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CHAPTER II: ORGANISATION

COORDINATOR'S REPORT

The All India Coordinated Spices and Cashewnut Improvement Project (AICS & CIP) was started during the IV Five Year Plan in 1971 with its headquarters located at the Central Plantation Crops Research Institute, Kasaragod. During the VII Plan, the ongoing project (AICS & CIP) was bifurcated into two separate projects, one on Cashew and another on Spices. The headquarters of the independent All India Coordinated Research Project (AICRP) on Cashew was shifted to the newly established National Research Centre for Cashew, Puttur in 1986.

The AICRP on Cashew has presently eight centres and one sub-centre of which four were started at the inception of AICS & CIP in the year 1971 [Bapatla (ANGRAU the then APAU); Madakkathara (KAU, shifted from Anakkayam); Vengurle (BSKKV the then KKV) and Vridhachalam (TNAU)]. During V Plan period, one centre at Bhubaneswar (OUAT) and in VI Plan, two centres, one at Jhargram (BCKVV) and another at Chintamani (UAS) were added. During VIII Plan, one centre at Jagdalpur (IGAU) and a sub centre at Pilicode (KAU) were also started. These centres of AICRP on Cashew are located in eight cashew-growing states of the country and are under the administrative control of different State Agricultural Universities.

The budget allocation of the project for the year 2001-2002 was Rs. 100.16 lakhs (Rs. 75.12 lakhs ICAR Share) and the expenditure was Rs. 77.35 lakhs (Rs. 58.01 lakhs ICAR Share).

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

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

CROP IMPROVEMENT

During the year under report, 95 trees have been identified for collection for Regional Cashew Gene Bank (RCGB) in different coordinating centres. Places surveyed during the year include Tetagunta, Simhachalam and Bapatla in Andhra Pradesh; Tapang and Ranasinghpur in Orissa; Ramnagar and Digha in West Bengal; Rajapuram, Odakkali, Malappuram and Parappa in Kerala; Thane, Sindhudurg and Raighad in Maharashtra and Panruti in Tamilnadu. Indigenous collection numbers (IC Nos.) have been obtained through NRC for Cashew for 716 collections from NBPGR, New Delhi. Total holdings in different RCGBs amount to 1188.

Among the germplasm planted in the field in Bapatla during 1997 the T.No. 40 with 0.533 Kg tree^{-1} for first harvest was found better. At Bhubaneswar OC-31 with 15.43 kg tree^{-1} for seven harvests was the better performer. Highest yield recorded at Chintamani was for 2/6 ARSC (14.00 kg tree^{-1}) for 17th year. At Madakkathara, H 719 hybrid with 3.3 kg tree^{-1} for 9th harvest was found better performer. At Pilicode germplasm accessions are under evaluation for their vegetative growth parameters. Balli-2 with 4.53 kg tree^{-1} was the highest yielder at Vengurle seven years after planting. At Vridhachalam, M 15/4 with 2.5 kg tree^{-1} was found better than other accessions. For testing the varieties in different agro climatic regions multi locations trial has been laid out at the main centers. During the year, highest yield

was obtained for M 44/3 (3.40 kg tree^{-1}) planted during 1993 at Bapatla. At Bhubaneshwar, maximum yield was obtained for H 320 (8.67 kg tree^{-1}) planted during 1992. At Chintamani maximum yield has been recorded for Hy 302 (5.52 kg tree^{-1}) planted during 1992. M 15/4 has yielded highest (2.90 kg tree^{-1}) planted during 1993 at Madakkathara. At Vridhachalam, M 15/4 has been found to be better yielder in MLT-92 trial (2.320 kg tree^{-1}) planted during 1994. Under the trial on performance of released varieties, BPP-8, Priyanka and BPP-2 were found to be vigorous types. At Madakkathara among the varieties tested, BPP-5, BPP-2 and BPP-3 were found superior. Under hybridization and selection programme, crossing of promising parents has been carried out at different centers. At Bapatla 85 and at Vengurle 824 hybrids were planted. At Bhubaneshwar, 461 nuts and at Chintamani 74 hybrid nuts have been obtained. Evaluation of existing, hybrids at Bapatla indicated high yield performance of hybrid 4/1 (14.6 kg tree^{-1}). At Bhubaneswar A1-85 could produce highest yield (2.92 kg tree^{-1}) from third annual harvest. At Madakkathara H-42 produced highest yield (2.90 kg tree^{-1}) for first annual harvest. At Vengurle, H 641 performed better (5.99 kg tree^{-1}) and at Vridhachalam M 10/4 x M 26/1 could produce highest yield (4.8 kg tree^{-1}) from 11th annual harvest.

CROP MANAGEMENT

At Bapatla 1000g N and 125g P_2O_5 could produce highest yield (2.35kg tree^{-1}) from third annual harvest. Under on farm trial in APFDC plantations a yield of 10.25 kg/tree^{-1} could be obtained. At Chintamani, 1.49kg tree^{-1} yield could be realized for higher dosage of fertilizer under on farm trial. At Jhargram, 500gN, 125g P_2O_5, could produce better canopy. At Madakkathara, 125g P_2O_5 could produce maximum yield (4.98 kg tree^{-1}). At Vengrle 1000 g N, 250 g P_2O_5 and 250 g K_2O could produce highest yield (3.90 kg tree^{-1}). At Vridhachalam, highest yield has been obtained for treatment with 1000g N, and 250 g P_2O_5 (1.040 kg tree^{-1}) for the variety VRI-2.

A new trial on high density plantation with different levels of fertilizer application has been laid out in all main centers. At Bapatla, BPP-8; at Bhubaneswar H 2/16; at Jhargram, Jhargram-1; at Madakkathara and Pilicode, Madakkathara-1 and V-7 at Vengurle were planted.

Testing of different spacings is being carried out at Jhargram and Vengrule. At Vengurle, 5 m x 5 m square planting with 75 per cent thinning could yield 400 kg block^{-1} of 50 m x50 m with 100 plants. High density demonstration garden has been maintained at Bapatla, Bhubaneswar, Chintamani and Vengurle. At Bhubaneswar high density planting could produce an yield of 1312.5 kg ha^{-1} for variety H 2/16.

Different intercropping trials are being carried out with annuals at different coordinating centers. At Bapatla, green gram was found to be a better intercrop during late kharif season. At Bhubaneswar, turmeric has been found to be remunerative with net profit of Rs.12,798/- ha^{-1}. At Vengurle, Cucumber was found remunerative with a net profit of Rs.34,998/- ha^{-1}. At Vridhachalam, groundnut was found remunerative as compared to other intercrops.

Drip irrigation trial has been laid out at Chintamani, Vengrule and Vridhachalam centers.

CROP PROTECTION

At Chintamani, least incidence of TMB was recorded on trees which received spray at flushing, flowering and fruiting stages. The population of natural enemies was highest in untreated control (T-10) during all the stages. However, in experiment initiated during 1995-96 on BLA

139-1 the yield was highest for trees sprayed with monocrotophos at flushing, endosulfan at flowering and carbaryl at fruiting (T-5, 6.96 Kg tree^{-1}). At Madakkathara trees sprayed during flowering and flushing stages could yield better as compared to other treatments (13.5 kg tree^{-1}). The treatment T-5 was found to be more effective than the other treatments after third spray at Vengurle and Vridhachalam.

In the experiment on alternative chemicals, the standard spray was the most effective treatment compared to other treatments at Bhubaneswar. At Chintamani, highest yield of 5.92 Kg tree^{-1} was recorded in treatment with profenophos. Spraying chlorpyriphos and profenophos was the most effective control for pests of cashew at Jhargram. Highest yield was reported from Madakkathara in treatment T5 (9.50 Kg tree^{-1}). At Vengurle, spraying with profenophos (0.05%) was found to be effective in controlling TMB. Standard spray (T1) was found to be most effective at Vridhachalam.

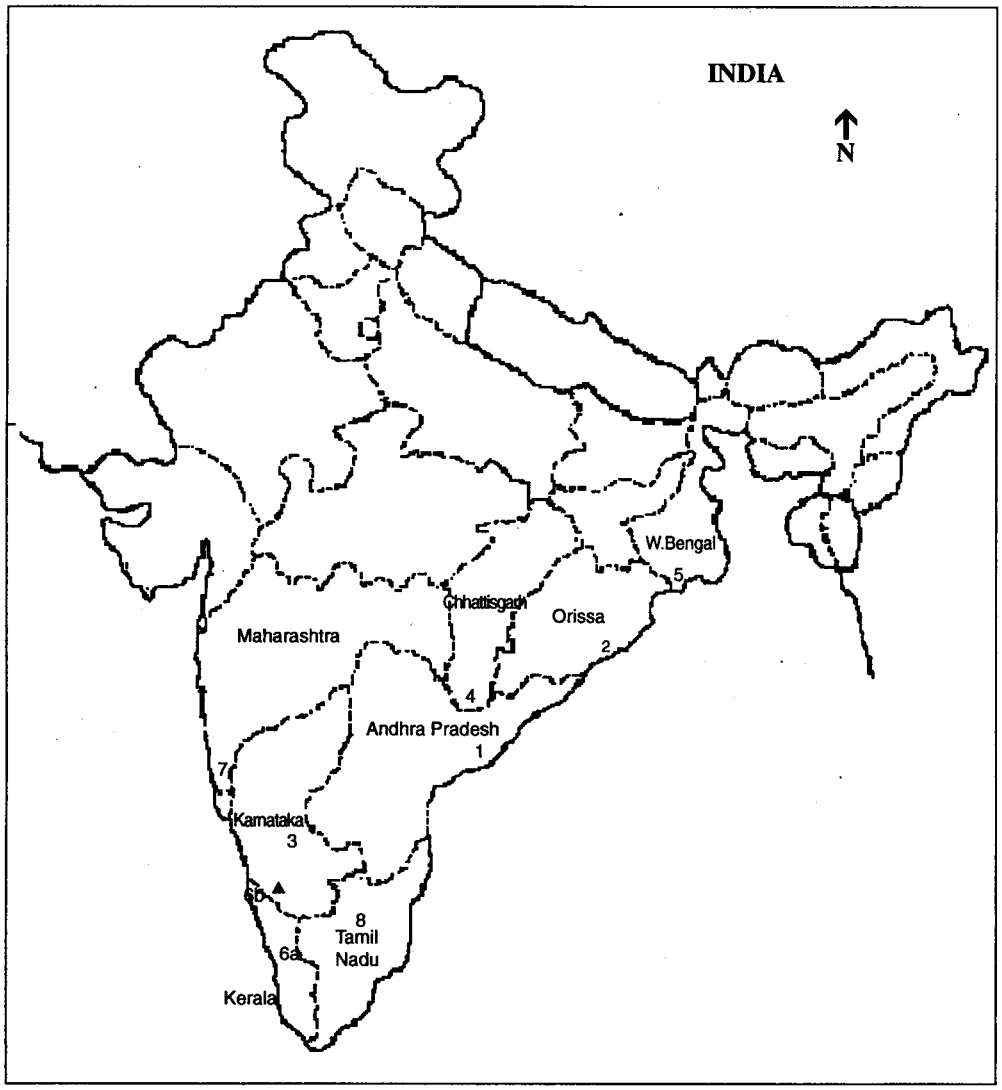
For control of cashew stem and root borer (CSRB) swabbing of trunk portion of the tree with neem oil and soil application of sevidol 8G 75g tree^{-1} was most effective prophylactic control tried at Bhubaneswar and Jhargram. Neem oil (5%) swabbing along with lindane (0.2%) and mudslurry + carbaryl (0.2%) at four intervals were found to be more effective at Madakkathara. At Vengurle, swabbing with mudslurry along with soil application of 0.2% carbaryl and 0.2% lindane was found to be promising. Swabbing coal tar thrice with the application of lindane (0.2%) was most effective treatment at Vridhachalam.

Under curative control trial, the treatment mud slurry + carbaryl swabbing with sevidol application (T2) could give better recovery percentage than other treatments at Bhubaneswar. The percentage of recovery was higher in T2 even in middle stages of CSRB attack and also higher in comparison to T3. At Madakkathara, maximum percentage of recovery of infested trees was seen in T1 treatment where neem oil (5%) swabbing + lindane (0.2%) was given in early and middle stages of infestation. Swabbing with *Metarrihizium anisopliae* + neem oil (5%) was also found to be equally effective. Swabbing of neem oil (5%) with soil application of lindane (2%) and swabbing of neem oil (5%) with *Metarrhizium anisopliae* during early stages was found to be effective at Vengurle. At Vridhachalam, extraction of grubs, swabbing of coal tar, soil application of sevidol and Metarrhizium anisopliae in combination during the early stages of attack is found to be most effective.

TRANSFER OF TECHNOLOGY

During the year, 13 demonstration plots have been laid down in farmers field with high density planting. Ten training programmes and 11 campaigns were conducted by different AICRP centres and also the scientists have participated in various seminars conducted by different agencies. A total of 4,97,655 grafts were produced and distributed to different government and non-government agencies as well as farmers.

CENTRES OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW



Headquarters of AICRP on cashew:

▲ National Research Centre for Cashew, Puttur 574 202

AICRP on Cashew Centres:

1. Cashew Research Station, (ANGRAU), Bapatla, 522 101, Guntur District, Andhra Pradesh.
2. Cashew Research Station, (OUAT), Bhubaneswar 751 003, Orissa.
3. Agricultural Research Station, (UAS), Chintamani 563 125, Kolar District, Karnataka.
4. SG College of Agriculture and Research Station, (IGAU), Jagdalpur 494 005, Bastar District, Chhattisgarh.
5. Regional Research Station, (BCKV), Jhargram 721 507, Midnapore District, West Bengal.
6. (a) Cashew Research Station, (KAU), Madakkathara 680 656, Thrissur District, Kerala.
6. (b) Regional Agricultural Research Station, (KAU), Pilicode 671 353, Kasaragod District, Kerala (Sub centre).
7. Regional Fruit Research Station, (KKV), Vengurle 416 516, Sindhudurg District, Maharashtra.
8. Regional Research Station, (TNAU), Vridhachalam 606 001, Cuddalore District, Tamil Nadu.

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

The eight coordinating centres and one sub centre are spread in the East Coast, West Coast and Maidan tracts (plateau region) of the country. The centres in the East Coast are located at Bapatla, Bhubaneswar, Jhargram and Vridhachalam. This zone receives low to medium rainfall ranging from 800mm to 2000 mm annually and is distributed over a period of 7-8 months from June to January. The soil is mainly sandy, red sandy loam, red loam and laterite. Bapatla centre is siutated at an elevation of 54.9 m from mean sea level (MSL) with 40° 54' latitude and 80° 28' longitude. At Bapatla the annual average rainfall is 1167 mm and the temperature ranges from 17.3 to 37.8°C; the soil is sandy soil with low organic matter, medium in N, low in P_2O_5 and K_2O. Average water holding capacity (AWC) of soil is 100 mm and the climate is sub humid (dry). At Bhubaneswar average rainfall is 1167 mm and the temperature ranges from 14.3 to 37.1°C. The soil is red soil, red loamy and laterite. The climate is sub humid (dry), AWC 100 mm. The Jhargram center is located 87° longitude and 78.8° latitude. At Jhargram average rainfall is 1622 mm and the temperature ranges from 11.3 to 39.4°C. The soil is red, laterite, shallow depth gravels, low in organic matter, N and high in P_2O_5 and K_2O. The climate is sub humid (dry), AWC 200 mm. At Vridhachalam average rainfall is 1215 mm and the temperature ranges from 18.7 to 35.7°C, the soil is red laterite, low in organic matter and N, medium in P_2O_5 and high in K_2O. The climate is semi arid (dry), AWC 125 mm.

The centres in the West Coast are located at Madakkathara, Pilicode and Vengurle. This zone receives rainfall ranging from 2800 to 3800 mm annually and is distributed over a period of 7-9 months from April/ June to December. The soil is typically sandy, sandy loam, sandy clay loam and laterite (Oxisol). Madakkathara receives an average rainfall of 3550 mm and the temperature ranges from 22 to 36.2°C, the soil is laterite (oxisol), medium in N, low in P and medium in K contents. The climate is per humid and AWC is 150 mm. At Vengurle average rainfall is 2916 mm and the temperature ranges from 17.4 to 32.9°C. Centre is situated at an elevation of 90 m from MSL; the soil is Sandy loam to sandy clay loam with high organic matter, N, K and low in P. The climate is humid, AWC is 150 mm.

Maidan tract is characterised by even land. The coordinating centres Chintamani and Jagdalpur fall in this region. Chintamani comes under region III (Southern dry region), zone V (Eastern dry zone) of Karnataka and receives average rainfall of 789 mm and the temperature ranges from 13.9 to 34.5°C. Centre is situated at an elevation of 300 m from MSL, the soil is red sandy loam, deficient in N, medium in P_2O_5 and high in K_2O. The climate is semi arid (dry), AWC is 150 mm.

1. CROP IMPROVEMENT

Germplasm collection, maintenance and description of types

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

West Coast
Madakkathara, Pilicode, and Vengurle

Maidan tracts/ others
Chintamani and Jagdalpur

The objectives of the project are:

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

Summary

During the year under report, 95 trees have been identified for collection for Regional Cashew Gene Bank (RCGB) in different coordinating centres. Places surveyed during the year include Tetagunta, Simhachalam and Bapatla in Andhra Pradesh; Tapang and Ranasinghpur in Orissa; Ramnagar and Digha in West Bengal; Rajapuram, Odakkali, Malappuram and Parappa in Kerala; Thane, Sindhudurg and Raighad in Maharashtra and Panruti in Tamilnadu. Indigenous collection numbers (IC Nos.) have been obtained through NRC for Cashew for 716 collections from NBPGR, New Delhi. Total holdings in different RCGBs amount to 1188. Among the germplasm planted in the field in Bapatla during 1997 the T.No. 40 with 0.533 g tree^{-1} for first harvest was found better. At Bhubaneswar OC-31 with 15.43 kg tree^{-1} for seven annual harvests was the better performer. Highest yield recorded at Chintamani was for 2/6 ARSC (14.00 kg tree^{-1}) for 17th annual harvest. At Madakkathara, H 719 hybrid with 3.3 kg tree^{-1} for 9th annual harvest was found better performer. At Pilicode germplasm accessions are under evaluation for their vegetative growth parameters. Balli-2 with 4.53 kg tree^{-1} was the highest yielder at Vengurle seven years after planting. At Vridhachalam, M 15/4 with 2.5 kg tree^{-1} was found better than other accessions.

1) Germplasm collection and conservation

The Regional Cashew Gene Bank (RCGB) holding has been 1116 cashew accessions which were conserved and being maintained in different Centres. During the year 95 accessions were collected by the centres of which 49 were field planted to bring the total to 1188. Among the conserved germplasm, for 716 accessions Indigenous Collection Numbers (IC No.) have been assigned by the NBPGR, New Delhi (Table 1.1).

The details of the centre by which collection has been made, source of collection, number of collections made and salient features are given in Table 1.2.

Table 1.1: Cashew germplasm holding in different centres.

Centre	No. of accessions			
	Existing	Collected during 2001	Total	Indigenous collection number assigned
East Coast				
Bapatla	126	4	130	80
Bhubaneswar	45	4	49	5
Jhargram	118	3 *	118	49
Vridhachalam	261	3	264	250
West Coast				
Madakkathara	135	61	196	73
Pilicode	64	4 *	64	64
Vengurle	237	16 *	237	142
Maidan tract/others				
Chintamani	120	-	120	53
Jagdalpur	10	-	10	
Total	**1116**	**95**	**1188**	**716**

* These were marked during the year and will be conserved.

Table 1.2: Cashew germplasm collected during 2000 by different centres.

Centre	Source of collection	No. of collections	Salient features
Bapatla (Andhra Pradesh)	Tetagunta, East Godavari	1	Intensive branching canopy, Red apple
	Simhachalam, Visakhapatnam	1	Extensive branching canopy, Yellow apple
	VDO Training Centre, Bapatla, Guntur	1	Extensive branching canopy, Yellow apple
	B-Pharm College, Bapatla, Guntur	1	Intensive branching canopy, Red apple
Bhubaneswar (Orissa)	Tapang, Khurda	1	Cluster bearing, yellow conical apple
	Banjha Kusum, Dhenkanal	1	Cluster bearing, red conical apple
	Ranasinghpur, Khurda	1	Cluster bearing, red conical apple
	Ranasinghpur, Khurda	1	Cluster bearing, yellow conical apple
Jhargram (West Bengal)	Ramnagar, Midnapore	2	Intensive branching, cluster bearing ty
	Digha, Midnapore	1	Intensive branching, Cluster bearing ty
Madakkathara (Kerala)	Rajapuram, Kasaragod	2	High yield and Bold nut
	Odakkali RRS,	1	High yield and cluster bearing
	Farmers plot, Malappuram	1	Dwarf cashew
Pilicode (Kerala)	Parappa, Kasaragod	4	Bold nuts and two non cluster bearing and two cluster bearing types
Vengurle (Maharashtra)	Thane and Raighad	4	High yielding types
	Sindhudurg	6	High yielding types
Vridhachalam (Tamil Nadu)	Panruti Taluk	3	Cluster bearing, high yielding and medium nut types
	Total	**32**	

2) Germplasm evaluation

Evaluation of cashew germplasm at different centres has been carried out during the year 2001. The characteristics of promising accessions in different centres are presented in Table 1.3 - 1.10.

BAPATLA

During the year the plant height, girth and the canopy spread were recorded. The germplasm accession T.No.227 had highest plant height of 260 cm, T.No. 21 with highest girth (32 cms), T.No.275 with highest sex ratio (0.43) and T.No.40 with highest nut yield (533 g./tree) have been recorded The performance of promising accessions is presented in Table 1.3.

Table 1.3: Performance of promising germplasm accessions planted in 1997 at Bapatla.

Accession	Plant Height (cm)	Plant Girth (cm)	Canopy spread (cm)	Sex ratio (Bisexual: male)	Nut yield (Kg tree^{-1}) I annual harvest
T.No.40	158.3	25.3	266	0.31	0.533
T.No.129	174.0	21.8	256	0.28	0.340
T.No.275	183.3	23.5	241	0.43	0.416
12/1	188.0	23.2	235	0.17	0.350
3/7	188.0	26.6	259	0.28	0.350
1/1	198.0	27.5	250	0.42	0.400
T.No.1	194.0	23.6	230	0.30	0.300
T.No.228	198.0	29.8	285	0.12	0.330
39/4-1	220.0	29.8	314	0.17	0.340

BHUBANESWAR

At Bhubaneswar, the maximum cumulative yield was recorded in OC - 31 with a yield of 15.43 Kg tree^{-1} followed by OC-22 with 13.47 Kg tree^{-1}. The yield recorded for promising germplasm accessions is presented in Table 1.4. None of the accessions showed tolerance to the pest TMB.

Table: 1.4. Performance of some promising germplasm accessions at Bhubaneswar.

Accession Number	Yield Kg tree^{-1}	Cum. Yield Kg tree^{-1}	Mean Nut Wt.(g)	Shelling %
		7 annual harvests		
OC-1	2.90	12.15	7.0	32.9
OC-6	2.40	13.27	6.0	33.0
OC-14	3.30	10.92	6.0	33.0
OC-22	3.00	13.47	8.8	29.5
OC-31	3.50	15.43	5.2	28.8
OC-46	3.60	10.88	7.7	32.5
OC-47	2.00	5.87	6.4	31.3
		5 annual harvests		
OC-55	1.90	4.37	7.0	30.0
OC-56	2.60	5.55	7.0	28.6
OC-59	1.90	4.31	7.4	31.1
OC-60	2.10	4.48	10.8	27.8
OC-63	3.30	8.04	7.4	32.4
OC-65	3.70	7.85	5.00	34.0
OC-67	2.50	4.82	7.00	32.9

CHINTAMANI

At Chintamani, the yield and yield characteristics were recorded during evaluation of germplasm accessions during the year. The highest yield (14.00 Kg tree^{-1}) was reported for 2/6 ARSC (3/108 Gubbi) followed by 44/1 ARSC (V-5). Maximum shelling percentage (30%) was recorded for 35/3 ARSC with least yield of 4.35 Kg tree^{-1}. The highest nut weight was observed in 41/3 ARSC. The data on promising germplasm accessions are presented in Table 1.5.

Table 1.5: Performance of promising germplasm accessions at Chintamani.

