CO-ORDINATOR'S REPORT

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

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

The budget allocation of the project for the year 2004-2005 was Rs.120.00 lakhs (Rs.90.00 lakhs ICAR Share) and the expenditure was Rs.114.79 lakhs (Rs. 86.09 lakhs ICAR Share).

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

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

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

CROP IMPROVEMENT

Cashew germplasm having highest yield cluster bearing habit, bold nut type and maximum nut weight were identified, collected and conserved in Regional Cashew Field Gene Bank (RCFGB) during 2004 thereby increasing the total germplasm accessions conserved to 1274. At Bapatla Tree No.277 gave the highest yield of 3.30kg during 2004 while at Chintamani ARSC 35/3 (MV 4/4) gave yield of 40kg/tree in its 16th year. At Madakkathara highest annual yield was recorded in V-1 (6.70kg/tree) followed by BPP-2 (3.50 kg/tree). At Pilicode Centre the dwarf type TPB-1 was utilized for hybridization with MDK-1 and ANK-1. At Vengurle the germplasm accessions collected from Goa viz. Balli-2 had a maximum cumulative nut yield of 10.18kg/tree for five harvests and at Vridhachalam TK-1 gave a mean nut yield 3.63 kg/tree with a cumulative nut yield of 4.91kg/tree in the second harvest.

In Multilocation Trial-II, the maximum nut yield per tree was recorded in T10/19 (10.74kg) which had a cumulative yield of 36.23kg for 9 harvests at Bapatla. At Bhubaneswar H-320 and H-303 gave the annual nut yield of 9.50 and 8.7kg/tree respectively and also had the highest cumulative nut yield of 50.80kg and 47.6kg/tree respectively for 9 harvests. HY-320 and NRCC Sel-2 showed consistent performance at Chintamani by having highest yield of 26.2kg and 19.75kg/tree during 2004. H-303 (1.55kg/tree) and HY-320 (4.65kg/tree) from Vengurle were found to have highest nut yield at Jagdalpur and Madakkathara respectively. The highest panicle count 13.60/m^2 was recorded in M44/3 at Vengurle and maximum number of flowering laterals per m^2 (59.2) was recorded in M-15/4 at Vridhachalam.

Among the released varieties available at Bapatla, Dhana had the highest number of bisexual flowers per m^2 (351.3) while BPP-4 had the highest nut yield per tree (3.33kg/tree) in the 4th harvest followed by BPP-8 (3.15kg/tree). At Jhargram NRCC-Sel-1 had highest plant height of 130cms in the 2nd year while VRI-2 had the highest stem girth of 9.25cm. The precocious dwarf KGN-1 had similar vegetative characters as that of the local check variety at Bapatla (BPP-5), Bhubaneswar (H2/16), Chintamani (Chintamani-1), Jhargram (BLA-39-4), Pilicode (MDK-1), Vengurle (V-7) and Vridhachalam (VRI-2).

Under hybridization trial at Bhubaneswar 616 hybrid seedlings have been planted during 2003 and 197 hybrid seedlings were planted during 2004 for further evaluation. Highest annual nut yield was obtained in A1-85 (10.20kg/tree). At Jhargram H-10 and H-32 were found to have dwarf growth habit. At Madakkathara out of the hybrids planted during 1993 highest annual nut yield/tree was recorded in H-17 (24.60kg), H-15 (21.70kg) and H-7 (18.70kg). All the highest yielding hybrids had P-3-2 as the common male parent. At Vengurla 175 hybrid seedlings obtained from 16 cross combinations have been planted during 2004. Among the 8 hybrids evaluated at Vridhachalam H-10 had the highest annual nut yield (6.42kg/tree) followed by H-13 (5.83kg/tree).

CROP MANAGEMENT

Under NPK trials, N levels had significant influence on nut yield at Bapatla and at Vridhachalam highest fertilizer dosage (1000g N, 250g P, 250g K) of NPK resulted in maximum nut yield. At Jhargram N levels significantly influenced the canopy size while at Madakkathara N, P and K levels did not have significant influence on yield.

In trial on fertilizer application in high density system, at Bapatla the vegetative growth parameters viz. plant height, stem girth and canopy spread were maximum in plant density of 600plants/ha with lowest fertilizer dosage of 75kg N, 25kg P and 25kg K per hectare. At Jagdalpur highest mean nut yield/tree was recorded with 600plants/ha and 225kg N, 75kg P and 75kg K/ha which was statistically similar with 200plants/ha and 75kg N, 25kg P and 25kg K/ha. At Madakkathara neither the tree density nor fertilizer dosages or other interactions could significantly influence in growth parameters or nut yield. At Vridhachalam the maximum canopy spread and yield per tree were recorded in 225kg N, 75kg P and 75kg K with plant density of 200 plants per hectare. But yield per unit area and per ha was maximum with same NPK dosage with plant density of 600 plants/ha.

