	23.5	25.20
5	HREC-05	-	27.9	30.7	25.0	23.3	26.73
6	HREC-06	31.4	29.3	29.9	26.6	28.5	29.14
7	HREC-07	26.1	28.0	27.3	30.6	29.6	28.32
8	HREC-08	30.4	29.6	26.9	31.6	29.9	29.68
9	HREC-09	27.3	26.5	27.2	25.1	22.6	25.74
10	HREC-10	29.2	29.1	30.8	27.3	27.7	28.82
11	HREC-11	25.2	24.8	24.9	24.2	24.7	24.76
12	HREC-12	24.7	27.4	27.7	29.7	28.6	27.62
13	HREC-13	29.7	29.7	29.0	30.5	32.2	30.22
14	HREC-14	24.6	26.5	28.3	26.7	24.5	26.12
15	HREC-15	29.4	28.4	28.9	26.9	29.2	28.56
16	HREC-16	30.4	29.6	28.3	30.2	31.9	30.08
17	HREC-17	29.1	27.1	27.0	25.1	-	27.08
18	HREC-18	29.7	28.3	28.9	26.3	27.6	28.16
19	HREC-20	31.0	29.1	29.1	27.2	34.2	30.12
20	HREC-21	30.7	30.4	29.1	31.4	28.2	29.96
21	HREC-22	22.8	26.0	27.3	27.9	24.5	25.70
22	HREC-23	27.4	27.0	27.6	26.0	27.9	27.18
23	HREC-24	32.4	30.2	28.5	29.7	27.9	29.74
24	HREC-25	29.7	28.3	26.0	29.2	27.5	28.14
25	HREC-26	29.1	28.8	28.7	28.6	33.9	29.82

26	HREC-27	27.6	29.6	30.4	30.9	20.7	27.84
27	HREC-28	27.9	26.3	28.8	22.1	25.3	26.08
28	HREC-29	27.8	27.0	29.7	23.4	25.6	26.70
29	HREC-30	26.0	27.1	27.4	27.9	28.1	27.30
30	HREC-31	26.0	28.0	30.5	27.5	22.9	26.98
31	HREC-32	29.4	27.0	26.7	24.8	25.1	26.60
32	HREC-33	27.3	25.6	26.7	22.9	27.1	25.92
33	HREC-35	28.8	27.8	28.0	26.6	28.9	28.02
34	HREC-36	28.0	28.3	27.0	30.0	23.0	27.26
35	HREC-38	32.1	27.7	27.8	23.3	28.3	27.84
36	HREC-39	32.0	29.1	25.9	29.3	30.6	29.38
37	HREC-40	30.0	28.7	27.4	28.7	29.8	28.92
38	HREC-41	27.5	28.3	28.9	28.4	28.3	28.28
39	HREC-42	32.9	30.8	29.4	30.0	27.3	30.08
40	HREC-43	32.1	28.8	27.3	27.1	27.3	28.52
41	HREC-44	33.1	29.4	26.7	28.4	30.4	29.60
42	HREC-45	30.2	29.6	29.7	29.0	30.1	29.72
43	HREC-46		27.7	25.7	29.7	30.9	28.50
44	HREC-49	28.8	28.7	29.7	27.7	30.1	29.00
45	HREC-50	25.5	26.5				26.00
46	HREC-51		30.0	31.1	28.8	28.8	29.68
	Minimum	22.80	24.80	24.90	22.10	20.70	24.76
	Maximum	33.10	30.80	31.10	31.60	34.20	30.22
	Average	28.70	28.11	28.16	27.52	27.68	28.00
	SD±	2.48	1.45	1.46	2.53	3.04	1.56
December 2016 Planting							
47	HREC-52		29.0	28.8	29.1	28.0	28.73
48	HREC-53		26.9	28.1	25.7	21.3	25.50
49	HREC-54		27.4	31.3	23.4	25.8	26.98
50	HREC-55		24.8	25.1	24.4	25.7	25.00
51	HREC-56		26.3	25.1	27.4	26.5	26.33
52	HREC-57		28.6	32.1	25.1	24.4	27.55
53	HREC-58		24.7	22.4	26.9	24.9	24.73
54	HREC-59		25.7	27.2	24.1	32.6	27.40
55	HREC-60		29.3	29.3	29.2	26.7	28.63
56	HREC-61		27.8	28.7	26.9	22.8	26.55
57	HREC-63		26.9	28.6	25.2	25.6	26.58
58	HREC-64		27.2	28.0	26.3	25.3	26.70
59	HREC-65		29.0	30.2	27.8	26.0	28.25
60	HREC-66		28.3	28.8	27.7	31.2	29.00
61	HREC-67		29.2	28.9	29.4	23.3	27.70
62	HREC-68		25.9	26.1	25.7	27.0	26.18
63	HREC-69		29.1	29.7	28.5	26.6	28.48
64	HREC-70		26.7	28.8	24.5	29.5	27.38
65	HREC-71		26.7	23.7	29.6	25.2	26.30
66	HREC-72		28.0	31.1	24.9	31.1	28.78

67	HREC-73		28.7	26.7	30.7	30.1	29.05
68	HREC-74		28.1	27.9	28.2	31.9	29.03
69	HREC-75		29.1	27.4	30.7	26.1	28.33
70	HREC-76		28.5	30.9	26.0	27.6	28.25
71	HREC-77		30.4	30.3	30.4	27.4	29.63
72	HREC-78		29.7	31.9	27.5	33.3	30.60
73	HREC-79		30.4	29.4	31.3	29.8	30.23
74	HREC-80		30.0	29.1	30.9	23.5	28.38
75	HREC-82		25.1	26.2	24.0	24.3	24.90
76	HREC-83		26.9	28.1	25.6	24.6	26.30
77	HREC-84		29.0	28.9	29.1	31.5	29.63
78	HREC-85		28.4	28.1	28.6	25.1	27.55
79	HREC-86		29.0	29.4	28.6	30.7	29.43
80	HREC-88		29.6	29.3	29.9	31.0	29.95
81	HREC-89		28.8	27.3	30.2	23.7	27.50
82	HREC-90		26.4	27.5	25.2	28.9	27.00
83	HREC-91		27.2	26.8	27.6	25.7	26.83
84	HREC-92		26.3	26.7	25.8	25.8	26.15
85	HREC-93		26.9	26.7	27.0	29.0	27.40
86	HREC-94		28.1	26.8	29.3	31.8	29.00
87	HREC-95		27.9	26.6	29.2	32.4	29.03
88	HREC-96		29.7	28.3	31.1	21.5	27.65
	Minimum		24.70	22.40	23.40	21.30	24.73
	Maximum		30.40	32.10	31.30	33.30	30.60
	Average		27.90	28.15	27.59	27.27	27.73
	SD±		1.50	2.04	2.25	3.21	1.47

Among the promising accessions, HREC 20 (32387) and ME 44/2 (HREC 75) were better with a shelling of 30.12 and 28.33%.

Sl. No	Accession Number	Original source	Cumulative yield (kg/tree)
I September 2014 planting			
1	HREC-10	K6 B	30.76
2	HREC-28	Tr. No. 274	28.95
3	HREC-20	32387	27.38
4	HREC-26	1/63 Chrompet	27.14
5	HREC-12	1/64 Madhurantakam	25.00
II December 2016 planting			
1	HREC-70	8/1-Kadur	15.8
2	HREC-75	N-44/2	15.2
3	HREC-57	1/26-Nileshwar	14.7
4	HREC-65	ME-4/4	14.5
5	HREC-71	39/14	14.3

Based on the cumulative yield, five accessions (except released varieties) from each phase of planting are short listed as below.

Apart from the above accessions, eight root stock grown trees in the germplasm block of first stage of planting (OP seedlings of Chintamani – 1 and UN 50) were identified for their better yield, bold nuts and compact growth, which will be maintained separately, and observation will be recorded further for *in-situ* characterization and cataloguing.

JADALPUR

1) GERMPLASM COLLECTION AND CONSERVATION

Table 1.18: Cashew germplasm holding in Jagdalpur Centre

Centre	Earlier existing	Collected during 2023-24	Existing
Jagdalpur	**76**	**2* (under *in-situ* evaluation)**	**78**

Germplasm collection:

1. Mokagam-1:

This germplasm was noticed in the forest plantations in the Chhattisgarh-Odisha border (Koraput District) in the year 2021. During the year 2023, it recorded the nut weight of 9.23 g with 1-2 nuts per panicle. The average yield of the tree as per survey record was 5-6 kg/tree.

2. Adenga-1:

This germplasm was noticed in the forest plantation in the Kondagaon District, Chhattisgarh in the year 2021.During the year 2023, it recorded nut weight of 6.02 g with 6.21 nuts per panicle. The average yield of the tree (21 years) as per survey record was 8 kg/tree.

Gen 1. Expt 1. Evaluation of promising cashew germplasm of Bastar region

Experimental details

Experimental Site : New Upland Research cum Instructional Farm, Lamker
Number of germplasm : 24
Number of plants/germplasm: 4
Replication : Unreplicated
Year of planting : 2018 and 2019
Observations : Characterization based on NBPGR descriptor/ DUS

Table 1.18: Growth parameters of cashew accessions during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	CARS-2	2018	2.92	31	3.00	3.14
2	CARS-4	2019	2.23	24	2.50	2.80
3	CARS-5	2018	3.00	32	2.33	2.60
4	CARS-7	2019	2.20	26	2.80	2.86
5	CARS-8	2018	3.30	36	3.70	3.42
6	CARS-9	2018	3.53	32	2.76	2.32
7	CARS-10	2018	2.70	33	3.13	3.15
8	CARS-13	2018	2.65	37	3.95	4.32
9	CARS-17	2018	2.58	36	3.05	4.10
10	CARS-20	2018	3.10	38	3.60	4.20

Table 1.19: Reproductive parameters of cashew accessions during the year 2023

Sl. No.	Accession	Year of Planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant) 2st year
1.	CARS-2	2018	Mid	109	6.16	47.12	30.11	1.85	2.50
2.	CARS-4	2019	Mid	100	5.22	53.33	31.21	1.94	3.04
3.	CARS-5	2018	Late	89	6.98	47.34	30.56	1.96	2.52
4.	CARS-7	2019	Early	85	6.02	46.33	32.21	2.36	3.58
5.	CARS-8	2018	Mid	98	11.04	65.45	27.98	1.66	2.55
6.	CARS-9	2018	Mid	87	8.98	52.23	27.11	1.62	2.08
7.	CARS-10	2018	Mid	82	9.92	57.34	29.23	1.77	2.56
8.	CARS-13	2018	Mid	94	6.98	38.12	30.78	1.88	2.92
9.	CARS-17	2018	Early	92	9.12	75.43	29.67	1.27	2.39
10.	CARS-20	2018	Late	91	8.23	43.23	31.12	1.50	2.17

The 24 cashew accessions collected from Bastar district were evaluated for biometric and yield characters. The minimum tree height (2.20 m) and stem girth (26 cm) were recorded in CARS-7. Canopy spread was lowest in CARS-5. Duration of flowering ranged from 81 days to 117 days. The shortest flowering duration was recorded in CARS-14 (81 days) however this was found to be susceptible to TMB. The maximum nut weight was recorded in CARS-8 (11.04 g) followed by CARS-10 (9.92 g). Similarly, apple weight was also recorded highest in CARS-8 (65.45 g). Whereas, shelling per cent was highest in CARS-7 (32.21 %). Nut yield for the second harvest was maximum in CARS-7 (2.36 kg) followed by CARS- 5 (1.96 kg). [Table no.1.18 & Table no.1.19].

JHARGRAM

At present the center is maintaining 41 primary germplasm collections, 93 secondary germplasm collections and 57 varieties, therefore, a total of 191 total germplasms.[Table No.1.20]

Table 1.20: Cashew germplasm accessions maintained at Jhargram Centre during 2022-23

No. of accessions till 2022		Accessions collected during 2023	Total number of accessions
Local germplasm collections	38	3	41
Germplasm obtained from other Centers	92	1	93
Varieties maintained at the centre	57	--	57
Total		4	**191**

There were 4 germplasms evaluated during 2022 – 23. The height range was between 3.3 – 4.3m at the age of 4-5 years, therefore, these plants would be considered as tall type. Other

growth parameters also pointed towards the vigorous nature of the germplasms. The flowering density per square meter of the canopy was moderate in JGM – 367, JGM – 394 and JGM - 395 ranging from 12.9 to 15.8, while in JGM- 368 no. of flowering panicles/m^2 was quite high (30). The early flowering germplasms was JGM – 394 and the duration of flowering for this germplasm was also long (80days). In case of JGM- 368 the ratio of hermaphrodite: male was 0.35 and therefore, the nuts/m^2(29.4) as well as nuts/panicle (7.1) were higher than the other germplasms, but produced only small nuts (4.1g). JGM- 395 bore bold nuts of 8g. The shelling percentage was more than 30 in all the germplasms. The yield was very promising at the age of 5 years in JGM – 367 and JGM 368. [Table No.1.22]

Table 1.21: Details of germplasm collected during 2022-23

Sl. No.	Item	Description		
1	Name of collecting centre :	AICRP on Cashew, RRS, BCKV, Jhargram.		
2	Team / Collector (s)	Dr. Mini Poduval, Dr. S. Jash and Dr. G. Chakraborty		
3	Source of collection	Farmer's Field		
4	Name and address of farmer / collection site	Mr. Pradip Pratihar, Tulsichoti, Mouza Kesia, P.O. Kiaboni, P.S. Garbeta, Block Garbeta I, Paschim Medinipur, West Bengal.	Mr. Nabin Mahata Kodalia, P.O. Chotonakdona, Goalore, Paschim Medinipur, West Bengal - 721157	Rajib Mahata, Kundrisole, Adalia, P.O. Chotonakdona, PS. Goaltore, Garbeta II, Paschim Medinipur, West Bengal - 721157
5	GPS location	22°81'00"N & 87°34'07"E	22°76'27"N & 87°14'17"E	22°78'40"N & 87°12'87"
6	Date of collection survey	13.04.23	04.05.23	04.05.23
7	Collector's Number	BCKV/2023/1	BCKV/2023/2	BCKv/2023/3
8	Age of tree	17 Years	9 Years	20 Years
9	Tree habit	Compact & Upright	Compact & Upright	Spreading
10	Branching pattern	Intensive	Intensive	Extensive
11	Season of flowering	February – March (Late)	February – March (Late)	February (Mid season)
12	Apple colour	Yellow	Yellow	Pink
13	Apple shape	Obovate	Round	Obovate
14	Apple Size	Big	Medium	Medium
15	Apple Weight		59	65 g
16	Nut Size	Bold	Medium	Bold nut
17	Nut Weight	8.6 g	7g	11 g
18	No.of fruits / panicle	5	6	4
19	Attachment of nut to apple	Loose	Loose	Loose

20	Estimated yield / m^2	155 g/m^2	103 g/m^2	175g/m^2
21	Other note from collector—			
i	Plant height (m)	8.10 m	5.20 m	10m
ii	Canopy spread (m)	11.57 m	5.97 m	10.4 m
iii	Trunk girth (cm)	104 cm	63 cm	104 cm
iv	Trunk bark type	Rough	Smooth	Rough
v	Flowering laterals / m^2	18/m^2	14	10
vi	Non flowering laterals / m^2	5/m^2	5	2
vii	Yield per plant (kg)	15 kg	8	10
viii	Soil type	Sandy Soil	Laterite	Sandy Loam
ix	TMB infestation	Not found	Not found	Not found
x	Shelling %	32.5 %	34.28%	30.9%

Table 1.22: Growth parameters of cashew germplasm at Jhargram Centre during the year 2023

Acc No	Year of Planting	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)			Mean canopy area (m^2)	Bisexual: Male Flower	Duration of Flowering	No. of laterals / m^2
				E-W	N-S	Average				
JGM - 367	2018	4.3	50.0	5.0	4.8	4.9	31.1	0.30	63	2.8
JGM - 368	2018	3.9	50.0	5.0	4.6	4.8	30.0	0.35	73	8.1
JGM - 394	2019	3.3	30.0	3.4	3.3	3.3	15.8	0.20	80	5.5
JGM - 395	2019	3.5	28.5	2.5	2.1	2.3	11.0	0.20	70	1.6

Table 1.23: Reproductive parameters of cashew germplasm at Jhargram Centre during the year 2023

Acc No	Year of Planting	No. of flowering laterals / m^2	Nuts/ m^2	Mean no. of nuts/ panicle	Nut Wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. Yield (kg/ tree)
JGM - 367	2018	12.9	21.6	5.0	6.9	35.5	4.7	6.7 (3^{rd} Harv.)
JGM - 368	2018	10.8	29.4	7.1	4.1	32.9	3.5	6.17 (3^{rd} Harv.)
JGM - 394	2019	15.8	11.4	2.8	7.8	33.4	1.4	3.2 (2^{nd} Harv.)
JGM - 395	2019	13.1	15.4	5.6	8.0	36.9	1.2	2.0 (2^{nd}Harv.)

Table 1.24: Cashew Apple Characters of cashew germplasm at Jhargram Centre during the year 2023

Acc No	Year of Planting	Apple Wt.(g)	Apple colour	Shape of apple
JGM - 367	2018	66.0	Yellow	Obo
JGM - 368	2018	32.0	Yellow	Conical
JGM - 394	2019	54.0	Pink	Obo
JGM - 395	2019	54.0	Yellow	Cylindrical

KANABARAGI

Four germplasms were collected and planted during 2020-21. Among the four germplasm the tree height is maximum in the KBG-3 (3.15 m) and minimum was in KBG-2 (2.35 m) whereas stem girth and canopy spread were maximum in KBG-4. [Table No.1.25]

Table 1.25: Vegetative parameters of germplasm collection.

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	KBG-1	2020	3.10	37.00	2.75	2.60
2	KBG-2	2020	2.35	35.00	2.64	2.48
3	KBG-3	2020	3.15	32.00	2.90	3.28
4	KBG-4	2020	2.95	37.00	3.20	3.10

There were only few flowers observed in KBG-1 whereas there was no flowering in other germplasm during 2022-23.

MADAKKATHARA

- A total of 152 germplasm accessions are being conserved in the germplasm block.
- Three local genotypes from Kannur district like Chandanakampara with bold nut and cluster bearing habit, Peratta 1 with high nut weight and shelling percentage, Peratta 2 with purple-colored nuts were selected for germplasm conservation.

Collection name	Nut Weight (g)			Kernel Weight (g)			Shelling %			Special features
	2021	2022	2023	2021	2022	2023	2021	2022	2023	
Chandanakampara	10.09	11.9	12.22	2.57	2.96	3.16	25.47	24.79	25.85	Bold nut & cluster bearing
Peratta 1	10.17	7.9	9.32	3.01	2.25	2.92	29.59	28.56	31.33	Popular local genotype
Peratta 2	6.4	8.33	7.82	2.17	1.97	2.26	33.9	23.66	28.9	Purple coloured nuts
Madakkathara 89	-	11.85	9.9	3.05	3.41	3.01	-	28.77	30.83	Bold nut

- Among eight cashew germplasm accessions evaluated for yield traits CRS 166 recorded the highest nut weight (14.62g). The highest yield was recorded in the accession CRS 203 having a nut weight of 9.46g and shelling percentage of 30.97. [Table No. 1.27]

Table 1.26: Growth parameters of cashew germplasm accessions evaluated during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	CRS 166	2013	4.93	85.98	6.81	6.53
2	CRS 203	2011	6.41	98.13	6.52	6.44
3	CRS 204	2011	6.12	87.52	6.13	6.16
4	CRS 205	2011	6.25	80.54	6.22	6.42
5	CRS 206	2011	6.05	94.11	6.17	6.84
6	CRS 207	2011	6.13	85.14	6.42	6.25
7	CRS 208	2011	6.12	92.15	6.72	6.89
8	CRS 209	2013	4.72	79.21	5.26	5.43

Table 1.27: Reproductive parameters of cashew germplasm accessions evaluated during 2023

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/tr)	Special features
1	CRS 166	2013	Dec (Mid)	97	14.62	127.5	24.28	2.68	7.23**	Bold nut
2	CRS 203	2011	Dec (Mid)	92	9.46	118.98	30.97	10.81	10.81*	Bold nut
3	CRS 204	2011	Dec (Mid)	93	10.6	105.02	30.37	7.45	7.45*	Bold nut
4	CRS 205	2011	Dec (Mid)	112	8.83	66.8	32.60	3.54	3.54*	High shelling %
5	CRS 206	2011	Dec (Mid)	99	7.86	107.34	30.15	8.76	8.76*	High shelling %
6	CRS 207	2011	Dec (Mid)	97	10.86	125.81	29.74	2.36	2.36*	Bold nut
7	CRS 208	2011	Dec (Mid)	103	9.23	134.02	29.90	1.32	1.32*	Bold nut
8	CRS 209	2013	Dec (Mid)	63	11.86	189.12	32.88	0.55	0.55*	Bold nut

PARIA

Germplasm collection

Centre	No. of accessions		
	Earlier existing	Collected during 2023	Existing
West Coast			
Paria	13	1	14
Total	13	1	14

During the fruiting season of 2023, one cashew germplasm BPP -8 was collected. With addition of this one accession, the total number of germplasm collections are increased to 14. Ten obtained from other Centers and four local types at the center are included in germplasm conservation block.

PILICODE

Germplasm collection

Two germplasm have been identified for collection during the diversity fair held in May 2023. Collection could not be done as the major cropping season was over. The identified types were selected based on their nut weight around 10g and high yielding nature (More than 10 kg per tree).

Germplasm characterization and evaluation:

Among the nine accessions evaluated PLD 88 had highest plant height (2.93m) while PLD 86 had lowest plant height (1.61m). Plant girth was highest in PLD 83 (27.37 cm). Plant spread in E-W direction was highest for PLD 83(2.73m) and was least in PLD 86 (1.18m). In N-

S direction, the spread was highest with PLD 83 (2.6m) and lowest in PLD 86 (1.20 m). PLD 83 and PLD 87 can be deemed as vigorous growing types and PLD 86 shows comparatively compact growth. [Table No.1.28]

Germplasm is mid-season flowering and are having bold nut nature except PLD 90. PLD 90 has lower nut size. Yield was highest in PLD 88 (0.38 Kg) followed by PLD 89 (0.36 Kg/ Plant). Cumulative yield was highest in PLD 88 (0.88 kg, 2 harvests). PLD 84 had jumbo nuts with 15g. [Table No.1.29]

Table 1.28: Growth parameters of cashew germplasm accessions during the year 2023 [YOP-2017]

Sl. No.	Accession	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
				E-W	N-S
1	PLD 83 (Thattukunnu)	2.38	27.37	2.73	2.60
2	PLD 84 (Mannamkund)	2.65	28.08	2.11	2.05
3	PLD 85 (Valiyanadan)	2.51	17.19	2.11	2.06
4	PLD 86 (Kanakakkunnu)	1.61	12.40	1.18	1.20
5	PLD 87 Ponmalapallinadan)	2.84	21.56	2.51	2.44
6	PLD 88 (Kodolipram)	2.93	18.30	2.01	2.21
7	PLD 89 (PA-6)	1.93	17.31	1.24	1.70
8	PLD 90 (AY-M1)	2.42	21.72	1.72	1.78
9	PLD 91 (MCP- New)	2.45	17.12	1.42	1.50

Table 1.29: Reproductive parameters of cashew germplasm accessions during the year 2023 [YOP-2017]

Accession	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cum.Yield (Kg/plant)	Special features
PLD 83 (Thattukunnu)	Dec (Mid)	55	10.70	85.0	28.35	0.34	0.59	Bold nut
PLD 84 (Mannamkund)	Dec (Mid)	57	15.00	186.5	23.55	0.29	0.55	Jumbo nut size
PLD 85 (Valiyanadan)	Dec (Mid)	61	9.00	72.0	31.25	0.30	0.56	Bold nut
PLD 86 (Kanakakkunnu)	Dec (Mid)	64	9.50	74.0	32.30	0.25	0.60	Bold nut
PLD 87 (Ponmalapallinada)	Dec (Mid)	56	11.60	82.0	27.90	0.08	0.19	Bold nut
PLD 88 (Kodolipram)	Dec (Mid)	57	10.25	72.5	28.40	0.38	0.88	Bold nut
PLD 89 (PA-6)	Dec (Mid)	70	9.75	82.3	32.50	0.36	0.67	Bold nut
PLD 90 (AY-M1)	Dec (Mid)	63	5.50	65.0	33.30	0.16	0.29	Pink coloration in the nut
PLD 91 (MCP- New)	Nov (Mid)	65	9.80	73.8	31.50	0.25	0.43	Bold nut

TURA

Fourteen genotypes have been collected, conserved and evaluated. Further three genotypes of Cashew viz., RC Cashew-1, RC Cashew-2 and RC Cashew-3 were characterized.

VENGURLA

Germplasm collection:

The germplasm identified from the farmer's field at village Sadure has a bold nut (9.30 g) and a high yield (15–20 kg/tree). Another one identified from the farmer's field at village Navale has a bold nut (11.0 g) with intensive branching, a yellow apple, and a ten-year-old tree yield of 8–9 kg/tree.

Germplasm characterization and evaluation:

The maximum plant height (5.15 m), stem girth (65.50 cm), E-W canopy spread (5.20 m) and N-S canopy spread (5.70 m) were recorded in RFRS 196.

Among 23 cashew accessions planted during 2011-2021, 20 accessions have started the flowering, fruiting and yield and 3 cashew accessions planted during 2020 to 2021 are yet to start flowering and fruiting [Table 1.30]. Among the 20 types, RFRS 212 had the longest flowering period (101.00 days) and RFRS 206, RFRS 208, and RFRS 209 had the shortest flowering period (91.00 days). Yield attributing data of 20 cashew germplasm revealed that RFRS 201 & RFRS 216 had the maximum nut weight (12.00 g) while maximum apple weight was observed in RFRS 207 (88.00 g). The highest shelling percentage (31.00%) was recorded in RFRS 216. The maximum annual nut yield (3.1 kg/tree) and cumulative nut yield at 7 harvests (9.0 kg/tree) was observed in RFRS 196 for the year 2022-23.[Table No.1.31]

Table 1.30: Growth parameters of cashew germplasm accessions during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	RFRS 196	2011	5.15	65.50	5.20	5.70
2	RFRS 197	2011	3.20	33.66	2.83	2.70
3	RFRS 198	2011	1.80	20.33	1.90	1.66
4	RFRS 200	2016	2.40	32.50	2.90	2.90
5	RFRS 201	2016	3.65	30.50	2.65	2.70
6	RFRS 202	2016	3.70	40.50	3.90	3.15
7	RFRS 203	2016	1.60	14.50	0.95	1.05
8	RFRS 204	2016	3.00	29.66	2.46	2.00
9	RFRS 205	2016	3.26	34.66	2.70	2.80
10	RFRS 206	2016	2.95	26.00	2.80	2.50
11	RFRS 207	2016	3.80	32.50	3.80	2.90
12	RFRS 208	2016	2.86	22.66	0.80	0.86
13	RFRS 209	2017	1.75	19.00	0.85	1.10
14	RFRS 210	2017	2.35	23.00	1.00	1.10
15	RFRS 211	2018	2.16	22.88	1.40	1.34
16	RFRS 212	2018	3.00	32.75	2.00	1.95
17	RFRS 213	2018	3.05	28.75	1.45	1.52
18	RFRS 214	2018	2.60	22.25	1.20	1.17
19	RFRS 215	2018	2.27	20.28	1.05	0.98
20	RFRS 216	2018	1.35	12.50	1.00	1.05
21	RFRS 217	2020	0.97	4.00	0.40	0.35
22	RFRS 218	2020	0.50	3.00	0.12	0.22
23	RFRS 219	2021	0.75	0.28	0.30	0.30

Table 1.31: Reproductive parameters of cashew germplasm accessions during the year 2023

Sl. No.	Accession	YOP	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/ tree)	Cum.Yield (Kg/ plant)	Special features
1	RFRS 196	2011	Nov- Dec	93.50	8.30	70.00	28.60	3.10	9.00	High shelling % (28.60 %)
2	RFRS 197	2011	Nov- Dec	92.50	8.20	72.10	28.20	2.00	5.68	High shelling % (28.20%)
3	RFRS 198	2011	Nov- Dec	95.00	7.20	51.50	30.30	1.90	5.92	High shelling % (30.30%)
4	RFRS 200	2016	Nov- Dec	94.00	10.20	80.00	27.00	2.40	5.24	Bold nut
5	RFRS 201	2016	Nov- Dec	97.00	12.00	64.40	26.00	2.08	5.26	Bold nut
6	RFRS 202	2016	Nov- Dec	99.50	8.00	50.00	28.90	2.29	4.81	High shelling % (28.90%)
7	RFRS 203	2016	Nov- Dec	95.00	8.03	55.00	29.50	1.80	3.40	High shelling % (29.50%)
8	RFRS 204	2016	Nov- Dec	95.00	9.07	65.00	29.30	1.10	2.29	High shelling % (29.30%) bold nut
9	RFRS 205	2016	Nov- Dec	93.50	7.90	50.00	28.40	1.80	1.80	High shelling % (28.40%)
10	RFRS 206	2016	Nov- Dec	91.00	6.40	55.00	29.20	0.45	0.45	High shelling % (29.20%)
11	RFRS 207	2016	Nov- Dec	98.00	7.85	88.00	30.00	1.40	2.92	High shelling % (30%)
12	RFRS 208	2016	Nov- Dec	91.00	8.50	42.00	28.30	1.20	2.21	High shelling % (28.30%)
13	RFRS 209	2017	Nov- Dec	91.00	8.40	81.25	28.70	1.07	1.82	High shelling % (28.70%)
14	RFRS 210	2017	Nov- Dec	94.50	8.20	62.00	29.20	1.23	1.93	High shelling % (29.20%)
15	RFRS 211	2018	Nov- Dec	100.00	4.87	33.00	29.80	1.69	3.52	High shelling % (29.80%)
16	RFRS 212	2018	Nov- Dec	101.00	8.30	78.50	29.60	2.18	3.93	High shelling % (29.60)

17	RFRS 213	2018	Nove. (Early)	92.70	9.10	65.00	28.50	1.25	1.86	High shelling % with bold nut
18	RFRS 214	2018	Nove. (Early)	98.30	8.05	63.70	27.60	1.29	2.27	Bold nut
19	RFRS 215	2018	Nove. (Early)	100.50	8.40	62.40	28.30	0.19	0.35	High shelling %
20	RFRS 216	2018	Nove. (Early)	92.50	12.00	65.00	31.00	0.12	0.12	High shelling % (31%) with bold nut

VRIDHACHALAM

Cashew germplasm accessions maintained at Vridhachalam Centre, 2023-24

- The germplasm collected during 2020-21 having bold nut with good yield were collected and grafted.
- The grafted plants were planted during 2021-22.
- Crop is n vegetative stage.

GEN.1a. Evaluation of CNSL free germplasm accessions

Centers: East Coast: Bapatla, and Vridhachalam
West Coast: Madakkathara and Vengurle
Plains/others: Jagdalpur and Hogalagere

Objective: To evaluate CNSL free accessions for yield and yield attributes

Experimental details:

Number of genotypes : 6 (NRC-116, NRC-188, NRC-189, NRC-281, NRC-285, RFRS-195)
Design : RCBD
No. of replications : 4
Spacing : 5 × 5m

MADAKKATHARA

- Grafts of four CNSL free genotypes were planted during September 2022 and are under evaluation

Table 1.32 : Growth parameters of CNSL free accessions during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	NRC 116	2019	1.9	14	1.62	1.6
2	NRC 281	2019	1.22	9.5	1.07	1.13
3	NRC 189	2019	1.02	8.5	0.94	0.92
4	NRC 285	2019	1.36	11.5	1.05	1.15

VENGURLA

The data revealed that there were non-significant results with respect to all vegetative growth parameters except stem girth (cm). Cashew accession RFRS-195 recorded significantly the maximum stem girth (29.13 cm) and at par with NRC-281 (25.03 cm). In terms of yield attributes, there was significant variation among the different accessions [Table No.1.33]. NRC-189 recorded the maximum apple weight (72.13 g) and nut weight (9.00 g) and found significantly superior over the rest of treatments. The highest yield was recorded in RFRS-195 (1.794 kg/tree) and found significantly superior over the rest of treatments. Shelling percentage was highest in NRC-281 (31.21 %) and found at par with RFRS-195 (31.20 %). [Table No.1.34]

Table 1.33: Growth parameters of CNSL free accessions during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	NRC-116	2018	1.60	17.05	1.47	1.26
2	NRC-188	2018	1.97	19.58	1.52	1.50
3	NRC-189	2018	1.85	20.20	1.51	1.56
4	NRC-281	2018	1.63	25.03	1.65	1.57
5	NRC-285	2018	1.68	18.78	1.09	1.41
6	RFRS-195	2018	2.10	29.13	1.81	1.93
Mean			1.81	21.63	1.51	1.54
SEm ±			0.21	2.46	0.25	0.18
CD @5%			N.S.	7.48	N.S.	N.S.
CV (%)			23.68	22.73	32.81	23.98

Table 1.34: Reproductive parameters of CNSL free accessions during the year 2023

Sl. No.	Accession	Year of planting	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/tree)	CY (kg/ plant)
1	NRC-116	2018	Nov to Dec	92.24	5.56	66.41	25.50	0.41	0.55
2	NRC-188	2018	Nov to Dec	94.95	5.25	45.23	30.10	0.49	0.63
3	NRC-189	2018	Nov to Dec	93.67	9.00	72.13	25.10	0.41	0.52
4	NRC-281	2018	Nov to Dec	83.92	4.88	25.28	31.21	0.35	0.48
5	NRC-285	2018	Nov to Dec	92.50	5.73	45.50	25.60	0.21	0.31
6	RFRS-195	2018	Nov to Dec	93.15	5.98	56.50	31.20	1.79	2.39
Mean				91.74	6.07	51.84	28.12	0.61	
SEm ±				2.10	0.25	1.11	0.19	0.02	
CD at 5%				0.27	0.73	0.64	0.87	-	
CV %				8.30	7.42	11.39	14.84	-	

VRIDHACHALAM

The scion sticks of RFRS-195 were collected and grafted. The scion sticks of NRC 5 types (NRC116, NRC188, NRC189, NRC281, NRC285) will be collected and planting will be taken up.

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	Modapuli (MP)	2021-22	2.48	23	1.48	1.39
2	Muthandikuppam (MTK)	2021-22	2.68	28	1.39	1.46
3	Elavathadi (ELV)	2021-22	2.78	24	2.45	2.86
4	Muthanai (MI)	2021-22	2.46	26	1.85	2.51

Gen.3. Expt. 1. Multi Location Trial – III

Centers: Plains / others: Hogalagere

HOGALAGERE

This experiment was planted on 8th December 2016 with three replications. The observations are recorded from 2019-20 onwards, statistically analyzed and presented below.

Table 1.35: Height of the trees in MLT –III entries during 2022

Sl. No	Acccn.No.	Pl. Ht.(m)	Trunk girth (cm)	Flow. Dur. (days)	Nut Wt. (g)	Apple Wt. (g)
1	BH 6	3.00	46.50	44	7.37	34.55
2	BH 85	3.30	48.50	52	10.65	47.95
3	H 1597	3.17	49.67	42	7.00	35.00
4	K 22-1	3.30	45.00	36	8.18	36.97
5	H 662	2.80	48.00	35	6.67	31.26
6	H 675	3.90	57.50	35	10.89	42.05
7	H 11	3.10	45.50	44	8.47	33.49
8	H 14	3.23	49.00	46	8.73	38.65
9	H 32/4	2.80	45.33	42	6.80	24.67
10	C-1	3.07	51.33	47	8.36	41.53
11	C-2	3.30	61.00	34	9.01	40.15
	Mean	3.18	49.76	41.4	8.4	36.93
	SEM ±	0.15	3.03	6.12	0.78	4.49
	CD at 5%	0.43	8.95	18.06	2.29	13.24
	CV %	8.01	10.56		16.09	21.05

The accessions differed significantly for tree height. Among the accessions, H 675 was tall in all the years, while H662 and H32/4 were short. Chintamani – 2 had maximum canopy spread while H 32/4 and BH 6 had minimum canopy spread. Chintamani – 2 recorded bigger trunk girth while K22-1 recorded smaller girth. The mean flowering duration was low for K22-1 (57.75 days) while the H32/4 recorded the maximum flowering duration of 69.50 days. The nuts of BH 85 were heavier (7.36g) followed by Chintamani – 2 (7.28g).

Table 1.36: Nut yield in entries of MLT – 3 during 2019 to 2022

Sl. No.	Accession No.	Annual nut yield (kg/tree)				Cumulative yield (kg/tree)
		2019	2020	2021	2022	
1	BH 6	2.00	3.76	3.71	3.58	13.05
2	BH 85	1.60	2.83	2.38	2.36	9.17
3	H 1597	1.70	3.08	2.88	3.11	10.77
4	K 22-1	1.70	3.26	3.33	3.63	11.92
5	H 662	2.10	3.92	4.05	3.87	13.94
6	H 675	2.10	3.12	3.58	3.36	12.16
7	H 11	2.00	2.87	3.21	3.98	12.06
8	H 14	1.70	3.15	2.86	3.34	11.05
9	H 32/4	2.10	4	3.10	2.99	12.19
10	C-1	2.20	3.84	4.05	4.49	14.58
11	C-2	1.80	2.53	3.27	3.31	10.91
	Mean	1.91	3.31	3.30	3.46	-
	SEM ±	0.09	0.25	0.22	0.30	-
	CD at 5%	0.27	0.73	0.64	0.87	-
	CV %	8.30	7.42	11.39	14.84	-

Table 1.37: Shelling percentage of entries in MLT – 3 during 2019 to 2022

Sl. No.	Accession No.	Shelling (%)			Mean shelling (%)
		2020	2021	2022	
1	BH 6	31.10	25.80	26.62	27.84
2	BH 85	30.90	28.50	30.08	29.83
3	H 1597	31.00	27.70	29.76	29.49
4	K 22-1	30.90	29.60	30.37	30.29
5	H 662	28.40	29.00	31.02	29.47
6	H 675	31.00	27.50	25.11	27.87
7	H 11	28.20	26.70	28.99	27.96
8	H 14	31.70	29.00	31.49	30.73
9	H 32/4	31.60	30.10	27.61	29.77
10	C-1	30.80	27.20	26.81	28.27
11	C-2	30.30	29.10	26.69	28.70
Mean		30.54	26.90	28.60	-
SEm ±		1.45	1.23	2.22	-
CD at 5%		4.28	3.62	6.54	-
CV %		7.98	7.90	13.43	-

The cashew apples of H 1597 were bigger (49.25g) among all accessions followed by BH 85 (47.08g). The cumulative nut yield was maximum for Chintamani-1 (14.58kg/tree) followed by H 662 (13.94 kg/tree). The shelling percentage varied over years. However, the average value was the highest for H14 (30.73%) followed by K22-1 (30.29%).

Gen.3. Expt.2. Multi Location Trial – V

Centers: East Coast: Bapatla
Plains / others: Darisai, Hogalagere and Jagdalpur

Objective: To evaluate the performance of released cashew varieties from various Centers for their suitability to different agro-climatic regions.

BAPATLA

Experimental details:
Year of Planting : September, 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	2	NRCC sel-2, Bhaskara
Tamilnadu	1	VRI-3
Goa	1	Goa-1
Total	**25**	

The mean plant height was significantly the highest in BPP-4 (3.60m) followed by UN -50 (3.95m) followed by Bhaskara (3.92m) and Amrutha (3.50m). Highest mean canopy height was noticed in UN -50 (3.60m) followed by Bhaskara (3.48) and Priyanka (3.38m). The mean trunk girth was highest in Amrutha (54.94 cm), Bhaskara (54.67cm) followed by Ullal -3 (53.22 cm). The mean canopy spread(E-W) was maximum in Vengurla-7 (6.43 m) followed by Ullal -3 (5.96 m) and Amrutha (5.92 m) and canopy spread (N-S) was maximum in Bhaskara (6.49m) followed by UN -50 (6.02 m) and Amrutha (5.97m). Canopy surface area was maximum in Vengurla-7 (30.67m2) followed by BPP-8 (28.67 m2) and UN-50 & Madakathara-2 (28.56m2).

Table 1.38: Yield parameters of cashew genotypes in MLT- V at Bapatla Centre

Sl.No.	Variety/ Genotype	Flowering Intensity/ Sqmt.)	Mean no of nuts/m^2	Mean no of nuts/ panicle
1.	BPP 4	18.23	22.35	4.56
2.	BPP 6	14.54	12.30	3.20
3.	BPP 8	18.96	14.20	3.40
4.	BBSR -1	13.20	13.16	2.30
5.	Chintamani-1	14.66	16.44	2.40
6.	Jhargram-1	14.52	27.22	2.85
7.	Madakathara-1	16.23	29.36	5.34
8.	Madakathara-2	15.57	31.56	3.45
9.	K-22-1	11.54	18.60	3.10
10.	Dhana	12.13	12.60	3.41
11.	Kanaka	8.90	11.30	2.34
12.	Priyanka	10.43	9.60	1.80
13.	Amrutha	11.00	14.56	2.03
14.	Vengurla -1	12.20	27.27	4.50
15.	Vengurla -4	10.80	29.76	3.07
16.	Vengurla -6	11.20	9.60	2.30
17.	Vengurla -7	10.14	5.56	2.34
18.	VRI-3	17.22	20.56	3.05
19.	NRCC Sel 2	16.13	14.60	1.70
20.	Ullal 1	12.32	17.56	2.52
21.	Ullal 3	11.54	14.78	3.10
22.	Ullal 4	13.44	18.56	2.40
23.	UN 50	14.81	12.50	1.90
24.	Goa 1	9.87	11.56	2.10
25.	Bhaskara	13.56	17.96	3.40
CD@5%		3.49	2.66	0.86
SEm ±		1.22	0.93	0.30
CV		15.93	9.32	18.03

Among the 25 genotypes studied, the duration of flowering ranged from 60 days to 101.0 days. The shortest flowering duration was recorded in BPP-6 (56.0 days) followed by Vengurla-1 (60.0 days) and Chintamani-1 (63.0 days). With respect to mean number of flower panicles per square meter and mean number of nuts per panicle was found to be significant. The flowering intensity per square meter was highest in BPP-8 (18.96) followed by BPP-4 (18.23) and VRI-3 (17.22). The mean no of nuts per square meter was found highest in Madakathara -2 (31.56) followed by Vengurla-4 (29.76) and Madakathara-1(29.36)). The mean no of nuts per panicle was found maximum in Madakathara -1 (5.34) followed by BPP 4 (4.56) and Vengurla-1(4.50).[Table No.1.38]

Table 1.39: Yield parameters of cashew genotypes in MLT-V at Bapatla Centre

Sl.No.	Variety	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut Yield /tree (kg) (Harvest No.6) 2023	Cum.nut yield (kg/tree) (for 6 Harvests) 2018-23
1.	BPP 4	6.12	39.43	28.30	7.43	31.41
2.	BPP 6	6.16	46.50	27.30	6.34	19.40
3.	BPP 8	7.86	54.17	29.10	9.06	32.38
4.	BBSR -1	5.96	52.53	30.14	3.88	16.29
5.	Chintamani-1	6.16	41.13	27.50	4.10	14.77
6.	Jhargram-1	5.76	33.60	27.40	3.46	14.42
7.	Madakathara-1	6.12	38.43	28.60	6.44	23.46
8.	Madakathara-2	6.14	53.43	28.20	4.55	18.51
9.	K-22-1	7.33	44.59	28.12	6.78	23.30
10.	Dhana	7.25	60.80	27.11	3.78	16.75
11.	Kanaka	6.16	58.90	27.17	3.56	16.03
12.	Priyanka	9.16	94.20	28.12	3.72	15.63
13.	Amrutha	7.10	36.27	30.25	3.46	14.36
14.	Vengurla -1	6.16	45.08	27.14	4.63	19.97
15.	Vengurla -4	7.14	91.50	26.34	4.99	17.63
16.	Vengurla -6	7.46	88.00	30.16	3.65	13.43
17.	Vengurla -7	8.10	64.00	29.24	3.42	15.40
18.	VRI-3	6.23	34.50	28.10	3.64	16.91
19.	NRCC Sel 2	7.11	50.00	28.14	3.95	16.68
20.	Ullal 1	4.70	33.30	28.24	4.74	21.53
21.	Ullal 3	6.12	38.30	30.05	3.65	16.83
22.	Ullal 4	5.66	43.19	29.12	4.93	15.00
23.	UN 50	7.18	58.30	28.17	3.36	14.58
24.	Goa 1	7.15	50.40	29.41	3.60	16.29
25.	Bhaskara	5.86	41.30	28.30	7.50	25.42
CD@5%		0.90	6.12	NS	0.85	-
SEm ±		0.31	2.15	1.37	0.297	-
CV		8.24	7.20	8.34	10.84	-

With respect to Mean nut weight, mean apple weight and mean annual nut yield per tree was found to be significant. The mean nut weight was found maximum, Priyanka (9.16 g) followed by Vengurla 7 (8.10g) and BPP-8 (7.86g). With regard to the mean apple weight, the highest was recorded in Priyanka (94.20 g) followed by Vengurla -4 (91.50) and Vengurla -6 (88.00 g). The shelling percentage was recorded highest in Amrutha (30.25) followed by Vengurla-6 (30.16). The maximum mean annual nut yield per tree during the year was recorded in BPP-8 (9.06 kg) followed by Bhaskara (7.50 kg) and BPP-4 (7.43 kg). The cumulative nut yield per tree during the year was recorded in BPP-8 (32.38 kg) and followed by BPP-4 (31.41Kg) and Bhaskara (25.42 kg). [Table No. 1.39]

Darisai

Genotypes: NRCC sel-1, NRCC sel-2, M44/3, M15/4, BPP3/33, BPP10/19, BPP30/1, BPPP3/28, H303, H255, H367 & H68

Design: RBD, Four plants per entry per replication

Spacing: 6m × 6m

Progress: Fresh planting done in September 2023

Hogalagere

The experiment was started on 2nd January 2015 with three replications. The first three years' crop was in juvenile stage. The observations recorded later were statistically analyzed and presented hereunder.

Table 1.40: Tree height of the varieties in MLT – V during 2018 to 2022

Sl. No.	Variety	Plant height (m)	Plant spread (m)	Trunk girth (cm)	Mean Nut Wt.(g)	Mean apple Wt.(g)
1	Chintamani-1	2.87	5.37	57.00	6.54	35.15
2	Madakathara	2.85	4.16	60.00	5.70	53.73
3	Vengurla-1	3.27	4.33	62.00	5.44	41.34
4	Priyanka	3.50	4.79	60.00	6.67	46.24
5	Goa-1	3.80	4.62	82.00	5.98	70.00
6	Bhaskara	3.83	4.95	73.17	6.50	52.43
7	Ullal-3	3.07	5.78	63.33	6.64	42.64
8	BPP-6	3.80	5.78	71.67	5.07	41.67
9	Madakkathar	2.90	5.13	61.00	5.87	55.48
10	Vengurla-6	3.23	4.68	58.00	6.28	51.01
11	Vengurla-7	3.43	6.84	68.00	8.00	41.66
12	K-22-1	3.70	5.03	47.00	5.88	36.05
13	NRCC-sel-2	3.60	6.16	58.67	6.91	48.60
14	Ullal-1	3.07	5.34	53.67	5.98	44.24
15	Ullal-4	3.53	4.85	65.33	5.87	61.00
16	UN-50	3.67	5.88	69.00	6.77	50.99
17	Kanaka	3.23	4.75	53.67	5.81	51.58
18	Jhargram -1	3.60	5.25	64.00	4.88	40.43
19	Chintamani-2	3.95	5.48	73.50	5.56	36.10
20	Amrutha-10	3.53	5.35	70.00	5.48	46.83
21	VRI-3	3.70	4.88	63.00	5.38	31.88
22	BPP-4	3.40	3.88	56.00	5.65	34.10
23	Dhana	3.43	5.15	67.67	6.51	45.22
Mean		3.46	5.14	63.65	-	-
SEM ±		0.18	0.28	4.70	-	-
CD at 5%		0.51	0.81	13.40	-	-
CV %		9.01	9.62	12.85	-	-

There was a continuous increase in the tree height over the years. During 2022 the trees of Chintamani – 2 were taller (3.95m) followed by Bhaskara (3.83m) while Madakkathara – 1 had least plant height (2.85m). During 2022, Vengurla 7 recorded higher plant spread (6.84m) followed by NRC Sel-2 (6.16m) while it was least in BPP – 4 (3.88m). The larger trunk girth of 73.50cm was recorded in Chintamani–2 followed by Bhaskara (73.17cm) during 2022. Kanaka recorded the shortest flowering duration of 50.53 days followed by Madakkathara–2 (51.20 days), while VRI-3 recorded the longest flowering duration of 73.80 days. [Table No.1.40]

Among all the varieties studied in MLT-V, Vengurla-7 recorded the bolder nut of 8g which was followed by NRCC sel-2 (6.91g), while Jharagram –1 consistently yielded smaller nuts (4.88g). Goa–1 recorded the bolder apple (70g) followed by Ullal–4 (61g). The smaller apples were recorded in VRI-3 (31.88g).[Table No.1.41]

Table 1.41: Nut yield of the varieties in MLT – V during 2018 to 2022

Sl. No.	Variety	Nut yield (kg/tree)					Cumulative yield (kg/tree)
		2018	2019	2020	2021	2022	
1	Chintamani-1	2.12	4.40	7.10	6.20	6.44	28.76
2	Madakathara-1	0.99	2.60	3.60	4.10	4.88	17.27
3	Vengurla-1	2.67	3.30	4.90	4.40	4.75	23.12
4	Priyanka	1.36	4.40	7.00	5.50	5.54	23.80
5	Goa-1	2.69	2.20	3.20	3.40	4.03	18.32
6	Bhaskara	1.12	3.20	5.30	5.60	5.83	23.15
7	Ullal-3	2.85	4.80	8.40	6.70	7.30	33.15
8	BPP-6	2.96	3.80	6.00	5.40	6.15	25.71
9	Madakkathara-	1.39	4.10	6.20	5.90	6.25	28.04
10	Vengurla-6	2.10	3.50	4.60	5.50	5.78	22.98
11	Vengurla-7	1.37	4.40	7.50	7.90	8.44	31.41
12	K-22-1	1.64	2.40	3.70	3.30	6.95	19.49
13	NRCC-sel-2	1.32	2.90	4.50	7.50	8.21	29.23
14	Ullal-1	2.47	4.00	6.20	5.80	6.51	26.28
15	Ullal-4	3.24	2.70	4.40	4.10	4.49	20.03
16	UN-50	0.93	2.90	4.00	5.10	5.69	20.02
17	Kanaka	1.25	3.40	5.60	5.10	5.53	22.68
18	Jhargram -1	1.68	2.80	4.40	3.70	5.80	19.68
19	Chintamani-2	1.05	3.20	4.80	5.50	5.35	24.00
20	Amrutha-10	2.56	2.70	3.70	4.10	5.96	22.32
21	VRI-3	2.70	3.50	6.10	6.20	4.65	24.95
22	BPP-4	1.76	3.10	4.90	4.40	4.46	20.12
23	Dhana	1.35	4.20	6.50	5.50	5.23	26.48
Mean		1.89	3.41	5.33	5.20	5.81	-
SEM ±		0.16	0.18	0.15	0.48	0.34	-
CD at 5%		0.45	0.51	0.43	1.37	0.96	-
CV %		13.57	8.90	4.87	15.88	9.98	-

Among all the released varieties studied in MLT – V, Ullal – 3 recorded the highest cumulative yield (33.15kg/tree) followed by Vengurla -7 (31.41kg/tree) which were better than the local

check Chintamani – 1 (28.76kg/tree). The lowest yield was recorded in Madakathara -1 (17.27kg/tree from five harvests).[Table No. 1.41]

Table 1.42: Shelling percentage of the varieties in MLT – V during 2018 to 2022

Sl. No.	Variety	Shelling (%)				
		2018	2020	2021	2022	Mean
1	Chintamani-1	32.90	30.50	29.80	28.71	30.48
2	Madakathara-1	27.40	30.50	24.80	25.61	27.08
3	Vengurla-1	34.40	32.20	30.70	33.31	32.65
4	Priyanka	33.90	29.00	29.20	30.72	30.71
5	Goa-1	33.50	33.70	31.90	31.44	32.64
6	Bhaskara	30.10	30.10	27.40	25.38	28.25
7	Ullal-3	32.40	31.00	28.20	27.45	29.76
8	BPP-6	34.90	30.30	30.50	28.09	30.95
9	Madakkathara-	34.30	34.10	29.90	30.80	32.28
10	Vengurla-6	32.10	30.10	28.80	27.04	29.51
11	Vengurla-7	33.20	32.60	29.50	32.21	31.88
12	k-22-1	32.60	30.00	29.10	28.46	30.04
13	NRCC-sel-2	33.40	31.20	31.80	32.87	32.32
14	Ullal-1	30.50	28.80	28.80	30.68	29.70
15	Ullal-4	34.70	31.00	30.80	29.86	31.59
16	UN-50	35.10	33.30	27.90	27.33	30.91
17	Kanaka	34.60	30.50	31.30	34.03	32.61
18	Jhargram -1	33.90	26.50	28.50	28.65	29.39
19	chintamani-2	34.90	30.30	28.90	29.30	30.85
20	Amrutha-10	33.20	28.90	30.50	27.93	30.13
21	VRI-3	34.60	29.90	29.70	30.92	31.28
22	BPP-4	34.00	29.90	28.30	27.96	30.04
23	Dhana	27.40	30.30	31.40	29.77	29.72
Mean		32.96	30.64	29.80	29.54	-
SEM ±		0.84	0.88	1.25	2.03	-
CD at 5%		2.39	2.52	3.56	5.80	-
CV %		4.42	5.48	7.26	11.94	-

Among all the varieties studied in MLT-V, Vengurla -1 recorded the higher shelling of 32.65 percent followed by Goa -1 (32.64%) and NRCC Sel2 (32.32%), while the least was recorded in Madakathara -1 (27.04%). [Table No. 1.42]

Jagdalpur

Experimental Details:

Design : RCBD
No of Replications : 2
No of Plants per replication : 4
Spacing : 6 X 6 m

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 and 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
ICAR-DCR, Puttur	2	NRCC Selection 2, Bhaskara
Tamilnadu	1	VRI-3
Goa	1	Goa-1
Total	25	

Table 1.43: Growth parameters of MLT-V entries during 2022-23 (YOP: 2019)

Sl. No.	Accession	Year of planting	Tree Height (m	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1.	BPP-4	2019	3.19	35.50	3.75	3.99
2.	BPP-6	2019	2.88	27.00	2.60	3.15
3.	BPP-8	2019	2.93	28.50	2.95	3.22
4.	Bhubaneswar-1	2019	2.48	24.00	2.21	2.27
5.	Chintamani-1	2019	1.99	25.50	2.77	2.88
6.	Jhargram-1	2019	2.47	22.50	2.47	2.16
7.	Madakathara-1	2019	2.31	17.50	2.07	2.13
8.	Madakathara-2	2019	1.84	19.50	2.06	2.09
9.	K-22-1	2019	2.34	19.50	1.97	1.90
10.	Dhana	2019	1.88	17.50	2.51	2.25
11.	Kanaka	2019	1.98	22.50	2.18	2.09
12.	Priyanka	2019	2.92	23.50	2.75	3.14
13.	Amrutha	2019	1.75	21.50	1.75	2.18
14.	Vengurle-1	2019	2.66	23.50	2.45	2.93
15.	Vengurle-4	2019	2.94	22.50	2.21	2.53
16.	Vengurle-6	2019	2.46	23.00	2.48	2.58
17.	Vengurle-7	2019	2.12	25.50	2.34	2.59
18.	VRI-3	2019	2.54	26.50	1.93	1.60
19.	Ullal-1	2019	2.73	28.50	3.75	3.54
20.	Ullal-3	2019	2.70	23.50	2.64	3.10

21.	Ullal-4	2019	2.89	25.50	3.08	3.40
22.	UN-50	2019	2.78	21.50	2.35	2.84
23.	NRCC Sel. 2	2019	2.03	22.50	2.81	2.92
24.	Bhaskara	2019	2.84	21.00	2.35	2.43
25.	Goa-1	2019	2.43	19.50	1.75	1.65
Mean			2.49	22.08	2.28	2.32
SEm ±			0.31	3.04	4.23	3.56
CD @5%			NS	8.93	NS	NS
CV (%)			17.79	19.49	34.21	33.79

Table 1.44: Reproductive and yield parameters of MLT-V entries during 2023 (YOP: 2019)

Sl. No.	Accession	YOP	Flowering time	Duration of flowering (days)	Nut weigh t (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant) 2nd harvest
1.	BPP-4	2019	Early	102.00	6.45	41.23	28.80	1.21	2.06
2.	BPP-6	2019	Early	89.00	5.09	42.42	29.10	1.46	2.58
3.	BPP-8	2019	Late	84.50	5.71	61.23	29.40	1.67	2.52
4.	Bhubaneswar-1	2019	Mid	89.50	4.32	36.12	31.10	0.97	1.76
5.	Chintamani-1	2019	Early	109.50	5.27	42.33	30.45	0.87	1.81
6.	Jhargram-1	2019	Mid	112.50	5.02	39.30	29.25	0.92	1.50
7.	Madakathara-1	2019	Late	92.00	6.18	43.43	30.05	1.12	1.78
8.	Madakathara-2	2019	Late	99.50	6.23	42.13	30.25	1.23	1.88
9.	K-22-1	2019	Late	81.50	6.21	34.43	29.20	0.96	1.57
10.	Dhana	2019	Late	78.00	7.43	50.14	29.25	1.31	2.02
11.	Kanaka	2019	Late	89.00	6.34	51.27	28.10	1.03	1.54
12.	Priyanka	2019	Late	113.50	9.45	66.67	28.70	1.09	1.82
13.	Amrutha	2019	Late	98.50	6.42	45.77	30.85	0.86	1.41
14.	Vengurle-1	2019	Late	84.00	5.45	44.92	31.25	1.83	3.15
15.	Vengurle-4	2019	Mid	91.00	7.89	47.91	29.75	2.02	3.33
16.	Vengurle-6	2019	Late	87.00	7.93	51.19	29.40	1.23	2.00
17.	Vengurle-7	2019	Mid	91.50	8.76	60.23	29.65	1.43	2.34
18.	VRI-3	2019	Late	84.50	5.81	42.13	30.30	1.12	1.99
19.	Ullal-1	2019	Mid	94.00	6.87	39.27	29.40	1.63	2.39
20.	Ullal-3	2019	Mid	84.50	5.43	43.12	29.10	1.29	2.17
21.	Ullal-4	2019	Mid	82.50	6.45	41.35	29.75	0.96	1.74
22.	UN-50	2019	Mid	97.00	7.23	56.23	28.75	1.21	2.12
23.	NRCC Sel. 2	2019	Mid	115.50	7.59	52.38	29.20	0.76	1.65
24.	Bhaskara	2019	Mid	102.50	6.43	49.23	30.30	1.16	1.98
25.	Goa-1	2019	Mid	82.00	6.89	45.53	28.45	1.12	1.90
Mean				94.27	6.57	48.54	29.46	1.16	1.94
SEm ±				4.04	0.10	0.96	0.18	0.10	0.13
CD @5%				12.12	0.34	3.02	0.59	0.32	0.41
CV (%)				15.29	8.76	9.32	6.67	18.13	16.18

At Jagdalpur, the multilocation trial was laid out in RBD with two replications during 2019 consisting of 25 released varieties. Among the top ten varieties from the data of vegetative and flowering parameters, the minimum tree height and trunk girth was recorded in Dhana (1.88 m, 17.70 cm respectively). Flowering duration ranged from 78 days (Dhana) to 115.50 days (NRCC Sel. -2). Nut weight (9.45 g) as well as apple weight (66.67 g) was highest in Priyanka[Table No.1.43].The shelling percent was observed maximum in Vengurle-1 (31.25 %). Nut yield was maximum in Vengurla-4 (2.02) followed by Vengurla-1 (1.83 kg), BPP-8 (1.67 kg) and Ullal-1 (1.63 kg). Cumulative nut yield was also recorded highest in Vengurla-4.[Table No. 1.44]

Gen.3. Expt.3. Multi Location Trial – (MLT – VI)

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

Objective: To evaluate selected released varieties in new Centers started during XI plan (2009)

Trial Details:

Design	**:**	RCBD
Replication	**:**	Three
Spacing	**:**	7 m X 7 m
Number of entries	**:**	8
Names of entries	**:**	V-4, Bhaskara, BPP-8, NRCC Sel-2,Dhana,VRI-3,VRI-H-1, H-303

PARIA

The growth characters of all varieties found non-significant during this year.

Table 1.45: Growth parameters during the year 2023 (YOP: 2022)

Variety	Plant height (m)	Stem girth (cm)
V-4	0.53	3.57
Bhaskara	0.49	3.17
BPP-8	0.45	2.60
NRCC Sel-2	0.49	2.97
Dhana	-	-
VRI-3	0.50	3.13
VRI-H-1	-	-
H-303	0.45	2.87
SEm.	0.02	0.18
CD@5%	NS	NS
CV%	8.48	10.32

TURA

The performance of the seven cashew genotypes was studied. Highest plant height was recorded in BPP-8 (5.57 m) followed by VRI (CW) H-1 (5.30m) and Vengurla-9 (5.20m). Plant spread (EW X NS) was recorded highest in Dhana (5.26m and 5.84m), while lowest in VRI-3 (4.61m, 5.01m) [Table No.1.46]. Highest nut weight and shelling percent were recorded in BPP-8 (8.1g and 32.06% respectively). The apple weight was recorded highest in Dhana (77.67g). The nut yield was highest in BPP-8 (7.84kg) followed by VRI-3 (6.98kg).[Table No.1.47]

Table 1.46: Growth parameters during the year 2023

Variety	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
				E-W	N-S
Dhana	2010	4.00	61.8	5.16	5.21
VRI (CW)H-1	2011	5.30	50.7	5.1	5.8
Bhaskara	2015	4.98	60.2	4.98	5.35
BPP-8	2015	5.57	60.5	5.26	5.84
VRI-3	2015	3.80	40.4	4.61	5.01
H-303	2015	5.20	60.2	5.11	5.14
V-4	2015	3.80	59.0	5.04	5.50
SEm (±)	---	0.32	0.81	0.25	0.18
CD (0.05)	---	0.88	2.52	0.7	0.5
CV (%)	---	10.25	6.98	10.23	7.38

Table 1.47: Reproductive parameters during the year 2023

Variety	YOP	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight(g)	Shelling %	Nut Yield (kg/tree)	Cum. Yield (kg/plant)
Dhana	2010	January	60-62	7.7	77.67	25.27	5.64	14.7
VRI (CW)H-1	2011	January	55-60	6.9	53	21.43	5.24	9.24
Bhaskara	2015	January	60-65	7.9	62.33	24.5	3.45	8.95
BPP-8	2015	March	55-60	8.1	52.33	32.06	7.84	9.84
VRI-3	2015	January	50-60	7.2	50	31.1	6.98	5.98
H-303	2015	March	55-60	7.8	56	31.47	3.48	7.98
V-4	2015	March	50-60	4.9	17.33	27.84	5.32	7.32
SEm (±)				0.09	1.02	0.63	0.54	0.25
CD (0.05)				0.31	2.88	2.28	1.98	0.88
CV (%)				3.42	5.75	5.34	6.26	3.32

Field view of the experimental Block

1. Salient achievement/s made in each project (Ongoing / Concluded)- not more than two points
    - Fourteen genotypes have been collected, conserved and evaluated. Further three genotypes of Cashew viz., RC Cashew-1, RC Cashew-2 and RC Cashew-3 were characterized.
    - Highest plant height (5.57 m), plant spread (5.26m x 5.84m), nut weight and shelling percent (8.1g and 32.06% respectively) and nut yield (7.84kg) was recorded in BPP-8 while the apple weight was recorded highest in Dhana (77.67g).

DARISAI

Genotypes:
NRCC sel-1, NRCC sel-2, M44/3, M15/4, BPP3/33, BPP10/19, BPP30/1, BPPP3/28, H303, H255, H367 & H68

Design: RBD
Four plant per entry per replication,
Spacing: 6m × 6m

Fresh planting done in September 2023

KANABARGI

Year of planting	: 2015
Design	: RBD
Replication	: Three
Spacing	: 6 m X 6m
Number of plants per replication	: 5
Varieties/No. of entries	: 8

Progress Report: This experiment was initiated during 2015. Vegetative growth parameters for the year 2022-23.