Accession Number	Year of Planting	Cumulative Yield (Kg tree^{-1})	Yield (Kg tree^{-1})	Mean Yield (Kg tree^{-1})	Nut Wt. (g)	Shelling %
2/6 ARSC (3/108 Gubbi)	1982	161.60 (17 ann. har.)	14.00	9.51	4.10	28.0
35/3 ARSC (ME 4/4)	1985	107.80 (13 ann. har.)	4.35	8.29	6.30	30.0
41/3 ARSC (5/37 Manjeri)	1985	128.59 (13 ann. har.)	-	9.89	7.18	29.5
44/1 ARSC (Vengurla-5)	1985	126.93 (13 ann. har.)	8.00	9.76	4.08	27.4
44/5 ARSC (Vengurla-5)	1985	121.00 (13 ann. har.)	2.50	9.31	4.08	27.4

MADAKKATHARA

The highest yield recorded was 3.3 kg for H 7-6 followed by 2.30 kg for A 6-1. The boldest nut (11.2g) has been observed in H 1589. However, cumulative yield was maximum (19.9 Kg tree^{-1}) in Anakkayam-1 for ten harvests (Table 1.6).

Table 1.6: Performance of promising germplasm accessions at Madakkathara.

Year of planting/ Accession No.	Yield		Nut Wt.(g)	Apple Wt.(g)
	Current Year (Kg tree^{-1})	Cumulative (kg tree^{-1})		
1988				
Brazil 239	-	6.85	10.30	100
Brazil 244	1.46	8.92	5.20	62
Anakkayam-1	0.83	19.9	4.8	32
BLA 39-4	-	12.65	5.05	58
K 22-1	0.54	9.40	5.30	40
H 3-13	1.23	10.65	7.0	48
H 3-17	0.90	12.69	8.0	45
1989				
H 680	0.80	7.37	7.0	56
H 718	-	5.98	5.20	54
H 1589	0.95	12.98	11.2	71
H 1596	1.70	12.95	7.1	45
H 1600	0.80	12.10	7.0	45
A 6-1	2.30	9.40	7.10	60
K 16-1	0.57	4.65	8.5	54
H 7-6	3.30	10.75	9.0	70
H 8-6	0.85	7.0	9.1	48
H 8-8	0.60	5.62	8.0	50
H 9-3	1.45	7.63	7.8	50
1993				
Vetore - 56	1.15	3.63	8.1	50

PILICODE

Observations on growth parameters of grafts planted during 1996 in the cashew germplasm conservation block were carried out (Table 1.7). Vigorous growth was shown by the accession PCKC 9 with 6.69 m height, 60.6 cm stem girth, highest spread.

Table 1.7: Growth observations on germplasm at Pilicode in grafts planted during 1996

Accession	Height (m)	Stem Girth (cm)	Canopy Spread (m)	Yield (Kg/tree)
PCKC 4	6.06	55.60	6.26	0.99
PCKC 8	6.01	53.72	5.06	0.34
PCKC 9	6.69	60.60	5.15	1.34
BM 1	6.02	44.35	5.70	0.43
OCT 2	4.36	43.55	4.30	0.30
KC-1	4.07	41.53	3.60	—
KJ-1	3.57	38.20	3.50	—
Elapara	2.75	31.00	2.50	—
KM-1	6.85	42.40	3.83	—
Kodolipram	3.95	39.8	4.75	—
Thumbassery	1.75	21.60	2.30	—

VENGURLE

A total of 161 elite types of cashew and 74 bold nut types are present in the germplasm collection at the Centre. In 1993, bold nut types from ICAR Research Complex, Goa were collected and field planted in 1994. Highest yield was obtained from the variety Bali-2 (4.530 Kg tree^{-1}) seven years after planting. The data on these bold nut types is presented below in Table 1.8.

Table 1.8: Performance of germplasm accessions planted in 1994 from Goa at Vengurle

Accession	Yield (Kg tree^{-1}) 2000	2001	Cumulative yield for 2 annual harvests	Nut Wt (g)	Shelling (%)
Bali-1	1.160	1.190	2.350	6.00	29
N.P.	1.580	2.170	3.720	7.5	25
Palkul	1.500	1.500	3.000	6.5	27
Bali-2	3.500	4.530	8.030	6.5	24
Balkul	1.450	4.530	5.980	8.5	29
Permagudi	0.850	0.320	1.170	8.5	26
Dodamarg	1.600	2.300	3.900	7.5	27
Nanaoda-2	1.500	1.750	3.250	8.5	24

VRIDHACHALAM

All the 264 accessions were evaluated for identifying high yielding varieties with export quality kernels. Among the new germplasm, ME 20/1 and M 78/2 have given the highest yield of 1.00 Kg tree^{-1} followed by ME 14/1, MA 2/4 and M 21/3 with 0.90 Kg tree^{-1}. The data on performance of promising new germplasm accessions is presented in Table 1.9. Among the old germplasm accessions conserved at the Centre, M 15/4 gave highest yield of 2.5 Kg tree^{-1} followed by M 4/3 with 1.30 Kg tree^{-1}. The performance of promising old germplasm accessions is given in Table 1.10.

Table 1.9 : Performance of promising new germplasm accessions at Vridhachalam

Accession No.	*Year of planting*	*Flowering habit*	*Tree canopy* (cm)	*Apple weight* (gm)	*Apple colour*	*Nut weight (g)*	*Shelling (%)*	*Yield (Kg tree^{-1})*
ME 20/1	1994	Mid	4.1	24.5	Pink	5.1	24.6	1.000
M 69/4	1994	Mid	4.1	35.5	Y. /R.S	5.7	26.1	0.850
ME 14/1	1994	Late	5.3	40.0	Pink	6.5	27.1	0.900
MA 2/4	1994	Late	4.2	40.0	Yellow	7.1	25.4	0.900
M 78/2	1994	Mid	3.9	45.5	Red	6.2	27.6	1.000
A 34/4	1994	Mid	4.6	40.0	Yellow	6.1	27.0	0.700
M 21/3	1994	Mid	4.8	25.6	Pink	5.90	27.0	0.900

Table 1.10 : Performance of promising old germplasm accessions at Vridhachalam

Accession No.	Year of planting	Nut weight (g)	Shelling (%)	Yield (Kg tree^{-1})
M 4/3	1989	6.0	26.5	1.300
M 26/4	1989	7.0	24.2	0.500
M 37/3	1989	6.9	27.0	0.900
M 63/4	1989	5.6	24.6	0.800
M 11/2	1989	6.7	26.5	1.100
M 6/1	1989	7.2	26.4	1.000
M 15/4	1989	6.5	26.5	2.500

Varietal evaluation

1. Multilocation trial-92 with varieties from Bapatla, Vengurle, Vridhachalam, and NRC Cashew, Puttur

Centres: East Coast
Bapatla, Bhubaneswar, Jhargram and Vridhachalam

West Coast
Madakkathara and Vengurle

Maidan tracts
Chintamani

The objective of the experiment is to evaluate the performance of new high yielding varieties in different locations.

Summary

For testing the varieties in different agro-climatic regions, multi locations trial has been laid out at the main centers. During the year, highest yield was obtained for M 44/3 (3.40 kg tree^{-1}) at Bapatla. At Bhubaneshwar, maximum yield was obtained for H 320 (8.67 kg tree^{-1}). At Chintamani maximum yield has been recorded for Hy 302 (5.52 kg tree^{-1}). M 15/4 has yielded highest (2.90 kg tree^{-1}) at Madakkathara. At Vridhachalam, M 15/4 has been found better yield in MLT-92 trial (2.320 kg tree^{-1}).

Experimental details:

Design	:	RBD
Replications	:	Three
Varieties	:	No. of entries - 13
Bapatla	:	3/28, 3/33, 10/19, 30/1
Vengurle	:	H 68, H 255, H 303, H 320, H 367
Vridhachalam	:	M 15/4, M 44/3
Puttur	:	VTH 107/3, VTH 40/1
Year of planting	:	1992

BAPATLA

During the year maximum plant height and canopy spread were recorded in T.NO. 10/19 (3.87m, 66.7 cm, 7.0g respectively). The flowering intensity was more in M 44/3 followed by M 15/4. Highest yield was obtained for variety M 44/3 (3.40 Kg tree^{-1}). The cumulative yield was higher in M-44/3 (16.41 Kg tree^{-1}) followed by M 15/4 (15.76 Kg tree^{-1}). The data on growth and flowering characteristics and yield are presented in Table 1.11.

BHUBANESWAR

Maximum number of flower panicles was recorded in 30/1 (26.0). However, maximum yield was obtained for H 320 (8.67 Kg tree^{-1}) and highest cumulative yield was obtained for H 320 (28.73 Kg tree^{-1}) followed by H 303 (25.44 Kg tree-^{1}). Maximum shelling percentage was found in NRCC-1 (32.5%). The data is presented in the Table 1.12.

CHINTAMANI

During the year maximum yield (5.52 Kg tree^{-1}) was recorded for Hy 302. However, highest cumulative yield for six annual harvests was recorded for NRCC-2 (18.54 Kg tree^{-1}). Highest nut weight was observed in Hy 255 (8.27 g.) and highest shelling percentage was recorded in NRCC-1 (30.7%). The data on growth and yield characteristics of varieties under MLT-92 is presented under Table 1.13.

Table 1.11: Performance of varieties under MLT 92 planted in 1993 at Bapatla

Var.	Plant Height (m)	Plant Girth (cm)	Flower intensity/ m2	No. of Fruits / panicle	Nut Wt (g)	Yield (kg tree^{-1})	Cum. yield (Kg tree^{-1}) for 6 ann. Har.	Shelling (%)
3/28	3.80	55.0	9.00	2.75	6.8	2.66	11.60	25.4
3/33	3.50	55.7	8.75	3.00	5.0	2.13	9.25	25.6
10/19	3.87	66.7	9.00	3.00	7.0	2.80	15.27	24.8
30/1	3.46	54.7	7.75	3.20	5.2	2.60	12.23	25.8
Hy 68	3.39	60.7	9.25	2.70	5.4	1.96	7.23	24.0
Hy 367	3.23	54.7	6.50	3.00	7.2	1.70	7.45	24.2
Hy 303	3.82	60.7	7.75	3.00	6.9	1.60	7.14	24.2
Hy 255	3.19	54.3	7.75	2.80	7.2	1.40	4.53	24.4
Hy 320	3.80	56.7	9.50	2.80	6.6	1.57	6.68	25.0
M 44/3	3.46	54.9	8.00	3.80	3.6	3.40	16.41	25.8
M 15/4	3.78	59.4	7.50	4.20	6.6	3.20	15.76	25.4
107/3	3.78	60.5	7.50	2.75	6.2	2.00	8.74	25.0
40/1	3.80	60.5	8.50	2.75	5.8	1.80	8.82	25.2

Table 1.12: Flowering and yield in varieties under MLT planted in 1992 at Bhubaneswar.

Variety	Plant height (m)	Plant girth (cm)	Canopy spread (m)	Yield (Kg tree^{-1})	Cum. yield (Kg tree^{-1}) 5 ann. har.	No. of fruits panicle^{-1}	Nut Wt (g)	Shelling %
NRCC-1	3.6	46.5	5.1	1.90	8.92	1.7	7.1	32.5
NRCC-2	3.8	54.2	6.4	5.13	17.85	4.0	9.0	31.9
M 44/3	2.9	42.5	4.6	2.57	12.32	3.3	6.0	32.3
M 15/4	4.5	69.0	7.5	2.43	13.00	2.0	6.9	32.8
3/33	4.5	77.5	7.3	4.93	17.83	2.7	5.7	31.2
10/19	4.7	75.6	8.2	3.53	14.13	3.0	6.1	30.5
30/1	4.4	69.6	7.4	5.90	25.30	4.7	6.0	30.6
3/28	4.9	72.8	7.6	2.40	15.91	1.7	7.8	32.2
H 303	4.6	72.1	7.8	6.43	25.44	4.0	8.3	30.5
H 320	5.5	75.0	7.1	8.67	28.73	2.0	7.5	28.4
H 255	5.1	83.8	8.4	3.30	17.53	1.3	9.8	30.7
H 367	4.1	65.2	7.8	7.23	20.81	1.7	9.5	30.0
H 68	5.0	75.3	7.4	3.77	15.55	5.0	7.3	29.2

Table 1.13: Flowering and yield characteristics under MLT planted in 1992 at Chintamani.

Variety	Canopy Shape	Yield (Kg tree^{-1})	Cum. yield (Kg tree^{-1}) 6th harvest	Nut Wt (g)	Shelling %
Hy 68	Compact	—	—	7.5	25.2
Hy 367	Medium	—	—	7.9	29.6
Hy 302	Medium	5.52	15.04	7.3	27.7
Hy 255	Medium	—	5.26	8.2	29.8
M 15/4	Compact	—	—	5.8	28.5
NRCC-1	Compact	5.15	12.29	6.6	30.7
NRCC-2	Sparse	—	18.54	5.3	27.0
T 30/1	Compact	—	—	4.6	29.0
T 3/33	Compact	1.00	6.46	6.2	27.4
T 10/19	Compact	—	3.45	4.8	30.0
T 3/28	Compact	0.80	—	6.5	28.2
Ullal-1	Medium	—	—	6.0	29.3

JHARGRAM

Maximum plant height (4.45 m) and girth (47.6 cm) were observed in H 255. Least height was noticed in M 44/3 (2.31 m). The data on growth characteristics of different varieties is presented in Table 1.14.

Table 1.14: Growth performance of different varieties under MLT-92 at Jhargram.

Varieties	Plant Height (m)	Plant Girth (cm)
T 30/1	2.76	26.2
T 3/33	2.87	29.7
H 303	2.88	42.2
H 255	4.45	47.6
H 320	3.92	38.4
M 44/3	2.31	22.6
NRCC-2	2.60	26.8

MADAKKATHARA

Maximum tree height was observed in NRCC-1 (5.94 m), maximum girth was also recorded in the same variety (71.00 cm). Highest canopy spread was observed in 3/33 (6.09 m). Minimum plant height was observed in HY 367 (4.14 m). Highest yield was obtained from M 15/4 (2.90 Kg tree^{-1}). The data on growth and yield characteristics is presented in Table 1.15.

Table 1.15: Growth and yield characteristics under MLT planted in 1993 at Madakkathara.

Variety	Plant Height (m)	Plant Girth (cm)	Canopy spread (m)	Yield (Kg tree^{-1})
T 30/1	5.10	61.75	5.22	1.43
T 3/33	5.72	62.75	6.09	1.55
T 10/19	4.81	54.86	4.77	2.45
T 3/28	4.96	58.25	5.80	0.70
H 68	4.93	57.25	4.51	1.13
H 367	4.14	53.75	5.55	1.35
H 303	5.14	51.12	3.43	1.82
H 255	4.66	52.13	4.76	1.90
H 320	4.64	52.13	4.45	1.00
M 44/3	4.99	52.46	5.60	1.55
M 15/4	4.75	66.75	6.00	2.90
NRCC-1	5.94	71.00	5.59	0.95
NRCC-2	4.54	59.13	5.33	2.40
Dhana	5.07	68.13	5.82	1.62
SEm±	0.22	1.42	0.17	0.13
CD	0.45	2.90	0.34	0.26

VENGURLE

Maximum tree height was observed in H 320 (1.43 m). NRCC Selection 2 has recorded minimum tree height (1.13 m). Maximum girth was recorded in H 367 (0.19 m). The canopy spread was maximum in Hy 367 (1.79 m). The vegetative growth data is presented in Table 1.16.

Table 1.16: The growth parameters of different varieties under MLT-92 at Vengurle.

Variety	Plant Height (cm)	Plant Girth (cm)	Canopy spread (m)
H 255	1.17	0.16	1.17
H 303	1.30	0.17	0.88
H 320	1.43	0.17	1.49
H 367	1.28	0.19	1.79
NRCC - 1	1.37	0.14	1.08
NRCC - 2	1.13	0.16	1.28
M 44/3	1.15	0.16	1.44
M 15/4	1.17	0.14	0.86
10/19	1.20	0.16	1.35
3/28	1.18	0.12	0.81
3/33	1.36	0.15	1.08
30/1	1.36	0.17	1.22

VRIDHACHALAM

Maximum plant height was observed in NRCC Sel. 1 (4.19m) and minimum height was observed in T.No. 3/33 (2.73 m). Highest plant girth was observed in M 15/4 and highest yield was obtained in M 15/4 (2.32 Kg tree^{-1} and cumulative yield (6.976 Kg tree^{-1}). The shelling outturn was below 30 per cent in all the varieties. However, maximum shelling percentage (26.1%) was observed in T. No. 10/19. The growth and yield data are presented in Table 1.17.

Table 1.17: Performance of different varieties under MLT planted in 1994 at Vridhachalam

Variety	Height (m)	Girth (cm)	Canopy Spread (m)	Yield (Kg Tree^{-1})	Cum. yield (Kg tree^{-1}) 3 Ann. harvests	Flowering period	No. of fruits panicle^{-1}	Nut Wt (g)	Shelling %
T 30/1	3.29	35.3	4.55	0.260	1.915	Early	2.5	7.0	20.6
T 3/33	2.73	34.7	3.98	0.400	2.485	Late	1.5	8.0	20.5
T 10/19	3.88	44.3	5.39	0.525	1.686	Mid	2.0	7.0	26.1
T 3/28	3.70	43.0	5.06	0.800	2.712	Late	1.0	7.0	23.0
H 68	3.32	38.8	5.44	0.900	3.417	Late	2.0	7.4	20.6
H 367	3.33	45.9	6.05	0.587	3.042	Mid	2.0	7.0	14.9
H 303	3.78	42.5	4.81	0.800	3.382	Late	3.0	8.0	22.5
H 255	3.34	48.1	5.73	—	1.812	Mid	—	—	—
H 320	3.72	45.4	5.81	0.668	3.418	Mid	1.5	8.3	20.5
M 44/3	3.24	40.2	4.94	2.310	6.408	Early	3.0	5.3	23.2
M 15/4	3.73	52.6	6.15	2.320	6.976	Early	4.0	6.3	22.8
NRCC-1	4.19	51.0	5.96	0.600	1.649	Late	2.0	6.9	16.2
NRCC-2	3.49	39.1	4.71	0.920	4.155	Mid	2.5	9.2	21.3

2. Performance of released varieties

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

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani

The objectives of the experiment are to evaluate the performance of released varieties in dif locations.

Summary

Under evaluation of released varieties, BPP-8, Priyanka and BPP-2 were found to be vigorous typ Madakkathara among the varieties tested, BPP-5, BPP-2 and BPP-3 were found superior.

BAPATLA

Among the released varieties which were evaluated in experiment, BPP-8, Priyanka and BPP-2 were found to be vigorous types highest sex ratio (0.51 was recorded for K followed by Dhana (0.39). The data is pre in Table 1.18.

Table 1.18 : Evaluation of released varieties at Bapatla

Variety	Plant Height (cm)	Plant Girth (cm)	Canopy Spread (cm) E-W	Sex Ratio (Bisexual : male)	Yield (Kg tree^{-1}) First Ann. har.
BPP-1	170	24.5	244	0.17	0.200
BPP-2	180	29.8	316	0.19	0.300
BPP-3	260	26.4	272	0.27	0.240
BPP-4	217	28.0	316	0.15	0.280
BPP-5	138	17.5	182	0.25	0.275
BPP-6	160	28.6	200	0.29	0.155
BPP-8	170	23.8	255	0.18	0.330
3/28	126	18.3	197	0.27	0.220
Kanaka	233	24.0	257	0.51	0.100
Dhana	176	21.6	268	0.39	0.133
Priyanka	190	25.6	278	0.19	0.200
Chintamani-1	96	11.3	107	0.19	0.100
VRI-1	150	16.7	181	0.23	0.100
VRI-2	136	25.0	252	0.30	0.250
VRI-3	175	18.0	186	0.21	0.100
Vengurla-1	145	24.5	223	0.17	0.220
Vengurla-2	180	26.5	228	0.28	0.240
Vengurla-3	175	25.7	206	0.25	0.177
Vengurla-4	194	30.4	256	0.14	0.150
Vengurla-5	202	32.0	272	0.29	0.180
Vengurla-6	110	11.0	98	0.20	0.130
BBSR-1	163	21.3	183	0.26	0.200
Ullal-1	78	10.8	82	0.24	0.100
Ullal-4	116	14.6	122	0.25	0.120
UN - 50	130	15.7	126	0.21	0.100

MADAKKATHARA

Among the 20 released varieties tested, maximum yield was observed for BPP-5 (1.60 Kg tree^{-1}) followed by BPP-2 and BPP-3 (1.48 Kg tree^{-1}) in the tenth year after planting. The data is presented in Table 1.19.

Table 1.19: Evaluation of released varieties planted in 1990 at Madakkathara

Variety	Year of Planting	Canopy type	Yield (Kg tree^{-1})	Nut wt. (g)	Flowering season
BPP-1	1990	Semi erect	0.917	4.6	Mid
BPP-2	1990	Semi erect	1.480	3.98	Mid
BPP-3	1990	Semi erect	1.480	4.90	Mid
BPP-4	1990	Semi erect	0.900	4.72	Mid
BPP-5	1990	Semi erect	1.600	4.33	Mid
BPP-6	1990	Semi erect	0.500	5.05	Late
Vengurla-1	1990	Semi erect	NA	NA	Mid
Vengurla-2	1990	Semi erect	1.450	4.28	Mid
Vengurla-3	1990	Semi erect	0.730	5.85	Late
Vengurla-4	1990	Semi erect	0.300	7.29	Mid
Vengurla-5	1990	Semi erect	1.600	4.79	Mid
Vengurla-6	1993	Semi erect	NA	NA	Mid
Jhargram-1	1991	Semi erect	NA	NA	Late
NRCC Sel-1	1991	Semi erect	NA	NA	Late
NRCC Sel-2	1993	Semi erect	NA	NA	Late
Ullal-1	1997	Semi erect	NA	NA	NA
Ullal-2	1997	Semi erect	NA	NA	NA
Ullal-3	1997	Semi erect	NA	NA	NA
Ullal-4	1997	Semi erect	NA	NA	NA
UN-50	1997	Semi erect	NA	NA	NA

Hybridisation and selection

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

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani

The objective of this experiment is to utilize the high yielding genotypes selected from germplasm for crossing with other genotypes having desirable traits like bold nuts, cluster bearing habit, compact canopy, short flowering period, late synchronized flowering types and high shelling percentage.

Summary

Under hybridization and selection programme, crossing of promising parents has been carried out at different centers. At Bapatla 85 hybrid progeny have been field planted. At Bhubaneshwar, 461 hybrid nuts have been obtained, 74 nuts have been obtained at Chinamani and 824 hybrids were planted at Vengurle. Evaluation of existing hybrids at Bapatla indicated high yield performance of hybrid 4/1 (14.6 Kg tree^{-1}) At Bhubaneswar A1-85 could produced highest yield (2.92 Kg tree^{-1}) for third annual harvest. At Madakkathara H-42 produced highest yield (2.90 Kg tree^{-1}) for first annual harvest. At Vengurle, H 641 performed better (5.99 Kg tree^{-1}) and at Vridhachalam M 10/4 x M 26/1 could produce highest yield (4.8 Kg tree^{-1}) for 11th annual harvest.

BAPATLA

At Bapatla, crossing programme was carried out during Feb - Mar. 2001. A total of 126 hybrid nuts were obtained, out of which 94 have been germinated in the nursery and field planted. Only 85 have established in the field.

Evaluation of the existing hybrids indicated maximum yield for hybrid 4/1 (14.6 Kg tree^{-1}). However, nut weight and shelling percentage were low in all hybrids. The data is presented in table 1.20.

Table 1.20: Performance of hybrids at Bapatla.

Hybrid	Parentage	Yield (Kg tree^{-1})	Cumulative yield (Kg tree^{-1})	Nut weight (g)	Apple weight (g)	Shelling %
2/15	1 X 40	10.80	161.0	6.4	55.0	26.0
3/10	56 X 40	6.80	137.5	5.0	34.0	27.0
3/13	56 X 40	8.20	187.3	5.0	30.0	26.0
3/25	56 X M 10/4	7.80	150.6	5.2	45.0	26.5
4/1	1 X 40	14.60	164.6	5.0	51.0	26.5

BHUBANESWAR

At Bhubaneswar, nineteen different cross combinations were made and 461 hybrid nuts were obtained. The maximum success under crossing was observed for BPP 30/1 x VTH 711/4 (15.04%). The hybrid seedlings obtained have been planted in the field for further evaluation.