In observational trial (HDP) at Bhubaneswar, the yield of different varieties at a spacing of 4x4m when recommended fertilizer dosage was 1.60 tones/ha in H 2-16 and was 1.75 tones/ha in V-4. The cumulative nut yield in case of Chintamani-1 ranged between 1.00 to 8.30kg/tree from four harvests at Chintamani Centre. At Madakkathara mean nut yield were similar in high density planting (4.50kg/tree) and normal planting 4.70kg/tree.

In intercropping trial at Bapatla, net profit/ha was Rs.13,650/- per ha in case of black gram and Rs.13,000/- per ha in case of green gram when additional fertilizer was applied to the inter crops with cashew as per recommendation. Maximum net returns were obtained from brinjal (Rs.5,200/ha) at Bhubaneswar however, cost : benefit ratio was highest for chillies 1:2.28 but was least in case of brinjal 1:1.135. At Jhargram highest net profit was obtained in case of pigeon pea (Upas-120) (Rs.21,382/- per ha) wherein 50 per cent of recommended fertilizer was applied to the inter crops. The highest cost benefit ratio (1:5.11 to 1:6.63) was also noticed in case of pigeon pea while tapioca, cucumber and ground nut led to highest net profits of Rs.23,834/ha, Rs.33,659/ha and Rs.16,188/ha at Madakkathara, Vengurle and Vridhachalam respectively.

CROP PROTECTION

At Vengurle application of endosulfan at flowering followed by neem oil at fruiting was superior over control and was at par with carbaryl spray at fruiting; monocrotophos spray at flushing and carbaryl spray at fruiting as well as monocrotophos spray at flushing. Damage by thrips at

peanut stage, pebble stage and mature nut stage was significantly lowest in the recommended spray schedule.

The new insecticides Chlorpyriphos, Triazophos, L-cyhalothrin and profenophos were found to be on par with each other and also with the recommended spray schedule in checking incidence of minor pests at Bapatla and Bhubaneswar. Incidence of leaf caterpillar, leaf folder was similar in case of recommended spray schedule and newer insecticides with the exception of chlorpyriphos. At Jhargram recommended spray schedule was the most effective treatment against other minor pests. The recommended spray schedule resulted in minimum damage score of TMB on shoot and panicle which was similar to L-cyhalothrin at Madakkathara. Triazophos was significantly superior in reducing TMB damage at Vengurle while profenophos was more effective and comparable with standard spray schedule at Vridhachalam.

In prophylactic control trial of cashew stem and root borer (CSRB), swabbing with neem oil 5 per cent thrice during Oct-Nov., Jan-Feb., and Apr-May was the most effective prophylactic treatment recorded at Bapatla, Bhubaneswar, Jhargram, Vengurle and Vridhachalam. At Jagdalpur and Madakkathara application of *Metarhizium anisopliae* spawn + neem cake resulted in the maximum pest free duration.

In curative control trial for the control of CSRB, lindane 0.2% having 66.67 per cent for treated trees without reinfestation at Bapatla, Chlorpyriphos 0.2% having 85.00 per cent of treated trees without reinfestation at Bhubaneswar and carbaryl 1.0% having cent per cent of treated trees without reinfestation at Chintamani and Jhargram were found to be the most effective insecticides for post extraction prophylaxis. At Jagdalpur, carbaryl and chlorpyriphos led to 40 per cent of treated trees without reinfestation while at Vengurle, Chlorpyriphos and lindane led to cent per cent of trees without reinfestation, which were the most effective post extraction prophylaxis treatment. However, at Madakkathara no definite trend was observed among the treatments.

In the survey of pests of regional importance, it was found at Bapatla that the activity of leaf and blossom webber was negatively and significantly influenced by related humidity; leaf miner activity was significantly and negatively influence by maximum and minimum temperature. The number of rainy days significantly and positively influenced the population of leaf miner. At Bhubaneswar the important local pests shoot tip caterpillar and leaf and blossom webber did not show any significant correlation with any weather parameters. At Jagdalpur the maximum temperature had a positive influence on TMB damage. Relative humidity and rain fall had significant and negative influence on thrips incidence. At Madakkathara, only the minimum temperature significantly and negatively influences the TMB population. At Vridhachalam, related humidity (evening) significantly and positively influenced leaf and blossom webber, leaf miner, shoot tip caterpillar and leaf folder damage.