Table 1.48: Growth parameters of different varieties during 2023 (YOP: 2015)

Sl. No	Variety	Year of planting	Tree Height (m)	Stem girth (cm)	Canopy spread-EW (m)	Canopy spread-NS (m)
1	H-303	2015	3.97	62.71	4.73	4.60
2	VRI H1 CW		3.08	47.87	3.52	3.45
3	NRCC-2		4.25	66.53	5.11	4.60
4	V4		4.17	62.70	4.64	4.94
5	Bhaskar		4.98	76.75	5.87	5.68
6	VIR-3		4.33	63.98	5.04	4.74
7	Dhana		4.25	66.98	4.74	4.74
8	BPP-8		4.49	55.00	4.44	4.27
Mean			4.17	62.81	4.76	4.63
SEm±			0.21	0.05	0.31	0.30
CD 5%			0.63	0.15	0.94	0.91
CV			8.51	12.30	11.33	11.28

Table 1.49: Yield parameters of different during 2023 (YOP: 2023)

Sl. No	Variety	Flowering Month			Duration of flowering days	Nut wt (gm)	Apple wt (gm)	Shelling %	Nut yield Kg/tree	Cumulative yield kg/plant	Special feature
		Early (Oct)	Mid (Nov-Dec)	Late (Jan)						5 years	
1	H-303	-	Dec	-	43	8.46	87.14	29.97	4.36	19.64	
2	VRI H1 CW	-	Dec	-	34	6.28	46.00	32.77	4.68	18.08	
3	NRCC-2	-	Dec	-	45	9.68	91.22	34.30	6.07	25.17	
4	V4	-	Dec	-	35	7.76	72.78	33.82	5.48	21.65	
5	Bhaskara	-	Dec	-	40	7.92	83.68	28.91	6.81	25.34	
6	VIR-3	-	Dec	-	45	5.88	51.61	25.83	4.02	18.29	
7	Dhana	-	Dec	-	40	7.40	62.44	29.43	5.26	19.97	
8	BPP-8		Dec		45	6.18	58.50	32.93	4.99	17.13	
Mean					40.88	7.45	69.17	31.00	5.21	20.66	
SEm+-						0.28	4.26	0.51	0.21	-	
CD (5%)						0.86	12.92	1.54	0.84		
CV (%)						6.57	10.66	2.84	10.99		

Among the different varieties, Bhaskara performed better under vegetative characters like tree height, stem girth canopy spread (4.98m, 76.75 cm, 5.87 m E-W and 5.68 m N-S) and the variety VRI CW H-1 showed poor performance (3.08 m, 47.87 cm, 3.52 m E-W and 3.45 m N-S) [Table No.1.48]. For yield parameters, NRCC Sel-2 recorded highest nut weight, apple weight and shelling percentage (9.68g, 91.22g and 34.3% respectively) whereas lowest was recorded in VRI-3 (5.88 g, 51.61g and 25.83% respectively). Nut yield kg/tree was highest in Bhaskara (6.81kg.) followed by NRCC Sel-2 (6.07 kg). Cumulative yield over 5 years was also highest in Bhaskara followed by NRCC Sel-2.[Table No.1.49].

Fig. ***Field view of the experimental Block***

Gen 4: Hybridization and Selection

Centers: East Coast: Bapatla, Bhubaneshwar, Jhargram and Vridhachalam
West Coast: Goa, Madakkathara, Pilicode and Vengurla
Plains / others: Darisai, Hogalagere and Jagdalpur

Objective: To utilize accessions with high yield and other desirable traits selected from the germplasm conserved at various AICRP Centers 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

Hybridization programme during the year 2022-23

Hybridization programme was done during the year 2022-23 and selected total five cross combinations, the F_1 seedlings were planted in the main field along with the local checks BPP-8 and BPP-9 on 22.12.2023

Sl. No.	Cross combination	No of flowers pollinated	Percentage of nuts harvested	% fruit set	No. of seeds germinated	% germination	No of plants in the main field
1	H-218 x H-368	75	17	22.66	13.0	100	10
2	H-491 x T. No. 228	100	23	23.00	16.0	84.21	14
3	H-695 x H 467	120	35	29.16	26.0	86.66	13
4	H 695 x H 474	100	29	29.00	22.0	75.86	13
5	BPP-4 x H 491	90	4	04.44	-	-	-
	Total	485					50

Evaluation of Existing F_1 Hybrids

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 released as BPP-10 and BPP-11.

Existing F_1 progenies have been evaluated for the vegetative characters, duration of flowering, yield, nut weight etc and the data is presented in the Table No.1.50 here under.

Table 1.50: Yield parameters of different cashew hybrids at Bapatla Centre planted during 2000

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Annual nut yield @14th harvest (Kg/tree) 2023	Cum.nut yield (Kg/tree) (for 14 Harvests) 2010-23
H179	BPP-6X T NO 2/22	5.34	34.7	26.53	6.30	71.57
H180	BPP-6X T NO 2/22	6.25	36.4	27.69	6.40	78.13
H186	T NO 228X T NO 273	4.61	28.90	28.56	5.60	87.75
H187	T NO 228X T NO 273	6.23	28.4	25.34	8.40	79.15
H190	T NO 228X T NO 273	3.64	33.45	24.87	10.20	79.93
H194	T NO 228 X F NO5	5.84	45.8	26.65	9.10	83.05
H197	T NO 228 X F NO5	5.56	38.5	27.54	11.10	103.33
H200	T NO 228 X BPP8	5.66	56.4	26.65	10.80	82.80
H218	**Priyanka X T NO 30/1**	**9.76**	**42.3**	**28.65**	**15.30**	**194.05**

The mean nut weight was maximum in H-218 (9.76 g) followed by H-180 (6.25 g). The mean apple weight was recorded highest in H-200 (56.40 g) followed by H-194 (45.8 g). The shelling percentage was found highest in H-218 (28.65) followed by H-180 (27.69). The annual nut yield per tree was found highest in H-218 (15.30 kg) followed by H-197 (11.10 kg). The cumulative nut yield per tree was found highest in H-218 (194.05 kg) which was followed by H-197 (103.33 kg) for 14 annual harvests.[Table No.1.50]

Table 1.51: Yield parameters of different cashew hybrids at Bapatla Centre planted during 2009

Hybrid No.	Cross combination	Mean Nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) 10th harvest (2023)	Cum. Nut yield (kg/tree) (for 10 Harvests) 2014-2023
H 439	M15/4 × T.N.30/1	6.44	41.35	27.34	2.60	16.93
H 440	M15/4xT.No.30/1	8.36	56.45	28.18	2.80	13.58
H 441	M15/4xT.No.30/1	5.45	45.25	26.78	3.10	9.93
H 442	M15/4xT.No.30/1	6.04	68.35	25.78	3.90	14.17
H 444	M15/4xT.No.30/1	6.54	40.45	27.82	4.30	16.16
H445	M15/4xT.No.30/1	6.55	43.25	29.52	**13.10**	**46.25**
H 446	M15/4xT.No.30/1	7.34	53.65	28.38	9.20	28.63
H 448	M15/4xT.No.30/1	**8.43**	46.45	25.78	11.20	40.20
H 450	BPP-5X H-320	5.33	28.45	20.42	2.20	11.27
H 451	BPP-5X H-320	5.44	32.35	25.38	2.50	7.35
H 452	BPP-5X H-320	4.46	57.35	26.98	3.00	9.88
H 453	BPP-5X H-320	4.66	48.35	25.28	2.95	11.45
H 454	BPP-5X H-320	3.96	28.25	26.38	2.80	12.81
H 455	BPP-5X H-320	3.76	54.25	27.24	6.20	16.20

H 456	BPP-5X H-320	5.36	52.35	25.42	1.80	7.76
H 457	BPP-5X H-320	4.43	27.75	**29.78**	2.40	11.56
H 458	PRIYANKAxBPP-2	5.44	45.25	26.84	1.90	10.20
H 459	H-36XVRI-3	6.56	37.25	27.68	2.00	12.10
H 460	VRI-3 XBPP-9	6.75	44.75	24.96	1.80	18.40
H 461	VRI-3 XBPP-9	**9.10**	54.35	29.31	15.3	**69.81**
H 462	BPP-3xPRIYANKA	8.34	**75.25**	28.68	5.6	21.15
H 463	BPP-3xPRIYANKA	8.25	**74.95**	29.62	4.2	15.55
H 464	BPP-3xPRIYANKA	8.36	44.75	29.06	5.6	44.43
H 465	BPP-3xPRIYANKA	5.56	**66.25**	28.64	2.30	23.40
H 466	BPP-3xPRIYANKA	4.14	34.25	27.38	4.10	25.75
H 467	BPP-3xPRIYANKA	**9.45**	76.55	28.76	9.30	55.40
H 468	BPP-3xPRIYANKA	5.67	45.15	29.30	2.4	18.33
H 469	BPP-3xPRIYANKA	5.35	44.25	29.48	10.0	33.19
H 470	BPP-3xPRIYANKA	6.52	**85.75**	28.34	3.4	18.26
H 471	BPP-3xPRIYANKA	7.43	66.75	26.41	2.0	12.10
H 472	VRI-3XBPP-8	6.70	66.55	24.42	2.0	42.45
H 473	VRI-3XBPP-8	7.24	68.65	23.69	3.6	18.75
H 474	VRI-3XBPP-8	**8.40**	48.75	25.52	12.40	40.95
H 475	VRI-3XBPP-8	7.34	**68.75**	24.47	2.30	12.10
H 476	BPP-5XM15/4	5.55	41.75	27.64	3.10	20.08
H 477	BPP-5XM15/4	5.99	48.75	22.78	4.30	23.05
H 478	BPP-5XM15/4	6.46	56.75	27.88	3.10	20.43
H 482	BPP-5XM15/4	5.48	58.55	**30.38**	3.20	27.05
H 483	M15/4 X TNO.228	4.55	55.75	20.48	9.75	**49.55**
H 484	M15/4 X TNO.228	4.56	42.25	20.68	3.1	20.45
H 485	M15/4 X TNO.228	7.69	52.25	25.68	2.6	31.73
H 486	VRI-2 X BPP-8	6.56	48.35	28.68	1.8	32.63
H 487	VRI-2 X BPP-8	6.44	55.35	27.76	2.30	26.10
H 488	VRI-2 X BPP-8	4.65	37.25	25.94	4.10	34.40
H 489	VRI-2 X BPP-8	6.45	40.15	26.82	3.20	14.43
H 490	VRI-2 X BPP-8	7.36	45.35	23.64	7.20	15.25
H 491	VRI-2 XBPP-8	**9.56**	**65.93**	28.55	**18.60**	**79.30**
H 492	VRI-2 X BPP-8	8.15	48.45	23.41	11.30	53.9
H 493	VRI-2 X BPP-8	5.57	30.45	23.68	2.30	33.60
H 494	VRI-2 X BPP-8	5.46	38.25	25.98	4.10	23.28
H 495	VRI-2 X BPP-8	5.56	33.45	25.84	4.20	16.30
H 496	VRI-2 X BPP-8	6.94	44.75	25.68	3.30	35.56
H 497	VRI-2 X BPP-8	5.98	37.51	23.78	4.10	28.75

The mean nut weight was highest in H-491 (9.56 g) followed by H-467 (9.45 g). The mean apple weight was highest in H-470 (85.75 g) followed by H-462 (75.25 g). The shelling percentage was maximum in H-482 (30.58) followed by H-457 (29.38). The mean annual nut yield was highest in H-491(18.60 kg/tree) followed by H-445 (13.1 kg/tree). The cumulative nut yield was maximum in H-491 (79.30 kg/tree) followed by H-461 (69.81 Kg/tree) for 10 annual harvests**.** [Table No.1.51]

Table 1.52: Yield parameters of different cashew hybrids at Bapatla Centre planted during 2011

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (Kg/tree) 7th harvest (2023)	Cum. yield (kg/tree) (for Seven Harvests) (2017-2023)
H647	T.No.2/22 x BPP-5	5.33	44.05	24.56	8.20	20.05
H648	T.No.71 x T.No.273	**7.46**	47.65	28.72	6.30	19.03
H 649	**BPP-9 x T.No.2/22**	**7.48**	**36.44**	**30.16**	**8.20**	**29.75**
H650	BPP-9 x T.No.2/22	6.35	38.55	25.22	5.66	19.01
H651	BPP-9 x T.No.2/22	5.53	36.45	27.25	14.6	35.65
H652	T.No.228 x T.No. 71	4.99	46.65	28.55	6.80	18.40
H653	T.No.228 x BPP-9	4.89	41.35	28.26	7.85	22.50
H654	BPP-8 x T.No.2/22	6.34	38.65	25.32	5.10	21.43
H655	T.No.2/22 x BPP-5	5.34	37.65	20.65	4.30	19.51
H656	T.No.228 x Priyanka	5.69	34.75	24.34	7.10	24.09
H657	T.No.228 x Priyanka	5.87	35.66	22.34	7.30	20.14
H658	T.No.228 x F.No.3	5.64	**72.85**	21.45	5.30	18.76
H659	BPP-5 x T.No.2/22	6.67	66.95	23.55	6.0	16.88
H 660	**BPP-5 x T.No.2/22**	**7.89**	**53.75**	**28.65**	**9.20**	**40.80**
H 661	**BPP-5 x T.No.2/22**	**7.78**	**43.85**	**27.92**	**5.60**	**24.68**
H 662	**BPP-5 x T.No.2/22**	**8.43**	**56.45**	**27.75**	**8.10**	**25.85**
H663	T.No.228 x Priyanka	6.57	43.55	27.82	4.60	24.25
H664	Priyanka x T.No.30/1	5.87	39.55	25.66	4.60	20.35
H665	BPP-8 x Priyanka	6.88	36.65	25.76	**10.30**	23.00
H666	T.No.273 xT.No. 71	5.67	42.55	26.66	6.90	18.70
H667	T.No.273 xT.No. 71	7.68	36.95	26.97	5.20	16.15
H668	T.No. 71 x T.No.273	5.78	36.45	26.56	1.40	14.05
H669	T.No. 71 x T.No.273	5.68	39.45	24.36	1.40	14.37
H670	F.No.5 x T.No.40	6.42	36.35	25.34	2.10	10.88
H671	F.No.5 x T.No.40	5.96	66.55	25.74	3.96	13.77
H672	F.No.3 x T.No.228	5.65	37.65	27.64	4.50	15.44
H673	F.No.3 x T.No.228	4.88	**68.55**	27.44	4.0	14.94
H674	T.No.30/1 x BPP-8	5.95	56.65	28.62	3.50	13.60
H675	T.No.30/1 x BPP-8	4.85	43.55	19.56	3.20	13.25
H676	T.No.228 x F.No.5	4.98	38.55	28.72	3.10	14.04
H677	T.No.228 x F.No.5	5.68	44.75	28.34	2.27	11.99
H678	BPP-8 x BPP-3	5.87	37.75	26.87	6.3	14.75
H679	BPP-8 x BPP-3	4.88	39.85	21.74	2.80	14.95
H680	Kavali x T.No.40/1	5.09	45.65	25.92	1.90	11.20
H681	R.K.Bhai x T.No.40/1	5.98	40.45	25.73	**10.75**	**21.20**
H682	R.K.Bhai x T.No.40/1	4.83	42.63	25.62	8.60	19.10
H683	R.K.Bhai x T.No.40/1	4.91	43.33	23.86	2.50	18.60
H684	ABT-3 x T.No.40/1	4.78	45.63	22.64	2.10	14.56
H685	ABT-3 x T.No.40/1	5.55	43.45	22.65	4.30	14.7
H686	ABT-3 x T.No.40/1	5.95	44.35	22.52	3.10	19.16
H687	BPP-6 x Sel-2	5.96	46.95	22.62	3.20	18.85
H688	BPP-6 x Sel-1	5.77	58.25	24.63	3.90	15.25
H689	BPP-8 x BPP-4	6.96	54.75	22.43	2.00	10.79
H690	BPP-8 x Ullal -4	6.88	54.75	**31.15**	1.80	17.55
H691	BPP-8 x Ullal-5	6.58	53.35	26.44	2.40	12.2
H692	T.No.228 x BPP-8	5.86	56.80	26.74	3.10	16.35
H693	BPP-8 x T.No.228	5.39	43.75	26.43	3.10	18.93

H694	BPP-8 x T.No.228	4.34	43.83	25.44	2.80	19.75
H 695	**BPP-8 x Ullal-3**	**6.78**	**46.85**	**28.35**	**14.36**	**88.45**
H696	BPP-8 x Ullal-3	6.56	47.65	23.64	8.10	18.95
H697	BPP-6 x NRCC-1	6.86	44.05	26.18	7.10	19.61
H698	T.No. 228 x BPP-8	7.87	44.05	27.74	2.90	13.55
H699	Priyankax T.No.10/19	4.99	58.05	26.96	1.40	12.65

The mean nut weight was highest in H-662 (8.43 g) followed by H-660 (7.89 g). The mean apple weight was highest in H-662 (72.85g) followed by H-673 (68.35g). The shelling percentage was maximum in H-649 (30.16) followed by H-690 (31.15). The mean annual nut yield was highest in H-695 (14.36Kg/tree) followed by H-681 (10.75 kg). The cumulative nut yield recorded highest in H-695 (88.45 kg / tree) followed by H-660 (40.80 kg / tree) for seven annual harvests. [Table No.1.52]

Table 1.53: Yield parameters of different cashew hybrids at Bapatla Centre planted during 2012

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (Kg/tree) 7th harvest (2023)	Cum. yield (kg/tree) (for seven Harvests) 2017-2023
H700	Kankady x BLA39/4	4.38	53.60	24.05	8.90	21.60
H701	Kankady x BLA39/4	4.67	55.40	28.06	4.30	25.10
H702	Kankady x BLA39/4	6.78	49.60	27.94	7.70	20.84
H703	Kankady x BLA39/4	4.77	63.40	28.08	**10.65**	**25.29**
H704	Kankady x BLA39/4	5.65	54.60	26.96	**9.90**	23.65
H705	Kankady x BLA39/4	6.63	73.45	26.66	9.10	**29.00**
H706	Kankady x BLA39/4	5.78	37.56	23.37	8.10	25.30
H707	T.No.10/19xKankady	5.85	57.10	24.76	6.90	15.68
H708	T.No.10/19xKankady	5.84	48.65	25.67	5.60	19.55
H709	T.No.10/19xKankady	7.50	56.80	**28.37**	4.60	14.31
H710	T.No.10/19xKankady	**7.60**	62.33	**28.40**	7.80	**29.18**
H711	T.No.10/19xKankady	6.25	53.50	27.80	6.40	17.80
H712	KankadyxT.No.10/19	5.85	53.10	**29.36**	**12.10**	**24.90**
H713	KankadyxT.No.10/19	6.90	44.65	26.34	4.00	14.03
H714	KankadyxT.No.10/19	7.14	65.10	20.44	6.70	18.20
H715	BPP-8 x Kankady	**7.91**	**75.76**	27.80	3.30	17.60
H716	BPP-8 x Kankady	**7.63**	44.60	21.59	4.40	**28.45**
H717	BPP-8 x Kankady	6.63	58.10	24.99	2.70	16.93
H718	BPP-8 x Kankady	5.82	55.85	25.44	3.15	18.20
H719	BPP-8 x Kankady	4.97	44.35	23.34	3.70	21.55
H720	BPP-8 x Kankady	6.37	**68.25**	21.88	4.60	11.23
H721	BPP-8 x Kankady	**7.60**	**66.10**	26.84	2.90	10.80
H722	KankadyxT.No.10/19	6.54	**66.05**	26.71	1.60	13.00

The mean nut weight was highest in H-715 (7.91 g) followed by H-716 (7.63 g). The mean apple weight was highest in H-715 (75.76 g) followed by H-720 (68.25 g). The shelling percentage was maximum in H-712 (29.36) followed by H-710 (28.40) and H-709 (28.37). The mean annual nut yield was highest in H-712 (12.10 kg/tree) followed by H-703 (10.65 kg/tree). The cumulative nut yield recorded highest in H-710 (29.18 kg/tree) followed by H-705 (29.00 kg/tree) for seven harvests. [Table No.1.53]

Table 1.54: Yield parameters of different cashew hybrids at Bapatla Centre planted during 2013

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree) 5th harvest (2023)	Cum. yield (kg/tree) (for Five Harvests) 2019-2023
H724	T.No. 30/1 X Kankady	6.45	35.60	**29.30**	5.15	18.30
H726	T.No. 30/1 X Kankady	**8.55**	43.10	27.40	5.30	19.76
H727	T.No. 30/1 X Kankady	7.10	38.10	**30.10**	8.60	27.30
H729	T.No. 30/1 X Kankady	6.90	39.65	28.10	**10.30**	20.46
H736	BPP-8 x BLA -39/4	6.35	44.34	24.30	4.80	21.60
H737	BPP-8 x BLA -39/4	6.96	51.23	28.15	5.30	22.30
H738	BPP-8 x BLA -39/4	7.90	52.43	26.18	5.30	24.50
H745	BLA -39/4 x BPP-8	7.30	49.88	27.20	6.30	27.20
H749	H 95-T4 x TNo -30/1	7.65	44.56	**30.31**	5.60	26.30
H751	H 95-T4 x TNo -30/1	7.30	43.63	**29.72**	6.90	31.00
H755	Kankady x BPP-9	7.60	**54.71**	26.73	6.40	**30.80**
H757	Kankady x BPP-8	7.85	53.60	28.12	3.90	19.45
H758	Kankady x BPP-8	**7.90**	**54.60**	29.60	**11.56**	**43.20**
H761	Kankady x H -95-T4	**8.10**	50.26	28.99	**18.20**	**44.56**

The mean nut weight was highest in H-726(8.55 g) followed by H-761 (8.10 g). The mean apple weight was highest in H-755 (54.71 g) followed by H-758 (54.60 g). The shelling percentage was maximum in H -749 (30.31) followed by H-727 (30.10) and H-751 (29.72). The mean annual nut yield was highest in H-761 (18.20 kg/tree) followed by H-758 (11.56 kg/tree). The cumulative nut yield recorded highest in H-761 (44.56 kg/tree) followed by H-758 (43.20 kg/tree) for five harvests. [Table No.1.54].

BHUBANESHWAR

During the fruiting season 2023, total 928 numbers of bisexual flowers were pollinated involving three cross combinations i.e. BBSR-1xVTH711/4, BBSR-1XKGN-1 and DhanaxVTH711/4. A total of 257 numbers of seed nuts were harvested (Table 2) and these seed nuts were sown in poly bags on 15.05.2023 for raising seedlings of F_1 progenies. 241 numbers of seed nuts were germinated. Out of which 148 numbers of F_1 progenies are planted in the main field following augmented design for future evaluation.

Table 1.55: Details of hybridization programme at Bhubaneswar Centre, 2022-2023

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants planted
1	BBSR-1 x VTH711/4	277	74	26.71	70	94.60	45
2	BBSR-1 × KGN-1	417	161	31.14	151	93.78	89
3	DhanaxTHV711/4	234	22	10.23	20	90.90	14
	Total	**928**	**257**	**-**	**241**	**-**	**148**

Evaluation Details

Evaluation of F_1 progenies (Year of planting 2017 and 2018): Bhubaneswar Center

Evaluation of 2017 and 2018 planted F_1 progenies revealed that genotypes A-1/17, B-5/18, G-6/18, H-2/18, H-3/18, K-1/18 and L-5/18 were found promising with respect to nut weight, shelling %, mean annual nut yield (kg plant^{-1}) and cumulative nut yield (kg plant^{-1}) at 4th harvest [Table No. 1.56]. Among the F_1 progenies, A-1/17 recorded maximum mean annual nut yield (5.6 kg plant^{-1}) and cumulative nut yield (12.03 kg plant^{-1}) at 4th harvest. However, nut weight and shelling were recorded maximum in F_1 progenies H3/18(11.0g) and L-5/18(31.27%) respectively. Genotype, L-5/18 was found to be one week to 15 days earlier in flowering compared to Balabhadra and BPP-8.

Table 1.56: Yield attributing parameters and nut yield of promising F1 progenies,2022-2023: Bhubaneswar Center

Accn #	YOP	Flow. Time	Flow. Durn. (days)	Nut Wt.(g)	Apple Wt.(g)	Shelling %	Mean Ann. nut yield (kg/Tr) at 4th hvst	Cum. nut yield (kg/ Tr) for 4 hvsts	Special features
A-1/17	2017	Dec.-Jan.	55	9.8	57.26	30.5	5.60	12.03	Bold nut & high yield
B-5/18	2018	Dec.-Jan.	58	8.3	52.42	31.0	4.41	8.15	Bold nut & high yield
G-6/18	2018	Dec.-Jan.	60	9.3	54.86	30.6	4.23	9.93	Bold nut & high yield
H-2/18	2018	Dec.-Jan.	53	10.5	61.52	28.53	3.46	5.8	Bold nut
H-3/18	2018	Jan.-Feb.	50	11.0	65.11	29.21	3.22	5.34	Bold nut
K-1/18	2018	Jan.-Feb.	48	8.8	73.26	30.80	2.87	5.7	Bold nut
L-5	2018	Nov.-Dec.	62	7.84	50.42	31.27	4.36	9.78	Cluster bearing

Evaluation of F_1 progeny (Year of planting 2020)

Details of the experiment:

Design	:	Augmented
Replication/ Blocks	:	04
Spacing	:	6m x 6m
Number of F_1 progeny	:	48
Year of planting	:	2020

Data presented in [Table No.1.57] revealed that F_1 progeny, K-3 recorded maximum plant height (4.24m) as well as canopy spread in E-W (5.05m) and N-S (5.18m) direction. Trunk girth was maximum in genotype D3 (37.95cm). Similarly, among the 48 evaluated F_1 progenies, K-8 exhibited lowest plant height (1.69m), trunk girth (20.16cm) and canopy spread in E-W (2.31m) and N-S (1.88) directions.

Among the check varieties, BBSR 'C'-1 recorded maximum plant height (3.22m) while trunk girth was maximum in variety, VRI-3 (31.12cm). Canopy spread in E-W(3.88m) and N-S(4.03m) direction was maximum in check variety, Bhubaneswar-1. KGN-1 recorded lowest values for all the vegetative growth parameters (plant height, trunk girth and canopy spread in E-W & N-S direction) [Table No.1.57].

Comparison between F_1 progenies and check varieties revealed that only two check varieties, VRI-3(31.12cm) and Bhubaneswar-1(4.03m) exhibited *statistical parity* with the highest trunk girth (37.95cm) and canopy spread in N-S direction (4.33m) respectively. For other vegetative parameters F_1 progenies were found superior than the check varieties.

Table 1.57. Growth parameters during the year 2023(Year of planting 2020): Bhubaneswar Center

Sl. No.	Accn.	YOP	Plant ht(m)	Stem girth(cm)	Canopy spread(m)	
					E-W	N-S
BLOCK-I						
1.	A1	2020	3.47	28.35	4.18	4.17
2.	A-2	2020	3.67	25.05	4.13	3.57
3.	B-1	2020	3.77	27.65	2.63	3.82
4.	B-2	2020	2.77	24.55	4.13	3.37
5.	C-1	2020	2.97	27.55	3.53	3.52
6.	C-2	2020	3.27	30.45	3.58	3.77
7.	C-3	2020	3.27	31.05	2.83	3.42
8.	D-1	2020	3.77	28.35	3.33	4.32
9.	D-2	2020	3.17	30.85	3.83	3.57
10.	D-3	2020	3.47	**37.95**	3.63	4.32
11.	E-1	2020	3.22	30.75	3.93	4.07
12.	E-2	2020	3.37	32.95	3.98	4.87
BLOCK-II						
13.	E-3	2020	3.22	26.16	3.29	3.50
14.	F1	2020	3.02	28.46	3.59	3.75
15.	F-2	2020	3.87	30.06	3.34	4.60
16.	G-1	2020	3.37	32.96	3.79	4.60
17.	G-2	2020	3.72	34.46	4.84	4.35
18.	G-3	2020	3.07	25.66	4.44	3.80
19.	G-4	2020	3.32	26.06	2.84	4.10
20.	H-1	2020	2.62	24.46	3.24	3.65
21.	H-2	2020	2.67	28.56	3.54	3.15
22.	H-3	2020	2.92	26.96	4.09	4.00
23.	H-4	2020	4.12	28.56	2.69	2.90
24.	H-5	2020	3.42	32.26	3.44	3.60
BLOCK-III						
25.	H-6	2020	2.80	29.81	3.36	3.78
26.	I-1	2020	3.35	26.51	3.66	4.63
27.	I-2	2020	3.85	36.51	4.61	4.53

28.	I-3	2020	3.30	36.81	3.96	4.08
29.	I-4	2020	2.45	24.71	2.56	2.28
30.	I-5	2020	3.40	32.01	3.36	4.08
31.	I-6	2020	3.10	33.41	4.31	2.28
32.	I-7	2020	3.50	32.81	4.56	4.08
33.	I-8	2020	3.70	33.61	3.66	4.23
34.	I-9	2020	3.45	31.61	3.31	4.08
35.	J-1	2020	3.20	29.31	3.36	4.13
36.	J-2	2020	2.50	26.11	3.26	3.68
BLOCK-IV						
37.	J-3	2020	3.09	28.56	3.56	3.38
38.	J-4	2020	3.29	28.26	3.61	4.38
39.	J-5	2020	3.39	33.86	4.36	4.33
40.	K-1	2020	2.89	29.06	4.06	3.28
41.	K-2	2020	3.19	26.46	3.11	3.68
42.	K-3	2020	**4.24**	31.96	**5.06**	**5.18**
43.	K-4	2020	2.99	28.96	3.46	3.48
44.	K-5	2020	3.19	30.06	3.61	3.38
45.	K-6	2020	3.39	26.66	3.81	4.33
46.	K-7	2020	2.64	26.36	2.46	3.18
47.	K-8	2020	1.69	20.16	2.31	1.88
48.	K-9	2020	3.19	29.36	3.86	3.63
Checks						
49.	VTH711/4	2020	2.81	28.67	3.15	3.42
50.	BBSR-1	2020	2.94	27.57	3.88	4.03
51.	BBSR “C”-1	2020	3.22	26.67	3.26	3.67
52.	VRI-3	2020	3.16	31.12	3.41	3.76
53.	V-4	2020	3.02	24.77	3.77	3.35
54.	Dhana	2020	2.60	25.95	2.75	2.82
55.	KGN-1	2020	1.60	15.70	1.66	1.85
56.	Bhaskara	2020	2.38	21.65	2.45	2.55
57.	OUAT Kalinga Cashew-1	2020	2.88	28.97	2.97	3.10
58.	Jagannatha	2020	2.77	26.57	3.27	3.02
59.	Balabhadra	2020	2.82	27.35	3.07	3.26
60.	BPP-8	2020	2.95	26.95	2.96	2.85
61.	V-7	2020	2.53	22.30	3.25	3.25
	Mean		**3.13**	**28.64**	**3.51**	**3.70**
	CD for two check varieties mean		**0.51**	**4.66**	**0.614**	**0.74**
	CD for two hybrids in same block		**1.01**	**9.33**	**1.229**	**1.49**
	CD for two hybrids in different block mean		**1.05**	**9.68**	**1.275**	**1.54**
	CD for a hybrid and check varieties mean		**0.83**	**7.65**	**1.008**	**1.22**
	CV(%)		**11.90**	**11.83**	**12.83**	**14.90**

The tested F_1 progenies viz. A-1 and A-2 exhibited early flowering while all other F_1 progenies recorded medium to late flowering during evaluation. The reproductive parameters presented in [Table No.1.58] revealed that among the evaluated F_1 progenies, I-7 recorded maximum nut weight (15.31g) followed by I-8(15.01g), I-2(13.98g) and G2(13.08g) which were *statistically at par*. Minimum nut weight was recorded in F_1 progeny H-5(6.08g). Evaluation of F_1 progenies for apple weight revealed that I-2 recorded significantly maximum apple weight (296.54g) followed by D-2(200.32g), I-6(130.04g), I-1(123.14g), I-7(122.84g), B-2(121.92g), I-8(116.54g) and G-2(114.71g). Minimum apple weight was recorded minimum in F_1 progeny, E-2(42.52g). Shelling % was maximum in genotype, J-1(34.27) followed by K-5(34.09), F-1 (33.79%) and F-2(33.71%). Lowest shelling% was recorded in genotype I-8(22.90. Genotypes evaluated for mean annual nut yield (kg plant^{-1}) at 1st harvest revealed that D-3 recorded highest nut yield (2.69) followed by H-6(2.35), G-2(2.06) and K-3(2.03) which were *statistically at par*.

Among the check varieties, nut weight ranged from minimum 6.08g in BBSR-1 to maximum 14.45g in VTH711/4 while apple weight ranged from minimum 39.17g in Vengurla-7 to maximum 146.8g in VTH711/4. Shelling was recorded maximum in genotype, BBSR 'C'-1 (31.44%) followed by Bhubaneswar-1(31.18%) and V-7(30.46%). The minimum shelling was recorded in KGN-1(27.87%). Mean annual nut yield plant^{-1} ranged from minimum 0.21 kg in KGN-1 to maximum 1.42 kg in OUAT Kalinga Cashew-1.

Comparison between the F_1 progenies and check varieties revealed that genotypes, D-3, H-6, G-2, K-3 and I-2 were superior to other tested genotypes w.r.t. nut weight, shelling % and mean annual nut yield at 1st harvest.

Table 1.58. Reproductive parameters during the year 2023 (Year of Planting2020): Bhubaneswar Center

Sl. No.	Accn	YOP	Flow. time	Nut wt(g)	Apple wt(g)	shelling %	Nut yld (kg/plant)	Spl features
1.	A1	2020	Nov.-Dec.(Early)	13.34	87.92	32.52	0.58	Jumbo nut
2.	A-2	2020	Nov.-Dec.(Early)	10.94	102.32	32.91	0.84	Bold nut
3.	B-1	2020	Nov.-Dec.(Early)	10.04	61.32	32.39	0.95	Bold nut
4.	B-2	2020	Nov.-Dec.(Early)	11.94	121.92	29.99	0.06	Jumbo nut
5.	C-1	2020	Nov.-Dec.(Early)	9.94	47.42	31.26	0.77	Bold nut
6.	C-2	2020	Dec.-Jan.(Mid)	9.27	54.32	29.33	1.37	Bold nut & high nut yield
7.	C-3	2020	Dec.-Jan.(Mid)	10.34	107.12	30.43	0.89	Bold nut & flowering twice in a year
8.	D-1	2020	Dec.-Jan.(Mid)	8.94	53.52	32.32	1.74	Bold nut & high yield
9.	D-2	2020	Jan.-Feb.(Late)	12.64	200.32	32.58	0.32	Jumbo nut but low nut yield
10.	D-3	2020	Dec.-Jan.(Mid)	10.54	64.98	32.45	2.69	Bold nut & high nut yield
11.	E-1	2020	Jan.-Feb.(Late)	9.69	64.82	31.42	1.26	Bold nut

12.	E-2	2020	Dec.-Jan.(Mid)	10.07	42.52	32.43	0.62	Bold nut
13.	E-3	2020	Jan.-Feb.(Late)	10.08	43.71	31.24	0.64	Bold nut
14.	F1	2020	Dec.-Jan.(Mid)	9.68	65.91	33.79	1.12	Bold nut & medium yielder
15.	F-2	2020	Dec.-Jan.(Mid)	9.41	48.71	33.71	1.17	Bold nut & medium yielder
16.	G-1	2020	Jan.-Feb.(Late)	9.58	77.21	32.82	0.99	Bold nut
17.	G-2	2020	Jan.-Feb.(Late)	13.08	114.71	31.25	2.06	Jumbo nut & high yield
18.	G-3	2020	Dec.-Jan.(Mid)	7.48	45.11	30.12	0.33	Cluster bearing
19.	G-4	2020	Jan.-Feb.(Late)	10.08	89.30	31.31	0.52	Bold nut
20.	H-1	2020	Dec.-Jan.(Mid)	9.08	78.31	24.07	0.57	Bold nut
21.	H-2	2020	Dec.-Jan.(Mid)	8.08	36.71	31.62	0.62	Bold nut
22.	H-3	2020	Dec.-Jan.(Mid)	8.58	81.71	32.07	0.88	Bold nut
23.	H-4	2020	Dec.-Jan.(Mid)	6.48	72.11	30.66	0.97	Medium size nut
24.	H-5	2020	Jan.-Feb.(Late)	6.08	50.37	32.40	1.37	Small nut, cluster bearing & medium yielder
25.	H-6	2020	Jan.-Feb.(Late)	8.26	56.94	26.75	2.35	Bold nut and high yielder
26.	I-1	2020	Jan.-Feb.(Late)	11.98	123.14	25.33	1.58	Jumbo nut & high yielder
27.	I-2	2020	Jan.-Feb.(Late)	13.98	296.54	28.76	0.56	Jumbo nut
28.	I-3	2020	Jan.-Feb.(Late)	11.98	81.54	30.84	0.61	Jumbo nut
29.	I-4	2020	Jan.-Feb.(Late)	8.58	86.94	28.27	0.58	Late flowering type
30.	I-5	2020	Jan.-Feb.(Late)	9.78	80.54	29.67	0.77	Late flowering type
31.	I-6	2020	Jan.-Feb.(Late)	12.98	130.04	23.75	1.05	Jumbo nut
32.	I-7	2020	Jan.-Feb.(Late)	15.31	122.84	27.32	0.80	Jumbo nut
33.	I-8	2020	Jan.-Feb.(Late)	15.01	116.54	22.90	1.21	Jumbo nut & medium yield
34.	I-9	2020	Jan.-Feb.(Late)	10.48	106.74	22.98	0.21	Bold nut
35.	J-1	2020	Jan.-Feb.(Late)	9.98	89.04	34.1	0.90	Bold nut
36.	J-2	2020	Jan.-Feb.(Late)	8.35	92.54	25.29	0.12	Bold nut
37.	J-3	2020	Dec.-Jan.(Mid)	9.54	73.22	29.79	0.39	Bold nut

38.	J-4	2020	Jan.-Feb.(Late)	8.37	58.42	27.18	0.74	Bold nut
39.	J-5	2020	Dec.-Jan.(Mid)	11.97	84.42	32.62	1.09	Jumbo nut & medium yielder
40.	K-1	2020	Jan.-Feb.(Late)	9.77	85.42	31.03	1.06	Bold nut & medium yielder
41.	K-2	2020	Dec.-Jan.(Mid)	8.30	88.42	32.42	1.10	Bold nut & medium yielder
42.	K-3	2020	Dec.-Jan.(Mid)	8.63	87.25	32.29	2.03	Bold nut & high yielder
43.	K-4	2020	Dec.-Jan.(Mid)	10.63	101.22	32.64	1.18	Bold nut & medium yielder
44.	K-5	2020	Jan.-Feb.(Late)	7.97	54.42	34.09	0.73	Late flowering
45.	K-6	2020	Dec.-Jan.(Mid	8.59	67.92	29.18	0.40	Bold nut
46.	K-7	2020	Dec.-Jan.(Mid	9.50	110.42	32.94	0.34	Bold nut & late flowering
47.	K-8	2020	Jan.-Feb.(Late)	12.17	87.52	26.48	0.04	Smallest among all hybrids & Jumbo nut
48.	K-9	2020	Dec.-Jan.(Mid)	6.30	43.02	30.42	1.64	Profuse flowering & high yielder
49.	VTH711/4	2020	Dec.-Jan.(Mid)	14.45	146.80	30.52	0.22	Jumbo nut
50.	BBSR-1	2020	Dec.-Jan.(Mid)	6.08	43.42	31.18	1.09	Medium yielder & high shelling %
51.	BBSR “C”-1	2020	Dec.-Jan.(Mid)	6.27	44.95	31.44	1.10	Medium yielder & high shelling %
52.	VRI-3	2020	Nov.-Dec.(Early)	6.47	46.47	30.32	1.29	Medium yielder
53.	V-4	2020	Dec.-Jan.(Mid)	7.12	62.05	30.06	0.94	Cluster bearing
54.	Dhana	2020	Dec.-Jan.(Mid)	9.22	73.45	28.80	1.06	Bold nut
55.	KGN-1	2020	Dec.-Jan.(Mid)	11.85	79.32	27.87	0.21	Jumbo nut
56.	Bhaskara	2020	Dec.-Jan.(Mid)	7.22	67.15	29.70	0.76	Cluster bearing
57.	OUAT Kalinga Cashew-1	2020	Jan.-Feb.(Late)	9.20	45.57	30.28	1.42	Bold nut and medium yielder
58.	Jagannatha	2020	Dec.-Jan.(Mid)	8.22	61.02	30.21	1.16	Medium yielder
59.	Balabhadra	2020	Nov.-Dec.(Early)	7.57	61.40	29.71	1.23	Medium yielder
60.	BPP-8	2020	Nov.-Dec.(Early)	8.7	52.02	29.83	1.30	Medium yielder

61.	V-7	2020	Dec.-Jan. (Mid)	9.18	39.17	30.46	0.84	Bold nut
	Mean			**9.75**	**81.64**	**30.21**	**0.94**	
CD for two check varieties mean				**1.74**	**11.85**	**1.12**	**0.50**	
CD for two hybrids in same block				**3.49**	**23.70**	**2.25**	**1.01**	
CD for two hybrids in different block mean				**3.62**	**24.60**	**2.34**	**1.05**	
CD for a hybrid and check varieties mean				**2.86**	**19.45**	**1.85**	**0.83**	
CV(%)				**13.15**	**11.00**	**2.60**	**37.45**	

Evaluation of F_1 progeny (Year of planting 2021)

Design : Augmented
Replication/ Blocks : 02
Spacing : 6mx6m
Number of F_1 progeny : 104
Year of planting : 2021

The said experiment was laid out in the year 2021 following augmented design consisting of 104 F_1 progenies distributed in 02 blocks. Now the plants are at vegetative stage.

Evaluation of F_1 progeny (Year of planting 2022)

Design : Augmented
Replication/ Blocks : 03
Spacing : 6mx6m
Number of F_1 progeny : 43
Year of planting : 2022

The said experiment was laid out in the year 2022 following augmented design consisting of 43 F_1 progenies distributed in 03 blocks. Now the plants are at vegetative stage.

Advanced varietal trial (AVT) - I (Year of planting, 2020)

Design : RBD
Replication/ Blocks : 02
Spacing : 6mx6m
Number of genotypes : 35
Year of planting : 2020

Data presented in the Table No.1.59 revealed that plant height ranged from minimum 1.1m in genotype, RP bold nut to maximum 3.59m in genotype D_6-8. Trunk girth was recorded minimum in genotype, BPP-8(12.0cm) while genotype, A-1 recorded the maximum for the trunk girth (31.2cm). Canopy spread both in E-W (4.31m) and N-S (4.90m) direction was recorded maximum in genotype D-28 while it was minimum in genotype, D-1 in both the directions (2.46m in E-W and 2.30m in N-S).

Table 1.59 :Growth parameters during the year 2023(Year of planting 2020): Bhubaneswar Center

Sl. No.	Accessions	Plant height(m)	Trunk girth(cm)	Canopy spread(m)	
				E-W	N-S
1.	A-1	3.03	**31.2**	3.66	4.00
2.	D-1	2.30	16.3	2.46	2.30
3.	D-25	2.81	26.1	3.43	3.63
4.	A-7	2.18	20.0	2.65	2.77
5.	E-20	2.44	20.3	2.51	2.68
6.	Q-5	2.69	26.3	3.53	3.57
7.	B-58	2.70	26.7	3.5	3.50
8.	B-77	2.60	17.3	2.95	2.54
9.	D-28	3.06	28.6	4.31	4.90
10.	F-32	3.05	29.4	4.25	4.31
11.	F-40	2.84	27.9	4.01	4.74
12.	D_6-8	**3.59**	24.2	3.42	3.70
13.	C_7 -10	2.19	22.8	2.92	3.83
14.	E7-2	2.60	20.6	2.47	2.79
15.	E_7-5	2.61	22.1	4.1	3.19
16.	Bhubaneswar-1	2.96	26.9	3.79	3.83
17.	BBSR'C'-1	3.19	23.8	3.47	3.73
18.	BBSR'C'-2	2.78	19.9	2.47	2.93
19.	M44/3	2.48	22.6	3.17	3.58
20.	VTH711/4	2.63	26.7	3.21	3.40
21.	Kankadi	2.41	20.9	2.53	3.19
22.	RP-1	2.60	20.9	3.59	3.50
23.	RP-2	2.61	23.2	3.45	3.31
24.	RP bold nut	1.10	19.6	2.95	2.49
25.	Kalyanpur Bold nut	3.21	27.4	3.32	3.82
26.	OS-5	3.00	27.9	3.61	3.40
27.	Khurda-1	2.77	25.7	3.76	3.96
28.	RP-4	2.43	21.2	2.75	2.47
29.	BPP30/1	2.56	22.0	2.76	2.83
30.	RP-6	1.22	20.3	2.98	2.54
31.	OUAT Kalinga Cashew-1(Check)	1.36	28.8	3.37	3.94
32.	BPP-8(Check)	2.89	12.0	3.67	3.53
33.	BH-6(Check)	2.72	25.9	3.83	3.83
34.	BH-85(Check)	2.63	18.8	3.06	3.26
35.	H-303(Check)	3.51	30.0	3.91	3.70
	Mean	**2.61**	**23.53**	**3.30**	**3.41**
	SEm(±)	**0.38**	**2.96**	**0.35**	**0.37**
	CD(5%)	**1.17**	**8.95**	**1.08**	**1.12**
	CV(%)	**10.47**	**17.78**	**15.30**	**15.33**

Data presented in Table No. 1.60 revealed that among the tested F_1 progenies, D-28 recorded maximum nut weight (12.05g) as well as apple weight (129.77g) while shelling % was recorded maximum in genotype, B-58(32.96). All the tested F_1 progenies exhibited mid-season flowering except genotypes, A-7 and E-20 which were early flowering type. Duration of flowering was maximum in E-20 (66 days) and minimum in genotype, B-77 (48.8days). Mean annual nut yield plant^{-1} recorded during the fruiting season 2023 ranged from minimum 0.14 kg (Kankadi) to maximum 3.36 kg(H-303) at 1st harvest. Genotypes which recorded more than 1.5kg plant^{-1} at 1st harvest are A-1(2.79), B-58(1.74) F-32(2.92), Bhubaneswar-1(1.63), M44/3(1.81), OS-5(2.5), OUAT Kalinga Cashew-1(2.99), BPP-8(2.24), BH-6(2.19) and H303(3.36).

Table 1.60 : Reproductive parameters during the year 2023(Year of planting 2020): Bhubaneswar Center

Sl. No.	Accessions	Flowering time	Duration of flowering(days)	Nut weight(g)	Apple weight(g)	shelling %	Nut yield(kg/plant) at 1st harvest	Cum. nut yield(kg plant^{-1})	Special features
1.	A-1	Dec. - Jan	57.1	8.30	36.3	30.3	2.79	-	Bold nut
2.	D-1	Dec. - Jan	55.70	8.35	50.2	29.21	0.18	-	Bold nut
3.	D-25	Dec. - Jan	59.45	7.65	40.3	30.32	1.41	-	Cluster bearing
4.	A-7	Nov.- Dec	63.2	6.91	40.9	30.86	1.04	-	Cluster bearing
5.	E-20	Nov.- Dec	66.00	7.23	37.03	29.92	0.91	-	Early type
6.	Q-5	Dec.- Jan	57.4	7.41	78.22	30.03	1.06	-	Cluster bearing
7.	B-58	Dec.- Jan	60.75	7.97	34.82	32.96	1.78	-	Cluster bearing & high nut yield
8.	B-77	Jan.- Feb	48.8	10.36	97.5	30.04	0.40	-	Bold nut
9.	D-28	Dec.- Jan	58	12.05	129.77	30.05	0.84	-	Bold nut
10.	F-32	Dec.- Jan.	60.5	8.86	66.16	30.76	2.92	-	Cluster bearing, bold nut & high nut yield
11.	F-40	Dec.- Jan	55	9.30	70.20	31.04	1.45	-	Cluster bearing & bold nut

12.	D_6-8	Dec.-Jan	53.5	6.79	46.34	28.22	0.36	-	Plant is vigorus
13.	C_7 -10	Dec.-Jan	60	7.51	50.44	30.58	0.94	-	Cluster bearing& spreading type
14.	E7-2	Dec.-Jan	56.5	8.57	68.30	30.02	0.47	-	Cluster bearing& bold nut
15.	E_7-5	Dec.-Jan	58	6.52	65.85	29.8	1.03	-	Cluster bearing
16.	Bhubaneswar-1	Dec.-Jan	64	6.62	61.60	32.09	1.63	-	Cluster bearing
17.	BBSR'C'-1	Dec.-Jan.	62.5	5.78	24.20	31.79	1.19	-	Cluster beraing
18.	BBSR'C'-2	Jan.-Feb	54.5	5.85	57.60	31.77	0.55	-	Cluster bearing
19.	M44/3	Nov.-Dec	62.5	4.58	34.66	32.66	1.9	-	Cluster bearing
20.	VTH711/4	Dec.-Jan	61	13.43	109.66	30.11	0.25	-	Bold nut
21.	Kankadi	Dec.-Jan	49.5	14.38	139.82	22.76	0.14	-	Bold nut
22.	RP-1	Dec.-Jan	64.5	4.63	24.26	31.17	1.44	-	Cluster bearing
23.	RP-2	Dec.-Jan	63	4.75	29.10	33.98	1.40	-	Cluster bearing
24.	RP bold nut	Jan.-Feb	52.5	8.31	39.12	29.78	0.49	-	Bold nut
25.	Kalyanpur Bold nut	Jan.-Feb	48	8.30	42.40	27.36	0.75	-	Bold nut & late type
26.	OS-5	Nov.-Dec	63	4.59	30.56	30.3	2.50	-	Cluster bearing
27.	Khurda-1	Jan.-Feb	58.5	9.87	100.38	31.17	1.02	-	Bold nut & profuse flowering
28.	RP-4	Jan.-Feb.	55	8.775	59.49	30.41	0.16	-	Bold nut
29.	BPP30/1	Nov.-Dec	62.5	6.86	44.4	30.42	1.32	-	Early type
30.	RP-6	Jan.-Feb	59.5	8.53	63.35	30.13	1.05	-	Cluster bearing
31.	OUAT Kalinga Cashew-1(Check)	Jan.-Feb	59	8.9	39.47	30.82	2.99	-	Bold nut

32.	BPP-8(Check)	Nov.-Dec)	61	7.965	64.93	30.15	2.24	-	Bold nut & early type
33.	BH-6(Check)	Dec.-Jan	60	7.65	43.39	30.61	2.19	-	Bold nut & high nut yield
34	BH-85(Check)	Nov.-Dec	64	6.98	56.06	29.73	0.96	-	Early type & cluster bearing
35	H-303(Check)	Dec.-Jan	53.5	6.39	43.9	30.32	3.36	-	Cluster bearing
Mean			**58.51**	**7.93**	**57.73**	**30.33**	**1.28**	-	-
SEm(±)			**2.93**	**0.42**	**3.93**	**0.70**	**0.20**	-	-
CD(5%)			**8.87**	**1.28**	**12.06**	**2.11**	**0.62**	-	-
CV%			**7.09**	**7.57**	**9.76**	**3.26**	**22.81**	-	-

Advanced Varietal Trial (AVT)-II (Year of planting,2022)

Design : RBD
Replication : 02
Spacing : 6mx6m
Number of entries : 20
Year of planting : 2022

This experiment was laid out in the year 2022 following statistical design RBD with two replications. 20 genotypes were planted adopting 6m x 6m spacing taking four plants genotype^{-1}. Now the plants are at vegetative stage.

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Nine hybrids were planted with replication in 2015 and evaluated with BPP- 8 as check variety There was statistically significant variation among the hybrids with respect to the growth parameters, except spread in N –S direction. At the age of 8 years, most of the hybrids were found as tall type and the height was above 5 meters, except H- 41 and H- 132, which are below 5.0 meter. H- 139 is a hybrid between a cross of KGN – 1(which is reported as a dwarf variety and BLA- 39 – 4 (a tall variety) was found a moderately tall hybrid. The trunk girth of H- 139 was the minimum (58.8cm).

Among the tested hybrids, H- 113 was reported with huge canopy (79.9m^2) and trunk girth. Flowering /m^2 was on par among the studied hybrids and heck variety. At the time of flowering, more than 24% vegetative laterals/m^2 were also produced in BPP- 8 (Check variety), H- 41 and H- 126. H- 139 was the earliest flowering hybrid which started flowering in January and also the long duration (100 days) flowering hybrid. The short duration flowering hybrid was H – 37 (71 days). Maximum bisexual flowers were recorded in H- 126 (0.35) followed by H – 132 (0.32). The range of nut production per square meter of canopy was between 17.3 to 55.8. The highest was with H- 126 and minimum in H- 139. The nuts/m^2 and the nuts /panicle were also highest in H- 126 (55.8, 12.1). Though H – 139 had minimum nuts/m^2 as well as nuts/panicle but it had the highest nut weight (8.4g), acceptable shelling

% (32.7) and the biggest cashew apples (84g). Another hybrid H- 113 bore bold nut (7.6g) with 32.2% shelling recovery, 16.4 kg yield /tree and also a cumulative yield of 38.7 kg/tree at 5th harvest, which was more than the check variety of BPP- 8. Therefore, H- 113 was found to be a promising hybrid for the red and laterite zone of West Bengal.

Cross combination	No. of flowers pollinated	No. of nuts harvested	% fruit set	No. of seeds germinated	% germination	No. of plants in the main field
H- 139 X JGM 282	706	135	35.83	120	88.89	120

Table 1.61: Growth parameters of different cashew hybrids at Jhargram Centre during the year 2022- 23 (Year of Planting: 2015)

Hybrid No.	Cross combination	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)			Mean canopy area (m^2)	Vegetative flush / m^2
				E-W	N-S	Average		
H-121	H- 2/15x Red Hazari	5.1	76.3	6.7	7.1	6.9	57.2	4.6
H-132	H- 2/15x Red Hazari	4.9	71.3	6.6	6.6	6.6	51.6	1.6
H-139	KGN – 1 x BLA – 39 -	5.0	58.8	7.3	7.3	7.3	62.5	1.6
H - 33	Local x 2/9 Dicherla	5.2	86.3	7.6	7.6	7.6	63.9	1.6
H-113	H- 2/15x Red Hazari	6.2	87.5	8.2	7.9	8.0	79.9	1.6
H - 35	Local x 2/9 Dicherla	6.0	80.0	6.8	6.8	6.8	61.2	2.1
H-126	H- 2/15x Red Hazari	5.4	80.0	7.4	7.4	7.4	63.8	4.3
H - 37	Local x 2/9 Dicherla	5.9	81.3	7.4	7.4	7.4	68.3	1.4
H - 41	Local x 2/9 Dicherla	4.9	77.5	6.6	7.4	7.0	57.0	4.4
BPP- 8		4.1	66.3	6.1	6.1	6.1	41.6	5.3
SEm±		0.22	3.75	0.35	0.39	0.35	4.77	0.44
C.D. at 5%		0.63	10.90	1.01	1.13	1.02	13.83	1.28
CV %		8.25	9.82	9.91	10.91	9.94	15.70	31.20

Table 1.62: Yield parameters of different cashew hybrids at Jhargram Centre during the year 2022- 23 (Year of Planting: 2015)

Hybrid No.	Cross combination	Bisexual: Male Flower	Duration of Flowering	No. of flowering laterals / m^2	Nuts/ m^2	Mean no. of nuts/ panicle	Nut Weight (g)
H-121	H- 2/15x Red Hazari	0.31	85	14.2	45.5	10.2	6.1
H-132	H- 2/15x Red Hazari	0.32	86	14.3	51.9	9.8	6.3
H-139	KGN – 1 x BLA -39-4	0.29	100	19.0	17.3	4.1	8.4
H- 33	Local x 2/9 Dicherla	0.31	95	16.4	41.2	8.6	6.3
H- 113	H- 2/15x Red Hazari	0.22	79	12.9	46.6	10.1	7.6
H- 35	Local x 2/9 Dicherla	0.31	81	17.8	30.2	6.2	5.5
H- 126	H- 2/15x Red Hazari	0.35	72	11.8	55.8	12.1	6.1
H- 37	Local x 2/9 Dicherla	0.22	71	18.3	48.3	10.5	4.9
H- 41	Local x 2/9 Dicherla	0.24	85	19.6	32.3	5.7	7.7
BPP - 8		0.24	84	14.5	34.7	7.0	7.7
SEm±				1.01	3.91	1.11	0.09
C.D. at 5%				2.92	11.33	3.23	0.25
CV %				12.69	19.35	26.42	2.57

Table 1.63: Yield parameters of different cashew hybrids at Jhargram Centre during the year 2022- 23 (Year of Planting: 2015)

Hybrid No.	Cross combination	Apple wt. (g)	Kernel Weight (g)	Shelling %	Annual nut yield (kg/ tree)	Cum. yield (kg/tree) (for 6 Harv.)
H-121	H- 2/15x Red Hazari	45.3	1.9	31.3	9.1	28.9
H-132	H- 2/15x Red Hazari	25.8	1.9	30.8	9.9	32.6
H-139	KGN - 1 x BLA -39-4	84.0	2.8	32.7	5.3	15.3
H- 33	Local x 2/9 Dicherla	46.8	2.1	33.1	8.3	29.4
H- 113	H- 2/15x Red Hazari	41.8	2.5	32.2	16.4	38.7
H- 35	Local x 2/9 Dicherla	28.0	1.8	32.9	7.0	22.1
H- 126	H- 2/15x Red Hazari	27.3	2.0	32.1	10.8	33.2
H- 37	Local x 2/9 Dicherla	22.5	1.7	33.6	8.0	38.0
H- 41	Local x 2/9 Dicherla	30.8	2.5	32.4	7.1	29.9
BPP - 8		67.5	2.4	31.2	6.5	20.7
S.Em±		1.21	0.05	0.78	0.89	
C.D. at 5%		3.50	0.14	2.27	2.59	
CV %		5.75	4.49	4.86	20.20	

There were 21 F_1 progenies produced from the crossing of Bidhan Jhargram – 2 as male parent and JGM- 282 as female parent, where Bidhan Jhargram- 2 is a tall, high yielding tree having bold nut, solitary bearer with high shelling % and JGM -282 is a semi tall, pruning responsive, high yielding tree having small nut, cluster bearer with high shelling %. The height range at the age of 5 years was recorded between 2.8 to 4.8m and the shortest plant was H- 183 (Table No.1.64). The range of trunk girth was noticed between 37 – 65cm and the hybrids H- 191, H- 182, H- 184, H- 190 and H- 198 had < 60cm trunk girth. The plants developed huge canopy were H – 199, H- 192, H- 198, H - 190 (canopy area was < 40m^2) and short stature plants were H- 183, H- 200 (Canopy area >25 m^2). H- 185, H- 186, H- 189, H- 199 and H- 200 hybrids were cluster bearers. The nut weight o F_1 progenies had increased 12 - 60 % compared to their female parent and where the female parent had >5g nut weight, the hybrids like H- 191, H- 199, H-189, H- 186, H- 196, H- 198, H- 184 and H- 182 had 7g or more nut weight. H- 191, H- 199, H-189 H- 198 and H- 186 produced < 8 kg yield /tree. The hybrid H- 200 with a small canopy area produced 6.7 kg nuts/plant and the nut weight was medium (6g) and shelling % was 35.5. Therefore, the F_1 progenies found promising for the red and laterite zone of West Bengal were H- 191, H-199, H-189 H- 198, H- 186 and H- 200.

Table 1.64: Growth parameters of different cashew hybrids at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2018)

Sl. No	Hybrid No	Cross combination	Mean tree height (m)	Mean stem girth (cm)	Canopy spread (m)			Mean canopy area (m^2)	Vegetative flush / m^2
					E-W	N-S	Average		
1	H-181	BJ - 2 x JGM - 282	4.2	55.0	4.7	5.2	4.9	30.6	4.5
2	H -182	BJ - 2 x JGM - 216	4.1	60.0	5.2	5.7	5.5	36.6	2.0
3	H-183	BJ - 2 x JGM - 216	2.8	45.0	3.4	3.7	3.6	14.3	0.8
4	H -184	BJ - 2 x JGM - 216	4.1	60.0	5.8	4.7	5.2	31.7	5.3
5	H -185	BJ - 2 x JGM - 216	3.6	55.0	5.8	4.7	5.2	28.8	3.5
6	H -186	BJ - 2 x JGM - 282	4.0	45.0	5.7	5.0	5.4	32.5	4.5
7	H -187	BJ - 2 x JGM - 216	4.1	50.0	6.0	5.4	5.7	38.7	3.3
8	H -188	BJ - 2 x JGM - 216	4.5	50.0	4.5	5.1	4.8	33.9	3.8

9	H -189	BJ - 2 x JGM - 216	4.2	50.0	5.3	4.9	5.1	32.1	4.0
10	H -190	BJ - 2 x JGM - 216	4.3	60.0	5.6	6.7	6.1	41.9	5.0
11	H -191	BJ - 2 x JGM - 282	4.5	65.0	5.2	5.4	5.3	33.9	3.3
12	H -192	BJ - 2 x JGM - 216	4.4	45.0	6.8	7.3	7.0	52.8	6.0
13	H -193	BJ - 2 x JGM - 216	4.8	45.0	5.3	5.4	5.3	39.5	4.8
14	H -194	BJ - 2 x JGM - 216	3.6	55.0	5.1	6.0	5.6	32.5	2.3
15	H -195	BJ - 2 x JGM - 216	4.6	55.0	5.5	5.2	5.3	38.8	1.5
16	H -196	BJ - 2 x JGM - 282	4.2	48.0	6.2	5.4	5.8	37.4	4.3
17	H -197	BJ - 2 x JGM - 216	3.8	40.0	4.5	4.6	4.6	25.5	1.0
18	H -198	BJ - 2 x JGM - 216	4.6	60.0	6.3	6.2	6.3	46.8	5.5
19	H -199	BJ - 2 x JGM - 216	4.2	45.0	7.3	7.4	7.4	55.9	2.5
20	H -200	BJ - 2 x JGM - 216	3.5	40.0	4.4	4.6	4.5	24.8	7.8
21	H -201	BJ - 2 x JGM - 282	4.2	45.0	4.2	3.9	4.1	25.7	3.8

Table 1.65: Yield parameters of different cashew hybrids at Jhargram Centre during the year2022 - 23 (Year of Planting: 2018)

Sl. No.	Hybrid No	Cross combination	Duration of Flowering (Days)	Bisexual : Male Flower	No. of flowering laterals / m^2	Nuts/ m^2	Mean no. of nuts/ panicle	Nut weight (g)
1	H - 181	BJ - 2 x JGM - 282	61	0.07	11.0	25.5	6.0	6.2
2	H -182	BJ - 2 x JGM - 216	82	0.04	16.8	23.3	5.8	7.0
3	H - 183	BJ - 2 x JGM - 216	82	0.02	14.8	20.5	5.0	6.0
4	H -184	BJ - 2 x JGM - 216	85	0.05	14.0	25.3	4.8	7.0
5	H -185	BJ - 2 x JGM - 216	86	0.35	16.0	46.0	12.5	5.0
6	H -186	BJ - 2 x JGM - 282	87	0.29	11.8	34.8	8.3	7.0
7	H -187	BJ - 2 x JGM - 216	81	0.16	16.5	28.5	7.0	4.8
8	H -188	BJ - 2 x JGM - 216	69	0.23	18.0	32.8	7.3	5.0
9	H -189	BJ - 2 x JGM - 216	84	0.31	11.8	35.3	8.5	7.0
10	H -190	BJ - 2 x JGM - 216	72	0.02	10.5	19.0	4.8	6.8
11	H -191	BJ - 2 x JGM - 282	79	0.16	16.0	29.0	5.3	8.0
12	H -192	BJ - 2 x JGM - 216	75	0.24	12.3	33.5	6.3	6.4
13	H -193	BJ - 2 x JGM - 216	79	0.09	16.3	27.0	9.3	5.0
14	H -194	BJ - 2 x JGM - 216	92	0.22	17.3	31.8	5.8	6.6
15	H -195	BJ - 2 x JGM - 216	76	0.08	17.3	27.0	6.5	6.0
16	H -196	BJ - 2 x JGM - 282	66	0.2	11.0	29.5	6.3	7.0
17	H -197	BJ - 2 x JGM - 216	72	0.21	17.5	30.8	6.8	5.6
18	H -198	BJ - 2 x JGM - 216	80	0.18	17.3	29.3	7.8	7.0
19	H -199	BJ - 2 x JGM - 216	77	0.26	17.0	34.8	7.8	7.6
20	H -200	BJ - 2 x JGM - 216	75	0.32	10.5	43.8	10.5	6.2
21	H -201	BJ - 2 x JGM - 282	77	0.23	13.5	32.8	8.8	6.2

Table 1.66: Yield parameters of different cashew hybrids at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2018)

Sl. No	Hybrid No	Cross combination	Shelling %	Mean Apple Wt (g)	Cashew Apple colour	Cashew Apple shape	Mean annual nut yield (kg/tree)	Cum. nut yield (kg/tree) 4^{th} harvest
1	H - 181	BJ - 2 x JGM - 282	35.5	37	Pink	Obovate	4.8	6.4
2	H -182	BJ - 2 x JGM - 216	34.3	40	Red	Obovate	6.0	10.9
3	H - 183	BJ - 2 x JGM - 216	36.7	36	Red	Obovate	1.8	8.5
4	H -184	BJ - 2 x JGM - 216	32.9	41	Pink	Obovate	5.6	8.4

5	H -185	BJ - 2 x JGM - 216	36.0	35	Pink	Cylindrical	6.6	13.4
6	H -186	BJ - 2 x JGM - 282	35.0	33	Pink	Conicle	7.9	12.6
7	H -187	BJ - 2 x JGM - 216	31.3	36	Pink	Obovate	5.3	10.9
8	H -188	BJ - 2 x JGM - 216	36.0	41	Pink	Obovate	5.5	9.7
9	H -189	BJ - 2 x JGM - 216	34.3	33	Pink	Obovate	7.9	17.2
10	H -190	BJ - 2 x JGM - 216	32.4	48	Pink	Obovate	5.4	15.8
11	H -191	BJ - 2 x JGM - 282	35.0	39	Red	Round	7.9	16.8
12	H -192	BJ - 2 x JGM - 216	31.3	37	Pink	Obovate	11.3	21.4
13	H -193	BJ - 2 x JGM - 216	32.0	34	Pink	Obovate	5.3	14.6
14	H -194	BJ - 2 x JGM - 216	30.3	38	Pink	Obovate	6.8	14.9
15	H -195	BJ - 2 x JGM - 216	33.3	37	Pink	Cylindrical	6.3	15.2
16	H -196	BJ - 2 x JGM - 282	35.7	39	Red	Obovate	7.7	21.9
17	H -197	BJ - 2 x JGM - 216	33.9	30	Red	Obovate	4.4	8.7
18	H -198	BJ - 2 x JGM - 216	31.4	42	Pink	Cylindrical	9.6	16.9
19	H -199	BJ - 2 x JGM - 216	26.3	41	Pink	Round	14.8	16.0
20	H -200	BJ - 2 x JGM - 216	35.5	46	Pink	Round	6.7	13.5
21	H -201	BJ - 2 x JGM - 282	32.3	35	Red	Conicle	5.2	9.8

Six F_1 hybrids were planted during 2019 in two different cross combinations where both the parents were tall type. Therefore, the canopy area was < 20 m^2 for all the plants at the age of 4 years. The bisexual: male ratio was highest in H- 206 and H- 207 hybrids [Table No.1.65]. Bidhan Jhargram- 2 as well as Jhargram 1 both the parents were early flowering varieties and the same was noticed in their hybrids. Except one hybrid H- 203, all other have flowering duration within 60-70days. Highest number of nuts/m^2 and nuts/panicle and shelling% and yield was recorded in H- 207 (583 and 21.8 and 36.1%, 5.3 kg/tree respectively) [Table No.1.66). But H- 207 had only 3.6g nut weight. More than 7 g nut weight which is desirable was recorded in H- 206 and H- 204.