The F1 progeny planted during 1995 were evaluated and the data on yield of 3rd annual harvest for 1995 planting and first annual harvest in 1996 planted seedlings is presented in Table 1.21. The highest yield was obtained for Bhubaneswar - 1 x H 2/16 i.e. Hybrid A1-85 (2.92 Kg tree^{-1}). Maximum shelling percentage (33.3%) also has been obtained for the hybrid A 1- 20 and A 1-23. The data is presented in Table 1.21.

Table 1.21: Performance of hybrids at Bhubaneswar.

Cross combinations	Hybrid No.	Year of planting	Yield (Kg tree^{-1}) (3rd ann. har.)	Cumulative yield (Kg tree^{-1}) (3rd ann. har.)	Nut Wt. (g)	Shelling %
Bhubaneswar-1	C14	1995	2.19	4.69	9.8	31.7
x VTH 711/4	A6	1995	1.90	5.90	9.0	32.9
Bhubaneswar	B1-3	1996	0.40	1.03	9.0	32.2
C-2 x VTH 711/4	B1-21	1996	0.35	1.10	8.5	28.8
Bhubaneswar	D6	1995	1.30	2.90	9.2	32.6
C-1 x Kankadi	B1-15	1997	1.90	2.55	8.0	32.5
	B1-17	1997	1.40	1.92	9.0	31.4
Bhubaneswar	B1-24	1997	1.65	1.85	10.4	32.7
C-1 x VTH 711/4	B1-33	1997	1.66	2.15	10.5	31.4
	A1-9	1997	1.26	2.02	7.2	31.2
Bhubaneswar	A1-13	1997	1.18	1.71	7.5	26.8
C-1 x VTH 711/4	A1-20	1997	1.25	1.91	7.5	33.3
Bhubaneswar 1	A1-23	1997	1.27	1.83	7.5	33.3
x H 2/16	A1-34	1997	1.49	1.92	7.1	32.1
	A1-54	1997	1.56	1.87	8.0	28.8
	A1-69	1997	1.97	2.32	7.0	32.8
	A1-78	1997	1.88	2.33	7.4	32.4
	A1-85	1997	2.92	3.72	7.4	29.7
	A1-87	1997	1.61	2.31	8.7	32.2
	A1-97	1997	2.00	2.41	7.1	30.1
	A1-105	1997	2.40	3.39	7.0	31.4
	A1-113	1997	2.31	2.83	7.3	31.5

CHINTAMANI

During the year 22 different crosses were made and 74 hybrid nuts were obtained. These seed nuts were planted in the field at close spacing to collect scions for further evaluation. The details of crossing are furnished in Table 1.22.

JHARGRAM

During the year hybridization was taken up using different cross combinations of Jhargram-1, M 44/3, BLA 39-4, Ansur No.1 and D.C. 5. The success rate of cross-pollination was 0.2%. The F1 plantswere planted in the nursery at closer spacing.

Table 1.22 : Details of hybridization carried out at Chintamani.

Sl.No.	Cross Combination	No. of F1 hybrids
1	ARSC 44/1 x ARSC 27/1	8
2	ARSC 44/1 x ARSC 52A/4	5
3	ARSC 35/3 x ARSC 52A/4	3
4	ARSC 5/1 x ARSC 52 A/4	1
5	ARSC 2/6 x ARSC 52 A/4	4
6	ARSC 3/1 x ARSC 27/1	9
7	ARSC 35/3 x ARSC 27/4	7
8	ARSC 39/6 x ARSC 27/4	4
9	ARSC 44/5 x ARSC 27/4	2
10	ARSC 44/5 x ARSC 27/1	1
11	ARSC 44/5 x ARSC 52 A/5	2
12	ARSC 44/1 x ARSC 52 A/5	1
13	ARSC 35/3 x ARSC 27/1	9
14	ARSC 35/3 x ARSC 52 A/5	2
15	ARSC 39/6 x ARSC 27/1	2
16	ARSC 39/6 x ARSC 52 A/4	1
17	ARSC 7/8 x ARSC 27/4	3
18	ARSC 7/8 x ARSC 27/1	1
19	ARSC 35/1 x ARSC 27/4	1
20	ARSC 35/1 x ARSC 52 A/5	2
21	VRI 3 x ARSC 27/1	3
22	ARSC 3/1 X ARSC 27/4	3

MADAKKATHARA

During the year 3 cross combinations were nade using BLA 139-1, Sulabha, Madakkathara-1, nd V-5. The performance of hybrids planted since 993 up to 2000 was recorded for height, girth, anopy spread and yield. Among the 56 hybrids lanted in 1993 highest yield was obtained from V-5 x H 1591 (2.9 Kg tree^{-1}). 27 hybrids planted in 1994, 85 hybrids planted in 1995, 12 hybrids planted in 1996, 12 hybrids planted in 1998 were evaluated for their growth characteristics. Nine hybrids were planted during 2000 and are establishing well. The data on promising hybrids is presented in Table 1.23.

Table 1.23: Performance of promising hybrids at Madakkathara.

Year of planting/ Cross combination	Hybrid No.	Plant Height (m)	Plant Girth (cm)	Canopy spread (m)	Yield (Kg tree^{-1})
1993					
BLA 139-1 x P 3-2	H-2	6.0	78	7.55	1.15
BLA 39-4 x P 3-2	H-13	5.0	63	6.65	1.10
BLA 39-4 x P 3-2	H-19	6.0	87	6.90	1.50
BLA 39-4 x P 3-2	H-26	5.0	71	7.05	2.60
BLA 39-4 x P 3-2	H-27	5.8	85	7.15	2.20
V-5 x H 1591	H-42	6.1	84	8.80	2.90
1994					
V-5 x H 1591	H-56	5.5	81	6.70	—
V-5 x H 1591	H-83	4.4	53	6.15	—
1995					
Madakkathara-1 x P 3-2	H-102	4.75	59	5.25	—
Anakkayam-1 x P 3-2	H-112	4.5	63	5.65	—
Anakkayam-1 x P 3-2	H-114	5.5	51	5.90	—
Anakkayam-1 x P 3-2	H-118	5.25	49	5.75	—
Madakkathara-1 x P 3-2	H-139	5.25	51	5.40	—
Madakkathara-1 x P 3-2	H-148	4.0	57	5.35	—
Madakkathara-1 x P 3-2	H-149	5.0	52	5.30	—
Madakkathara-1 x P 3-2	H-165	5.0	60	5.30	—
1996					
BLA 139-1 x Vetore-56	H-177	4.5	53	4.40	—
1998					
BLA 139-1 x Kankadi	H-196	1.75	17	2.0	—
BLA 139-1 x Kankadi	H-200	1.75	17	2.05	—
BLA 139-1 x Kankadi	H-201	2.60	23	2.15	—

VENGURLE

During the year 14 different cross combinations were undertaken and 1051 hybrid seeds were obtained of which seedlings could be obtained from 824 hybrids only. These will be planted during planting season. The performance of promising hybrids planted in 1991 is presented in Table 1.24. H 641 performed better than other hybrids in terms of yield (5.99 Kg tree^{-1}). Maximum nut weight was recorded for H 675 (18.47g).

Table 1.24: Performance of promising hybrids at Vengurle.

Hy.No	Cross combination	Nut wt (g)	Yield Kg tree^{-1}	Apple wt (g)	Shelling %
H 636	V-5 Kankadi	8.78	4.260	45	28.5
H 640	V-5 x Kankadi	8.00	4.290	60	29.5
H 641	V-5 x Kankadi	8.70	5.990	50	28.5
H 662	V-5 x Kankadi	8.00	5.100	40	29.0
H 675	V-5 x Kankadi (Hy)	18.47	5.800	50	29.0
H 677	V-5 x Kankadi (Hy)	8.32	4.090	62	28.5
H 681	V-5 x Kankadi (Hy)	9.44	4.480	62	8.00
H 689	V-5 x Kankadi (Hy)	8.20	3.560	78	28.0
H 764	V-2 x Kankadi	8.30	5.560	76	28.5
H 784	V-2 x Kankadi	8.00	4.300	86	29.0

VRIDHACHALAM

The performance of F1 hybrids was evaluated during the year including eight different combinations. Highest cumulative yield was obtained for M 10/4 x M 26/1 (39.3 kg) for 11 annual harvests and highest yield was also obtained for the same hybrid (4.8 Kg tree^{-1}). The cross combinations M 10/4 x M 45/4, M 26/2 x M 45/4 and M 44/3 x M 45/1 showed moderate TMB resistance. The details of the performance of hybrids is presented in Table 1.25.

Table 1.25: Performance of hybrids planted during 1987 at Vridhachalam.

Cross Combination	Specific characters of parents	Hy. No.	Mean yield per year (Kg tree^{-1})	Highest yield obtained (Kg tree^{-1})	Cumu. yield11 ann. har. (Kg tree^{-1})	Nut Wt. (g)	Shelling (%)	Apple weight (g/tree)	No. of fruits/ panicle
M 10/4 x M 26/1	High yield	H 10	3.57	4.8	39.3	6.60	26.5	59	5
M 10/4 x M 45/4	TMB Resistant	H 11	2.10	3.0	23.2	6.20	27	60	5
M 10/4 x M 75/3	High yield	H 12	2.19	3.3	24.1	6.30	27	61	4
M 26/2x M 26/1	High yield and cluster bearing	H 13	3.07	4.4	33.8	6.30	27.1	63	4
M 26/2 x M45/4	TMB Resistant	H 14	2.40	3.8	26.5	6.00	27.2	62	5
M 26/2 x M 75/3	High yield	H 15	2.25	3.6	24.8	6.30	26.5	63	5
M 44/3 x M 26/1	High yield	H 16	3.08	3.8	33.9	6.20	26	62	4
M 44/3 x M 45/1	TMB Resistant	H 17	2.62	3.9	28.9	6.00	26.5	60	4

2. CROP MANAGEMENT

NPK Fertiliser experiment

Centres : East Coast
Bapatla, Jhargram, and Vridhachalam

West Coast
Madakkathara, and Vengurle

Maidan tracts/ others
Chintamani and Jagdalpur

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

Summary

At Bapatla 1000g N and 125g P_2O_5 could produce highest yield (2.35Kg tree^{-1}) for third annual harvest. Under on farm trial in APFDC plantations a yield of 10.25 Kg tree^{-1} could be obtained. At Chintamani, 1.49 Kg tree^{-1} yield could be realized for higher dosage of fertilizer under on farm trial. At Jhargram, 500gN, 125g P_2O_5, could produce better canopy. At Madakkathara, 125g P_2O_5 could produce maximum yield (4.98 Kg tree^{-1}). At Vengurle 1000 g N, 250 g P_2O_5 and 250 g K_2O could produce highest yield (3.90 Kg tree^{-1}). At Vridhachalam, highest yield has been obtained for treatment with 1000g N, and 250 g P_2O_5 (1.040 Kg tree^{-1}) for the variety VRI-2.

Experimental details:

Design	:	Three factorial confounded design with 27 treatment combinations
Replications	:	Two
Treatments	:	N - 0,500, and 1000 g/plant P - 0,125, and 250 g/plant K - 0,125, and 250 g/plant.
No. of plants per plot	:	Six

BAPATLA

Highest yield was obtained for N2P1K0 (2.35 Kg tree^{-1}). Highest cumulative yield was recorded for same treatment (9.10 Kg tree^{-1}) for 3 annual harvests. The yield data for different treatments is presented in Table 2.1.

On farm trial was carried out in APFDC Plantations. The average yields of these seedling progenies has been very poor. Therefore, one higher dose of fertilizer treatment has been imposed to find out the possibilities of increasing yield in the existing plantations. The data on growth and yield characteristics of the on-farm trial is presented in Table 2.2.

Table 2.1: Effect of N P K fertilizers application on yield performance of cashew at Bapatla.

	P0	P1	P2	Mean	K0	K1	K2
N0	1.250	1.362	1.279	1.297	1.410	1.269	1.212
N1	1.977	1.961	2.201	2.046	1.852	1.998	2.288
N2	1.080	2.348	2.057	1.828	1.387	2.071	2.026
Mean	1.435	1.890	1.845		1.549	1.779	1.842
K0	1.212	1.731	1.363				
K1	1.634	2.051	1.985				
K2	1.803	1.557	2.177				

Table 2.2: Effect of higher doses of fertilizer conducted in APFDC plantation.

Treatments	Plant Girth (cm)	Canopy spread (m)	No. of panicles m^{-2}	Yield (Kg $tree^{-1}$)
T1 - 500-125-125 (NPK)	134.0	12.5	16.3	7.25
T2 - 1000-250-250	139.8	13.4	18.0	9.75
T3 - 1500-375-375	139.2	13.6	18.5	10.25

CHINTAMANI

The various dosages of N, P, and K fertilizers influenced the vegetative growth of cashew. Plant height, girth and canopy spread were significantly influenced by P_2O_5, 250g $tree^{-1}$ (5.37 m, 99.55 cm & 9.81-9.98 m respectively) and canopy spread did not show any significant increase. However, during the year due to unfavorable weather conditions, the trees failed to produce any yield. The effect of N, P, and K fertilizers is presented in Table 2.3.

Table 2.3: Effect of NPK and their interaction on plant height at Chintamani

	P0	P1	P2	Mean	K0	K1	K2
N0	5.2	5.28	5.44	5.30	5.16	5.54	5.21
N1	4.89	5.51	5.24	5.21	5.23	5.17	5.24
N2	4.95	5.33	5.39	5.23	5.25	5.34	5.09
Mean	5.01	5.37	5.36	—	5.22	5.35	5.18
K0	4.83	5.54	5.28	—	—	—	—
K1	5.13	5.40	5.51	—	—	—	—
K2	5.08	5.18	5.29	—	—	—	—

CD 5% for P= 0.27 SEm± for P = 0.09
CD 5% for N/P/K = NS SEm± For N/P/K = 0.09
CD 5% for NP/NK /PK= NS SEm± For NP/NK/PK = 0.16

Two on farm trials are under maintenance by the center in farmers field which are planted in 1996. Both of these are located in Kolar District with variety Chintamani-1. Yield obtained from the above trials are 1.49 and 1.31 Kg $tree^{-1}$ respectively.

JHARGRAM

At Jhargram the interaction effect showed that the treatment combination N1P1K0 resulted

in maximum height (6.71m), N0P1K1 in maximum girth (85.83 cm) and N1P1K0 in maximum canopy spread under NPK fertilizer trial imposed in Jhargram-1 cashew grafts. The details of the NPK interaction on growth characteristics of cashew are presented in Table 2.4.

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

Treatment	Plant Height (m)	Plant Girth (cm)	Canopy spread (m)
N0P0K0	6.49	82.33	8.48
N0P0K1	5.65	78.67	7.88
N0P0K2	5.69	76.67	7.77
N0P1K0	5.27	77.50	8.06
N0P1K1	5.40	85.83	8.15
N0P1K2	5.62	84.83	8.72
N0P2K0	5.70	82.17	8.21
N0P2K1	6.11	80.17	8.53
N0P2K2	6.02	75.83	8.58
N1P0K0	5.65	80.00	8.72
N1P0K1	5.02	70.67	8.14
N1P0K2	4.88	73.83	8.08
N1P1K0	6.71	84.83	9.72
N1 P1K1	5.61	72.33	8.62
N1 P1K2	6.69	80.67	8.83
N1P2K0	6.01	68.00	6.87
N1 P2K1	5.78	75.83	8.13
N1 P2K2	4.09	71.92	8.36
N2P0K0	5.65	68.33	7.07
N2 P0K1	5.59	80.00	7.71
N2 P0K2	4.64	65.33	7.78
N2P1K0	5.89	84.00	8.28
N2P1K1	5.60	81.67	7.75
N2P1K2	5.71	78.00	8.85
N2P2K0	5.38	57.50	6.66
N2P2K1	4.40	71.00	7.01
N2P2K2	5.68	67.50	7.73
SEm for K	0.310	4.954	0.21
CD 5%	0.861	13.752	0.60
SEm for P	0.222	9.927	0.39
CD 5%	0.484	21.631	0.85
SEm for N	0.236	2.239	0.32
CD 5%	0.479	4.544	0.66
SEm for KP	0.385	17.194	0.67
CD 5%	0.839	37.466	1.45
SEm for KN	0.409	3.878	0.57
CD 5%	0.830	7.870	1.15
SEm for PN	0.409	3.878	0.56
CD 5%	0.830	7.870	1.15
SEm for NxPxK	0.708	6.716	0.98
CD 5%	1.437	13.629	2.30

MADAKKATHARA

At Madakkathara the growth parameters were recorded. Maximum height (6.17m) was observed for N2P0K1. Tree girth, canopy spread and yield were not influenced by any of the fertilizer treatments. Application of N0P2K0 resulted in maximum yield (4.98 Kg tree^{-1}) in interaction trial. The data on the effect of N, P and K on growth and yield characteristics of cashew are presented in Table 2.5.

Table 2.5: Effect of N, P & K on growth and yield characteristics of cashew at Madakkathara

Treatment	Plant Height (m)	Plant Girth (cm)	Canopy Spread (m)	Yield (Kg tree^{-1})
N0P0K0	4.58	62.17	5.77	1.11
N0P0K1	5.58	64.17	6.51	1.03
N0P0K2	4.88	61.05	5.33	1.01
N0P1K0	4.92	64.00	6.04	0.88
N0P1K1	4.50	55.50	6.68	1.14
N0P1K2	4.33	53.83	5.68	2.21
N0P2K0	5.08	62.67	6.57	4.98
N0P2K1	5.50	69.83	6.22	3.21
N0P2K2	5.00	65.67	6.34	1.03
N1P0K0	5.50	71.33	6.74	2.06
N1P0K1	4.75	62.33	6.45	1.53
N1P0K2	5.00	63.50	5.80	1.35
N1P1K0	5.67	63.00	5.82	1.51
N1P1K1	4.67	56.33	5.58	0.68
N1P1K2	5.25	72.83	6.62	1.48
N1P2K0	4.75	61.00	5.64	1.62
N1P2K1	5.54	71.00	6.23	1.38
N1P2K2	5.92	71.33	6.33	1.60
N2P0K0	6.00	76.83	6.97	2.00
N2P0K1	6.17	66.33	6.31	2.45
N2P0K2	5.68	73.17	6.39	0.74
N2P1K0	5.50	65.67	7.18	2.41
N2P1K1	5.38	73.17	6.75	3.15
N2P1K2	4.96	69.00	6.32	2.17
N2P2K0	5.00	62.17	6.78	1.86
N2P2K1	5.75	66.17	6.80	1.87
N2P2K2	5.75	68.33	6.47	3.23
SEm±	0.65	8.60	0.58	1.18
CD 5%	1.33	NS	NS	NS

VENGURLE

At Vengurle, among the interactions of N and P the N3P3 (3.758 Kg tree^{-1}) interaction was significantly superior over other treatments. Among N and K interaction, N3K3 (3.217 Kg tree^{-1}) was significantly superior over other interactions. Among the P and K interaction the P3K3 (2.967 Kg tree^{-1}) was superior over other treatments. The interaction N3P3K3 (3.90 Kg tree^{-1}) followed by N3P3K2 (3.10 Kg tree^{-1}) were superior treatments in NPK interaction. The details of growth and yield in response to NPK fertilizers are presented in Table 2.6.

Table 2.6. Effect of N, P and K interaction on yield at Vengurle.

Treatments	K1	K2	K3
N1P1	0.375	0.575	0.600
N1P2	0.650	0.775	1.150
N1P3	0.950	1.250	1.400
N2P1	1.950	2.200	1.750
N2P2	3.550	2.430	2.500
N3P3	2.700	1.830	3.600
N3P1	1.720	2.480	2.650
N3P2	2.850	3.150	3.100
N3P3	3.780	3.600	3.900
CD 5% N, P, K	0.120	SEm±	0.041
CD 5% NP, NK, PK	0.207	SEm±	0.071
CD 5% NXPXK	0.359	SEm±	0.124

VRIDHACHALAM

The trial has been laid out with VRI-2 grafts and data on tree height, canopy spread and flowering period indicated the maximum height of 2.10 m in treatment T 21 (N 1000g, P 125g and K 125g). The flowering period was from February to March. The incidence of pest and disease was high in this trial. Highest yield has been obtained for T25 (1000g N, 250g P_2O_5) for the year (1.040 Kg tree^{-1}). The data is presented in Table 2.7.

Table 2.7: Performance of cashew in response to N, P & K interaction at Vridhachalam.

Treatment	Plant Height (m)	Plant Girth (cm)	Canopy spread (m)	Yield (Kg tree^{-1})
N0P0K0	1.75	29	2.96	0.410
N0P0K1	1.90	25	2.46	0.305
N0P0K2	1.25	19	2.22	0.450
N0P1K0	2.01	35	2.42	0.450
N0P1K1	2.00	32	2.18	0.385
N0P1K2	1.60	30	2.06	0.456
N0P2K0	2.00	26	3.46	0.430
N0P2K1	1.40	24	1.78	0.500
N0P2K2	1.90	29	2.53	0.480
N1P0K0	1.88	26	3.13	0.475
N1P0K1	1.88	27	2.71	0.505
N1P0K2	1.96	26	2.58	0.460
N1P1K0	1.80	27	3.56	0.480
N1P1K1	1.50	25	1.88	0.475
N1P1K2	1.60	27	1.67	0.625
N1P2K0	1.40	26	2.07	0.745
N1P2K1	1.70	32	1.77	0.750
N1P2K2	1.80	19	2.31	0.760
N2P0K0	1.72	24	2.71	0.720
N2P0K1	2.10	17	2.92	0.690
N2P0K2	2.10	17	2.92	0.720
N2P1K0	1.90	25	2.61	0.800
N2P1K1	1.76	30	3.15	0.870
N2P1K2	1.88	18	1.73	1.020
N2P2K0	1.52	42	3.99	1.040
N2P2K1	1.66	32	2.95	0.980
N2P2K2	1.59	26	2.51	1.010

Fertiliser application in high density cashew plantations

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

West Coast
Madakkathara, Pilicode, and Vengurle

The objective of this experiment is to study the response of vegetatively propagated material of cashew to different doses of NPK fertilizers at different spacings for a given regional variety.

Design: Split-plot

Main plot: Plant density

S1	200 plants/ha (10m x 5m)
S2	400 plants/ha (6m x 4m)
S3	500 plants/ha (5m x 4m)

Sub-plot: Fertilizer dose

M1	75 Kg N,	25 Kg P_2O_5,	25 Kg K_2O/ha
M2	150 Kg N,	50 Kg P_2O_5,	50 Kg K_2O/ha
M3	225 Kg N,	75 Kg P_2O_5,	75 Kg K_2O/ha

Total area: 2.5 ha

Fertilizers application level:

1st year:	1/5th
2nd year:	2/5th
3rd year:	3/5th
4th year:	4/5th
5th year:	Full dose

The experiment is in its initial stages in all the Coordinating Centres and the detailed layout and experimental progress will be reported after establishing the experiment. At Bapatla, the trial has been laid out with BPP-8 variety and the data will be recorded. At Bhubaneswar, the experiment was laid out with H 2/16 with four replications. The plants are only two years old. At Chintamani, the experiment was laid out with Chintamani-1 grafts in four replications. At Jhargram, the lay out has been initiated and planting is being done. At Madakkathara, the trial is laid out with variety Madakkathara-1. At Pilicode, the experiment has been laid out with Madakkathara-1 grafts during August 2000. At Vengurle, the experiment has been initiated with V-7 grafts with four replications during 2000. The sub-plot treatments of fertilizer doses were altered according to the soil fertility level. In this experiment M1 - 57Kg N, 31Kg P_2O_5, 18Kg K_2O ha^{-1}; M2 - 113Kg N, 63Kg P_2O_5, 36Kg K_2O ha^{-1}; M3 - 170Kg N, 94Kg P_2O_5, 55Kg K_2O ha^{-1} were applied (Table 2.8).

Table 2.8: Growth parameters of spacing trial at Vengurle

Treat.	Plant Height (m)			Plant Girth (cm)			Canopy Spread (m)					
							(E-W)			(N-S)		
	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2	M3
S1	0.74	0.69	0.80	16	9	10	0.84	0.86	1.22	0.75	0.79	0.93
S2	0.58	0.58	0.77	8	11	10	0.50	0.57	0.73	0.54	0.60	0.72
S3	0.80	0.79	0.75	12	11	11	0.93	1.11	1.03	1.05	1.17	1.13
SE m (±) for S			0.04			0.01			0.08			0.09
SE m (±) for M			0.03			0.02			0.06			0.06
SE m (±) for S at same M			0.06			0.04			0.09			0.11
SE m (±) for M at same S			0.06			0.03			0.10			0.12

Spacing and high density planting trials

1. Spacing trial

Centres : East Coast
Jhargram

West Coast
Vengurle

The main objective of this experiment is to find out the optimum plant population per unit area at different ages of plantation for maximization of yield.

Summary

Testing of different spacings is being carried out at Jhargram and Vengrule. At Vengurle, 5 m x 5 m square system of planting with 75 per cent thinning could yield 400 kg/block of 50 m x 50 m with 100 plants.

Experimental details:

Design	:	RBD
Replications	:	3
Plot size	:	25m x 25m
Area covered	:	2.25 ha
Variety	:	Red Hazari (Jhargram), V-4 (Vengurle)
Year of planting	:	July 1982 (Jhargram), July 1990 (Vengurle)

Different spacing trials:

T1	5m x 5m	:	Square with no thinning
T2	5m x 5m	:	Square with thinning of 50% plants (after 6 years in 1990)
T3	5m x 5m	:	Square with thinning of 75% plants (after 11 years)
T4	10m x 5m	:	Rectangular
T5	10m x 5m	:	Rectangular with thinning of 50% plants (after 6 years, done in 1990)
T6	10m x 10m	:	Square
T7	10mx10m x 10m	:	Triangular
T8	8m x 8m	:	Square
T9	8m x 8m x 8m	:	Triangular
T10	6m x 6m	:	Square
T11	6m x 6m x 6m	:	Triangular
T12	5m x 5m	:	Square with selective thinning of 50-75% plants. During 1990, 50% plants were removed selectively.

VENGURLE

At Vengurle, the yield in treatment of 5 m x 5 m square (324.00 Kg block^{-1}), 5 m x 5 m square with thinning (368.00 Kg block^{-1}) and 5 m x 5 m square with 75 per cent thinning (400.00 Kg block^{-1}) were on par with each other and were significantly superior over the rest of treatments. Similarly, the per hectare yields were also high in these treatments. The growth characters such as height, girth, canopy spread were not significant among the treatments. Considering the yield in

the initial years of planting, 5 m x 5 m was good under Vengurle conditions in Vengurla-4 variety planted under spacing trial experiment. The data on growth and yield performance of cashew trees is presented in Table 2.9.

Table 2.9: Growth and yield performance of cashew trees under spacing trial at Vengurle.

Treatment	Plant Height (m)	Plant Girth (cm)	Canopy spread (m)		Nut Yield (Kg)			No. of plants	
			N-S	E-W	Per tree	Per block (50m x 50 m)	Per ha.	per block (50m x 50m)	Per ha.
T_1	4.03	50	5.47	5.02	3.24	324.00	1296.00	100	400
T_2	4.08	54	5.15	4.90	3.68	368.00	1472.00	100	400
T_3	4.02	54	5.34	5.19	4.00	400.00	1600.00	100	400
T_4	4.23	47	4.88	5.20	3.84	192.00	768.00	50	200
T_5	4.03	52	5.09	5.28	3.91	196.00	782.00	50	200
T_6	4.22	49	4.52	4.99	3.10	77.50	310.00	25	100
T_7	3.75	51	4.88	5.02	3.70	107.30	425.50	29	115
T_8	4.26	53	5.24	4.77	4.06	158.34	633.40	39	156
T_9	4.22	46	4.90	5.27	3.22	144.90	579.60	45	180
SEm±	0.08	1.22	0.12	—	0.17	9.85	39.39	—	—
C.D. 5%	—	3.68	0.36	—	0.51	29.52	118.05	—	—

2. High density planting trial

Centres : East Coast
Bapatla and Bhubaneswar

West Coast
Vengurle

Maidan tracts/ others
Chintamani

Summary

High density demonstration garden has been maintained at Bapatla, Bhubaneswar, Chintamani and Vengurle. At Bhubaneswar high density planting could give an yield of 1312.5 kg ha^{-1} for variety H 2/16.

BAPATLA

The trial will be laid out with 4 m x 4 m (625 plants ha^{-1}) and 8 m x 8 m (156 plants ha^{-1}) in fresh plot, after clearing out old trees.

BHUBANESWAR

The trial was laid out with 4 m x 4 m (625 plants ha^{-1}) during 1996 with variety H 2/16. During the year 2001 in the high density plot 1312.5 Kg ha^{-1} yield was recorded. Similar trial has been laid out in farmers' field with variety V-4. Recommended dose of fertilizer was also applied and 875 Kg ha^{-1} yield was recorded for second annual harvest.

CHINTAMANI

During 1997 high density planting was established using Chintamani-1 grafts at a spacing of 4 m x 4 m. During the year 90 Kg yield has been harvested from the whole plot. The growth parameters are presented in Table 2.10.

Table 2.10. Growth characteristics of Chintamani-1 grafts at Chintamani.

Parameters	Plant height (m)	Plant Girth (cm)	Canopy spread (m)
Maximum	3.6	33.0	3.46
Minimum	1.65	12.0	2.00
Mean	2.91	16.33	2.65

VENGURLE

High density planting was taken up with the variety Vengurla-7 at a spacing of 4 m x 4 m during August 1998 in an area of 0.2 ha. During the period under report, the trees have started yielding and 6.2 Kg of nuts could be obtained per plot. The data recorded on growth parameters is presented in Table 2.11.

Table 2.11: Growth characteristics of high density planting at Vengurle.

Replications	Plant Height (m)	Plant Girth (cm)	No. of branches	Canopy spread (m)
1	3.05	36	6.42	3.52
2	2.84	40	5.37	3.14
3	3.09	36	7.12	3.43
4	2.81	34	6.62	3.66
5	3.04	33	4.42	3.54
6	3.41	40	8.75	3.85
7	2.91	37	8.00	3.58
8	3.03	36	7.25	3.89
9	3.17	33	8.87	3.49
10	2.95	33	6.50	3.43
11	2.84	32	6.25	3.18
12	2.90	34	6.70	3.51
Mean	3.00	35.33	6.86	3.51
S.D.	0.16	2.56	1.23	0.24
C.V %	5.43	7.25	17.89	6.72

The above data are averages of 10 grafts in each row.

Cashew based cropping system

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

West Coast
Madakkathara and Vengurle

The objectives are to:

(a) Identify compatible inter-crops with cashew in the initial stages of orchard development.
(b) *Study the economic benefits of inter-cropping system.*
(c) Work out a soil fertility management strategy for the inter-cropping system.

Summary

Different intercropping trials are being carried out with annuals at different coordinating centers. At Bapatla, intercropping was done during late Kharif season. Green gram was found to be a better intercrop. At Bhubaneswar, turmeric has been found to be remunerative with net profit of Rs.12,798/- ha^{-1}. At Vengurle, Cucumber was found remunerative with a net profit of Rs.34,998/- per hectare. At Vridhachalam, groundnut was found remunerative than other intercrops.

Experimental details:

Main plot : 4
Sub-plot -3 : 3
- F0 - No additional fertilizer to inter-crop
- F1 - Additional fertilizer application to the inter-crops as per the state recommendation.
- F2 - 50% of the additional fertilizer application to the inter-crop.

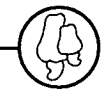
No. of replications : 3
Design : Split plot

BAPATLA

During the year Kharif intercropping experiments were conducted. During Kharif season green gram, red gram, black gram and Bengal gram have been grown as intercrops where green gram and red gram were found most economical. However, these intercrops did not fetch net income over cost of cultivation. The data on yield and returns of intercrops in cashew is given in Table 2.12.

Table 2.12: Yield and net returns from intercrops in cashew at Bapatla

Intercrop	Yield		Total income	Expenditure
	g $2m^{-2}$	Kg ha^{-1}		
Green gram	75	369	6100	6533
Red gram	62.66	313	4700	6533



BHUBANESWAR

The cashew plants were spaced at 10 m x 10 m as a main crop and the other intercrops were grown at different spacing. The cashew intercropped with turmeric fetched net profit of Rs. 12,798/- followed by cashew + bhindi (Rs. 2,616/-). The details of yield obtained for the main crop as well as for intercrop is presented in Table 2.13.

In case of turmeric cashew leaves were used as mulching material to suppress weed growth and to provide organic fertilizer.

Table 2.13: Performance of cashew and its intercrops at Bhubaneswar.

Crop	Yield (Q ha^{-1})		Total returns (Rs)		
	Cashew	Intercrop	Cashew	Intercrop	Net profit
Cashew alone	6.5	—	22500	—	22500
Cashew+cowpea	9.6	8.83	1250	2649	1399
Cashew+pumpkin	7.6	12.5	1050	3083	2033
Cashew+bhindi	7.5	30.83	3550	6166	2616
Cashew+turmeric	7.2	53.83	19500	32298	12798
Cashew+greengram	7.6	1.0	850	1500	650

Table 2.14: Performance of cashew and its intercrops at Bhubaneswar.

Intercrop	Yield (Kg $plot^{-1}$)	Yield (Kg ha^{-1})	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net Profit (Rs.)	Biomass (Kg $plot^{-1}$)
Snake gourd	25.30	3953	13950	36548	22598	8.94
Ridge gourd	26.40	6600	13924	38169	24245	11.46
Bitter gourd	16.93	4233	12741	28272	15981	9.93
Bottle gourd	26.67	6668	12222	28178	15956	7.80
Cucumber	35.00	8750	15941	50939	34998	11.79

JHARGRAM

During the period under report, intercropping was done with Groundnut, red gram and okra along with cashew at the centre. Mean yield of groundnut was 2.38 kg plot-1/ 7.44 q ha^{-1}. However, redgram and okra could not be harvested due to severe grazing.

VENGURLE

During the period under report, ridge gourd (Konkan Harita), bitter gourd (Konkan Tara), cucumber (Sheetal), snake gourd (Konkan Shweta), and bottle gourd (Pusa Navin) were grown as intercrops with cashew each at a spacing of 60 cm x 90 cm. Maximum yield was obtained for cucumber and has been found remunerative followed by ridge gourd. Yield obtained from intercrops and economics of growing are presented in Table 2.14.

VRIDHACHALAM

The experiment was conducted in high-density cashew plantation at 4 m x 4 m spacing with four crops such as blackgram, cowpea, sesame and groundnut. The maximum tree height

(455 cm) and with cowpea had more canopy spread (3.87 m) was obtained in the plot grown with sesame as intercrop. The soil moisture was high when the intercrop was groundnut (19%). From the experiment, it is found that groundnut is highly profitable as an intercrop in cashew plantation. The details of the performance of intercrops under cashew plantations are given in Table 2.15.

Table 2.15: Performance of cashew and its intercrop at Vridhachalam.

Treatment	Plant Height (m) main crop	Plant Girth (cm)	Moisture content (%)	Intercrop Yield (Kg)	Revenue from intercrop Rs.
T1 Cashew + Blackgram	4.50	42.5	18	361	3500
T2 Cashew + Cowpea	4.20	40.2	18	426	2300
T3 Cashew + Sesame	4.55	38.1	17	116	2500
T4 Cashew + Groundnut	4.08	41.6	19	790	4300
Cashew as sole crop	3.80	44.3	17	—	—

Drip irrigation trial

Centres : East Coast
Vridhachalam

West Coast
Vengurle

Maidan tracts/ others
Chintamani

The objective is to study the response of cashew to supplementary irrigation during flushing and flowering phases and to work out the critical stages of irrigation.

Experimental details:

Treatments	:	Five	
T1	:	No irrigation	
T2	:	Irrigating 20% of cumulative pan evaporation	
T3	:	Irrigating 40% of cumulative pan evaporation	
T4	:	Irrigating 60% of cumulative pan evaporation	
T5	:	Irrigating 80% of cumulative pan evaporation	
Spacing	:	7m x 7m	
Planting material	:	Softwood grafts	
Variety	:	Chintamani	: Chintamani-1
		Vengurle	: Vengurla-7
		Vridhachalam	: VRI-3

CHINTAMANI

Planting of 240 grafts of Chintamani-1 has been done during September 1997. The establishment of plants is quite satisfactory at Chintamani Centre. Drip irrigation system installation is under progress.

VENGURLE

At Vengurle, this trial has been laid out at Agricultural Research Station, Mulde, Kudal, and Sindhudurg District. Soft wood grafts of Vengurla-7 were planted at a spacing of 5 m x 5 m for the purpose of implementing the trial. The drip irrigation treatments have been imposed from January 2000.

VRIDHACHALAM

Planting of the experiment will be taken up carried out soon after establishment of drip irrigation facilities at Vridhachalam in 2001-2002.

3. CROP PROTECTION

Chemical control of pest complex in cashew

1. Control of major pest: Tea mosquito bug, Helopeltis antonii.

Centres : East Coast
Jhargram and Vridhachalam

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani and Jagdalpur

The objective of the project is to find out an effective spray schedule for the management of tea mosquito bug and other minor pests of cashew. This project also aims at testing the alternate chemicals in comparison with standard insecticidal spray schedule against pests of cashew.

Summary

Chintamani, least incidence of TMB was recorded in trees which received spray at flushing, flowering and fruiting stages. The population of natural enemies was highest in untreated control (T10) during all the stages. However, in experiment initiated during 1995-96 on BLA 139-1 the yield was highest for trees sprayed with monocrotophos at flushing, endosulfan at flowering and carbaryl at fruiting (T5, 6.96 Kg tree^{-1}). At Madakkathara trees sprayed during flowering and flushing stages could yield better compared to other treatments (13.5 kg tree^{-1}). The treatment T5 was found to be more effective than the other treatments after third spray, but however, the results were not significant at Vengurle. Standard spray (T5) was found to be most effective treatment at Vridhachalam in controlling TMB as well as minor pests of cashew.

Treatments:

T1	:	Monocrotophos (0.05%) one spray at flushing
T2	:	Endosulfan (0.05%) one spray at flowering
T3	:	Carbaryl (0.1%) one spray at fruiting
T4	:	T1 and T2
T5	:	T1, T2, and T3
T6	:	T1 and T3
T7	:	T2 and T3
T8	:	Endosulfan (0.05%) at flowering stage followed by neem oil (2%)
T9	:	Carbaryl (0.1%) at flowering stage followed by neem oil (2%) at fruiting stage
T10	:	Control

CHINTAMANI

The percent incidence of TMB and the number of natural enemies at flowering, fruiting and harvesting stages in different treatments is presented in Table 3.1. In trees, which received spray at flowering and fruiting stages, least incidence of TMB was recorded. However, the population of natural enemies was highest in untreated control (T10) during all the stages. The yield was highest in T5 (6.96 Kg tree^{-1}), which was significantly higher than all other treatments.

JHARGRAM

Due to the low population (0.4 - 1.3%) of TMB at Jhargram, the experiment of control on major pest - TMB was not carried out during the year.

MADAKKATHARA

The most effective treatment was spraying endosulfan (0.05%) at flowering and carbaryl (0.1%) at fruiting stage (T7) followed by spraying endosulfan (0.05%) and neem oil 2% (T8). The trees treated with T7, highest yield was obtained (13.00 kg tree^{-1}) followed by T5 (10.33 kg tree^{-1}). The details of pest incidence are presented in Table 3.2.

Table 3.1: Incidence of tea mosquito bug and natural enemies at Chintamani.

Treatment	TMB (%)		Leaf miner (%)	Inflorescence thrips		Natural enemies (No.)		Yield (kg tree^{-1})
	30 days after II spray	30 days after III spray	30 days after I spray	30 days after II spray	30 days after III spray	30 days after II spray	30 days after III spray	
T1	16.20	8.96	2.73	10.17	12.49	2.02	3.42	1.02
T2	2.55	7.68	23.92	1.86	12.89	1.32	2.02	2.02
T3	23.62	1.02	24.12	9.83	2.65	4.52	2.62	1.85
T4	1.56	8.12	2.37	1.47	12.75	0.68	1.96	3.26
T5	1.52	1.00	2.53	1.54	2.86	0.75	0.42	6.96
T6	15.68	1.56	2.53	9.63	2.54	1.48	0.68	2.05
T7	2.62	1.02	24.44	1.86	2.41	1.30	0.62	4.68
T8	2.51	1.50	24.67	1.68	2.15	1.26	0.52	5.02
T9	1.56	2.06	25.35	1.66	2.36	1.38	0.58	5.16
T10	23.78	9.56	26.56	10.29	13.02	4.60	4.80	1.69
SEm±	0.86	0.48	1.50	0.43	0.58			0.36
CD 5%	2.59	1.43	3.50	1.30	1.73			1.07

Table 3.2: Incidence of tea mosquito bug (TMB) at Madakkathara

Treatment	Pre-treatment count		After II spray		After III spray		Yield (Kg tree^{-1})
	Shoot (%)	Panicle (%)	Panicle (%)	Nut (%)	Panicle (%)	Nut (%)	
T1	Skipped the spray						6.70
T2	1.33	6.50	9.72	—	18.66	11.00	8.80
T3	0.00	3.40	4.11	—	6.11	4.33	9.30
T4	4.60	5.84	7.22	—	11.65	5.60	6.50
T5	0.00	6.50	6.50	—	4.60	5.30	10.33
T6	0.00	4.33	7.66	—	8.43	2.15	9.30
T7	2.60	6.75	7.22	—	8.33	1.11	13.00
T8	0.00	6.62	8.10	—	11.36	7.11	9.75
T9	1.11	3.40	5.00	—	7.75	5.25	8.75
T10	0.00	4.70	5.33	—	7.45	3.22	8.50

VENGURLE

The pesticide treatments in first spray was not significantly effective, because of the low incidence of TMB whereas, observation recorded 30 days after the II spray indicated that the incidence of pest was significantly low in spraying endosulfan 0.05% at flowering (T2) followed by spraying endosulfan (0.05%) at flowering and carbaryl (0.1%) at fruiting stage (T7) and T5 (standard spray) as compared to the control. The treatment T5 was found to be more effective than the other treatments after III spray, but however, the results were not significant. The data on various pesticide treatments is presented in Table 3.3.

Table 3.3: Incidence of tea mosquito bug (TMB) at Vengurle

Treatment	Percent damage after 30 days					
	I Spray		II Spray		III Spray	
	Per cent	Transformed value	Per cent	Transformed value	Per cent	Transformed value
T1	5.38	(11.63)	18.57	(25.51)	36.70	(37.27)
T2	9.90	(18.27)	18.93	(25.78)	37.25	(37.59)
T3	7.31	(15.70)	18.87	(25.75)	34.70	(36.06)
T4	1.97	(7.58)	11.05	(19.17)	26.85	(31.11)
T5	3.91	(11.28)	14.30	(22.18)	23.92	(26.13)
T6	2.40	(8.63)	13.34	(21.39)	31.44	(34.10)
T7	5.91	(12.86)	11.11	(18.86)	25.17	(29.81)
T8	3.37	(8.81)	16.05	(23.09)	35.70	(30.60)
T9	2.34	(8.48)	11.10	(18.93)	27.31	(31.40)
T10	4.16	(11.39)	19.72	(26.33)	37.38	(37.68)
SEm±	2.465		2.328		2.139	
CD 5%	NS		NS		6.352	

VRIDHACHALAM

At Vridhachalam, the most effective treatment was the standard spray (T5) (Endosulfan 35 EC 1.5 ml l^{-1} + urea 0.3% at flushing, Monocrotophos 1.25 ml l^{-1} at flowering and carbaryl 2g l^{-1} at fruiting stage) followed by T7 i.e., skipping the first spray. (Table 3.4).

Table 3.4: Incidence of tea mosquito bug (TMB) at Vridhachalam

Treatment	Pre treatment count	Post treatment count		
		I spray	II spray	III spray
T1	3.3	2.3	1.8	1.0
T2	2.9	2.2	1.6	1.3
T3	2.8	1.8	1.2	0.9
T4	3.2	2.4	2.0	1.1
T5	2.7	1.7	1.0	0.3
T6	2.6	1.9	1.5	0.6
T7	2.9	1.5	1.4	0.5
T8	3.1	2.3	1.6	0.8
T9	2.7	2.3	1.7	0.7
T10	3.0	3.6	3.2	3.9
CD 5%	2.02	0.58	0.51	0.69
SE m	0.96	0.29	0.24	0.33

2. Control of minor pests

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

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani and Jagdalpur

Treatments:

T1 : Monocrotophos (0.05%) one spray at flushing
T2 : Endosulfan (0.05%) one spray at flowering
T3 : Carbaryl (0.1%) one spray at fruiting
T4 : T1 and T2
T5 : T1, T2, and T3
T6 : T1 and T3
T7 : T2 and T3
T8 : Endosulfan (0.05%) at flowering stage followed by neem oil (2%)
T9 : Carbaryl (0.1%) at flowering stage followed by neem oil (2%) at fruiting stage
T10 : Control

BAPATLA

Among various treatments, the standard spray (T5) was found most effective against pests such as leaf miner, webber, leaf folder and shoot tip caterpillar on foliage, apple and nut borer and webber on nuts, etc. The pest population was ranging from 0.08 to 0.25 sq.m^{-1}. Under this treatment nut yield of 16.26 kg tree^{-1} could be harvested followed by T7 with 14.4 kg tree^{-1}. The data on incidence of minor pests of cashew at Bapatla is presented in Table 3.5-3.6.

BHUBANESWAR

The treatments T1, T4, T5 and T6 were good in controlling shoot tip caterpillar and leaf folder. The population of inflorescence thrips was not significantly influenced by Ist spray (1.63 to 4.30%) but the population drastically influenced after the II spray and after the III spray the population was significantly lower (1.73%). The inflorescence thrips and leaf folders were susceptible for T5 treatment. The natural enemies observed in the experiment were spiders, predator spiders (Angeope sp.), mirid bugs, lady bird beetles and black ants. Maximum population of spiders was observed in T10, whereas, the effect of different treatments was non significant at 30 days after the I, II and III sprays on spider population. The data on incidence of various pests of cashew is given in Table 3.7.

Table 3.5. Incidence of minor pests of cashew at Bapatla.

Treatment	Leaf miner		Leaf and blossom webber				Leaf folder	
	Pre-treat. Count	30 DAS 1st spray	Pre-treat. Count	30 DAS 1st spray	30 DAS 2nd spray	30 DAS 3rd spray	Pre-treat. Count	30 DAS 1st spray
T1	0.50	0.08	0.92	0.33	1.00	0.92	0.33	0.08
	(1.22)	(1.04)	(1.38)	(1.15)	(1.40)	(1.38)	(1.15)	(1.04)
T2	0.17	0.92	0.83	1.50	0.33	0.83	0.33	1.08
	(1.08)	(1.38)	(1.35)	(1.58)	(1.15)	(1.35)	(1.15)	(1.44)
T3	0.33	1.00	0.75	1.25	0.33	0.33	0.17	0.58
	(1.15)	(1.41)	(1.32)	(1.50)	(1.15)	(1.15)	(1.07)	(1.25)
T4	0.75	0.25	0.67	0.42	0.25	0.83	0.08	0.08
	(1.32)	(1.12)	(1.28)	(1.19)	(1.12)	(1.35)	(1.04)	(1.04)
T5	0.42	0.17	0.58	0.25	0.25	0.25	0.08	0.08
	(1.19)	(1.08)	(1.25)	(1.12)	(1.12)	(1.12)	(1.04)	(1.04)
T6	0.50	0.17	0.50	0.25	0.83	0.33	0.33	0.08
	(1.22)	(1.08)	(1.22)	(1.12)	(1.34)	(1.15)	(1.15)	(1.04)
T7	0.08	0.92	0.50	1.00	0.25	0.25	0.42	0.92
	(1.04)	(1.38)	(1.22)	(1.41)	(1.12)	(1.12)	(1.19)	(1.38)
T8	0.25	0.92	0.50	1.33	0.25	0.33	0.42	0.92
	(1.11)	(1.38)	(1.22)	(1.47)	(1.12)	(.15)	(1.8)	(1.38)
T9	0.25	1.08	0.50	1.50	0.25	0.25	0.33	1.17
	(1.12)	(1.44)	(1.22)	(1.55)	(1.12)	(1.12)	(1.15)	(1.47)
T10	0.33	1.00	0.83	1.58	1.75	3.00	0.33	1.08
	(1.15)	(1.41)	(1.35)	(1.61)	(1.66)	(1.99)	(1.15)	(1.44)
SEm		0.03		0.03	0.06	0.06		0.05
CD 5%		0.08		0.10	0.19	0.17		0.14

DAS - Days after spray

Table 3.6. Incidence of minor pests of cashew at Bapatla.