Table 1.67: Growth parameters of different cashew hybrids at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2019)

Sl. No.	Hybrid No	Cross combination	Mean tree height (m)	Mean stem girth (cm)	Canopy Spread (m)			Mean canopy area (m^2)	Vegetative flush / m^2
					E-W	N-S	Average		
1	H - 202	Jhargram- 1 x BPP 8	4.5	40.0	4.4	4.3	4.4	28.1	4.3
2	H - 203	Bidhan Jhargram - 2 x Jhargram- 1	4.3	45.0	4.9	4.7	4.8	33.2	6.0
3	H - 204	Bidhan Jhargram - 2 x Jhargram- 1	3.8	42.0	3.5	4.0	3.8	20.8	4.3
4	H - 205	Jhargram- 1 x BPP 8	4.7	45.0	5.0	4.9	5.0	37.6	11.0
5	H - 206	Bidhan Jhargram - 2 x Jhargram- 1	4.0	37.0	3.4	3.7	3.6	21.6	1.0
6	H - 207	Jhargram- 1 x BPP 8	3.7	40.0	5.5	5.2	5.3	34.8	3.8
7	H - 208	Jhargram- 1 x BPP 8	4.5	40.0	4.4	4.3	4.4	28.1	4.3

Table 1.68: Reproductive parameters of different cashew hybrids at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2019)

Sl. No.	Hybrid No	Cross combination	No. of flowering laterals / m^2	Bisexual : Male Flower	Duration of flowering	Nuts/ m^2	Mean no. of nuts/ panicle	Nut Weight (g)
1	H - 202	Jhargram- 1 x BPP 8	10.3	0.27	60	22.8	7.0	5.4
2	H - 203	Bidhan Jhargram - 2 x Jhargram- 1	15.5	0.31	82	18.0	5.3	6.8
3	H - 204	Bidhan Jhargram - 2 x Jhargram- 1	15.3	0.31	66	19.5	4.0	7.2
4	H - 205	Jhargram- 1 x BPP 8	15.3	0.13	67	27.3	6.0	4.6
5	H - 206	Bidhan Jhargram - 2 x Jhargram- 1	12.8	0.38	66	19.5	4.3	7.0
6	H - 207	Jhargram- 1 x BPP 8	12.0	0.38	63	58.3	21.8	3.6

Table 1.69: Reproductive parameters of different cashew hybrids at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2019)

Sl. No	Hybrid No	Cross combination	Shelling %	Mean apple Weight (g)	Cashew Apple colour	Cashew Apple shape	Mean annual nut yield (kg/tree)	Cum. nut yield (kg/tree) 2^{nd} harvest
1	H - 202	Jhargram- 1 x BPP 8	35.2	43	Y	Obo	2.5	3.5
2	H - 203	Bidhan Jhargram - 2 x Jhargram- 1	33.8	53	Y	Cy	2.1	2.4
3	H - 204	Bidhan Jhargram - 2 x Jhargram- 1	34.7	37	Y	Con	1.9	2.3
4	H - 205	Jhargram- 1 x BPP 8	32.6	48	Y	Con	2.7	4.5
5	H - 206	Bidhan Jhargram - 2 x Jhargram- 1	31.4	70	Y	Obo	2.5	3.5
6	H - 207	Jhargram- 1 x BPP 8	36.1	36	Y	Cy	5.3	6.2

VRIDHACHALAM

Crossing programme was formulated to improve the existing released varieties of Tamil Nadu. The varieties VRI 2 and VRI 3 were used as female parents. Promising types from germplasm were selected for specific characteristics and used as male parents for crossing programme. L X T method of hybridization was carried out and the F_1 seeds were planted during 2005, 2006 and 2008. Evaluation of the seedlings was carried out based on the recommendations of the AICRP group meeting. The promising F_1 hybrids alone were selected to suit the objectives and carried over for further evaluation.

The hybrids planted during 2005, 2006 and 2008 were evaluated for characteristics viz., high yield, cluster bearing, good fruit set, high percentage of bisexual flowers, bold nuts, dwarfness and easy peeling testa. Hybrid HC-10 was observed to have the typical characteristic of high yield even under water stress conditions. HC 6 shows shorter internode and dwarf in nature. Hybrid HC-10 has been considered for varietal release. Planting material (grafts) has been produced for MLT to different Centers.

The pooled mean data results are presented below:

Table 1.70: Pooled mean data for growth parameters of different cashew hybrids at Vridhachalam Centre (2014-21)

Hybrid No.	Cross combinations	Year of planting	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy area (m^2	Ratio of bisexual: male flowers
HC1	VRI 2 X VRI 3	2005	4.27	62.34	28.8	6.48
HC2	VRI 3 x VSK 2	2005	4.77	43.82	28.3	13.16
HC3	VRI 3 x TK 1	2005	4.44	61.44	42.3	9.06
HC5	VRI 3 x VRI 2	2005	4.83	53.76	33.1	7.88
HC6	VRI 3 x KGN 1	2005	3.43	38.54	16.6	8.74
HC8	VRI 3 x PKP 1	2005	4.97	53.86	43.8	8.48
HC10	VRI 3 x KK 1	2006	4.53	48.68	37.2	15.84
HC 17	VRI 3 x AM 1	2006	3.83	39.14	17.0	8.88
HC 22	VRI 3 X TK 1	2008	4.33	38.24	21.9	11.62
HC 24	VRI 3X M 33/3	2008	3.64	38.74	14.7	5.90
HC 25	VRI 3 X VSK 3	2008	3.60	53.26	17.4	15.08
HC 27	VRI 3 X SL 1	2008	4.09	41.98	22.9	4.26
HC 30	VRI 3 x PV 1	2008	4.19	47.08	21.5	12.72

Table 1.71: Pooled mean data for yield parameters of different cashew hybrids at Vridhachalam centre (2014-21)

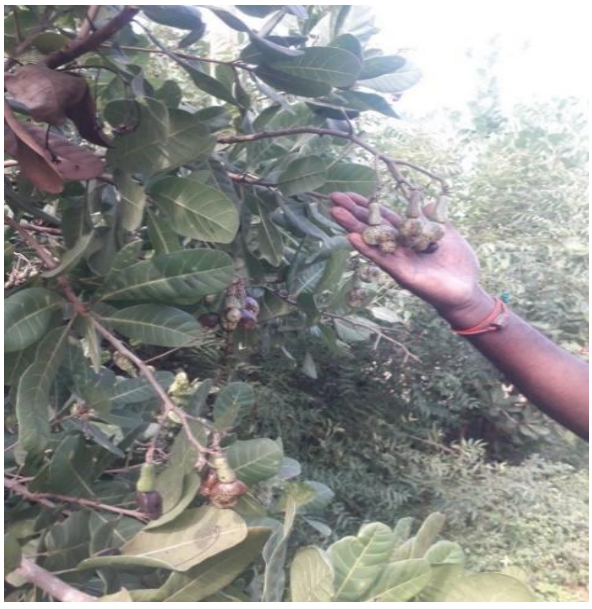
Hybrid No.	Cross combinations	Year of planting	Mean nut wt (g)	Mean apple wt (g)	Shelling (%)	Mean nut yield (Kg/tree)	Cum yield (Kg/tree) (9 harvests)
HC1	VRI 2 X VRI 3	2005	5.90	25.93	27.60	5.20	35.21
HC2	VRI 3 x VSK 2	2005	6.30	31.83	26.50	4.10	27.30
HC3	VRI 3 x TK 1	2005	6.60	37.37	24.60	3.80	19.57
HC5	VRI 3 x VRI 2	2005	7.00	40.91	27.70	6.70	33.27
HC6	VRI 3 x KGN 1	2005	5.90	52.11	26.04	6.10	23.72
HC8	VRI 3 x PKP 1	2005	6.30	50.87	26.10	6.10	24.10
HC10	VRI 3 x KK 1	2006	**7.40**	**34.46**	**28.70**	**11.70**	**45.32**
HC 17	VRI 3 x AM 1	2006	6.10	34.26	27.08	5.60	29.48
HC 22	VRI 3 X TK 1	2008	7.30	48.86	28.66	5.60	25.13
HC 24	VRI 3X M 33/3	2008	7.00	31.86	26.14	6.20	26.92
HC 25	VRI 3 X VSK 3	2008	7.60	52.77	30.10	9.10	34.85
HC 27	VRI 3 X SL 1	2008	7.80	48.74	31.20	6.30	31.41
HC 30	VRI 3 x PV 1	2008	8.00	50.43	26.70	8.10	35.83

- The already existing 101 germplasm were removed.
- The scion sticks were collected from the germplasm and grafted.
- The grafted germplasms were planted during 2021.
- All the germplasm are in vegetative stage so hybridization was carried out using VRI2, VRI.3 and HC.6.

- A total of 178 numbers of hermaphrodite flowers were pollinated in two different cross combinations and 10 nuts were harvested.
- HC.6 which is a semi dwarf F_1 was selfed.

Details of hybridization programme during 2023-24

Sl. No.	Cross combination	No. of flowers pollinated	No. of nuts harvested	fruit set (%)	No. of seeds germinated	Germination (%)	No. of plants in the polybag
1	VRI.3 X VRI.2	120	15	13.50	7	68	4
2	VRI.2 X VSK.3	125	12	16.50	8	58	6
3	VRI.3 X PV 1	155	17	18.0	9	60	5
4	VRI 3 X AM 1	160	17	18.0	8	60	5
5	HC.6 selfed	150 (selfed)	15	13.0	5	45	5
	Total	710	76	79	37	291	25



GOA

During the flowering season (December 2022 to March 2023), 989 crosses involving different parental combinations were affected. Per cent nut set of the crosses varied from 3.13 (Tudal-1x T-11) to 29.94 (Kn2/98 xValpoi-2) and, a total of 122 crosses resulted in the development and maturity of crossed seed nuts which were collected and hybrid seedlings were raised.

Among 1st set of 10 genotypes of crossed seedling progeny, cumulative raw nut yield for 8 harvests varied from 36.13 kg/tree (H-5/05) to 121.23 kg/tree (H-31/05) with mean nut weight of 9.14g and shelling percentage of 31.84 in the former, and 6.06g and 31.42 in the latter respectively (Table 3). Two crossed seedlings viz. H 21/05 and H-27/05 continued to record promising performance with nut yield of 12.67kg/tree and 14.17 kg/tree respectively during 2023 season with pooled mean nut weight of 8.46g and 7.85g, and per cent shelling of 31.18 and 28.12 respectively, hence were short listed for varietal release for the state of Goa In the second evaluation block comprising of 234 crossed seedling genotypes, established during July, 2019, 65 genotypes started flowering, of which fruits were obtained from 30 crossed genotypes indicating their precocious nature Among the crossed genotypes which started flowering and fruiting, the nut weight was in between 6.62g (HB-18/7) and 13.5g (HB-18/192). Twelve genotypes produced bigger sized nuts of more than 10g mean apple size varied from 42 g (HB-18/376) to 172g (HB18/333) with apples having higher TSS (>11 ^{o}B) in most of the genotypes.

Table 1.72: Performance of first Set of Hybrids

Sl. No	Accession	Year of Planting	Flowering Time	Nut weight (g)	apple weight (g)	Shelling Percentage	Nut Yield (kg/tree)	Cumulative nut yield (kg/tree) after 9 harvests
1	H- 31/05	2008	Jan (early)	6.06	48.6	31.42	10.32	121.23
2	H- 27/05	2008	Jan (early)	7.85	74.3	28.12	14.17	95.39
3	H- 21/05	2008	Dec (mid)	8.46	78.8	31.18	12.67	94.94
4	H- 12/05	2008	Jan (early)	8.12	80.4	28.73	5.8	59.55
5	H- 11/05	2008	Jan (early)	7.02	82.2	31.46	6.27	55.93
6	H- 22/05	2008	Jan (early)	9.86	84.12	32.64	7.21	52.62
7	H- 23/05	2008	Jan (early)	7.78	72.4	34.19	7.32	47.55
8	H- 14/05	2008	Jan (early)	7.89	77.5	29.69	8.2	41.58
9	H- 30/05	2008	Jan (early)	7.59	82.6	28.02	8.42	39.53
10	H- 5/05	2008	Jan (early)	9.14	69.3	31.84	7.51	36.13
Mean				7.85	75.66	30.61	8.93	67.59
SD				1.03	10.86	2.12	2.89	28.91
SEm±				0.30	3.13	0.61	0.83	8.35
CV%				13.10	14.35	6.92	32.30	42.78
CD@5%				0.59	6.27	1.22	1.67	16.69

Table 1.73: Performance of second Set of Hybrids (year of planting 2019)

Sl. No	Accession	Flowering Time	Nut weight (g)	apple weight (g)	Shelling Percentage (%)	Nut Yield (kg)	Cum. nut yield (kg)after 2 harvests
1	39Ax Valpoi -7 (HB18/178)	Feb	7.25	76.54	28.48	0.055	0.0904
2	Vengurla-4 xTiswadi-3 (HB18/346)	Feb	12.87	136.4	21.43	0.055	0.078
3	Tiswadi -3 x Vengurla -4 (HB18/384)	Jan	8.61	76.54	29.53	0.8	0.83
4	Valpoi-7 x 39-A (HB- 18/248)	Feb	7.43	96	23.3	0.11	0.13
5	Tiswadi-3 x 10 A (HB-18/108)	Jan	9.2	87.51	26.42	0.03	0.05
6	Tiswadi-3 X Vengurla-4 (HB-18/376)	Jan	9.33	42	26.31	0.11	0.13
7	39 -A x Valpoi-7 (HB - 18/179)	Feb	8.2	70.6	31.21	0.20	0.24
8	Valpoi-7 x 39 - A(HB - 18/201)	Jan	9.45	65	21.12	0.09	0.11
9	Tiswadi-3 x Vengurla-4 (HB-18/327)	Jan	11.99	89.01	39.49	0.74	fruited for the first time
10	Tiswadi-3 x Vengurla -4 (HB-18/241)	Jan	10.39	90.6	30.24	0.18	
11	Vengurla - 4 x Tiswadi -3 (HB - 18/360)	Jan	7.54	67.76	26.86	0.48	
12	Valpoi - 7 x 39 A (HB-18/203)	Jan	7.7	82.77	31.77	0.18	
13	39 A x Valpoi-7(HB -18/178)	Jan	7.25	76.55	24.23	0.13	
14	Valpoi - 7 x 39 A (HB-18/192)	Jan	13.22	119.78	23.27	0.19	
15	Tiswadi -3 x Vengurla -4 (HB-18/329)	Jan	11.98	89.01	31.12	0.10	
16	Vengurla 4 x Tiswadi -3 (HB-18/325)	Jan	9.55	80.25	25.7	0.07	
17	Vengurla 4 x Tiswadi -3 (HB-18/333)	Jan	11.72	171.91	26.57	0.38	
18	10 Ax Tiswadi -3 (HB-18/187)	Jan	11.59	126.33	26.21	0.22	
19	Tiswadi -3 x 10 A(HB-18/105)	Jan	11.91	95.2	30.39	0.39	
20	Valpoi7 x 39 A (HB -18/266)	Jan	11.1	72.7	28.23	0.59	
21	Valpoi-7x Tiswadi - 3 (HB-18/26)	Jan	9.41	68.33	26.34	0.07	
22	Tiswadi -3 x Vengurla -4 (HB - 18/365)	Jan	7.53	90.76	28.51	0.03	

23	Valpoi-7x Tiswadi - 3 (HB-18/7)	Jan	6.62	89.7	27.32	0.07	
24	39 A x Valpoi-7(HB -105/16)	Jan	9.66	72	22.15	0.09	
25	Tiswadi -3 xVengurla -4 (HB-18/382)	Jan	8.53	95.47	26.65	0.37	
26	10 A x Tiswadi -3 (HB 0 18/87)	Jan	11.58	126.49	22.02	0.14	
27	Valpoi - 7 x Tiswadi - 3 (HB - 18/4)	Feb	8.64	79.35	27.15	0.13	
28	8A x Vengurla -4 (HB- 18/123)	March	10.1	69.24	27.74	0.07	
29	Valpoi- 2 x Kn 2/98 (HB- 53/16)	Jan	7.22	95.27	28.11	0.05	
30	Vengurla - 4 x Tiswadi - 3(HB - 18/323)	Jan	11.42	69.56	26.18	0.18	
Mean			**9.63**	**88.95**	**26.99**	**0.21**	
SD			**1.92**	**25.63**	**3.71**	**0.21**	
SEm±			**0.35**	**4.68**	**0.68**	**0.04**	
CV%			**19.94**	**28.81**	**13.75**	**96.63**	
CD@5%			**0.70**	**9.36**	**1.36**	**0.08**	

Salient Features:

Goa Cashew -6 (HB-21/05) Proposed for State (Goa) Varietal Release

Av. Nut yield /tree : 10.4 kg

Mean nut wt : 8.46 g

Mid-season : March- May

MADAKKATHARA

- A total 540 crosses were done with an objective to develop hybrids with bold nut and high shelling percentage and 61 hybrid seed nuts were planted in the nursery.

Table 1.74 : Details of hybridization Programme during 2023

Sl. No.	Cross combination	No. of flowers pollinated	No. of nuts harvested	% fruit set	No. of seeds germinated	% germination	No. of plants in the main field
1	Dhana x Raghav	180	28	15.5	25	89.3	25
2	Kanaka x Raghav	180	22	12.2	20	90.9	20
3	Dhana x Dharasree	180	20	11.1	16	80.0	16
	Total	540	70		61		

- 40 hybrid progenies were planted in augmented block design along with three check varieties during October 2023.

PILICODE

Hybridization was carried out between KAU Nihara (parent selected for dwarfness), Priyanka (High yielding popular variety) and PLD 83 (Promising local germplasm).

Table 1.75: Details of hybridization programme during 2023 (year of planting 2022 and 2023)

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field (including 2022)
1	Priyanka x Nihara	60	1	1.6	1	100	3
2	Nihara x Priyanka	58	1	1.7	1	100	3
3	Priyanka X PLD 83	61	2	3.2	2	100	2
4	PLD 83 X Priyanka	62	1	1.6	1	100	1
5	Nihara X PLD 83	64	0	0	0	0	0
6	PLD 83 X Nihara	32	0	0	0	0	0
	Total	**337**	**5**	**1.35**	5	100	**9**

VENGURLA

Hybridization programme during 2023:

During the year 2022-23, a hybridization program was started with the objective of combining desirable traits in single genotype. In three separate cross combinations, a total of 361 hermaphrodite flowers were pollinated. From three cross combinations, a total of 108 F_1 hybrid nuts were obtained. The nuts were sown in polybags and after germination, 65 F_1 cashew progenies were obtained and these progenies were planted in the field for further evaluation [Table No.1.76].

Table 1.76: Details of hybridization programme during 2023 (year of planting 2023)

Sl. No.	Cross combination	No. of flowers pollinated	No. of nuts harvested	% fruit set	No. of seeds germinated	% germination	No. of plants in the main field
1	V-7 X H-2992	111	23	36.04	20	86.96	18
2	V-2 X RFRS-172	115	41	53.91	25	60.98	22
3	V-5 X RFRS-172	135	44	51.85	30	68.18	25
	Total	**361**	**108**	**-**	**75**	**-**	**65**

Evaluation of hybrids:

Twelve F_1 cashew progeny were evaluated as promising hybrids during cashew season 2022-23. [Table No.1.77] shows that among the twelve promising F_1 cashew progeny, H-3784 recorded the maximum height (9.80 m) whereas the lowest minimum height (3.00 m) was observed in H-3956. The highest stem girth (115.0 cm) was observed in H-3784 and H-3783. The E-W canopy spread (9.20 m) was maximum in H-3783 and while N-S canopy spread (9.80 m) was maximum in H-3775. The data from the Table No.1.78 revealed that the maximum flowering duration (98.0 days) was recorded in H-3748. With regard to yield attributes of promising hybrids, the maximum nut weight was recorded in H-3968 (13 g), followed by H-3748 (12.5g). The highest apple weight of 106.0 g was recorded in H-4101. The highest annual nut yield was recorded in H-3757 (18.56 kg/tree). The cumulative nut yield for the last 7 harvests was highest in H-3757 (64.896 kg/tree).

Table 1.77: Growth parameters during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	H- 3748	2004	8.30	81	5.90	6.50
2	H- 3784	2005	9.80	115	8.10	8.30
3	H- 3757	2005	9.10	103	8.80	9.50
4	H-3775	2005	8.60	94	8.40	9.80
5	H- 3755	2005	8.30	72	8.00	5.70
6	H-3783	2005	9.20	115	9.20	9.60
7	H- 3867	2009	4.90	39	3.30	3.40
8	H- 3956	2010	3.00	38	2.70	2.60
9	H- 3968	2011	4.30	39	3.00	2.80
10	H- 3994	2013	4.50	40	4.20	3.70
11	H- 4001	2013	5.10	48	4.00	3.70
12	H- 4101	2016	3.20	42	3.80	4.00

Table 1.78: Reproductive parameters during the year 2023 (year of planting - 2005)

Sl. No.	Accession	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Annual Nut Yield (kg/tree)	Cumulative Yield (kg/plant) How many years?	Special Features
1	H- 3748	Nov-Dec	98	12.50	80	30.00%	2.000	12.90	Bold nut
2	H- 3784	Nov-Dec	94	7.50	75	27.30%	11.720	47.56	High yield
3	H- 3757	Nov-Dec	95	7.20	47	28.50%	18.560	64.89	High yield
4	H-3775	Nov-Dec	95	10.10	45	29.00%	5.340	28.30	Bold nut
5	H- 3755	Nov-Dec	95	11.21	30	27.50%	6.600	27.92	Bold nut
6	H-3783	Nov-Dec	95	8.50	80	26.50%	5.900	24.00	Bold nut
7	H- 3867	Nov-Dec	84	8.20	85	28.00%	2.021	17.46	Bold nut
8	H- 3956	Nov-Dec	95	10.50	80	27.50%	1.900	10.95	Bold nut
9	H- 3968	Nov-Dec	95	13.00	93	29.00%	2.710	8.746	Bold nut
10	H- 3994	Nov-Dec	96	6.70	35	26.50%	6.640	18.26	
11	H- 4001	Nov-Dec	95	8.20	50	28.00%	4.726	14.75	Bold nut
12	H- 4101	Nov-Dec	95	8.20	106	29.30%	4.257	6.675	Big apple

The 2757 F_1 cashew progenies planted at 5m x 5m during 1999 to 2004 were evaluated during 2015. Out of these F_1 progenies, the best performing 56 hybrids were evaluated as promising hybrids. Among these 56 F_1 hybrids, replicated trial of the top performing 18 hybrids initiated at AICRP-Cashew Vengurla Centre during July, 2016 under Gen.4.

Progress:

Data showed that all yield attributes for the various hybrids differed significantly from one another (Table No.1.80). Significantly the highest apple weight of 113.67 g recorded in H-883 and it was significantly superior over rest of the treatments. The maximum nut weight of 12.80 g recorded in H-883 and it was found to be significantly superior over rest of the treatments. H-1187 recorded the highest shelling percentage (32.37%) and it was at par with treatments H-801 (31.60 %) & H-939 (31.50%). So far as yield is concerned, significantly the highest yield of the new set of promising hybrids was recorded in H-1039 (10.07 kg/tree) and it was found at par with treatment H-1174 (9.17 Kg/tree). The highest cumulative yield recorded in treatment H-1039 (21.15 kg/tree).

Table 1.79: Growth parameters during the year 2023 (year of planting 2016)

Sl. No.	Hybrid No.	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	H-735	2016	2.32	23.10	1.53	1.49
2	H-778	2016	3.33	44.07	3.45	3.33
3	H-801	2016	2.46	29.43	1.86	1.91
4	H-883	2016	3.05	34.07	2.52	2.40
5	H-939	2016	2.52	31.60	2.28	2.28
6	H-991	2016	2.93	34.53	2.40	2.48
7	H-969	2016	2.16	25.63	2.43	2.62
8	H-958	2016	2.88	36.87	2.63	2.88
9	H-992	2016	2.84	29.53	2.65	2.56
10	H-1016	2016	2.61	34.37	2.15	2.47
11	H-1039	2016	3.11	45.97	3.80	3.87
12	H-1155	2016	2.67	40.97	2.40	2.64
13	H-1174	2016	3.05	37.10	2.61	2.88
14	H-2005	2016	2.83	38.00	2.87	2.55
15	H-1675	2016	2.09	23.83	2.48	2.20
16	H-1187	2016	3.21	34.43	2.84	2.60
17	H-1306	2016	2.91	36.07	2.63	2.79
18	V-9	2016	2.75	40.63	2.68	2.65
Mean			**2.76**	**34.46**	**2.57**	**2.59**
SEm ±			**0.28**	**4.76**	**0.40**	**0.42**
CD @5%			**N.S.**	**N.S.**	**N.S.**	**N.S.**
CV (%)			**17.53**	**23.91**	**26.95**	**28.23**

Table 1.80: Reproductive parameters during the year 2023 (year of planting 2016)

Sl. No.	Accession	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/tree)	Cum. Yield (Kg/plant)	Special Features
1	H-735	94.89	11.40	80.33	26.10	2.76	4.74	Bold nut
2	H-778	95.33	7.64	59.00	29.70	8.66	16.31	High yield
3	H-801	95.89	6.33	44.33	31.60	3.06	7.21	High shelling %
4	H-883	97.61	12.80	113.67	29.53	3.99	8.32	Bold nut
5	H-939	96.67	8.73	48.00	31.50	4.95	9.60	High shelling
6	H-991	97.28	8.30	43.00	30.57	8.70	16.63	High shelling
7	H-969	94.89	10.10	84.00	29.87	5.57	9.21	Bold nut
8	H-958	96.33	9.63	81.00	29.47	6.66	10.24	Bold nut
9	H-992	97.28	10.17	100.33	28.23	5.28	7.79	Bold nut
10	H-1016	96.67	10.20	85.00	29.33	3.25	7.14	Bold nut
11	H-1039	95.83	8.50	49.33	30.27	10.07	21.15	Cluster bearing and high yield
12	H-1155	96.05	8.23	44.33	28.63	2.29	4.49	High shelling %
13	H-1174	95.39	11.17	71.00	29.50	9.17	13.36	Cluster bearing with bold nut
14	H-2005	93.00	10.45	72.00	28.50	2.03	2.96	Bold nut
15	H-1675	96.44	11.37	91.67	27.27	1.69	3.09	Bold nut
16	H-1187	95.56	9.97	78.33	32.37	8.10	12.69	High shelling %
17	H-1306	93.83	10.80	71.33	29.10	4.45	9.23	Bold nut
18	V-9	94.06	9.07	79.00	29.27	4.16	8.67	
Mean		**95.72**	**9.71**	**71.98**	**29.49**	**5.27**	-	-
SEm ±		**1.25**	**0.38**	**3.41**	**0.60**	**0.27**	-	-
CD @5%		**N.S.**	**1.11**	**9.84**	**1.74**	**0.77**	-	-
CV (%)		**2.26**	**6.83**	**8.21**	**3.54**	**8.78**	-	-

HOGALAGERE

The experiment was started on 06th December 2016 with four replications. The observations were recorded from 2019-20 onwards and the data was statistically analyzed and presented here under. The hybrids and their parentage are given below.

Sl. No.	Hybrid	Parentage
1	H-01	Ullal-3 X Kankady-7/6
2	H-81	Ullal-3 X Vetore-56
3	H-151	NRCC-2 X Vetore-56
4	H-188	V-5 X Vetore-56
5	H-191	Ullal-3 X Vetore-56
6	H-216	2/77-Tuni X Vetore-56

Table 1.81: Tree height of the hybrids during 2019 to 2022

Sl. No.	Accession No.	Tree height (m)				Tree spread (m)			
		2019	2020	2021	2022	2019	2020	2021	2022
1	H-01	2.00	3.00	3.40	3.45	2.83	3.30	3.45	3.45
2	H-81	2.00	3.30	3.70	3.93	3.96	4.00	4.35	4.48
3	H-151	2.00	3.40	4.10	3.70	3.66	3.45	3.80	4.35
4	H-188	1.70	2.70	3.00	3.20	3.35	3.60	3.80	4.13
5	H-191	2.10	2.70	3.10	3.38	2.81	2.90	3.10	3.58
6	H-216	1.70	3.10	3.60	3.55	3.11	3.55	3.65	4.23
	Mean	1.92	3.03	3.50	3.53	3.28	3.47	3.70	4.03
	SEM ±	0.10	0.11	0.18	0.18	0.11	0.28	0.30	0.27
	CD at 5%	0.30	0.34	0.53	0.54	0.32	0.85	0.89	0.80
	CV %	7.35	6.39	8.82	8.75	4.84	13.92	13.76	11.41

Among all the hybrids studied, H-81 was taller (3.93m) in 2022 followed by H-151 (3.70m) while H –188 recorded less height (3.20m). Among all the hybrids the canopy spread was more in H-81 (4.48m) followed by H-151 (4.35m) in 2022, while it was the least in H-01 (3.45m). [Table No.1.81]

Table 1.82: Trunk girth of the hybrid trees during 2019 to 2022

Sl. No.	Accession No.	Trunk girth (cm)			
		2019	2020	2021	2022
1	H-01	32.80	41.00	43.50	51.50
2	H-81	40.50	46.50	50.70	56.25
3	H-151	37.00	47.00	54.40	55.00
4	H-188	34.50	41.00	43.10	51.75
5	H-191	29.00	37.50	41.40	49.25
6	H-216	35.00	44.30	47.30	55.75
Mean		34.80	42.88	46.70	53.25
SEM ±		2.16	1.91	2.17	1.96
CD at 5%		6.52	5.76	6.53	5.91
CV %		10.76	7.72	8.03	6.38

Table 1.83: Flowering duration of the hybrid trees during 2019 to 2022

Sl. No.	Accession No.	Flowering duration (days)				
		2019	2020	2021	2022	Mean
1	H-01	84.00	76.00	67.00	46.25	68.31
2	H-81	73.00	80.00	54.00	51.25	64.56
3	H-151	78.00	82.00	62.00	59.00	70.25
4	H-188	82.00	74.00	54.00	44.50	63.63
5	H-191	74.00	85.00	65.00	43.75	66.94
6	H-216	76.00	90.00	68.00	48.25	70.56
Mean		77.83	81.17	62.00	48.83	-
SEM ±		3.30	3.88	7.51	5.41	-
CD at 5%		10.00	11.71	22.63	16.31	-
CV %		7.40	3.88	4.05	19.20	-

Table 1.84: Nut weight of the hybrid trees during 2019 to 2022

Sl. No.	Accession No.	Nut weight (g)				
		2019	2020	2021	2022	Mean
1	H-01	9.30	6.50	7.10	5.08	7.00
2	H-81	8.80	10.50	8.80	4.59	8.17
3	H-151	6.20	10.30	7.50	6.10	7.53
4	H-188	6.50	10.40	7.60	7.10	7.90
5	H-191	9.90	8.90	7.70	7.39	8.47
6	H-216	7.60	9.50	8.20	7.13	8.11
Mean		8.05	9.35	7.80	6.23	-
SEM ±		0.28	0.35	0.25	0.70	-
CD at 5%		0.86	1.06	0.77	2.11	-
CV %		6.10	6.51	5.63	19.46	-

The hybrids differed significantly for their trunk girth (Table No.1.82). It was more in H-81 (56.25cm) followed by H-216 (55.75m), while it was least in H-191 (49.25m) in 2022. The hybrids differed significantly for their flowering duration. It was longer in H-216 (70.56days) followed by H-151 (70.25days), while it was shortest in H-188 (63.63days) in 2022. Among all the hybrids H-191 recorded nut weight of 8.47g followed by H-81 (8.17g) and H-216 (8.11g), while it was lowest in H-01 (7.00g).

Table 1.85: Apple weight of the hybrid trees during 2019 to 2022

Sl. No.	Accession No.	Apple weight (g)			
		2021	2022	2023	Mean
1	H-01	59.80	84.90	40.35	61.68
2	H-81	78.00	102.30	57.75	79.35
3	H-151	75.20	97.40	50.00	74.20
4	H-188	71.40	83.80	59.13	71.44
5	H-191	70.00	94.00	63.00	75.67
6	H-216	67.50	113.80	53.50	78.27
Mean		70.32	96.10	53.95	-
SEM ±		2.98	5.47	5.44	-
CD at 5%		8.98	16.49	16.41	-
CV %		7.34	9.87	17.47	-

Table 1.86: Nut yield of the hybrid trees during 2019 to 2022

Sl. No.	Accession No.	Annual nut yield (kg/tree)				Cumulative nut yield (kg/tree)
		2019	2020	2021	2022	
1	H-01	1.83	3.43	3.72	4.80	13.78
2	H-81	2.02	2.97	3.95	4.32	13.26
3	H-151	1.93	3.21	3.19	4.15	12.48
4	H-188	2.05	3.18	3.52	4.21	12.96
5	H-191	2.22	3.29	4.15	5.22	14.88
6	H-216	1.96	2.99	2.52	3.18	10.65
	Mean	2.00	3.18	3.51	4.31	-
	SEM ±	0.07	0.16	0.18	0.38	-
	CD at 5%	0.21	0.48	0.54	1.14	-
	CV %	5.88	8.61	8.8	15.23	-

Table 1.87: Shelling percentage in hybrids during 2019 to 2022

Sl. No.	Accession No.	Shelling (%)			
		2020	2021	2022	Mean
1	H-01	28.40	28.50	27.23	28.04
2	H-81	29.80	26.00	24.44	26.75
3	H-151	29.90	28.30	28.52	28.91
4	H-188	30.00	26.20	26.61	27.60
5	H-191	31.70	30.20	32.36	31.42
6	H-216	29.80	28.00	28.00	28.60
	Mean	29.93	27.80	27.86	-
	SEM ±	1.45	1.75	2.48	-
	CD at 5%	4.36	5.27	7.48	-
	CV %	8.36	10.50	15.42	-

The hybrids differed significantly with respect to apple weight. The larger apples were recorded in H-81 (79.35g), followed by H-216 (78.27g) while they were smaller in H-01 (61.68). The cumulative yield was maximum in H-191 (14.88 kg/tree) followed by H-01 (13.78 kg/tree), while it was the minimum in H-216 (10.65). The shelling (%) varied significantly among the hybrids studied and it was maximum in H-191 (31.42%) and minimum in H-81 (26.75%).

JAGDALPUR

Expt. 1. Evaluation of F-1 progenies of hybridization programme of 2022.

Evaluation Details

Design : Augmented RCBD
Replication/ Blocks : 7
Spacing : 6 x 6 m
Number of F-1 : 35
Number of checks : 2 (CARS-8 and Vengurle-9)

All the 35 F-1's are in vegetative stage.

Expt. 2. Evaluation of F-1 progenies of hybridization programme of 2020

Design	:	Augumented RCBD
Replication/ Blocks	:	7
Spacing	:	6 x 6 m
Number of entries	:	29

Among the twenty-nine F_1 progenies which were planted in the year 2021 initial biometric observations were recorded, maximum tree height was recorded in JH-20-12 (2.05 m), stem girth in JH-20-24 (19 cm) whereas minimum canopy spread in in JH-20-11.Out of 29 F_1 progenies, 12 progenies recorded precocity.

Table 1.88: Growth parameters of top ten F-1 progenies of hybridization programme of 2020 during the year 2023

Sl. No.	Accession	Cross	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
						E-W	N-S
1	JH-20-5	VTH 711/4 X H-303	2021	1.95	18	1.62	1.40
2	JH-20-6	VRI-1 X V-4	2021	1.90	18	1.57	1.62
3	JH-20-11	V-4 X H-303	2021	1.12	14	0.78	0.85
4	JH-20-12	V-4 X H-303	2021	2.05	18	1.60	1.62
5	JH-20-15	NRCC Sel-2 X V-4	2021	1.52	11	1.53	1.26
6	JH-20-19	H-303 X VTH 711/4	2021	1.59	15	0.94	1.15
7	JH-20-20	H-303 X VTH 711/4	2021	1.18	14	1.01	1.15
8	JH-20-22	H-303 X VTH 711/4	2021	1.70	17	0.95	1.07
9	JH-20-23	H-303 X VTH 711/4	2021	1.23	15	0.90	1.23
10	JH-20-24	H-303 X VTH 711/4	2021	1.91	19	1.30	1.42
11	V-4	National Check	2021	0.98	14	0.78	0.87
12	Indira Kaju	Local Check	2021	0.85	13	0.91	0.78

Table 1.89: Reproductive parameters of top ten F-1 progenies of hybridization programme of 2020 during the year 2023

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Nut yield (kg/tree)	Cumulative yield (kg/plant) 1st Harvest
1	JH-20-5	2021	Mid	109	8.49	69.23	0.217	0.217
2	JH-20-6	2021	Mid	114	3.57	24.32	0.172	0.172
3	JH-20-11	2021	Late	119	5.75	37.32	0.098	0.098
4	JH-20-12	2021	Early	109	3.81	24.34	0.144	0.144
5	JH-20-15	2021	Late	128	3.41	26.23	0.077	0.077
6	JH-20-19	2021	Mid	138	6.09	46.82	0.101	0.101
7	JH-20-20	2021	Late	136	5.71	41.32	0.108	0.108
8	JH-20-22	2021	Mid	125	7.98	47.34	0.142	0.142
9	JH-20-23	2021	Mid	142	4.57	35.32	0.057	0.057
10	JH-20-24	2021	Early	136	10.96	78.34	0.162	0.162
11	V-4	2021	Mid	117	7.54	49.65	0.132	0.132
12	Indira Kaju	2021	Mid	106	9.94	75.43	0.117	0.117

The flowering time recorded mid for maximum F-1's, flowering duration ranged from 106 days (Indira Kaju) to JH-20-19 (138 days) (Table ..). Nut weight was maximum in JH-20-24 (10.96 g) followed by Indira Kaju (9.94 g) and JH-20-5 (8.49 g). Apple weight was maximum in JH-20-24 (78.34 g) followed by Indira Kaju (75.43 g) and JH-20-5 (69.23 g). The data on first year harvest recorded maximum in JH-20-5 (0.217 kg/tree) followed by JH-20-6 (0.172 kg/tree).

Gen.4: Rapid polyclonal hybrid evaluation trial

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

The objective of this experiment is to utilize accessions with high yield and other desirable traits selected from the germplasm conserved at various AICRP Centers 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.

Accession details:

Sl. No	Accession No.	Original source of collection
1	C2-6	CRS, Bhubaneshwar
2	H-12/05	ICAR Research Complex for Goa
3	H-2917	RFRS, Vengurla
4	VRI (cw) H1	CRS, Vridhachalam
5	H-504	CRS, Bapatla
	Spacing	**3 m x 2 m**
	Number of seeds /accession	30

BAPATLA

The polyclonal hybrid seedlings were planted in the main field with Augumented block design along with their parents and local checks.

Experimental details:

No. of accessions : 5
Spacing : 3m x 2m

Promising Hybrids/Genotype	No. of Seed collected from each genotype	No. of seeds sown	No. of seeds germinated	% seed germinated
H-504	36	33	31	93.94
C2-6	39	34	30	88.23
H-12/05	45	43	38	88.37
H-2917	33	29	26	89.65
VRI (cw)H1	54	49	45	91.84

MADAKKATHARA

70 polyclonal hybrid progenies obtained from three hybrids in the polyclonal hybrid evaluation trial were planted in augmented design along with the check varieties during September 2023

VENGURLA

Evaluation details:

A total of 154 F_1 polyclonal progenies were obtained from the five hybrids in the polyclonal hybrid evaluation trial in last Cashew season (2022-23). Among them, 75 were obtained from VRI (cw) H-1, thirty nine from C2- 6, thirty two from H-2917 and eight from H 12/05. These are planted in the field shortly.

Experimental details

No. of accessions : 5
Spacing : 3m × 2m
Number of seeds /accession : 30
Year of planting : July, 2018

Gen. 5. Characterization of germplasm for cashew apple

Centers: East Coast : Bapatla
West Coast : Pilicode

Objective: To identify germplasm having preferred apple characters suitable for value addition.

BAPATLA

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

Accessions : 6
Design : CRD
Replication : 3

Among the 13 genotypes evaluated during the year 2022-23, the maximum nut weight was recorded in Priyanka (9.70 g) followed by BPP-8 (8.07 g). The maximum apple weight was recorded in Priyanka (98.2 g) followed by BPP-8 (60.40 g). The maximum mean annual nut yield per tree was recorded in BPP-8 (9.25 kg/tree) followed by Priyanka (8.25 kg/tree). The apple to nut ratio was highest in T.No.8/7 (12.95) followed by T.No. 2/14 (11.52). The juice

recovery percentage was found maximum in Priyanka (68.60 %) followed by BLA-39/4 (68.30%).

Table 1.90: Physical parameters of cashew germplasm for cashew apple.

S.No	Germplasm	Nut wt (g)	Apple wt (g)	Nut yield /tree (kg)	Apple to nut ratio	Mean No. of nuts /Panicle	Juice recovery (%)	Colour of apple
1.	Priyanka	9.70	98.20	8.25	10.12	3.37	68.60	Red Yellow
2.	T.No: 2/14	4.45	51.30	4.49	11.52	4.08	54.30	Yellow
3.	T.No.17/5	4.23	37.30	4.74	8.81	4.25	55.20	Yellow
4.	T.No. 5/1	4.86	39.10	3.69	8.14	4.46	60.10	Yellow
5.	BLA. 139/1	4.74	36.56	4.30	7.71	7.68	58.40	Yellow
6.	BLA. 39/4	4.20	37.13	7.40	8.83	6.78	68.36	Yellow
7.	T.No. 3/4	4.48	42.30	4.80	8.81	3.39	59.00	Yellow
8.	T.No. 8/7	3.96	51.30	4.30	12.95	6.20	54.10	Yellow
9.	T.No. 18/3	4.80	47.46	4.00	9.88	4.86	55.15	Yellow
10.	Hy 95-T4	5.70	49.16	5.76	8.62	5.69	60.40	Yellow
11.	T.No. 12/1	4.43	44.70	3.90	10.09	3.84	57.60	Yellow
12.	T.No. 228	4.47	39.30	5.15	8.79	7.76	68.30	Red Yellow
13	BPP-8	8.07	60.40	9.25	7.48	5.45	65.80	Yellow
CD @ 5%		0.64	8.61	1.22	1.45	0.86	5.64	
SEm±		0.22	2.93	0.41	0.49	0.29	1.92	
CV		7.18	10.39	13.27	9.11	9.91	5.44	

Table 1.91: Chemical Parameters of Cashew germplasm for cashew apple

Sl.No	Germplasm	TSS (o Brix)	Vitamin-C (mg/100 g)	Tannins (mg/100 g)	Acidity (%)
1.	Priyanka	11.80	130.10	3.03	0.43
2.	T.No. 2/14	10.30	134.50	3.15	0.47
3.	T.No.17/5	11.00	148.20	3.13	0.49
4.	T.No. 5/1	9.37	134.10	3.14	0.89
5.	BLA. 139/1	10.07	135.20	3.30	1.06
6.	BLA. 39/4	9.39	148.30	3.17	0.77
7.	T.No. 3/4	11.01	165.60	3.19	0.79
8.	T.No. 8/7	10.86	164.70	3.18	0.49
9.	T.No. 18/3	11.10	161.60	3.16	0.53
10.	Hy 95-T4	10.29	159.10	3.14	0.54
11.	T.No. 12/1	10.30	125.10	3.25	0.66
12.	T.No. 228	10.17	130.10	3.17	0.68
13.	BPP-8	10.31	137.10	3.03	0.53
CD at (5%)		NS	8.89	NS	0.13
SEm±		0.67	3.04	0.17	0.044
CV		11.15	3.65	9.58	11.94

Among the 13 genotypes, the total soluble solids (TSS) ranged from 9.37^0 Brix to 11.80^0 Brix. However, the highest TSS was recorded in Priyanka (11.80^0Brix). The maximum vitamin C content was recorded in T.No.3/4 (165.60 mg/100gm) followed by T.No.8/7 (164.70 mg/100 gm). The tannin content was lowest in Priyanka and BPP-8(3.03 mg/100 g) followed by TNo.17/5 (3.13 mg/100 gm). The acidity content was lowest in Priyanka (0.43%) followed by T.No.2/14 (0.47%).

PILICODE

Accessions : 6
Design : CRD
Replication : 3

Juice recovery was highest in PLD 20 while it was lowest in MDK 1 x PLD 57. TSS was high in MDK 1 x PLD 57. Vitamin C was highest in PLD 57 X MDK 1. Tannin and acidity contents were also higher in this. Due to high tannin and acidity, this germplasm is not suited for processing.

Table 1.92: Physical parameters of cashew germplasm for cashew apple.

Sl.No	Germplasm	Nut wt (g)	Apple wt (g)	Yield /tree (kg)	Apple nut ratio	Juice recovery (%)	Colour of the apple
1	PLD 57 x ANK 1	6.57	53.89	3.68	8.27	34.65	Orange red
2	MDK 1 x PLD 57	5.85	45.90	4.38	7.95	25.50	Yellow
3	PLD 4	7.35	77.50	7.50	10.55	41.00	Yellow
4	PLD 12	8.67	74.35	3.65	8.54	61.80	Yellowish orange
5	PLD 15	6.88	69.45	5.90	10.00	43.65	Orange red
6	PLD 20	7.76	75.70	4.38	9.79	72.05	Yellow
Mean		7.18	66.13	4.91	7.18	46.44	-
SEm ±		0.04	0.43	1.17	0.04	0.49	-
CD @5%		0.14	0.91	-	0.14	1.69	-
CV (%)		0.78	1.47	33.61	0.78	1.49	-

Table 1.93: Chemical parameters of cashew germplasm for cashew apple

Sl.No	Accession	TSS (°Brix)	Vitamin-C (mg/100 g)	Tannins (mg/100 g)	Acidity (%)
1	PLD 57 x ANK 1	12.00	206.85	0.14	0.41
2	MDK 1 x PLD 57	13.70	203.80	0.13	0.32
3	PLD 4	11.67	201.20	0.13	0.28
4	PLD 12	12.40	194.75	0.13	0.27
5	PLD 15	9.99	192.75	0.10	0.26
6	PLD 20	11.68	198.15	0.13	0.32
	Mean	11.91	199.58	0.12	0.31
	SEm ±	0.04	0.33	0.004	0.01
	CD @5%	0.15	1.14	0.014	0.02
	CV (%)	0.53	0.23	4.61	2.29

Vitamin C content was highest in the Germplasm PLD 57 x ANK 1. Lowest was in PLD 15. Lowest tannin content was in PLD 15. Lowest acidity was also in this germplasm.

Gen. 6. Evaluation of promising bold nut, bigger size apple types and high yielding cashew genotypes

Centers: East Coast : Bapatla, Bhubaneswar, Jhargram and Vridhachalam
West Coast : Goa, Madakkathara, Pilicode and Vengurle
Plains / others: Hogalagere, Jagdalpur and Kanabargi

Objective: To evaluate the performance of promising bold nut bigger size apple and high yielding cashew genotypes at different AICRP Centers.

Experimental details:

Total Number of genotypes	:	16
Design	:	RCBD
No. of replications	:	2
No. of plants per genotype	:	4
Spacing	:	6m x 6m
Year of planting	:	2022

Material:

Sl. No.	Sponsoring centre	Cashew genotypes
1	CRS, Bapatla	H-218
2	CARS, Jagdalpur	CARS-8, CARS-10
3	CCARI, Goa	Tiswadi-3, Tudal-1, HB22/05
4	RFRS, Vengurle	H-3043, H-2873
5	CRS, Bhubaneswar	C-136, D-21, E-22
6	DCR, Puttur	H-126, H-130, NRC-301, NRC-493 and V-7

Treatments	Code No.	Treatments	Code No.
T_1	A	T_{10}	J
T_2	B	T_{11}	K
T_3	C	T_{12}	L
T_4	D	T_{13}	M
T_5	E	T_{14}	N
T_6	F	T_{15}	0
T_7	G	T_{16}	P
T_8	H	T_{17}	Q
T_9	I		

BAPATLA

Experimental details:

Year of Planting : November, 2019
Design : RBD
No of Treatments :16
No of Replications : 2
No of Plants per replication : 4
Spacing : 6m x 6m

Sponsoring Centers	No.	Cashew Genotypes
CRS, Bapatla	1	H-218
CARS, Jagadalpur	2	CARS-8, CARS-10
ICAR-CCARI, Goa	3	HB-22/05, Tiswadi-3,Tudal-1
RFRS, Vengurla	3	H-3043, H-2873, V-7
CRS, Bhubaneswar	3	C-136, D-21 and E-22
ICAR-DCR, Puttur	4	H-126, H-130, NRC-301 and NRC-493

Results:

Table 1.94: **Growth parameters of promising bold nut, bigger size apple types and high yielding cashew genotypes.**

Sl.No.	Variety/ Genotype (CODED)	Mean plant height (m)	Canopy height (m)	Trunk girth (cm)	Canopy spread (m) EW	Canopy spread (m) NS
1	A	1.91	1.45	26.50	2.56	2.54
2	B	2.22	**1.94**	27.38	2.69	2.65
3	**C**	1.55	1.18	21.42	2.15	2.22
4	D	1.42	1.07	21.33	1.52	1.53
5	E	1.83	1.58	25.83	2.92	1.44
6	F	2.17	1.78	25.00	**3.25**	2.58
7	G	2.15	1.73	27.50	2.73	2.70
8	**H**	1.88	1.63	22.88	2.58	2.58
9	I	2.00	1.35	25.15	2.70	**3.90**
10	J	2.25	1.73	27.38	**3.30**	2.87
11	K	**2.39**	**1.89**	**31.75**	2.62	**3.22**
12	L	**2.38**	**2.00**	23.75	**3.11**	3.14
13	M	1.94	1.54	**29.25**	2.89	3.18
14	N	1.99	1.62	29.17	2.63	2.46
15	O	**2.35**	1.63	**34.00**	2.90	**3.20**
16	P	2.01	1.83	24.67	**3.17**	2.50
Mean		2.03	1.62	26.43	2.73	2.67
CD@5%		0.48	0.42	NS	NS	0.71
SEm ±		0.16	0.14	2.7	0.4	0.23
CV		11	11.84	14.47	20.76	12.46

Among the 16 genotypes studied from different Centers, significant differences were observed with respect to mean plant height, canopy height. The mean plant height was highest in genotype K (2.39m) followed by L (2.38m) and O (2.35 m). Highest mean canopy height was noticed in Genotype L (2.00) followed by Genotype B (1.94m). The mean trunk girth was recorded highest in O (34.00cm) followed by K (31.75cm) and M (29.25cm). The mean canopy spread (E-W) was recorded maximum in J (3.30 m) followed by Genotype F (3.25m) and Genotype P (3.17 m). The mean canopy spread (N-S) was recorded maximum in I (3.90 m) followed by Genotype K (3.22 m) and O (3.20 m).[Table No. 1.94]

Table 1.95: Yield parameters of promising bold nut, bigger size apple types and high yielding cashew genotypes at Bapatla Centre

Sl.No.	Variety/ Genotype	Date of first Flowering	Date of last Flowering	Duration of days	Flowering Intensity/ Sqmt.)	Mean no of nuts/m^2	Mean no of nuts/ panicle
1	A	20.02.23	10.05.23	80	6.70	17.00	1.95
2	B	16.02.23	10.05.23	76	3.95	16.30	1.10
3	C	20.02.23	10.05.23	80	10.00	15.40	1.50
4	D	16.02.23	10.05.23	86	6.20	17.40	1.30
5	E	06.02.23	05.05.23	89	11.00	21.30	2.75
6	F	16.02.23	04.05.23	78	6.75	14.80	1.50
7	G	22.02.23	10.05.23	78	4.55	11.00	1.65
8	H	10.03.23	21.05.23	73	4.65	16.75	1.35
9	I	15.02.23	10.05.23	75	2.40	10.90	1.53
10	J	20.02.23	10.05.23	80	2.20	12.35	3.15
11	K	14.02.23	09.05.23	74	4.00	11.25	1.85
12	L	16.02.23	13.05.23	87	4.95	12.00	1.30
13	M	16.02.22	10.05.23	84	5.00	20.65	1.40
14	N	13.02.23	10..05.23	87	3.90	13.75	2.50
15	O	20.02.23	17.05.23	87	4.60	10.80	1.50
16	P	14.02.23	11.02.2023	66	4.75	11.28	1.30
CD@5%					2.86	3.95	0.74
SEm ±					0.94	1.30	0.24
CV					24.87	12.61	19.97

Among the 16 coded genotypes studied, the duration of flowering ranged from 66.0 days to 87.0 days. The shortest flowering duration was recorded in genotype P (66.0 days) and followed by genotype H (73.0 days) and genotype K (74 days). The flowering intensity per square meter was highest in genotype E (11.00) followed by Genotype C (10.00) and genotype F (6.75). the mean number of flower panicles per square meter and mean number of nuts per panicle were found to be significant. The mean no of nuts per square meter was found highest in genotype E (21.30) followed by genotype M (20.65) and genotype D (17.40). The mean no of nuts per panicle was found maximum in genotype J (3.15) followed by genotype E (2.75) and genotype N (2.50).).[Table No. 1.95]

Table 1.96: Yield parameters of promising bold nut, bigger size apple types and high yielding cashew genotypesat Bapatla Centre

Sl .No.	Variety	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut Yield /tree (kg) (Harvest No.1) 2023
1	A	8.20	66.20	34.14	0.550
2	B	12.00	76.75	37.50	0.400
3	C	11.00	74.60	31.81	0.288
4	D	15.00	79.00	40.00	0.275
5	E	9.33	37.00	30.33	0.745
6	F	10.00	55.65	45.00	0.505
7	G	12.00	82.00	50.00	0.395
8	H	8.50	63.00	41.17	0.275
9	I	8.80	59.50	31.81	0.523
10	J	12.00	43.30	33.32	0.950
11	K	10.16	63.10	31.10	0.335
12	L	12.50	62.25	40.00	0.375
13	M	12.20	124.40	34.42	0.403
14	N	10.00	77.90	30.00	0.405
15	O	9.00	46.70	22.22	0.975
16	P	16.20	81.40	27.16	0.300
CD@5%		2.07	8.25	7.17	0.29
SEm ±		0.68	2.71	2.36	0.94
CV		8.72	5.62	9.53	27.72

Mean nut weight, mean apple weight, shelling percentage and mean annual nut yield per tree were found to be significant. The mean nut weight was maximum in genotype P (16.20 g) followed by genotype D (15.00g) and genotype L (12.50g). With regard to the mean apple weight, the highest was recorded in genotype M (124.40 g) followed by genotype G (82.00 g) and Genotype P (81.40 g). The shelling percentage was recorded highest in genotype G (50.00) followed by F (45.00) and H (41.17). The maximum mean annual nut yield per tree during the year was highest in genotype O (0.975 kg) followed by genotype J (0.950 kg) and genotype E (0.750 kg).).[Table No. 1.96]

BHUBANESHWAR

Experimental details:

Total number of genotypes	:	17
No. of replications	:	2
No. of plants per genotypes	:	4
Spacing	:	6m x 6m
Year of planting	:	2019

Data presented in Table 8 revealed that plant height (4.86m) and trunk girth (41.37cm) were recorded maximum in genotype 'K'code while canopy spread was observed maximum in genotype ' B' code (5.43m in E-W & 5.77m in N-S direction). Genotype, 'D' code recorded lowest for trunk girth (30.13cm) as well as canopy spread in both directions (2.68 in E-W &2.52m in N-S). Among the evaluated genotypes, 'G' code(2.94m) recorded the lowest plant height while trunk girth(30.13cm) and canopy spread both in E-W(2.68m) and N-S(2.52m) directions were recorded minimum in 'D'code.

Table 1.97: Growth parameters during the year 2023(Year of planting 2019):Bhubaneswar Center

Sl. No.	Accessions Code	Year pf planting	Plant height(m)	Trunk girth(cm)	Canopy spread(m)	
					E-W	N-S
1.	A code	2019	3.48	37.54	4.00	4.51
2.	B code	2019	3.60	39.00	5.43	5.77
3.	C code	2019	3.59	41.10	4.97	4.63
4.	CARS-8	2019	2.95	30.13	2.68	2.52
5.	E code	2019	3.20	33.11	4.74	3.08
6.	F code	2019	3.58	35.82	4.70	4.88
7.	G code	2019	2.94	34.44	3.90	4.07
8.	H code	2019	3.84	37.73	4.37	4.94
9.	I code	2019	3.62	31.80	3.83	4.15
10.	J code	2019	3.67	34.38	4.69	4.55
11.	K code	2019	4.86	41.37	4.55	4.95
12.	L code	2019	4.48	39.89	4.52	5.13
13.	M code	2019	3.37	35.13	4.65	4.62
14.	N code	2019	3.55	36.73	4.32	4.64
15.	O code	2019	3.87	35.55	4.54	4.52
16.	P code	2019	3.40	35.71	4.16	4.50
17.	Q code	2019	3.67	38.91	4.55	4.83
	Mean	**-**	**3.63**	**36.37**	**4.38**	**4.48**
	SEm(±)	**-**	**0.310**	**2.025**	**0.28**	**0.47**
	CD(5%)	**-**	**0.938**	**6.129**	**0.85**	**1.43**
	CV%	**-**	**12.082**	**7.876**	**9.05**	**14.886**

Flowering time and duration of flowering recorded in coded genotypes exhibited wide variations during the evaluation (Table 9). 'E' code recorded flowering twice in a year i.e. June-July and September-October. 'A' code and 'N' code exhibited earliness in flowering (November-December). Other coded genotypes noted medium ('B' code, 'D' code, 'G' code 'I' code, 'J 'code 'K 'code, 'O' code and 'Q' code) to late ('C' code, 'F' code, 'H' code & 'L' code,) flowering season. Similarly, duration of flowering was recorded maximum in code 'E' (67.85

days) while the minimum duration of flowering was recorded in 'L' code(50.61days). [Table No. 1.97]

Among the evaluated genotypes 'D' code(13.4g) recorded maximum nut weight while apple weight was recorded maximum in 'M' code(233.55g). Shelling was recorded maximum in genotype Ó' code (34.01%). The mean annual nut yield (3.25 kg plant^{-1}) and cumulative nut yield(4.21kg plant^{-1}) were recorded maximum in genotype 'B'code while genotype, 'L' code recorded the lowest nut yield (0.14 kg plant^{-1}) at 2nd harvest. [Table No. 1.98]

Table 1.98: Reproductive parameters during the year 2023(Year of planting 2019): Bhubaneswar Center

Sl. No.	Accessions	Flowering time	Duration of flowering(days)	Nut weight(g)	Apple weight(g)	shelling %	Nut yield(kg/plant)	Cum. nut yield(kg plant^{-1})	Special features
1.	A code	Nov.-Dec.	62.20	9.75	121.20	32.46	0.95	1.79	Compact canopy
2.	B code	Dec.-Jan.	58.50	9.8	89.20	33.37	3.25	4.21	Spreading canopy & high yielder
3.	C code	Jan.-Mar	56.20	10.05	82.75	31.27	1.30	1.46	Profuse flowering & vigorous plant
4.	D code	Dec.- Jan	55.00	13.4	94.62	27.13	0.50	0.60	Canopy upright & open
5.	E code	Dec.-Jan	67.85	7.6	38.30	32.28	0.92	1.82	Two times flowering in a year
6.	F code	Jan. Feb	52.50	11.125	127.30	30.94	0.64	0.96	Plant is vigorous & late type
7.	G code	Dec.-Jan	56.06	8.2	72.15	32.74	0.87	1.28	Problem of gummosis
8.	H code	Late(Jan.-Feb.)	62.50	9.8	84.95	31.59	0.57	1.03	Late flowering
9.	I code	Dec.-Jan.(Mid)	58.53	8.85	113.9	34.36	1.81	2.69	Very short harvesting period
10.	J code	Dec.-Jan.(Mid)	60.74	11.4	99.50	27.11	1.72	2.56	Medium yielder
11.	K code	Dec.-Jan.(Mid)	58.00	9.8	117.60	33.20	1.05	1.63	Canopy upright & open
12.	L code	Ja.-Feb.(Late)	50.61	11.91	88.50	30.86	0.14	0.52	Low yielder
13.	M code	Dec.-Jan.(Mid)	56.00	12.3	233.55	30.25	1.31	2.20	Big size apple

14.	N code	Nov. – Dec(Early)	59.78	11.8	107.50	32.93	2.27	3.62	High yielder
15.	O code	Dec.-Jan.(Mid)	56.50	8.25	91.50	34.01	1.21	2.16	Plant is vigorous
16.	P code	Dec.-Jan.(Mid)	54.00	13.15	117.80	30.41	1.74	2.57	Canopy spreading type
17.	Q code	Dec.-Jan(Mid)	61.50	8.85	96.00	30.27	1.72	3.51	Cluster bearing & high yielder
	Mean		**58.02**	**10.35**	**106.31**	**31.48**	**1.29**	**-**	**-**
	SEm(±)		**2.59**	**0.40**	**10.75**	**0.62**	**0.11**	**-**	**-**
	CD(5%)		**7.84**	**1.23**	**32.54**	**1.90**	**0.33**	**-**	**-**
	CV%		**6.31**	**5.59**	**14.30**	**2.80**	**12.23**	**-**	**-**

JHARGRAM

Experimental details:

Total Number of genotypes : 16
No. of replications : 2
No. of plants / genotype /replication : 3
Spacing : 6m x 6m
Design : Randomized Block Design
Year of Planting : 25th September, 2019

Details:

All the varieties were found to be a par with respect to the growth characters studied. Significant variations were noticed among the bold nut varieties with respect to reproductive characters especially nuts/m^2, nut weight, kernel weight, apple weight and yield/tree. Highest nuts/m^2 was recorded in O code which was at par with K code. (< 50 nuts/m2) followed by N code which was at par with Q code (<38 nuts/m^2). Minimum number of nuts/m^2 was noticed in E -22 (1.4 nuts/m^2). All the varieties had very few nuts/panicle (range was 1 – 5). Nut weight varied from 6.9 to 13.6 g/nut. Nut weight above 10 g was recorded in P code, N code, J code, E -22, O code and M code. Except E- 22 and D- 21 all other varieties had < 30% shelling recovery. Yield was recorded highest in O code (4.4 kg/tree) followed by Q code which was at par with P code, J code, N code and K code (Yield between 1.5 to 2.1 kg/tree). Apple weight was maximum in N code (139 g) which was at par with M code (107.3g) followed by J code (89 g). Comparing the nut weight, yield and shelling %, it could be said that O code and Q code were the promising bold nut types for West Bengal condition.