Treatment	Shoot tip caterpillar				Apple and nut borer (%)		Leaf and blossom webber		Yield kg tree^{-1}
	Pre-treat. Count	30 DAS 1st spray	30 DAS 2nd spray	30 DAS 3rd spray	30 DAS 2nd spray	30 DAS 3rd spray	30 DAS 2nd spray	30 DAS 3rd spray	
T1	0.33	0.17	0.50	1.08	4.72	5.01	6.64	6.95	7.63
	(1.15)	(1.08)	(1.22)	(1.44)	(12.52)	(12.83)	(14.90)	(15.02)	
T2	0.25	0.83	0.33	1.17	1.63	3.48	1.87	8.02	8.30
	(1.11)	(1.35)	(1.15)	(1.47)	(6.18)	(10.74)	(7.80)	(16.45)	
T3	0.17	0.50	0.50	0.33	3.09	1.73	3.86	1.97	9.87
	(1.08)	(1.22)	(1.22)	(1.15)	(10.15)	(7.54)	(11.30)	(7.82)	
T4	0.08	0.25	0.25	1.00	1.08	2.47	1.59	10.88	8.32
	(1.04)	(1.12)	(1.12)	(1.41)	(5.83)	(8.99)	(7.22)	(19.09)	
T5	0.08	0.25	0.17	0.25	1.17	1.39	0.86	0.95	16.26
	(1.04)	(1.12)	(1.08)	(1.12)	(6.11)	(6.78)	(5.32)	(5.48)	
T6	0.08	0.25	0.58	0.42	3.09	2.44	4.18	2.80	10.02
	(1.04)	(1.12)	(1.25)	(1.19)	(10.05)	(8.96)	(11.71)	(9.59)	
T7	0.25	0.75	0.33	0.50	1.47	2.65	1.81	2.59	14.40
	(1.12)	(1.32)	(1.15)	(1.22)	(6.72)	(9.30)	(7.74)	(9.23)	
T8	0.08	0.92	0.25	0.50	2.31	2.58	1.32	3.51	12.85
	(1.04)	(1.38)	(1.12)	(1.22)	(8.49)	(9.17)	(6.48)	(10.77)	
T9	0.25	0.83	0.25	0.50	1.28	2.43	0.99	4.79	12.80
	(1.12)	(1.35)	(1.12)	(1.22)	(6.45)	(8.85)	(5.70)	(12.37)	
T10	0.25	0.75	0.92	2.50	7.65	10.95	10.36	22.98	7.53
	(1.12)	(1.32)	(1.38)	(1.87)	(16.01)	(19.28)	(18.57)	(28.61)	
SEm		0.03	0.05	0.03	1.24	0.85	0.83	1.38	0.86
CD 5%		0.10	0.13	0.09	3.70	2.52	2.48	4.12	2.55

DAS - Days after spray

Note: Figures in paranthensis are square root (X+1) transformed values.

Table 3.7: Occurrence of minor pests of cashew at Bhubaneswar.

Treatments	% Infestation by shoot tip borer		% Infestation by leaf folder	Mean inflorescence thrips population					Mean score of thrips	Yield (Kg tree^{-1})
	Pre-treatment count	30 days after 1st spray	30 days after 1st spray	30 days after 1st spray		30 days after 2nd spray		30 days after 3rd spray		
				YT	BT	YT	BT			
T1	4.9	0.50	0.63	1.73	—	1.60	1.63	0.48	0.13	4.350
	(2.32)	(0.98)	(1.03)	(1.48)	—	(1.42)	(1.46)	(0.99)		
T2	5.1	3.57	2.20	3.80	—	0.34	0.43	0.42	0.12	3.450
	(2.35)	(2.01)	(1.63)	(2.06)	—	(0.92)	(0.96)	(0.96)		
T3	4.6	3.2	2.30	1.97	—	1.50	0.71	0.31	0.05	4.320
	(2.20)	(1.92)	(1.67)	(1.57)	—	(1.38)	(1.16)	(0.90)		
T4	5.0	0.73	0.43	1.77	—	0.50	0.40	0.48	0.15	3.560
	(2.30)	(1.02)	(0.98)	(1.49)	—	(0.99)	(0.92)	(0.88)		
T5	5.4	0.30	0.47	1.63	—	0.26	0.25	0.23	0.05	6.560
	(2.42)	(0.87)	(0.96)	(1.46)	—	(0.83)	(0.85)	(0.85)		
T6	4.5	0.70	0.63	3.27	—	1.53	0.55	0.38	0.18	4.650
	(2.21)	(1.01)	(1.03)	(1.92)	—	(1.41)	(1.02)	(0.94)		
T7	5.7	3.13	2.17	2.00	—	0.40	0.36	0.35	0.10	3.780
	(2.40)	(1.89)	(1.62)	(1.56)	—	(0.93)	(0.93)	(0.92)		
T8	5.5	2.93	2.10	4.30	—	0.30	0.44	0.41	0.30	2.950
	(2.44)	(1.84)	(1.60)	(2.16)	—	(0.89)	(0.97)	(0.95)		
T9	4.7	3.43	4.27	2.97	—	0.40	0.42	0.42	0.10	3.560
	(2.17)	(1.98)	(1.66)	(1.86)	—	(0.93)	(0.94)	(0.94)		
T10	6.7	4.4	2.72	6.20	—	2.13	3.01	1.73	0.73	1.560
	(2.63)	(2.21)	(1.86)	(2.58)	—	(1.61)	(1.76)	(1.49)		
SEm±	0.32	0.26	0.13	0.14	—	0.13	0.17	0.07		
CD 5%	0.67	0.55	0.38	0.43	—	0.40	0.51	0.21		

YT - Yellow thrips; BT - Black thrips

CHINTAMANI

The incidence of leaf miner was least in trees receiving spray at flushing stage. Similarly, inflorescence thrips population was lowest in trees receiving sprays at flowering and fruit setting stages. The data on incidence of different minor pests is included in Table 3.1.

JHARGRAM

The incidence of leaf miner, shoot and blossom webber and shoot tip caterpillar were very low in T4 and T5 treatments. The average incidence of leaf miner was 1.5, 1.6 and 1.3 respectively in T5, T4 and T1 during the first round of treatment as compared to 1.2 in control. It was observed that insect control is effective when the plants were sprayed two to three rounds of treatments T4 and T5. Maximum nut yield was 1.650 in T4 and 1.620 Kg tree^{-1} in T5 as compared to 0.840 Kg tree^{-1} in control. The details of incidence of different pests of cashew are presented in Table 3.8.

Table 3.8. Incidence of minor pests of cashew at Jhargram

Treat-ments	Pre-treatment count			After 1st spray			After 2nd spray			yield Kg tree^{-1}
	Leaf miner	S&B Webber	Shoot tip caterpillar	Leaf miner	S&B Webber	Shoot tip caterpillar	Leaf miner	S&B Webber	Shoot tip caterpillar	
T1	1.3	0.8	1.5	1.62	1.40	1.78	3.52	4.42	3.60	1.294
	(6.55)	(5.13)	(7.04)	(7.29)	(6.80)	(7.64)	(10.79)	(12.13)	(10.94)	
T2	1.36	0.80	1.4	2.82	3.7	1.89	5.68	4.86	3.98	1.270
	(6.72)	(5.13)	(6.80)	(9.65)	(11.09)	(7.91)	(13.78)	(12.74)	(11.50)	
T3	1.14	0.5	1.6	3.9	3.7	2.12	6.36	5.41	4.86	1.190
	(6.91)	(4.05)	(7.27)	(11.39)	(11.09)	(8.36)	(14.61)	(13.45)	(12.71)	
T4	1.6	0.7	1.6	1.61	1.42	1.14	2.28	2.20	1.64	1.650
	(7.27)	(4.80)	(7.27)	(7.26)	(6.82)	(6.18)	(8.71)	(8.53)	(7.32)	
T5	1.5	0.8	1.4	1.69	1.46	1.08	1.28	2.21	1.60	1.620
	(7.04)	(5.13)	(6.80)	(7.490)	(7.24)	(5.98)	(8.71)	(8.54)	(7.39)	
T6	1.2	0.8	1.3	2.24	1.49	1.60	3.84	2.28	1.86	1.602
	(6.29)	(5.13)	(6.55)	(8.37	(7.03)	(7.27)	(11.27)	(8.70)	(7.78)	
T7	1.78	0.9	1.2	3.89	4.80	1.89	4.94	5.18	2.48	1.410
	(7.70)	(5.44)	(6.29)	(11.39)	(12.66)	(7.91)	(12.84)	(13.16)	(9.08)	
T8	1.69	1.2	1.4	3.74	4.94	1.30	5.29	5.34	3.43	1.350
	(7.49)	(6.29)	(6.80)	(11.15)	(12.89)	(6.55)	(13.30)	(13.38)	(10.03)	
T9	1.6	0.9	1.6	3.94	4.40	3.65	5.44	5.02	4.48	1.290
	(7.27)	(5.44)	(7.27)	(11.32)	(12.11)	(10.99)	(13.47)	(12.93)	(9.08)	
T10	1.2	0.9	1.6	4.29	4.98	4.12	7.49	9.4	8.94	0.840
	(6.29)	(5.44)	(7.27)	(11.97)	(12.90)	(11.69)	(15.88)	(17.85)	(18.39)	
CD 5%	0.08	0.09	0.08	0.14	0.12	0.08	0.15	0.12	0.12	0.13

*S&B = Shoot and Blossom

MADAKKATHARA

The incidence of minor pests like leaf miner, leaf roller, blossom webber and thrips were also low in T5 followed by T2. Population of natural enemies like ants, spiders and chrysopa were hig in T8 than in T2. The Details of observation don on minor pests of cashew is presented in Table 3. and natural enemies in Table 3.10.

Table 3.9. Incidence of minor pests of Cashew at Madakkathara

Treatments	Pre-treatment count		After II spray			After III Spray	
	Leaf miner		Leaf roller	Blossom webber	Thrips	Thrips	Mean score
	Shoot (%)	Leaves (%)		(%)			
T2	—	0.31	—	—	—	2.65	0.28
T3	—	0.16	0.13	—	—	—	—
T4	0.11	0.25	—	—	—	—	—
T5	—	0.06	—	—	—	—	—
T6	—	0.33	—	0.06	—	—	—
T7	0.20	0.26	—	—	—	3.45	0.30
T8	—	0.15	0.26	0.50	—	—	—
T9	—	0.39	—	0.11	0.33	2.8	0.19
T10	0.07	0.28	—	0.18	—	—	—

Table 3.10: Occurrence of natural enemies of cashew pests at Madakkathara.

Treatment	Pre-treatment count		After II spray		After III spray	
	Ants	Spiders	Ants	Spiders	Ants	Spiders
T2	2.80	2.40	4.20	—	2.80	2.80
T3	3.30	—	2.50	—	3.30	—
T4	4.60	2.60	1.60	1.55	2.60	1.60
T5	2.10	—	2.55	—	3.20	—
T6	3.60	1.30	2.40	2.60	2.10	—
T7	1.10	—	1.40	—	1.00	2.70
T8	2.80	—	2.60	—	4.60	—
T9	2.50	2.30	3.40	1.10	3.50	—
T10	3.70	2.60	3.80	1.60	4.70	3.10

VENGURLE

Treatments T5, T3, T6 and T7 were found to be equally effective in managing inflorescence thrips. Treatment T5 was effective at peanut, pebble nut as well as mature nut stage. In peanut and pebble nut stage, T7, T3 and T6 were also at par with T5. The details of incidence of minor pest of cashew are presented in Table 3.11.

Table 3.11 : Incidence of inflorescence thrips on cashew at Vengurle

Treatment	Average nut surface damaged at		
	Pea nuts	Pebble nuts	Matured nuts
T1	22.08	28.77	25.62
	(28.01)	(32.45)	(30.43)
T2	18.75	28.08	29.10
	(25.66)	(31.85)	(32.65)
T3	20.34	24.34	25.23
	(26.41)	(29.54)	(30.00)
T4	21.20	26.74	23.66
	(27.33)	(31.08)	(29.10)
T5	17.59	22.08	21.66
	(24.77)	(28.03)	(27.71)
T6	21.24	26.24	24.99
	(27.44)	(30.76)	(29.95)
T7	19.66	28.95	28.74
	(26.32)	(32.54)	(32.42)
T8	20.44	26.87	26.58
	(26.74)	(31.23)	(31.63)
T9	20.74	27.50	24.58
	(27.05)	(31.64)	(29.72)
T10	21.66	32.70	31.87
	(27.73)	(34.89)	(34.36)
SEm±	0.943	0.991	0.970
CD at 5%	NS	2.942	2.880

VRIDHACHALAM

Observations were made for the incidence of various minor pests such as pink leaf folder (*Anigraea albomaculata* Hamp), green leaf folder (*Sylepta auaratiacalis* Fish), nut borer (*Thylocoptila panerosema*) and other minor pests population and were found to be minimum. The data is presented in Table 3.12.

Table 3.12 : Incidence of minor pests of cashew at Vridhachalam

Treatment	Pre treatment count			Post treatment count		
	PLF	GLF	FNB	PLF	GLF	FNB
T1	2	0.8	1.3	1.1	0.3	0.8
T2	3	0.7	2.1	1.3	0.5	1.6
T3	2.8	0.9	1.8	1.5	0.6	1.4
T4	3.2	0.7	1.5	0.6	0.0	1.1
T5	2	1.1	1.6	0.2	0.0	0.3
T6	1.9	1.3	1.5	0.6	0.0	0.5
T7	2.4	0.8	2.3	0.8	0.20	1.3
T8	2.7	1.3	1.4	1.1	0.3	0.6
T9	3.1	1.4	1.3	1.3	0.6	0.8
T10	2.9	0.9	1.8	4.3	3.6	3.2
SEm±				0.58	1.22	0.60
CD at 5%				0.27	0.58	0.29

PLF - Pink leaf folder; GLF - Green leaf folder; FNB - Fruit & nut borer.

3. Evaluation of new chemicals for control of TMB and other pests

Centres : East Coast
Bapatla, Bhubaneswar and Vridhachalam

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani and Jagdalpur

Summary

In the experiment on alternative chemicals, the standard spray was the most effective treatment compared to other treatments at Bhubaneswar. At Chintamani, highest yield of 5.92 Kg tree^{-1} was recorded in treatment with profenophos. Spraying chlorpyriphos and profenophos was the most effective control for pests of cashew at Jhargram. Highest yield was reported from Madakkathara in treatment T5 (9.50 Kg tree^{-1}). At Vengurle, spraying with profenophos (0.05%) was found to be effective in controlling TMB. Standard spray (T1) was found to be most effective at Vridhachalam.

Treatments:

T 1	:	Recommended sprays for the region
T 2	:	Chlorpyriphos 0.05%
T 3	:	Triazophos 0.1%
T 4	:	Ethofenprox 0.015%
T 5	:	Profenophos 0.05%
T 6	:	Control

BAPATLA

The recommended spray schedule (T1) has been found equally effective with the new insecticides such as Profenophos 0.05% and chlorpyriphos 0.05% against foliage feeders and nut feeders. The yields obtained for these treatments are on par, 16.3 Kg tree^{-1}, 16.3 Kg tree^{-1} and 16.2 Kg tree^{-1} respectively for the above treatments. The data on incidence of miner pests of cashew for spray schedule of new insecticides is presented in Table 3.13a and 3.13b.

Table 3.13a. Incidence of minor pests of cashew at Bapatla.

Treatment	Leaf miner		Leaf and blossom webber				Leaf folder	
	Pre-treat. Count	30 DAS 1st spray	Pre-treat. Count	30 DAS 1st spray	30 DAS 2nd spray	30 DAS 3rd spray	Pre-treat. Count	30 DAS 1st spray
T1	0.42	0.17	0.58	0.25	0.25	0.25	0.08	0.08
	(1.19)	(1.08)	(1.25)	(1.12)	(1.12)	(1.12)	(1.04)	(1.04)
T2	0.67	0.25	0.42	0.17	0.17	0.17	0.67	0.25
	(1.29)	(1.12)	(1.19)	(1.08)	(1.08)	(1.08)	(1.29)	(1.12)
T3	0.75	0.33	0.50	0.42	0.33	0.42	0.58	0.75
	(1.32)	(1.15)	(1.22)	(1.19)	(1.15)	(1.19)	(1.25)	(1.32)
T4	0.92	0.42	0.67	0.58	0.50	0.58	0.67	0.83
	(1.38)	(1.19)	(1.29)	(1.25)	(1.22)	(1.25)	(1.29)	(1.35)
T5	0.50	0.17	0.75	0.25	0.25	0.17	0.50	0.17
	(1.22)	(1.08)	(1.32)	(1.12)	(1.11)	(1.08)	(1.22)	(1.08)
T6	0.58	1.08	0.67	1.33	1.58	2.92	0.58	0.83
	(1.25)	(1.44)	(1.29)	(1.52)	(1.60)	(1.97)	(1.25)	(1.35)
SEm		0.03		0.03	0.05	0.05		0.04
CD 5%		0.29		0.10	0.16	0.15		0.12

DAS - Days after spray

Table 3.13b. Incidence of minor pests of cashew at Bapatla.

Treatment	Shoot tip caterpillar				Apple and nut borer (%)		Leaf and blossom webber		Yield Kg tree^{-1}
	Pre-treat. Count	30 DAS 1st spray	30 DAS 2nd spray	30 DAS 3rd spray	30 DAS 2nd spray	30 DAS 3rd spray	30 DAS 2nd spray	30 DAS 3rd spray	
T1	0.17	0.25	0.17	0.25	1.19	0.70	0.88	0.95	16.3
	(1.08)	(1.12)	(1.08)	(1.12)	(6.15)	(4.80)	(5.39)	(5.48)	
T2	0.33	0.25	0.17	0.17	1.54	1.25	1.25	1.25	16.2
	(1.15)	(1.12)	(1.08)	(1.08)	(7.05)	(6.29)	(6.30)	(6.29)	
T3	0.50	0.67	0.42	0.42	3.40	2.26	4.08	1.60	13.1
	(1.22)	(1.29)	(1.19)	(1.19)	(10.44)	(8.37)	(11.58)	(7.16)	
T4	0.58	0.67	0.67	0.50	3.55	2.33	3.35	2.69	13.2
	(1.25)	(1.29)	(1.29)	(1.22)	(10.84)	(8.56)	(10.43)	(9.39)	
T5	0.42	0.17	0.17	0.17	1.37	1.41	1.29	1.39	16.3
	(1.19)	(1.08)	(1.08)	(1.08)	(6.66)	(6.67)	(6.45)	(6.63)	
T6	0.42	1.00	1.00	1.42	11.84	12.03	15.56	20.87	7.67
	(1.19)	(1.41)	(1.41)	(1.55)	(20.08)	(20.16)	(23.03)	(27.16)	
SE m		0.04	0.05	0.03	0.95	0.17	1.28	0.83	0.74
CD 5%		0.12	0.16	0.10	2.94	3.61	3.95	2.56	2.28

DAS - Days after spray

Note: Figures in paranthensis are square root (X+1) transformed values.

BHUBANESWAR

Under the trial, three alternative chemicals were tested namely, T2 - chlorpyriphos (0.05%), T3 - Triazophos (0.1%) and T5 - Profenophos (0.05%). The incidence of Tea Mosquito Bug (TMB) was not noticed during the period. The other two minor pests recorded were inflorescence thrips and shoot tip caterpillars. The standard spray was the most effective treatment compared to other treatments. All the other three chemicals were found equally effective in controlling shoot tip caterpillar. The details of incidence of various pests in response to the treatment with new chemicals are presented in Table 3.14.

Table 3.14: Incidence of pests recorded after spraying with new chemicals at Bhubaneswar.

Treatment	Shoot tip caterpillar (%)		Yellow Inflorescence thrips		Black Inflorescence thrips			Mean score value of thrips infestation	Yield (Kg Tree^{-1})
	One DBS	30 DAS	30 days after Ist spray	30 days after II spray	30 Days after Ist spray	30 days after II spray	30 days after III spray		
T1	4.17	0.96	2.12	0.72		0.77	0.19	0.07	5.750
	(2.1)	(1.17)	(1.6)	(1.08)		(1.13)	(0.83)		
T2	6.82	1.07	2.04	0.82		1.04	0.33	0.08	6.450
	(2.69)	(1.16)	(1.59)	(1.14)		(1.24)	(0.91)		
T3	4.74	1.23	3.09	0.91		1.13	0.40	0.12	7.250
	(2.27)	(1.28)	(1.87)	(1.18)	—	(1.27)	(0.95)		
T5	4.30	1.41	2.26	0.95		0.96	0.47	0.09	4.370
	(2.18)	(1..33)	(1.64)	(1.2)		(1.00)	(0.99)		
T6	4.97	4.17	6.17	2.12		3.99	1.07	0.19	2.130
	(2.33)	(2.09)	(2.56)	(1.63)		(2.14)	(1.20)		
SEm±	0.20	0.269	0.16	0.098		0.059	0.098		
CD 5%	0.62	0.83	0.497	0.30		0.18	0.30		

DBS = Days before spray
DAS = Days after spray
Figures in paranthesis are transformed means

CHINTAMANI

The results indicated that new chemicals tried were comparable to the standard chemicals in control of TMB, leaf and blossom webber and inflorescence thrips. Highest yield of 5.92 kg/tree was recorded in T4. The details of the incidence of pests of cashew are presented in Table 3.15.

Table 3.15. Incidence of pests recorded after spraying with new chemicals at Chintamani.

Treatment	TMB (%)		Inflorescence thrips		Yield (kg/tree)
	30 DAS II spray	30 DAS III spray	30 DAS II spray	30 DAS III spray	
T1	1.69	1.10	2.92	1.74	5.26
T2	1.75	1.13	1.84	2.17	5.55
T3	1.86	1.18	1.52	1.58	5.92
T5	2.04	1.11	1.65	2.06	5.60
T6	25.4	10.55	13.12	18.70	2.16
SEm±	0.45	0.37	0.20	0.33	0.25
CD 5%	1.36	1.12	0.60	0.99	0.75

JHARGRAM

Standard treatment T1 was the most effective one in controlling pests of cashew at Jhargram. Among the new insecticides tested, chlorpyriphos and profenophos (0.05%) were effective against inflorescence thrips. A good control over shoot tip caterpillar could be obtained in T1 (2.40) and T2 (3.60) respectively. The details of incidence of TMB and other pests of cashew at Jhargram are presented in Table 3.16.

Table 3.16. Incidence of pests recorded after spraying with new chemicals at Jhargram.

Treat ments	Pre-treatment count		After I Spray		After II Spray		After III Spray		Yield kg/tree
	Shoot tip caterpillar	Inflore scence thrips	Shoot tip caterpillar	Inflore scence thrips	Shoot tip caterpillar	Inflore scence thrips	Shoot tip caterpillar	Inflore scence thrips	
T1	2.2	0.12	2.40	1.26	2.76	1.84	3.06	2.31	2.100
	(8.53)	(1.99)	(8.91)	(6.36)	(9.56)	(7.76)	(10.10)	(8.74)	
T2	2.1	0.30	3.60	1.90	4.44	4.60	6.8	5.90	1.496
	(8.33)	(3.14)	(10.94)	(7.92)	(12.16)	(12.39)	(15.12)	(14.06)	
T3	2.3	0.40	3.64	1.93	4.80	4.93	7.1	5.96	1.530
	(8.72)	(3.63)	(10.98)	(7.94)	(12.66)	(12.84)	(15.45)	(14.13)	
T5	2.1	0.4	2.54	1.38	4.22	4.10	5.34	5.20	1.920
	(8.33)	(3.63)	(9.14)	(6.63)	(11.86)	(6.98)	(13.36)	(13.18)	
T6	2.1	0.30	4.53	2.24	6.99	6.72	9.69	11.40	0.754
	(8.33)	(3.14)	(12.28)	(8.57)	(15.36)	(15.02)	(18.13)	(19.73)	
CD 5%	0.11	0.10	0.09	0.12	0.12	0.09	0.12	0.11	0.16

MADAKKATHARA

When compared to the standard spray, T2, T3 and T5 were found equally good. Highest yield was recorded in T5 (9.50 kg/tree) followed by T3 (8.90 kg/tree). Minor pests like leaf miner, leaf roller and blossom webber were also found to be low in T1, T3 and T6 treatment. The details of incidence of pest of cashew in response to the new chemicals are presented in Table 3.17.