Table 1.99: Growth parameters of bold nut type genotypes at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2019)

Sl. No.	Code No	Mean tree height (m)	Mean stem girth (cm)	Canopy spread (m)			Mean canopy area (m^2)	Vegetative flush / m^2
				E-W	N-S	Average		
1	D code	2.8	27.3	2.5	4.1	3.3	12.1	7.1
2	F Code	2.7	28.3	2.2	2.0	2.1	5.6	8.3
3	J code	2.8	30.3	3.3	3.5	3.4	14.1	3.4
4	K-code	3.0	36.0	4.2	3.7	3.9	16.9	6.2
5	L Code	2.8	26.7	3.3	3.4	3.4	13.6	11.2
6	M Code	2.0	28.0	2.3	2.8	2.5	8.1	6.0
7	N Code	2.5	24.0	2.3	2.4	2.4	7.7	5.6
8	O Code	3.0	27.0	3.1	2.8	2.9	11.3	7.5
9	P Code	2.7	29.3	3.5	3.4	3.5	13.6	4.8
10	Q Code	2.9	30.7	3.1	3.9	3.5	14.5	6.4
11	E 22	2.6	28.7	2.3	2.6	2.5	7.7	8.1
12	C -136	1.5	17.3	1.5	1.6	1.5	2.8	7.6
13	D- 21	2.7	26.7	3.2	2.8	3.0	10.4	13.1
S.Em±		0.23	3.11	0.39	0.26	0.26	1.58	1.38
CD at 5%		0.68	9.07	1.14	0.75	0.76	4.62	4.03
CV%		15.53	19.42	23.86	14.89	15.39	25.77	32.65

Table 1.100: Reproductive parameters of bold nut type genotypes at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2019)

Sl. No.	Code No	Duration of Flowering (Days)	Bisexual : Male Flower	No. of flowering laterals / m^2	Nuts/ m^2	Mean no. of nuts/ panicle	Nut weight (g)
1	D code	86	0.27	14.0	17.0	4.3	6.9
2	F Code	84	0.17	8.4	18.0	1.8	9.0
3	J code	81	0.29	7.6	29.5	3.3	11.6
4	K-code	85	0.33	7.7	51.3	2.2	9.5
5	L Code	88	0.25	13.1	8.8	2.0	8.1
6	M Code	89	0.31	5.8	13.8	0.9	10.2
7	N Code	80	0.27	9.5	40.8	1.0	13.3
8	O Code	83	0.24	10.6	52.1	3.5	10.3
9	P Code	88	0.34	8.4	27.1	2.5	13.6
10	Q Code	81	0.25	12.5	38.4	5.3	9.5
11	E 22	77	0.25	9.8	1.4	1.0	11.4
12	C -136	82	0.10	10.3	2.4	1.2	7.9
13	D- 21	80	0.18	12.0	13.3	1.5	9.3
S.Em±				1.13	1.75	0.31	0.15
CD at 5%				3.31	5.11	0.90	0.45
CV%				19.70	12.57	22.76	2.63

Table 1.101: Reproductive parameters of bold nut type genotypes at Jhargram Centre during the year 2022 - 23 (Year of Planting: 2019)

Sl. No.	Code No	Kernel Weight (g)	Shelling %	Mean apple Weight (g)	Cashew Apple colour	Cashew Apple shape	Mean annual nut yield (kg/tree)
1	D code	2.3	33.7	74.7	Yellow	Cylindrical	0.5
2	F Code	3.0	32.8	56.0	Yellow	Cylindrical	0.6
3	J code	3.6	31.1	89.0	Pink	Cylindrical	1.6
4	K-code	3.1	32.4	67.7	Pink	Cylindrical	1.5
5	L Code	2.9	35.6	68.3	Pink	Elongated	0.3
6	M Code	3.2	31.7	107.3	Pink	Elongated	0.6
7	N Code	4.0	30.2	139.0	Red	Obovate	1.6
8	O Code	3.3	32.4	45.0	Yellow	Conical	4.4
9	P Code	3.9	28.4	76.0	Red	Conical	1.7
10	Q Code	3.0	31.2	53.3	Yellow	Cylindrical	2.1
11	E 22	4.0	35.3	53.0	Pink	Obovate	0.1
12	C -136	2.2	28.1	74.7	Yellow	Cylindrical	0.1
13	D- 21	2.6	28.0	40.7	Yellow	Cylindrical	0.5
S.Em+		0.66	0.07	2.45			0.22
CD at 5%		1.92	0.20	7.14			0.65
CV%		3.60	3.75	5.83			32.45

VRIDHACHALAM

The trial has been initiated with the planting materials (13 types why?) collected from DCR, Puttur during 2019. Evaluation of 13 coded genotypes of cashew revealed that the tree height was maximum in F code (4.10 m) while the canopy spread in East-West (4.98 m) and North-South (5.28 m) was recorded maximum in J code.

The experimental details are given below

Experimental details:

Total Number of genotypes : 13
Design : RCBD
No. of replications : 2
No. of plants per genotype : 4
Spacing : 6m x 6m
Year of Planting : 20.11.2019

Table 1.102: Growth parameters during the year 2023-24

Sl. No.	Accession code	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	D	2019	3.75	31.75	3.72	3.85
2	E	2019	3.95	36.63	4.45	4.58
3	**F**	2019	**4.10**	35.49	4.32	4.75
4	G	2019	3.58	36.21	4.35	4.96
5	I	2019	3.28	32.32	3.75	4.25
6	**J**	2019	3.81	36.52	**4.98**	**5.28**
7	K	2019	3.59	36.59	4.55	4.75
8	**L**	2019	3.88	37.85	4.45	3.85
9	M	2019	3.54	34.65	3.74	3.65
10	N	2019	2.98	13.45	2.69	3.25
11	O	2019	2.56	24.55	3.65	3.74
12	P	2019	3.25	26.44	3.74	3.96
13	Q	2019	3.52	35.65	3.95	3.94
	Mean		3.52	32.16	4.03	4.22
	SEm ±		0.23	2.41	0.35	0.31
	CD @5%		0.58	5.96	0.79	0.92
	CV (%)		19.17	16.48	17.82	17.35

GOA

Under this programme, grafts of 16 coded bold nut genotypes sourced from different AICRP Centers were planted in the field following Randomized Block Design with three replications for further evaluation.

MADAKKATHARA

The seventeen bold nut genotypes exhibited significant differences with respect to stem girth, nut weight, apple weight, shelling percentage and yield. The highest value for stem girth was observed in the genotype F. The highest nut weight was observed in the genotypes, P, D, J, N and F. The genotype M recorded highest apple weight (160.15 g). Shelling percentage was the highest in the genotypes O and C. The nut yield per tree was the highest in the genotype E (1.77 kg/tree/year).

Table 1.103: Growth parameters during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	C	2019	3.16	19.38	4.61	4.94
2	D	2019	3.53	18.44	3.48	3.81
3	E	2019	3.30	17.38	4.27	4.80
4	F	2019	3.59	23.19	5.11	5.33
5	G	2019	3.18	20.19	5.34	5.40
6	H	2019	2.48	13.12	3.30	3.10
7	J	2019	3.85	20.21	5.54	5.18
8	K	2019	3.54	21.44	5.19	5.48
9	L	2019	3.26	17.63	4.14	4.17
10	M	2019	2.98	17.63	3.90	4.70
11	N	2019	2.67	15.00	4.20	4.60
12	O	2019	3.76	21.50	5.51	5.58
13	P	2019	2.93	18.00	4.87	5.24
14	Q	2019	3.81	19.78	3.62	3.92
Mean			3.29	18.78	4.51	4.74
SEm±			0.27	1.59	0.49	0.58
CD @5%			-	4.88	-	-
CV (%)			11.69	12.03	15.57	17.45

Table 1.104: Reproductive parameters during 2023 (YOP – 2019)

Sl. No.	Accession	Flowering time (month followed by early/ mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	C	Oct (Early)	103	10.35	86.01	32.16	0.32	0.5**	
2	D	Dec (Mid)	82	15.07	97.89	25.31	0.24	0.32**	
3	E	Oct (Early)	127	10.82	22.02	29.81	1.77	2.17**	Low apple weight
4	F	Dec (Mid)	92	13.62	117.11	25.94	0.19	0.22**	
5	G	Dec (Mid)	97	10.07	104.55	29.69	0.07	0.17**	
6	H	Dec (Mid)	76	10.73	103.87	28.51	0.05	0.05*	
7	J	Oct (Early)	118	14.50	72.33	24.18	0.67	0.67*	
8	K	Dec (Mid)	108	11.90	79.79	27.08	1.13	1.27**	
9	L	Oct (Early)	93	11.49	61.79	29.12	0.29	0.33**	
10	M	Dec (Mid)	103	13.14	160.15	28.18	0.56	0.67**	High apple weight
11	N	Oct (Early)	87	14.47	70.12	26.78	0.66	1.26**	
12	O	Dec (Mid)	89	10.14	41.49	32.94	0.29	0.31**	
13	P	Oct (Early)	112	15.21	101.34	26.67	0.76	0.76*	
14	Q	Oct (Early)	101	9.33	62.37	28.30	0.15	0.35**	
Mean			99.15	12.21	84.35	28.20	0.52	0.65	
SEm±				0.39	3.32	0.89	0.18		
CD @5%				1.21	10.14	2.77	0.54		
CV (%)				4.59	5.56	4.15	48.99		

- *Cumulative yield for one harvest, ** cumulative yield for 2 years

PILICODE

Seventeen coded genotypes were evaluated. Regarding plant height, the genotype A (165.38 cm) and I (165.00cm) were statistically on par with most of the others except G, J, K, H and F. Genotype F (123.7 cm) had the lowest height. Highest girth was observed with genotype O (7.62 cm) which was statistically on par with K (7.17 cm), M (6.94 cm) and P (6.88 cm). Least girth was observed genotype J (5.87cm), G (5.67 cm), I (5.89 cm) H (6.06 cm) and I(6.02 cm).

The plant spread in EW direction was highest for the genotypes I (72.54 cm) and C (64.17 cm). The genotypes H (37.26 cm), and B (44.37 cm) and H (37.26 cm) had lower spread in EW direction. Regarding spread in NS direction, genotypes, I (68.20 cm), N (67.96 cm), N (67.96 cm), F (67.12 cm), were on par with most of the genotypes and had the higher spread whereas it was lowest in H (39.25 cm). Nut weight was highest in F (13.8g), Lowest in E (7.6g). Kernel weight was highest in C (3.6g), F (3.5g) and B (3.4g). Lowest kernel weight was in K

(2.3g) which was on par with E (2.4 g). Shelling percentage was highest in E (31.59%) which was on par with many other genotypes. Genotype K had lower shelling percentage as well as kernel weight indicating lower kernel filling nature. It had an appreciable nut weight of 9.7 g.[Table No.1.105]

Table 1.105: Growth parameters during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m) correct values for m	Stem Girth (cm)	Canopy Spread (m) correct values for m	
					E-W	N-S
1	A	2019	165.38	6.60	55.35	53.58
2	B	2019	144.80	6.71	44.37	55.41
3	C	2019	157.12	6.79	64.17	67.12
4	D	2019	160.61	6.82	52.99	58.80
5	E	2019	150.16	6.70	55.75	58.80
6	F	2019	123.71	6.43	55.89	67.96
7	G	2019	140.74	5.89	48.30	51.61
8	H	2019	125.78	6.06	37.26	39.25
9	I	2019	165.00	6.20	72.54	68.20
10	J	2019	139.32	5.87	53.82	57.11
11	K	2019	137.13	7.17	56.99	56.54
12	L	2019	147.80	6.75	50.96	58.06
13	M	2019	154.93	6.94	54.51	63.87
14	N	2019	149.38	6.61	56.17	67.96
15	O	2019	156.35	7.62	51.20	56.68
16	P	2019	155.06	6.88	61.13	60.63
17	Q	2019	143.06	6.62	58.79	58.94
Mean			**148.02**	**6.63**	**54.72**	**58.85**
SEm ±			**7.81**	**0.27**	**3.42**	**3.72**
CD @5%			**23.40**	**0.80**	**10.25**	**11.16**
CV (%)			**7.46**	**5.69**	**8.84**	**8.95**

Table 1.106: Reproductive parameters during the year 2023

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Nut weight (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
1	A	2019	November mid	0.80	28.70	0.39	0.39
2	B	2019	November mid	12.30	27.64	0.28	0.28
3	C	2019	December mid	12.00	30.00	0.33	0.33
4	D	2019	December mid	11.80	25.42	0.47	0.47
5	E	2019	December mid	7.60	31.59	0.36	0.36
6	F	2019	December mid	13.80	25.35	0.41	0.41
7	G	2019	December mid	9.70	28.87	0.29	0.29
8	H	2019	December mid	12.00	27.50	0.40	0.40
9	I	2019	December mid	-	-	0.11	0.11
10	J	2019	December mid	8.80	30.68	0.38	0.38
11	K	2019	December mid	9.70	23.71	0.42	0.42
12	L	2019	December mid	10.20	27.45	0.37	0.37
13	M	2019	November mid	10.70	28.97	0.39	0.39
14	N	2019	December mid	9.50	28.42	0.27	0.27
15	O	2019	December mid	9.60	31.25	0.31	0.31
16	P	2019	December mid	10.90	29.36	0.40	0.40
17	Q	2019	November mid	9.50	27.37	0.23	0.23
Mean				9.93	28.27	0.34	0.34
SEm ±				**0.14**	**0.91**	**0.06**	**0.06**
CD @5%				**0.42**	**2.73**	**-**	**-**
CV (%)				**1.88**	**4.54**	**25.70**	**25.70**

VENGURLA

Experimental details

Total Number of genotypes : 16
Design : RCBD
No. of replications : 2
No. of plants / genotype : 4
Spacing : 6m × 6m
Year of planting : 2019

Evaluation details:

The trial was laid out in June, 2020. The growth of all experimental grafts was satisfactory. The second-year growth observations of the trial were recorded and presented. Data revealed that there were significant differences with respect to all vegetative growth parameters. The maximum tree height (1.81m) observed in genotype code K and minimum in genotype code B (0.68m). Genotype code M recorded the maximum stem girth (19.00 cm) and minimum in genotype code A (6.90 cm). The maximum EW canopy spread (1.74m) and NS canopy spread (1.79m) was observed in genotype code K and minimum in genotype code A (0.38 m & 0.51, respectively). [Table. No. 1.107]

Table 1.107: Growth parameters during the year 2023

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	A	2020	0.86	6.90	0.38	0.51
2	B	2020	0.68	7.45	0.55	0.53
3	C	2020	0.98	7.15	0.44	0.61
4	D	2020	1.46	13.15	0.76	0.75
5	E	2020	1.51	15.60	1.35	1.45
6	F	2020	1.35	18.35	1.49	1.47
7	G	2020	1.37	15.85	1.34	1.37
8	H	2020	1.47	18.10	1.44	1.35
9	I	2020	1.48	14.10	1.27	1.35
10	J	2020	1.69	17.60	1.61	1.68
11	K	2020	1.81	17.60	1.74	1.79
12	L	2020	1.58	18.35	1.64	1.60
13	M	2020	1.75	19.00	1.59	1.63
14	N	2020	1.25	12.75	1.24	1.29
15	O	2020	1.17	13.35	1.23	1.24
16	P	2020	1.42	16.75	1.68	1.56
17	Q	2020	1.63	18.35	1.55	1.39
Mean			**1.38**	**14.73**	**1.25**	**1.27**
SEm ±			**0.14**	**2.12**	**0.21**	**0.18**
CD @5%			**0.42**	**6.40**	**0.64**	**0.56**
CV (%)			**14.34**	**20.31**	**24.00**	**20.49**

JAGDALPUR

Among the seventeen entries of different Centers evaluated, there were no significant differences with respect to mean plant height, stem girth and canopy spread in E-W direction. The minimum canopy spread in N-S direction was observed in P (2.28 m).

Table 1.108: Growth parameters of cashew entries at Jagdalpur Centre

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1.	A	2019	2.60	31.00	3.28	2.90
2.	B	2019	2.46	30.00	2.55	2.50
3.	C	2019	2.63	32.50	3.19	3.58
4.	D	2019	2.42	29.00	2.60	2.55
5.	E	2019	2.38	28.00	3.25	3.03
6.	F	2019	2.79	34.50	3.40	3.84
7.	G	2019	2.60	29.00	3.07	3.23
8.	H	2019	2.21	35.50	3.89	3.85
9.	I	2019	2.53	28.00	2.85	1.09
10.	J	2019	2.30	29.00	2.72	2.60
11.	K	2019	2.72	25.00	2.11	2.03
12.	L	2019	2.38	32.50	3.35	3.15
13.	M	2019	2.69	31.00	3.13	4.10
14.	N	2019	2.64	31.00	3.33	3.63
15.	O	2019	2.72	31.50	3.00	3.33
16.	P	2019	2.09	27.00	2.43	2.28
17.	Q	2019	2.25	32.50	3.13	2.70
Mean			2.46	30.41	3.01	2.96
SEm ±			0.12	1.12	0.43	0.47
CD @5%			NS	NS	NS	1.42
CV (%)			10.96	10.09	24.65	22.71

The duration of flowering ranged from 101.00 days to 116.50 days. The shortest flowering duration was recorded in H (101.00 days) and followed by H (101.25 days). With respect to nut weight, the maximum nut weight was recorded in J (13.56 g) which was on par with P (13.26 g) followed by D (12.33 g). Significantly maximum apple weight was observed in M (119.78 g) followed by J (106.50 g). Shelling per cent was recorded highest in O (31.06 %). The maximum nut yield and cumulative nut yield were recorded in P (1.87 and 2.77 kg/tree).[Table No. 1.109]

Table 1.109: Yield parameters of cashew entries at Jagdalpur Centre

Sl. No.	Accession	Year of planting	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
1.	A	2019	Mid	102.00	9.98	75.94	28.15	0.37	0.68
2.	B	2019	Late	109.75	10.12	64.62	28.29	0.42	0.89
3.	C	2019	Late	110.25	7.95	50.39	30.65	0.32	0.43
4.	D	2019	Mid	101.50	12.33	80.50	26.89	0.57	0.84
5.	E	2019	Mid	103.25	7.49	51.87	30.12	0.56	1.16
6.	F	2019	Late	104.75	10.76	58.00	27.67	0.38	0.56
7.	G	2019	Early	107.50	7.91	84.92	29.08	0.46	0.84
8.	H	2019	Late	101.00	10.23	66.96	28.12	0.67	0.96
9.	I	2019	Mid	112.50	8.83	56.23	29.90	0.78	1.26
10.	J	2019	Late	103.75	13.56	106.50	28.75	0.75	1.31
11.	K	2019	Mid	107.38	11.56	87.50	26.24	0.73	1.17
12.	L	2019	Mid	107.00	9.93	78.00	25.89	0.28	0.37
13.	M	2019	Mid	105.50	11.41	119.78	28.28	0.46	0.85
14.	N	2019	Early	116.50	11.36	83.50	27.23	1.04	2.02
15.	O	2019	Late	101.25	8.79	88.25	31.06	1.76	2.54
16.	P	2019	Late	104.25	13.26	89.00	27.24	1.87	2.77
17.	Q	2019	Mid	108.50	9.46	63.00	29.13	1.65	2.66
Mean				106.27	10.29	78.95	28.23	0.77	1.25
SEm ±				5.09	0.16	4.08	0.71	0.08	0.11
CD @5%				NS	0.49	12.24	2.19	0.23	0.34
CV (%)				7.43	8.98	11.65	4.46	20.21	18.62

KANABARGI

Year of planting : 2020
Design : RBD
Replication : Three
Spacing : 6 m X 6m
Number of plant /replication : 2
Varieties/No. of entries : 13

Results: This experiment was initiated during 2019. Vegetative growth parameters and yield parameters for the year 2022-23.

Table 1.110: Performance of different bold nut varieties of cashew at HREC, Kanabargi

Sl. No	Accession	Year of planting	Tree Height (m)	Stem girth (cm)	Canopy spread-EW (m)	Canopy spread-NS (m)
1	D	2019	3.15	34.50	2.73	2.80
2	E		2.04	29.33	2.45	1.80
3	F		2.46	42.17	3.14	3.37
4	G		1.92	34.33	2.77	2.25
5	I		2.01	28.83	2.29	2.40
6	J		2.93	39.33	3.09	2.79
7	K		2.68	34.17	2.92	2.51
8	L		2.97	43.17	3.47	3.46
9	M		2.57	33.67	2.81	2.52
10	N		2.64	38.67	3.16	3.25
11	O		2.36	33.50	2.97	2.85
12	P		2.67	36.15	3.50	3.52
13	Q		2.50	35.50	2.82	2.87
	Mean		**2.53**	**35.64**	**2.93**	**2.80**
	SEm±		**0.17**	**2.74**	**0.38**	**0.33**
	CD @5%		**0.49**	**7.99**	**1.12**	**0.96**
	CV%		**11.38**	**13.31**	**22.67**	**20.33**

Table 1.111: Performance of different bold nut varieties of cashew at HREC, Kanabargi for yield parameters.

Sl. No	Accession	Flowering Month			Duration of flowering days	Nut wt (gm)	Apple wt (gm)	Shelling %	Nut yield Kg/tree	cumulative yield kg/plant	Special feature
		Early (Oct)	Mid (Nov-Dec)	Late (Jan)						1st year	
1	**D**	-		Jan	35	13.82	120.17	29.33	0.29	0.29	Bold nut
2	**E**	-	Nov-Dec	-	62	6.97	68.67	34.20	0.74	0.74	
3	**F**	-	Nov-Dec	-	48	9.37	74.33	29.30	0.72	0.72	
4	**G**	- -	Nov-Dec	-	45	7.47	81.17	29.73	0.79	0.79	
5	**I**	-	Nov-Dec	-	48	7.05	55.20	31.67	0.94	0.94	
6	**J**	-	Nov-Dec	-	43	10.02	60.26	27.43	0.92	0.92	
7	**K**	-	Nov-Dec	-	49	8.92	98.11	35.57	0.40	0.40	
8	**L**	-	Nov-Dec	-	43	12.11	100.18	31.27	0.30	0.30	
9	**M**	-	Nov-Dec	-	52	10.85	257.17	29.33	0.42	0.42	Big apple
10	**N**	-	Nov-Dec	-	49	9.60	91.82	32.60	0.72	0.72	

11	**O**		Nov-Dec	-	47	8.44	75.08	34.80	0.33	0.33	
12	**P**		Nov-Dec	-	52	12.68	105.77	28.33	0.56	0.56	
				-							
13	**Q**		Nov-Dec	-	58	9.82	86.50	29.50	0.43	0.43	
Mean					48.54	9.78	98.03	31.01	0.58		
Sem						0.36	5.33	0.57	0.15		
CD						1.05	15.57	1.65	0.43		
CV						6.38	9.42	3.17	43.3		

Among the 13 accessions, Code D recorded plant height (3.15 m) and nut weight (13.82 g) apple weight (120.17 g) with shelling % of 34.8%. Apple weight was maximum in Code-M (257.17) and least was recorded in Code-I (55.7 g) Nut yield kg/tree was maximum in Code L (0.94 kg) followed by Code J (0.92 kg) least was recorded in Code-D (0.29 kg). Shelling percentage was maximum in Code-K (35.5 %) and least was recorded in Code-J (27.43 %). During the first harvest Code I (0.94 kg) followed by Code-J and least in Code-D (0.29kg.)[Table No.1.111]

Fig. Field view of Gen. 6

Gen. 7. Trial on Dwarf genotypes in cashew

Centers: East Coast : Bapatla, Bhubaneswar, Jhargram and Vridhachalam

West Coast : Madakkathara, Pilicode and Vengurle

Plains / others: Hogalagere, Jagdalpur, Kanabargi

Objective: To assess dwarf and semi-dwarf accessions for their yield potential and seedling selection from these accessions for yield and yield attributing characters.

EXPERIMENTAL DETAILS:

Genotypes	**:**	**16 Accessions** NRC 214, NRC 314, NRC 315, NRC 312, NRC 313, NRC 306, NRC 415, BDB 58, DB 626, TR8, Taliparamba, NRC 492, HC-6, H-3831, JGM-282 and local check (VRI-3)
Spacing	**:**	3m x 3m, 4m x 4m and 5m x 5m
Replications	**:**	Three
Parameters to be recorded	**:**	Tree height, Tree spread, Girth, Canopy coverage (% of the allotted area), Number of flowering laterals, Nut weight, Yield (kg/tree) and Cumulative yield (kg/tree).
Pruning	**:**	Need based
Centers	**:**	**10 Centers** Vengurla, Kanabargi, Hogalagere, Puttur, Madakkathara, Vridhachalam, Bapatla, Jagadalpur, Bhubaneshwar, Jhargram
Plants unit/ accession	**:**	Four
Design	**:**	Split Plot (Spacing as main plot and varieties as sub plots)
Year of planting	**:**	2023
Important		High yielding varieties of the respective Centers to be planted in the periphery of the experiment to aid in introgression

BHUBANESHWAR

The trial has been laid out during 29.09.2023. Plants are at vegetative stage.

JHARGRAM

The plants were planted in November 2023. The experiment is in initial stage.

VRIDHACHALAM

The trial has been laid out during 10.11.2022. The experiment is in initial stage.

Trial on dwarf genotypes in cashew

MADAKKATHARA

- Among twelve dwarf genotypes evaluated, the lowest height of 0.9m was observed in the genotypes, Nethra Vamana and Thaliparamba.

Table 1.112: Growth parameters of dwarf accessions during the year 2023

	Year of planting	HEIGHT	GIRTH	EW	NS
S1	2022	1.348	11.049	1.180	1.194
S2	2022	1.219	9.372	1.135	1.131
S3	2022	1.245	10.345	1.130	1.145
SE(m)		0.067	0.866	0.068	0.055
CD @ 5%		-	-	-	-
CV (%)		32.00	50.67	35.67	28.96
DB	2022	1.311	10.216	1.208	1.216
H 3831	2022	1.061	10.039	1.050	1.031
JGM	2022	1.213	10.999	1.307	1.321
NRC 214	2022	1.494	11.386	1.188	1.171
NRC 312	2022	1.358	9.927	1.056	1.064
NRC 313	2022	1.243	9.269	0.964	1.028
NRC 314	2022	1.440	10.319	1.269	1.269
NRC 315	2022	1.090	9.344	0.964	0.964
NRC 415	2022	1.572	10.460	1.337	1.309
NETHRA VAMANA	2022	0.984	9.977	0.904	1.070
TALIPARAMBA	2022	0.993	10.456	1.210	1.192
VRI 3	2022	1.489	10.672	1.326	1.243
SE(m)		0.073	0.582	0.068	0.078
CD @ 5%		0.208	-	0.192	0.221
CV (%)		17.38	17.035	17.76	20.33
S1 x DB	2022	1.450	11.637	1.313	1.333
S1 x H 3831	2022	1.083	9.333	0.950	0.937
S1 x JGM	2022	1.410	12.500	1.460	1.390
S1 x NRC 214	2022	1.427	11.750	1.093	1.120
S1 x NRC 312	2022	1.367	10.993	1.297	1.220
S1 x NRC 313	2022	1.483	10.250	1.117	1.303
S1 x NRC 314	2022	1.593	12.110	1.313	1.413
S1 x NRC 315	2022	1.077	10.303	0.867	0.787
S1 x NRC 415	2022	1.523	9.540	1.340	1.200
S1 x NETHRA VAMANA	2022	1.113	11.417	1.040	1.167
S1 x TALIPARAMBA	2022	1.090	11.167	1.103	1.213
S1 x VRI 3	2022	1.563	11.583	1.270	1.250
S2 x DB	2022	1.190	9.450	1.067	1.110
S2 x H 3831	2022	0.993	9.750	1.033	1.013
S2 x JGM	2022	1.227	9.623	1.303	1.210
S2 x NRC 214	2022	1.547	12.067	1.287	1.317
S2 x NRC 312	2022	1.310	8.033	1.013	1.080
S2 x NRC 313	2022	0.997	7.910	0.823	0.857
S2 x NRC 314	2022	1.507	8.540	1.303	1.237

S2 x NRC 315	2022	1.153	8.677	1.020	1.067
S2 x NRC 415	2022	1.653	11.300	1.357	1.407
S2 x NETHRA VAMANA	2022	0.860	8.913	0.870	0.990
S2 x TALIPARAMBA	2022	0.763	9.367	1.260	1.200
S2 x VRI 3	2022	1.427	8.830	1.287	1.080
S3 x DB	2022	1.293	9.560	1.243	1.203
S3 x H 3831	2022	1.107	11.033	1.167	1.143
S3 x JGM	2022	1.003	10.873	1.157	1.363
S3 x NRC 214	2022	1.510	10.340	1.183	1.077
S3 x NRC 312	2022	1.397	10.753	0.857	0.893
S3 x NRC 313	2022	1.250	9.647	0.953	0.923
S3 x NRC 314	2022	1.220	10.307	1.190	1.157
S3 x NRC 315	2022	1.040	9.053	1.007	1.040
S3 x NRC 415	2022	1.540	10.540	1.313	1.320
S3 x NETHRA VAMANA	2022	0.980	9.600	0.803	1.053
S3 x TALIPARAMBA	2022	1.127	10.833	1.267	1.163
S3 x VRI 3	2022	1.477	11.603	1.420	1.400
Factor(B) at same levels of Factor A		0.127	1.008	0.117	0.135
Factor(A) at same levels of Factor B		0.139	1.297	00.131	0.141

PILICODE

Under this trial the grafts of dwarf types were procured from DCR Puttur and planted in the field in November 2022.

VENGURLA

The trial was laid out in 2022. The trial is in initial stage and growth of all the experimental grafts is satisfactory.

KANABARGI

The planting of Dwarf genotypes has been done at HREC, Hidkal Dam, Hukkeri, Belagavi during September-2023. The accessions under this trial were planted on 8th October, 2023 adopting following layout plan with three different spacing viz., 5m X 5m, 4m X 4m and 3m X 3m. Clarify date of planting.

II. CROP MANAGEMENT

II. CROP MANAGEMENT

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

Centers: East Coast : Bhubaneshwar
West Coast : Paria
Plains / others: Hogalagere

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

Details of the Experiment:

Design : RBD

Replication : 04

Spacing : 7 x7m

Treatments : 06

T_1 : 100 % RDF (500:250:250g NPK/plant/year)

T_2 : 100 % RDF + 10kg FYM/plant /year

T_3 : T_2+ Foliar spray of micro-nutrients (3 % urea+0.5 % MAP+ 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 micronutrients (0.5 % $ZnSo_4$+0.1 % Solubor+ 0.5 % $MgSo_4$)

T_6 : Control

BHUBANESWAR

Year of planting : 2014

Variety : Balabhadra

Table 2.01: Growth parameters during 2022-23

Treatments	Tree height (m)	Stem girth (cm)	Average spread of the canopy (m)	Canopy spread (m)	
				E-W	N-S
T_1	4.65	56.93	5.99	6.21	5.78
T_2	4.68	57.51	6.27	6.45	6.09
T_3	4.81	57.94	6.34	6.46	6.19
T_4	5.02	58.99	6.37	6.53	6.21
T_5	5.45	63.31	6.87	6.95	6.79
T_6	4.25	52.00	5.44	5.68	5.20
Mean	4.81	57.78	6.21	6.38	6.04
SEm±	0.16	0.98	0.07	0.15	0.21
CD at 5%	0.49	2.97	0.32	0.48	0.64
CV(%)	6.82	3.41	5.67	4.86	6.98

The vegetative growth parameters were significantly varied among various treatments. The treatment T_5: application of 100% RDF+10 kg FYM along with a foliar spray of major nutrients (3% Urea + 0.5% MAP+ 1% K_2SO_4) and secondary and micro-nutrients (0.5% $ZnSO_4$+0.1% Boron+0.5% $MgSO_4$) was superior with respect to plant height (5.45 m), trunk girth (63.31 cm), as well as canopy spread, then rest of the treatments. [Table No.2.01]

Table 2.02: Reproductive parameters during 2023

Treatments	Apple Weight (g)	Nut weight (g)	Shelling (%)	Nut yield (kg/ plant)	Cum. nut yield (kg/plant) for 6 harvest
T_1	53.17	7.15	28.84	5.05	19.67
T_2	54.13	7.23	28.89	5.28	21.24
T_3	55.64	7.43	28.97	5.88	22.64
T_4	58.70	7.69	29.75	6.20	23.18
T_5	57.31	7.92	29.97	6.82	25.34
T_6	52.94	6.93	28.46	4.23	17.85
Mean	55.31	7.39	29.15	5.58	
SEm±	1.87	0.08	0.58	0.26	
CD at 5%	5.65	0.24	1.74	0.78	
CV (%)	6.78	2.13	3.97	9.31	

Application of 100% RDF+10 Kg FYM along with foliar spray of major nutrients (3% Urea + 0.5% MAP+ 1% K_2SO_4), secondary and micro-nutrients (0.5% $ZnSO_4$+0.1% Boron+0.5% $MgSO_4$) (T_5) was found to produce significantly high nut weight (7.92 g) as well as nut yield per tree (6.82 kg). The results of cumulative nut yield/tree for 6 harvests revealed variations from 17.85 kg in T_6 to maximum of 25.34 kg in T_5 revealing the superiority of T_5 among the different macro and micro-nutrients application.

PARIA

Treatment details:

T_1: 100% recommended dose of N, P and K fertilizer (RDF)*
T_2: 100% RDF + 10 kg FYM/plant/year
T_3: 100% RDF + 10 kg FYM/plant/year + foliar spray**^** of major nutrients [3% Urea from 2nd year onwards to 5 years; and Urea 2.0 to 3.0% based on available N content of experimental site and on the basis of leaf analysis**^^**after 5 years onwards + 0.5% H_3PO_4 + 1% K_2SO_4]
T_4: 100% RDF + 10 kg FYM/plant/year + foliar spray**^** of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor** + 0.5% $MgSO_4$)
T_5: 100% RDF + 10 kg FYM/plant/year + foliar spray**^** of major nutrients [3% Urea from 2nd year onwards to 5 years; and Urea 2.0 to 3.0% based on available N2 content of experimental site and on the basis of leaf analysis**^^** after 5 years onwards + 0.5% H_3PO_4 + 1% K_2SO_4] + foliar spray**^** of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor** + 0.5% $MgSO_4$)
T_6: Control.

* 100% RDF = The dose of N, P and K fertilizer as per the center's recommendation. (750-150-150 N-P-K g/plant)
** Solubor = Source of fertilizer for Boron.
^ Foliar spray needs to be given at three different stages viz; flushing, flowering and nut development.
^^ Leaf analysis on crop growth stage.

Year of planting: 2022 Variety: Vengurla-7

Table 2.03 Growth parameter of cashew

Treatments	Plant height (m)	Plant girth (cm)
T_1	0.61	3.50
T_2	0.64	3.60
T_3	0.63	3.53
T_4	0.69	3.67
T_5	0.62	3.50
T_6	0.63	3.57
SEm±	0.02	0.13
CD@5%	NS	NS
CV%	5.34	6.15

The growth characters of all treatments were found to be on par with each other during the current year.

HOGALAGERE

Treatment Details:

T_1: 100% Recommended Dose of N, P and K Fertilizer (RDF)*
T_2: 100% RDF+10kg FYM / plant / year
T_3: 100% RDF+10kg FYM / plant / year + foliar spray of major nutrients (3% Urea+0.5% H_3PO_4+1% K_2SO_4)
T_4: 100% RDF+10kg FYM / plant / year + foliar spray of secondary and micronutrients (0.5% Zn SO_4+0.1% Solubor**+0.5% $MgSO_4$)
T_5: 100% RDF+10kg FYM / plant / year + foliar spray of major nutrients (3% Urea+0.5% H_3PO_4+1% K_2SO_4) + foliar spray of secondary and micronutrients (0.5% Zn SO_4+0.1% Solubor+0.5% $MgSO_4$)
T_6: Control

*100% RDF = the dose of N, P and K fertilizer as per the SAU recommendation
**Solubor = Source of fertilizer for Boron

Year of planting: 2012; Variety: Chintamani-1; Spacing: 8 m X 8 m

Table 2.04 : Growth parameters as influenced by nutrient management during 2022-23

Treatment details	Tree height (m)	Stem girth (cm)	Average spread of the canopy (m)	Canopy spread (m)	
				E-W	N-S
T_1	4.22	70.33	6.46	6.65	6.28
T_2	4.27	73.00	6.67	6.96	6.39
T_3	4.33	75.00	6.90	7.06	6.75
T_4	4.54	78.25	7.05	7.08	7.02
T_5	5.13	81.99	7.31	7.45	7.16
T_6	3.97	67.39	6.01	6.00	6.02
Mean	4.41	74.33	6.73	6.86	6.60
SEm±	0.23	1.94	0.18	0.24	0.23
CD @5%	0.69	5.86	0.53	0.72	0.70
CV (%)	10.45	5.23	5.26	7.01	7.04

Among the different treatment combinations, T_5: 100% RDF+10 kg FYM /plant/year + foliar spray of major nutrients (3% Urea+0.5% H_3PO_4+1% K_2SO_4) + foliar spray of secondary and

micronutrients (0.5% $ZnSO_4$+0.1% Solubor+0.5% $MgSO_4$) recorded significantly higher growth parameters like tree height (5.13 m), stem girth (81.99 cm) and mean canopy spread (7.31 m) over other treatments and followed by T_4 (4.54 m, 78.25 cm and 7.05 m, respectively) where the control recorded lower growth parameters (Table 2.04).

Table 2.05: Reproductive parameters as influenced by nutrient management

Treatment details	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut Yield (kg/tree)	Cumulative Yield (kg/plant)
T_1	February (late)	111	6.95	32.50	28.45	10.92	62.03
T_2		114	7.08	34.31	29.13	12.30	65.82
T_3		116	7.22	35.23	29.47	13.13	70.39
T_4		125	7.43	37.40	30.13	13.79	72.27
T_5		129	7.51	37.97	30.15	15.21	79.15
T_6		107	6.87	30.61	27.60	9.83	52.28
Mean		117	7.19	35.00	29.62	12.53	66.99
SEm±		3.81	0.11	1.45	0.86	0.64	3.26
CD @5%		11.48	0.33	4.38	2.61	1.93	9.82
C V (%)		6.51	3.07	8.31	5.84	10.20	9.73

Table 2.06: Cost- Economics as influenced by different nutrient management

Treatments details	Rs. (lakh/ha)			B:C ratio
	Cost of cultivation	Gross return	Net return	
T_1	0.69	1.70	1.01	2.46
T_2	0.73	1.92	1.19	2.62
T_3	0.76	2.05	1.29	2.69
T_4	0.75	2.15	1.41	2.89
T_5	0.77	2.37	1.60	3.07
T_6	0.65	1.53	0.89	2.37

The treatment T_5: 100 % RDF +10 kg FYM / plant / year + foliar spray of major nutrients (3 % Urea+ 0.5 % H_3PO_4 +1 % K_2SO_4) + foliar spray of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1 % Solubor + 0.5 % $MgSO_4$) registered significantly higher yield parameters *viz.,* duration of flowering (129 days), shelling % (30.91%), nut yield (15.21 kg/plant), and cumulative yield (79.15 kg/plant) over control (100 days, 28.37 %, 9.83 kg/plant, and 52.28 kg/plant, respectively). The B:C ratio was noticed to be higher in T_5 (3.07), followed by T_4 (2.89) [Table 2.05 and 2.06].

Hort.2: Fertilizer application in high density cashew plantations

Centers: Plains / others: Hogalagere

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

HOGALAGERE

Experimental Details

Year of planting	: 2014
Design	: Split plot
Variety	: Ullal-1
No. of replications	: 03
Main plot	: Plant density (3 levels)
Sub plot	: Fertilizer level (3 levels)

Treatment Details

Plant density : S_1- 200 Plants/ha (10 m × 5 m)
: S_2- 400 Plants/ha (6 m × 4 m)
: S_3- 500 Plants/ha (5 m × 4 m)

Fertilizer : M_1- 75 kg N: 25 kg P_2O_5, 25 kg K_20/ha
: M_2-150 kg N:50 kg P_2O_5:50 kg K_20/ha
: M_3-225 kg N:75 kg P_2O_5:75 kg K_20/ha

Fertilizer application :1st year: 1/5th
2ndyear: 2/5th
3rd year: 3/5th
4th year: 4/5th
5th year: full dose

Table 2.07: Growth parameter as influenced by different spacing and fertilizer levels (2022-23)

Treatments	Plant height (m)	Stem girth (cm)	Canopy spread(m)		Average Canopy spread (m)
			E-W	N-S	
Main plot					
S_1	4.28	69.36	5.58	5.37	5.48
S_2	3.86	62.65	4.98	4.65	4.81
S_3	3.58	54.90	4.58	4.21	4.39
SEm ±	0.01	0.69	0.09	0.09	0.06
CD @ 5%	0.04	2.71	0.35	0.34	0.22
Sub plot					
M_1	3.74	59.90	4.84	4.48	4.66
M_2	3.90	62.31	5.07	4.75	4.91
M_3	4.08	64.70	5.24	4.99	5.12
SEm ±	0.02	0.19	0.04	0.05	0.03
CD @ 5%	0.07	0.58	0.12	0.15	0.09
Interaction					
S_1M_1	4.02	67.28	5.34	5.01	5.17
S_1M_2	4.24	69.11	5.63	5.29	5.46
S_1M_3	4.58	71.70	5.78	5.81	5.79
S_2M_1	3.75	60.62	4.84	4.45	4.64

S_2M_2	3.89	63.00	5.01	4.69	4.85
S_2M_3	3.93	64.33	5.10	4.79	4.95
S_3M_1	3.47	51.81	4.34	3.98	4.16
S_3M_2	3.55	54.83	4.57	4.27	4.42
S_3M_3	3.73	58.06	4.84	4.38	4.61
SP means @ same level of MP					
SEm ±	0.04	0.32	0.07	0.08	0.05
CD @5%	0.12	1.00	0.20	0.26	0.16
MP means @ same or diff. levels of SP					
SEm ±	0.03	0.74	0.10	0.11	0.07
CD @5%	0.11	2.83	0.38	0.40	0.26
CV (%)	6.84	9.33	8.24	10.47	8.51

Table 2.08 : Yield parameters as influenced by different spacing and fertilizer levels during 2022-23

Treatments	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut Yield (kg/ tree)	Cumulative Yield (kg/ tree)
Main plot							
S_1	February (late)	121	7.74	36.36	30.72	8.28	26.08
S_2		117	7.49	35.46	30.38	7.55	23.73
S_3		115	7.24	34.94	29.92	6.96	22.32
SEm ±		1.04	0.02	0.13	0.05	0.08	0.24
CD @ 5%		4.08	0.07	0.50	0.20	0.30	0.93
Sub plot							
M_1	February (late)	116	7.40	35.40	30.22	7.35	23.17
M_2		117	7.49	35.55	30.31	7.58	24.02
M_3		119	7.59	35.80	30.49	7.86	24.94
SEm ±		0.20	0.01	0.04	0.04	0.03	0.24
CD @ 5%		0.62	0.03	0.11	0.11	0.10	0.73
Interaction							
S_1M_1	February (late)	119	7.65	36.17	30.58	8.00	24.96
S_1M_2		120	7.74	36.30	30.70	8.25	25.83
S_1M_3		123	7.83	36.60	30.88	8.58	27.44
S_2M_1		116	7.38	35.22	30.28	7.37	23.07
S_2M_2		117	7.48	35.46	30.39	7.58	23.83
S_2M_3		117	7.61	35.69	30.47	7.70	24.28
S_3M_1		113	7.17	34.80	29.81	6.67	21.47
S_3M_2		115	7.23	34.90	29.84	6.90	22.39
S_3M_3		116	7.32	35.12	30.13	7.29	23.09
SP means @ same level of MP							
SEm ±		0.35	0.02	0.06	0.06	0.06	0.41
CD @5%		1.07	0.05	0.20	0.19	0.18	1.26
MP means @ same or diff. levels of SP							
SEm ±		1.08	0.02	0.14	0.07	0.09	0.41
CD @5%		4.17	0.08	0.52	0.25	0.33	1.38
CV (%)		8.66	6.76	7.07	5.49	5.98	7.97

Table 2.09: Yield influenced by different spacing and fertilizer during 2022-23

Treatment	Yield (kg/ha)			
Subplot\Main plot	**S_1**	**S_2**	**S_3**	**Mean**
M_1	1600	3065	3337	2668
M_2	1650	3151	3451	2751
M_3	1717	3203	3644	2855
Mean	1656	3140	3478	2758
		SEm ±	CD	CV %
Main plot (MP)		16.18	63.54	10.76
Sub plot (SP)		12.56	38.71	8.37
SP means @ same level of MP		21.76	67.04	
MP means @ same or diff. levels of SP		24.03	83.26	

Among the different interactions (Tables 2.07 to 2.09), S_1M_3 showed significantly higher growth parameters like tree height (4.58 m), stem girth (71.70 cm) and average canopy spread (5.79 m). Yield parameters were also higher in same treatment like flowering duration (123 days), nut weight (7.83 g), apple weight (36.60 g), nut yield (8.58 kg/plant) and cumulative yield (27.44 kg/plant) as compared to other treatment combinations.

Hort.3: Drip irrigation trial

Centers:: East Coast Bhubaneswar
Plains / others: Jagdalpur

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

Experimental details:

Design : RBD
Spacing : 7 x 7m
Replication : Four
Treatment details : Five
T_1: No irrigation
T_2: Irrigation 20% of Cumulative Pan Evaporation (CPE)
T_3: Irrigation 40% of Cumulative Pan Evaporation (CPE)
T_4: Irrigation 60% of Cumulative Pan Evaporation (CPE)
T_5: Irrigation 80% of Cumulative Pan Evaporation (CPE)

BHUBANESWAR

Year of Planting : 2021
Variety : BPP-8

Table 2.10: Weather parameters during 2023

Months	Rainfall	No. of Rainy days	Temperature (°C)		Relative Humidity (%)		Wind speed(km/hr.)
			Max. (Average)	Min. (Average)	Max. (Average)	Min. (Average)	
February	0	0	32.4	18.4	90	35	1.4
March	48.5	2	34.2	21.4	91	51	0.8
April	92.2	3	37.2	24.7	90	52	1.2

The treatment will be imposed from the year 2024 as the plants are now two years old. Evapo-transpiration data of 30 years has been collected and mean values will be used for imposing the irrigation levels.

JAGDALPUR

Year of Planting : 2018
Variety : Vengurla-4

Table 2.11: Growth parameters under different treatments during 2023

Treatment	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Average spread of the canopy (m)
			E-W	N-S	
T_1	2.85	33.25	3.37	3.24	3.29
T_2	3.01	33.75	3.65	3.45	3.66
T_3	3.03	33.50	3.74	3.64	3.67
T_4	3.12	34.74	3.82	3.60	3.75
T_5	3.21	36.75	3.80	3.72	3.79
Mean	3.04	34.40	3.68	3.53	3.63
SEm ±	0.14	1.59	0.23	0.26	0.15
CD @5%	NS	NS	NS	NS	NS
CV (%)	9.05	9.28	14.50	12.50	8.09

During the experimentation, there was no significant difference with respect to growth parameters.

Table 2.12: Reproductive and yield parameters under different treatments during 2023

Treatment	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (kg/plant) 2 harvest
T_1	Feb (Mid)	81.50	6.64	40.81	29.34	1.31	2.28
T_2	Feb (Mid)	85.75	6.84	41.17	29.45	1.54	2.70
T_3	Feb (Mid)	94.75	7.03	42.20	29.64	1.94	3.19
T_4	Feb (Mid)	98.00	7.28	44.55	28.86	2.04	3.43
T_5	Feb (Mid)	110.00	7.61	44.42	29.64	2.28	3.89
Mean		94.00	7.08	42.63	29.38	1.82	3.09
SEm ±		1.93	0.14	1.00	0.34	0.18	-
CD @5%		6.04	0.43	NS	NS	0.54	-
CV (%)		11.12	8.95	6.69	9.41	19.18	-

The duration of flowering was maximum in irrigation at 0.80 IW/CPE. In the case of yield parameters, i.e., nut yield per plant and cumulative nut yield per plant, were also significantly elevated in treatment-5 at 2.28 kg per plant and 3.89 kg per plant, respectively. Nut weight was recorded to be the highest in T_5 (7.61 g). Apple weight and shelling percent were found to be non-significant (Table 2.12).

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

Plains / others: Jagdalpur

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

JAGDALPUR

Experimental details

Year of Planting : 2018
Variety : NRCC Selection 2

Treatment details:

T_1 : 4 x 4 m
T_2 : 8 x 8 m

Table 2.13 : Growth parameters in high density trial during 2023

Spacing	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Canopy surface area (m^2)	Ground area coverage by canopy (%)
			E-W	N-S		
4 m x 4 m	1.92	24.34	1.86	1.89	12.26	24.45
8 m x 8 m	1.98	27.43	1.89	1.92	15.86	6.78
t value	0.72	0.52	1.12	0.89	-1.49	4.56
$P < 0.05$	NS	NS	NS	NS	NS	NS

All the growth parameters under both spacings showed non-significant results (Table 2.13). However, maximum tree height, stem girth, canopy spread, and canopy surface area were recorded at 8 x 8 m spacing. Ground coverage by canopy was observed to be higher in 4 x 4 m (24.45%).

Table 2.14: Reproductive parameters in high density trial during the year 2023

Treatment	Flowering time (early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/tree)	Cum. Yield (kg/plant) 2 harvest
4 x 4 m	Feb (Mid)	89.00	7.52	46.69	29.12	0.89	1.00
8 x 8 m	Feb (Mid)	92.00	7.46	44.23	29.32	0.93	1.17
t value	-	0.67	0.76	0.35	0.12	-0.28	
$P < 0.05$	-	NS	NS	NS	NS	NS	

Duration of flowering, nut weight, apple weight, shelling per cent, and nut yield recorded non-significant results.

Table 2.15: Yield and B:C ratio in high density trials

Harvest	Yield (kg/ha.)		Net returns (Rs/ha.)		B:C ratio	
	(4 x 4 m)	(8 x 8 m)	(4 x 4 m)	(8 x 8 m)	(4 x 4 m)	(8 x 8 m)
1st	256.37	35.84	-29,885	-19,378	-0.54	-0.85
2nd	556.25	145.08	30,320	13,775	1.19	0.81

*The cost of establishment is included for calculating the B:C ratio for the first harvest
**Selling price of cashew (var. NRCC Sel. 2) for the year 2023 was 110 and 90 per kg for shiny and dull nuts respectively.

Cost of cultivation cumulative up to third year
4 x 4 m = 25,280
8 x 8 m = 16,960

Comparing the yield and economics of two spacings, the yield per ha was recorded as higher in 4 x 4 m spacing (556.25 kg/ha). The net returns were also recorded to be higher at 4 x 4 m spacing (Rs. 30,320) and the highest B:C ratio of 1.19 was recorded in 4 x 4 m spacing (Table 2.15).

Hort.6: Intercropping in Cashew

Centers: East Coast : Bapatla, Bhubaneswar, Jhargram
West Coast : Madakkathara , Vengurla
Plains / others: Darisai, Jagdalpur and Kanabargi

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.

BAPATLA

Experimental Details

Year of Planting	:	1997 (Main Plot)
Variety	:	BPP-6
Design	:	RBD
Replications	:	4
Treatments	:	5
Treatments		T_1: Cashew + Aster
		T_2: Cashew + Marigold
		T_3: Cashew + Chrysanthemum
		T_4: Cashew + Crossandra
		T_5: Cashew alone

Sale Price (Rs/Kg)

Raw Cashew Nuts	: 90.00	Chrysanthemum	: 40.00
Aster	: 40.00	Crossandra	: 300.00
Marigold	: 20.00		

Table 2.16: Yield and economics of cashew and inter crops in intercropping trial

Treatments	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	Total	Cashew	Inter crop	Total	Net	
T_1	7.40	11.54	8.20	12.79	30000	32000	62000	115110	46160	161270	99270	1.60
T_2	26.20	40.87	8.30	12.95	30000	28000	58000	116550	81740	198290	140290	2.41
T_3	2.50	3.90	8.60	13.41	30000	38000	68000	120690	15600	136290	68290	1.00
T_4	1.50	2.50	7.80	12.17	30000	32000	62000	109530	75000	184530	122530	1.97
T_5	-	-	7.20	11.23	30000	---	30000	101070	---	101070	71070	2.37
CD@5%	2.07	1.43	NS	1.15								
S.Em. ±	0.64	0.44	0.32	0.37								
CV (%)	13.60	6.00	7.86	5.90								

Among the four different intercrops; T_2 (Cashew +Marigold) recorded maximum yield of 4087 kg/ha and was superior over the rest of the treatments followed by T_1 (Cashew + Aster) of 1154 kg/ ha. Marigold intercropped in cashew orchard resulted in the highest net profit of Rs.140290/- with B:C ratio of 2.41 followed by Crossandra with the net profit of Rs. 1,22,530/- and B:C ratio of 1.97.[Table. No.2.16]

Bhubaneswar

Experimental details:

Year of Planting : 2021
Variety : Jagannatha
Spacing : 7 x 7m
Treatment details : Five
T_1: Cashew + Okra
T_2: Cashew + Dolichos bean
T_3: Cashew + Cow pea
T_4: Cashew + Marigold
T_5: Cashew alone

Table 2.17: Yield and economics of cashew and intercrops in intercropping trial at during the year 2022-23

Treatment details	Yield of intercrop (q/ha)	Yield of cashew (q/ha)	Cost of cultivation (Rs./ha)			Return (Rs./ha)				B:C ratio
			Cashew	Intercrop	Cashew + Intercrop	Cashew	Intercrop	Total	Net	
T_1	68.1	-	68520	36160	104680	-	136200	136200	31520	0.30
T_2	45.8	-		30880	99400	-	114500	114500	15100	0.15
T_3	70.4	-		32640	101160	-	140800	140800	39640	0.39
T_4	55.2	-		62120	130640	-	165600	165600	34960	0.26
T_5	-	-		-	68520	-	-	68520	68520	1.00

Price of intercrops: Okra: Rs. 20/kg, Dolichos bean: Rs. 25/kg, Cowpea: Rs. 20/kg and Marigold: Rs. 30/kg

Cowpea was the most profitable crop with B:C ratio of 0.39 followed by okra with B:C ratio of 0.30

DARISAI

Year of Planting (Main plot) : (Cashew 2012)
Variety : V4
Design : RBD
Replication : 03
Spacing (Cashew) : 8 x 8 m

Treatment Details:

T_1- Cashew (Var: V4) + Tomato (Var. Swarn Samridhi)
T_2- Cashew (Var: V4) + Cabbage (Var. Golden acre)
T_3- Cashew (Var: V4) + French Bean (Var. Arka Komal)
T_4- Cashew (Var: V4) + Pea (Var. Arkel)
T_5- Cashew (Var.V4)

Table 2.18 : Yield Data of Cashew and Intercrop during 2018-19 to 2022-23

	Mean Yield of intercrop q/ha						Mean Yield of cashew q/ha						Cashew equivalent yield q/ha
	2018-19	2019-20	2020-21	2021-22	2022-23	5 year Mean	2018-19	2019-20	2020-21	2021-22	2022-23	5 year Mean	
T_1	112.26	105.32	99.72	107.03	93.03	103.47	7.16	7.54	7.89	5.33	6.24	6.83	32.45
T_2	221.34	209.85	187.14	204.97	215.4	207.74	8.05	8.65	9.21	6.22	7.2	7.87	35.56
T_3	44.86	40.46	38.49	43.92	42.92	42.13	7.08	7.73	8.11	5.48	6.4	6.96	20.60
T_4	54.46	49.29	46.81	51.77	52.2	50.90	7.42	8.12	8.61	5.82	6.64	7.32	26.22
T_5	---	-	-	-	-	-	8.92	9.73	10.48	7.08	7.23	8.69	8.69
CD 5%						15.34	-	-	-	-	-	1.11	4.83
SEm±						4.63	-	-	-	-	-	0.334	1.46
CV (%)						9.93	-	-	-	-	-	7.68	10.22

Table 2.19 : Mean yield and economics of cashew and intercrops

Treatment Details	Mean Yield of intercrop q/ha	Mean Yield of cashew q/ha	LER	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
				Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net Profit	
T_1	103.47	6.83	1.65	57372	51572	108944	71715	269022	340737	231793	3.13
T_2	207.74	7.87	1.70	57372	62141	119513	82635	290836	373471	253958	3.12
T_3	42.13	6.96	1.46	57372	31516	88888	73080	143242	216322	127434	2.43
T_4	50.90	7.32	1.56	57372	46670	104042	76860	198510	275370	171328	2.64
T5	---	8.69	--	57372	---	57372	91245	---	91245	33873	1.59
CD at 5%	15.34	1.11	-	-	-	-	-	-	-	-	-
SEm±	4.63	0.334	-	-	-	-	-	-	-	-	-
CV (%)	9.93	7.68	-	-	-	-	-	-	-	-	-

- Cashew- Rs. 105/ kg, Tomato- Rs. 26/ kg, Cabbage-Rs. 14/kg, French Bean-Rs. 34/ kg, Pea-Rs. 39/kg

The maximum cashew equivalent yield was obtained in Cashew+ Cabbage intercropping with 35.56 q/ha and was found to be on par with Cashew+ Tomato, whereas 32.45 q/ha yield was obtained (Table 2.18). The highest net return of Rs. 253958 was also recorded in Cashew + Cabbage intercropping, followed by Cashew + Tomato (Rs. 231793), whereas the lowest net return of Rs 33873 was recorded in sole Cashew treatment. The highest B:C ratios of Rs. 3.13 and Rs. 3.12 were observed when cashew was intercropped with tomato and cabbage, respectively.

After advancement of the canopy, in the year 2023 cashew plants will intercrop with shade loving crops like ginger, turmeric, elephant foot yam and colocasia, as per the details below:

Treatment Details:

T_1- Cashew + Ginger (Var: Nadia)
T_2- Cashew + Turmeric (Var: Rajendra Sonia)
T_3- Cashew + Elephant foot yam (Var: Gajendra)
T_4- Cashew + Colocasia (Var: Birsa Arbi-1)
T_5- Cashew

JAGDALPUR

Experimental Details:

Year of Planting (Main plot)	:	2020
Variety	:	Indira Kaju-1
Design	:	RBD
Spacing (Cashew)	:	6 x 6 m
Replication	:	4
Intercrops	:	6

Notation	Treatments	Variety of Intercrop
T_1	Cashew + Sweet Potato	Indira Madhur
T_2	Cashew + Colocasia	Indira Kochai -1
T_3	Cashew + Keukand	SC-2
T_4	Cashew + Bunda	Chhattisgarh Sakhen Bunda
T_5	Cashew + Elephant foot yam	Gajendra
T_6	Cashew + Tapioca	Sree Jaya
T_7	Cashew alone	Indira Kaju-1

Table 2.20: Yield and economics of cashew and inter crops during 2023

	Yield of intercrop		Yield of cashew		% Ground coverage	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	kg/plot	q/ha	kg/ tree	q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T_1	28.56	153.23	0.38	1.05	22.92	35580	99340	134920	9450	306460	315910	180990	1.34
T_2	19.78	98.87	0.41	1.13	26.58	35580	90032	125612	10170	296610	306780	181168	1.44
T_3	32.67	180.21	0.45	1.24	24.54	35580	48678	84258	11160	90105	101265	17007	0.20
T_4	25.56	143.23	0.39	1.08	26.28	35580	62032	97612	9720	214845	224565	126953	1.30
T_5	20.65	115.65	0.42	1.16	23.82	35580	140361	175941	10440	404775	415215	239274	1.36
T_6	26.65	143.34	0.32	0.88	16.98	35580	52450	88030	7920	107505	115425	27395	0.31
T_7	0	0	0.54	1.49	34.02	35580	-	35580	13410	0	13410	22170	0.62

Mean	21.98	119.22	0.42	1.15	25.02	-	-	-	-	-	-	-	-
SEm ±	0.83	8.76	0.03	0.07	-	-	-	-	-	-	-	-	-
CD@5%	2.54	26.46	NS	0.23	-	-	-	-	-	-	-	-	-
CV (%)	11.12	13.21	5.12	9.26	-	-	-	-	-	-	-	-	-

Sale Price (Rs/Kg)

Raw Cashew Nuts : 90 Rs/kg

Intercrop : Sweet Potato - Rs. 2000/q , Colocasia - Rs. 3000/q , Keukand - Rs. 500/q , Bunda – Rs. 1500/q , Elephant foot yam – Rs. 3500/q, Tapioca - Rs. 750/q

The yield of intercrop was highest in the cashew + keukand intercropping system (32.67 kg/plot and 180.21 q/ha, respectively); however, the yield of cashew in cashew alone was 0.54 kg/tree and 1.49 q/ha, respectively. Ground coverage (%) by cashew canopy was highest in cashew alone (34.03%). The cost of cultivation and net return were observed to be highest in cashew and elephant foot yam, i.e., Rs. 1,75,941/ha and Rs. 2,39,274. The maximum B:C ratio was recorded in the cashew + colocasia intercropping system (1.44), followed by cashew + elephant foot yam (1.36), and cashew + sweet potato (1.34) [Table No. 2.20].

JHARGRAM

Experimental Details :

Year of planting: 2022
Variety : Vengurla – 7
Design : RBD
Spacing : 6 x 6 m
Replications : 6

Intercrops evaluated :

T_1: Cashew+Cowpea (Local),
T_2:Cashew+Cluster bean (Pusa Nababahar),
T_3: Cashew +Green gram (Swati),
T_4: Cashew + Ground nut (TG 51)
T_5: Cashew+ Kodo millet (Indira kodo-1)
T_6: Cashew alone
T_7: Cow pea
T_8: Cluster bean
T_9: Greengram
T_{10}: Groundnut
T_{11}: Kodo millet

The available space for intercrops :98.61 %.

Table 2.21: Economics of intercropping system under cashew plantation during 2022-23

Treatment	Total (kg/plot)	Plot size (m^2)	Intercrop q/ha	Cost of cashew /ha	Return from cashew (Rs.)	Return from intercrop (Rs.)	Total return (Rs.)	Cost of intercrop (Rs.)	Total cost (Rs.)	Net return (Rs.)	B:C ratio
T_1	3.00	25	11.8	45000	0	23666	23666	40000	85000	61334	-0.72
T_2	8.50	25	33.5	45000	0	134110	134110	28000	73000	61110	0.84
T_3	1.50	25	5.9	45000	0	35500	35500	30265	75265	39765	-0.53
T_4	3.30	25	13.0	45000	0	130165	130165	50000	95000	35165	0.37
T_5	3.17	25	12.5	45000	0	112463	112463	50000	95000	17463	0.18
T_6	-	-	-	45000	0	-	-	-	-	-	
T_7	3.50	25	13.8	-	-	27611	27611	40000	40000	12389	-0.31
T_8	7.90	25	31.2	-	-	124643	124643	28000	28000	96643	3.45
T_9	1.10	25	4.3	-	-	26033	26033	30265	30265	-4232	-0.14
T_{10}	4.00	25	15.8	-	-	157776	157776	50000	50000	107776	2.16
T_{11}	2.80	25	11.0	-	-	99399	99399	50000	50000	49399	0.99

Cow pea – Rs. 20/kg, Cluster bean - Rs. 40/kg, Greengram - Rs. 60/kg, Kodo millet - Rs. 100/kg, Groundnut - Rs. 90/kg

Table 2.22: Land Equivalent ratio for intercropping system under cashew

Treatment	Land equiv. for intercrop	Land equiv. for cashew	LER	% saving of land
Cashew + Cowpea	0.86	0.0	0.86	-14.3
Cashew + Cluster bean	1.08	0.0	1.08	7.6
Cashew + green gram	1.36	0.0	1.36	36.4
Cashew + kodo millet	0.83	0.0	0.83	-17.5
Cashew + Ground nut	1.13	0.0	1.13	13.1

In case of intercropping, positive returns were obtained from cashew + cluster bean, cashew + kodo millet and cashew + groundnut. Cluster bean both as sole crop and as an intercrop with cashew supported maximum B:C ratio followed by cashew + kodo millet (Table 2.21). The highest land equivalent ratio was with cashew + greengram (1.36), thus total land saving was 36.4%. It was observed from the LER value that intercropping under cashew plantation was profitable in terms of saving land [Table No. 2.22].

KANABARGI

Experimental details

Year of planting :2016
Variety : Vengurla-4
Design : RBD
Spacing :6 m x 6 m
Replication :3
Intercrops :

T_1 -Cashew +Cabbage
T_2 -Cashew +Cauliflower
T_3 -Cashew + Knol Khol
T_4 -Cashew +Gaillardia
T_5 -Cashew + Aster
T_6 -Cashew + Chrysanthemum
T_7 -Cashew alone

Table 2.23: Yield and economics of cashew based intercropping system during the year 2023

Treatment Details	Yield of intercrop		Yield of Cashew		% Ground cover	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	kg/plot	q/ha	kg/ tree	q/ ha		Cashew	Intercrop	Total	Cashew	Intercrop	Total	Net	
T_1	28.50	64.13	7.75	21.47	40%	32600	51600	84200	257610	64125	321735.0	237535.00	2.82
T_2	20.35	45.79	7.67	21.25	40%	32600	45100	77700	254950.8	45787.5	300738.3	223038.30	2.87
T_3	33.57	75.53	7.76	21.50	40%	32600	51100	83700	257942.4	75532.5	333474.9	249774.90	2.98
T_4	24.25	54.56	7.85	21.74	40%	32600	46475	79075	260934	136406.3	397340.3	318265.25	4.02
T_5	13.50	30.38	7.67	21.25	40%	32600	51225	83825	254950.8	91125	346075.8	262250.80	3.13
T_6	18.36	41.31	7.06	19.56	40%	32600	56650	89250	234674.4	123930	358604.4	269354.40	3.02
T_7	-	-	6.90	19.11	-	45975		45975	229356	0	229356.0	183381.00	3.99
Sem±	0.42	0.97	0.24	0.61	-	-	-	-	-	-	-	-	-
CD@ 5%	1.36	3.07	0.73	2.01	-	-	-	-	-	-	-	-	-
CV(%)	3.24	3.24	5.41	5.41	-	-	-	-	-	-	-	-	-

Cabbage @ Rs. 10/kg, Cauliflower @Rs. 10/kg, knol khol @Rs. 10/kg,
Gaillardia @ RS. 25/kg, Aster 30/kg, Chrysanthemum @ Rs. 30/kg (Rates as per APMC)

The trial was laid out during sixth year by planting intercrops in the existing cashew plantation, spaced at 6 x 6 m. Intercrops evaluated were aster; gaillardia, chrysanthemum, cabbage, cauliflower, Knol khol.

Among the different intercrops tried under cashew, flower crops performed better than the vegetables with respect to yield of the intercrops. Among different flowers gaillardia recorded more yield followed by aster and chrysanthemum whereas in vegetable crops, knol khol performed better for yield over cabbage and cauliflower.

MADAKKATHARA

Experimental Details:

Year of Planting (Main plot) : 2019
Variety : Priyanka
Design : Randomized Block Design
Spacing (Cashew) : 5 x 5m
Replication : 4
Intercrops : 6

T_1 : Cashew + White Turmeric (*Curcuma Zedoaria)*
T_2 : Cashew + East Indian Arrowroot (*Curcuma angustifolia*)
T_3 : Cashew + Black Turmeric (*Curcuma caesia*)
T_4 : Cashew + Aromatic Turmeric (*Curcuma aromatica*)
T_5 : Cashew + Mango Ginger(*Curcuma amada*)
T_6 : Cashew + Turmeric (*Curcuma longa*)
T_7 : Control (Cashew alone)

Table 2.24: Yield and economics of cashew and intercrops during 2023

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	kg/plot	q/ha	kg/tree	q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T_1	16.98^{c}	212.31^{c}	0.5	2.00	46.07	30000	528000	558000	22800	1273860	1296660	738660	1.33
T_2	33.38^{a}	417.23^{a}	0.58	2.32	41.07	30000	528000	558000	26448	2086150	2112598	1554598	2.79
T_3	8.37^{d}	104.62^{d}	0.61	2.42	41.07	30000	758400	788400	27588	1569300	1596888	808488	1.03
T_4	26.2^{b}	327.47^{b}	0.45	1.80	48.93	30000	750000	780000	20520	3274700	3295220	2515220	3.23
T_5	12.69^{cd}	158.63^{cd}	0.55	2.20	47.93	30000	456000	486000	25080	951780	976860	490860	1.01
T_6	13.5^{c}	168.71^{c}	0.48	1.90	45.37	30000	486000	516000	21660	1012260	1033920	517920	1.01
T_7	-	-	0.48	1.90	36.36	30000	0	30000	21660	0	21660	-8340	-0.28
Mean	-	-	-	-	-	-	-	-	-	-	-	-	-
SEm±	1.438	1.797	0.125	0.499	-	-	-	-	-	-	-	-	-
CD 5%	4.33	54.17	-	NS	-	-	-	-	-	-	-	-	-
CV (%)	15.52	15.52	48.01	48.01	-	-	-	-	-	-	-	-	-

Raw Cashew Nuts : Rs. 114/kg
Intercrops: White turmeric : Rs. 60/kg ; East Indian Arrowroot – Rs. 50/kg; Black Turmeric Rs. 150/kg; Aromatic Turmeric Rs. 100/kg; Mango Ginger Rs. 60/kg; Turmeric Rs. 60/kg

During the year, the highest yield per unit area from intercrop was recorded in East Indian Arrowroot (417.23 q/ha) followed by Aromatic Turmeric (327.47 q/ha). The economic analysis revealed the highest B:C ratio of 3.23 in the treatment T_4, aromatic turmeric as intercrop. The B: C ratio of above one was recorded in all treatments with intercrop indicates an additional income from cashew plantations in the early stages [Table No 2.24].

Paria

Experimental Details:

Year of planting : 2010
Variety : Vengurla-4
Design : RBD
Spacing : 8 x 8 m
Replication : 3

Treatments:

T_1: Cashew + Coriander
T_2: Cashew + Fenugreek
T_3: Cashew + Spinach
T_4: Cashew+ Amaranthus
T_5: Cashew alone

Table 2.25: Yield(q/ha) of intercrops during year 2017-2022

Treatments	2017	2019	2020	2021	2022	Pooled
T_1	45.00	44.00	43.00	42.50	42.00	43.30
T_2	35.50	30.00	33.00	32.25	32.00	32.55
T_3	47.00	46.00	45.00	44.00	43.50	45.10
T_4	8.50	9.00	8.50	8.30	8.50	8.56
T_5	0.00	0.00	0.00	0.00	0.00	0.00
SEm±	1.13	1.06	0.81	0.88	0.88	0.47
CD @5%	3.67	3.47	2.65	2.86	2.60	1.42
CV %	7.17	7.15	5.43	5.97	5.47	4.63

Table 2.26: Yield(q/ha) of cashew during year 2017-2022

Treatments	2017	2019	2020	2021	2022	Pooled
T_1	1.62	2.22	4.77	4.08	3.85	3.31
T_2	0.80	2.89	3.91	3.95	3.70	3.05
T_3	0.82	1.54	1.96	2.52	2.40	1.85
T_4	0.34	1.57	2.91	2.34	2.27	1.89
T_5	0.83	0.62	2.53	2.26	2.03	1.65
SEm±	0.71	1.31	0.64	0.75	0.75	0.17
CD @5%	NS	NS	NS	NS	0.82	0.49
CV (%)	113.59	104.69	34.32	42.89	15.20	28.31

Table 2.27: Yield and economics of intercropping in cashew (pooled data)

Treatments	Yield of intercrop		Yield of Cashew		Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	kg/plot	q/ha	kg/ plot	q/ ha	Cashew	IC	Cashew+ IC	Cashew	IC	Total	Net	
T_1	0.43	43.30	2.12	3.31	11300	22200	33500	36410	95260	131670	98170	2.93
T_2	0.32	32.55	1.95	3.05	11300	22200	33500	33550	71610	105160	71660	2.14
T_3	0.45	45.10	1.18	1.85	11300	22200	33500	20350	99220	119570	86071	2.56
T_4	0.08	8.56	1.21	1.89	11300	22200	33500	20790	21400	42190	8690	0.25
T_5	0.00	0.00	1.05	1.65	11300	00	11300	18150	0	18150	6850	0.60
SEm±	-	0.47	-	0.17	-	-	-	-	-	-	-	-
CD @5%	-	1.42	-	0.49	-	-	-	-	-	-	-	-
CV %	-	4.63	-	28.31	-	-	-	-	-	-	-	-

Selling price: -Coriander 2200 Rs./q, Fenugreek 2200 Rs./q, Spinach 2200 Rs./q, Amaranthus 2500 Rs./q and cashew 11000 Rs./q

Among the different intercrops in cashew studied, cashew + spinach (T_3) got a higher intercrop yield (45.10 q/ha), while cashew + coriander (T_1) got a higher cashew nut yield (3.31 q/ha). Further, in the economics of growing intercrops, it is seen that a higher B:C ratio of 2.93 under treatment cashew + coriander (T_1) is followed by B:C ratio of 2.56 under treatment cashew + spinach (T_3). [Table No 2.27]

VENGURLA

Year of planting (Main plot) : December, 2016
Variety : Vengurle-9
Design : RBD
Spacing (Cashew) : 7 × 7m
Replication : 5

Intercrops
T_1: Cashew + Yard long bean (Wali)
T_2: Cashew + Dolichos bean (Wal)
T_3: Cashew + Cowpea
T_4: Cashew + Chilli
T_5: Cashew + Brinjal
T_6: Cashew alone

Table 2.28: Yield and economics of cashew and inter crops during 2023

Treatments	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	Total	Cashew	Inter crop	Total	Net	
T_1	12.20	48.80	4.72	9.63	72640	34168	106808	125190	244000	369190	262382	3.46
T_2	6.84	27.36	4.19	8.54	72640	24679	97319	111020	136800	247820	150501	2.55
T_3	5.64	22.56	4.36	8.89	72640	28305	100945	115570	112800	228370	127425	2.26
T_4	4.76	19.04	3.97	8.10	72640	36480	109120	105300	95200	200500	91380	1.84
T_5	10.13	40.52	3.89	7.93	72640	40520	113160	103090	202600	305690	192530	2.70
T_6	0.00	0.00	4.07	8.30	72640	0	72640	107900	0	107900	35260	1.49
Mean	-	-	-	-	-	-	-	-	-	-	-	-
SEm ±	0.38	1.51	0.11	0.23	-	-	-	-	-	-	-	-
CD @5%	1.14	4.57	0.33	0.68	-	-	-	-	-	-	-	-
CV (%)	10.68	10.68	5.94	5.94	-	-	-	-	-	-	-	-

Sale Price (Rs/Kg)
Raw Cashew Nuts : Rs.130/- per kg

Intercrops:
Yardlong bean : Rs. 50/kg
Dolichos bean : Rs. 50/kg
Cowpea : Rs. 50/kg
Chilli : Rs. 50/kg
Brinjal : Rs. 50/kg

Intercropping in cashew trial with new sets of regionally important intercrops indicated that the treatment T_1 (Yard-long bean as an intercrop) recorded significantly higher yield (48.80 q/ha) and superior over the rest of the treatments. The maximum cashew nut yield (main crop) 9.63 q/ha was recorded in treatment T_1 (yard-long bean as an intercrop). The highest net returns of Rs. 2,62,382/- was obtained from cashew + Yard-long bean (T_1) intercropping system with B:C ratio of 3.46.[Table No. 2.28]

VRIDHACHALAM

Year of planting : 2022
Main Crop : Cashew -VRI-3
Design : RBD
Spacing : Cashew – 5 x 4 m
Replication : 4

Treatments:

T_1- Cashew +Gomphrena
T_2- Cashew + Cock's comb
T_3- Cashew + Tuberose
T_4- Cashew +Chrysanthemum
T_5- Cashew + African Marigold
T_6- Cashew + Golden rod
T_7- Cashew alone

Table 2.29 :Yield and economics of cashew and inter crops during 2021-22

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	kg/ plot	q/ ha	kg/ tree	q/ ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T_1	6.0	50	11.2	22.4	42.10	35000	55000	90000	179200	125000	304200	214200	3.38
T_2	4.8	40	10.8	21.6	39.2	35000	45000	90000	172800	100000	272800	182800	3.03
T_3	4.8	40	12	24.0	43.5	35000	80000	115000	192000	180000	372000	257000	3.23
T_4	9.0	75	10	20.0	40.4	35000	45000	80000	160000	150000	310000	230000	3.87
T_5	18.0	150	12	24.0	44.0	35000	75000	110000	192000	300000	492000	382200	4.47
T_6	6.0	50	11	22.0	41.6	35000	49000	84000	176000	125000	301000		3.58
T_7	-	-	6.0	12.3	45.2	35000	-	35000	98400	-	98400	634000	2.81
Mean	-	-	-	-	-	-	-	-	-	-	-	-	2.78
SEm ±	-	-	-	-	-	-	-	-	-	-	-	-	0.307
CD @5%	-	-	-	-	-	-	-	-	-	-	-	-	0.651
CV (%)	-	-	-	-	-	-	-	-	-	-	-	-	15.53

Sale Price (Rs./kg)

Raw Cashew Nuts :Rs. 80/kg
Intercrops : Gomphrena- Rs.25/kg, Cockscomb- Rs.25/kg,
Tuberose- Rs.45/kg, Chrysanthemum- Rs.20/kg,
AfricanMarigold-Rs.20/kg, Goldenrod-Rs.25/kg.

Among the different intercrops studied African marigold recorded the maximum yield of 150 q/ha with a net return of 3.82 lakhs and a cost benefit ratio of 4.47. It was followed by chrysanthemum.

HOGALGERE

Experiment has been initiated and plants are in the first year of establishment stage.

Experimental details:

No. of treatments : 07
No. of fruit trees\replication : 12 (10 x 5 m)
Design : RCBD
No. of replications : 03
Date of planting : 10.11.2023

Treatment details:

Treatment no	Cropping system	Inter crop for first five years
T_1	Cashew + Mango (Amrapali)	Palmarosa, Veg cowpea, Avare, Greengram
T_2	Cashew + Guava (Alahabad safeda)	
T_3	Cashew + Drumstick (Bhagya)	
T_4	Cashew + Aonla (Kanchana)	
T_5	Cashew + Custard apple (Arka Sahana)	
T_6	Cashew + Cover crop (Cowpea)	
T_7	Cashew alone (control)	

Inference: Experiment has been initiated and plants are in the first year of establishment stage.




Fertilizer application and organic management of Cashew


Pruning response of different cashew varieties

Ultra High Density planting in cashew

Hort.7: Organic Management of Cashew

Centers: East Coast : Bapatla
Plains / others: Darisai and Hogalagere

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

BAPATLA

Year of Planting	:	October,2014
Variety	:	BPP-8
Design	:	RBD
Spacing	:	7 x7m
Treatments	:	8
Replications	:	3
Duration	:	12 years
No of plants/ treatment	:	6

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) + Rock phosphate
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)

Table 2.30: Growth parameters of cashew in organic management

Treatment	Mean plant height (m)	Canopy height (m)	Trunk girth (cm)	Canopy spread (E-W)	Canopy spread (N-S)	Mean canopy spread (m)	Canopy surface area (m^2)
T_1	3.10	2.72	49.40	5.72	5.69	5.70	39.63
T_2	3.67	3.20	61.87	6.45	6.69	6.62	45.33
T_3	3.07	2.63	58.47	5.79	6.16	5.97	44.27
T_4	3.79	3.21	63.80	6.55	7.23	6.84	54.37
T_5	3.31	2.75	61.87	6.21	6.31	6.26	38.30
T_6	3.21	2.64	49.73	5.31	5.64	5.47	37.10
T_7	3.41	3.00	57.87	5.90	6.03	5.96	40.22
T_8	3.23	2.84	50.53	5.39	5.95	5.67	41.22
CD@5%	NS	NS	NS	NS	NS	NS	3.69
SEm ±	0.27	0.25	4.32	0.55	0.52	0.37	1.23
CV (%)	13.86	15.26	13.20	15.99	14.18	10.94	6.56

Among the treatments, the mean plant height was recorded highest in T_4 (3.79 m) followed by T_2 (3.67 m) and T_7 (3.41m). Highest mean canopy height was noticed in T_4 (3.21 m) followed by T_2 (3.20 m). The mean trunk girth was recorded highest in T_4 (63.80 cm) followed by T_5 (61.87 cm) and T_2 (61.87 cm). The canopy spread (E-W) was recorded maximum in T_4 (6.55 m) followed by T_2(6.45 m). The canopy spread (N-S) was recorded maximum in T_4 (7.23 m) followed by T_2 (6.69 m). The mean canopy spread was recorded maximum in T_4 (6.84 m) followed by T_2 (6.62 m) and canopy surface area was recorded maximum in T_4 (54.37 m^2) followed by T_2(45.33 m^2). .[Table No. 2.30]

Table 2.31: Yield parameters of cashew in organic management

Treatment	Duration (days)	Flowering Intensity (m^2)	Mean no of nuts/m^2	Mean no of nuts/ panicle
T_1	75	11.91	11.15	1.97
T_2	76	14.73	10.88	2.71
T_3	75	11.01	8.06	2.05
T_4	73	14.85	11.45	2.91
T_5	77	11.55	10.87	1.72
T_6	80	10.72	7.15	1.32
T_7	86	13.70	9.11	1.59
T_8	79	12.73	10.65	2.02
CD@5%		1.67	NS	0.885
SEm ±		0.55	1.28	0.290
CV (%)		7.48	22.38	24.57

The shortest flowering duration was recorded in T_4(73.0 days) and followed by T_1 and T_5 (75.0 days). With respect to flowering intensity and mean number of nuts per panicle was found to be significant. The flowering intensity per square meter was highest in T_4 (14.85) followed by T_2 (14.73). The mean number of nuts per square meter was found highest in T_4 (11.45) followed by T_1 (11.15). The mean no. of nuts per panicle was found maximum in T_4 (2.91) followed by T_2 (2.71).[Table No.2.31]

Table 2.32: Yield parameters of cashew in organic management during 2023

Treatment	Nut weight (g)	Apple weight (g)	TSS (^{0}Brix)	Shelling (%)	Nut yield /tree (kg) (6 harvest)	Cumulative nut yield kg/tree (2018-2023)
T_1	7.99	59.13	10.09	26.60	5.70	34.62
T_2	8.02	60.83	10.34	27.98	6.40	36.35
T_3	7.79	59.30	9.96	27.77	6.10	33.57
T_4	8.14	65.30	11.25	27.86	7.11	39.75
T_5	7.91	52.02	9.78	26.62	4.85	28.30
T_6	7.76	60.70	9.65	25.64	5.20	29.40
T_7	7.56	53.10	10.20	28.07	4.95	29.03
T_8	7.58	47.73	9.56	28.11	5.86	32.78
CD@5%	0.12	3.64	NS	0.67	1.08	4.97
SEm ±	0.04	1.19	0.45	0.22	0.35	1.62
CV	0.84	3.60	7.78	1.38	10.69	8.53

Mean nut weight, mean apple weight and mean annual nut yield per tree were found to be significant among the treatments. The mean nut weight was found maximum in T_4 (8.14 g) followed by T_2 (8.02 g) and T_1 (7.99 g). Mean apple weight, the highest was recorded in T_4 (65.30 g) followed by T_2 (60.83 g). The shelling percentage was recorded highest in T_8 (28.11) followed by T_7 (28.07). The maximum mean annual nut yield per tree during the year was recorded in T_4 (7.11 kg) followed by T_2 (6.40 kg) The cumulative nut yield was recorded highest in T_4 (39.75 kg/tree) followed by T_2 (36.35 Kg/tree) for six annual harvests.

DARISAI

Experimental Details:

Year of planting	: 2012
Variety	: Balabhadra
Design	: RBD
Spacing	: 5 x 5m
Replications	: 03

Treatments details:

T_1 - 100 % N as FYM (100kg/ plants) 270q/ha
T_2 - 100 % N as FYM (100kg/ plants) 270q/ha + Bio-fertilizers (*Azatobacter* + *Azospirillum* +PSB) 200g.
T_3 - 50 % N as FYM (50kg/ plants) 135q/ha + Bio-fertilizers (200g)
T_4 - 100 % N as Vermicompost (33kg/plants) 89.1q/ha + 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 (25kg/ plants) 67.5q/ha + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200g).
T_8 - Recommended doses of fertilizer (N:P:K:500:250:250g/plant) (N:P:K:: 135:67.5:67.5kg/ha) + 10 kg FYM (Control).

Table 2.33: Growth parameters during the year 2023

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy (m)
			E-W	N-S	
T_1	4.78	66.7	6.57	6.4	6.48
T_2	4.44	67.4	6.8	5.6	6.2
T_3	5.03	69.3	7.2	6.4	6.8
T_4	5.00	68.8	5.8	6.3	6.05
T_5	4.68	70.04	5.6	6.7	6.15
T_6	4.97	69.8	6.2	7.0	6.7
T_7	5.06	71.2	5.3	7.2	6.25
T_8	5.08	72.2	7.1	6.4	6.75
SEm ±	0.21	4.44	0.29	0.32	0.42
CD @5%	0.41	7.68	0.90	1.12	1.05
CV (%)	7.52	11.07	8.09	11.5	10.6

Intercropping of cashew with different vegetable crops, *viz.,* tomato, cabbage, french bean, and pea along with sole cashew, was conducted before the advancement of the canopy in the years 2018-19 to 2022-23.

The maximum cashew equivalent yield was obtained in Cashew+ Cabbage intercropping with 35.56 q/ha and was found at par with Cashew+ Tomato, where a 32.45 q/ha yield was obtained (Table 2.33). The highest net return of Rs.253958.00 was also recorded in Cashew + Cabbage intercropping, followed by Cashew + Tomato (Rs.231793.00), whereas the lowest of Rs.33873.00 was recorded in sole Cashew treatment. From the above

table, it is clear that with an investment of Rs.1, a farmer can receive Rs. 3.13 and Rs. 3.12 when cashew is intercropped with tomato and cabbage, respectively.

To conclude this experiment, it can be said that before the advancement of canopy, farmers may opt for cashew and tomato intercropping to get high productivity and profitability from cashew-planted orchards.

HOGALAGERE

The different combinations of organic manures, bio-fertilizers, naturally available rock phosphate, and in-situ green manuring were applied at different quantity levels along with the control i.e., the recommended dose of fertilizers and FYM, and the results are presented below.

Year of planting: 2014

T_1- 100% N from locally available source (sheep manure)

T_2- 100% N as sheep manure + Bio fertilizer consortium (BFC) @200 /tree/year

T_3- 50% N as sheep manure + BFC @200g/tree/year + Rock Phosphate

T_4- 100% N as vermicompost +BFC @ 200g/tree/year

T_5 - Recycling of organic residue with the addition of 20 % cow dung slurry (wt. basis-20% weight of organic residue as cow dung slurry)

T_6- *in-situ* green manuring (retain litter + planting of cowpea)

T_7- 25% as FYM+ Recycling of organic residue +in situ green manuring/ green leaf manuring + BFC @200g/tree/year

T_8- Recommended dose of fertilizer +10 Kg FYM

Variety : Ullal-1
Design : RCBD
Spacing : 7 ×7 m
Replication : 03

Table 2.34: Growth parameter as influenced by different organic management during 2022-23

Treatment details	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Average spread of the canopy (m)
			E-W	N-S	
T_1	3.27	63.98	5.26	4.97	5.12
T_2	3.42	66.29	5.57	5.48	5.53
T_3	3.28	65.09	5.38	5.22	5.30
T_4	3.49	66.96	5.70	5.87	5.78
T_5	3.19	63.01	4.99	4.83	4.91
T_6	3.13	61.16	4.87	4.66	4.77
T_7	3.64	70.76	5.86	6.26	6.06
T_8	3.73	70.71	6.51	6.46	6.49
Mean	3.40	57.69	5.52	5.47	5.49
SEm±	0.29	4.91	0.48	0.45	0.31
CD @5%	0.88	10.53	1.45	1.36	0.95
C V (%)	14.88	9.06	15.05	14.18	9.90

Among the organic treatments (Table 2.34), T_7- 25 % N as FYM + Recycling of organic residue + *in-situ* green manuring/ green leaf manuring + Bio-fertilizers (200 g) was recorded higher growth parameter like tree height (3.64 m) stem girth (70.76 cm) and average canopy spread (6.06 m) after the T_8 (3.7 m, 70.71 cm and 6.06 m, respectively).

Table 2.35: Reproductive parameters during the year 2022-23

Treatment details	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut yield (kg/ tree)	Cumulative yield (kg/plant)
T_1	February (late)	116	6.99	32.82	28.97	10.76	32.30
T_2		119	7.24	34.68	29.72	11.78	36.15
T_3		117	7.20	34.00	29.45	11.02	33.14
T_4		121	7.31	35.38	30.04	12.03	37.07
T_5		114	6.93	31.90	28.43	10.52	29.84
T_6		114	6.87	30.46	27.93	9.14	27.27
T_7		124	7.38	36.30	30.28	12.80	40.17
T_8		126	7.43	37.45	30.70	13.21	40.86
Mean		119	7.17	34.12	29.44	11.41	34.60
SEm±		3.00	0.22	1.29	0.59	0.49	0.51
CD @5%		9.11	0.65	3.90	1.78	1.50	1.54
C V (%)		4.33	5.22	6.53	3.45	7.49	5.55

From the reproductive parameters (Table 2.35), the treatment T_7- 25% N as FYM + recycling of organic residue + in situ green manuring/ green leaf manuring + Bio-fertilizers (200 g) recorded significantly higher nut yield and cumulative yield (12.80 kg/plant and 40.17 kg/plant, respectively) after T_8 (13.21 kg/plant and 40.86 kg/plant, respectively) (Table 8). Gross return, net return, and B:C ratio was also higher in T_8 (Rs. 2.694 lakh/ha, Rs. 1.817 lakh/ha, and 3.07) followed by T_7 (Rs. 2.611 lakh/ha, Rs. 1.785 lakh/ha, and 3.16, respectively).

Hort. 11: Ultra high-density planting in cashew

Cenrers: East Coast :	Bapatla, Bhubaneswar, Jhargram and Vridhachalam
West Coast :	Madakkathara and Vengurla
Plains	Kanabargi

The objective of this trial is to identify the suitable variety for ultra-high density (UHDP) and to study the economic feasibility of ultra-high-density vs normal planting density planting in cashew.

BAPATLA

Experimental details:

Year of Planting	:	December,2022
Design	:	Split plot (Main Plot and Sub plot)
Each Plot size	:	256 m^2
Treatments	:	8
Replications	:	3
Duration	:	10 years
No of plants/ treatment	:	6
Total no of plots	:	27
Each plot size	:	256 m^2
Total area of the Experiment	:	6912 m^2
Main Plot (Spacings)	:	S_1: 2.5 x 2.5 m
		S_2: 3.0 x 3.0 m
		S_3: 8.0 x 8.0 m
Sub Plot (Varieties)	:	V_1: VRI-3
		V_2: NRCC Sel-2
		V_3: BPP-11

The trial has been laid out in Split Plot design during December, 2022, plants are have established well and are in vegetative stage.

BHUBANESWAR

Experimental details:

Year of Planting	:	2020	
Design	:	Split plot	
Replication	:	03	
Treatments		Main plot: Spacing	Sub plot: Varieties
		S_1:2.5 x 2.5 m	V_1: VRI-3
		S_2: 3.0 x 3.0 m	V_2: NRCC Sel-2
		S_3: 7.5 x 7.5 m (Control)	V_3: Balabhadra (Local)

Table 2.36: Growth parameters during 2023 (Year of planting 2020)

Treatments	Tree height (m)	Trunk girth (cm)	Canopy spread (m)		Average spread of the canopy (m)
			E-W	N-S	
S_1	1.96	19.35	2.08	2.17	2.13
S_2	2.05	20.04	2.32	2.29	2.31
S_3	2.30	20.93	2.35	2.32	2.33
SEm±	0.05	0.74	0.04	0.07	0.05
CD at 5%	0.20	2.90	0.17	0.27	0.19
CV(%)	7.36	11.01	5.89	9.07	6.41
V_1	1.98	20.85	2.17	2.24	2.21
V_2	2.21	18.81	2.22	2.23	2.23
V_3	2.12	20.67	2.36	2.30	2.33
SEm±	0.02	0.59	0.05	0.06	0.04
CD at 5%	0.07	1.82	0.14	0.18	0.12
CV(%)	3.35	8.82	6.22	7.56	5.00
S_1V_1	1.86	20.00	1.99	2.15	2.07
S_1V_2	2.03	17.70	2.00	2.08	2.05
S_1V_3	1.99	20.35	2.24	2.28	2.26
S_2V_1	1.96	19.81	2.30	2.28	2.29
S_2V_2	2.14	19.21	2.31	2.22	2.26
S_2V_3	2.05	21.11	2.37	2.37	2.37
S_3V_1	2.10	22.73	2.21	2.30	2.26
S_3V_2	2.46	19.53	2.35	2.40	2.38
S_3V_3	2.34	20.54	2.48	2.25	2.37
Mean	2.10	20.11	2.25	2.26	2.26
SEm±	0.04	1.02	0.08	0.10	0.07
CD at 5%	0.13	3.16	0.25	0.30	0.20
CV(%)	4.62	8.38	5.16	7.16	4.75

Spacing did not significantly influence the growth character except canopy spread. Plants with a spacing of 3 x 3 m had the maximum canopy spread, which was significantly different from 2.5 x 2.5 m and 7.5 x 7.5 m. The highest plant height (2.30 m) was observed in the spacing 7.5 x 7.5 m and lowest (1.96 m) in 2.5 x 2.5 m. Variety NRCC Sel-2 (V_2) resulted in maximum plant height (2.21 m) and interaction of S_3V_2 had maximum plant height (2.46 m). Maximum average canopy spread was seen in spacing S_3 (2.33 m) and variety V_3 (2.33 m). The interaction effect of S_3V_2 resulted highest canopy spreading (2.38 m) among all the treatments. Spacing of S_3 found maximum trunk girth of 20.93 cm and variety V_1 observed highest trunk girth of 20.85 cm. The interaction of S_3V_1 resulted maximum (22.73 cm) trunk girth among all the treatments. [Table No.2.36]

Table 2.37: Reproductive parameters of cashew during 2023

Treatments	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut yield (kg/ plant)	Cum. nut yield (kg/plant) for 2 harvests
S_1		102	7.37	59.22	29.75	0.49	0.78
S_2		105	7.61	60.21	29.79	0.52	0.82
S_3		107	7.62	61.44	29.46	0.58	0.87
Mean		157	11.3	90.43	44.5	0.80	
SEm±		1.46	0.10	0.69	0.21	0.02	
CD at 5%		5.72	0.40	2.69	0.83	0.09	
CV (%)		4.16	4.07	3.41	2.14	12.13	
V_1		140	6.74	49.07	28.28	0.52	0.808
V_2		86	8.19	68.08	30.37	0.59	0.898
V_3		89	7.67	63.73	30.35	0.48	0.779
Mean		157.5	11.3	90.44	44.5	0.80	
SEm±		2.61	0.07	0.40	0.28	0.03	
CD at 5%		8.04	0.21	1.23	0.85	0.08	
CV(%)		7.45	2.66	1.99	2.79	14.51	
S_1V_1		140	6.59	48.27	28.36	0.50	0.796
S_1V_2		80	8.08	66.54	30.37	0.54	0.866
S_1V_3		87	7.44	62.87	30.53	0.43	0.693
S_2V_1		139	6.83	48.84	28.47	0.50	0.768
S_2V_2		87	8.22	67.85	30.58	0.58	0.904
S_2V_3		89	7.78	63.95	30.32	0.48	0.793
S_3V_1		141	6.82	50.10	28.02	0.57	0.862
S_3V_2		90	8.28	69.84	30.17	0.65	0.935
S_3V_3		91	7.78	64.37	30.20	0.53	0.830
Mean		105	7.53	60.29	29.67	0.54	
SEm±		4.52	0.12	0.69	0.48	0.05	
CD at 5%		13.92	0.36	2.13	1.47	0.14	
CV(%)		4.22	1.24	1.52	0.72	5.88	

Variety had significant effect on yield attributes of cashew. V_2 (NRCC Sel-2) resulted in maximum nut weight (8.19 g), nut yield per plant (0.596 kg) and apple weight (68.08 g). Spacing S_3 (7.5 x 7.5 m) revealed highest nut weight (7.62 g), nut yield per plant (0.587 kg) and apple weight (61.44 g) among all the treatments. Interaction effect of S_3V_2 resulted in maximum nut weight (8.28 g), nut yield per plant (0.657 kg) and apple weight (69.84 g) in the experiment. [Table No.2.37]

JHARGRAM

Year of planting : 2018

Main Plot : Spacing

S_1 : 8 x 8 m (Control)
S_2 : 5 x 5 m
S_3 : 3 x 3 m
Design : Split plot

Sub plot: Variety

V_1 : VRI-3
V_2 : NRCC sel - 2
V_3 : K- 22 -1 (Control)
Replication : 3

Table 2.38: Growth parameter of varieties under ultra-high-density planting of cashew during the year 2022-23

Treatment	Plant height (m)	Trunk girth (cm)	Canopy spread		Average spread (m)	Canopy area (m^2)	Ground coverage (%)	Biomass removal (kg)	Vegetative laterals / m^2
			E-W	N-S					
S_1	3.1	39.2	4.4	4.2	4.3	20.6	23.0	21.0	8.2
S_2	3.4	39.4	4.3	4.3	4.3	22.7	59.1	19.8	6.4
S_3	2.4	35.6	2.5	2.3	2.4	6.6	51.5	17.6	11.8
Mean	3.0	38.1	3.7	3.6	3.7	16.6	44.5	19.4	8.8
SEm±	0.02	NS	0.07	0.03	0.05	0.37	1.41	NS	0.13
CD @ 5%	0.08		0.34	0.10	0.20	1.54	6.32		0.49
CV% (a)	6.6	8.9	17.1	6.9	11.5	20.0	28.4	25.2	13.0
V_1	2.8	32.3	3.2	3.1	3.1	11.9	34.5	10.3	5.4
V_2	3.1	37.4	4.0	3.9	4.0	19.6	50.9	21.3	6.1
V_3	3.1	44.4	3.9	3.8	3.9	18.3	48.2	26.7	14.9
Mean	3.0	38.1	3.7	3.6	3.7	16.6	44.5	19.4	8.8
SEm±	0.04	0.51	NS	0.06	0.06	0.48	NS	0.6	0.21
CD at 5%	0.15	2.10		0.22	0.24	2.01		2.64	0.79
CV%(b)	11.8	12.1	15.6	15.9	13.8	26.1	31.06	33.3	21.0
S_1V_1	3.0	33.7	3.6	3.3	3.5	14.7	15.4	9.3	4.9
S_1V_2	3.2	37.7	5.0	4.7	4.8	25.0	28.6	22.7	4.2
S_1V_3	3.2	46.3	4.6	4.5	4.5	22.0	25.1	31.0	15.5
S_2V_1	3.1	31.3	3.7	3.7	3.7	15.1	42.8	9.7	3.5
S_2V_2	3.5	38.7	4.4	4.5	4.4	26.1	63.7	20.7	5.0
S_2V_3	3.8	48.3	4.8	4.7	4.8	26.8	71.0	29.0	10.8
S_3V_1	2.4	32.0	2.3	2.2	2.3	5.8	45.3	12.0	7.9
S_3V_2	2.5	36.0	2.8	2.4	2.6	7.8	60.4	20.7	9.3
S_3V_3	2.4	38.7	2.4	2.3	2.3	6.0	48.7	20.0	18.3
Mean	3.0	38.1	3.7	3.6	3.7	16.6	44.5	19.4	8.8
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2.39: Yield parameter of varieties under ultra-high-density planting of cashew

Treatment	Duration of flowering	Flowering /m²	Nuts /m²	Nuts / Panicle	Nut weight (g)	Apple weight (g)	Shelling %	Yield / plant (kg)	Yield /ha (q)	Cum. yield (kg/ plant) 5 harvests
S_1	68.00	14.8	27.90	5.60	7.10	52.00	32.00	2.80	4.30	4.30
S_2	68.60	13.0	25.70	6.80	6.80	51.90	32.20	2.10	3.30	3.30
S_3	66.70	8.2	19.80	4.40	6.80	51.10	30.80	0.70	1.80	1.80
Mean	67.70	12.0	24.50	5.60	6.90	51.70	31.60	1.80	3.10	3.10
SEm+	0.33	0.19	0.53	0.08	0.01			0.04	0.06	
CD at 5%	1.51	0.90	2.69	0.31	0.05	NS	NS	0.18	0.24	
CV%(a)	4.33	14.60	19.50	13.30	1.80	4.50	5.30	20.40	16.70	
V_1	64.30	14.20	27.10	6.30	6.10	42.90	30.80	1.60	2.60	2.60
V_2	74.20	12.40	26.60	6.40	7.60	60.60	32.60	2.20	4.00	4.00
V_3	64.70	9.40	19.70	4.10	7.00	51.60	31.60	1.70	2.90	2.90
Mean	67.70	12.00	24.50	5.60	6.90	51.70	31.60	1.80	3.10	3.10
SEm+	0.33	0.20	0.44	0.15	0.04	0.35		0.05	0.08	
CD at 5%	1.54	0.91	2.25	0.56	0.13	1.44	NS	0.22	0.32	
CV%(b)	4.41	14.7	16.30	24.40	4.80	6.10	4.90	26.10	21.70	
S_1V_1	63.70	15.90	30.30	5.70	6.40	45.00	31.60	2.30	3.40	3.40
S_1V_2	73.30	15.90	31.10	6.20	7.70	61.60	33.30	3.40	5.90	5.90
S_1V_3	67.00	12.50	22.40	4.90	7.20	49.30	31.00	2.60	3.60	3.60
S_2V_1	65.30	12.80	26.80	7.80	5.90	43.30	31.50	1.80	2.20	2.20
S_2V_2	75.00	15.00	29.60	6.60	7.50	59.70	32.20	2.30	4.00	4.00
S_2V_3	65.30	11.30	20.70	6.10	6.90	52.70	32.9	2.10	3.70	3.70
S_3V_1	64.00	13.90	24.30	5.40	5.80	40.30	29.30	0.60	2.10	2.10
S_3V_2	74.30	6.40	19.10	6.50	7.60	60.40	32.20	0.90	2.10	2.10
S_3V_3	61.70	4.30	16.10	1.30	7.00	52.70	30.90	0.60	1.20	1.20
Mean	67.70	12.00			6.90			1.80	3.10	3.10
SEm+	1.00	0.59	24.5	5.6	0.11	51.70	31.60	0.16	0.23	
CD at 5%	4.61	2.74	NS	NS	0.38	NS	NS	0.67	0.95	

Variations were also noticed with nuts/panicle and nut weight. Nuts/panicle was highest with 5 X 5m spacing, while the two varieties NRCC sel-2 and VRI – 3 were at par. In the case of nut weight, the boldest nut was reported under NRCC Sel – 2 and irrespective of variety, widest spacing had a positive effect on nut weight. Varietal effect was recorded on cashew apple weight. Individual as well as interactive effects of spacing and variety were recorded on yield/tree. Irrespective of spacing, NRCC Sel-2 produced the maximum yield per tree. Therefore, with respect to yield and nut weight NRCC Sel – 2, was found to be the most suitable variety for UHDP.

VRIDHACHALAM

Year of planting : 09.01.2023
Design : Factorial RBD
Replication : 3
Treatments : Main plot and sub plot details
Main plot - spacings : 3
1. 2.5 x 2.5 m
2. 3.0 x 3.0 m
3. 8.0 x 8.0 m
Sub plot - Varieties : 3

1. NRCC Selection -2
2. VRI-3
3. VR (CH) – 1

Number of plants/treatment: Three

The trials have been initiated and the observations are in progress.

MADAKKATHARA

Experimental details:

Year of planting : 2017
Design : Split Plot
Replication : 3
Treatments

Main plots : S_1 -2.5 x 2.5 m
S_2- 3.0 x 3.0 m
S_3- 8.0 x 8.0 m

Sub plot : Variety details
V_1- VRI-3
V_2- NRCC Sel-2
V_3-Poornima

Table 2.40: Growth parameters during 2023

Treatment	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Average spread of the canopy (m)
			E-W	N-S	
S_1	2.34[b]	37.51[a]	2.47[b]	2.57[b]	2.52[b]
S_2	2.37[b]	39.65[a]	2.58[b]	2.70[b]	2.64[b]
S_3	3.00[a]	27.16[b]	5.38[a]	5.64[a]	5.51[a]
Mean	2.57	34.78	3.48	3.64	3.56
SEm ±	0.05	1.32	0.23	0.17	0.20
CD @5%	0.19	5.19	0.92	0.68	0.78
CV (%)	5.74	11.39	20.17	14.24	16.75
V_1	2.41[b]	36.61	2.87[b]	2.83[b]	2.85[b]
V_2	2.79[a]	34.01	3.81[a]	4.06[a]	3.93[a]
V_3	2.51[b]	33.70	3.75[a]	4.01[a]	3.88[a]
Mean	2.57	34.77	3.48	3.64	3.56
SEm ±	0.07	1.70	0.21	0.16	0.20
CD @5%	0.211	NS	0.67	0.50	0.57
CV (%)	7.99	14.65	18.39	13.39	15.61
S_1V_1	2.35	37.55	2.41	2.41	2.41
S_1V_2	2.36	36.49	2.37	2.56	2.46
S_1V_3	2.32	38.51	2.63	2.73	2.68
S_2V_1	2.36	40.39	2.66	2.73	2.70
S_2V_2	2.38	39.33	2.51	2.68	2.60
S_2V_3	2.36	39.22	2.57	2.69	2.63
S_3V_1	2.52	31.89	3.53	3.35	3.44
S_3V_2	3.63	26.22	6.54	6.94	6.74
S_3V_3	2.84	23.38	6.06	6.47	6.34
Factor(B) at same levels of Factor A					
SEm ±	0.12	2.94	0.39	0.30	0.32
CD @5%	0.37	NS	1.14	0.87	0.99
Factor(A) at same levels of Factor B					
SEm ±	0.11	2.74	0.38	0.28	0.33
CD @5%	0.35	NS	1.30	0.97	1.11

Table 2.41: Reproductive parameters during the year 2023

Treatment	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight(g)	Shelling %	Nut Yield (kg/tree)	Nut Yield per unit area (t/ha)	Cumulative Yield (kg/plant)
S_1	Nov (early)	90-110	8.83	80.24	28.90	0.37[b]	0.59[a]	0.96
S_2	Nov (early)	90-110	10.05	81.80	26.60	0.44[b]	0.49[a]	1.07
S_3	Nov (early)	90-110	10.34	79.24	27.34	1.85[a]	0.29[b]	3.72
Mean			9.74	80.43	28.32	0.88	0.46	
SEm ±			0.49	3.84	1.06	0.07	0.04	

CD @5%			NS	NS	NS	0.27	0.18	
CV (%)			15.30	14.3	11.56	23.15	29.77	
V_1	Nov (early)	90-110	7.77	62.53	28.58	1.44[a]	0.60[a]	2.37
V_2	Nov (early)	90-110	13.68	102.88	24.45	0.58[b]	0.38[b]	1.69
V_3	Nov (early)	90-110	7.83	75.88	29.81	0.64[b]	0.39[b]	1.71
Mean			9.76	80.43	28.32	0.88	0.46	
SEm ±			0.46	2.86	0.89	0.17	0.04	
CD @5%			1.41	8.83	4.39	0.54	0.13	
CV (%)			14.04	10.68	11.19	58.98	28.68	
S_1V_1			7.65	59.81	28.98	0.40	0.65	1.11
S_1V_2			11.36	103.46	26.90	0.33	0.53	0.87
S_1V_3			7.47	77.46	31.62	0.37	0.60	0.9
S_2V_1			7.21	63.4	29.54	0.58	0.65	1.12
S_2V_2			15.03	106.17	22.17	0.39	0.44	1.08
S_2V_3			7.92	75.85	28.19	0.35	0.39	1.03
S_3V_1			8.46	64.39	27.22	3.34	0.52	4.81
S_3V_2			14.46	99.01	25.19	1.02	0.16	3.12
S_3V_3			8.10	74.32	29.62	1.19	0.19	3.23
Mean			9.74	80.43	28.32	0.88	0.46	
Factor(B) at same levels of Factor A								
SEm ±			0.79	4.96	1.50	0.30	0.07	
CD @5%			NS	NS	NS	0.93	NS	
Factor(A) at same levels of Factor B)								
SEm ±			0.81	5.58	1.62	0.26	0.08	
CD @5%			NS	NS	NS	0.8	NS	

The growth and yield parameters exhibited significant differences among the treatments (Table 2.40 and 2.41). The tree height (3.0 m), average canopy spread (5.51 m) and nut yield per tree (1.85 kg) were significantly high in S_3, the control plot. But the nut yield per unit area was significantly high in S_1 and S_2 (0.59 and 0.49 kg respectively). The highest nut weight was recorded in variety NRCC Sel-2 (13.68 g) and shelling per cent in variety Poornima. Among the three varieties evaluated, the variety VRI -3 recorded significantly higher nut yield per tree (1.44 kg).

VENGURLA

Experimental details

Year of planting : July, 2018
Design : Split plot
Replication : Three

Treatments

Main plot: Spacing
1. 2.5 × 2.5 m
2. 3.0 × 3.0 m
3. 8.0 × 8.0 m

Sub plot details: Varieties
1. VRI-3
2. NRCC-Sel-2
3. Vengurle-9

Number of plants/treatments: Three

Table 2.42: Growth parameters during the year 2023

Treatment	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Average spread of the canopy (m)
			E-W	N-S	
S_1	1.56	18.57	1.31	1.25	1.28
S_2	1.60	19.52	1.41	1.38	1.39
S_3	1.99	22.80	1.72	1.79	1.76
Mean	1.72	20.30	1.48	1.47	1.48
SEm ±	0.13	1.15	0.10	0.04	0.06
CD @5%	N.S.	N.S.	N.S.	0.15	0.24
CV (%)	8.89	21.77	18.64	15.68	16.41
V_1	1.82	21.09	1.66	1.52	1.59
V_2	1.61	19.31	1.46	1.49	1.48
V_3	1.72	20.49	1.32	1.41	1.36
Mean	1.72	20.30	1.48	1.47	1.48
SEm ±	0.05	1.47	0.09	0.08	0.08
CD @5%	0.16	N.S.	N.S.	N.S.	N.S.
CV (%)	8.89	21.77	18.64	15.68	16.41
S_1V_1	1.53	18.30	1.43	1.23	1.33
S_1V_2	1.54	19.50	1.45	1.39	1.42
S_1V_3	1.61	17.90	1.04	1.13	1.09
S_2V_1	1.60	18.53	1.32	1.22	1.27
S_2V_2	1.50	18.07	1.36	1.50	1.43
S_2V_3	1.70	21.97	1.54	1.42	1.48
S_3V_1	2.32	26.43	2.22	2.12	2.17
S_3V_2	1.80	20.37	1.58	1.57	1.58
S_3V_3	1.85	21.60	1.37	1.68	1.53
Mean	1.50	20.30	1.48	1.47	1.48
SEm ±	0.09	2.55	0.16	0.13	0.14
CD @5%	0.27	7.86	0.49	N.S.	0.43
CV (%)	8.89	21.77	18.64	15.68	16.41

Table 2.43: Reproductive parameters during the year 2023

Treatment	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut yield (kg/tree)	Cumulative Yield (kg/plant)
S_1	Nov. (Early)	97.89	6.95	56.60	29.58	2.09	4.49
S_2	Nov. (Early)	98.27	7.19	53.89	29.70	2.81	5.90
S_3	Nov. (Early)	98.40	8.08	56.71	29.52	3.12	6.52
Mean		98.19	7.41	55.73	29.60	2.67	-
SEm ±		0.59	0.54	0.94	0.13	0.10	-

CD @5%		N.S.	N.S.	N.S.	N.S.	0.38	-
CV (%)		1.54	9.52	4.09	3.32	9.93	-
V_1	Nov. (Early)	97.33	6.97	43.97	30.31	2.60	5.49
V_2	Nov. (Early)	98.34	7.11	56.20	28.54	2.35	4.93
V_3	Nov. (Early)	98.89	8.14	67.03	29.95	3.08	6.50
Mean		98.19	7.41	55.73	29.60	2.67	-
SEm ±		0.50	0.24	0.76	0.33	0.09	-
CD @5%		N.S.	0.72	2.34	1.01	0.27	-
CV (%)		1.54	9.52	4.09	3.32	9.93	-
S_1V_1	Nov. (Early)	97.33	6.07	43.50	30.40	2.12	4.56
S_1V_2	Nov. (Early)	98.33	7.00	58.37	28.67	1.95	4.26
S_1V_3	Nov. (Early)	98.02	7.77	67.93	29.68	2.21	4.66
S_2V_1	Nov. (Early)	96.50	7.40	45.07	30.13	2.49	5.32
S_2V_2	Nov. (Early)	98.98	6.63	53.43	28.90	2.46	5.10
S_2V_3	Nov. (Early)	99.32	7.53	63.17	30.07	3.49	7.27
S_3V_1	Nov. (Early)	98.17	7.43	43.33	30.40	3.18	6.58
S_3V_2	Nov. (Early)	97.70	7.70	56.80	28.07	2.63	5.41
S_3V_3	Nov. (Early)	99.33	9.10	70.00	30.10	3.53	7.53
Mean		98.19	7.40	55.73	29.60	2.67	-
SEm ±		0.87	0.41	1.31	0.57	0.15	-
CD @5%		N.S.	N.S.	4.05	N.S.	0.47	-
CV (%)		1.54	9.52	4.09	3.32	9.93	-

The UHDP trial was initiated in July-2018 at AICRP-Cashew, RFRS, Vengurla and 2022-23 was the third year of experimentation. The data regarding vegetative growth, flowering, nut yield and yield contributing characters were recorded.

The spacing effect showed significant results for vegetative growth parameters except plant height (m), plant girth (cm), and EW canopy spread (m). Plant height (m) showed significant results with respect to varieties. While the interaction effect of vegetative growth parameters showed significant results except for NS canopy spread (m). The precocity of flowering was observed in varieties V_1 (VRI-3), V_2 (NRCC-Sel-2), and V_3 (V-9). All three varieties started flowering early in the 2ndweek of November, 2022.

Data revealed that spacing is non-significant with respect to all reproductive parameters except nut yield; the highest nut yield was observed in S_3 (3.12 kg/tree). Among the different varieties, there was a significant result with all reproductive parameters, and the duration of flowering ranged from 97.33 to 98.89 days: nut yield (7.11–8.14 g), apple weight (43.97–67.03 g), shelling percentage varies from 28.54 to 30.31, and nut yield varies from 2.35 to 3.08 kg/tree. Among the interaction effects of spacing and variety, all reproductive parameters were statistically non-significant except apple yield and nut yield. Apple yield varies from 43.33 g to 70.00 g (S_3V_3), and nut yield varies from 1.95 to 3.53 kg/tree (S_3V_3). The highest cumulative yield for 3 harvests was observed in spacing S_3 (6.52 kg/tree), variety V-9 (6.50 kg/tree), and interaction effect S_3V_3 (7.53 kg/tree).[Table No. 2.43]

KANABARGI

Experimental details:

Year of planting	: September-2022
Location	: Horticultural Research and Extension Centre, Kanabargi
Design	: Split plot
Replications	: 3

Treatments:

Main plot: Spacing	Sub plot: varieties
S_1: 2.5 x 2.5 m	V_1 : VRI-3
S_2: 3.0 x 3.0 m	V_2 : NRCC-2
S_3 : 8.0 x 8.0 m	V_3 : Vengurla- 9

The varieties VRI-3, NRCC-Sel-2 and V-9 were planted during the month of September 2022 at three different spacing. The plants were pruned during the month of May, 2022 and June, 2022.The plants are in the vegetative stage and observations will be recorded during 2023-24.

Hort.12 : Pruning response of different cashew varieties

Centers: East Coast :	Jhargram and Vridhachalam
West Coast :	Madakkathara and Vengurla
Plains / others:	Hogalagere

The project aims at assessing pruning response of different varieties released by AICRP Centers

JHARGRAM

Experimental details:

Year of planting	: 2022
Variety	: BPP – 8

Treatment details :

T_1 : Control
T_2 :- 25% leader in June
T_3 : 25% lateral in June
T_4 : 50% lateral in June
T_5 : 25% leader in August
T_6 : 25% lateral in August
T_7 : 50% lateral in August
T_8 : 25% leader in September
T_9 : 25% lateral in September
T_{10} : 50% lateral in September

Design : Randomized Block Design
Spacing : 8 x 8 m
Replication : 3
No. of plants/ repl. : 2
No. of trees req./ treat/rep.: 10
Total number of plants : 100 (30 trees x 3 months= 90 for treatment imposition for 3 months + 10 trees for control)
Package of practices : Uniform POP should be followed i.e. application of RDF and plant protection schedule.

Table 2.44: Growth parameter of plants under pruning treatment during the year 2022-23

Treatment	Plant height (m)	Trunk girth (cm)	E-W spread (m)	N-S spread (m)	Average spread (m)	Canopy area (m^2)	Vegetative laterals /m^2	Fresh weight of biomass removal (kg)	Dry weight biomass removal (kg)
T_1	4.8	63.0	5.5	5.2	5.3	34.3	2.3	0.0	0.0
T_2	5.9	85.4	8.0	8.3	8.2	77.7	6.4	92.2	73.8
T_3	6.4	89.6	8.2	8.8	8.5	83.0	7.7	67.4	53.9
T_4	6.0	94.2	8.5	7.8	8.1	75.8	10.0	124.0	99.2
T_5	5.4	92.0	6.7	7.2	6.9	55.1	11.5	117.1	93.7
T_6	5.1	102.2	6.8	7.1	7.0	50.7	12.0	82.2	65.8
T_7	5.7	63.8	6.4	6.4	6.4	48.8	11.5	79.6	63.7
T_8	4.5	88.5	5.2	5.4	5.3	31.0	6.5	87.1	69.7
T_9	5.5	92.5	5.5	5.7	5.6	40.3	6.5	62.5	50.0
T_{10}	5.0	87.0	5.3	5.5	5.4	34.8	7.6	163.5	130.8
Mean	5.43	85.8	6.61	6.74	6.67	53.15	8.2	87.56	70.06
S.Em±	0.22	NS	0.20	0.26	0.18	2.32	0.74	8.37	6.70
CD at 5%	0.70		0.65	0.84	0.57	7.50	2.37	27.02	21.62
CV%	8.9	23.1	6.8	8.6	5.9	9.8	20.1	21.4	21.4

Table 2.45: Yield parameter of plants under pruning treatment during the year 2022-23

Treatment	Nuts / m^2	Nuts/ panicle	Nut weight (g)	Kernel weight (g)	Shelling %	Apple weight (g)	Yield /tree (kg)
T_1	27.3	5.4	6.7	2.5	37.1	60.8	6.3
T_2	35.5	8.8	7.6	2.5	32.7	76.7	7.3
T_3	27.4	8.3	7.7	2.5	32.9	70.7	9.6
T_4	29.0	7.2	7.8	2.6	32.7	73.4	8.6
T_5	18.5	6.9	7.5	2.5	33.6	67.9	2.8
T_6	13.7	6.9	7.5	2.5	33.6	69.5	5.2
T_7	16.1	6.8	7.5	2.5	33.2	64.5	3.0
T_8	22.9	6.6	7.7	2.5	32.7	66.0	2.8
T_9	22.7	6.3	7.7	2.5	32.6	68.5	7.2
T_{10}	22.2	7.6	7.8	2.5	32.1	68.8	3.0
Mean	23.53	7.08	7.55	2.51	33.32	68.68	5.58
S.Em±	2.03	NS	0.09	NS	0.55	1.19	0.60
CD at 5%	6.57		0.29		1.76	3.83	1.94
CV%	19.33	22.57	2.62	3.23	3.66	3.87	24.18

The treatments were on par with respect to the height of plant. Irrespective of the type of pruning. The maximum canopy spread was noticed in plants pruned in June and August. But in case of plants pruned in September, shoot extension period was short and as winter season started, therefore, growth was restricted and after winter, flowering started in February. Therefore, the canopy spread was minimal. Significant difference was noticed with respect to canopy area and a huge canopy was developed by the plants pruned in June followed by plants pruned in August and both the treatments had a larger canopy area than the control. The control treatment had the highest number of flowering laterals/m^2 and the lowest number of vegetative laterals/m^2.

All other treatments were on par with respect to flowering laterals/m^2 and vegetative laterals/m^2. Maximum nuts/m^2 was recorded with 25% leader shoot pruning in June, while all other treatments were at par. Nut weight and apple weight did not vary due to pruning. Shelling % was highest in the control treatment. Pruning had a significant positive effect on yield/tree and irrespective of method of pruning, June was found to be the best month for pruning, which showed the highest positive effect on yield improvement (Table 2.44 and 2.45).

VRIDHACHALAM

Experiments details

Year of planting : June, 2021
Variety : VRI-H-1
Design : RBD
Spacing : 7 x 7 m
Replications : 5

Table 2.46 : Growth parameters during the year 2023

Treatment	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Flowering laterals /m²	Non-flowering laterals /m²
			E-W	N-S		
T_1	3.75	78.79	5.50-6.90	5.30-6.60	7.10	12.30
T_2	4.10	82.81	5.80-7.40	5.70-7.10	8.30	13.20
T_3	3.89	80.18	5.70-7.30	6.10-6.90	7.30	13.10
T_4	3.80	79.80	5.70-6.90	6.30-6.90	7.30	13.10
T_5	4.69	89.10	7.00-7.80	6.90-7.70	9.50	16.00
T_6	4.57	87.20	6.30-7.80	6.1-7.8	8.70	14.50
T_7	4.25	84.7	6.10-7.60	5.90-7.60	9.10	14.60
T_8	4.79	91.10	6.80-8.10	6.40-7.50	9.90	15.90
T_9	4.88	95.70	7.10-8.30	7.10-7.90	10.30	16.70
T_{10}	4.75	92.30	6.90-8.10	6.50-7.80	9.70	16.30
Mean	4.10	86.17	-	-	8.72	14.57
SEm ±	0.119	1.413	-	-	0.757	0.825
CD @5%	0.321	3.815	-	-	NS	NS
CV (%)	6.884	4.122	-	-	20.30	13.12

Table 2.47 : Reproductive parameters during the year 2023

Treatment	Flowering time	Duration flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut yield (kg/tree)
T_1	Dec(Early)	90	6.6	69	30.00	12.50
T_2	Dec(Early)	95	6.8	71	30.40	13.10
T_3	Dec(Early)	94	6.7	70	30.30	13.20
T_4	Dec(Early)	93	6.7	69	30.20	12.50
T_5	Dec(Early)	98	7.0	68	30.40	13.50
T_6	Dec(Early)	97	6.9	70	30.50	13.60
T_7	Dec(Early)	95	6.9	71	30.00	13.70
T_8	Dec(Early)	110	7.1	72	30.30	13.50
T_9	Dec(Early)	114	7.2	73	30.60	13.90
T_{10}	Dec(Early)	110	7.1	72	30.00	13.80
Mean		99.60	6.90	70.50	30.20	13.33
SEm ±		0.721	0.082	0.690	0.704	0.816
CD @5%		2.17	0.237	1.987	NS	NS
CV (%)		1.60	2.681	2.199	5.173	12.84

Among the different levels of pruning the treatment T_9 (25% lateral in September) recorded the highest tree height of 4.79 m, girth of 95.70 cm [Table No. 2.46] and recorded longer duration of flowering 114 days, higher nut weight (7.2 g), apple weight (73 g), higher shelling percentage (30.6 %), and nut yield per tree (13.9 kg/tree) and also recorded the maximum average canopy spread. It was followed by T_{10} (50% lateral in September) and T_8 (25% leader in September). [Table No. 2.47]

MADAKKATHARA

Experimental details:

Year of Start	:	June, 2021
Spacing	:	7 x 7m
No. of replication	:	3
No. of trees req./ treat/rep.	:	10
Total number of plants	:	100 (30 trees x 3 months= 90 for treatment imposition for 3 months + 10 trees for control)
Package of practices	:	KAU POP

Table 2.48: Growth parameters during the year 2023

Treatment	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Average spread of the canopy (m)	Flowering laterals /m²	Non-flowering laterals /m²
			E-W	N-S			
T_1	4.68^{a}	83.52	7.47^{ab}	7.36^{ab}	7.42^{abc}	8.50	12.40
T_2	4.31^{abc}	102.35	7.83^{ab}	7.82^{a}	7.83^{ab}	9.20	13.65
T_3	4.00^{bc}	80.78	6.76^{bcd}	6.83^{abc}	6.79^{cd}	8.68	13.18
T_4	4.16^{bc}	86.55	5.56^{d}	6.07^{c}	5.81^{e}	8.43	12.93
T_5	4.26^{abc}	89.70	8.47^{a}	7.79^{a}	8.13^{a}	9.10	13.33
T_6	4.08^{bc}	88.12	5.74^{cd}	6.50^{bc}	6.12^{de}	9.05	13.73
T_7	4.40^{ab}	85.47	6.83^{bc}	6.85^{abc}	6.84^{cd}	8.53	14.00
T_8	3.87^{c}	85.95	7.03^{b}	6.92^{abc}	6.98^{bcd}	8.60	14.05
T_9	3.88^{c}	83.40	6.76^{bcd}	6.64^{bc}	6.69^{cde}	8.63	14.10
T_{10}	3.89^{c}	81.65	7.06^{b}	6.41^{bc}	6.73^{cd}	8.00	12.03
Mean	4.15	86.75	6.95	6.92	6.93	9.67	13.34
SEm±	0.16	6.57	0.43	0.38	0.32	0.43	0.78
CD @5%	0.47	NS	1.23	1.08	0.91	NS	NS
CV (%)	8.77	16.94	13.84	12.21	10.28	11.00	13.14

Table 2.49: Reproductive parameters during the year 2023

Treatment	Flowering time	Duration of flowering (days)	Nut weight (g	Apple weight (g)	Shelling %	Nut yield (kg/tree)	Cumulative yield (kg/plant)
T_1	Nov (Early)	95	8.49	60.75	29.21	3.02	3.02
T_2	Nov (Early)	95	8.43	57.96	30.58	2.51	2.51
T_3	Nov (Early)	97	8.65	61.65	27.83	2.20	2.20
T_4	Nov (Early)	102	8.60	62.15	28.80	2.72	2.72
T_5	Nov (Early)	94	8.60	63.48	29.11	3.05	3.05
T_6	Nov (Early)	95	8.86	61.07	28.1	3.18	3.18
T_7	Nov (Early)	103	6.84	58.28	28.47	2.56	2.56
T_8	Nov (Early)	98	7.63	61.04	27.91	2.36	2.36
T_9	Nov (Early)	97	7.26	60.27	26.33	3.07	3.07
T_{10}	Nov (Early)	104	7.74	56.26	30.40	2.29	2.29
Mean			8.11	60.29	28.77	2.70	-
SEm±			0.50	2.50	1.13	0.34	-
CD @5%			NS	NS	NS	NS	-
CV (%)			13.86	8.81	8.81	27.91	-

The experiment was conducted in variety Dhana planted at a spacing of 5 X 5 m. Significant difference was observed among treatments in tree height and average spread of canopy. The tree height was highest in the control plot (4.68). The average canopy spread was significantly high (8.13 m) in treatment T_5 (25% leader in August). The canopy spread of Treatment T_1 (Control) and T_2 (25% leader in June) were on par with treatment T_5 (7.4 m and 7.8 m respectively). Significantly lower canopy spread was observed in treatment T_4(5.81 m), T_6 (6.12 m) and T_9 (6.68 m). The various pruning treatments in the variety Dhana had no significant influence on stem girth, nut yield per tree, nut weight, apple weight and shelling per cent, number of flowering and non-flowering laterals during the first year of experiment. [Table No. 2.48]

VENGURLA

Year of planting : June, 2021
Variety : Vengurla-4
No. of trees req./ treat/rep. : 10
Total number of plants :100 (30 trees x 3 months= 90 for treatment imposition for 3 months + 10 trees for control)

Table 2.50: Growth parameters during the year 2023

Treatments	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy (m)	Flowering laterals /m²	Non-flowering laterals /m²
			E-W	N-S			
T_1	6.42	63.60	6.49	7.20	6.84	10.00	12.20
T_2	6.29	69.30	7.53	6.70	7.11	8.60	11.60
T_3	6.30	82.00	7.09	6.97	7.03	9.20	11.00
T_4	6.27	77.00	6.06	6.18	6.12	8.60	10.20
T_5	6.24	69.60	6.18	5.98	6.08	11.60	12.80
T_6	6.22	68.90	6.28	6.32	6.30	10.20	13.40
T_7	6.30	76.70	6.00	5.92	5.96	8.40	10.80
T_8	6.21	78.90	7.53	6.79	7.16	7.80	10.20
T_9	6.23	85.20	8.68	7.54	8.11	8.60	10.60
T_{10}	6.28	69.20	6.32	6.69	6.50	9.40	14.00
Mean	6.28	74.04	6.82	6.63	6.72	9.24	11.68
SEm ±	0.03	4.05	0.45	0.38	0.37	0.49	0.60
CD @5%	0.09	11.66	1.31	N.S.	1.06	1.40	1.71
CV (%)	1.17	12.23	14.89	12.65	12.20	11.73	11.39

Table 2.51: Reproductive parameters during the year 2023

Treatments	Flowering time	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/ tree)	Cumulative Yield (kg/plant)
T_1	Nov. (Early)	96.30	8.22	47.36	29.58	9.00	17.90
T_2	Nov. (Early)	95.80	8.80	46.14	30.22	10.09	19.68
T_3	Nov. (Early)	95.60	8.44	50.88	29.92	10.89	20.06
T_4	Nov. (Early)	97.10	8.68	55.84	30.14	10.12	20.51
T_5	Nov. (Early)	96.10	8.64	59.92	29.86	13.50	26.00
T_6	Nov. (Early)	96.30	8.76	55.58	29.04	11.08	22.41
T_7	Nov. (Early)	96.50	8.80	51.96	29.42	9.90	19.08
T_8	Nov. (Early)	96.10	8.44	50.02	30.04	9.78	19.22
T_9	Nov. (Early)	96.10	8.40	48.56	29.70	10.00	20.86
T_{10}	Nov. (Early)	96.60	8.32	46.18	30.00	10.50	20.58
Mean		96.25	8.55	51.24	29.79	10.49	20.63
SEm ±		0.39	0.13	1.36	0.31	0.37	-
CD @5%		N.S.	N.S.	3.93	N.S.	1.08	-
CV (%)		0.91	4.95	5.96	2.32	7.96	-

Among the treatments, the results for flowering duration (days) were non-significant. The results regarding yield attributes showed significant results except nut weight (g) and shelling percentage. The maximum apple weight (59.92 g) was observed in treatment T_5 (25% leader in August), and it was significantly superior over the rest of the treatments. The yield data showed that the treatment T_5 (the 25% leader) in August (13.50 kg/tree) was significantly superior over the rest of the treatments. Similarly, the highest cumulative yield for 2 harvests (26.00 kg/tree) noted in treatment T_5.