Table 3.17: Incidence of pests recorded after spraying with new chemicals at Madakkathara

Treat ment	TMB Replication I		Replication II		Replication III		Leaf miner	Blossom webber	Apple & nut borer	Yield (kg/ tree)
	(%)	Score	(%)	Score	(%)	Score				
T1	1.5	0.01	—	—	1.6	0.01	3.50			6.80
T2	2.8	0.23	2.7	0.21	4.7	0.31	—	3.65	—	7.50
T3	3.4	0.31	4.8	0.28	—	—	4.50	—	1.40	8.90
T5	1.0	0.02	—	—	2.6	0.14	3.20	0.07	2.60	9.50
T6	1.0	0.01	1.8	0.13	1.65	0.17	1.66	0.1	—	8.20

VENGURLE

The insecticide profenophos (T5) has been observed to be significantly effective over the other treatments, except T1 at pebble stage whereas rest of the treatments were at par with each other and significantly superior over control. At mature nut stage all the treatments were observed at par with effective over the control. The details of incidence of TMB in response to new chemicals are presented in Table 3.18.

Table 3.18: Incidence of pests recorded after spraying with new chemicals at Vengurle

Treatment	Average per cent shoots/ panicles damaged 30 days after			Average nut surface damaged by flower thrips during stage		
	I spray	II spray	III spray	Pea nuts	Pebble nuts	Matured nuts
T1	10.48 (18.86)	18.49 (25.48)	21.75 (27.65)	19.94 (25.48)	23.23 (27.77)	21.87 (27.90)
T2	11.53 (19.81)	18.71 (25.58)	23.90 (26.72)	18.22 (25.23)	23.27 (28.85)	22.34 (28.21)
T3	10.42 (18.94)	18.12 (25.10)	21.75 (27.75)	16.66 (24.11)	23.27 (28.82)	22.65 (28.42)
T5	10.04 (18.32)	19.65 (26.36)	25.22 (27.62)	17.09 (24.44)	20.93 (27.25	20.93 (27.23)
T6	11.28 (19.50)	29.91 (31.20)	34.27 (34.97)	17.81 (28.53)	31.87 (34.37)	28.59 (32.35)
SEm±	1.066	0.755	1.014	0.997	0.477	0.400
CD at 5%	N.S.	2.327	3.125	N.S.	1.472	1.233

VRIDHACHALAM

The standard spray (T1) was the most effective treatment against TMB and leaf and blossom webber in cashew. Spraying of alternate chemicals viz., chlorpyrifos, profenophos, triazophos and ethofenprox against these pests were found to be on par with each other. Data is reported in Table 3.19.

Table 3.19: Incidence of pests recorded after spraying with new chemicals at Vridhachalam

Treatment	TMB (Score) after 30 days		Leaf & Blossom Webber (%) after 30 days
	II spray	III spray	
T1	1.2	0.8	3.8
T2	1.8	1.6	4.1
T3	2.1	1.2	5.3
T4	1.6	1.3	5.8
T5	2.1	1.7	4.3
Control	3.4	3.7	14.8
SE m	0.39	0.30	0.72
CD 5%	0.88	0.68	1.60

Control of stem and root borer
1. Prophylactic control trial

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

West Coast
Madakkathara, Pilicode, and Vengurle

The objective is to evaluate different pesticides and neem products for prophylaxis against attack by stem and root borer.

Summary

For control of cashew stem and root borer (CSRB) swabbing of neem oil and soil application of Sevidol 8G 75g tree-1 was most effective prophylactic control tried at Bhubaneswar and Jhargram. Neem oil 5% swabbing along with lindane 0.2% and mudslurry + carbaryl 0.2% at four intervals were found to be more effective in Madakkathara. At Vengurle, swabbing with mudslurry along with 0.2% carbaryl and 0.2% lindane soil application was found to be promising. Swabbing coal tar thrice with the application of lindane 0.2% was most effective treatment at Vridhachalam.

Treatments:

Swabbing with Neem oil 5% in 25 trees

T1 Twice + Sevidol 75g
T2 Thrice + Sevidol 75g
T3 Four times + Sevidol 75g

Swabbing with coal tar + kerosene (1:2) in 25 trees or mudslurry + carbaryl

T4 Twice + lindane 0.2%
T5 Thrice + lindane 0.2%
T6 Four time + lindane 0.2% T7 Control

BHUBANESWAR

Among the treatments tried, neem oil swabbing + Sevidol soil application was found to be better than mudslurry swabbing. Maximum infestation (28%) was observed in untreated control. The details of occurrence of CSRB in prophylactic trial are given in Table 3.20. Neem oil swabbing with Sevidol application costed at Rs.11.00 whereas mudslurry treatment costed only Rs.10.00 per tree for each treatment.

Table 3.20: Occurrence of CSRB in prophylactic trial at Bhubaneswar.

Treatment	No. of trees treated	Infested trees (%)										Stages of infestation			
		Mar.	April	May	June	July	Aug.	Sept	Oct	Nov	Dec	Early	Middle	Adv	Dead
T1	25	4.0	4.0	8.0	8.0	16.0	16.0	16.0	0.0	8.0	8.0	—	8	4	—
T2	25	0.0	0.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	4.0	—	4	4	—
T3	25	0.0	0.0	0.0	12.0	12.0	4.0	4.0	0.0	0.0	0.0	8	4	—	—
T4	25	0.0	0.0	0.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	—	—	4	—
T5	25	0.0	0.0	0.0	4.0	8.0	8.0	12.0	12.0	0.0	8.0	8	4	—	—
T6	25	4.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0	4.0	—	—	—	—
T7	25	20.0	24.0	24.0	24.0	24.0	28.0	28.0	28.0	28.0	28.0	4	12	8	4

JHARGRAM

Swabbing of neem oil (5%) and soil application of Sevidol 8G 75g/tree was most effective prophylactic control in two application schedules per year. The infestation of CSRB was negligible in T4 and T5. The occurrence of CSRB in prophylactic control experiment is presented in Table 3.21.

Table 3.21: Occurrence of CSRB in prophylactic trial at Jhargram

Treatment	No. of trees	Trees with CSRB egg before treatment	No. of trees infested after treatment	% of infestation	Stages of infestation							
					Early		Middle		Advanced		Dead	
					No.	%	No.	%	No.	%	No.	%
T1	20	5	—	—	—	—	—	—	—	—	—	—
T2	20	4	—	—	—	—	—	—	—	—	—	—
T3	20	7	—	—	—	—	—	—	—	—	—	—
T4	20	7	1	5	—	—	1	5	—	—	—	—
T5	20	4	2	10	—	—	2	8	—	—	—	—
T6	20	7	2	5	—	—	2	8	—	—	—	—
T7	20	7	6	30	2	10	4	16	—	—	—	—

MADAKKATHARA

Neem oil 5% swabbing at four intervals along with lindane 0.2% (T3) and mudslurry + carbaryl 0.2% in an interval of four times an year were found to be more effective than other treatments. The occurrence of CSRB in prophylactic control treatment is presented in Table 3.22.

Table 3.22: Occurrence of CSRB in prophylactic trial at Madakkathara

Treatment	No. of trees infested											
	Jan.	Feb.*	Mar.	Apr.	May*	June	July	Aug.	Sept.*	Oct.	Nov.*	Dec.
T1	7	7	—	1	1	—	—	1	2	—	1	1
T2	2	2	—	—	—	—	—	—	1	—	—	1
T3	2	2	—	—	—	—	—	—	—	—	—	—
T4	5	5	—	—	—	—	—	1	2	—	—	1
T5	5	5	—	—	1	—	—	—	—	—	—	—
T6	1	1	—	—	—	—	—	—	—	—	—	—
T7	5	5	5	5	5	5	6	6	6	5	6	8

*Clearance and treatment application.

VENGURLE

The observations were recorded up to March 2000 and the first three treatments were discontinued due to unavailability of Sevidol 4G. New experiment was laid in October 2000 excluding first three treatments. From the data recorded, swabbing with mudslurry along with 0.2% carbaryl and soil application of 0.2% lindane under T1 and T2 were found to be promising. Above application four times an year was also found to be equally effective. The details of treatment against CSRB are presented in Table 3.23.

Table 3.23: Occurrence of CSRB in prophylactic trial at Vengurle

Treatments	No. of trees treated	No. of trees infested	Per cent infestation	Per cent prevention
T3	25	3	12	88
T4	25	1	4	96
T5	25	1	4	96
T6	25	7	28	72

VRIDHACHALAM

The most effective treatment was swabbing coal tar thrice with the application of lindane 0.2% (T5). The treatment T3 i.e., swabbing neem oil 5% two times with soil application of Sevidol 75g/tree was also found to be equally good treatment. The data are presented in Table 3.24.

Table 3.24. Incidence of CSRB under prophylactic control at Vridhachalam

Treatments	No. of trees treated	No. of trees infested	Per cent infestation	Per cent prevention
T1	25	4	16	74
T2	25	3	12	88
T3	25	1	4	96
T4	25	3	12	88
T5	25	0	0	100
T6	25	1	4	96
T7	25	7	28	72
SE m				4.86
CD 5%				10.60

2. Curative trial

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

West Coast
Madakkathara, Pilicode, and Vengurle

Summary

Under curative control trial, the treatment mud slurry + carbaryl swabbing with Sevidol application (T2) was found better recovery percentage than other treatments at Bhubaneswar. The percentage of recovery was higher in T2 even in middle stages of CSRB attack and also higher in comparison to T3. At Madakkathara, maximum percentage of recovery of infested trees was seen in T1 treatment where neem oil 5% swabbing + lindane 0.2% was given in early and middle stages of infestation. Swabbing with *Metarrihizium anisopliae* + 5% neem oil was also found to be equally effective. Swabbing Neem oil 5% with 2% lindane soil application and swabbing neem oil 5% with *Metarrhizium anisopliae* during early stages was found to be effective in Vengurle. At Vridhachalam, extraction of grubs, swabbing of coal tar, soil application of Sevidol and *Metarrhizium anisopliae* in combination during the early stages of attack was found to be most effective.

Treatments:

T1 : Extraction of grubs
T2 : Swabbing twice with neem oil 5% or
Mudslurry + carbaryl or
Coal tar + kerosene (1:2)
Anyone of the above which is most effective
T3 : T1 + T2 + lindane soil application 0.2%
T4 : T1 + T2 + Sevidol 8 G 75g/tree
T5 : T1 + T2 + *Metarrhizium anisopliae* - Spore suspension
T6 : Control

Design : CRD

BHUBANESWAR

Out of various curative trials, the mud slurry + carbaryl swabbing with Sevidol (T2) application was found to show better recovery percentage (78%) than the mud slurry + carbaryl with lindane (T1) application (62%). The fungal treatment (T3) showed least recovery percentage (53%). However, the plants treated during early stages of infestation showed higher recovery percentage (upto 100%) and those in the terminal stage did not show any recovery. The data on curative control trial is presented in Table 3.25.

Table 3.25: Occurrence of CSRB under curative trial treatments at Bhubaneswar.

Treat ment	No. of tree	Stages of attack						Recovery							
		Early		Middle		Advanced		Early		Middle		Advanced		Total	
		No	(%)	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)
T1	53	20	38	15	28	18	34	19	95	13	37	1	6	33	62
T2	54	22	41	18	33	14	26	22	100	17	94	3	21	42	78
T3	45	15	33	22	27	18	40	15	100	9	75	0.0	0.0	24	53

JHARGRAM

The percentage of recovery was higher in T2 even in middle stages of CSRB attack. The percentage of recovery was also higher in comparison to T3. However, the percentage of recovery in the treatment including T2 was not effective in advanced stages of infestation. The details of occurrence of CSRB in curative trial are presented in Table 3.26.

Table 3.26: Occurrence of CSRB under curative trial treatments at Jhargram.

Treatments	No. of trees	Stage of attack						Recovery stage					
		Early		Middle		Advanced		Early		Middle		Advanced	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
T1	20	5	25	4	20	2	10	3	15	2	10	—	—
T2	20	4	20	2	10	1	5	4	20	3	15	—	—
T3	20	4	20	5	25	2	10	2	10	2	10	—	—
T4	20	4	20	5	2	5	3	15	—	—	—	—	—

MADAKKATHARA

Maximum percentage of recovery of infested trees was seen in T1 treatment where neem oil 5% swabbing + lindane 0.2% was given in early and middle stages of infestation. Swabbing with *Metarrihizium anisopliae* + 5% neem oil was also found to be equally effective. In advanced stages of infestation however, none of the treatments were effective. The data on curative control of CSRB is presented in Table 3.27.

Table 3.27: Occurrence of CSRB under curative trial treatments at Madakkathara.

Treat ments	No. of trees	Stage of attack						Recovery stage					
		Early		Middle		Advanced		Early		Middle		Advanced	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
T1	8	3	12	3	12	2	8	3	75	2	70	1	<10
										1	<30	1	dead
T2	8	3	12	3	12	2	8	3	60	2	<20	1	<20
										1	<10	1	<10
T3	8	2	4	3	4	3	12	2	80	2	<30	2	<10
								1	90	1	60		

VENGURLE

Maximum control of CSRB in infested trees was observed under both the treatments i.e., swabbing neem oil 5% with 2% lindane soil application (T1) and swabbing neem oil 5% with *Metarrhizium anisopliae* (T2) during early stages. At middle stage of infestation 40% protection was observed with treatment T1 whereas 40% protection could be obtained with T2. At advanced stages both the treatments could give only 20% recovery. The data on curative control of CSRB in infested trees at Vengurle is presented in Table 3.28.

Table 3.28: Occurrence of CSRB under curative trial treatments at Vengurle.

Treat	No. of trees treated			No. of trees recovered			Stage wise recovery (%)		
ment	Early	Middle	Advance	Early	Middle	Advance	Early	Middle	Advance
T1	5	5	5	5	2	1	100	40	20
T2	5	5	5	5	3	1	100	40	20

VRIDHACHALAM

The practices such as extraction grubs, swabbing of coal tar, soil application of Sevidol and *Metarrhizium anisopliae* in combination during the early stages of attack in the young trees was the most practical solution for curative trial of CSRB attacked cashew trees. The occurrence of CSRB at Vridhachalam under curative trial is presented in Table 3.29.

Table 3.29: Occurrence of CSRB under curative trial treatments at Vridhachalam

Treatment	Total No. of tree treated	Stage of attack (No.)			Recovery (No.)		
		Early	Middle	Advanced	Early	Middle	Advanced
T_1 Extraction of grubs	16	4	3	3	4	1	-
T_2 - Swabbing twice (coal tar : Kerosene)	14	4	3	3	4	1	-
T_3 - 1+2 Lindane 20 EC 2% soil drenching	10	4	3	3	4	2	-
T_4 1+2 + Sevidol 75 g soil application	18	3	4	3	3	1	-
T_5 1+2 + *Metarhizium anosopliae* spawn	16	4	3	3	6	2	-
CD 5%						0.14	
SE m						0.06	

Bio-ecology of pests of regional importance and survey of pest complex and natural enemies

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

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani and Jagdalpur

The project is aimed to study population dynamics of pests of regional importance and to correlate the same with weather parameters.

BAPATLA

During the survey it has been observed that the incidence of stem and root borer was high (10-12 %) in Prakasam district while moderate (1-7 %) in Guntur district. The incidence of foliage feeders was low. The data on population dynamics and corresponding weather data are presented in Table 3.30. The correlation study results are presented in Table 3.31

Table 3.30: Data on weather parameters with pest population at Bapatla.

Month	Fortnight	Temp (°C)		RH		Rain fall (mm)	No. Rainy days	Percentage damage					
		Max	Min	AM	PM			LM	LF	LBW	STC	ANB	BB
Sep.00	I	34.5	26.1	75.8	66.9	2.6	1	0.42	0.71	0.52	—	—	—
	II	32.6	24.9	85.3	77.2	86.6	5	0.63	0.88	1.08	—	—	—
Oct.00	I	32.3	24.8	85.1	75.7	21.1	2	0.92	1.04	1.33	—	—	—
	II	32.1	22.2	83.6	74.9	12.9	2	0.91	0.90	1.17	—	—	—
Nov.00	I	31.1	21.7	85.1	75.7	20.4	2	0.92	0.94	1.04	0.48	—	2.04
	II	30.2	20.2	88.3	76.4	34.8	1	0.83	1.06	0.71	1.62	—	4.00
Dec.00	I	29.7	18.3	90.8	75.6	29.3	1	0.48	1.10	0.60	0.92	—	5.71
	II	29.3	16.3	88.2	63.3	—	—	0.73	0.67	0.42	1.04	—	6.52
Jan.01	I	28.9	18.3	92.2	71.1	—	—	0.5	0.21	0.56	1.13	—	11.9
	II	29.8	16.5	91.1	66.4	—	—	0.40	0.31	0.48	0.98	—	8.11
Feb. 01	I	30.7	17.1	95.3	66.8	—	—	0.31	—	0.79	0.69	0.77	4.65
	II	31.3	20.8	91.1	73.2	—	—	0.21	—	1.04	0.40	0.85	1.85
Mar. 01	I	31.8	20.7	81.1	63.1	—	—	—	—	1.17	0.92	2.19	—
	II	32.7	24.2	81.1	75.4	—	—	—	—	1.52	0.29	1.96	—
Apr. 01	I	32.6	24.3	81.7	73.5	14.6	3	—	—	2.01	0.92	2.03	—
	II	33.1	26.2	75.2	73.8	5.5	1	—	—	2.74	1.50	2.57	—
May 01	I	38.1	28.3	70.1	67.2	—	—	—	—	1.53	0.53	1.08	—
	II	40.6	28.3	53.4	44.7	1.20	—	—	—	0.91	0.31	0.56	—

TMB = Tea mosquito bug
ANB = Apple and nut borer
BW = Shoot and blossom webber
STC = Shoot tip caterpillar
LM = Leaf miner

Table 3.31. Correlation between weather parameters and pest population at Bapatla.

Parameter	LBW	ANB	LM	LF	STC	BB
Temp (Max.)	0.32	0.24	-0.48	-0.34	0.24	-0.34
Temp (Min.)	0.59	0.36	-0.35	-0.17	0.36	-0.79
RH (AM)	-0.34	-0.29	0.46	0.31	-0.29	0.58
RH (PM)	0.25	-0.04	0.41	0.44	-0.04	-0.01
Rainfall	0.31	0.12	0.02	0.15	0.12	-0.24

LBW = Leaf and blossom webber LM = Leaf miner LF - Leaf Folder
ANB = Apple and nut borer STC = Shoot tip caterpillar BB - Bark borer

BHUBANESWAR

Observations on major pests and natural enemies was done in comparison with the ecological factors in selected trees from January 2001 to December 2001 and the data is presented in Table 3.32.

The shoot tip caterpillar (*Hypatima haligramma* M.) was active during January to February and from July to December, the peak incidence of the pest (16.5%) was during second fortnight of October. Leaf beetle (*Monolepta longitarsus* Jac.) was found during June and July and August coinciding with new flushes after the onset of southwest monsoon. Peak period was the second fortnight of July(3.24%). Leaf miner (*Acrocercops syngramma* M.) was present during July to December with a peak (16.8%) in second fortnight of October. Apple and nut borer (*Nephopteryx* sp.) was observed during March to May with a peak (9.95%) in the first fortnight of April. Yellow and Black inflorescence thrips (*Frankliniella schultzei* T and *Haplothrips ceylonicus* Sch. respectively) were also recorded. The later was observed from second fortnight of January to second fortnight of April with a maximum during the second fortnight of February. The yellow thrips were observed from January to April with a maximum (7.05%) during first fortnight of February.

A study of field parasitisation of major insect pests on cashew indicated that shoot caterpillar(12%), leaf and blossom webber(10%) and leaf miner(20%) were parasitized. The other predators present in cashew ecosystem were spiders, lady bird beetle, *Verania cinta* Gorh., *Menochilus sexmaculata* F.), black ant, mirid bug etc.

The plantations of Ganjam district were affected by TMB. Infestations of CSRB has been low (1-2 %) in the interior district such as Cuttack when compared to Puri and Khurda (4-30%).

CHINTAMANI

Maximum tea mosquito bug population (37.08%) was seen in the first week of March. It was found to be feeding on guava from July to September and on neem from September to January. Leaf miners were found from last week of October to first week of February with a maximum of 21.02% during third week of December. Inflorescence thrips were found from the first week of April to third week of June with a peak incidence (15.96 No./panicle) in first week of April. Fruit and nut borer was noticed during the first week of April and reached maximum of 14.06% during third week of June and there after sudden reduction was noticed. A total of eighteen insect species feeding and breeding on different parts of cashew tree have been recorded. The seasonal occurrence of major pests of cashew at Chintamani is presented in Table 3.33.

Table 3.33: Seasonal occurrence of pests of cashew at Chintamani.

Months	Week	TMB (%)	Leaf miner (%)	Inflorescence thrips No. infl.$^{-1}$	Fruit & Nut borer (%)
Jan.	I	23.14	10.02	—	—
	II	26.82	8.08	—	—
	III	27.96	6.11	—	—
	IV	30.14	3.02	—	—
Feb.	I	31.26	0.42	—	—
	II	32.26	—	—	—
	III	34.02	—	—	—
	IV	35.16	—	1.32	—
Mar.	I	37.08	—	2.42	—
	II	31.06	—	3.08	—
	III	20.02	—	5.12	—
	IV	16.11	—	6.98	—
	V	8.92	—	8.71	—
Apr.	I	6.23	—	9.36	0.03
	II	3.84	—	10.48	0.32
	III	1.62	—	11.99	0.63
	IV	0.92	—	13.02	0.93
May	I	0.13	—	15.96	1.48
	II	—	—	12.11	2.43
	III	—	—	10.02	3.98
	IV	—	—	8.06	5.63
	V	—	—	7.11	7.83
Jun.	I	—	—	5.83	11.08
	II	—	—	3.02	12.93
	III	—	—	2.11	14.06
	IV	—	—	0.98	8.01
Jul.	I	—	—	0.36	7.32
	II	—	—	0.12	6.48
	III	—	—	—	5.32
	IV	—	—	—	3.02
Aug.	I	—	—	—	—
	II	—	—	—	—
	III	—	—	—	—
	IV	—	—	—	—
	V	—	—	—	—
Sep.	I	—	—	—	—
	II	—	—	—	—
	III	—	—	—	—
	IV	—	—	—	—
Oct.	I	—	—	—	—
	II	—	—	—	—
	III	—	—	—	—
	IV	—	0.68	—	—
Nov.	I	—	0.96	—	—
	II	—	1.36	—	—
	III	—	4.82	—	—
	IV	—	9.32	—	—
	V	—	11.42	—	—
Dec.	I	—	13.68	—	—
	II	—	18.98	—	—
	III	—	21.02	—	—
	IV	—	18.11	—	—

JHARGRAM

Stem and root borer was the severe pest in neglected plantations in West Bengal. The pest was recorded throughout the year. The TMB was recorded during the month of October however the population was below harmful level. Maximum population of TMB was recorded (1.5%) during January. Shoot and blossom webber was recorded from August to March. Peak period of infestation was observed in October(12.8%). Incidence of shoot tip caterpillar was found during January to April and August to December. The peak period of incidence was during September(11.4%). The thrips were observed during January to April. Both leaf thrips and inflorescence thrips were noticed in cashew trees. The period of maximum attack due to thrips was during March(11%). The infestation of leaf miner incidence was high during October (11%) coinciding with new flush formation. Apple and nut borer was recorded during March to May, but its population was very low. Termites were found damaging the plant in red and laterite zones but the population was low. The incidence of leaf folder was noticed in flushing stage. Only few localized infestation were noticed in certain localities. The data on occurrence of pests is correlated with weather parameters at Jhargram in Table 3.34.

Table 3.34: Correlation of weather parameters with pests of cashew at Jhargram.

Month	Temp (°C)		RH		Rain fall (mm)	No. of Rainy days	Percentage damage					
	Max	Min	AM	PM			TMB	BW	LM	Thrips	ANB	STC
Jan.	23.3	11.5	78.2	49.6	9.0	2	1.5	1.1	1.6	1.2	—	5.6
Feb.	26.6	18.4	74.6	48.5	3.1	2	1.2	0.7	8.6	9.6	—	7.8
Mar.	31.8	21.6	74.6	49.6	15.8	5	0.8	0.6	3.3	11.0	1.2	5.3
Apr.	35.5	21.0	76.4	45.6	22.4	4	—	—	—	7.6	2.6	0.6
May	37.5	24.4	80.4	45.5	40.5	7	—	—	—	—	0.8	—
Jun.	36.0	33.9	80.0	50.7	95.3	9	—	—	—	—	—	—
Jul.	35.0	23.6	92.6	73.4	240.6	17	—	—	—	—	—	—
Aug.	36.5	23.4	90.2	72.2	270.8	20	—	1.2	0.6	—	—	1.8
Sep.	35.4	25.0	87.5	68.5	320.4	19	—	6.7	5.8	—	—	11.4
Oct.	31.6	22.9	83.4	51.0	180.6	12	0.3	12.8	11.0	—	—	6.6
Nov.	28.2	15.6	82.7	45.4	31.7	6	0.8	11.2	6.7	—	—	3.4
Dec.	26.4	11.6	74.2	41.0	13.7	4	1.3	4.6	1.2	—	—	1.5

TMB = Tea mosquito bug BW = Shoot and blossom webber LM = Leaf miner
ANB = Apple and nut borer STC = Shoot tip caterpillar

MADAKKATHARA

The tea mosquito infestation was comparatively less during the year. However, low population of TMB was noticed throughout the year except June, July and August. The minor pests recorded were leaf miner (July to October), ranging from 0.33 to 4.5, leaf roller during August - September ranging from 1.65 to 1.88 and infestation of apple and nut borer was comparatively high during January to May ranging from 1.75 to 4.66%.

The natural enemies and other agents noticed in the unsprayed area were ants, spiders, mirid bugs, chrysopa, honeybees, flies and wasps. The details of pests recorded are presented in Table 3.35 and 3.36.

Table 3.35: Seasonal occurrence of pests of cashew at Madakkathara.

Month	Temp (°C)		RH		Rain fall (mm)	No. of Rainy days	TMB					
	Max	Min	AM	PM			Shoots		Panicle		Nut	
							(%)	Score	(%)	Score	(%)	Score
Jan.	32.6	23.2	71	41	0.0	0	—	—	3.4	0.04	—	—
Feb.	34.5	22.9	86	48	12.2	1	—	—	7.66	0.25	3.40	0.14
Mar.	34.9	24.0	84	54	4.4	1	—	—	—	—	6.66	0.24
Apr.	34.2	34.7	88	63	243.1	8	—	—	—	—	6.85	0.30
May	32.3	24.5	89	73	192.6	4	—	—	—	—	—	—
Jun.	28.4	23.1	94	79	677.2	23	—	—	—	—	—	—
Jul.	29.0	22.7	93	77	477.7	19	—	—	—	—	—	—
Aug.	37.5	23.1	97	76	256.2	21	—	—	—	—	—	—
Sep.	30.8	23.2	91	67	206.1	6	—	—	—	—	—	—
Oct.	30.7	23.0	91	71	215.8	8	0.22	0.08	—	—	—	—
Nov.	31.6	23.1	83	60	115.8	6	0.06	0.01	—	—	—	—
Dec.	29.5	22.2	72	48	0.0	0	0.43	0.14	—	—	—	—

Table 3.35: Monthly occurrence of minor pests and natural enemies at Madakkathara.

Month	Leaf miner		Leaf Roller (%)	Blossom Webber (%)	ANB	Ants	Spider	Bees/ flies/ wasps
	Shoot (%)	Leaves (%)						
Jan.	—	—	—	—	—	4.60	—	—
Feb.	—	—	—	—	—	5.50	4.50	1.20
Mar.	—	—	—	—	1.15	5.00	0.30	2.50
Apr.	—	—	—	—	3.45	3.60	—	—
May	—	—	—	—	4.66	4.60	—	—
Jun.	—	—	—	—	—	2.00	4.50	2.60
Jul.	—	0.33	—	—	—	1.55	—	4.30
Aug.	—	1.65	1.88	—	—	1.89	2.20	1.50
Sep.	—	4.50	1.65	—	—	2.55	1.80	2.40
Oct.	—	—	—	—	—	3.60	3.40	1.06
Nov.	—	—	—	—	—	5.80	1.45	2.50
Dec.	—	—	—	—	—	6.33	3.50	3.80

VENGURLE

Tea mosquito bug and flower thrips found to attack cashew trees severely during December to March. The leaf miner and CSRB were found to infest cashew throughout the year but in low intensities. The details of occurrence of various pests and natural enemies of cashew pests are presented below in Table 3.37.

Table 3.37: Occurrence of pests of cashew and their natural enemies at Vengurle

Common Name	Scientific Name	Month of Occurrence	Intensity (%)
Tea-mosquito bug	*Helopeltis antonii*	Jan.-Mar. Apr. May.- Dec.	6.25-27.08
Flower thrips	*Rhipiphorothrips sp.*	Jan.-Mar. Apr. May-Nov. Dec.	11.54-34.61
Stem and rooTborer	*Plocaederus ferrugineus*	Throughout year	8-10
Leaf miner	*Acrocercops syngramma*	Throughout year	5-10
Aphid	*Toxoptera odinae*	Jan.-Mar.	1-2
Mealy bug	*Ferrisia virgata*	Feb.-Mar.	Sporadic
Leaf eating beetles	*Manolepta sp. Coenoblus sp.*	Jun.-Aug	2-12
Leaf cutting weevils	*Depous Marginatus*	Jun.-Aug.	2-10
Web worm	*Orthaga Exvinacae*	Oct.-Nov.	5-8
Semilooper	-	Oct.-Nov.	1 tree^{-1}
Apple and nut borer	*Nephopleryx sp.*	Jan.-Apr.	2-10

VRIDHACHALAM

The occurrence of pests and natural enemies was recorded in farmer's plantations at Pudukoorapettai Village. In the fields, observations were taken at every fortnight on the intensity of pest infestation and their seasonal abundance (Table 3.38). The natural enemies of cashew and their hosts in the stage at which attacked, period of occurrence and their intensity is also presented in Table 3.38-3.39.

Table. 3.38: Occurrence of cashew pests at Vridhachalam.

Common Name	Scientific Name	Month of occurance	Intesity %
Stem and Root borer	*Plocaederus ferrugineus*	Round the year	6.00
Tea Mosquito bug	*Helopeltis antonii*	Oct.-Dec.	5.20
Leaf miner	*Acrocercops syngramma*	Aug.-Oct.	3.40
Green leaf folder	*Sylepta aurantiacalis*	Jul.-Dec.	8.90
Leaf and Blossm webber	*Lamida moncusalis*	Jun.-Dec.	9.72
Shoot tip caterpillar	*Hypatima haligramma*	Nov.-Dec.	3.80
Diamond hairy caterpilar	*Metanastria hyrtaca*	Sep.-Dec.	7.70
Hairy caterpillar	*Lymantria abuscta*	Sep.-Dec.	3.20
Apple and nut borer	*Thylocoptila panrosema*	Feb-Apr.	4.69
Leaf weevil	*Myllocerus sp.*	Round the year	2.51
Leaf twisting weevil	*Apoderus tranquebaricus*	Oct.-Dec.	1.00
Aphids	*Toxoptera odinae*	Dec.	0.49
Oriental mealy bug	*Planococcus sp.*	Sep.-Dec.	2.20
Leaf thrips	*Rhiphiphorothrips cruentatus*	Jul.-Aug.	2.48
Flower thrips	*Scirtothrips dorsalis*	Apr.-May	20.00
Termites	*Odontotermes obesus*	Throughout the year	2.0

Table 3.39: Occurrence of natural enemies of pests of cashew at Vridhachalam

Natural enemy	Host	Stage of attack	Occurrence	Intensity
Parasitoids				
Cotesia (Apanteles sp)	Green leaf folder	Larval	Sep.-Dec.	26.00
Brachymeria sp	Diamond hairy caterpiller	Pupae	Aug.-Dec.	16.00
Predators				
Menochilus sexmaculatus	Aphids Thrips	Adult and Nymphs	Jun.-Jul.	3.00
Scymnus sp	Mealy bugs	Adults and Nymphs	Sep.-Nov.	1.20
Chrysoperla cornea	Mealy bugs	Nymphs	Oct.-Mar.	1.45
Preying Mantids	Leaf folder leaf and blossom webber	Adult	Oct.-Mar.	1.45
Spiders	Leaf folder leaf and blossom webber	Adult	Sep.-Apr.	1.40
Metarhizium anisopliae	Stem and root borer	Grub & pupae	Aug.-Dec.	4.2
Beauveria bassiana	Stem and root borer	Grub & pupae	Sep.-Dec.	3.2

Screening of germplasm to locate tolerant/resistant types to major pests of the region

Centres : East Coast
Bhubaneswar, Jhargram, and Vridhachalam

West Coast
Madakkathara and Vengurle

Maidan tracts/ others
Chintamani

The objective is to identify germplasm accessions tolerant/resistant to the pests, of regional importance.

BAPATLA

Under 11 year age group of trees, incidence of leaf miner (1.06 Nos.) and leaf and blossom webber (1.86 Nos.) were found low in GG 4/4. Apple and nut borer (1.12%) and leaf and blossom webber (1.12%) were found low in H 3/6. Low incidence of leaf folders has been recorded in T 241 (1.12 Nos), Leaf and blossm Webbers have been low in T 275. Incidence of apple and nut borer was low (2.54%) in TII-10 and leaf miner activity was low in GG 3/2 and GG 3/1. Among 8 year age group entry 30/1 had low incidence of foliage, fruit and nut pests. Leaf miner and apple and nut borer activity was low in Hy 68. The data on infestation is presented in Table 3.40.

BHUBANESWAR

Screening of MLT86 accessions against the resistance/ tolerance to shoot tip caterpillar revealed that out of the 16 accessions tested, none of the cashew types were found resistant to shoot tip caterpillar during its peak activity. However, M 15/4 was least affected (0.4%) and NRCC 1 showed highest damage (14.2%).

The accessions in the germplasm were also tested for the tolerance/ resistance and out of the 40 accessions tested it was found that the accession OC-34 was least infested by shoot tip caterpillar (0.5%) followed by OC-8 and OC-15 (0.9 - 1.2%) infestation. The accession OC-26 showed high susceptibility (22.71%) followed by OC-20 (21.54%). The data on shoot tip caterpillar infestation in screening trial of MLT varieties is given in Table 3.41.

CHINTAMANI

The grafts of released varieties namely, V-1, V-2, V-3, V-4, V-5, BPP-1, BPP-3, BPP-4, BPP-5, BPP-6, Ullal-1, Ullal-3, Ullal-4, Chintamani-1 and NRCC - 2 were exposed to second instar nymphs of TMB for 48 hours under caged condition. The results revealed that none of the varieties were resistant/tolerant to this pest.

JHARGRAM

Seven germplasm accessions were screened against inflorescence thrips and shoot tip caterpillar. The Ansur-1 showed least attack by shoot tip caterpillar (4.1%) and the same has showed least damage due to inflorescence thrips (3.2%). The highest damage due to shoot tip caterpillar was observed in M 44/3(5.8%) and same variety has showed highest inflorescence thrips attack (5.4%). The data is presented in Table 3.42.

Table 3.40 : Incidence of minor pests of cashew in germplasm accessions.

Accession	LF	LM	LBW	ANB (%)	LBW on nuts
EG 2	2.25(1.30)	1.25(1.50)	2.68(1.92)	2.15(8.43)	5.37(13.30)
EG 3	2.68(1.92)	1.12(1.46)	1.59(1.16)	2.32(8.76)	3.48(10.75)
VP 2	2.31(1.82)	1.93(1.71)	2.31(1.82)	2.91(9.82)	5.82(13.96)
VP 4	1.25(1.50)	2.75(1.94)	2.37(1.84)	3.38(10.59)	2.54(9.17)
SK 1	2.75(1.94)	3.87(2.21)	2.25(1.80)	1.87(7.86)	1.86(7.84)
SK 7	1.87(1.69)	2.62(1.90)	1.12(1.46)	3.37(10.59)	2.49(12.23)
RP	1.12(1.46)	1.11(1.41)	1.06(1.44)	2.06(8.25)	3.09(10.12)
H 3/28	1.81(1.68)	2.51(1.87)	1.72(1.65)	4.85(12.72)	3.88(11.36)
H 3/33	2.12(1.77)	1.93(1.71)	1.84(1.69)	3.38(10.59)	2.54(9.17)
H 10/19	3.43(1.85)	1.51(1.58)	1.31(1.52)	4.49(12.23)	4.49(12.23)
H 30/1	1.31(1.52)	1.25(1.50)	1.09(1.45)	1.52(7.08)	1.51(7.06)
HY 68	3.31(2.08)	1.37(1.54)	1.75(1.66)	2.51(9.09)	4.17(11.78)
HY 367	3.18(2.04)	2.56(1.89)	1.93(1.71)	4.95(12.85)	5.94(11.14)
HY 303	3.75(2.18)	3.01(2.00)	1.66(1.63)	3.74(11.15)	4.67(12.48)
HY 255	3.12(2.03)	1.56(1.60)	1.87(1.69)	4.17(11.78)	6.25(14.48)
HY 320	2.56(1.89)	2.01(1.73)	1.72(1.65)	3.41(10.64)	5.68(13.79)
HY 44/3	3.31(2.08)	2.12(1.77)	209(1.76)	4.27(11.93)	5.12(13.08)
M 15/4	2.43(1.85)	2.25(1.80)	2.19(1.79)	4.87(12.75)	5.69(13.90)
107/3	3.18(2.04)	1.06(1.44)	2.25(1.80)	4.31(11.98)	6.89(15.22)
40/1	4.01(2.24)	2.19(1.79)	2.16(1.78)	4.12(11.71)	7.22(15.59)
AP 6	1.88(1.70)	2.62(1.90)	2.63(1.91)	1.96(8.05)	6.86(15.18)
HY 7/3	1.62(1.62)	3.31(2.08)	1.68(1.64)	2.35(8.82)	2.35(8.82)
H 12/16	2.81(1.95)	3.06(2.01)	1.31(1.52)	1.11(6.02)	4.41(12.11)
T 210	2.01(1.73)	2.06(1.75)	2.31(1.82)	4.54(12.30)	6.81(15.13)
T 282	2.63(1.91)	2.51(1.87)	3.09(2.02)	6.01(14.18)	2.11(8.13)
H 3/6	2.19(1.79)	1.99(1.70)	1.31(1.52)	1.12(6.08)	1.12(6.07)
H 4/6	2.19(1.79)	4.25(2.29)	1.34(1.53)	2.94(9.87)	3.67(11.04)
H 3/4	2.36(1.75)	3.25(2.06)	1.28(1.51)	1.78(7.67)	2.38(8.87)
GG 4/4	1.81(1.68)	1.06(1.44)	1.06(1.44)	3.78(11.21)	1.52(7.08)
GG 3/1	2.25(1.80)	1.25(1.50)	1.12(1.46)	1.87(7.86)	4.67(12.48)
GG 3/2	2.13(1.77)	1.37(1.54)	1.18(1.48)	3.28(10.43)	3.28(10.43)
GG 3/3	2.68(1.92)	1.56(1.60)	1.25(1.50)	2.38(8.87)	1.78(7.67)
GG 4/4	2.51(1.87)	1.63(1.62)	1.31(1.52)	1.69(7.47)	3.38(10.59)
GG 4/2	2.63(1.91)	1.63(1.62)	1.43(1.56)	3.93(11.43)	2.36(8.84)
T 71	3.31(2.08)	1.56(1.60)	2.37(1.84)	3.31(10.47)	1.65(7.38)
T 241	1.12(1.46)	4.25(2.29)	1.09(1.45)	2.25(8.63)	3.37(10.58)
T 275	3.75(2.18)	2.56(1.89)	1.03(1.42)	3.01(9.97)	2.11(8.13)
T 129	4.31(2.30)	3.06(2.01)	2.43(1.85)	1.89(7.90)	1.88(7.88)
SD	0.25	0.16	0.10	1.58	2.31
Mean	1.87	1.71	1.68	11.27	12.63

LF - Leaf folder LM - Leaf miner LBW - Leaf & blossom webber

ANB - Apple & nut borer. Figures in paranthesis are square root (X+1) transformed values

Table 3.41: Screening of MLT varieties for shoot tip caterpillar infestation at Bhubaneswar

Varieties in MLT 92	Shoot tip caterpillar infestation (%)
M 44/3	4.8-12.4
M 15/4	0.00-0.04
BPP 30/1	3.2-10.4
H 368	1.2-6.3
H 302	5.8-13.5
H 255	2.5-5.3
BPP 3/28	1.2-2.8
H 320	2.3-8.9
H 68	1.5-6.0
BPP 3/33	1.0-3.0
BPP 10/19	2.3-9.3
NRCC - 2	9.5-11.5
NRCC - 1	10.2-14.2

Table 3.42: Screening of cashew accessions for tolerance to pests at Jhargram

Accession	Shoot tip caterpillar (%)	Inflorescence thirps (%)
Jhargram-1	5.6	5.3
M 44/3	5.8	5.4
Red Hazari	5.6	5.1
DC 5	4.9	5.2
Ansur-1	4.1	3.2
BLA 39-4	4.8	4.5
JMG 74/6	5.1	4.7

MADAKKATHARA

Caging experiments were conducted on grafts of five released varieties for testing tolerance to TMB. Caging of two insects per cage resulted in feeding of leaves, the data of which is presented in Table 3.43. Out of 9 varieties screened, H 3-17, Priyanka, Kanaka and K 22-1 were found to be apparently tolerant to TMB.

Table 3.43: Screening of cashew varieties for TMB infestation at Madakkathara

Varieties	Score
Madakkathara-1	2-3
H 3-17 (Dharasree)	1-2
Madakkathara-2	2-3
H 1591 (Priyanka)	1-2
Goa 11/6	2-3
H 1598 (Kanaka)	0-1
H 1608 (Dhana)	2-3
K 10-2 (Sulabha)	2-3
K 22-1	1-2

VENGURLE

Two released varieties and three hybrids were screened against TMB and the damage was recorded as percentage incidence and mean score. Highest damage was observed in hybrids (22.56-36.52%). Least damage was observed in V-1 (15.38%). The data on screening of germplasm against TMB is presented in Table 3.44.

Table 3.44: Screening of germplasm against TMB at Vengurle.

Name of variety/ hybrid	Flushing time of flushing	Symcronization time	Flowering of flowering	Symcronization Score	Avg.
V-1	Nov-Dec	Synchronous	Dec-Jan	Synchronous	15.38
V-2	Nov-Dec	Synchronous	Dec-Jan	Synchronous	16.83
V-3	Nov-Dec	Synchronous	Dec-Jan	Synchronous	23.71
V-4	Nov-Dec	Synchronous	Dec-Jan	Synchronous	26.92
V-5	Nov-Dec	Synchronous	Dec-Jan	Synchronous	21.15
V-6	Nov-Dec	Synchronous	Dec-Jan	Synchronous	17.96
V-7	Nov-Dec	Synchronous	Jan	Synchronous	36.52
Hy 303	Nov-Dec	Synchronous	Dec-Jan	Synchronous	28.46
Hy 320	Nov-Dec	Synchronous	Dec-Jan	Synchronous	22.56
Hy 367	Nov-Dec	Synchronous	Dec-Jan	Synchronous	35.39

VRIDHACHALAM

F1 hybrids of high yielding varieties and TMB field tolerant types were screened for natural incidence of TMB. Lowest incidence of TMB was observed in M 26/2 x M 26/1 (H 13) with a mean score of 1.10 and highest damage was observed in M 44/3 x M 45/1 (H 17) with a mean score of 2.25. The observation recorded from field confinement tests are presented in Table 3.45. The MLT entries and germplasm types were also screened against the pests of cashew (Table 3.46). The mean score of damage by TMB in MLT entries ranged from 1.10 - 2.60.

Table 3.45: Screening of F1 hybrids against various pests of cashew at Vridhachalam.

Cross Combination	Hybrid No	TMB mean score	Mean percent damage of shoot quadrant				Mean % damage of thrips per quadrant	
			Leaf and Blossom Webber	Leaf folder	Hairy caterpillar	Mealy bug	Leaf damage	Nut damage
M 10/4 X M 26/1	H 10	1.50	17.20	16.00	—	—	11.00	1.70
M 10/4 X M 45/4	H 11	1.30	21.50	29.50	—	5.90	10.00	—
M 10/4 X M 75/3	H 12	1.50	16.00	32.00	19.00	4.50	7.75	—
M 26/2 X M 26/1	H 13	1.10	17.00	22.00	—	—	16.00	1.50
M 26/2 X M 45/4	H 14	1.70	18.75	19.00	—	5.50	11.85	1.80
M 26/2 X M 75/3	H 15	1.85	14.75	36.00	13.00	—	18.00	2.50
MM 44/3 X M 26/1	H 16	2.35	11.25	35.00	11.00	—	10.75	1.75
M 44/3 X M 45/1	H 17	2.40	15.50	—	—	—	5.80	—
SEm		0.20	1.06	1.78	2.31	0.28	1.10	0.18
CD 5%		0.43	3.43	3.83	4.96	0.61	2.37	0.40

Table 3.46: Screening of MLT 92 accessions for tolerance against pests at Vridhachalam

Accession	Incidence of TMB		Percent damage due to minor pests				
	Score	%	SBW	LF	HC	Mealy bug	Leaf thrips
H 1598	2.30	10.05	23.20	25.20	1.95	—	3.10
H 1600	1.55	7.05	16.55	19.50	—	—	—
H 1608	1.10	6.85	14.20	35.70	3.60	1.55	—
H 1610	1.15	7.05	10.55	15.80	—	5.80	7.80
H 129	1.90	8.25	21.00	25.50	—	—	10.75
H 40	1.85	8.30	15.60	24.75	—	—	—
H 2/15	1.10	9.80	15.80	35.80	2.20	3.30	—
H 2/ 16	2.25	9.75	15.00	24.20	—	—	—
H 33/3	2.60	10.60	10.80	15.80	—	—	6.60
H 44/3	2.30	9.55	30.30	28.20	2.60	3.80	15.70
H 26/2	1.15	4.05	25.60	30.50	1.80	—	—
VTH 30/4	1.80	4.30	15.80	25.80	—	—	—
VTH 59/2	1.10	3.60	20.20	24.70	1.60	—	—
V2	2.10	9.80	20.20	15.80	—	—	—
V3	1.90	8.30	15.60	20.60	—	—	—
V4	2.25	9.75	20.60	25.80	2.20	7.50	—
V5	2.30	10.20	12.20	18.20	—	—	—
CD 5%	0.16	0.23	0.74	0.35	0.14	0.16	0.49
SE m	0.07	0.11	0.35	0.16	0.06	0.07	0.23

1. HISTORY, OBJECTIVES, GROWTH AND SALIENT ACHIEVEMENTS

The All India Coordinated Spices and Cashew nut Improvement Project (AICS & CIP) was started during the fourth five Year Plan in 1971. The AIC&CIP had five centres (four University centres and one ICAR-institute based centre) identified for conducting research on cashew. These centres were located at Bapatla (Andhra Pradesh), Vridhachalam (Tamil Nadu), Anakkayam (Kerala) (later shifted to Madakkathara), Vengurle (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 (Madhya Pradesh) and a sub centre at Pilicode (Kerala) were started.

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

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

The headquarters of the independent cashew project was shifted to National Research Centre for Cashew, Puttur in 1986. Presently, there are eight coordinating centres and one sub-centre, four in the east coast viz. Bapatla, Bhubaneswar, Jhargram, Vridhachalam, three in the west coast viz. Madakkathara, Vengurle, Pilicode and one in the Maidan Parts of Karnataka- Chintamani and one in the Central India at Jagdalpur.

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

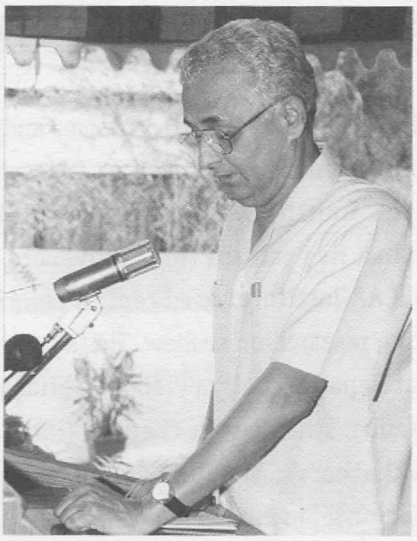
1. Evolving high yielding varieties with export grade kernels, tolerant/resistant to pests and diseases;
2. Standardising agro techniques for the crop under different agro climatic conditions; and
3. Evolving cost effective and efficient pest and disease management practices.