HOGALAGERE

Experimental details

Year of Start : August, 2021
Variety : Chintamani-1

Table 2.52: Growth parameters as influenced by different pruning response during the year 2022-23

Treatment details	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Average spread of the canopy (m)
			E-W	N-S	
T_1	3.48	62.80	6.04	6.15	6.10
T_2	4.22	74.30	7.13	7.28	7.20
T_3	4.87	81.00	7.68	8.28	7.98
T_4	3.85	69.70	6.84	6.71	6.77
T_5	3.67	68.40	6.16	6.45	6.31
T_6	5.39	84.80	8.29	8.92	8.60
T_7	5.14	84.30	8.11	8.42	8.27
T_8	4.59	76.60	7.34	7.58	7.46
T_9	4.65	78.40	7.65	7.95	7.80
T_{10}	4.10	72.20	6.71	6.94	6.82
Mean	4.40	75.25	7.20	7.47	7.33
SEm±	0.17	1.98	0.16	0.13	0.10
CD @5%	0.50	5.67	0.47	0.36	0.27
CV(%)	8.85	5.87	5.05	3.75	4.91

The treatment with 25% lateral shoot pruning in September (T_6) was recorded with higher growth parameters like number of flowering laterals/sq meter (28.60 no.) and lower non-flowering laterals/sq. meter (3.0 no.) as compared to other treatments (Table 2.52).

Table 2.53: Yield parameters as influenced by different pruning response during the year 2022-23

Treatment details	Flowering time	Duration of flowering (days)	Flowering laterals/m^2	Non-flowering laterals/m^2	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut yield (kg/ tree)	Cumulative yield (kg/ plant)
T_1	February (late)	91	16.40	10.20	6.92	28.62	29.22	7.94	10.69
T_2		96	22.70	7.20	7.31	35.75	29.75	9.38	13.02
T_3		99	26.50	5.10	7.49	36.44	29.90	10.69	14.57
T_4		94	20.10	8.80	7.19	34.93	29.43	8.37	11.93
T_5		92	18.40	9.10	7.01	31.50	29.33	8.04	11.55
T_6		104	28.60	4.00	7.69	37.66	30.20	12.51	16.52

T_7		102	26.80	4.20	7.60	36.76	30.17	11.84	15.80
T_8		97	24.40	6.70	7.39	36.17	29.65	9.84	13.50
T_9		98	24.70	6.20	7.42	35.98	29.81	10.05	13.86
T_{10}		95	22.10	8.00	7.07	32.10	29.55	9.16	12.74
Mean	-	97	23.07	6.85	7.31	34.59	29.70	9.78	13.42
SEm±	-	2.03	0.51	0.28	015	1.16	0.42	0.50	0.54
CD @5%	-	5.82	1.45	0.81	0.44	3.32	1.22	1.45	1.54
CV (%)	-	4.68	4.90	9.18	4.66	7.48	3.21	11.52	8.97

Nut yield and cumulative yield (kg/plant) were also recorded higher in 25% lateral pruning in September (12.51 and 16.52 kg/plant, respectively) as compared to control (7.94 and 10.69 kg/plant, respectively). The B:C ratio was noticed to be higher in T_6 (2.36).

Hort.13 : Development of Cashew based cropping system

Centers: East Coast : Vridhachalam
West Coast : Madakkathara, Pilicode

The project aims to identify the most beneficial intercrop and also the effect on soil properties and finally the economic benefits of various cropping systems.

VRIDHACHALAM

Experiment details

Date of planting : 20.12.2023
Main Crop : Cashew -VRI-3
Design : RCBD
Spacing :
Main Crop : Cashew – 10 X 5 m

Sub Plot
Pomegranate- 2.5 x 2.5 m
Guava-5 x 5m
Acid Lime - 6 x 6m
Amla - 6 x 6m
Custard Apple - 4 x 4m

Replication: 3

Treatments: 7

T_1- Control (Cashew alone)
T_2-Cashew + Pomegranate
T_3-Cashew +Guava
T_4-Cashew +Custard Apple
T_5- Cashew + Acid Lime
T_6- Cashew +Amla
T_7- Cashew +Cover crop (Sun hemp)

MADAKKATHARA

The experiment will be initiated in the coming season. The land clearing was partially completed. Cashew grafts have been produced for planting in the experimental plot.

PILICIODE

Experimental details:

Design	: RBD
Treatments	: 7
Replication	: 3

Spacing: 10 X 5 m, one fruit plant will be planted in the middle of four cashew plants.

Treatment details:

T_1: Cashew + Mango (Arka Suprabhath)
T_2: Cashew + Guava (Arka Kiran)
T_3: Cashew + Lime (Balaji)
T_4: Cashew + Rambutan (Arka Coorg Prathip)
T_5: Cashew + Avocado (Arka Supreme)
T_6: Cashew + Sitaphal (Arka Sahan)
T_7: Cashew alone

The experiment will be initiated in the coming season. Treatment combinations and varieties of fruit crops have been finalized and process has been started for obtaining planting materials.

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

Centers: East Coast : Bapatla, Bhubaneshwar, and Vridhachalam
West Coast : Madakkathara, Paria and Vengurla
Plains / others: Jagdalpur and Kanabargi

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.

BAPATLA

Experimental details:

Treatments: 07

Treatment details:

T_1	:	Thiamethoxam 25 WG	:	0.2 g/l
T_2	:	Imidacloprid 200 SL	:	0.3ml/l
T_3	:	Carbosulfan 25 EC	:	2.0 ml/l
T_4	:	Thiacloprid 25 SC	:	1.5 ml/l
T_5	:	λ – Cyhalothrin 5 EC	:	0.6ml/l

T_6: Monocrotophos 36 SL (1.6 ml/l) at flushing, Chlorpyriphos 20 EC (2.0 ml/l) at flowering and Profenofos 50 EC (1.0 ml/l) at fruit & nut development stage.

T_7 : Untreated check

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

During the year 2022-23, the incidence of different important foliage, flower and nut feeding pests of cashew was very low during the season. During this season the incidence of Tea mosquito bug infestation was not observed. The incidence of regional important pests like leaf and blossom webber, leaf miner, shoot tip cater pillar and apple and nut borer was very low (< 5 per cent of incidence). Hence treatments were not imposed during the season.

BHUBANESHWAR

Details of Treatment:

T_1	:	Thiamethoxam 25 WG	:	0.1 g/l
T_2	:	Thiamethoxam 25 WG	:	0.2 g/l
T_3	:	Carbosulfan 25 EC	:	2.0 ml/l
T_4	:	Buprofezin 25 SC	:	2.0 ml/l
T_5	:	*Beauveria bassiana* WP	:	1.0 g/l
T_6	:	*Beauveria bassiana* WP	:	5.0 g/l
T_7	:	λ – Cyhalothrin 5 EC	:	0.6 ml/l
T_8	:	Untreated check		

Insect pests namely shoot tip caterpillar (STC), flower thrips, leaf thrips and leaf minor incidence were noticed with variable intensity during the season in 2023. The STC incidence varied from 4.80 to 6.36 per cent damaged shoot before spraying and was significant. Significantly, least STC incidence was recorded in the treatment L cyhalothrin (T_7) followed by T_2 and T_3 with infestation varying from 0.029 to 0.065 damaged shoot as against 1.068 damaged shoot in untreated control (Table No 3.01). The leaf thrips incidence varied from 0.747 to 1.086 per leaf before spraying. Significantly minimum population (0.029-1.068/leaf) of the pest was observed in T_4, T_2 and T_3 at 15 days after spraying as against 1.068 leaf thrips was recorded in the untreated control. The leaf damaged (%) by leaf minor varied from 5.10 to 9.03% before insecticidal treatment and the maximum damaged percent recorded in T_7 followed by T_2 and T_1 with untreated check 9.22 %.

The spider population varied from 1.12 to 3.64 per lateral among the treatments. The spider population was higher in T_1 (Thiamethoxam) T_4, and T_5 i.e, *Beauveria microbial* insecticides.

Table 3.01: Efficacy of different Insecticides on insect pests of cashew during 2023

Trt.	Leaf Thrips		Flower Thrips		Shoot tip caterpillar		Leaf miner	
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre-treatment % damage	Post treatment % damage	Pre-treatment % damage	Post treatment % damage
T1	0.857 (1.36)	0.065 (1.03)	1.08 (1.44)	0.73 (1.31)	5.26 (2.50)	3.17 (2.04)	7.28 (2.88)	3.80 (2.19)
T2	0.847 (1.36)	0.035 (1.02)	1.14 (1.46)	0.28 (1.13)	4.80 (2.41)	1.66 (1.63)	5.10 (2.47)	1.73 (1.65)
T3	0.747 (1.32)	0.037 (1.09)	1.26 (1.50)	0.46 (1.21)	6.15 (2.68)	2.85 (1.96)	8.00 (3.00)	5.12 (2.47)
T4	0.770 (1.33)	0.029 (1.01)	1.62 (1.62)	0.82 (1.35)	5.35 (2.52)	3.64 (2.15)	7.78 (2.96)	6.74 (2.78)
T5	0.827 (1.35)	0.066 (1.03)	1.03 (1.43)	1.03 (1.43)	5.21 (2.49)	3.50 (2.12)	9.03 (3.17)	7.83 (2.97)
T6	0.813 (1.35)	0.049 (1.02)	1.14 (1.46)	0.85 (1.36)	5.73 (2.59)	4.35 (2.31)	7.12 (2.85)	6.83 (2.79)
T7	0.813 (1.35)	0.061 (1.03)	1.19 (1.48)	0.21 (1.10)	6.36 (2.71)	1.23 (1.49)	8.62 (3.10)	1.28 (1.50)
T8	1.086 (1.44)	1.068 (1.44)	1.18 (1.48)	1.21 (1.49)	5.32 (2.51)	5.79 (2.61)	7.43 (2.90)	9.22 (3.19)
CD 5%	0.017	0.008	0.018	0.015	0.075	0.062	0.043	0.115
SE(m) ±	0.006	0.003	0.006	0.005	0.025	0.02	0.014	0.038
CV (%)	0.704	0.426	0.683	0.671	1.667	1.714	0.843	2.669

*****Values in the parentheses of damage score are square root transformation values.

VRIDHACHALAM

The following treatments were imposed as per approved technical programme.

T-1 : Thiamethoxam 25 WG @ 0.2 g/ L all the three sprays
T-2 : Imidachloprid 200 SL @ 0.6 ml/lit. all the three sprays
T-3 : Carbosulfan 25 EC @ 2 ml/L all the three sprays
T-4 : Thiacloprid 25 SC @1.5 ml/L all the three sprays
T-5 : λ-Cyhalothrin 5 EC -(0.6ml/lit) all the three sprays
T-6 : POP Recommendation by the University
T-7 : Untreated control

The findings showed that, following three spraying cycles, the POP recommendation (Thiamethoxam 25 WG @ 0.2 g/ L (I spray), Lambda-Cyhalothrin 5 EC @ 0.6 ml/L (II spray), and Carbosulfan 25 EC @ 2 ml/L (III spray)) was the most effective treatment in terms of reducing the damage and TMB population (Tables 3.02). Besides, POP-treated trees produced the highest yield of 7.4 kg/tree followed by λ-Cyhalothrin 5 EC (0.6 ml/lit) treated trees which produced 6.8 kg/tree. Both the treatments were shown to be safe for pollinators at 15 DAS as compared to 1DAS and 7DAS. The insecticides' overall efficacy was as follows: T6 > T5 > T1 > T2 > T4 > T3. The natural enemy population were less in insecticide treated field compared to untreated trees.

Table 3.02: Effect of insecticides on the incidence of TMB at Vridhachalam

Treatments	Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)	
		I Spray			II Spray			III Spray	
		7 DAS	15 DAS		7 DAS	15 DAS		7 DAS	15 DAS
T1	2.81 (1.95)	1.60 (1.61)	0.83 (1.35)	3.39 (2.09)	0.92 (1.38)	0.58 (1.25)	3.53 (2.13)	0.59 (1.26)	0.26 (1.12)
T2	2.84 (1.9)	1.94 (1.71)	1.06 (1.43)	3.38 (2.09)	1.37 (1.53)	0.80 (1.34)	3.53 (2.12)	1.31 (1.52)	0.66 (1.29)
T3	2.81 (1.95)	2.62 (1.90)	1.75 (1.66)	3.39 (2.09)	2.01 (1.73)	1.32 (1.52)	3.50 (2.12)	1.85 (1.68)	0.92 (1.38)
T4	2.84 (1.96)	2.53 (1.87)	1.31 (1.52)	3.40 (2.09)	1.73 (1.65)	0.93 (1.38)	3.52 (2.12)	1.58 (1.60)	0.88 (1.37)
T5	2.81 (1.95)	1.11 (1.45)	0.56 (1.25)	3.40 (2.09)	0.90 (1.37)	0.52 (1.23)	3.57 (2.13)	0.49 (1.22)	0.23 (1.11)
T6	2.86 (1.96)	1.13 (1.45)	0.64 (1.28)	3.40 (2.10)	0.43 (1.21)	0.29 (1.13)	3.55 (2.13)	0.24 (1.11)	0.07 (1.03)
T7	2.86 (1.96)	3.24 (2.06)	3.33 (2.08)	3.40 (2.09)	3.46 (2.11)	3.52 (2.12)	3.58 (2.14)	3.65 (1.87)	3.68 (2.16)
CD	NS	0.02	0.03	NS	0.02	0.04	NS	0.32	0.04
SE(m)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.11	0.01
SE(D)	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.16	0.02
CV	1.14	1.06	1.37	0.4	1.06	1.85	0.71	14.97	2.07

DAS – Days After Spraying

Values in the parentheses are $\sqrt{x+0.5}$ transformed values; POP recommendation: Thiamethoxam 25 WG @ 0.2 g/ L, λ-Cyhalothrin 5 EC @ 0.6ml/L, Carbosulfan 25 EC @ 2 ml/L

Table 3.03: Efficacy of insecticides on TMB population / 24 leader shoots at Vridhachalam

Treatments	Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)	
		I Spray			II Spray			III Spray	
		7 DAS	15 DAS		7 DAS	15 DAS		7 DAS	15 DAS
T1	8.17 (3.02)	2.16 (1.78)	1.36 (1.43)	8.63 (3.103	1.16 (1.47)	1.05 (1.43)	9.52 (3.24)	0.45 (1.20)	0.23 (1.11)
T2	8.18 (3.03)	3.26 (2.05)	1.73 (1.53)	8.61 (3.102	1.57 (1.60)	1.35 (1.53)	9.52 (3.24)	1.43 (1.56)	0.65 (1.28)
T3	8.19 (3.03)	3.96 (2.22)	2.40 (1.80)	8.61 (3.10)	2.73 (1.93)	2.27 (1.80)	9.51 (3.24)	1.95 (1.71)	1.24 (1.49)
T4	8.20 (3.03)	3.68 (2.16)	1.98 (1.62)	8.62 (3.10)	1.78 (1.66)	1.65 (1.62)	9.52 (3.24)	1.62 (1.62)	0.93 (1.39)
T5	8.17 (3.03)	1.69 (1.64)	0.94 (1.35)	8.62 (3.103	0.95 (1.39)	0.82 (1.35)	9.54 (3.24)	0.22 (1.10)	0.11 (1.05)
T6	8.16 (3.02)	1.68 (1.63)	0.95 (1.21)	8.63 (3.10)	0.560 (1.24)	0.47 (1.21)	9.52 (3.24)	0.12 (1.06)	0.06 (1.03)
T7	8.14 (3.02)	8.32 (3.05)	8.47 (3.21)	8.63 (3.10)	8.82 (3.13)	9.34 (3.21)	9.53 (3.24)	12.41 (3.66)	13.42 (3.79)
CD	NS	0.05	0.05	NS	0.03	0.05	NS	0.02	0.02
SE(m)	0.004	0.018	0.017	0.001	0.012	0.017	0.001	0.007	0.009
SE(D)	0.006	0.026	0.024	0.001	0.017	0.024	0.001	0.01	0.013
CV	0.281	1.736	1.91	0.05	1.326	1.91	0.045	0.862	1.16

Table 3.04: Efficacy of insecticides on Per cent reduction of TMB population / 24 leader shoots at Vridhachalam

Tr.	I Spray		II Spray		III Spray	
	% reduction over control		% reduction over control		% reduction over control	
	7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS
T1	73.95	77.68	69.75	88.67	96.32	98.25
T2	60.79	71.99	57.34	85.46	88.45	95.16
T3	52.42	61.08	49.44	75.67	84.30	90.74
T4	55.78	88.44	52.61	82.34	86.91	93.01
T5	79.60	78.86	75.08	91.19	98.19	99.14
T6	79.72	77.27	75.19	94.91	98.99	99.49
T7	-	-	-	-	-	-

POP recommendation: Thiamethoxam 25 WG @ 0.2 g/ L, Lambda-Cyhalothrin 5 EC @ 0.6ml/L, Carbosulfan 25 EC @ 2 ml/L
Mean of three replications

Table 3.05: Efficacy of insecticides against foliar pests in cashew

Trt.	Mean damage after 3rd spray						YIeld Kg/tree
	TMB Damage % damage		Leaf Miner % damage		Leaf and Blossom Webber % damage		
	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	
T1	5.83 (13.97)	0.47 (3.94)	8.53 (16.97)	4.162 (11.76)	11.58 (19.88)	1.90 (7.93)	6.81 (2.80)
T2	5.85 (13.99)	0.71 (4.79)	8.40 (16.84)	4.41 (12.12)	11.68 (19.98)	1.96 (8.06)	6.71 (2.78)
T3	5.85 (13.99)	0.95 (5.61)	8.32 (16.76)	4.97 (12.88)	11.77 (20.06)	2.59 (9.25)	6.45 (2.73)
T4	5.86 (14.01)	0.84 (5.27)	8.36 (16.80)	4.85 (12.71)	11.73 (20.0)	2.46 (9.03)	6.58 (2.75)
T5	5.83 (13.97)	0.39 (3.59)	8.33 (16.77)	3.62 (10.97)	11.53 (19.84)	1.92 (7.96)	6.98 (2.83)
T6	5.83 (13.97)	0.19 (2.53)	8.51 (16.95)	3.40 (10.62)	11.58 (19.89)	1.38 (6.74)	7.35 (2.89)
T7	5.87 (14.01)	6.91 (15.23)	8.64 (17.09)	9.94 (18.37)	11.76 (20.04)	18.80 (25.68)	5.93 (2.63)
CD	NS	0.49	NS	0.158	NS	0.26	0.02
SE(m)	0.01	0.17	0.07	0.05	0.10	0.09	0.01
SE(D)	0.01	0.24	0.10	0.08	0.14	0.13	0.01
CV	0.13	5.69	0.85	0.83	1.01	1.66	0.62

Table 3.06: Efficacy of insecticides against foliar pests in cashew

Trt.	Mean damage after 3rd spray					
	Leaf Thrips Population (Nos.)		Thrips Damage grade (0-4 score)		Apple and Nut Borer % damage	
	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS
T1	12.68 (20.85)	2.57 (1.89)	1.30 (1.51)	0.51 (1.24)	4.28 (11.86)	0.55 (4.29)
T2	12.61 (20.79)	2.83 (1.95)	1.23 (1.49)	0.83 (1.35)	4.15 (11.75)	0.64 (4.78)
T3	12.69 (20.86)	3.19 (2.04)	1.26 (1.50)	0.96 (1.40)	4.16 (11.77)	0.86 (5.22)
T4	12.53 (20.72)	2.91 (1.97)	1.30 (1.51)	0.68 (1.29)	4.16 (11.76)	0.61 (4.64)
T5	12.72 (20.89)	2.25 (1.80)	1.26 (1.50)	0.50 (1.22)	4.24 (11.88)	0.49 (3.88)
T6	12.57 (20.76)	1.63 (1.62)	1.34 (1.52)	0.31 (1.14)	4.28 (11.86)	0.39 (3.21)
T7	12.68 (20.85)	15.67 (4.08)	1.40 (1.54)	2.85 (1.96)	4.13 (11.76)	6.30 (14.58)
CD	NS	0.078	NS	0.047	NS	0.445
SE(m)	0.09	0.03	0.02	0.02	0.05	0.15
SE(D)	0.13	0.04	0.03	0.02	0.07	0.21
CV	0.86	2.37	2.71	2.28	0.83	5.11

Table 3.07: Field evaluation of insecticides for residual toxicity against Tea Mosquito Bug and its damage at Vridhachalam

Treatments	No. of adults survived after 24 hours after caging on			Damage grade (0-4 scale) 48 h after caging		
	Same day	Third day	Seventh day	Same day	Third day	Seventh day
T1	0.00	1.75	4.15	1.30 (1.51)	2.64 (1.90)	3.22 (2.05)
T2	0.00	2.23	3.50	1.32 (1.52)	2.48 (1.86)	3.27 (2.07)
T3	0.00	3.13	4.33	1.37 (1.53)	2.44 (1.85)	3.35 (2.08)
T4	0.00	2.60	4.63	1.59 (1.61)	2.67 (1.91)	3.25 (2.06)
T5	0.00	1.23	3.46	1.29 (1.51)	2.68 (1.92)	3.26 (2.06)
T6	0.00	2.23	3.35	1.19 (1.48)	2.18 (1.78)	3.13 (2.03)
T7	6.00	6.00	5.50	2.89 (1.97)	3.62 (2.15)	3.88 (2.21)
CD				0.09	0.05	0.02
SE(m)				0.03	0.01	0.01
SE(D)				0.042	0.02	0.01
CV				3.208	1.705	0.726

MADAKKATHARA

Experimental details:

No. of replications : 3
No. of trees per replication : 2
Design : RCBD
Variety : Madakkathara – 1
Age of the tree : 21

T_1 : Thiamethoxam 25 WG : 0.1 g/l
T_2 : Thiamethoxam 25 WG : 0.2 g/l
T_3 : Carbosulfan 25 EC : 2 ml/l
T_4 : Thiacloprid : 1.5 ml/l
T_5 : λ – Cyhalothrin 5 EC : 0.6 ml/l
T_6 : POP, KAU (L-cyhalothrin-quinalphos-thiamethoxam)
T_7 : Untreated check

The trial was conducted in the early season variety Madakkathara – 1. Significantly lower TMB damage was recorded in treatment, Thiacloprid 25 SC @ 1.5 ml/L, Lambda cyhalothrin and POP, KAU (L-cyhalothrin-quinalphos-thiamethoxam) (Table 3.8). Thiacloprid @ 1.5 ml/L recorded the highest B:C ratio of 2.25 (Table 3.9). The infestation of thrips and leaf miner was noticed in the experimental plot. Significantly lower leaf miner infestation was recorded in all

treatments to the control. However, there was no significant difference in thrips infestation. There was no significant difference in population of natural enemies.

Table 3.08: Efficacy of different insecticides on insect pests of cashew during 2023

Treatment	Mean damage after third spray					
	TMB		Thrips		Leaf miner	
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment % damage	Post treatment % damage
T1	0.58	0.22	0.174	0.27	2.06	3.81
	-1	(0.848)[a]	-0.821	-0.878	-1.578	(2.046)[b]
T2	0.62	0.144	0.236	0.13	2.07	5.58
	-1.2	(0.802)[b]	-0.858	-0.79	-1.58	(2.464)[b]
T3	0.42	0.19	0.313	0.26	3.1	6.83
	-0.96	(0.830)[ab]	-0.901	-0.859	-1.89	(2.647)[b]
T4	0.37	0.055	0.292	0.22	16.62	5.62
	-1	(0.744)[c]	-0.89	-0.842	-4.135	(2.449)[b]
T5	0.3943	0.072	0.25	0.198	4.47	3.77
	-0.94	(0.753)[C]	-0.866	-0.829	-2.16	(2.680)[b]
T6	0.44	0.073	0.319	0.173	18.72	6.65
	-0.97	(0.757)[c]	-0.905	-0.815	-4.364	(2.67)[b]
T7	0.42	0.242	0.439	0.197	7.61	5.81
	-0.96	(0.846)[a]	-0.968	-0.831	-2.76	(3.345)[a]
Mean	0.51	0.16	0.289	0.153	7.63	6.56
CD @5%	NS	0.04	NS	NS	NS	0.654
SE(m) ±	0.047	0.013	0.018	0.032	0.261	0.212
CV (%)	8.198	2.753	3.57	6.8	17.39	14.052

Table 3.09: Yield and economics of cashew in chemical control trial during 2023

Treatment details	Yield of Cashew (t/ ha)	Cost of Cultivation (Rs /ha)	Returns (Rs. /ha)		B: C
			Total	Net	
T1	2.03	73999	229482	155483	2.10
T2	2.10	75998	234270	158272	2.08
T3	1.88	82771	214662	131891	1.59
T4	2.32	81180	264138	182958	2.25
T5	2.02	74080	230052	155972	2.11
T6	2.06	75608	234270	158662	2.10
T7	1.38	72000	157662	85662	1.19

It was noticed that the treatment T4 -Thiacloprid 1.5 ml/L gave the highest B: C ratio of 2.25 which also the highest net returns of Rs. 182958 during the study.

PARIA

T_1: Thiamethoxam 25% WG 1g/10 lit
T_2: Thiamethoxam 25% WG 2g/10 lit
T_3: Carbosulfan 25% EC 20ml/10lit
T_4: Buprofezin 25% SC 20 ml/10 lit
T_5: *Beauveria bassiana* 10 g/10 lit
T_6: *Beauveria bassiana* 50 gm/10 lit
T_7: L-Cyhalothrin 5% EC 6 ml /10 lit
T_8: Untreated control

After the first spray, the results revealed significantly the lowest (0.33 damage score) shoot damage by TMB when crop was treated with carbosulfan found statistically at par with buprofezin (0.40 damage score), L- cyhalothrin (0.46 damage score) and thiamethoxam (0.005%) with 0.55 damage score. The next two most effective treatments were thiamethoxam @ 0.0025% (0.72 damage score) and *beauveria bassiana* @ 50 gm with 0.79 damage score. After the second spray, the treatment carbosulfan was found to be superior to all other treatments for managing TMB with significantly the lowest (0.26 damage score) shoot damage and which was on par with buprofezin with 0.30 damage score. The highest shoot damage score was observed in control after all the spray. The order of effectiveness of various treatments against TMB was found to be carbosulfan 0.05% ≥ buprofezin 0.05% ≥ L-cyhalothrin 0.003% ≥ thiamethoxam 0.005% > thiamethoxam 0.0025% ≥*Beauveria bassiana* 1 x 10^8cfu/ml @ 50 gm/10 lit water >*Beauveria bassiana* 1 x 10^8cfu/ml @ 10 gm/10 lit water > control [Table No. 3.10].

In the case of panicle damage by TMB, carbosulfan recorded the lowest (0.31 damage score) panicle damage after the second spray and was found statistically at par with buprofezin with 0.39 damage score. The next two most effective treatments were L- cyhalothrin with 0.53 damage score and thiamethoxam @ 0.005% with 0.67 damage score. A similar trend was observed after the third spray in which the significantly lowest (0.24 damage score) panicle damage was observed in carbosulfan. The order of effectiveness of various treatments against TMB was found to be carbosulfan 0.05% ≥ buprofezin 0.05%> L- cyhalothrin 0.003% > thiamethoxam 0.005% >*Beauveria bassiana* 1 x 108 cfu/ml @ 50 gm/10 lit water ≥ thiamethoxam 0.0025% >*Beauveria bassiana* 1 x 108 cfu/ml @ 10 gm/10 lit water > control [Table No.3.11].

The percent damage reduction over control of various insecticides against TMB incidence on laterals and panicles at 15 days after spray was calculated. Among all the treatments, the carbosulfan 25% SC 20 ml/10 lit was found to be most effective with 89.70 percent damage reduction over control on the laterals at 15 days after first spray. After the second and third spray carbosulfan 25% SC 20 ml/10 lit was found to be an effective treatment with 91.14 and 91.45 percent damage reduction over control on laterals. In the case of panicles, carbosulfan 25% SC 20 ml/10 lit water was found superior to all other treatments for managing TMB with 89.07 and 91.43 percent damage reduction over control after the second and third spray [Table No. 3.12].

Yield Economics

The results revealed that during 2022-23, the maximum yield (898 kg/ha) was obtained in carbosulfan25% SC 20 ml/10 lit while the lowest yield was noted in control. Considering the economics of the treatments, the highest net realization (69826.00) was observed in L-Cyhalothrin 5% EC 6 ml/10 lit. While in the case of B:C ratio, it was highest with L-Cyhalothrin 5% [Table No. 3.10]

Table 3.10: Efficacy of different insecticides against tea mosquito bug incidence in cashew at Paria Centre during the year 2022-23

Treat. No.	On shoots (Damage score 0-4)															
	First spray				Second spray				Third spray				Pooled			
	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Pooled
T_1	1.43 (1.56)	1.15 (0.83)	1.06 (0.61)	1.10 (0.72)	1.42 (1.52)	1.21 (0.96)	1.12 (0.76)	1.16 (0.86)	1.35 (1.33)	1.17 (0.86)	1.15 (0.82)	1.16 (0.84)	1.40 (1.47)	1.18 (0.88)	1.11 (0.73)	1.14 (0.81)
T_2	1.40 (1.45)	1.10 (0.70)	0.95 (0.39)	1.02 (0.55)	1.42 (1.50)	1.06 (0.63)	0.97 (0.43)	1.01 (0.53)	1.36 (1.36)	1.05 (0.60)	0.96 (0.41)	1.00 (0.51)	1.39 (1.44)	1.07 (0.64)	0.96 (0.41)	1.01 (0.53)
T_3	1.43 (1.54)	0.99 (0.48)	0.83 (0.18)	0.91 (0.33)	1.38 (1.40)	0.93 (0.36)	0.81 (0.16)	0.87 (0.26)	1.38 (1.40)	0.89 (0.30)	0.80 (0.14)	0.85 (0.22)	1.39 (1.45)	0.94 (0.38)	0.81 (0.16)	0.88 (0.27)
T_4	1.41 (1.5)	1.01 (0.53)	0.87 (0.26)	0.94 (0.40)	1.44 (1.58)	0.96 (0.41)	0.83 (0.19)	0.89 (0.30)	1.37 (1.38)	0.93 (0.37)	0.84 (0.21)	0.89 (0.29)	1.41 (1.49)	0.97 (0.44)	0.85 (0.22)	0.91 (0.33)
T_5	1.42 (1.52)	1.40 (1.45)	1.37 (1.39)	1.39 (1.42)	1.45 (1.60)	1.37 (1.37)	1.35 (1.32)	1.36 (1.35)	1.36 (1.35)	1.33 (1.26)	1.32 (1.24)	1.32 (1.25)	1.41 (1.49)	1.36 (1.36)	1.35 (1.31)	1.36 (1.34)
T_6	1.43 (1.55)	1.18 (0.89)	1.09 (0.68)	1.13 (0.79)	1.40 (1.47)	1.22 (1.00)	1.15 (0.82)	1.19 (0.91)	1.35 (1.31)	1.16 (0.84)	1.11 (0.73)	1.13 (0.78)	1.39 (1.44)	1.19 (0.91)	1.11 (0.74)	1.15 (0.83)
T_7	1.42 (1.51)	1.05 (0.61)	0.90 (0.32)	0.98 (0.46)	1.40 (1.46)	1.03 (0.57)	0.94 (0.39)	0.99 (0.48)	1.37 (1.38)	1.01 (0.53)	0.87 (0.26)	0.94 (0.39)	1.40 (1.45)	1.03 (0.57)	0.91 (0.32)	0.97 (0.44)
T_8	1.41 (1.50)	1.46 (1.64)	1.51 (1.78)	1.49 (1.71)	1.47 (1.65)	1.49 (1.72)	1.52 (1.81)	1.50 (1.76)	1.41 (1.50)	1.44 (1.58)	1.46 (1.64)	1.45 (1.61)	1.43 (1.55)	1.47 (1.65)	1.50 (1.74)	1.48 (1.69)
SEm.±	0.05	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.04	0.05	0.03	0.04	0.03	0.03	0.02	0.03
CD at 5%	NS	0.16	0.14	0.13	NS	0.14	0.13	0.11	NS	0.14	0.10	0.11	NS	0.10	0.07	0.08
CV (%)	5.83	7.93	7.32	9.50	6.14	7.06	6.65	7.67	5.07	7.28	5.62	7.92	6.54	9.02	6.70	10.12
Figures are $\sqrt{X + 0.5}$ transformed values and those in parentheses are original values.																

Table 3.11: Efficacy of different insecticides against tea mosquito bug incidence in cashew at Paria Centre during the year 2022-23

Treat. No.	On panicles (Damage score 0-4)											
	Second spray				Third spray				Pooled			
	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Pooled
T_1	1.47 (1.66)	1.29 (1.16)	1.22 (0.98)	1.25 (1.07)	1.43 (1.54)	1.27 (1.12)	1.18 (0.90)	1.23 (1.01)	1.45 (1.60)	1.28 (1.14)	1.20 (0.94)	1.24 (1.04)
T_2	1.42 (1.53)	1.12 (0.74)	1.04 (0.59)	1.08 (0.67)	1.45 (1.59)	1.14 (0.81)	1.06 (0.63)	1.10 (0.72)	1.44 (1.56)	1.13 (0.78)	1.05 (0.61)	1.09 (0.69)
T_3	1.47 (1.65)	0.95 (0.41)	0.84 (0.20)	0.90 (0.31)	1.45 (1.62)	0.91 (0.32)	0.81 (0.15)	0.86 (0.24)	1.46 (1.63)	0.93 (0.37)	0.82 (0.18)	0.88 (0.27)
T_4	1.44 (1.58)	1.00 (0.50)	0.88 (0.27)	0.94 (0.39)	1.44 (1.57)	0.96 (0.43)	0.87 (0.26)	0.92 (0.34)	1.44 (1.58)	0.98 (0.46)	0.87 (0.27)	0.93 (0.36)
T_5	1.49 (1.72)	1.41 (1.49)	1.32 (1.24)	1.36 (1.37)	1.46 (1.63)	1.38 (1.42)	1.33 (1.27)	1.36 (1.34)	1.47 (1.67)	1.40 (1.46)	1.32 (1.25)	1.36 (1.35)
T_6	1.45 (1.61)	1.27 (1.12)	1.11 (0.73)	1.19 (0.92)	1.45 (1.60)	1.23 (1.02)	1.17 (0.88)	1.20 (0.95)	1.45 (1.61)	1.25 (1.07)	1.14 (0.80)	1.20 (0.94)
T_7	1.45 (1.60)	1.06 (0.63)	0.96 (0.43)	1.01 (0.53)	1.43 (1.55)	1.08 (0.66)	0.92 (0.35)	1.00 (0.50)	1.44 (1.58)	1.07 (0.64)	0.94 (0.39)	1.01 (0.52)
T_8	1.46 (1.62)	1.50 (1.75)	1.53 (1.83)	1.51 (1.79)	1.47 (1.66)	1.48 (1.68)	1.50 (1.75)	1.49 (1.72)	1.46 (1.64)	1.49 (1.72)	1.51 (1.79)	1.50 (1.75)
SEm.±	0.04	0.04	0.04	0.03	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.02
CD at 5%	NS	0.12	0.12	0.08	0.15	0.15	0.13	0.11	NS	0.09	0.08	0.06
C. V. %	5.26	5.81	6.15	5.47	5.87	7.20	6.77	8.08	5.93	6.25	6.15	6.37
Figures are $\sqrt{X + 0.5}$ transformed values and those in parentheses are original values.												

Table 3.12: Reduction in TMB damage over control in various insecticidal sprays during 2022-23

Treatments	Percent damage reduction over control of various insecticides against TMB incidence on laterals and panicles at 15 days after spray (DAS)					
	First spray		Second spray		Third spray	
	Laterals	Panicles	Laterals	Panicles	Laterals	Panicles
T_1	65.54	-	58.12	46.45	49.69	48.76
T_2	77.90	-	76.01	67.76	74.75	63.81
T_3	89.70	-	91.14	89.07	91.45	91.43
T_4	85.21	-	89.48	85.06	87.17	85.33
T_5	21.91	-	27.12	32.42	24.44	27.62
T_6	61.80	-	54.43	60.29	55.60	49.71
T_7	82.21	-	78.60	76.50	84.32	80.00
T_8	-	-	-	-	-	-

Table 3.13: Yield and economics of cashew in chemical control trial at Paria Centre during 2022-23

Treatments	Yield of cashew (kg/ha)	Cost of cultivation (Rs/ha)	Gross realization (Rs/ha)	Net realization (Rs/ha)	B:C ratio
T_1	483	8003	57960	49957	7.24
T_2	711	10390	85320	74930	8.21
T_3	898	22815	107760	84945	4.72
T_4	855	19656	102600	82944	5.22
T_5	374	9126	44880	35754	4.92
T_6	673	23166	80760	57594	3.49
T_7	811	8986	97320	88334	10.83
T_8	186	0.00	0.00	0.00	0.00

VENGURLA

Treatment details

T_1	:	Thiamethoxam 25 WG	:	0.1 g/l
T_2	:	Thiamethoxam 25 WG	:	0.2 g/l
T_3	:	Carbosulfan 25 EC	:	2 ml/l
T_4	:	Buprofezin 25 SC	:	2 ml/l
T_5	:	λ – Cyhalothrin 5 EC	:	0.6 ml/l
T_6	:	Untreated check		

Data on cumulative mean incidence of TMB at seven days after spraying revealed that the treatment T5 (λ cyhalothrin 5 EC @ 0.6 ml/lit) was significantly superior over rest of the treatments with the least incidence (0.18) followed by T2 treatment (Thiamethoxam 25WG @ 0.2 g/lit) with incidence of 0.24 (Table 3.14). At fifteen days after spraying, treatment T5 (λ cyhalothrin 5 EC @ 0.6 ml/lit) was significantly superior over rest of the treatments and recorded TMB incidence (0.21) and followed by T2 (Thiamethoxam 25WG @ 0.2 g/lit) with TMB incidence (0.29). T2 (Thiamethoxam 25WG @ 0.2 g/lit) was most effective with least incidence of thrips with 0.17 and 0.25 which was significantly superior over other treatments at 7 DAT and 15 DAT, respectively

The treatment T5 (λ cyhalothrin 5 EC @ 0.6 ml/lit) recorded maximum yield (10.20 kg/tree) which was significantly superior over all other treatments followed by T2 (Thiamethoxam 25WG @ 0.2 g/lit) (9.05 kg/tree) for tea mosquito bug and thrips (Table 3 No.15).

Table 3.14: Efficacy of different insecticides against tea mosquito bug incidence in cashew during the year 2022-23

Treatments	Incidence of TMB (0-4 scale)							Cumulative mean incidence of TMB (0-4 scale)		Yield (kg/tree)
	Pre-Count	1st spray		2nd spray		3rd spray				
		7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	
T_1	0.50	0.25	0.54	0.33	0.33	0.29	0.29	0.29	0.39	8.35
T_2	0.58	0.21	0.42	0.25	0.25	0.25	0.21	0.24	0.29	9.05
T_3	0.50	0.67	0.50	0.50	0.29	0.33	0.33	0.50	0.37	8.28
T_4	0.67	0.29	0.42	0.42	0.29	0.33	0.29	0.35	0.33	8.26
T_5	0.46	0.12	0.25	0.21	0.21	0.21	0.17	0.18	0.21	10.20
T_6	0.71	0.42	0.83	0.83	0.87	1.00	0.92	0.75	0.87	2.85
S.E.±	0.26	0.01	0.01	0.01	0. 01	0.02	0.01	0.02	0.03	0.19
C.D. at 5%	NS	0.02	0.03	0.03	0.03	0.04	0.03	0.05	0.06	0.56
C.V.	-	6.00	5.66	4.87	5.30	6.08	7.03	5.65	6.00	4.76

Table 3.15: Percent reduction in tea mosquito bug of cashew over control

Treatments	First spray		Second spray		Third spray	
	7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS
T_1	40.48	34.94	60.24	62.07	71.00	68.48
T_2	50.00	49.40	69.88	71.26	75.00	77.17
T_3	59.52	39.76	39.76	66.67	67.00	64.13
T_4	30.95	49.40	49.40	66.67	67.00	68.48
T_5	71.43	69.88	74.70	75.86	79.00	81.52

Table 3.16: Yield and economics of the treatments

Treatments	Yield t/ha	Cost of insecticide Rs/ha	Cost of cultivation Rs/ha	Returns		B:C ratio
				Total Rs/ha	Net Rs/ha	
T_1	1.67	737	109387	217100	107713	1.98
T_2	1.81	1474	110124	235300	125176	2.14
T_3	1.66	3400	112050	215800	103750	1.93
T_4	1.65	3592	112242	214500	102258	1.91
T_5	2.04	912	109562	265200	155638	2.42
T_6	0.57	-	-	74100	-	-

Cashew nut Rs. 130/kg, Thiamethoxam Rs 921/250g, Carbosulfan Rs 850/lit, Buprofezin Rs. 989/lit, Lambda cyhalothrin Rs 190/250ml. It was noticed that *λ* – Cyhalothrin 5 EC (0.6 ml/l) was found to be the best in terms of B:C ratio i.e, 2.42 and had the maximum returns of Rs. 155638 .

JAGADALPUR

No. of replications : 3
No. of trees per replication : 2
Design : RCBD
Variety : Vengurla-4
Age of the tree : 20

T_1 : Thiamethoxam 25 WG : 0.1 g/l
T_2 : Thiamethoxam 25 WG : 0.2 g/l
T_3 : Carbosulfan 25 EC : 2 ml/l
T_4 : Buprofezin 25 SC : 2 ml/l
T_5 : *Beauveria bassiana* WP : 1 g/l
T_6 : *Beauveria bassiana* WP : 5 g/l
T_7 : *λ* – Cyhalothrin 5 EC : 0.6 ml/l
T_8 : Untreated check

Table 3.17: Efficacy of different insecticides on insect pests of cashew during 2023

Treatment	Mean damage after third spray									
	TMB		Thrips		Shoot tip caterpillar		Leaf miner		Leaf folder	
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment % damage	Post treatment (% damage)	Pre treatment (% damage)	Post treatment (% damage)	Pre treatment (% damage)	Post treatment (% damage)
T_1	1.10 (1.43)	0.85 (0.92)	0.98 (0.99)	0.91 (0.95)	12.410 (3.52)	5.580 (2.36)	4.585 (2.14)	0.507 (0.712)	8.270 (2.876)	3.034 (1.739)
T_2	1.33 (1.52)	0.47 (0.69)	1.07 (1.03)	0.39 (0.62)	11.407 (3.38)	2.600 (1.61)	4.501 (2.12)	0.220 (0.469)	8.045 (2.836)	2.189 (1.475)
T_3	0.95 (1.40)	0.77 (0.88)	1.20 (1.10)	0.58 (0.76)	12.110 (3.48)	2.870 (1.69)	4.660 (2.16)	0.334 (0.578)	7.902 (2.811)	2.302 (1.513)
T_4	0.88 (1.37)	0.72 (0.85)	0.89 (0.94)	0.93 (0.96)	12.361 (3.52)	4.900 (2.21)	5.201 (2.28)	0.785 (0.886)	8.845 (2.974)	3.585 (1.877)
T_5	0.93 (1.39)	1.08 (1.04)	1.10 (1.05)	0.85 (0.92)	11.880 (3.45)	5.063 (2.25)	5.337 (2.31)	0.680 (0.825)	8.300 (2.881)	3.950 (1.954)
T_6	1.15 (1.45)	0.98 (0.99)	0.95 (0.97)	0.80 (0.89)	11.750 (3.43)	4.560 (2.14)	4.551 (2.13)	0.538 (0.733)	8.130 (2.851)	3.286 (1.808)
T_7	1.00 (1.41)	0.17 (0.41)	0.89 (0.94)	0.71 (0.84)	11.610 (3.41)	1.775 (1.33)	4.687 (2.16)	0.189 (0.435)	7.855 (2.803)	1.650 (1.241)
T_8	1.19 (1.47)	1.50 (1.22)	1.21 (1.10)	1.91 (1.38)	12.480 (3.53)	12.275 (3.50)	5.275 (2.30)	1.897 (1.377)	8.850 (2.975)	7.725 (2.775)
Mean	1.19	069	1.06	0.79	12.568	5.769	4.897	0.457	8.023	3.867
CD 5%	NS	0.23	NS	0.16	NS	1.105	NS	0.120	NS	0.478
SE(m) ±	0.09	0.07	0.07	0.05	0.339	0.373	0.343	0.041	0.334	0.161
CV (%)	10.38	9.97	8.83	6.78	3.341	5.842	5.378	1.821	3.990	3.091

*Values in the parentheses of damage score are square root transformation values

Table 3.18: Yield and economics of cashew in chemical control trial during 2023

Treatment	Yields of cashew (kg/ha)	Cost of cultivation (Rs/ha)	Returns (Rs/ha)		B:C
			Total	Net	
T_1	1277	31449.01	121315	89865.99	2.86
T_2	1400	32017.86	133000	100982.14	3.15
T_3	871	35513.31	82745	47231.69	1.33
T_4	1044	36253.58	99180	62926.42	1.74
T_5	878	31152.90	83410	52257.10	1.68
T_6	824	32242.72	78280	46037.28	1.43
T_7	1468	32826.04	139460	106633.96	3.25
T_8	736	29611.12	69920	40308.88	1.36

*Selling price of cashew @Rs. 95/kg nut

The efficacy of different insecticides were statistically superior over untreated control. The mean of three sprays showed significantly lowest damage score for TMB and thrips in T_7 (L-cyhalothrin 5 EC @ 0.6ml/l) followed by T_2 (Thiamethoxam 25 WG @ 0.2 g/l). The lowest per cent damage for shoot tip caterpillar and leaf miner were also recorded in T_7 (L-cyhalothrin 5 EC @ 0.6ml/l) which was statistically on par with T_2 (Thiamethoxam 25 WG @ 0.2 g/l). However, the significantly lowest per cent damage was observed in T_7 (L-cyhalothrin 5 EC @ 0.6ml/l) (Table No. 3.17).

The population trends of various natural enemies in respect of all the insecticide treatments gradually decimated the population of spiders, lady bird beetle and *Brumus* after each round of insecticide spray. The minimum population of natural enemies was observed in T_7 (L-cyhalothrin 5 EC @ 0.6ml/l).

KANABARGI

T_1: Thiamethoxam 25 WG @ 0.2g/L
T_2: Imidacloprid 200 SL @ 0.3 ml/L
T_3: Carbosulfan 25 EC @ 2.0 ml/L
T_4: Thiacloprid 25 SC @ 1.5ml/L
T_5: Lambda-cyhalothrin 5 EC @ 0.6 ml/L
T_6: Profenophos 50EC @ 2.5 ml/L
T_7: Untreated Control

The results of the insecticides against TMB revealed that, after, first, second and third spray, the efficacy of different insecticides was statistically superior over untreated control. The pretreatment damage score of TMB was non-significant in all treatments including untreated control with 2.75 damage score (DS). After 15 days, both T3 and T6 (T_3: Carbosulfan 25 EC @ 2.0 ml/L and T_6 Profenphos 50EC @ 2.5 ml/L) showed least damage score (0.41 and 0.18) which were on par with each other followed by T2 (T_5: Lambda-cyhalothrin 5 EC @ 0.6 ml/L) with 1.40 DS and T1 (Thiamethoxam 25 WG @ 0.1 g/l) with 1.62 DS.

Table 3.19: Efficacy of different insecticides on insect pests of cashew during 2023

Treatment	TMB		Thrips	
	Pre treatment D S (0-4)	Post-treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)
T_1	3.84 (2.08)	1.62 (1.46)	2.98 (1.86)	0.07 (0.75)
T_2	4.62 (2.26)	2.54 (1.74)	2.46 (1.72)	1.09 (1.26)
T_3	2.90 (1.84)	0.41 (0.95)	1.92 (1.55)	2.20 (1.64)
T_4	4.31 (2.19)	2.34 (1.69)	2.77 (1.81)	0.18 (0.82)
T_5	4.00 (2.12)	1.40 (1.38)	2.62 (1.77)	1.89 (1.52)
T_6	2.74 (1.80)	0.18 (0.83)	3.16 (1.91)	1.92 (1.55)
T_7	3.28 (1.95)	2.75 (1.80)	2.62 (1.77)	2.31 (1.68)
Mean	3.67	1.61	2.65	1.38
CD @ 5 %	NS	0.48	NS	0.21
SE(m) ±	0.18	0.16	0.15	0.07
CV (%)	9.37	7.55	12.33	10.39

Influence of insecticides on insect pests other than tea mosquito bug

After 15 days of third spray, the damage score was lowest (0.11) in T1 (Thiamethoxam 25 WG @ 0.2g/L) which was on par with T4 (Thiacloprid 25 SC @ 1.5ml/L) with 0.28 damage score. The lowest TMB mean damage score (0.24) was observed in T6 (Profenphos 50EC @ 2.5 ml/L) which was at par with T3 (Carbosulfan 25 EC @ 2.0 ml/L) with 0.66 DS/leader shoot. However lowest thrips mean damage score was found in T1 (Thiamethoxam 25 WG @ 0.2 g/l) with 0.11 which was at par with T4 (Thiacloprid 25 SC @ 1.5ml/L) with 0.28 (Table No.3.20)

Per cent damage reduction over control in various insecticidal sprays assessed according to the equation of Henderson and Tilton (1955). Percentage damage reduction over control varied among the insecticides from 1st spray to 3rd spray. All the treatments showed an increased percentage control of TMB damage in laterals over the control. Lowest percentage damage of TMB over control was observed in T_3- Carbosulfan 25 EC @ 2.0 ml/L and T_3- Profenphos 50EC @ 2.5 ml/L throughout the experiment.

Table 3.20: Reduction in TMB damage over control in various insecticidal sprays in cashew during the year 2023

Treatments	Per cent damage reduction					
	First spray		Second spray		Third spray	
	Laterals	Panicles	Laterals	Panicles	Laterals	Panicles
T_1	31.50	39.98	30.55	25.53	45.89	51.67
T_2	5.96	4.13	7.71	10.20	18.20	18.54
T_3	36.74	37.94	45.61	35.12	63.99	68.13
T_4	17.64	22.33	27.38	28.86	39.90	42.45
T_5	32.51	35.66	38.88	26.41	62.20	65.53
T_6	38.92	39.93	59.33	48.15	69.40	72.53
T_7	-	-	-	-	-	-

Per cent damage reduction over control in various insecticidal sprays assessed according to the equation of Henderson and Tilton (1955)

Table 3.21: Yield and economics of cashew in chemical control trial during 2023

Treatments	Yield of Cashew (t/ha)	Cost of Cultivation (Rs. /ha)	Returns (Rs. /ha)		B: C
			Total	Net	
T_1	1.604	62352	152380	90028	2.444
T_2	1.451	60080	137845	77765	2.294
T_3	1.821	59520	172995	113475	2.907
T_4	1.109	61987	105355	43368	1.700
T_5	1.65	58048	156750	98702	2.700
T_6	1.989	58238	188955	130717	3.245
T_7	0.926	54000	87970	33970	1.629

Selling price of cashew @Rs. 95 /kg nut

The highest benefit: cost ratio was recorded in T_2- Profenophos 50EC @ 2.5 ml/L followed by T_3-Carbosulfan 25 EC (2 ml/l) and T_5-L-cyhalothrin 5EC (0.6ml/l) [Table No 3.21].

Influence of insecticides on the pollinators of cashew was observed and recorded before and after 7 and 15 days after each spray. Bee activity was found in all treatments after first spray except neonicotinoids, but after second and third spray, bee activity was noticed only in treatment T_7.

Expt.4 : Evaluation of Botanicals for the control of Tea Mosquito Bug and other insect pests

Centers: East Coast :	Bapatla and Vridhachalam
West Coast :	Paria, Pilicode, Madakkathara and Vengurla
Plains / others:	Hogalagere, Jagdalpur and Kanabargi

Objective: Evaluation of botanicals for the control of foliage and floral pests of Cashew.

BAPATLA

T_1: Azadirachtin1% @ 1 ml/l
T_2: NSKE 5%
T_3: Novel plus 10%
T_4: Custard leaf extract @ 7.5%,
T_5: Chilli Garlic Extract @ 2%, Pongamia seed extract @ 4%
T_6: LamdaCyahalothrin 5EC @ 0.6 ml/l
T_7: Untreated control

During the year 2022-23, the incidence of different important foliage, flower and nut feeding pests of cashew was very low during the season. During this season the incidence of Tea mosquito bug infestation was not observed.

The incidence of regional important pests like leaf and blossom webber, leaf miner, shoot tip cater pillar and apple and nut borer was very low (< 5 per cent of incidence). Hence treatments were not imposed during the season.

VENGURLA

T_1: Nirgudi (*Vitex negundo*) plant extract @ 5%
T_2: Kalmagh (*Andrographis paniculata*) plant extract @ 5%
T_3: Tiriphal (*Zanthoxylum piperitum*) seed extract 5%
T_4: Dhatura (*Datura stramonium*) seed extract @ 5 %
T_5: Custard apple leaves + Bael leaves + Ruhi leaves + Tulsi leaves + Drumstick leaves + Hibiscus leaves + Bitter gourd juice @ 5 % extract (on the basis of farmers feedback)
T_6: Satvin (*Alstonia scholaris*) bark extract @ 5%
T_7: Neem seed (*Azadirachta indica*) kernel extract @ 5 %
T_8: Deshi cow urine @10%
T_9: Standard check (λ cyhalothrin5EC @ 0.6ml/lit)
T_{10}: Botanical formulation “AAVYA” @ 4 g/l of water (Ajit Paul)
T_{11}: Untreated control

The cumulative incidence of TMB revealed that at 7 DAS the treatment T9 (Lambda cyhalothrin 0.6 ml/l) noticed 0.23 TMB incidence and was found to be significantly superior over the rest of the treatments. Among the different botanical treatments, the treatment T6 Satvin (*Alstonia scholaris*) bark extract 5% was found to be the most effective (0.36) for management of TMB, but it was at par with all other treatments except T11 (Untreated control) [Table No. 3.22]. At fifteen days after spraying, treatment T9 (standard check) noticed 0.25 TMB incidence and found to be significantly superior over the rest of the treatments. Among the different botanical treatments, the treatment T6 Satvin bark extract 5% was found to be the most effective (0.44) for management of TMB, but it was at par with all other treatments except T11 (Untreated control).

The maximum yield (9.00 kg/tree) was recorded in treatment T9 (Standard check) which was significantly superior to all other treatments. Among the different botanicals, treatment Satvin bark extract 5% recorded maximum yield (5.35 kg/tree) but was at par with all other treatments.

Regarding spider population, there was no significant difference in all treatments which indicates no adverse effect on spiders.

Table 3.22: Incidence of tea mosquito bug in 0-4 scale in different treatments (2022-23)

Treatments	Incidence of TMB in 0-4 scale							Cumulative mean incidence of TMB (0-4 scale)		Yield (kg/tree)
	Pre-Count	1st spray		2nd spray		3rd spray				
		7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	
T_1	0.57	0.24	0.32	0.39	0.46	0.51	0.58	0.38	0.45	4.80
T_2	0.57	0.22	0.30	0.37	0.45	0.51	0.38	0.37	0.44	4.80
T_3	0.57	0.24	0.32	0.40	0.49	0.55	0.61	0.40	0.47	3.98
T_4	0.57	0.24	0.32	0.40	0.47	0.54	0.59	0.39	0.46	5.13
T_5	0.57	0.22	0.30	0.39	0.46	0.53	0.58	0.38	0.45	4.72
T_6	0.57	0.21	0.29	0.37	0.45	0.51	0.57	0.36	0.44	5.35
T_7	0.57	0.22	0.30	0.37	0.45	0.51	0.59	0.37	0.45	4.12
T_8	0.55	0.25	0.33	0.42	0.49	0.55	0.62	0.41	0.48	4.38
T_9	0.59	0.14	0.16	0.24	0.26	0.30	0.33	0.23	0.25	9.00
T_{10}	0.57	0.24	0.32	0.40	0.47	0.54	0.59	0.39	0.46	5.08
T_{11}	0.50	0.36	0.53	0.67	0.80	0.93	1.04	0.65	0.79	3.00
SEm ±	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.02	0.49
CD at 5%	NS	0.03	0.04	0.05	0.05	0.05	0.06	0.08	0.06	1.45
CV%	-		7.84	8.05	6.08	5.78	5.84	12.46	8.62	17.17

VRIDHACHALAM

Experimental details

Design	:	RBD	No. of trees/treatment	:	06
Treatment	:	09	Replications	:	03
Variety	:	VRI-3	Year of Planting	:	2005
			No. of trees /replication	:	02

The following treatments were imposed as per approved technical programme.

T-1 : Azadirachtin 1% @ 1.0 ml/L

T-2 : Neem Seed Kernal Extract (NSKE) 5%

T-3 : Novel Plus 10%

T-4 : Region specific botanicals to the Centre that gave good result in previous years) Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 2 days. Soaked in Mud pot with 10 litres of water.

T-5 : Region specific botanicals to the centre that gave good result in previous years) Pongam oil 5 %

T-6 : Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/L of water)

T-7 : Untreated check

Spraying of combined leaf extracts of Adathoda, Datura, Vitex, Calotropis and neem was very effective in controlling the TMB incidence, followed by Azadirachtin 1% @ 1.0 ml/lit .

Phytotoxic effect of botanicals on cashew

The observations showed that none of the botanical treatments caused any phytotoxic symptoms such as injury to leaf tip and leaf surface, wilting, vein clearing, necrosis, epinasty and hyponasty at the recommended level of spray [Table No.3.25] and found safe to natural enemies.

Table 3.23 : Effect of Botanicals on the incidence of TMB at Vridhachalam

Treatments	Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)	
		III Spray			IV Spray			V Spray	
		7 DAS	15 DAS		7 DAS	15 DAS		7 DAS	15 DAS
T1	2.45 (1.85)	1.08 (1.44)	0.72 (1.31)	3.07 (2.01)	1.07 (1.43)	0.63 (1.27)	3.42 (2.10)	0.75 (1.32)	0.438 (1.19)
T2	2.44 (1.85)	1.42 (1.55)	1.17 (1.47)	3.05 (2.01)	1.49 (1.57)	0.97 (1.40)	3.43 (2.10)	1.28 (1.51)	1.053 (1.43)
T3	2.45 (1.85)	1.25 (1.50)	0.96 (1.40)	3.07 (2.02)	1.21 (1.48)	0.83 (1.35)	3.36 (2.08)	0.91 (1.38)	0.871 (1.36)
T4	2.45 (1.85)	0.82 (1.34)	0.52 (1.23)	3.08 (2.02)	0.85 (1.36)	0.42 (1.19)	3.42 (2.10)	0.56 (1.25)	0.125 (1.06)
T5	2.45 (1.85)	1.68 (1.63)	1.35 (1.53)	3.07 (2.01)	1.97 (1.72)	1.25 (1.50)	3.42 (2.10)	1.58 (1.60)	1.251 (1.50)
T6	2.47 (1.86)	0.51 (1.23)	0.26 (1.12)	3.08 (2.02)	0.68 (1.29)	0.35 (1.16)	3.32 (2.08)	0.27 (1.12)	0.09 (1.04)
T7	2.43 (1.85)	2.68 (1.92)	2.85 (1.96)	3.06 (2.01)	3.24 (2.06)	3.29 (2.07)	3.39 (2.09)	3.58 (2.14)	3.65 (2.15)
C.D.	NS	0.01	0.01	NS	0.007	0.009	NS	0.01	0.05
SE(m)	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.02
SE(d)	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.02
C.V.	0.25	0.71	0.19	0.14	0.23	0.37	0.48	0.40	1.93

Table 3.24: Efficacy of Botanicals on TMB population / 24 leader shoots at Vridhachalam

Treatments	Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)	
		III Spray			IV Spray			V Spray	
		7 DAS	15 DAS		7 DAS	15 DAS		7 DAS	15 DAS
T1	6.48 (2.73)	3.16 (2.04)	1.24 (1.50)	8.30 (3.05)	1.04 (1.43)	0.53 (1.23)	12.69 (3.70)	0.82 (1.35)	0.56 (1.25)
T2	6.25 (2.69)	3.94 (2.22)	1.91 (1.70)	8.20 (3.03)	1.86 (1.69)	0.96 (1.40)	12.65 (3.69)	1.78 (1.66)	1.03 (1.42)
T3	6.51 (2.74)	3.55 (2.13)	1.63 (1.62)	8.26 (3.04)	1.485 (1.57)	0.78 (1.33)	12.52 (3.69)	1.35 (1.53)	0.84 (1.35)
T4	6.48 (2.73)	2.07 (1.75)	0.96 (1.40)	8.13 (3.02)	0.75 (1.32)	0.35 (1.16)	12.53 (3.67)	0.57 (1.25)	0.12 (1.06)
T5	6.62 (2.76)	4.03 (2.24)	2.12 (1.76)	8.43 (3.07)	2.07 (1.75)	1.08 (1.44)	12.66 (3.69)	1.85 (1.68)	1.28 (1.51)
T6	6.44 (2.72)	1.22 (1.49)	0.46 (1.20)	8.46 (3.07)	0.52 (1.23)	0.19 (1.09)	12.69 (3.70)	0.35 (1.16)	0.02 (1.01)
T7	6.32 (2.70)	6.44 (2.72)	6.73 (2.78)	8.39 (3.06)	9.27 (3.20)	10.26 (3.35)	12.43 (3.66)	12.77 (3.71)	13.02 (3.74)
C.D.	NS	0.01	0.02	NS	0.01	0.01	NS	0.034	0.01
SE(m)	0.01	0.00	0.00	0.015	0.01	0.01	0.01	0.01	0.00
SE(d)	0.02	0.00	0.01	0.021	0.01	0.01	0.02	0.02	0.01
C.V.	1.06	0.33	0.81	0.86	0.47	0.60	0.50	1.06	0.37

Table 3.25: Efficacy of Botanicals against foliar pests at Vridhachalam

Treatments	Mean damage after 5th spray										Yield (Kg per tree)
	TMB Damage %		Leaf Miner %		Leaf and Blossom Webber %		Apple and Nut Borer %		Leaf Thrips Population (Nos.)		
	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	
T1	3.28 (10.43)	0.96 (5.64)	5.70 (13.80)	1.33 (6.63)	8.76 (17.21)	1.63 (7.34)	3.90 (11.38)	0.94 (5.58)	11.35 (3.56)	0.89 (1.37)	5.28 (2.50)
T2	3.25 (10.39)	1.33 (6.63)	5.71 (13.82)	1.756 (7.61)	8.729 (17.17)	1.85 (7.81)	3.92 (11.41)	1.51 (7.06)	11.28 (3.50)	1.23 (1.49)	5.19 (2.48)
T3	3.28 (10.43)	1.28 (6.50)	5.71 (13.82)	1.57 (7.20)	8.73 (17.18)	1.71 (7.52)	3.96 (11.47)	1.21 (6.32)	11.33 (3.51)	1.07 (1.44)	5.10 (2.47)
T4	3.26 (10.40)	0.48 (3.99)	5.64 (13.73)	1.09 (6.00)	8.67 (17.12)	1.57 (7.10)	3.98 (11.51)	0.73 (4.92)	11.26 (3.50)	0.72 (1.31)	5.65 (2.57)
T5	3.23 (10.35)	1.95 (8.02)	5.65 (13.74)	1.91 (7.95)	8.73 (17.18)	2.08 (8.29)	3.99 (11.52)	1.74 (7.59)	11.29 (3.50)	1.51 (1.58)	5.06 (2.46)
T6	3.22 (10.34)	0.21 (2.64)	5.67 (13.77)	0.83 (5.23)	8.73 (17.18)	0.67 (4.69)	3.96 (11.48)	2.17 (8.47)	11.36 (3.51)	0.12 (1.06)	5.96 (2.63)
T7	3.26 (10.41)	3.92 (11.42)	5.67 (13.77)	6.27 (14.50)	8.72 (17.17)	10.16 (18.58)	3.98 (11.51)	5.56 (13.64)	11.39 (3.52)	12.26 (3.64)	5.78 (2.60)
C.D.	NS	0.029	NS	0.02	NS	0.15	NS	0.19	NS	0.02	0.01
SE(m)	0.06	0.01	0.03	0.01	0.031	0.05	0.02	0.06	0.01	0.01	0.00
SE(d)	0.08	0.01	0.05	0.01	0.04	0.07	0.03	0.08	0.01	0.01	0.00
C.V.	0.97	0.25	0.48	0.15	0.31	1.01	0.42	1.40	0.23	0.58	0.11

PARIA

T_1: Custard apple 10%
T_2: NAU Product 1%
T_3: Akdo 1%
T_4: Tulsi 10%
T_5: Nirgudi 5%
T_6: Kalmagh 10%
T_7: Cow urine 10%
T_8: L- cyhalothrin 6ml/10 lit
T_9: Untreated control

Overall, results of pooled over periods and spray revealed significantly maximum (1.69 damage score) shoot damage was observed in control. Whereas, the significantly lowest (0.37 damage score) shoot damage was recorded in L- cyhalothrin. The next most effective treatment was Novel plus 1 percent (NAU Product) with 0.66 damage score. The order of effectiveness of various treatments against TMB was found to be L- cyhalothrin > NAU Product 1% > Kalmagh10% > Tulsi 10% ≥ Nirgudi 5% ≥ Custard apple 10% ≥ Cow urine 10% ≥ Akdo 1% ≥ control.