The first Workshop of All India Coordinated Spices and Cashew nut Improvement Project was held at Kasaragod in October 1971 in which the research programmes were drawn up, identifying the problems and fixing the priorities. Subsequently, the progress of work was reviewed and research programmes modified / added as per the need in the Workshops held in Trivandrum, Kerala (1972); Coimbatore, Tamil Nadu (1975); Panjim, Goa (1978); Trichur, Kerala (1981); Calicut, Kerala (1983); Trivandrum, Kerala (1985); Bhubaneswar, Orissa (1987); Coimbatore, Tamil Nadu (1989); National Group discussion in lieu of X Biennial Workshop at Kasaragod, Kerala (1991); Bangalore, Karnataka (1993), Kasaragod, Kerala (1995) and Dapoli, Maharashtra (1997), Bhubaneswar, Orissa (1999) and Puttur, Karnataka (2001). Three group discussions were also held one in horticulture at CPCRI, Regional Station, Vittal (1986), another in NRCC, Puttur (2001) and other in entomology at Trichur (1988). One group discussion was held at Cashew Research Station, Madakkathara to discuss about High density planting with different levels of fertilizer and pruning in cashew plantation and Soil fertility based fertilizer recommendations during the year 2000.

Highlights of XV Biennial Workshop of AICRP on cashew

The XV Biennial Workshop of All India Coordinated Research Project on Cashew was held during 18-20 October 2001 at National Research Centre for Cashew, Puttur. Dr. G. Kalloo, Deputy Director General (Hort.), ICAR inaugurated the Workshop. Dr. P. Rethinam, Chairman, Coconut Development Board, Kochi presided over the Inaugural function. Dr. RN Pal, Asst. Director General (PC), ICAR delivered the Keynote Address. The Annual Report for the year 2000-2001 was released by Dr. KVA Bavappa, FAO Consultant and first copy was received by the DDG (Hort.) Dr. Bavappa and Dr. V. Rajagopal, Director, CPCRI Kasaragod offered felicitations. In this Workshop, Scientists from various Coordinating Centres under different Agricultural Universities, sister Institutes, Directors and Asst. Directors of State Agriculture/ Horticulture Departments, Nurserymen and people from processing industry were also present. The workshop comprised of four technical sessions, viz. Crop Improvement, Crop Management, Crop Protection and Interaction between Development Departments and Research Centres. A brief highlight of deliberations during these technical sessions is given below:

Inauguration of XV biennial workshop of AICRP on Cashew Left to right: Dr. G. Kalloo, Dr. KV Ahamed Bavappa, Dr. P. Rethinam, Dr. EVV Bhaskara Rao



Dr. G. Kalloo, Deputy Director General (Hort.) addressing the delegates of the XV biennial workshop of AICRP on Cashew

The Session on Crop Improvement was chaired by Dr. KVA Bavappa and co-chaired by Dr. KRM Swamy, Principal Scientist, NRCC. During the session, three Status Papers were presented which are as under:

1. Status of cashew germplasm collection in the country by Dr. KRM Swamy, NRCC
2. DNA Fingerprinting of cashew germplasm by Mr. Anik Luke Dhanraj, UAS, Bangalore
3. Status of micropropagation in cashew by Dr. Thimmappaiah, NRCC

During the session, scientists from the concerned centers presented the work done report. Important decisions taken during the session include:

- The F1 hybrids from different centres and TMB tolerant material/F1 hybrids from Vridhachalam and NRCC and other centres may be included in the new evaluation trial to be initiated in all the Centres.
- The clonal accessions having yield data for 6 annual harvests are characterized as per

IPGRI descriptors. Germplasm Catalogue-IV will be brought out by NRCC. Chintamani Centre to send the information for the 40 accessions, if characterization has been completed. All the other centres are also required to characterize the accessions, which are having statistically analysed data on six annual harvests.

The Session on Crop Management was chaired by Dr. H.H. Khan, Project Coordinator (Palms), CPCRI, Kasaragod and co-chaired by Mr. N. Yadukumar, Principal Scientist, NRCC. During the session, two Status Papers were presented by Mr. N. Yadukumar which were as under:

1. High density Planting of Cashew
2. Soil test based indications of cashew crop response

Important decisions taken during the session were:

- A Technical bulletin on high-density planting may be published by NRCC incorporating technologies developed by the Centres.
- In the cashew based cropping system the moisture at the root zone of cashew plant and interspaces may be recorded at different depths. Net income should be calculated under each system while presenting the reports. Intercrops, which can act as trap crop for tea mosquito bug may be identified and effect of organic matter added to soil by various mixed crops is also to be recorded and results have to be presented.

The Session on Crop Protection was chaired by Dr. S. Palaniswamy, Professor & Head, HC&RI, TNAU, Periyakulam and Co-chaired by Dr. D. Sundararaju, Senior Scientist, NRCC. Dr. PS Bhat, Sr. Scientist, NRCC, presented a status paper on 'Insecticide Residues in Cashew'. The important decisions taken during this session were as follows:

- 'Spray Holiday' was declared for West Coast region and in the East Coast region need based sprays could be suggested. The pre-disposing factors for outbreak of tea mosquito bug may be determined in correlation with the weather parameters such as relative humidity, minimum temperature and bright sunshine hours.
- All AICRP Centres should record the details about pests, which lead to yield reduction.

The IV session on 'Interaction between development departments and research centres' was chaired by Mr. PP Balasubramanian, Director, Directorate of Cashewnut & Cocoa Development, Kochi.

In this session, two presentations were made. In the first presentation, Mr. Vikas Patil, Official from the Dept. of Horticulture, Govt. of Maharashtra, highlighted the developmental efforts undertaken by Maharashtra Govt. for promoting cashew cultivation. In the second presentation, Mr. PP Balasubramanian presented the various development programmes that are envisaged during X Plan and yield forecasting for 2002 season. Considerable discussions were held and the following decisions were taken.

- All the AICRP Centres should conduct Demonstration Farmers Day to impart training on the latest cashew production technology.
- The yield forecasting exercise will be standardized with the help of enumerators in order to ensure uniformity of data collected.

Group meeting of Horticulturists of AICRP Centres on Cashew

A Group Meeting was held under the Chairmanship of Dr. KRM Swamy, Principal Scientist (Hort.) on 20.10.2001 at 9.00 AM in the Committee Room of NRCC Puttur to finalise the entries for the new trial of promising hybrids, TMB tolerant material and dwarf material (KGN-1) of Madakkathara Centre. Horticulturists and/or Breeders of all the Centres and Dr. MG Bhat, Principal Scientist, NRCC were present in the Group Meeting.

As the dwarf accession (KGN-1) of CRS Madakkathara needs closer spacing as compared to promising hybrids and TMB tolerant material, it was decided to have a separate preliminary evaluation trial at different locations for testing KGN-1 dwarf and precocious bearing accessions.

It was also decided during the group meeting that a new multi location trial will be initiated at AICRP centers of Bapatla, Bhubaneswar, Chintamani, Madakkathara, Vengurle and Vridhachalam.

Significant achievements of the project:

1. During the year under report, 95 trees have been identified for collection for Regional Cashew Gene Bank (RCGB) in different coordinating centres. Indigenous collection numbers (IC Nos.) have been obtained through NRC for Cashew for 716 collections from NBPGR, New Delhi. Total holdings in different RCGBs amount to 1188.

2. Under hybridization and selection programme, crossing of promising parents has been carried out at different centers. At Bapatla 85 and at Vengurle 824 hybrids were planted. At Bhubaneshwar, 461 nuts and at Chintamani 74 hybrid nuts have been obtained. Evaluation of existing, hybrids at Bapatla indicated high yield performance of hybrid 4/1 (14.6 kg tree^{-1}). At Bhubaneswar A1-85 could produce highest yield (2.92 kg tree^{-1}) from third annual harvest. At Madakkathara H-42 produced highest yield (2.90 kg tree-^{1}) for first annual harvest. At Vengurle, H 641 performed better (5.99 kg tree^{-1}) and at Vridhachalam M 10/4 x M 26/1 could produce highest yield (4.8 kg tree^{-1}) from 11th annual harvest.

3. Testing of different spacings is being carried out at Jhargram and Vengrule. At Vengurle, 5m x 5 m square planting with 75% thinning could yield 400 kg/block from a block of of 50m x 50 m having 100 plants.

4. High density demonstration gardens have been maintained at Bapatla, Bhubaneswar, Chintamani and Vengurle. At Bhubaneswar high density planting could produce an yield of 1312.5 kg ha-1 for variety H 2/16.

5. Different inter cropping trials are being carried out with annuals at different coordinating centers. At Bapatla, greengram was found to be a better intercrop during late Kharif season. At Bhubaneswar, turmeric has been found to be remunerative with net profit of Rs.12,798/- per hectare. At Vengurle, Cucumber was found remunerative with a net profit of Rs.34,998/- per hectare. At Vridhachalam, groundnut was found remunerative than other intercrops.

6. In the experiment on alternative chemicals, compared to other chemicals, standard spray was the most effective treatment compared to other treatments at Bhubaneswar and Vridhachalam. At Chintamani, highest yield

of 5.92 Kg tree^{-1} was recorded in treatment with profenophos. Spraying chlorpyriphos and profenophos was the most effective control for pests of cashew at Jhargram. Highest yield was reported from Madakkathara in treatment T5 (9.50 Kg tree^{-1}). At Vengurle, spraying with profenophos (0.05%) was found to be effective in controlling TMB.

7. During the year, 13 demonstration plots have been laid down in farmers field with high density planting. Ten training programmes and 11 campaigns were conducted by different AICRP centres and also the scientists have participated in various seminars conducted by different agencies. A total of 4,97,655 grafts were produced and distributed to different government and non-government agencies as well as farmers.

2. TRANSFER OF TECHNOLOGY EFFORTS

During the year, 13 demonstration plots have been laid down in farmers field with high density lay out. 10 training programmes and 11 campaigns were conducted by different AICRP centres and also the scientists have participated in various seminars conducted by different agencies. A total of 4,97,655 grafts were produced and distributed to different government and non-government agencies as well as farmers. The centre-wise production of grafts is given below.

Grafts produced

Centre	No. of grafts
Bapatla	21,000
Bhubaneswar	32,000
Chintamani	18,128
Jagdalpur	6,984
Jhargram	5,000
Madakkathara	1,21,693
Pilicode	11,880
Vengurle	1,82,670
Vridhachalam	98,300
Total	4,97,655

BAPATLA

Under revolving fund scheme sponsored by DCCD, Kochi planting materials of high yielding varieties were produced under Regional nursery programme. 21000 grafts were produced and sold to farmers during the year 2001.

BHUBANESWAR

Six demonstration plots have been raised during the year with clonal material. Three Dooradarshan programmes have been telecast on "Mangament of cashew during flowering, fruiting, harvesting and post harvest management with control of cashew pests", in which scientists of the center have participated. Ten campaigns were conducted in districts of Khurdha, Puri, Dhenkanal, Ganjam, Nayagarh, Cuttack and Jajpur.

CHINTAMANI

Scientists have participated in programmes sponsored by DCCD, Kochi and also high yielding cashew grafts were produced and supplied to farmers. Two trainings have been conducted to farmers in Cashew Production Technology and maintenance of model clonal orchards.

JHARGRAM

The center has conducted one training programme for farmers at Kapgari, and another at Horticultural farm, Jhargram in collaboration with Government of West Bengal. One training programme was organized at Pukuria in cashew grafts production and crop protection in which 32 farmers have participated. The scientists have participated in TV programme on "Cashew cultivation and propagation". Under DCCD sponsored farmers training programme 200 farmers have participated.

MADAKKATHARA

The center has conducted 10 training programmes in which 52 farmers, one IAS Officer and 16 students have participated. The scientists have participated in three Radio/TV programmes on cashew propagation, new varieties and planting technique and control of tea mosquito bug.

PILICODE

The center had laid out two demonstration plots during the year. Eight training programmes/ seminars have been conducted and a total of 346 farmers have participated in them. The scientist had participated in a Radio programme on manuring in cashew plantations.

VENGURLE

During the year five demonstration plots have been laid out under Institute village linkage programme. Cashew grafts of V1, V4, V6 and V7 varieties have been produced and distributed to farmers.

BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2000-2001

ALLOCATION (Rs. in Lakhs)

Centre	Pay & Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	10.20	0.25	1.20	-	11.65	8.74
Bhubaneswar	11.56	0.25	1.20	-	13.01	9.76
Chintamani	8.70	0.25	1.20	1.00	11.15	8.36
Jagdalpur	4.50	0.20	0.80	3.00	8.50	6.38
Jhargram	8.90	0.25	1.20	2.00	12.35	9.26
Madakkathara	13.00	0.25	1.20	-	14.45	10.84
Pilicode	4.10	0.15	0.40	1.00	5.65	4.24
Vengurle	8.30	0.25	1.20	-	9.75	7.31
Vridhachalam	12.20	0.25	1.20	-	13.65	10.24
TOTAL	81.46	2.10	9.60	7.00	100.16	75.12

ACTUAL EXPENDITURE (Amount in Rupees)

Centre	Pay & Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	10,22,278	26,355	1,53,289	85,208*	12,87,130	9,65,348
Bhubaneswar	11,25,728	16,251	1,20,000	45,521*	13,07,500	9,80,625
Chintamani	8,15,381	7,788	1,19,436	-	9,42,605	7,06,954
Jagdalpur	2,35,730	6,071	79,928	-	3,21,729	2,41,296
Jhargram	5,75,667	19,062	65,423	-	6,60,152	4,95,114
Madakkathara	10,42,910	16,661	1,60,664	-	12,20,235	9,15,176
Pilicode	2,87,237	5,518	21,469	-	3,14,224	2,35,668
Vengurle	7,39,000	22,834	1,19,409	-	8,81,243	6,60,932
Vridhachalam	6,58,835	20,888	1,19,965	-	7,99,688	5,99,766
TOTAL	65,02,766	1,41,428	9,59,583	1,30,729	77,34,506	58,00,879

* Revalidated from previous years budget.

5. MONITORING OF PROJECT BY COORDINATOR

The details of the visit by Project Coordinator to review the programmes being implemented at different centres is as follows:

1.8.2001	Vridhachalam
4.8.2001	Bhubaneswar
6.8.2001	Chintamani
19-20.1.2002	Jagdalpur
12.2.2002	Jhargram
14.2.2002	Bhubaneswar

During the visit to these centres, the technical programmes allotted to each of the centres and the progress made so far were reviewed along with inspection of the field experiments. X Plan priorities for each centre was also discussed. University authorities were met to appraise the progress of work in the centres.

6. FUNCTIONING OF EACH CENTRE

BAPATLA

The center has been established since 1971. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, three in Crop Management and four in Crop Protection are being carried out. A new trial on fertilizer application in high density plantations is being initiated during the year. Among the germplasm entries, T 228, GG 4/4, T 241and HY 3/4 have shown tolerance to some of the minor pests of cashew.

BHUBANESWAR

The center has been established since 1975. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, three in Crop Management and four in Crop Protection are being carried out. In hybridization programme, BH-6 and BH-85 are selected for further evaluation. The same hybrids are also recommended for multiplication and supply to the farmers. The center has generated grafts and many of the trials have been reestablished after being affected by cyclone in 1999. High density planting taken up at the center needs pruning after the completion of harvests.

CHINTAMANI

The center has been established since 1980. At present there are three scientists working under the project in the posts of Horticulturist, Junior Agronomist and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, four in Crop Management and three in Crop Protection are being carried out. A scion bank is established in an area of 0.75 hectares with varieties of Chintamani-1 (200 plants), Ullal-1, Ullal-3, Ullal-4, NRCC-1 and NRCC-2 (50 plants each). It was suggested that the center may collect grafts of released varieties which are not present in the collections of NRCC, Puttur.

JAGDALPUR

The center has been established since 1993. At present there are no scientists working under the project. Presently there are two projects in Crop Improvement, two in Crop Management and two in Crop Protection which are allotted to the center.

JHARGRAM

The center has been established since 1982. At present there are two scientists working under the project in the posts of Junior Horticulturist and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, four in Crop Management and four in Crop Protection are being carried out. In view of the regular strike of the field staff and other disturbances, it was suggested to take up planting in some other farms, where the work can be completed without interruption. Necessary guidance were also given

to the Junior Horticulturist for production of grafts for field experiments.

MADAKKATHARA

The center has been established since 1972. At present there are three scientists working under the project in the posts of Agronomist, Junior Breeder and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, four in Crop Management and four in Crop Protection are being carried out. A precocious dwarf, KGN1 which is promising for high density planting is maintained in the germplasm. The center has also developed training facility for cashew production technology and cashew apple processing. The accessions H 3-17, Priyanka, Kanaka and K 22-1 have shown moderate tolerance to TMB. A new trial on fertilizer application in high density plantation has been laid out during the year with Madakkathara -1 variety.

PILICODE

The center has been established since 1993. At present there is one scientist working under the project in the post of Junior Horticulturist. Presently there are two projects, one in Crop Improvement, and one in Crop Management. The germplasm contains one dwarf variety.

VENGURLE

The center has been established since 1970. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, five in Crop Management and four in Crop Protection are being carried out. The center has achieved the targeted production of 1.5 tonne per hectare from high density planting with variety V-4. A new trial on fertilizer application in high density plantation with variety V-7 has been laid out during the year.

VRIDHACHALAM

The center has been established since 1971. At present there are three research associates working in the vacant post of scientists in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently there are three projects in Crop Improvement, four in Crop Management and four in Crop Protection are being carried out. It was suggested that newly joined research associates may visit NRCC, Puttur to familiarize themselves with data collection and experimental details. It was also advised to establish released varieties block with all the forty released varieties in the country by procuring from different centers. The germplasm H 11 and H 14 have been found to be tolerant to TMB.

7. PROBLEMS IN FUNCTIONING OF THE CENTRES

At Chintamani the technical assistant is on study leave. During the year germplasm collection also could not be made due to the vacancy in the post of Horticulturist. Under high density planting trial only one replication is planted and hence the trial has to be replanted. At Jagdalpur both the posts of scientists are vacant and therefore technical programmes of the project are not implemented properly. At Jhargram due to trade union strike none of the technical programmes have been implemented during the year except few routine noting of observations. At Vridhachalam there was some problem in clearing the trees for taking up fresh plantation for drip irrigation trial. However it was decided to lay out the experiment in new area besides the high density plantation experiment. It was also noticed that high temperature in the region causes mortality of the plants at higher doses of nitrogen. Therefore it was suggested to apply fertilizer during the period when adequate soil moisture is available. At this center scientific posts are lying vacant against which research associates were appointed until regular appointments are being made. Many of the research programmes were incomplete due to the absence of regular scientists.

8. METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2001

Bapatla

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	29.4	17.3	92.0	69.0	—	—
February	31.0	18.8	93.0	70.0	—	—
March	32.3	22.5	74.0	70.0	—	—
April	32.8	25.3	78.0	74.0	151.7	4
May	39.3	28.3	60.0	56.0	—	—
June	36.6	26.5	65.0	52.0	80.6	8
July	36.3	26.5	66.0	53.0	81.5	5
August	33.7	24.6	82.0	73.0	221.1	13
September	33.1	25.0	84.0	79.0	215.1	9
October	31.3	24.0	91.0	82.0	324.4	13
November	30.4	21.8	93.0	85.0	52.9	4
December	29.5	18.0	92.0	71.0	7.9	1

Bhubaneswar

Month	Temperature (°C)		Mean RH (%)		Total rain (mm)
	Maximum	Minimum	AM	PM	
January	30.1	12.8	89.2	52.6	0
February	33.4	19.3	95.0	39.8	0
March	34.8	22.1	94.3	50.3	71.9
April	38.0	25.0	88.0	48.2	14.1
May	39.2	26.7	90.3	59.3	80.7
June	32.5	25.1	94.3	82.0	439.8
July	32.6	24.7	94.8	82.6	793.5
August	31.4	25.3	93.5	82.5	355.6
September	33.2	25.2	93.5	74.3	140.4
October	32.2	23.6	94.2	68.4	160.8
November	29.5	20.2	93.0	64.5	54.1
December	29.1	13.6	91.0	41.0	0

Chintamani

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	27.5	NA	81.0	83.6	0.0	-
February	31.8	NA	81.6	63.6	0.0	-
March	32.9	NA	86.6	57.4	9.8	1
April	34.1	NA	89.0	61.6	62.2	3
May	35.1	NA	84.4	53.5	56.8	2
June	31.1	NA	78.8	58.7	0.4	1
July	30.9	NA	82.2	63.6	51.5	3
August	29.1	NA	83.9	70.5	77.8	5
September	29.3	NA	87.0	71.6	271.3	10
October	27.5	NA	96.1	85.6	418.4	11
November	26.5	NA	84.3	83.6	49.0	2
December	25.9	NA	87.6	81.2	0.0	-

Jhargram

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	24.9	12.7	79.8	49.6	9.6	2
February	27.9	18.8	79.9	49.2	2.1	2
March	30.9	21.2	76.1	45.6	15.8	3
April	34.8	21.8	77.5	48.1	42.0	7
May	36.8	23.7	84.4	51.4	46.3	5
June	36.1	23.2	81.3	51.6	94.8	8
July	34.3	24.6	90.2	75.0	230.8	13
August	36.1	25.7	92.3	76.2	296.3	20
September	35.4	24.8	85.3	66.9	280.3	13
October	32.3	23.6	81.9	53.8	162.5	10
November	27.6	15.5	80.5	45.5	30.8	5
December	25.6	11.7	73.8	40.9	13.2	4

Madakkathara

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	32.6	23.2	71.0	41.0	0	0
February	34.5	22.9	86.0	48.0	12.2	1
March	34.9	24.0	84.0	54.0	4.4	1
April	34.2	24.7	88.0	63.0	243.1	8
May	32.3	24.5	89.0	73.0	192.6	4
June	28.4	23.1	94.0	79.0	676.2	23
July	29.0	22.7	93.0	77.0	477.7	19
August	27.5	23.1	97.0	76.0	256.2	21
September	30.8	23.2	91.0	67.0	206.1	6
October	30.7	23.0	91.0	71.0	215.8	8
November	31.6	23.1	83.0	60.0	115.8	6
December	29.5	22.2	72.0	48.0	0	0

Pilicode

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	31.7	20.7	85.2	52.2	0.0	-
February	31.6	22.8	90.2	66.4	0.0	-
March	32.0	23.3	92.2	77.9	0.0	-
April	31.5	25.1	87.8	70.0	0.0	-
May	32.4	25.0	87.3	70.3	340.4	12
June	29.6	24.5	95.6	86.3	1191.8	28
July	28.4	22.9	95.2	83.6	902.7	30
August	28.3	22.6	95.7	81.6	509.8	29
September	31.5	22.6	92.2	72.0	175.0	8
October	30.2	22.5	94.3	74.1	376.0	17
November	31.4	22.1	92.8	69.3	49.7	7
December	31.7	19.1	88.7	49.0	2.0	1

Vengurle

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	32.08	16.98	87.1	54.8	0	0
February	32.07	16.25	85.8	55.2	0	0
March	31.51	19.12	85.4	57.1	0	0
April	32.69	24.16	77.3	64.5	0	0
May	33.49	24.80	75.3	65.6	134.40	7
June	31.70	25.00	83.5	77.1	578.40	28
July	30.57	25.17	84.3	80.6	731.20	27
August	29.16	24.49	88.5	82.3	1735.00	31
September	29.70	23.86	89.1	76.1	189.00	18
October	30.50	23.72	86.6	76.4	117.00	13
November	33.69	20.36	79.0	62.2	0	0
December	32.84	16.47	84.0	58.0	0	0

Vridhachalam

Month	Temperature (°C)		RH (%)		Total rain (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
January	27.65	18.53	81.7	60.5	8.0	1
February	33.04	20.78	87.9	46.5	0.0	-
March	35.23	21.92	86.7	51.8	0.0	-
April	35.66	24.11	85.6	63.4	62.1	3
May	38.85	22.91	82.4	54.9	207.9	4
June	36.49	22.88	75.7	54.0	7.0	2
July	36.73	23.11	82.4	68.6	89.4	5
August	36.59	23.26	79.1	73.9	139.6	6
September	36.45	22.64	86.9	78.8	166.2	6
October	33.90	19.81	85.4	26.3	182.2	11
November	31.47	19.85	87.8	78.4	88.0	6
December	30.04	20.07	84.5	77.6	53.0	5

9. RESEARCH PUBLICATIONS

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Kokate K.D., Haldankar P.M., Deshpande S.B. and Patil, B.P. 2002. Cashew kernel exports. Shetkari, January/February, pp 95-96.

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