In the case of panicle damage by TMB, treatment T_8 (L- cyhalothrin) recorded the lowest (0.71 damage score) panicle damage after the second spray and was found statistically at par with Novel plus 1 percent (NAU Product) with 0.95 damage score. The next most effective treatment was Kalmagh 10% with 1.15 damage score, and the rest of the botanicals were found less effective for the management of TMB.

The order of effectiveness of various treatments against TMB was found to be L-cyhalothrin > NAU Product 1% ≥ Kalmagh 10% ≥ Tulsi 10% ≥ Nirgudi 5% ≥ Cow urine 10% ≥ Akdo 1% Custard apple 10% > control.

MADAKKATHARA

Evaluation of botanicals for the control of foliage and floral pests of Cashew.

T1 – NSKE 5%
T2 – *Pongamia oil emulsion 5%*
T3 – Acorus calamus 2%
T4 – Acorus calamus 5%
T5 – *Andrographis paniculata* leaf extract 5 %
T6 – Lambda- cyhalothrin 5 EC 0.6 ml/L
T7 – Untreated check

Significant difference in TMB damage was observed among the treatments evaluated. Among the botanicals evaluated, T4 (*Acorus calamus* rhizome powder extract 5%) recorded the lowest TMB damage [Table No. 3.26]. Incidence of leaf miner was only observed in the experimental plot and no significant difference was observed among the treatments. No noticeable infestation was observed in case of thrips, aphids and mealy bugs.

Table 3.26: Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2023

Treatments	TMB damage on shoots/inflorescences (0-4 scale) at DAS			
	On shoots		On Inflorescence	
	Before Spray	15 DAS	Before Spray	15 DAS
T1	0.01	0.29	0.07	0.19
	-0.714	(0.877)	-0.752	(0.830)^{abc}
T2	0.06	0.05	0.11	0.1
	-0.747	(0.743)^{b}	-0.78	(0.775)^{bcd}
T3	0.06	0.08	0.36	0.059
	-0.748	(0.761)^{b}	-0.918	(0.748)^{cd}
T4	0.01	0.07	0.25	0.03
	-0.711	(0.751)^{b}	-0.859	(0.729)^{d}
T5	0.09	0.12	0.11	0.26
	-0.769	(0785)^{b}	-0.779	(0.865)^{ab}
T6	0.06	0.05	0.28	0.02
	-0.75	(0.744)^{b}	-0.876	(0.721)^{d}
T7	0.22	0.6	0.14	0.32
	-0.847	(1.04)^{a}	-0.797	(0.902)^{a}
Mean	0.103	0.156	0.262	0.195
SE(m) ±	0.03	0.051	0.05	0.031
CD @ 5%	NS	0.156	NS	0.094
CV	6.91	10.74	10.55	6.67

HOGALAGERE

The new trial on evaluation of botanicals against TMB damage on shoots / inflorescences was conducted during 2022-23 with new set of treatments.

Table 3.27: Evaluation of botanicals against TMB damage on shoots / inflorescences

Treatments	TMB damage on shoots / inflorescences (0-4 scale) at DAS*				Mean	Nut yield (kgs/pl)	% damage reduction over control (H-T formula)
	On shoots		On Inflorescence				
	Pre-count	15 DAS	Pre-count	15 DAS			
T_1	2.11 (1.62)	0.64 (1.07)	2.24 (1.65)	0.60 (1.05)	0.62	9.31 (2.96)	73.90
T_2	2.08 (1.61)	0.72 (1.10)	2.1 (1.61)	0.62 (1.06)	0.67	6.14 (2.77)	70.67
T_3	2.01 (1.58)	1.37 (1.36)	2.07 (1.60)	0.72 (1.10)	1.05	4.10 (2.07)	52.32
T_4	1.98 (1.57)	1.28 (1.33)	2.42 (1.70)	0.68 (1.09)	0.98	5.27 (2.35)	56.89
T_5	2.04 (1.59)	0.29 (0.89)	2.38 (1.70)	0.53 (1.01)	0.41	8.10 (2.74)	83.58
T_6	2.23 (1.65)	0.22 (0.85)	2.17 (1.63)	0.48 (0.99)	0.35	9.52 (3.26)	85.73
T_7	2.10 (1.61)	2.19 (1.64)	2.39 (1.69)	2.77 (1.80)	2.48	5.27 (2.55)	-

Mean	2.08	0.96	2.25	0.91	0.94	6.81	-
SE(m) ±	0.06	0.04	0.08	0.05	-	0.10	-
CD @ 5%	0.17	0.12	0.23	0.16	-	0.28	-
CV	6.21	6.15	8.13	8.17	-	6.28	-

*Values in the parenthesis are square root transformed values.

Table 3.28: Evaluation of botanicals against different pests in cashew during 2022-23

Treatment	Incidence of different pests on shoots or inflorescence at DAS							
	Apple & Nut Borer (% damage) *		Thrips (No./shoot or panicle) **		Aphids (No. affected shoots/plant) **		Mealy bugs (No. shoots affected/plant)	
	BS	15	BS	15	BS	15	BS	15
T_1	2.24 (1.65)	0.89 (1.18)	2.27 (1.66)	0.90 (1.18)	2.41 (1.70)	0.83 (1.15)	2.43 (1.71)	0.83 (1.15)
T_2	2.37 (1.69)	0.96 (1.21)	2.20 (1.64)	0.92 (1.19)	2.25 (1.66)	0.95 (1.20)	2.22 (1.65)	0.84 (1.16)
T_3	2.42 (1.71)	1.07 (1.25)	2.34 (1.68)	1.02 (1.23)	2.21 (1.64)	1.06 (1.25)	2.38 (1.70)	0.99 (1.22)
T_4	2.24 (1.65)	0.96 (1.21)	2.37 (1.69)	0.98 (1.22)	2.19 (1.63)	1.04 (1.24)	2.17 (1.63)	0.88 (1.17)
T_5	2.39 (1.70)	0.78 (1.13)	2.21 (164)	0.88 (1.17)	2.45 (1.72)	0.77 (1.13)	2.33 (1.68)	0.67 (1.08)
T_6	2.42 (1.71)	0.63 (1.06)	2.40 (1.70)	0.79 (1.14)	2.31 (1.68)	0.61 (1.05)	2.24 (1.65)	0.66 (1.08)
T_7	2.37 (1.69)	2.35 (1.68)	2.17 (1.63)	2.25 (1.66)	2.19 (1.64)	2.20 (1.64)	2.27 (1.65)	2.18 (1.63)
Mean	2.35	1.09	2.28	1.11	2.29	1.07	2.29	1.01
SEm ±	0.06	0.04	0.09	0.04	0.07	0.04	0.07	0.04
CD @ 5%	0.19	0.12	0.26	0.12	0.20	0.12	0.19	0.11
CV (%)	6.58	5.85	9.24	5.84	7.02	5.80	6.81	5.22

* Values in the parenthesis are Arcsine transformed values; **Values in the parenthesis are square root transformed values

The results of first year revealed that L-Cyhalothrin 5EC a standard check treatment recorded minimum TMB damage score of 0.35 and 85.73 percent damage reduction over control (Table No. 3.27), followed by combination of Azadirachtin 1% - NSKE 5% - Neem Soap (0.41, 83.58%) and Azadirachtin 1% (0.62, 73.90%). While in untreated control, Novel plus 10% (Banana pseudo stem extract- Navasari) and Neem Soap (10g/L) (IIHR Bangalore) treatments recorded maximum TMB damage score of 2.48, 1.05 and 0.98 respectively. Similar trend was also noticed with apple and nut borer, thrips, aphids and mealybug population in cashew ecosystem).

All the botanical treatments recorded higher natural enemy population compared to L-cyhalothrin 5 EC exhibiting its toxic effects on natural enemy population.

JAGADALPUR

T1 : Azadirachtin @ 1%
T2 : NSKE @ 5%
T3 : Novel plus 10%
T4 : *Dhatura metal* 5% decoction (leaf and fruit)
T5 : *Cleistanthus collins* 3 % decoction (leaf)
T6 : L-cyhalothrin 5 EC (0.6ml/l)
T7 : Untreated check

The results revealed that the mean of three spray L-cyhalothrin 5 EC @ 0.6ml/l. However, on inflorescence, T_4 (*Dhatura metal* 5% decoction) and T_5 (*Cleistanthus collins* 3 % decoction) showed least damage score among botanical insecticide with 0.18 DS. The mean of three spray showed that the damage score was significantly low (0.14) in T7 (L-cyhalothrin 5 EC @ 0.6ml/l).

Table 3.29: Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2023

Treatments	TMB damage on shoots/inflorescences (0-4 scale) at DAS					
	On shoots			On Inflorescence		
	Before Spray	15 DAS	R %	Before Spray	15 DAS	R %
T1	0.34	0.42	52.06	0.56	0.63	32.72
T2	0.23	0.48	19.01	0.67	0.84	25.02
T3	0.36	0.58	37.48	0.72	0.88	26.91
T4	0.39	0.28	68.16	0.59	0.52	47.29
T5	0.22	0.18	57.67	0.46	0.58	24.60
T6	0.31	0.18	77.47	0.64	0.14	86.92
T7	0.26	0.67	-	0.61	1.02	-
Mean	0.30	0.40	-	0.61	0.66	-
SE(m) ±	NS	0.13	-	NS	0.16	-
CD @ 5%	0.06	0.04	-	0.02	0.05	-
CV	10.23	9.82	-	7.29	9.07	-

*R % indicate reduction percentages (Henderson-Tilton formula)

The TMB damage score on shoot was recorded lowest in L-cyhalothrin 5 EC (0.6ml/l) followed by *Cleistanthus collins* 3 % decoction (leaf) with reduction percentage of 77.47 and 57.67 %. The second lowest reduction percentage among botanical was observed in *Datura metel* 5% decoction. The minimum damage score of TMB on inflorescence was recorded in L-cyhalothrin 5 EC (0.6ml/l) with reduction percentage of 86.92 %. The lowest reduction percentage of among botanical insecticides was recorded in in *Datura metel* 5% decoction.

The pre-treatment observation of leaf miner, thrips, shoot tip caterpillar and leaf folder for various treatments was non-significant. None of the botanical insecticides showed promising results for leaf miner and lowest per cent damage was recorded for T_6 (L-cyhalothrin 5 EC 0.6 ml/ l).

The higher reduction percent for thrips among botanical insecticide was recorded in NSKE @ 5 % followed by Azadirachtin @ 1%, similarly NSKE @ 5 % had highest reduction per cent for shoot tip caterpillar among various tested botanical.

Table 3.30: Efficacy of different botanicals against pest complex during 2023

Treatment	Incidence of different pests on shoots or inflorescence at DAS											
	Leaf Miner (% damage)			Thrips (No./shoot or panicle)			Shoot tip caterpillar			Leaf folder		
	BS	15 DAS	R %	BS	15 DAS	R %	BS	15 DAS	R %	BS	15 DAS	R %
T1	2.67	2.41	5.12	1.08	0.65	59.03	6.54	5.11	25.82	2.18	1.64	18.12
T2	2.24	1.81	15.06	0.97	0.58	59.30	8.93	4.78	49.18	2.71	1.79	28.11
T3	2.38	1.82	19.62	0.79	0.62	46.58	5.54	4.78	18.08	2.29	1.27	39.64
T4	2.29	1.77	18.75	0.93	0.67	50.96	6.91	5.35	26.49	2.65	1.56	35.93
T5	2.40	1.86	18.53	1.02	0.75	49.95	8.92	5.56	40.82	2.23	1.67	18.49
T6	2.46	0.31	86.75	0.89	0.09	93.12	7.11	0.43	94.26	2.54	0.67	71.29
T7	2.67	2.54	-	0.81	1.19	-	6.76	7.12	-	2.34	2.15	-
Mean	2.44	1.79		0.93	0.65		7.24	4.73		2.39	1.68	
SE(m) ±	NS	0.66		NS	0.19		NS	1.21		NS	0.57	
CD @ 5%	0.63	0.23		0.09	0.06		0.46	0.42		0.45	0.19	
CV (%)	14.45	9.04		8.99	11.81		7.31	9.61		9.98	11.31	

The population of *Oxypes sweta* was recorded highest in T_1 (Azadirachtin @ 1%) followed by untreated control. *Menochilus sexmaculatus* and *Brumus* spp. population was recorded highest in untreated control.

KANABARGI

T1: Azadirachtin 1% @ 1.0 ml/L
T2: NSKE @ 5 %
T3: Novel plus 1% (Banana Pseudo stem Extract-Navasari)
T4: Neem soap IIHR 10 g/l
T5: Azadirachtin 1% @ 1.0 ml/L-NSKE 5%- Neem soap 10g/L
T6: Lambda-cyhalothrin 5 EC @ 0.6 ml/L
T7: Untreated Control

Table 3.31: Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2023

Treatments	TMB damage on shoots / inflorescences (0-4 scale) at DAS				Mean	Incidence at DAS	
	On shoots		On Inflorescence			Thrips (No./shoot or panicle) *	
	Before Spray	15 DAS	Before Spray	15 DAS		BS	15 DAS
T_1	1.97. (1.57)	0.62 (1.06)	1.97 (1.57)	0.68 (1.08)	1.31	3.92 (2.10)	1.23 (1.32)
T_2	2.06 (1.60)	1.01 (1.23)	2.20 (1.64)	1.19 (1.30)	1.61	3.94 (2.11)	1.19 (1.30)
T_3	2.03 (1.59)	1.95 (1.56)	2.09 (1.61)	1.93 (1.56)	2.00	3.80 (2.02)	2.41 (1.70)
T_4	2.09 (1.61)	1.62 (1.45)	2.02 (1.59)	1.51 (1.42)	1.81	3.78 (2.07)	2.02 (1.59)
T_5	2.05 (1.60)	1.05 (1.25)	1.96 (1.57)	1.14 (1.28)	1.55	3.98 (2.12)	1.96 (1.57)
T_6	2.02 (1.59)	0.57 (1.04)	2.08 (1.61)	0.48 (0.99)	1.29	3.87 (2.09)	1.06 (1.25)
T_7	2.16 (1.63)	1.89 (1.55)	2.35 (1.69)	1.94 (1.56)	2.08	3.93 (2.10)	2.96 (1.86)
Mean	2.05	1.24	2.10	1.27		3.89	1.83
SE(m) ±	0.05	0.07	0.13	0.09	0.17	0.09	0.16
CD @ 5%	0.14	0.22	0.39	0.26	0.25	0.25	0.24
CV	10.73	6.19	10.30	7.61	8.71	7.16	8.19

*Values in the parentheses of damage score are square root transformation values

Among the botanicals, azadiracthin 1% @ 1ml/l recorded significantly low tea mosquito bug damage on shoots (0.62) and on panicles (0.68) on 0 to 4 scale basis at 15 days after spray which is superior to other botanicals such as Novel plus 10% (Banana Pseudo stem Extract-Navasari), NSKE @ 5 % and Neem soap IIHR 10 g/l. Further, azadiracthin 1% @ 1ml/l was on par with standard check, lambda - Cyhalothrin 5EC @ 0.6 ml/l which registered 0.57 and 0.48 tea mosquito bug damage on 0 to 4 scale on shoots and panicles, respectively, at 15 days after spray indicating azadiracthin 1% @ 1ml/l is effective and led to less population of thrips and aphids as compared to other botanicals but, was on par with standard insecticide check, lambda - Cyhalothrin 5EC @ 0.6 ml/l.

During the experimentation, the natural enemy population especially predators such as *Oxypes sweta, Menochilus sexmaculatus, Chrysoperla* sp and Syrphida were also recorded to know the safety of the different treatments in cashew ecosystem. Among the various treatments, the botanical insecticides have recorded statistically higher predator population as compared to standard insecticide check, lambda - Cyhalothrin 5EC @ 0.6 ml/l indicating that botanicals are relatively safer than insecticides.

The effectiveness of treatments measured by the cashew nut yield per tree indicated that botanicals were inferior to standard check, lambda - Cyhalothrin 5EC @ 0.6 ml/l which registered highest nut yield (2.91 kg nuts/tree) indicating the superiority of standard check.

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

Centers: East Coast : Bapatla, Bhubaneshwar, 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.

BAPATLA

Trt. No	Treatment	Dose
1.	Fipronil Swabbing	2 ml/l
2.	Neem oil Swabbing (5%)	50 ml/l
3.	Imidacloprid (Swabbing and Drenching)	2 ml/l
4.	Chlorpyrifos (Treated Check)	10 ml/l
5.	Un treated check (only removal of CSRB grubs)	-

Among the insecticides evaluated as post extraction prophylaxis, Imidacloprid (Swabbing and drenching) @ 2ml/l have offered protection to the tune of 75 % trees without re-infestation followed by Fipronil Swabbing 2 ml/l with 60 % trees without re-infestation. The other treatments Chlorpyrifos 10 ml/l (Treated Check) and neem oil 5% (Swabbing) has offered 55 and 45 percent protection without re-infestation and are superior over the control treatment which recorded 35 % trees without re-infestation (Table No.3.32). Preferential zone of attack is collar + root in 48 percent of trees (48/100) followed by stem+ collar + root in 22 percent of trees.

Table 3.32: Efficacy of insecticides as Post extraction prophylaxis (PEP) against cashew stem and root borer at Bapatla Centre 2022-23

Trt No	Treatment	Total No. of trees treated	No. of trees Reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree (Rs.)
1.	Fipronil Swabbing (2 ml/l)	20	8	40.0	60.0	101.60
2.	Neem oil Swabbing (5%)	20	11	55.0	45.0	110.80
3.	Imidacloprid (2 ml/l) - (Swabbing and Drenching)	20	5	25.0	75.0	111.60
4.	Chlorpyriphos (10 ml/l) (Treated Check)	20	9	45.0	55.0	110.80
5.	Untreated check (only removal of CSRB grubs)	20	13	65.0	35.0	93.30 (Labour charges)

* Labour charges: Rs.93.3 per tree

Table 3.33: Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Bapatla 2022-23

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	0	0	0.0	0	0.0
	60-80cm	0	0	0.0	0	0.0
	80-100 cm	15	4	26.7	11	73.3
	>100 cm	85	42	49.4	43	50.6
Total		**100**	**46**	46.0	**54**	54.0
Age of the tree	< 10 years	0	0	0.0	0	0.0
	10-15 years	0	0	0.0	0	0.0
	>15years	100	46	46.0	54	54.0
Total		**100**	**46**	46.0	**54**	54.0
Zone of attack	C + R	48	23	47.9	25	52.1
	C + S	8	1	12.5	7	87.5
	R	7	2	28.6	5	71.4
	S	6	2	33.3	4	66.7
	C	9	4	44.4	5	55.6
	C + S + R	22	14	63.6	8	36.4
Total		**100**	**46**	46.0	**54**	54.0
Yellowing of canopy	Canopy yellowing	10	10	100.0	0	0.0
	Canopy not yellowing	90	36	40.0	54	60.0
Total		**100**	**46**	46.0	**54**	54.0
% of bark circumference damaged	<25	53	13	24.5	40	75.5
	26-50	30	18	60.0	12	40.0
	51-75	10	8	80.0	2	20.0
	>75	7	7	100.0	0	0.0
Total:		**100**	**46**	46.0	**54**	54.0

Table 3.34: Two-way table (Stem girth Vs Age of the tree)

Stem Girth / Age of the tree	<60 cm	60-80 cm	80-100 cm	>100 cm	Total
<10 years	0	0	0	0	0
10-15 Years	0	0	0	0	0
>15 Years	0	0	15	85	100
Total	0	0	15	85	100

BHUBANESHWAR

Experimental Details

Number of trees: 112

Number of treatments: 6

T1: Fipronil Swabbing (2 ml/ lit)
T2: Neem oil swabbing (5%)
T3: Imidacloprid (2 ml/l) (swabbing and drenching)
T4: Chlorpyrifos (10 ml/l) (Treated check)
T5: Mechanical extraction of grub (treated check)
T6: Untreated check (only removal of CSRB grubs)

The total number of infested plants by CSRB was 112 out of which 52 plants (53.58%) showed without reinfestation over the PEP treatments. The maximum recovery was achieved in T_3 i.e, *Imidacloprid* (2 ml/l) (swabbing and drenching) followed by T_1 Fipronil Swabbing (2 ml/ lit) and T_4 Chlorpyrifos (10 ml/l).

The physical parameters on infestation of CSRB revealed that the infestation increased with increase in stem girth up to 80-100 cm. Highest infestation (66.66%) was recorded in plant having stem girth 60-80 cm. Highest infestation of CSRB was found in age group 10-15 years but highest recovery (65.62%) was recorded in plants of age group more than 15 years. The stem and collar region zone of attack recorded highest incidence of stem borer *i.e*. 36 out of 112 plants (50.00%). However, highest recovery (100 %) was noticed in case of root zone attack. Out of 112 plants, 59.37 % infested under 51-75 cm of bark circumference damaged by the CSRB. Out 112 plants, 12 (10.21 %) showed yellowing of canopy while the remaining cashew plants were healthy.

Table 3.35: Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer during 2023

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with reinfestation	% trees without reinfestation
T1	20	1	8	40.00	60.0
T2	19	3	10	52.63	47.37
T3	20	2	7	35.00	65.00
T4	22	3	9	40.90	59.10
T5	16	5	8	50.00	50.00
T6	15	-	10	66.66	33.34
Total	112		52	46.42	53.58

Table 3.36: Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial

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	8	0	0.00	8	100
	60-80cm	30	20	66.66	10	30.00
	80-100 cm	48	21	43.75	27	56.25
	>100 cm	26	11	42.30	15	57.69
Total		**112**	**52**	**46.42**	**60**	**53.58**
Age of the tree	< 10 years	20	10	50.00	10	50.00
	10-15 years	60	31	51.66	29	48.33
	>15years	32	11	34.37	21	65.62
Total		**112**	**52**	**46.42**	**60**	**53.58**
Zone of attack	C + R	12	5	41.66	7	58.33
	C + S	36	18	50.00	18	50.00
	R	8	0	0.00	8	100.00
	S	24	13	54.16	11	45.83
	C	16	8	50.00	8	50.00
	C + S + R	16	8	40.00	8	50.00
Total		**112**	**52**	**46.42**	**60**	**53.58**
Yellowing of canopy	Canopy yellowing	20	12	60.00	8	40.00
	Canopy not yellowing	92	40	43.47	52	56.52
Total		**112**	**52**	**46.42**	**60**	**53.58**
% of bark circumference damaged	<25	20	7	35.00	13	65.00
	26-50	32	16	50.00	16	50.00
	51-75	32	19	59.37	13	40.62
	>75	28	10	35.71	18	64.28
Total:		**112**	**52**	**46.42**	**60**	**53.58**

VRIDHACHALAM

Treatment

T_1 : Fipronil 5% SC Swabbing 2ml/lit.
T_2 : Neem Oil suspension 5%.
T_3 : Imidachloprid 17.8 SL Swabbing and Drenching 2ml/lit.
T_4 : Chlorpyriphos 20 EC 10ml/lit.
T_5 : Treated check (only removal of CSRB grubs followed).

Maximum recovery of 72% was observed in chlorpyriphos 20 EC @10 ml/lit. of water as swabbing and drenching of CSRB infested trees as against mere recovery of 6.25 in treated check (only removal of CSRB grubs). Treatments with Fipronil 5% SC swabbing @ 2ml/lit. and Imidachloprid 17.8 SL Swabbing and Drenching @ 2ml/lit. lead to 64.2 and 54.5% recovery respectively. The overall results indicate that chlorpyriphos recorded maximum recovery, followed by Fipronil and Imidachloprid which are at par in reducing the CSRB infestation, with an average cost of protection of Rs.105/-, Rs.117/- and Rs. 126/- respectively (Table No.3.37).

Table 3.37: 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 from CSRB	Frequency of treatment	Cost of treatment /Tree
T_1	28	18	64.29^b	3	117.00
T_2	18	7	38.89^d	3	97.00
T_3	22	12	54.55^c	3	126.00
T_4	25	18	72.00^a	3	105.00
T_5	16	01	6.25^e	3	75.00
Total	**109**	**56**			

Observations recorded in the physical parameters of treated cashew trees under Post Extraction Prophylaxis (PEP) curative trial revealed that the cashew trees having 80-100 cm of stem girth (68.18 %) were more prone to the attack of CSRB infestation (Table 3.38). Comparing the age of the cashew infested trees, more than 15- year- old cashew trees (57.78%) were more susceptible to attack of CSRB. Preferential zone of attack of re-infestations by CSRB in the trees were Collar + Stem +Root zone followed by Collar + Root and Collar with 75.86, 61.54 and 60 per cent re- infested trees respectively. Yellowing of canopy showed 81.25 per cent re-infestation. Trees with less than 25 per cent bark circumference damage had maximum re-infestation with 64.15 per cent followed by 26-50 per cent bark circumference damage (39.47 % re-infestation). This implies that early detection of borer infestation and simultaneous prophylaxis treatment on a community basis is very important to mitigate persistent attack of cashew stem and root borer.

Table 3.38: Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) curative trial observed at Vridhachalam

Physical Parameters		Total no. of trees treated	No.of trees reinfested	% of trees reinfested	No. of trees not reinfested	% of trees not reinfested
Stem girth	< 60 cm	15	6	40.00	9	60.00
	60-80 cm	44	26	59.09	18	40.91
	80-100 cm	22	15	68.18	7	31.82
	> 100 cm	28	9	32.14	19	67.86
Total		109	56		53	
Age of the tree	<10 years	10	5	50.00	5	50.00
	10-15 years	54	25	46.29	29	53.70
	> 15 years	45	26	57.78	19	42.22
Total		109	56		53	
Zone of attack	Collar+Root	26	16	61.54	9	39.13
	Collar+Stem	21	9	38.89	11	61.11
	Root	9	0	0	7	100.00
	Stem	8	3	33.33	4	66.67
	Collar	10	6	37.50	5	62.50
	Stem+Root	6	0	0	3	100.00
	Collar+Stem+Root	29	22	73.08	7	26.92
Total		109	56		53	
Yellowing of canopy	Canopy yellowing	48	39	81.25	9	18.75
	Canopy not yellowing	61	17	27.87	44	72.13
Total		109	56		53	
% of bark circumference damaged	< 25	53	30	64.15	19	35.85
	26-50	38	15	39.47	23	60.53
	51-75	18	6	33.33	12	66.67
	> 75	0	0	0	0	0
Total		109	56		53	

Table 3.39: Two-way table (Stem girth Vs Age of the tree)

Stem Girth / Age of the tree	<60 cm	60-80 cm	80-100 cm	>100 cm	Total
<10 years	5	0	0	0	5
10-15 Years	22	25	9	0	56
>15 Years	8	13	13	14	48
Total	35	38	22	14	109

Table 3.40: Results of chi-square (X^2) test showing associations between physical parameters of tree and effect of POP treatments

Parameters	Chi square value (X^2)	df	P value
% of bark circumference	0.047	3	13.15
Canopy	0.521	1	17.67
Zone of attack	0.001	6	7.28
Age of tree	0.541	2	17.89
Stem diameter	0.003	3	14.08

MADAKKATHARA

Age of the trees : >20
Number of trees : 100
Number of treatments : 5
Design : CRD

SL. No.	Treatments	Dose
T1	Fipronil (swabbing)	2 ml/L
T2	Neem oil (swabbing)	50 ml/L
T3	Imidachloprid (swabbing and drenching)	2 ml/L
T4	Chlorpyrifos (treated check)	10 ml/L
T5	Untreated check (only removal of CSRB grubs)	-

Among the insecticides evaluated as PEP, swabbing with fipronil @ 2 ml/L (T1) has offered the highest recovery with 95 per cent followed by the drenching of chlorpyriphos @ 10 ml/L (90 %). On cost basis, fipronil (Rs. 122/tree/year) was comparatively low to other treatments.

The maximum infestation was observed in trees with stem girth of more than 100 cm (76 trees) and age more than 15 years. In most of trees, infestation was noticed on the collar, stem, and root region. The recovery of trees after post-extraction prophylaxis was closely associated with per cent bark circumference, zone of attack, and stem diameter.

Table 3.41: Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer during 2023

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree
T1	20	1	1	5	95	122/-
T2	20	1	4	20	80	124/-
T3	20	1	4	20	80	153/-
T4	20	1	2	10	90	128/-
T5	20	1	9	45	55	100/-

Table 3.42: Physical parameters of treated cashew trees under post extraction prophylaxis (PEP)trial.

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	0	-	-	-	-
	60-80cm	6	1	16.66	5	83.33
	80-100 cm	18	3	16.66	15	83.33
	>100 cm	76	16	21.05	60	78.95
Total		100	20	20	80	80
Age of the tree	< 10 years	0	0	0	0	0
	10-15 years	0	0	0	0	0
	>15years	100	20	20	80	80
Total		100	20	20	80	80
Zone of attack	C + R	23	3	13.04	20	86.95
	C + S	3	2	66.66	1	33.33
	R	32	1	3.13	31	96.87
	S	3	1	33.33	2	66.66
	C	4	0	0	4	100
	C + S + R	35	13	37.14	22	62.86
Total		100	20	20	80	80
Yellowing of canopy	Canopy yellowing	24	5	20.83	19	79.16
	Canopy not yellowing	76	15	19.74	61	80.26
Total		100	20	20	80	80
% of bark circumference damaged	<25	45	3	6.66	42	93.33
	26-50	32	10	31.25	22	68.75
	51-75	23	7	30.44	16	69.56
	>75	0	0	0	0	0
Total		100	20	20	80	80

Table 3.43: Results of chi-square (X2) test showing associations between physical parameters of tree and effect of POP treatments

Parameters	Chi square value (X2)	Df	P value
% of bark circumference	9.097*	3	0.01
Canopy	0.0137	1	0.91
Zone of attack	13.47*	4	0.01
Age of tree	-	-	-
Stem diameter	0.91*	2	0.34

* p< 0.05

Table 3.44: Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB)

Treatment	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	Overall mean
T1	80	75	80	84.4	95.45	95	84.98
T2	65	85	75	62.5	68.18	80	72.61
T3	75	80	85	78.13	59.09	80	76.2
T4	90	85	75	78.12	90.9	90	84.84
T5	50	45	55	37.5	54.54	55	49.51

Table 3.45: Per cent of trees reinfested after PEP (post extraction prophylaxis)

Physical parameters		2018-19	2019-20	2020-21	2021-22	2022-23	Overall mean
Stem diameter	< 19 cm	-	-	-	-	-	0
	19-32 cm	23.08	49	57.3	89.12	33.32	50.36
	> 32 cm	30	24	30.8	26.5	21.05	26.47
Age of the tree	<10 years	-	-	-	-	-	0
	10-15 years	6.67	16	-	-	-	4.53
	>15 years	33.33	28	28.6	25.45	20	27.08
Zone of attack	C	12.5	0	11	-	0	4.7
	S	-	-	-	-	33.33	6.67
	R	8.82	10	-	4.166	13.13	7.22
	C+S	-	-	13.3	0	66.66	15.99
	C+R	21.43	20	10	16.66	13.04	16.23
	R+S	-	-	-	-	-	0
	C+S+R	81.25	77	42	66.66	37.14	60.81
Yellowing of canopy	Canopy yellowing	75	83	-	64.52	20.83	48.67
	Canopy without yellowing	21.74	22	28.6	10.12	19.74	20.44
% of bark circumference damaged	< 25	16.67	-	-	-	6.66	4.666
	26-50	18.6	9	15.4	34.48	31.25	21.746
	51-75	40	73	25	45.45	30.44	42.778
	>75	-	100	59.8	88.88	-	49.736

VENGURLA

Treatment details

T_1 - Fipronil 5 EC swabbing @ 2 ml/lit
T_2 - Neem oil swabbing @ 5%
T_3 - Imidacloprid 17.8 SL swabbing and drenching @ 2 ml/lit
T_4 - Chlorpyriphos 20 EC @ 0.2 % (10ml/lit)
T_5 - Treated check (only removal of grub)
T_6 - Untreated check

The data revealed that for curative management of CSRB, the treatment T1 (Fipronil 5 EC swabbing @ 2 ml/lit) was found most effective with 90 per cent trees without reinfestation followed by T4 (Chlorpyriphos 20 EC @ 0.2 %) with 80 per cent trees without reinfestation and T3 (Imidachloprid: 17.8 SL swabbing and drenching @ 2.0 ml/lit) with 75 per cent trees without reinfestation.

During the year 2022-23, a total 120 trees were treated with different treatments for curative management of CSRB. Out of which 53 trees were found reinfested and 67 trees were found without reinfestation after application of different treatments.

The infested trees having the stem girth more than 100 cm were more prone to CSRB reinfestation (25%). The infested trees having the age more than 15 years were more prone to CSRB reinfestation (29.17%), whereas, the trees having less than 10 years aged were found to be the least damaged by CSRB (1.67%).

The collar + stem zone was found to be more preferred by CSRB for reinfestation. The trees having removal of more than 75 per cent bark were prone to CSRB attack (15.00%), whereas, the trees having <25 per cent bark removal were less prone to CSRB attack (6.67%). Yellowing of canopy was observed only in 8.34% reinfested trees.

Table 3.46: Effect of curative treatments against Cashew Stem and Root Borer (CSRB) 2022-23

Treatments	Total number of trees treated	No. of trees without re-infestation/ persistent attack	% trees without re-infestation/ persistent attack	No. of reinfested trees	% reinfestation
T_1	20	18	90	2	10
T_2	20	11	55	9	45
T_3	20	15	75	5	25
T_4	20	16	80	4	20
T_5	20	6	30	14	70
T_6	20	1	5	19	95
Total	120	67	-	53	-

Table 3.47: Physical parameters of treated cashew trees under post extraction prophylaxis without reinfestation (2022-23)

Physical parameter		Reinfestation		Without Reinfestation	
		No. of trees	% out of total trees	No. of trees	% out of total trees
Stem girth	< 60 cm	3	2.50	3	2.50
	60-100 cm	20	16.67	44	36.66
	>100 cm	30	25.00	20	16.67
Total		53	44.17	67	55.83
Age of the tree	< 10 years	2	1.67	2	1.67
	10-15 years	16	13.33	21	17.50
	>15 years	35	29.17	44	36.66
Total		53	44.17	67	55.83
Zone of attack	C + R	13	10.83	24	20.00
	C + S	30	25.00	22	18.33
	C + S+ R	10	8.34	21	17.50
Total		53	44.17	67	55.83
Yellowing of canopy	Yes	10	8.34	1	0.83
	No	43	35.83	66	55.00
Total		53	44.17	67	55.83
Percentage of bark circumference damaged	< 25%	8	6.67	40	33.33
	26-50%	14	11.67	23	19.17
	51-75%	13	10.83	4	3.33
	>75%	18	15.00	0	0.00
Total		53	44.17	67	55.83

Table 3.48: Physical parameters of treated cashew trees under post extraction prophylaxis without reinfestation (2022-23)

Physical parameter	Chi square value			Observation
	Calculated	Critical	Test (p)	
Stem girth	10.75	5.99	0.00464	Significantly high impact
Age of the tree	1.15	5.99	0.56236	No significant impact
Zone of attack	6.61	5.99	0.03666	Significantly high impact
Yellowing of canopy	13.16	3.84	0.0000	Significantly high impact
Percentage of bark circumference damaged	27.06	7.81	0.0000	Significantly high impact

(p > 0.05)

HOGALAGERE

The results on infestation and re-infestation of the CSRB in different treatments applied during Oct.-Nov., Jan - Feb and April - May months during 2022-23 revealed that Fipronil (2ml/l) and Chlorpyriphos (0.2%) treatments were found most effective against grubs of CSRB with mean recovery (trees without re-infestation) of 87.00% and 73.00% trees, respectively.

Table 3.49: Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) during 2022-23

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree (Rs.)
Fipronil @ 2ml/lt swabbing (during Oct.-Nov., Jan.- Feb. and April - May)	15	3	2	13.00	87.00	102
Neem oil 5% swabbing	15	3	11	73.00	27.00	12
Imidacloprid 17.8 SL @ 2ml/l as swabbing and drenching	15	3	6	40.00	60.00	201
Chlorpyriphos 20 EC (0.2%) @ 10ml/l	15	3	4	27.00	73.00	18
Treated check - only removal of CSRB grubs	15	3	9	60.00	40.00	0
Untreated control	15	0	12	80.00	20.00	0

Table 3.50: Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial during 2022-23

Physical parameters		No. plants observed after PEP	No. plants reinfested after PEP	% CSRB Preference
Stem girth	< 60 cm	10	4	40.00
	60-100 cm	15	14	84.00
	> 100 cm	13	10	76.90
Total		**N=38**	**N=28**	**-**
Age of the tree	<10 years	0	0	0.00
	10-15 years	10	5	50.00
	>15 years	10	7	70.00
Total		**N=20**	**N=12**	**-**
Zone of attack	C + R	6	3	50.00
	C + S	11	8	72.00
	C + S + R	7	3	57.00
Total		**N=24**	**N=14**	**-**

Whereas in Imidacloprid 17.8 SL treatment found to be next best treatment. In treated check, where only grub extraction was adopted indicated 40% of treated trees could recover from reinfestation. However, the other treatments also maintained their superiority in suppressing the population over control.

Trees with 60-100 cm stem girth showed maximum damage (83% preference for infestation) and with respect to age of trees, more than 15 years old trees were highly prone to CSRB damage (69%) might be due to maximum availability of dead, cracks & crevices and loose bark for CSRB oviposition. The zone of CSRB attack was noticed maximum at collar + stem (57%). The plants with less than 25% bark circumference damage recorded 80.00 per cent recovery of the infested trees compared to severely bark damaged plants.

JAGADALPUR

This trial was carried out in forest plantation in Ghatkawali village of Bastar District during 2022-23. The insecticide treatments were given sequentially swabbed on the trunk, stem and exposed roots and drenching of the insecticides in the root region after the removal of grubs and cocoons from the infested trees.

Table 3.51: Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Jagdalpur

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation
T_1: Fipronil swabbing (2ml/l)	18	1	2	11.11	88.88
T_2: Neem oil swabbing (5%)	18	1	8	44.44	55.55
T_3: Imidacloprid (2 ml/l)	18	1	6	33.33	66.66
T_4: Chlorpyriphos (10 ml/l)	18	1	2	11.11	88.88
T_5: Treated check (only removal of CSRB grubs)	18	1	12	66.66	33.33
Total	90		30		

The maximum recovery of 88.88 per cent was observed in T_4 (Chlorpyriphos @ 10 ml/l) and T_1 (Fipronil @ 2ml/l) of CSRB infested tree followed by T_3 (Imidacloprid @ 2 ml/l) swabbing and drenching whereas, as minimum recovery of 33.33 per cent was observed in T_5 (treated check: only removal of CSRB grubs).

Table 3.52 : Physical parameters of treated cashew trees under post extractionprophylaxis (PEP) trial at Jagdalpur during 2022-23

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 diameter	< 19 cm	8	2	25.00	6	75.00
	19-32 cm	14	5	35.71	9	64.29
	> 32 cm	68	35	51.47	33	48.53
Total		90	42		48	
Age of the tree	<10 years	0	0	0	0	0
	10-15 years	27	11	40.74	16	59.29
	>15 years	63	34	53.96	30	47.61
Total		90	45		45	
Zone of attack	C	24	11	45.83	13	54.17
	S	13	4	30.76	9	69.24
	R	3	1	33.33	2	66.66
	C+S	19	10	52.63	9	47.37
	C+R	18	9	50.00	9	50.00
	R+S	4	1	25.00	3	75.00
	C+S+R	9	4	44.44	5	55.56
Total		90	40		50	
Yellowing of canopy	Canopy yellowing	36	20	55.55	16	44.44
	Canopy without yellowing	54	31	57.41	23	42.59
Total		90	51		39	
% of bark circumference damaged	< 25	0	0	0	0	0
	26-50	21	7	33.33	14	66.66
	51-75	34	17	50.00	17	50.00
	>75	35	19	54.28	16	45.72
Total		90	43		47	

The cashew trees having >32 cm of diameter was more prone to the attack of CSRB. Comparing the age of the cashew infested trees, in respect to re-infested after PEP > 15 years old cashew trees were more susceptible to the attack of CSRB. Preferential zone of re-infestation by CSRB in the trees were collar + stem and collar + root zone. Trees with more than 75 per cent bark circumference damage had maximum re-infestation.

Table 3.53: Two-way table (Stem diameter vs Age of Tree)

Age of Tree / Stem diameter	<10 years	10-15 years	>15 years	Total
< 19 cm	0	5	0	8
19 - 32 cm	0	20	4	14
> 32 cm	0	2	59	68
Total	0	27	63	90

Two-way table revealed that maximum damage of CSRB on was observed in stem diameter > 32 cm and tree age above 15 years.

Table 3.54: Chi square analysis for various tree parameters

Parameters	Chi square value ($\chi 2$)	Df	P value
% of bark circumference	8.25*	3	0.04*
Canopy	1.85	1	0.84^{NS}
Zone of attack	12.23	6	0.79^{NS}
Age of tree	1.89*	2	0.03*
Stem diameter	6.78**	2	< 0.01**

* p< 0.05 ** P < 0.01, NS: - Non significant

Chi square analysis showed that there is significant influence of stem diameter (P < 0.01) and age of thee (P = 0.03) and % of bark circumference (P = 0.04) for the infestation of CSRB in cashew (Table 3.54).

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

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

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

BAPATLA

Observations:

Trees were selected randomly in the cashew plantations visited in the surrounding areas of Bapatla and in certain 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. 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.

Results:

Table 3.55: Influence of abiotic factors on the activity of pest complex of cashew

Variable	LBW	LM	LF	STC	ANB	Spiders
X_1-Maximum Temp	-0.896	-0.166	-0.079	0.036	-0.025	0.103
X_2-Minimum Temp	0.940	-0.166	-0.046	-0.041	0.063	0.014
X_3-RH (m)	-0.084	-0.048	-0.032	0.011	0.013	0.035
X_4-RH (e)	-0.168	0.011	0.011	-0.003	0.001	0.0002
X_5-Rain fall	-0.011	-0.003	-0.004	0.0001	-0.003	-0.003
R^2 Value	0.138	0.386	0.340	0.261	0.124	0.114
% Variation	13.8	38.6	34.0	26.1	12.4	11.4

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

Table 3.56: Regression analysis between pests and natural enemies of cashew and weather parameters during 1st Oct, 2022 to 30th Sep, 2023

Sl. No	Biotic factor	Regression equation	R^2
1.	LBW	$29.272-0.896(X_1)+0.940(X_2)-0.084(X_3)-0.168(X_4)-0.011(X_5)$	0.138
2.	LM	$13.955-0.166(X_1)-0.166(X_2)-0.048(X_3)+0.011(X_4)-0.003(X_5)$	0.386
3.	LF	$6.038-0.079(X_1)-0.046(X_2)-0.032(X_3)+0.011(X_4)-0.004(X_5)$	0.340
4.	STC	$-0.814+0.036(X_1)-0.041(X_2)+0.011(X_3)-0.003(X_4)+0.0001(X_5)$	0.261
5.	ANB	$-1.534-0.025(X_1)+0.063(X_2)+0.013(X_3)+0.001(X_4)-0.003(X_5)$	0.124
6.	Spiders	$-5.014+0.103(X_1)+0.014(X_2)+0.035(X_3)+0.0002(X_4)-0.003(X_5)$	0.114

LBW: Leaf and blossom webber; LM: Leaf miner; LF: Leaf folder; STC: Shoot tip caterpillar; ANB: Apple and nut borer

X_1-Maximum Temperature; X_2-Minimum Temperature; X_3-Relative Humidity (m); X_4-Relative Humidity (e); X_5-Rain fall

During the experimental period (1st Oct, 2022 to 30th Sep, 2023), the relation between the percent pest damage (Y) and weather variables such as Max.Temp (X_1), Min.Temp.(X_2), Relative Humidity (m) (X_3), Relative Humidity (e) (X_4) and Rainfall (X_5) was worked out by subjecting the data collected over 52 standard weeks to Multiple Linear Regression Analysis.

Relationship of per cent leaf and blossom webber damaged shoots with selected weather variables was subjected to multiple regression analysis. Results revealed that all weather variables together in question accounted for 13.8 per cent variation in per cent shoot damage by leaf and blossom webber (R^2= 0.138). However, none of the variables was found to influence the damage by LBW independently.

Leaf miner population showed, all weather variables together in question accounted for 38.6 per cent variation in per cent leaf damage by leaf miner (R^2= 0.386). However, none of the variables was found to influence the damage by leaf miner independently.

With regard to leaf folder damaged leaves with selected weather variables was subjected to multiple regression analysis. Results revealed that all weather variables together in question accounted for 34.0 per cent variation in per cent leaf damage by leaf folder (R^2= 0.340). However, none of the variables was found to influence the damage by leaf folder independently (Table No.3.56).

Relationship of per cent shoot damage caused by shoot tip caterpillar with selected weather variables was subjected to multiple regression analysis. Results revealed that all weather variables were found to influence the damage by shoot tip caterpillar independently. All independent variables have accounted for 26.1 percent of total variation in percent shoot damage by shoot tip caterpillar (R^2=0.261).

With regard to Apple and nut borer all five independent variables have accounted for 12.4 % of total variation in percent nut damage by apple and nut borer (ANB) (R^2=0.124). The data indicated that none of the variables were found to influence the damage by apple and nut borer independently.

With regard to natural enemies; spiders' population all independent variables have accounted for 11.4 % of total variation in per cent in number (R^2= 0.114). The data indicated that none of the variables were found to influence the number of spider population (Table 3.57).

Table 3.57: Incidence of different cashew pests during different months during 2022-23

Month	Incidence of major cashew pests (% Damage)				
	LBW	LM	LF	STC	ANB
October- 2022	0.00	2.07	0.69	0.00	0.00
November- 2022	0.00	3.21	1.36	0.00	0.00
December- 2022	0.00	2.44	0.92	0.00	0.00
January- 2023	0.00	2.06	0.38	0.10	0.00
February- 2023	0.20	2.74	0.69	0.48	0.00
March- 2023	0.06	1.14	0.24	0.40	0.48
April- 2023	0.11	0.51	0.00	0.02	1.06
May- 2023	0.13	0.22	0.02	0.00	0.32
June- 2023	4.86	0.13	0.04	0.00	0.00
July- 2023	10.39	0.12	0.02	0.05	0.00
August- 2023	2.35	0.08	0.00	0.06	0.00
September- 2023	0.39	0.58	0.02	0.00	0.00

BHUBANESHWAR

Seasonal incidence of insect pests during 2023 revealed that there was low incidence of shoot tip caterpillar and flower thrips while leaf miner, leaf and blossom webber incidence remained negligible. A positive correlation with weather was observed for the shoot tip caterpillar except for sunshine hour (-0.165). In case flower thrips incidence, a non- significant correlation was observed with the Relative Humidity (FN) (r=-0.065). A significant positive correlation was observed with maximum temperature P(r=0.132), and bright sunshine (r= 0.646*)

In case of leaf miner, a positive correlation with weather was observed excepting sunshine hour (-0.148) and significantly positive in wind velocity (-0.536*).

Table 3.58: Correlation of pest incidence with weather parameters

Weather Factor	Leaf Thrips	Shoot tip caterpillar	Leaf miner
Max. temp.(^{0}C)	0.132	-0.158	0.117
Min.temp.(^{0}C)	-0.108	-0.245	0.185
Rain fall (mm)	-0.238	-0.118	0.227
Rainy days (No.)	-0.137	-0.291	0.083
Relative Humidity (FN)	0.065	0.259	0.121
Relative Humidity (AF)	-0.065	0.181	0.187
Wind velocity	0.309	0.054	0.536*
BSSH	0.646**	-0.165	-0.148

VRIDHACHALAM

The incidence of TMB was confined to flushing through fruiting season. Its activity was observed from first week of January 2023 to third week of April 2023. Maximum TMB damage was observed during the second week of March with mean damage score ranging between 7.395 and 19.637. Nut borer activity during non-bearing periods could not be traced out. However, Nut borer larvae were seen in the new flush bearing shoots during November and December 2022. Cashew leaf miner incidence is most common in new flushes during July to December reaching the peak during September – October (17.30%) in Cuddalore district of Tamil Nadu, but incidence can be seen upto January at low level. During peak infestation period, 3 to 8 blisters and nine caterpillars are observed on a single leaf in Cuddalore District of Tamil Nadu. The Cashew leaf folder was also observed from July 2022 - November 2022 with 7.30 % to 26.20 % leaf damage observed in young plantations. Maximum damage was noticed during August 2022 and 2023 and September 2022 and 2023. Whereas, Leaf and blossom webber damage was observed maximum during August 2022 and 2023. Cashew Leaf thrips population (19.35) was noticed in March 2023. However, shoot tip caterpillar was observed during January to February – 2023, but incidence was noticed during January 2023. The CSRB damage (20%) was prevailing throughout the season but maximum was recorded during August 2023. Whereas flower thrips population was maximum during second fortnight of March 2023.

Table 3.59: Correlation coefficient (r) for abiotic factors and insect pests of cashew at Vridhachalam

Weather Parameters	TMB Population (Y1)	Leaf and blossom webber (% damage) (Y2)	Leaf miner (% damage) (Y3)	Leaf thrips Population (Y4)	Apple and nut borer (%damage) (Y5)	Leaf folder (%damage) (Y6)	Shoot tip caterpillar (%damage) (Y7)
Min.Temp. (X1)	-0.408**	0.354**	0.041	-0.007	-0.348**	0.232	-0.143*
Max.Temp. (X2)	-0.023*	0.272*	-0.174	0.226*	-0.196	0.085	-0.268*
RH% m(X3)	0.190	-0.326**	0.085	-0.040	0.310*	-0.155	0.100
RH% e(X4)	-0.113	-0.071	0.298*	-0.100	0.123	0.042	0.130
Rainfall (X5)	-0.283*	0.100	0.154	-0.092	-0.096	0.186	0.097
Rainy days (X6)	-0.380**	0.125	0.236	-0.221	-0.159	0.197	0.241*
Wind speed (Km/hr.) (X7)	0.174	-0.427**	-0.223	0.101	0.126	-0.359**	0.003
Sunshine (hours) (X8)	0.445**	-0.069	-0.280*	0.303*	0.131	-0.193	-0.211

*Significant at 1% level; **significant at 5% level.

The results of Correlation studies revealed that TMB population had significant negative correlation (r= -0.408) with the minimum temperature and (r= -0.023) with maximum temperature. Further, rainfall (r= -0.283) and rainy days (r= -0.380) had negative correlation with TMB population, but significant positive correlation with sunshine hours (r= 0.445). With regard to the per cent damage of leaf and blossom webber, an significant positive correlation was observed with minimum temperature (r= 0.355) and maximum temperature (r= 0.272 and significant negative correlation was noticed for windspeed (r=-0.427).

With regard to per cent leaf miner damage, showed a significant negative correlation while sunshine hours (r= -0.280). The results of the leaf thrips population damage(r=0.303) revealed that, it had a significant positive correlation with sunshine hours. Whereas for leaf folder damage, a significant negative correlation with wind speed (r= -0.359) was observed. Whereas, apple and nut borer had negative correlation with minimum temperature (r=-0.348) and positive correlation with morning Relative Humidity (r=0.310). With regard to shoot tip caterpillar damage, a significant positive correlation was observed with rainy days (r= 0.241).

The results revealed that the spider population had significant negative correlation with relative humidity in the evening (r= -0.250) but significant positive correlation was observed with Sunshine hours (r= 0.363).With regard to the population of ants, a positive correlation was observed with sunshine hours (r= 0.484) and negative correlation with rainfall (r= -0.359) as well as rainy days (r= -0.458).With regard to coccinellid population, significant positive correlation was observed with maximum (r= 0.680) temperature and minimum temperature (0.654) Whereas for the population of braconids, it had significant positive correlation with minimum (r= 0.524) temperature and maximum temperature (r= 0.453) and negative correlation with morning and evening Relative Humidity. The results of the wasp population revealed that, it had significant positive correlation with minimum (r=0.303).

Table 3.60: Regression analysis between pests of cashew and weather parameters during June - 2022 and September - 2023 at Vridhachalam.

Sl. No.	Biotic factors	Regression equation	R^2
1.	TMB Population(Y1)	$Y_1 = -62.810 + (-2.415)\ X_1 + 1.448^*X_2 + 0.816\ X_3 + (-0.055)X_4 + (-0.010)X_5 + (-0.519)X_6 + 0.241^*X_7 + 0.496X_8$	0.531*
2.	Leaf and blossom webber (% damage) (Y2)	$Y_2 = 61.131 + (0.604^*)\ X_1 + 0.405^*\ X_2 + (-0.954)\ X_3 + (0.255^*)X_4 + (0.007)X_5 + (-0.197^*)X_6 + (-2.120^*)X_7 + (-0.495)X_8$	0.305
3.	Leaf miner (% damage) (Y3)	$Y_3 = -12.469^* + 1.025^*X_1 + (-0.812)\ X_2 + (-0.171)\ X_3 + 0.209X_4 + (-0.016)X_5 + 0.248^*X_6 + (-1.016^*)X_7 + 0.005^*X_8$	0.229*
4.	Leaf thrips Population(Y4)	$Y_4 = -69.617^* + (-1.368)X_1 + (1.829)X_2 + 0.349^*X_3 + 0.162X_4 + 0.039X_5 + (-1.321)X_6 + (-0.527^*)\ X_7 + (-0.020^*)X_8$	0.226*
5.	Apple and nut borer (% damage) (Y5)	$Y_5 = -11.855^* + (-0.161^*)X_1 + 0.078^*X_2 + (0.142^*)X_3 + 0.006^*X_4 + (0.001)X_5 + (-0.115^*)X_6 + (-0.006)\ X_7 + 0.043^*X_8$	0.211*
6.	Leaf folder (% damage) (Y6)	$Y_6 = 45.038^* + (1.164^*)X_1 + (-0.329^*)X_2 + (-0.579^*)X_3 + (0.173^*)X_4 + 0.0294X_5 + (-0.526^*)X_6 + (-2.210^*)X_7 + (-0.624^*)X_8$	0.223*
7.	Shoot tip caterpillar (% damage) (Y7)	$Y_7 = 24.846^* + (-1.856^*)X1 + 1.080^*X_2 + (-0.092)X_3 + 0.117X_4 + (-0.002)X_5 + (-0.665^*)X_6 + (-0.347)X_7 + 0.263X_8$	0.176

*Significant at 1% level; **Significant at 5% level.

Minimum temperature (°C) (X1), Maximum temperature (°C) (X2), Relative Humidity (Morning %) (X3), Relative Humidity (Evening %) (X4), Rainfall (X5), Rainy days (X6), Wind speed (Km/hr.) (X7) and Sunshine (hours) (X8).

CSRB infested trees were identified at monthly intervals and the number of grubs were also recorded. The stage of grubs was identified based on the brown Prothoracic shield width (cm) (January to September 2023).

Table 3.61. Month-wise Cashew Stem and Root Borer (CSRB) infestation during 2023 at Vridhachalam

Sl. No.	Month	No. of CSRB infested trees	No. of Grubs	No. of cocoons (F)	No. of Adults	Stage of the Grubs / infested trees				
						A	B	C	D	E
1.	Jan 2023	28	80	5	0	14	20	16	20	10
2.	Feb 2023	10	25	4	0	0	8	8	9	0
3.	Mar 2023	-	-	-	-	-	-	-	-	-
4.	Apr 2023	-	-	-	-	-	-	-	-	-
5.	May 2023	20	45	8	0	5	10	10	15	5
6.	Jun 2023	15	35	4	0	6	8	9	10	2
7.	Jul 2023	10	22	4	0	4	4	4	10	0
8.	Aug 2023	35	80	3	0	12	18	18	22	10
9.	Sep 2023	10	25	2	0	8	1	8	8	0

A= Less than 45 days; **B**= 45-90 days; **C**= 91-120 days;
D= 121-150 days : **E**= More than 180 days; **F**= Pupa

The following flower thrips in the Vridhachalam centre were collected and sent to ICAR, DCR, Puttur and the flower thrips was identified as follows:

Sl. No.	Scientific Name	Taxonomic position
1.	*Frankliniella schultzei* (Trybom)	Thysanoptera: Terebrantia: Thripidae
2.	*Frankliniella schultzei* (Trybom)	Thysanoptera: Terebrantia: Thripidae
3.	*Scirtothrips dorsalis* Hood	Thysanoptera: Terebrantia: Thripidae
4.	*Scolothrips asura* Ramakrishna & Margabandhu (This is predatory thrips)	Thysanoptera: Terebrantia: Thripidae

MADAKKATHARA

The correlation between TMB damage and weather parameters revealed a significant negative correlation with minimum temperature (-0.358*) evening relative humidity and minimum temperature, but a significant positive correlation with maximum temperature. In the case of thrips, a significant negative correlation was established with morning and evening relative humidity and rainfall but a significant positive correlation with sunshine hours and maximum temperature. In case of thrips, a significant negative correlation was established with minimum temperature (-0.331*) morning and evening relative humidity and positive correlation with max temperature, evaporation and sun shine hours. No noticeable infestation was observed in case of other minor pests of cashew.

Table 3.62: Correlation of weather parameters on the activity of pest complex of cashew

Variable	TMB	Thrips
X1-Maximum Temp	0.308*	0.349*
X2-Minimum Temp	-0.358*	-0.331*
X3-RH (m)	-0.172	-0.558*
X4-RH (e)	-0.364*	-0.533*
X5-Rain fall	-0.291*	-0.252
X6 – Wind velocity	0.063	0.041
X7 – Evap.	0.199	0.31*
X8 – Sun shine hours	-0.031	0.415**
R2 Value	0.271	0.349
% Variation	72.9	65.1

Table 3.63: Regression analysis between pests and natural enemies of cashew and weather parameters during 2023

Sl. No.	Biotic factor	Regression equation	Adjusted R^2
1	Tea mosquito bug	0.86–(0.020X1) + (0.046X2)-(0.011X3)-(0.001X4)-(0.002X5)+(0.029X6)+ (0.002X7)+(0.004X8) -(0.007X9)	0.098
2	Thrips	0.328-(0.002X1) – (0.00X2) – 0.002X3) – (0.001X4)+(0.00X5)-(0.001X6)+(0.000X7)-(0.003X8)-(0.001X9)	0.195

Table 3.64: Incidence of different cashew pests during different months during 2023

Months	Incidence of major cashew pests		
	TMB(DS)	Thrips (DS)	Leaf Miner (%)
Aug 2022	0	0	0.05
Sept 2022	0.37	0	0.48
Oct 2022	0.18	0	0.24
Nov 2022	0.07	0.02	0.58
Dec 2022	0.15	0.09	1.8
Jan 2023	0.13	0.04	0.89
Feb 2023	0.13	0	0.19
Mar 2023	0.08	0.05	0.29
Apr 2023	0	0	0
May 23	0	0	0
Jun 2023	0	0	0
Jul 2023	0	0	0

PARIA

Correlation studies indicated that minimum temperature (-0.658), morning relative humidity (-0.462), evening relative humidity (-0.532) and evaporation (-0.583) had a significant negative correlation with the TMB population. Bright sunshine hours (0.286) had a non-significant positive correlation with the TMB population. Morning relative humidity (0.430) showed a significant positive correlation with the activity of spider during the period. Whereas, maximum temperature (-0.147), minimum temperature (-0.277) and wind velocity (-0.174) had a non-significant negative correlation with the spider population. In the case of the ant population, minimum temperature (-0.449), wind velocity (-0.538) and evaporation (-0.650) had a significant negative correlation. The population of lady bird beetle showed a maximum temperature (-0.025), minimum temperature (-0.096), morning relative humidity (-0.328) and evening relative humidity (-0.180) with a non-significant negative correlation and a non-significant positive correlation with the rest of the weather parameters (Table No.3.65 & 3.66).

Table 3.65: Correlation of weather parameters on the activity of pest and natural enemies at Paria center during the year 2022-23

Weather Parameters	TMB	Spider	Ants	Lady bird beetle
X_1 - Maximum Temp	0.111	-0.147	-0.111	-0.025
X_2 – Minimum Temp	-0.658*	-0.277	-0.449*	-0.096
X_3 - RH (m)	-0.462*	0.430*	-0.320	-0.328
X_4 - RH (e)	-0.532*	0.121	-0.070	-0.180
X_5 - Bright sunshine hours	0.286	0.009	0.012	0.129
X_6 - Wind velocity	-0.084	-0.174	-0.538*	0.131
X_7 - Evaporation	-0.583*	0.088	-0.650*	0.044
R^2	0.861	0.465	0.533	0.172
% Variation	86.1	46.5	53.3	17.2

Table 3.66: Regression analysis between pests and natural enemies of cashew and weather parameters at Paria centre during the year 2022-23

Sl.No	Biotic factor	Regression equation	Adjusted R^2
1	TMB (Y_1)	$Y_1 = 0.137 + (0.097) X_1 + (-0.078) X_2 + (-0.006) X_3 + (-0.004) X_4 + (0.035) X_5 + (0.356) X_6 + (-0.317) X_7$	0.861
2	Spider (Y_2)	$Y_2 = 0.707 + (-0.017) X_1 + (-0.034) X_2 + (0.006) X_3 + (0.004) X_4 + (-0.028) X_5 + (0.049) X_6 + (0.044) X_7$	0.465
3	Ants (Y_3)	$Y_3 = 9.242 + (-0.052) X_1 + (-0.007) X_2 + (-0.023) X_3 + (0.008) X_4 + (0.096) X_5 + (-0.440) X_6 + (-0.598) X_7$	0.533
4	Lady bird beetle (Y_4)	$Y_4 = 0.790+ (0.002) X_1 + (-0.009) X_2 + (-0.005) X_3 + (0.000) X_4 + (-0.020) X_5 + (0.020) X_6 + (0.037) X_7$	0.172

VENGURLA

During the year 2022-23 incidence of TMB started in the month of November, 2022 and reached its peak in the same month (0.616) and declined thereafter. The incidence of thrips was started from December, 2022 and reached its peak in the month of January, 2023 (0.388) and declined thereafter. The incidence of apple and nut borer was noticed in the month of January with the setting of apples and nuts and it was maximum in the months of February and March, 2023 (3.28 and 3.27%).

The correlation studies indicated that the infestation of tea mosquito bug showed significantly negative correlation with evening RH (r = -0.804). The incidence of thrips showed significantly negative correlation with minimum temperature (r = -0.827). The incidence of apple and nut borer showed significant negative correlation with minimum temperature (r = -0.704). Whereas, there was no significant correlation with remaining weather parameters (3.68).

Table 3.67: Seasonal incidence of different pests (2022-23)

Month	Incidence of TMB (0-4 scale)	Incidence of Thrips (0-4 scale)	Incidence of ANB (%)
Apr	0	0	0
May	0	0	0
Jun	0	0	0
Jul	0	0	0
Aug	0	0	0
Sep	0	0	0
Oct	0	0	0
Nov	0.616	0	0
Dec	0.340	0.190	0
Jan	0.259	0.388	2.47
Feb	0.203	0.296	3.28
Mar	0.068	0.265	3.27

Table 3.68: Correlation between cashew pest incidence and weather parameters (April, 2022 to March, 2023)

Weather Parameters	TMB	Flower thrips	Apple and nut borer
Maximum Temp	0.145	0.002	0.063
Minimum Temp	-0.467	-0.827*	-0.704*
RH (m)	-0.256	0.321	-0.334
RH (e)	-0.804*	-0.562	-0.391
Rainfall	-0.431	-0.442	-0.374

***** - Significant at 5% level of significance. ***r*** **=** 0.576 at 5% level of significance

Table 3.69: The regression equation of different pests of cashew (Y) as dependent variable and weather parameters (X) as independent variable for the year 2022-22 is given below.

Sl. No.	Insect pests	Regression Equation	R^2	Adjusted R^2
1	TMB	Y_1= - 0.513+0.001x1+0.008x2+0.019x3−0.019x4+0.000x5	0.876	0.773
2	Thrips	Y_2=1.304-0.003x1-0.030x2-0.006x3+0.001x4+0.00x5	0.742	0.526
3	ANB	Y_3=13.842+0.042x1-0.310x2 −0.123x3+0.048x4+0.000x5	0.641	0.343

(*X_1 is maximum temp. X_2 is minimum temp. X_3 is morning RH, X_4 is evening RH and X_5 is rainfall.)

The regression equation indicated that an increase in 1% evening relative humidity decreases TMB incidence by 0.019. Regarding thrips, an increase in 1% minimum temperature decreases thrips incidence by 0.030. Regarding apple and nut borer, an increase in 1% minimum temperature decreases incidence of apple and nut borer by 0.310. The multiple regression equation was developed for predicting the TMB, thrips and apple and nut borer incidence and was predicted to an extent of 87, 74 and 64 per cent, respectively.

HOGALAGERE

The incidence of these insect pests and natural enemies was recorded throughout the year at different crop phonological stages of cashew. The data obtained were subjected for correlation and regression with prevailing weather parameters to know the influence of weather factors on insect population (Table No.3.70 &3.71).

Table 3.70: Correlation of pest population and weather parameters during 2022-23

Weather parameters	TMB	CSRB	ANB	Thrips	Aphids
X_1 - Maximum Temp (^{o}C)	(-) 0.108	(-) 0.243	(+) 0.476*	(+) 0.319*	(+) 0.450
X_2 - Minimum Temp (^{o}C)	(+) 0.358**	(+) 0.619*	(-) 0.075*	(-) 0.322*	(-) 0.250
X_3 - RH (m) (%)	(-) 0.152	(+) 0.276*	(-) 0.105	(-) 0.330	(-) 0.329
X_4 - RH (e) (%)	(+) 0.062*	(-) 0.164	(-) 0.306**	(+) 0.390	(-) 0.456*
X_5 - Rain fall (mm)	(+) 0.123**	(+) 0.239*	(-) 0.152*	(-) 0.292	(-) 0.311*
X_6 - No. of rainy days	(+) 0.088**	(+) 0.263*	(-) 0.086*	(+) 0.296	(-) 0.321*

Among them, tea mosquito bug and cashew stem and root borer were found to be the major insect pests in the region.

Table 3.71: Regression equation for incidence of pests and weather parameters during 2022-23

Sl. No.	Pest	R value	Multiple Regression equation (Y=a+bx)
1	TMB	0.404	$Y=(0.471*X_1)+(-1.177X_2)+(-0.116*X_3)+(0.140*X_4)+(-0.012*X_5)+(0.172*X_6)$ + 13.89
2	ANB	0.551	Y=(1.929*X1)+(-0.811*X2)+(0.170*X3)+(0.158*X4)+(-0.042*X5)+(0.580*X6) -61.65
3	CSRB	0.647	Y=(-0.073*X1)+(-0.517*X2)+(-0.103*X3)+(0.015*X4)+(0.003*X5)+(-0.052*X6) + 22.89
4	Thrips	0.587	Y=(1.265*X1)+(-1.242*X2)+(-0.099*X3)+(0.195*X4)+(-0.008*X5)+(0.002*X6) -10.94
5	Aphids	0.647	Y=(1.557*X1)+(-1.258*X2)+(-0.057*X3)+(0.217*X4)+(-0.009*X5)+(-0.017*X6) -24.95

KANABARGI

Results indicated that TMB incidence had highly significant positive correlation with Minimum Temp (+0.85), evening relative humidity (+0.52), rainfall (+0.77) and number of rainy days (+0.82) and negative correlation with maximum temperature (-0.32) and morning relative humidity (-0.48). The infestation of thrips showed significant positive correlation with maximum temperature (+0.85) and number of rainy days (+0.34) and negative correlation was obtained with rest of the weather parameters.

Table 3.72: Correlation of weather parameters on the activity of pest complex of cashew

Weather Parameters	TMB (% damage)	Thrips (No./shoot or panicle)
X_1-Maximum Temp	(-) 0.32	(+) 0.85*
X_2-Minimum Temp	(+) 0.85**	(-) 0.57*
X_3-RH (m)	(-) 0.48	(-) 0.30
X_4-RH (e)	(+) 0.52*	(+) 0.41
X_5-Rain fall	(+) 0.77**	(-) 0.35
X_6 – No. of rainy days	(+) 0.82**	(+) 0.34

* Significant at 0.05% & ** highly significant at 0.01%

Table 3.73: Regression analysis between pests and natural enemies of cashew and weather parameters during 2023

Sl. No.	Biotic factor	Regression equation	Adjusted R^2
1.	TMB	Y = (-0.0927 X1) + (-0.2310 X2) + (-0.0419 X3) + (-0.0032 X4) + (0.0013 X5) + (-0.0172 X6) + 4.253	0.72
2.	Thrips	Y = (0.0421 X1) + (0.0195 X2) + (-0.0834 X3) + (0.0137 X4) + (0.0038 X5) + (-0.1834 X6) + 3.984	0.37
Natural enemies			
1	Spider	Y = (0.0946 X1) + (0.2323 X2) + (0.0791 X3) + (-0.0052 X4) + (-0.0007 X5) + (-0.0512 X6) + (-7.322)	0.37
2	Lady bird beetle	Y = (0.2247 X1) + (-0.3443 X2) + (-0.0513 X3) + (0.0319X4) + (0.0407 X5) + (0.0032 X6) + 7.1457	0.52
3	Green lace wing	Y = (0.1327 X1) + (-0.2341 X2) + (-0.0016 X3) + (0.0215 X4) + (-0.0074 X5) + (0.0069 X6) + 3.1253	0.61
4	Syrphid	Y = (0.0225 X1) + (-0.0613 X2) + (-0.0512 X3) + (-0.0163 X4) + (-0.0034 X5) + (0.0196 X6) + (-2.9847)	0.43

Where X1- Max. temp; X2- Min temp; x3- Max. RH; X4- Min RH; X5- Rainfall & X6- Rainy days.

JAGADALPUR

The TMB damage score had highly significant negative correlation with minimum temperature (-0.648**), maximum temperature (-0.523**) and wind velocity (-0.507**) at 1 per cent level of significance. The significant positive correlation was found with morning relative humidity (0.578**). The damage score of thrips showed highly significant and negative correlation with wind velocity (-0.667**) at 1 per cent level of significance whereas negative correlation with maximum temperature (-0.479*) and minimum temperature (-0.449*) at 5 per cent level of significance.

The per cent damage of shoot tip caterpillar showed significant positive correlation with morning relative humidity (0.456**) whereas negative correlation with maximum temperature (-0.479*). Leaf miner showed significant positive correlation with sun shine hours (-0.389*) at 5 per cent level of significance. No correlation with weather factors was observed for leaf folder in the current season.

Table 3.74: Correlation of weather parameters on the activity of pest complex of cashew

	TMB	Thrips	Shoot tip caterpillar	Leaf miner	Leaf folder
X_1-Maximum Temp	-0.523**	-0.479*	-0.478*	-0.203	-0.359
X_2-Minimum Temp	-0.648**	-0.449*	-0.304	-0.322	-0.366
X_3-RH (m)	0.578**	0.502**	0.456*	0.145	0.276
X_4-RH (e)	-0.231^{NS}	-0.004	0.117	-0.222	-0.094
X_5-Rain fall	-0.350^{NS}	-0.062^{NS}	0.123	-0.129	0.009
X_6 – Wind velocity	-0.507**	-0.667**	-0.129	0.065	-0.112
X_8 – Sun shine hours	0.195^{NS}	-0.101	0.034	0.389*	0.272

* Significant at 0.05% & ** highly significant at 0.01%

The TMB incidence starts from October and attains its peak in December month which slightly reduces from March. Similarly, thrips incidence was also recorded highest in December month. The incidence of shoot tip caterpillar, leaf folder and leaf miner were observed whole year. The maximum incidence of shoot tip caterpillar was recorded in July-August, leaf miner in October and leaf folder in September month respectively.

Table 3.75: Incidence of different cashew pests during different months of 2022-23

Months	Incidence of major cashew pests				
	TMB	**Thrips**	**Shoot tip caterpillar**	**Leaf miner**	**Leaf folder**
Aug. 2022	0.00	0.00	2.59	7.75	5.87
Sept. 2022	0.00	0.00	2.49	7.79	6.22
Oct. 2022	0.18	0.00	2.00	8.46	5.34
Nov. 2022	0.67	1.08	1.82	7.12	4.36
Dec. 2022	0.87	2.54	2.14	6.89	5.85
Jan. 2023	0.84	1.51	1.41	4.38	3.56
Feb. 2023	0.46	0.80	1.42	2.85	2.64
Mar. 2023	0.13	0.85	1.26	3.24	3.21
Apr. 2023	0.01	0.21	1.16	2.76	3.03
May 2023	0.00	0.00	1.11	2.17	2.57
Jun. 2023	0.00	0.00	1.04	1.87	2.51
Jul. 2023	0.00	0.00	2.59	7.75	5.87

The impact of weather parameters on insect pests and natural enemies were presented in the form of multiple linear regression equation. Based on the multiple regression analysis by taking pest incidence and damage per cent (Y) as a dependent variable and weather parameters (X) as independent variables following equations were fitted. Results of multiple linear regression analysis between weather parameters and incidence of TMB established a equation Y = -15.52 + 0.35 X1+ 0.21 X2 -0.01 X3 + 0.09 X4 + 0.03 X5 + 0.07 X6 - 0.19 X7 with Adjusted R2 0.49**($p<0.01$). Similarly, a significant equation was also established for thrips incidence Y = -4.93 + 0.24 X1 -0.18 X2 + -0.01 X3 + 0.02 X4 + 0.04 X5 -0.19 X6 – 0.23 X7 with Adjusted R2 0.43* ($p<0.05$).

Table 3.76: Regression analysis between pests and natural enemies of cashew and weather parameters during 2023

Sl. No.	Biotic factor	Regression equation	Adjusted R^2
1.	TMB	Y = -15.52 + 0.35 X1 0.21 X2 -0.01 X3 + 0.09 X4 + 0.03 X5 + 0.07 X6 -0.19 X7	0.49**(p<0.01)
2.	Thrips	Y = -4.93 + 0.24 X1 -0.18 X2 + -0.01 X3 + 0.02 X4 + 0.04 X5 -0.19 X6 – 0.23 X7	0.43* (p<0.05)
3.	Shoot tip caterpillar	Y = 28.66 -1.27 X1 + 0.74 X2 + 0.03 X3 + 0.08 X4 - 0.18 X5 + 0.38 X6 + 0.78 X7	0.35
4.	Leaf Miner	Y = 14.43 -0.53 X1 + 0.17 X2 + 0.02 X3 - 0.01 X4 – 0.07 X5 + 0.53 X6 + 0.61 X7	0.25
5.	Leaf folder	Y = 43.26 -1.11 X1 + 0.29 X2 + 0.04 X3 – 0.15 X4 – 0.09 X5 + 0.39 X6 + 0.97 X7	0.17

X1: Max Temp. X2: Min Temp. X3: Rainfall X4: RH(m) X5: RH(e) X6: Wind velocity X7: BSH

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

Centers: East Coast : Bapatla, Bhubaneshwar and Vridhachalam
West Coast : 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

Experimental details:

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)*

During the year 2022-23, among the 39entries screened to identify the tolerant lines against the pests of cashew, all entries were observed no incidence of leaf and blossom webber (0.00 per cent damage) during the experimental period. With regard to Leaf miner all entries were recorded very low incidence during the period, the damage range was 0.0 to 2.4 per cent. The damage caused due to leaf folder was observed very neglizable i.e. almost zero in all entries (0.00 – 0.50 per cent damage). The incidence of shoot tip caterpillar damage was observed maximum in Tudal- 3 (8.54 per cent shoot damage) and remaining entries were recorded damage range between 0.00 – 4.44 per cent damage. The entry Valpoi-2 has recorded with highest incidence of Apple and nut borer (11.11 %) and Goa -3, H- 355, H- 445, H- 446, H- 471, H- 474, H- 504, H- 585, H- 710 and H- 715 were observed no incidence during this season.

TABLE 3.77: S**creening of cashew germplasm to locate tolerance / resistance to major pests of the region (2022-23)**

Infestation by	Min. damage recorded (range)	Germplasm	Max. damage recorded (range)	Germplasm
Leaf and blossom webber	0-5%	Gangavaram– 1, Gangavaram– 2,Gangavaram–3, Valpoi- 2, T.No. – 10, Tudal– 3, Goa- 4, Goa- 3, BPP-8, BPP-9, BPP-10, BPP-11, H- 218, H- 355, H- 356, H- 365, H-445, H- 446, H- 448, H- 461, H- 464, H- 467, H-471, H- 474, H- 490, H- 491, H- 504, H- 530, H- 531, H- 541, H- 585, H- 596, H- 663, H- 690, H- 695, H- 709, H- 710, H- 715, H- 716	5.1-10%	-
Leaf miner	0-5%	Gangavaram– 1, Gangavaram– 2,Gangavaram–3, Valpoi- 2, T.No. – 10, Tudal– 3, Goa- 4, Goa- 3, BPP-8, BPP-9, BPP-10, BPP-11, H- 218, H- 355, H- 356, H- 365, H-445, H- 446, H- 448, H- 461, H- 464, H- 467, H-471, H- 474, H- 490, H- 491, H- 504, H- 530, H- 531, H- 541, H- 585, H- 596, H- 663, H- 690, H- 695, H- 709, H- 710, H- 715, H- 716	5.1 -10%	-
Leaf folder	0-5%	Gangavaram– 1, Gangavaram– 2,Gangavaram–3, Valpoi- 2, T.No. – 10, Tudal– 3, Goa- 4, Goa- 3, BPP-8, BPP-9, BPP-10, BPP-11, H- 218, H- 355, H- 356, H- 365, H-445, H- 446, H- 448, H- 461, H- 464, H- 467, H-471, H- 474, H- 490, H- 491, H- 504, H- 530, H- 531, H- 541, H- 585, H- 596, H- 663, H- 690, H- 695, H- 709, H- 710, H- 715, H- 716	5.1-10%	-
Shoot tip caterpillar	0-5%	Gangavaram– 1, Gangavaram– 2,Gangavaram–3, Valpoi- 2, T.No. – 10, Goa-4, Goa- 3, BPP-8, BPP-9, BPP-10, BPP-11, H-218, H- 355, H- 356, H- 365, H- 445, H- 446, H-448, H- 461, H- 464, H- 467, H- 471, H- 474, H- 490, H- 491, H- 504, H- 530, H- 531, H- 541, H- 585, H- 596, H- 663, H- 690, H- 695, H- 709, H- 710, H- 715, H- 716	5.1-10%	Tudal– 3
Apple and nut borer	0-5%	Gangavaram– 1, Gangavaram– 2,Gangavaram–3, T.No. – 10, Goa- 4, Goa- 3, BPP-8, BPP-9, BPP-10, BPP-11, H- 218, H- 355, H- 356, H- 365, H- 445, H- 446, H- 448, H- 461, H- 464, H- 467, H- 471, H- 474, H- 490, H-491, H- 504, H- 530, H- 531, H- 541, H- 585, H-596, H- 663, H- 690, H- 695, H- 709, H- 710, H-715, H- 716	5.1-10%	Valpoi- 2, Tudal– 3

VRIDAHACHALAM

Screening of the cashew germplasm accessions available at Regional Research Station, Vridhachalam was made to locate the tolerant/ resistant/ susceptible cashew types against TMB and other foliar feeding insects *viz*., leaf and blossom Webber, Leaf miner, Shoot tip caterpillar, Leaf folder and apple and nut borer pests. Totally 110 Germplasm accessions were available at Regional Research Station, Vridhachalam. TMB Mean damage score (0-4 scale in 24 leader shoots) ranged from 1.1 to 1.4 damage scale and the per cent damage of Leaf and blossom Webber ranged from 1.0 to 1.1 and the per cent Leaf miner damage and Shoot tip caterpillar per cent damage was observed as 0.1 and 0.2 per cent whereas the Leaf folder per cent damage ranged from 0.5 and 0.6 in germplasm accessions.

VENGURLA

Data recorded on screening of cashew germplasm against TMB, thrips and ANB during the year 2022-23 revealed that the lowest TMB incidence (0.095) was noticed in variety V-3 whereas; it was maximum in V-9 and Hy-1174 (0.587). In flower thrips incidence, the lowest (0.321) thrips infestation was recorded in variety V-7 whereas it was maximum in V-9 (1.119). The lowest apple and nut borer (ANB) incidence (1.19%) was noticed in variety V-7 whereas it was maximum in V-9 (5.06%).

Data recorded on screening of cashew germplasm against TMB, thrips and ANB revealed that the lowest TMB incidence (0.095) was noticed in variety V-3 whereas; it was maximum in V-9 and Hy-1174 (0.587). Regarding thrips, the lowest (0.321) thrips infestation was recorded in variety V-7 whereas it was maximum in V-9 (1.119). The lowest apple and nut borer (ANB) incidence (1.19%) was noticed in variety V-7 whereas it was maximum in V-9 (5.06%).

HOGALAGERE

The reaction of germplasm and MLT-2002 entries maintained at the HREC, Hogalagere centre were observed against major pests of cashew and the reaction of germplasm against major pest provided in the table 3.78. The study revealed that none of the yielding germplasm accessions /entries have shown resistant reactions to TMB infestation and other major pests across years.

Table 3.78: Screening of germplasm entries for tolerant/resistant to the major pests of the region during 2022-23

Infestation by	Min. damage recorded (range)	Germplasm accessions	Max. damage recorded (range)	Germplasm accessions
TMB	(0.80-0.90)	HREC-42, H-11, HREC-12, H-675, BH-85, HREC-31, HREC-21, HREC-75, HREC-06, HREC-49	(0.91-0.99)	HREC-44, H-32/4, H-1597, H-662, HREC-29, HREC-10, Chintamani-2, HREC-26, K-22-1, Chintamani-1, H-14, HREC-28, HREC-45, HREC-27, BH-6, HREC-24
CSRB	(< 5.0)	HREC-42, HREC-24, HREC-27BH-6, H-14, H-675, HREC-26HREC-10, HREC-06, HREC-44HREC-21, H-662, H-11, H-32/4	(> 5.0)	HREC-75, BH-85, H-1597, Chintamani-1, HREC-45, Chintamani-2, K-22-1, HREC-28HREC-12, HREC-49, HREC-31,HREC-29
ANB	(< 18.0)	HREC-06, HREC-27, HREC-29, BH-6, BH-85, HREC-31, HREC-49, HREC-24, HREC-44H-675, HREC-28, H-11, H-14H-662	(>18.0)	HREC-75, K-22-1, HREC-26,H-32/4, Chintamani-1, H-159, Chintamani-2, HREC-12, HREC-42, HREC-21, HREC-45,HREC-10
Thrips	(0.10-0.20)	Chintamani-2, HREC-10, BH-85, HREC-26, K-22-1, HREC-06, HREC-49, HREC-31, HREC-21, H-32/4, HREC-27, H-675, HREC-28, HREC-44	(> 0.21)	Chintamani-1, HREC-24, HREC-45, BH-6, H-14, H-662, HREC-12HREC-42, HREC-75, H-1597H-11, HREC-29

JAGDALPUR

The germplasm recorded low score for thrips and TMB. The lowest score for TMB were recorded in NRC-192 (0.19), whereas, germplasm NRC-140, NRC - 137 and NRC-131 had minimum score for TMB (0.19). The shoot tip caterpillar infestation was ranged from 4.56 to 13.24 per cent and minimum per cent of leaf damage was reported in NRC-131. The lowest damage with respect to leaf miner and leaf folder was recorded in NRC-191 (0.59 %) and NRC-190 (2.29 %) respectively.

The local germplasm collections were screened for insect-pest infestation. It is evident from the data (Table 3.79) revealed that the lowest damage score of TMB was observed in CARS-5 (0.17) whereas lowest score of thrips was recorded in germplasm CARS-6 (0.00). The minimum damage for shoot tip caterpillar, leaf miner and leaf folder were found in CARS-7, CARS-8 and CARS-8, respectively.

The entries in MLT-V were also screened for infestation of insect-pests. The experimental data presented in Table revealed that lowest score of thrips was recorded in germplasm BPP-6 and NRCC Selection-2 (0.19 DS) whereas maximum in V-6 (1.12). The lowest TMB infestation (DS) was reported in germplasm VRI-3, UN-50 and BPP-4 with 0.15 score however, maximum TMB score was reported in V-9 (0.78). The minimum damage per cent of shoot tip caterpillar, leaf miner and leaf folder were found in Ullal-1, Jhargram-1 and Madakkathara -1, respectively.

Table 3.79: Minimum and maximum damage scores recorded in germplasm during 2022-23

Infestation by	Min. damage recorded (range)	Germplasm accessions	Max. damage recorded (range)	Germplasm accessions
TMB	0-1	All accessions	3-4	-
Thrips	0	CARS-6	3-4	-
Shoot tip caterpillar	0-5	NRC-131, BPP-4, Bhubaneswar-1, K-22-1, VRI-3, Ullal-1 Bhaskara	15-20	CARS-5, CARS-10
Leaf miner	0-5	NRC-130, NRC-136, NRC-137, NRC-191, NRC-192, VTH 711/4, BPP-4, BPP-6, Chintamani-1, Jhargram-1, K-22-1, Kanaka, V-1, V-6, VRI-3, NRCC Sel., Ullal-1, Ullal-3, Ullal-4, UN-50, Goa-1, Bhaskara	15-20	NRC-131, V-9, Mad-1
Leaf folder	0-5	CARS-8, NRC-131, NRC-137, NRC-190, BPP-4, Jhargram-1, Kanaka, Bhaskara, Mad-1	15-20	V-9

Ent.5: Observations on region-specific pollinators on cashew

Centers: East Coast : Bhubaneshwar and Vridhachalam
West Coast : Madakkathara, Paria and Vengurla
Plains / others: Hogalagere, Kanabargi and Jagdalpur

The objective of this project is to record the flower visitors, their foraging behavior and nesting habits and bee flora of the region.

BHUBANESWAR

Insect visitors documented on cashew flowers at Odisha include 15 species belonging to 10 families of three insect orders. The Hymenopterans were the major floral visitors comprising of bees (belonging to Apidae and Halictidae), ants and wasps followed by Dipterans.
Observations showed that many of the dipterans are just visitors of cashew flowers; they collect nectar by bending sideways without touching stigma. Besides they rarely visit freshly opened flowers.

PARIA

The different pollinators and flower visitors recorded during the flowering period of cashew were *A.c.indica, A. dorsata, A.florea, A. mellifera, Tetragonula* sp., and ants.

HOGALAGERE

The monitoring and documentation of flower visitors and pollinators of cashew was done throughout the flowering duration of cashew during 2022-23.

Table 3.80: Documentation of flower visitors and pollinators of cashew in various agro-ecological regions during 2022-23

Sl. No.	Scientific name	Taxonomic position	Common name	Type of Foraging		
				Pollen	Floral Nectar	Extra floral Nectar
1	*Ceratina (=Pithitis) benghami*	Hymenoptera: Apidae	Solitary bee	+	-	-
2	*Braunsapis* sp	Hymenoptera: Apidae	Solitary bee	+	-	-
3	*Ceratina smargula* (Fab.)	Hymenoptera: Apidae	Solitary bee	+	-	-
4	*Halictus* sp.	Hymenoptera: Apidae	Solitary bee	+	-	-
5	*Trigona irridiennis* Smith	Hymenoptera: Apidae	Stingless bee	+	+	-
6	*Apis cerana* Fab	Hymenoptera: Apidae	Indian bee	+	+	+
7	*Apis florea* Fab	Hymenoptera: Apidae	Little bee	+	+	+
8	*Eristalinus obliquus*	Diptera: Syrphidae	Hover fly / flower fly	-	+	+
9	*Camponotus campressus*	Hymenoptera: Formicidae	Carpenter black ant	+	+	+
10	*Oecophylla smargdina*	Hymenoptera: Formicidae	Red weaver ant	+	+	+
11	*Musca domestica*	Diptera: Muscidae	House fly	-	+	+
12	Unidentified sp.	Diptera: Tipulidae	Daddy long legs	-	+	-

The results indicated that 12 species of flower visitors and pollinators were found foraging on the cashew pollen as well as nectar of the flowers (Table 3.80). The collected insect specimens were taxonomically identified at Insect Biosystematics laboratory, Department of Entomology, UAS, GKVK, Bengaluru.

5. Transfer of technologies and success stories and variety wise information on grafts produced and sold:

Centre	No. of grafts produced during 2023
Bapatla	40000
Bhubaneswar	15000
Hogalagere	1680
Jagdalpur	7860
Jhargram	6000
Darisai	5000
Kanabargi	8000
Madakkathara	49412
Paria	204
Pilicode	8500
Vengurle	78035
Vridhachalam	90000
TOTAL	309691

Transfer of Technology

Bapatla

Scientists of Bapatla visited the cashew orchards at Srinivasapuram village of Jangareddygudem division, Muddappagudem village of Buttayagudem mandal West Godavari District and observed severe infestation of Tea mosquito bug and flower and nut feeding pests and suggested the control measures.

The cashew orchards at Karagapadu village of Gopalapuram mandal East Godavari District were visited and the management practices against flower and nut feeding pests as well as protection of the young cashew plants in view of the raising temperatures adopting mulching, protection with palmyrah leaves and protected irrigation were suggested.

Madakkathara

During 2023, the technology for commercial cashew apple processing was transferred for commercialization in Karnataka and in Maharashtra.

i. Commercialization of traditional delicacy, Cashew Sprouts- Success story of a budding agri entrepreneur

The germinated nuts or cashew sprouts are relished in their raw form or in curries, and are a traditional delicacy among rural people. Cashew Research Station, Madakkathara has developed technologies for year-round production of cashew sprouts in a forced production system. The station has launched the commercial sale of product. An entrepreneur has also been assisted under Agricultural Infrastructure Development Funder under central government for a project cost of 1.41 crore for primary processing of cashew

ii. Spearhead achievements in Cashew Apple Processing

The major commercial products from the station are cashew apple syrup, cashew apple mixed jam, cashew apple pickle, cashew apple carbonated drink, cashew apple candy, cashew apple toffee and cashew apple energy bar. The technology for clarification of cashew apple juice, detanning of cashew apple, long term storage of cashew apple juice and preparation of products have been approved by the University under transfer of technology. Currently three farmer group / entrepreneurs/ institution from Maharashtra, Tamil Nadu and Karnataka have availed the technology for commercialization.

Vengurla

Transfer of technologies:

a) Field demonstration on maintenance of newly planted grafts, CSRB management were conducted in Asagani, Tal. Malvan, Adeli, Tal. Vengurla, Parabwada, Tal. Vengurla. Various other aspects viz., cashew production technologies, Fertilizer management in cashew and pest and disease of cashew were demonstrated in different locations based on the need.

6.Report on TSP / SCSP/NEH programme with relevant photographs

Bapatla

Tribal sub plan / SCSP/ NEH / MGMG etc.,

SCSP programmes were conducted to create awareness about cashew cultivation and distribution of agricultural inputs at the following villages; Annapanenivarigudem, Karagapadu, Muddappagudem, Gangavaram, Narayanapuram, Peddanadipalle and approximately 100 farmers attended and interacted in each of the programmes.

Bhubaneswar

The Center has conducted the following number of training programme on various cashew production technologies and area expansion during 2023.

Programmes	No. of training programme conducted	No. of beneficiaries	Area Expansion (ha.)	No. of beneficiaries
SCSP	4	200	5.56	11
TSP	2	100	3.92	8

Darisai:

The Center was involved in area expansion with recommended varieties and trainings to enhance knowledge of the cashew farmers.

TARGET				ACHIEVEMENT	
Sl.No	Activities	Area (ha)	Participants	Area (ha)	Participants
1.	Area Expansion under SCSP	2	25	2	25
2.	Area Expansion under TSP	1	4	1	4
3.	Cashew grafts distributed.	5000	-	5000	
4.	Off campus training	-	-	1	40
5.	Training under TSP	1	40	1	40
6.	Training under SC-SP	2	80	1	40
7.	Technical Leaflets		-	1500 Nos	

Hogalagere

Various trainings in SCSP were conducted as below and it was noticed that farmers are considering Cashew crop as an alternative to mango crop as a main crop and further the farmers are interested in processing aspects of cashew apple and value addition of nut Training on scientific production technologies in cashew for improvement of yield and demonstrations on grafting and pruning techniques in cashew were organized in Shidlaghatta and Chikkaballapur taluks.

Jagdalpur

Conducted two training programmes under TSP in the Kumhrawand village.

Jhargram

Distribution of cashew grafts and fungicide, fertilizer and manure under area expansion scheme of SCSP were done at the following blocks; Jamboni and Depal. Trainings on Propagation, Cultivation, Processing of Cashewnut were organized at Tulsiboni SKUS Ltd., Jamboni block, Jhargram and Kasafaltalya Samabay Krishi Unnayan Samity Limited, Purba Medinipur. Area expansion programme were taken up at Jamboni and Gobindapur.

Madakkathara

SCSP training programme was organized at Thrissur in which 56 farmers participated and farm implements were distributed. Under TSP programme, cashew grafts were distributed to the farmers of Chinnaparakudi Tribal Hamlet for expansion of 2 ha area.

Paria

TSP programmes on scientific cultivation of cashew were organized at KVK, Dediapada and Waghai organized in which 40 farmers participated.

Pilicode

Under TSP, an awareness seminar on Scientific cashew production was organized at Pookkkunnumala colony for the tribal farmers. A total of 9 beneficiaries for area expansion were selected after field verification and grafts of cashew variety Priyanka was distributed to them. Awareness seminar on Cashew Cultivation was organized at Kozhikode for 50 farmers and Front-line demonstrations in 2 ha has been established.

Under SCSP, three seminars on Scientific cashew production were held at Aralam, Kodombelur Parappa and Navodaya Colony, Periya. A total 10 beneficiaries for area expansion were selected after field verification and grafts of Priyanka were distributed. Awareness seminar on cashew cultivation was organized at Kasaragod and Kannur for 160 farmers and front-line demonstrations in 2 ha has been established.

Vengurla

Under SCSP programme cashew area expansion was done at Asagani and Kirlos villages, training on Cashew production technology and distribution of cashew grafts and other agricultural inputs was taken up at Asagani, Adeli, Parabwada, Nirwade, and Sawantwadi.

Vridhachalam

Under TSP, training on Creating awareness about cashew cultivation and expanding cashew area with VRI 3 and VRI (Cw) H1 grafts was done at Thavadanallur.

Under SCSP, Creating awareness about cashew cultivation and expanding cashew area in Pelanthurai and Manakollai of Cuddalore District.

A training on creating awareness about cashew cultivation and expanding cashew area in Scheduled Caste areas was conducted at Silambur, Rangiyam and Athukurichi of Ariyalur District.

7. Training programmes and exhibitions organized/attended with relevant photographs

Bapatla

Dr. YSRHU- Cashew Research Station, Bapatla and ICAR-Directorate of Cashew Research, Puttur jointly organized the Annual Group Meeting of AICRP on Cashew- 2022 at Dr. YSRHU- Horticultural Research Station, VR Gudem on 19th – 21st, January, 2023. Dr. AK Singh, DDG, ICAR, New Delhi., Dr. V.B. Patel, ADG, ICAR, New Delhi, Dr. T. Jankiram , Hon'ble Vice Chancellor, Dr. YSRHU, Dr. Dinakara Adiga, Director and Project Coordinator, Dr. T N Raviprasad, Scientist-in-Charge; ICAR- DCR, Puttur, Dr. L. Naram Naidu, Director of Research, Dr. YSRHU and scientists from different AICRP cashew Centers participated in the meeting and the results were discussed in detail. The research programme for the next year were also finalized.

Organized the Rythu Sadassu at Narakodur, Santhapalem, Kothavalasa, wherein the specimens, charts and models about cashew cultivation were displayed; and cashew awareness programmes were organized at Amalapadu, Rotary Community Hall, Jangareddygudem and at Dr. YSRHU- CRS, Bapatla. Training programme on cashew apple utilization and value-added products were also organized for two batches of rural women.

Bhubaneswar

Under SCSP, trainings on Improved Production Technology on Cashew cultivation, District Level Seminar on Cashew were orgainised at Paljhar, Sakhigopal, Nimakana, Rukuda, Deogarh, ,Banapur, Bahadajhola and Srichandanpur in which more than 50 farmer participated in each programme.

Hogalagere

SCSP programmes on cashew awareness training were organized at Anur, Chikkapura and chikkaballapur**.**

The scientists of this center participated and exhibited Cashew displays in UAS, Bangalore, GKVK, Krishi mela and in National Horticulture Fair-2023 organized at IIHR, Bangalore.

Jhargram

Trainings were organized on different aspects of cashew cultivation technology, at Jhargram Purba Medinipur and Paschim Medinipur in which more than60 farmers had participated and interacted to know the detailed aspects of cashew cultivation techniques.

Madakkathara

Organised an exhibition on cashew cultivation and value addition at Sahithya academy hall, Thrissur, organized DCCD funded training programme on cashew apple utilization for unemployed women conducted at Madakkathara, Kottopadam, Palakkad; Ezhukone, Kollam and at Kasaragodu.

Paria

Training programme were organized on cashew apple utilization at AES, Paria, Kaparada and at Mohangam, Valsad wherein more than 60 farm women participated.

Pilicode

One day training on cashew cultivation was organized by RARS Pilicode with financial assistance from DCCD Kochi at Karanathakad, Kasaragod.

Vengurla

Scientists of this center attended “DCCD sponsored MIDH scheme – National Level Training Programme on Cashew” at KSNUAHS, Shivamogga, Karnataka.

Vridhachalam

A total of 12 trainings on “Propagation techniques in cashew and Soft wood grafting techniques in cashew” , “Value addition in Cashew” as well as “Training on Hi-Tech production technology of Cashew” were organized in which more than 400 participants from TAFCORN, ATMA were trained.

Kanabargi

Scientist of this Center participated in Krishi and Totagarike Mela at UAS, Dharwad and UHS, Bagalkot respectively , and at training on at Changad village Maharashtra organised by KVK Konneri, Kolaphur.

Tura

One day Training programme was held on “Advanced Production Technologies for Cashew including usage of Cashew Protect” in which 20 farmers participated.

8. Participation in seminar/Conference/Symposia/Workshop/Group Meeting/Webinar and Lectures delivered

Bhubaneswar

Dr P. K. Panda and Dr K. Sethi attended National Conference on Encashing technological innovations for production and productivity of cashew, 30th-31st January, 2023 at Bhubaneswar organized by Directorate of Cashew and Cocoa Development, Kochi, Kerala

Dr Kabita Sethi, Jr. Horticulturist, imparted training to the plantation supervisor of Odisha State Cashew Development Corporation Ltd. on 28th March,2023 under "Skill Development Training Programme on Cashew Production and Value Addition organized from 24th March to 29th March,2023- MIDH-HRD scheme

Dr Kabita Sethi attended and deliver lecture on the topic entitled "Improved Package and Practices in Cashew Cultivation for Income Generation "in the Workshop on "Challenges and Opportunities in Horticulture for Doubling Farmers income" organized by KVK, Khorda, ICAR-Central Institute of Fresh Water Aquaculture, Kausalyaganga, Bhubaneswar.

Hogalagere

Dr. Jagadish, and Dr. Srikantaprasad D, Scientists of AICRP on Cashew, Hogalagere have attended National level training programme on "Cashew cultivation processing and value addition" organized by KSNUAHS, Shivamogga and DCCD, Govt. of India, Cochin from 6-8th September-2023.

Madakkathara

Dr. Jalaja S. Menon attended as a resource person in the DCCD National conference on cashew conducted from 30th to 31st January 2023 at Odisha State convention centre, Loka Seva Bhavan, Bhubaneswar.

Dr Nasiya Beegum A.N participated in the short course training programme on "Improved crop protection technologies in cashew with major emphasis on IPM" conducted by DCR, Puttur.

Dr. Jalaja S. Menon attended 5th International congress on Kerala Studies in seminar on "Agriculture in Kerala: Challenges and future", conducted at Thrissur on 20, 21 & 22 of May 2023 and presented a paper on "Raising Production and Productivity-Recent Trends in Cashew Production".

Dr.Jalaja S. Menon, Assistant Professor & Head participated in the 25th National Plantation Crops Symposium (PLACROSYM-XXV) from 12th to 14th December 2023 at ICAR-IIOPR, Pedavegi and presented a paper entitled "Enriching nutritional quality of tropical fruit nectar by blending clarified cashew apple juice.

Vengurla

Dr. V. S. Desai, Junior Entomologist delivered online lecture on Foliage Pest Management in Cashew nut on 21.02.2023 to staff of Agriculture Department of Maharashtra.

Mr. Lalit S. Khapare, Junior Cashew Breeder delivered lecture on recent advances in cultivation of cashew and fruit crops and demonstrated about nursery management technology in cashew in interstate farmers training programme organized by ATMA, Department of agriculture, Belgaon at RFRS, Vengurla on 01.03.2023.

Tura

Delivered a talk on "Present scenario of Cashew cultivation in NE – an overview" during the Workshop "Cashew Area Expansion Future Focus on North Eastern States of India" held on 28th September, 2023 at Guwahati

9. Linkage and collaboration made.

Bhubaneswar

Developed collaboration with Orissa Sate Cashew Development Corporation Ltd., Govt. of Odisha, Orissa Forest Development Corporation, Govt. of Odisha and Directorate of Horticulture, Govt. of Odisha, for various cashew related trainings and programmes

Hogalagere

Collaborated with Karnataka State Department of Horticulture, Bangalore, ARS- Chintamani (UASB), KVK and COH-Kolar for conducting trainings to create awareness on cashew cultivation.

Madakkathara

Various extension activities, training programmes and graft distribution have been conducted in collaboration with KVKs, KSSAC, DCCD and state government agricultural department and also with Kerala State Agency for Area Expansion of Cashew Cultivation, grafts of improved varieties of cashew were distributed at subsided rate.

Paria

Has developed collaboration with DOA, Valsad/DOH, Valsad and ATMA, Valsad.

Tura

Training cum Farmers'-Scientists Interaction programme on "Production and Post-Harvest Management of Cashew" was organized in collaboration with ATMA, West Garo Hills.

10. Publications

a. Research publications: National and International

Bapatla

PhD Research work of Dr. K. Umamaheswararao, Senior Scientist (Hort) & Head, entitled as “A ready to serve beverage obtained by standardizing and enriching of cashew apple juice with other juice powder are a method for manufacturing the same” was published in the Indian Patent Office Journal No. 30/2023 Dt 28.07.2023

Bhubaneswar

Sethi, K., Dash, M., Panda, P. K., Mohana G. S and Adiga J. D. Assessment of adaptability of cashew varieties to changing environmental conditions of Odisha. Scientia Horticulturae, 324(1-9).

Gouda S., Panda, P. K., Sethi, K., Jena, C., and Panda, R.K. 2023. Influence of various mulching techniques and NAA application on flowering and nut parameters of cashew cv. BPP-8 under Odisha condition. International Journal of Plant and Soil, 35(23),132-138.

Panda, P. K., Gouda, S. Sethi, K. and Jena, C. 2023. Effect of different water retention technique with foliar application of NAA on yield and quality of cashew (Anacardium occidentale L.) cv.BPP-8. In: Progressive Horticulture Conclave, Feb. 3-5,2023 at GBPUT, Pantnagar, Uttarakhand.Pp.128

K, Rakhee, Sethi, K. and Dash, M. 2023. Characterization of cashew (Anacardium occidentale L.) genotypes based on morpho-economic traits. In: PLACROSYM23 Dec. 12-14,2023 at IIOPR, A.P. Pp.17.

Hogalagere

Rajendra, B. N., Ramachandra, R. K., Aswathanarayana Reddy, N., Honnabyraiah, M. K., Vishnuvardhana, Jagadeesh, S. L., Anjaneya Reddy, B., Ramesh, M. and Subramanyam, B., 2023, Role of differential nutrient management on growth and yield attributes of cashew (Anacardium occidetale l.) in maidan tracts of Karnataka. International Journal of Bio-resource and Stress Management (IJBSM), 14(2):237-242..

Jagdalpur

Ramteke, V. Nanda, H., Nirala, Y. S. and Mohana, G. S. 2023. Studies on crossability in cashew (Anacardium occidentale L.) genotypes. Journal of Horticultural Sciences 18 (2)

Madakkathara

Meera V. Menon, Jalaja S. Menon, AC Asna, AN Nasiya Beegum and Teresa Alex (2023) Long term effect of soil nutrient management on composition and structure of weed community in a cashew plantation. Indian Journal of weed science 55(3): 319-323.

Pilicode

International and National : Manjusha, A.V.M., Laya, P.K., Premachandran, A. et al. First report of wilt disease in cashew (Anacardium occidentale L.) caused by Fusarium decemcellulare in Kerala, India. CABI Agric Biosci 4, 7 (2023). https://doi.org/10.1186/s43170-023-00142-w (NAAS : Nil IF : 3.9)

Vengurla

Y.R. Govekar, L.S. Khapre, S.V. Deshmukh, S.S. Bhure and S.N. Pawar, effect of different bioinoculants on growth attributes of cashew grafts under nursery condition, Pharma Innovation 2023; 12(7):1846-1848.

Vridhachalam

Sathish, G.and K.Sundharaiya. 2023. Soil and water conservation and irrigation management in Cashew. Agriculture & Food e Newsletter. Oct.2023, Vol. 5(10):60-63.

Sathish, G. and A.Baskaran. 2023. Nutritional deficiency symptoms and management in Cashew. Kalnadai velanmai. Nov.2023, Vol. 5 (5):22-24.

Paper presented in Symposia/Workshop/Seminar :

Bhubaneswar

Panda, P. K., Sethi, K. and Jena, C.2023. Importance of quality planting materials in production and productivity of cashew. In: Souvenir of National Conference on "Encashing technological interventions for production and productivity of cashew", 30-31, January,2023,Bhubanesewar,Odisha. Pp32-37.

Madakkathara

Jalaja S. Menon. 2023. Technologies for commercial utilisation of cashew apple. In: Proceedings of National Conference on cashew, Bhubaneswar, 30-31 January 2023.

Jalaja S.Menon, Asna,A.C.,JyothilakshmiT.S. and Shabana Jasmine, T.T. 2023. Enriching nutritional quality of tropical fruit nectar by blending clarified cashew apple juice. In: Proceedings of 25th National Plantation Crops Symposium (PLACROSYM-XXV), Pedavegi, 12th to 14th December 2023

b. Extension bulletin/ Pamphlet/Leaflet

Bhubaneswar

Two numbers of leaflet has been published from the centre during 2023 viz., Nutana kajubagichara barsika karjyabali panjika [Package of practices for newly established cashew orchard] OUAT Publication No. 2023110046 and Adhika amalakhyama lanka amba kisama [Improved cashew cultivars for higher returns] OUAT Publication No. 2023110047

Darisai

Published two pamphlets on cashew production viz., Jharkhand rajya ke liye kaju utpadan pradyogiki. [Cashew production technologies for Jharkhand] and
Kaju: purvi sinhbhum ke liye vardaan [Cashew: a boon to East Singhbum].

Vridhachalam

A total of 7 pamphlets in Tamil and English Pamphlet were published on Hi-tech Cashew cultivation stepping stone to bumper yield, High Density Planting in Cashew, VRI (CW) Hybrid 1 Cashew Variety crop production management, Maximizing high yield in Cashew cultivation, Hi-tech Cashew cultivation of Cashew, Value addition Cashew and Varietal characters Cashew.

Kanabargi

One technical leaflet on “cashew production technology” in Kannada was published.

c. Technical bulletin:

Bapatla :

Technical folder on “Jeedimaamidi saagulo melakuvalu” [Cultivation techniques for cashew] and published on “Jeedimaamidi niaasinchu cheedapeedalu – nivaarana” [Management of pests infesting cashew] in Telugu language

Madakkathara

Technical pamphlet on Cashew Aphids, Kasumavile ilappenukal -Tech.Bull. -11

d. Technical/Popular article/Customized instruction materials:

Bhubaneswar

Sethi, K. and Panda, P.K.2023. Kaju Kalami chara Utpadanara Baisaiyka Diga. AICRP on Cashew, OUAT, Bhubaneswar.Pp.20.

Madakkathara

Nasiya Beegum AN, Asna A C, Jalaja S Menon (2023) Kasumavile keeda niyanthrana thinuini ((2023)-Cashew Protect- A mobile app for cashew pest identification. Mobile app. Krishijagaran. June 2023 (Malayalam)

Jalaja S Menon, Asna A C and Nasiya Beegum A N (2023)*Samrambakathwa Sadhyathaklumayi Kashumangayum* (Entrepreneurial opportunities in cashew apple processing.) Kalpadhenu Oct- Dec 2022 (Malayalam)

Pilicode

Meera Manjusha A.V., Amal Premachandran and Laya P.K., 2023, First report of Fusarium causing isolated wilt in Southern India., *The Cashew and Cocoa Journal*., XI (2): April –June 2023 p:16-17.

Vengurla

V. S. Desai and G. M. Golvankar; Value Added Products of Pomegranate; *Shetkari* - Vol. 23, Issue 7 - October 2023.

V. S. Desai and G. M. Golvankar; Foliage pest and disease management in cashew; *Krushikonnati* weekly magazine – 5 December 2023.

V. S. Desai and G. M. Golvankar; Foliage pest and disease management in mango; *Krushikonnati*weekly magazine

12. Awards/Recognitions

Bhubaneswar

Dr P. K. Panda selected as resource person in the Technical Session of National Conference on Cashew "Encashing Technological Innovations for production and productivity of cashew", 30-31st, january,2023 at Bhubaneswar,Odisha.

Jagdalpur

Awarded with ISHRD Himadri Young Scientist Award by INDIAN SOCIETY OF HORTICULTURAL RESEARCH AND DEVELOPMENT (ISHRD), Uttrakhand 2022 at Progressive Horticulture Conclave Held at GBPUAT, Pantnagar

Madakkathara

The Cashew Research Station, Madakkathara was recognized nationally as the "Best AICRP Centre on Cashew – 2022" based on research involvements, development of F1 progenies and working in tune to the needs at national level, at the Annual Group Meeting held at Dr. Y.S.R. Horticultural University, Andhra Pradesh in January 2023.

15. Radio talks/ TV Programmes

BAPATLA

Management of Cashew orchards in flowering season by Dr. K. Umamaheswara Rao, Senior Scientist (Hort) & Head, telicast in Maa cable on 01.02.2023

Bhubaneswar

Two AIR programmes on Sitadinia Panipariba Phasalara Jatna and Amba Amala O Parabarti Jatna as well as Kaju Phasalara jatna in DD, Bhubaneswar.

Paria

Scientists of this center participated in a Phone in live programme on DD Girnar on 07/04/2023 regarding Scientific cultivation of cashew and cashew pest control on AIR.

Vengurla

Scientists of this center participated radio talk on Foliar Pest Management of Cashew on AIR on 29.09.2023.

Vridhachalam

The scientists of this center participated in Radio talks and TV talks on Hi-Tech production technology steps to get bumper yield in Cashew, Varietal wealth of Cashew, Crop protection in Cashew , Munthiri payiril Orunginaintha Poochi Melaanmai (IPM in cashew) in Tamil.

17. Personnel: Staff position, Promotion, Retirement, Research Management Position, Scientific, Technical, Administration etc.

Bapatla

Name of the personnel	Designation
Scientific Staff:	
Dr.K .UmamaheswaraRao	Sr. Scientist (Hort.)&Head
Dr. B. Nagendra Reddy	Scientist (Ento.)
Dr. G. Sravanthi	Scientist (Ento.)
Technical Staff/Sub-Assts.	
Sri G. Samuel	Agricultural Extension Officer
Sri. G. SrinivasaRao	Class-IV (Grafter)

Bhubaneswar

Name of the personnel	Designation
Scientific Staff:	
Dr.(Mrs.) Kabita Sethi	Jr. Horticulturist & OIC(I/C)
Dr(Mrs) Pravasini Behera (Additional charge)	Jr. Entomologist
Technical Staff/Sub-Assts.	
Mr. Gajanan Sethi	Sr.Technical Assistant
Sri Dhanurjaya Almango	Grafter

Darisai

Name of the personnel	Designation
Scientific Staff:	
Dr. Arti Beena Ekka	Sr. Scientist & Head (Horticulture)
Supporting Staff	
Mr. Aditya Raut	Field Assisstant

Hogalagere

Name of the personnel	Designation
Scientific Staff:	
Dr. N. Aswathanarayana Reddy	Jr. Entomologist
Dr. Srikantaprasad D	Horticulturist
Dr. Jagadish	Jr. Horticulturist
Technical Staff/Sub-Assts.	
Mr. B. Subramanyam	Sr. Technical Asst.
Mr. M. Ramesh	Sr. Technical Asst.
Mr.H.V.Ramachandrappa (on contract basis)	Grafter

Jagdalpur

Name of the personnel	Designation
Scientific Staff:	
Mr. Vikas Ramteke	Jr. Horticulturist
Technical Staff/Sub-Assts.	
Mr. Jagdeo	Grafter

Jhargram

Name of the personnel	Designation
Scientific Staff:	
Dr. Mini Poduval	Horticulturist

Madakkathara

Name of the personnel	Designation
Scientific Staff:	
Dr. Jalaja S. Menon	Horticulturist
Dr. Naziya Beegum A.N	Jr. Entomologist
Dr. Asna A.C	Jr. Breeder

Paria

Name of the personnel	Designation
Scientific Staff:	
Dr. S. K. Desai	Scientist (Hort.)
Prof. S. G. Parmar	Scientist (Agril Ento.)
Technical Staff/Sub-Assts.	
Mr V.A. Darbar	Technical Asst
Mr. L. K. Bhoye	Supporting Staff

Pilicode

Name of the personnel	Designation
Scientific Staff:	
Dr. Meera Manjusha A.V.	Jr. Horticulturist
Technical Staff/Sub-Assts.	
Amal Premachandran	Jr. Technical Assistant

Vengurla

Name of the personnel	Designation
Scientific Staff:	
Dr. R. T. Bhingarde	Horticulturist
Shri. L. S. Khapare	Jr. Horticulturist
Dr. V. S. Desai	Jr. Entomologist
Technical Staff/Sub-Assts.	
Shri. R. P. Gorivale	Sr. Technical Assistant
Shri. D. J. Wagh	Jr. Technical Assistant

Vridhachalam

Name of the personnel	Designation
Scientific Staff:	
Dr.A. Baskaran,	Horticulturist
Dr. G. Satish	Jr. Horticulturist
Dr.S. Jaya Prabhavathi	Jr. Entomologist
Technical Staff/Sub-Assts.	
Thiru R Kannan	Sr. Technical Assistant
Th.K.Ragaventhra	Jr. Technical Assistant
Th Manivasagam	Grafter

Kanabargi

Name of the personnel	Designation
Scientific Staff:	
Mr. Naveen M Puttaswamy,	Horticulturist

Goa

Name of the personnel	Designation
Scientific Staff:	
Chaudhari Ganesh Vasudeo	ARS, Scientist (Vegetable Science)

Tura:

Name of the personnel	Designation
Scientific Staff:	
Dr. Hammylliende Talang,	Scientist (Hort.)

18. Budget and Expenditure for the year 2023(Rupees in lakhs):

BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING THE YEAR 2023-24

Allocation : **(Rs. in lakhs)**

Centre	Details of sanctioned provision					
	Pay and Allowances	TA	RC	NRC	Grand Total	ICAR share
Bapatla	55.69	1.80	18.90	0.573	76.97	57.73
Bhubaneswar	68.88	1.00	15.70	0.000	85.58	64.18
Darisai	09.53	0.67	07.12	0.173	17.49	13.12
Hogalagere	64.37	1.80	21.72	0.573	88.46	66.35
Jagdalpur	30.99	1.20	16.87	0.000	49.06	36.79
Jhargram	19.36	1.20	09.40	0.000	29.96	22.47
Madakkathara	58.39	1.73	15.71	0.533	76.36	57.27
Paria	34.34	1.20	08.33	0.000	43.87	32.90
Pilicode	21.61	0.75	08.43	0.000	30.79	23.09
Vengurla	89.25	1.80	17.41	0.440	108.90	81.68
Vridhachalam	89.87	2.00	17.64	0.000	109.51	82.13
Kanabargi	0.00	0.60	09.17	0.000	09.77	7.33
ICAR Res. Compl. For Goa, Goa	0.00	0.00	05.67	0.000	05.67	4.25
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.00	03.20	0.000	03.20	2.40
Provision for PC Cell	0.00	0.00	02.32	0.373	2.69	2.02
Total	**542.28**	**15.75**	**177.59**	**2.665**	**738.28**	**553.71**
ICAR Share	**406.71**	**11.81**	**133.19**	**2.00**	**553.71**	**--**
Provision for SCSP						30
Provision for TSP						15
Provision for NEH						90
GRAND TOTAL						**688.71**

Actual Expenditure

(Rs. in lakhs)

Centre	Pay and Allowances	TA	RC	NRC	Total	ICAR Share	SCSP	TSP
Bapatla	54.08	0.64	18.89	0.00	73.61	55.207	4.79	1.34
Bhubaneswar	56.64	0.25	15.69	0.00	72.58	54.430	2.57	0.91
Darisai	08.06	0.21	04.22	0.00	12.49	09.367	0.64	0.32
Hogalagere	73.23	1.42	21.72	0.57	96.94	72.705	3.38	--
Jagdalpur	36.88	1.09	16.87	0.00	54.84	41.130	2.74	3.03
Jhargram	21.98	0.90	7.05	0.00	29.93	22.447	1.28	1.73
Madakkathara	49.54	1.18	15.71	0.53	66.96	50.220	2.20	1.03
Paria	37.61	0.68	8.33	0.00	46.62	34.965	1.61	2.21
Pilicode	15.41	0.75	8.42	0.00	24.58	18.435	2.58	2.53
Vengurla	91.20	0.51	17.41	0.44	109.56	82.170	2.82	--
Vridhachalam	101.92	1.18	11.15	0.00	114.25	85.690	2.53	0.71
Kanabargi	0.00	0.24	9.16	0.00	9.40	07.050	--	--
ICAR Res. Compl. For Goa, Goa	0.00	0.00	5.67	0.00	5.67	04.252	--	--
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.00	2.65	0.00	2.65	01.990	--	--
Provision for PC Cell	0.00	0.00	02.32	0.373	2.693	02.019	--	--
Total	**546.55**	**9.05**	**165.26**	**1.913**	**722.773**	**542.08**		
ICAR Share	**409.91**	**6.79**	**123.945**	**1.435**	**542.08**	**--**		
Provision for NEH						**89.88**	--	--
Provision For SCSP						**27.14**	--	--
Provision for TSP						**13.81**	--	--
GRAND TOTAL						**672.91**	--	--

19. Meteorological data

Bhubaneswar

Months	Temperature(^{0}C)		Relative Humidity(%)		Rainfall (mm)	No. of rainy days	BSH
	Max.	Min.	Max.	Min.			
January,2023	29.5	16.4	88	46	0.0	0	3.7
February,2023	32.4	18.4	90	35	0.0	0	5.3
March,2023	34.2	21.4	91	51	48.5	3	4.4
April,2023	37.2	24.7	90	52	92.2	3	6.1
May,2023	37.8	26.4	88	57	103.7	6	5.2
June,2023	37.9	27.1	89	64	142.3	9	2.1
July,2023	33.3	26.8	93	79	215.5	14	3.4
August,2023	33.1	26.2	91	74	488.7	11	2.0
September,2023	32.9	25.2	93	76	448.2	14	2.3
October,2023	33.0	23.5	86	60	52.7	3	4.8
November,2023	30.9	20.3	87	51	18.5	2	5.0
December,2023	27.7	16.1	87	50	21.3	1	5.3
Total	**399.8**	**272.5**	**1072.7**	**696.4**	**1631.6**	**66**	**49.5**
Mean	**33.32**	**22.70**	**89.39**	**58.03**	**-**	**-**	**4.12**

Darisai

Month	Temperature		Humidity %		Rainfall (mm)	Normal Rainfall (mm)	No of Rainy Days
	Max.	Min.	Max.	Min.			
January 23	33.0	7.8	72	31	00	15.7	0
February 23	37.8	8.2	73	50	00	13.0	0
March 23	39.4	15.4	82	65	51.0	25.0	4
April 23	42.0	19.2	87	78	56.6	30.6	1
May 23	39.6	20.0	89	77	62.2	62.0	3
June 23	39.4	22.4	92	78	155.2	218.8	9
July 23	37.2	23.8	88	63	181.4	301.9	17
August 23	36.4	22.5	89	52	329.0	256.1	14
September 23	35.1	23.5	87	43	229.8	184.4	18
October 23	36.0	19.0	87	52	114.4	65.2	5
November 23	32.1	13.8	83	45	22.6	16.8	1
December 23	30.0	11.6	83	44	69.6	10.2	3
Total					1271.8	1199.7	75

Hogalagere

Weather data of HREC Hogalagere 2023							
Months	**Rainfall (mm)**	**Rainy days (No.s)**	**Temperature (^{0}c)**		**Relative Humidity (%)**		**Wind speed (km/hr)**
			Max. (Average)	**Min. (average)**	**Max. (average)**	**Min. (average)**	**Max. (average)**
January	0.0	0	29.1	13.8	80.1	38.8	4.3
February	0.0	0	32.4	13.0	80.0	29.3	5.0
March	92.2	4	33.3	17.2	88.1	34.3	4.7
April	5.0	1	35.7	19.9	97.4	34.3	4.3
May	88.0	10	35.5	22.1	91.0	49.0	4.3
June	47.5	4	32.5	22.6	77.7	46.1	2.4
July	60.0	8	29.8	21.7	81.4	52.3	4.1
August	47.5	4	32.5	21.8	84.1	30.2	3.0
September	160.5	9	30.2	21.5	79.3	42.6	3.0
October	188.1	11	27.9	18.9	82.2	49.3	2.5
November	267.2	18	26.4	19.1	88.3	54.1	2.6
December	52.3	1	26.8	17.1	93.6	56.5	19.9
Total	1008.3	70	31.0	19.1	85.3	43.1	5.1

Jagdalpur

Month	**Max. Temp °C**	**Min. Temp °C**	**Rainfall mm**	**Relative Humidity**		**Wind Vel. Kmph**	**Evap. mm**	**BSH**
				I	**II**			
Jan-23	29.6	10.8	0.0	87	32	1.4	2.7	7.4
Feb-23	32.3	11.0	0.0	79.7	26.1	1.9	4.1	9.2
Mar-23	32.1	17.0	105.5	85.4	45.2	2.5	3.9	4.0
Apr-23	34.4	20.1	64.9	85.9	41.3	2.3	4.8	6.3
May-23	35.3	21.0	163.5	81.8	42.6	2.8	5.0	6.5
Jun-23	35.7	22.7	232.9	78.8	44.8	3.4	5.5	5.2
Jul-23	29.5	22.6	398.3	91.5	76.0	4.2	1.8	2.8
Aug-23	29.9	22.1	213.3	91.5	71.2	3.4	3.1	2.5
Sep-23	29.4	22.1	232.3	93.6	75.9	2.6	2.7	3.0
Oct-23	31.7	17.9	6.2	89.7	48.7	1.5	3.4	7.6
Nov-23	30.4	16.1	15.8	87.5	49.3	1.5	2.3	5.8
Dec-23	27.5	11.7	54.0	87.6	49.3	1.7	1.9	5.6
Average	31.5	17.9	123.9	86.7	50.2	2.4	3.4	5.5
Total			1486.7					

Jhargram

Month	Temperature (ºC)		RH %	Max Wind Speed (mph)	Cloud Cover %	Total Rainfall (mm)	Rainy Days	Average Pressure (mb)	Sun Shine Hours
	Max	Min							
January	29	15		11.9				1014.3	
February	33	17	36.6	14.8	8.0	40.8	3	1.11	336.67
March	39	23		23.4				1009.7	
April	41	26		18.7				1005.4	
May	41	27	42.6	21.4	25.33	264.75	6	1003.6	254.33
June	40	29		20.3				999.8	
July	34	27		17.9				1001.1	
August	32	26	76.3	15.2	62.67	1073.94	57	1002.1	47.00
September	32	26		15.4				1003.2	
October	31	23		12.2				1009.9	
November	30	20	56.0	11.6	20.0	100.86	6	1013.6	285.00
December	27	17		12.1				1015.3	
Total						1480.35			

Madakkathara

Month	Temperature (ºC)		Mean RH (%)		Cum. Rain fall (mm)	No. of Rainy days	Sunshine hours (Total)	Wind speed	Evaporation (Total)
	Max.	Min.	Max	Min					
January	32.86	22.18	71.6	39.8	0	0	296.4	5.36	186.1
February	35.73	21.8	70	25.5	0	0	37.8	3.88	179.70
March	36.13	24.3	78.5	39.5	1.70	0	242.2	3.53	166.50
April	36.38	25.38	85.2	50.8	119.6	4	288.3	2.52	181.5
May	34.775	25.875	88.75	59	13.5	2	186.1	1.85	123.4
June	31.58	24.28	94.25	74.5	199.30	17	98.90	1.43	79.6
July	29.98	23.67	95.83	77.17	779.50	28	129.50	1.45	98.60
August	32.73	24.4	92.5	61.5	9.30	1	217.50	6.70	111.2
September	30.43	23.63	95.75	78	511.50	24	81.6	1.2	66.10
October	32.64	23.76	93.6	64.8	263.9	17	187.9	1.28	104.4
November	33.00	24.35	84.25	60	201.50	5	171	2.88	93.6
December	32.37	24.85	79.5	56.5	32.3	1	186.3	6.500	129.3

Paria

Month	Max. Temp.	Min. Temp.	RH (M)	RH (E)	Wind velocity	Rainfall (mm)	Sunshine hours	Evaporation (mm)
Jan-23	32.03	12.01	81.38	48.73	2.19	0.00	8.94	3.36
Feb-23	36.04	14.50	70.14	65.53	2.26	0.00	10.01	3.79
Mar-23	35.89	19.80	88.73	78.91	2.95	1.60	8.40	5.25
Apr-23	37.38	24.24	89.68	91.60	3.32	1.60	10.06	8.27
May-23	36.70	24.55	79.93	52.68	5.74	1.60	10.43	8.19
Jun-23	35.25	25.99	79.46	63.16	7.46	495.10	7.58	6.70
Jul-23	30.14	26.08	94.58	86.86	5.65	2179.00	0.56	2.15
Aug-23	30.84	26.69	90.96	77.64	7.08	2301.00	3.20	3.60
Sep-23	31.70	26.09	93.09	80.88	3.39	2590.70	3.60	4.22
Oct-23	34.91	24.20	91.32	57.23	1.56	2590.70	8.48	6.74
Nov-23	34.89	19.65	88.86	53.46	1.20	2615.70	7.98	6.11
Dec-23	31.58	17.87	94.19	90.57	1.35	2615.70	7.71	5.10
Total:						2615.70		

Pilicode

Month	Max Temp.	Min Temp.	RH 1	RH 2	BSS	Rain (mm)	Evaporation (mm)
January	32.9	20.3	92.5	61.6	8.5	0.0	2.1
February	32.9	21.8	92.9	61.8	8.3	0.0	4.5
March	34.2	22.2	89.5	56.5	8.6	0.0	5.4
April	33.8	24.9	86.0	73.2	8.5	0.0	6.2
May	34.2	25.6	81.1	67.8	8.1	26.8	5.9
June	32.4	24.5	90.7	78.7	4.6	454.2	5.5
July	30.4	23.2	92.2	86.5	1.7	1084.9	5.9
August	31.5	23.9	88.0	80.0	7.3	148.8	5.6
September	30.4	23.7	91.3	85.9	4.5	672.4	6.0
October	32.0	24.5	91.0	82.6	6.8	109.3	4.7
November	33.1	24.2	90.1	82.5	7.7	133.9	3.1
December	34.1	24.4	88.1	82.3	8.5	17.8	3.4

Vengurla:

Month	Temperature (0c)		Humidity (%)		Rain fall (mm)	No. of rainy days
	Maximum	Minimum	Maximum	Minimum		
Jan. 2023	32.58	16.93	98.00	46.00	0.00	0
Feb. 2023	34.68	17.05	96.00	24.00	0.00	0
March 2023	34.20	21.85	88.00	25.00	0.00	0
April 2023	36.77	21.27	95.00	35.00	0.00	0
May 2023	35.26	28.79	100.00	58.00	0.00	0
June 2023	34.97	26.18	98.00	35.00	336.80	14
July 2023	33.93	25.87	98.00	73.00	1748.20	31
Aug. 2023	32.77	27.52	97.00	85.00	259.91	24
Sep. 2023	32.07	29.44	98.00	85.00	453.30	25
Oct. 2023	33.74	29.95	98.00	84.00	95.10	4
Nov. 2023	34.28	30.35	97.00	86.00	101.00	5
Dec. 2023	33.37	30.53	97.00	44.00	0.00	0

Vridhachalam

Month / Weather factors	Rainfall (mm)	Rainy Days (No.)	Temperature (^{0}C)		Relative Humidity (%)		Sun Shine (Hrs)
			Max.	Min.	Morning	Evening	
Jan 2023	0.0	0	31.0	20.4	94	74	5.44
Feb 2023	14.4	2	31.6	20.8	94	71	7.76
March 2023	33.0	2	34.7	22.3	94	70	7.82
April 2023	4.0	1	35.0	24.0	97	79	2.15
May 2023	164.8	4	36.8	25.8	91	69	6.96
June 2023	73.6	6	36.9	26.8	90	65	6.71
July 2023	45.9	5	35.7	25.8	91	62	4.40
Aug 2023	121.2	7	36.5	25.2	90	64	7.29
Sept 2023	79.6	7	35.7	25.6	91	70	5.93
Oct 2023	24.4	4	34.4	0.0	92	74	5.60
Nov 2023	341.6	16	30.3	24.2	94	87	3.47
Dec 2023	7.8	1	29.9	23.3	94	84	2.17
Average	**960.7**	**55**	**34.0**	**22.0**	**93**	**72**	**5.48**