While screening the germplasm for locating tolerant/resistant types at Bapatla, all the entries were found on par with each other in their susceptibility to shoot tip caterpillar. An increase of 7.3 per cent in the number of nuts was recorded due to application of boron at Bhubaneswar. At Jagdalpur, inflorescence thrips were not observed in CARS-3. The lowest incidence of leaf and blossom webber was recorded on Vengurle – 5 (6.8%)and lowest damage by shoot tip caterpillar in M-26/1 (7.4%) at Jhargram.

TRANSFER OF TECHNOLOGY

During the year, under report a total of over 4 lakh grafts were produced and distributed to several government and non-government organizations as well as to cashew cultivators. Scientists of different centres were involved in conducting more than 46 trainings on different aspects of cashew cultivation, and organized 17 campaigns on different aspects. A total of 112 demonstration plots involving soil and water conservation practices and recommended technologies have been monitored by different AICRP-Cashew centres. Among these demonstration plots, 16 plots were laid afresh during the year under report.

CENTRES OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

MAP

HEADQUARTERS OF AICRP ON CASHEW

- **National Research Centre for Cashew, Puttur 574 202**

AICRP on cashew Centres:

1. Cashew Research Station, (ANGRAU), Bapatla, 522 101, Guntur District, Andhra Pradesh
2. Cashew Research Station, (OUAT), Bhubaneswar 751 003, Orissa
3. Agricultural Research Station, (UAS), Chintamani 563 125, Kolar District, Karnataka.
4. SG College of Agricultural and Research Station, (IGAU), Jagdalpur 494 005, Chattisgarh
5. Regional Research Station, (BCKV), Jhargram - 721 507, Midnapore West District, West Bengal
6. Cashew Research Station, (KAU),Madakkathara 680 651, Kerala
7. Regional Agricultural Research Station, (KAU), Pilicode 671 353, Kasaragod District, Kerala.
8. Regional Fruit Research Station, (KKV), Vengurle 416 516, Maharashtra.
9. Regional Research Station, (TNAU), Vridhachalam 606 001, Cuddalore District, Tamil Nadu.

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

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

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

Maidan tract is characterized 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 789mm and the temperature ranges from 13.9 to 34.5° C. Centre is situated at an elevation of 300m 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 150mm.

I. CROP IMPROVEMENT

Gen 1: Germplasm collection, maintenance and description of cashew types

Centres: East Coast

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast

Madakkathara, Pilicode and Vengurla

Plains / others

Chintamani and Jagdalpur

The objectives of the project are:

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

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

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

SUMMARY:

Thirty one cashew types having high yield, cluster bearing habit, bold nut type and maximum nut weight were identified, collected and conserved in Regional Cashew Field Gene Bank (RCFGB) during 2004 thereby increasing the total germplasm accessions conserved to 1274. At Bapatla, Tree No.277 gave the highest yield of 3.30kg/tree during 2004 while at Chintamani ARSC 35/3 (MV 4/4) gave yield of 40.00kg/tree in its 16th year. At Madakkathara, highest annual yield was recorded in V-1 (6.70kg/tree) followed by BPP-2 (3.50 kg/tree). At Pilicode Centre, the dwarf type TPB-1 was utilized for hybridization with MDK-1 and ANK-1. At Vengurle, the germplasm accessions collected from Goa *viz.,* Balli-2 had a maximum cumulative nut yield of 10.18kg/tree for five harvests and at Vridhachalam TK-1 gave a mean nut yield 3.63kg/tree with a cumulative nut yield of 4.91kg/tree in the second harvest.

Germplasm Collection:

During 2004, 31 cashew accessions were collected by various Centres and planted in respective Regional Cashew Field Gene Banks (RCFGB), bringing the total accessions conserved so far to 1274 (Table 1.1). At Bhubaneswar, 3 accession with cluster bearing habit and 5 accessions having bold nut types were incorporated from different location. At Chintamani Centre, two accessions having bold nut and high yield were collected locally. At Jhargram Centre, two accessions having upright canopy and medium nut weight were collected from farmer's plot.

Table 1.1: Cashew germplasm holding in different centres.

Centre	No. of accessions		
	Existing	Collected during 2004	Total existing 2004-05
East Coast			
Bapatla	131	--	131
Bhubaneshwar	81	8	89
Jhargram	123	2	125
Vridhachalam	264	--	264
West Coast			
Madakkathara	146	2	148
Pilicode	65	--	65
Vengurla	265	--	265
Maidan tract/others			
Chintamani	124	2	126
Jagdalpur	44	17	61
TOTAL	**1243**	**31**	**1274**

Germplasm Evaluation:

The growth parameters and yield of cashew germplasm have been evaluated at different Centres during 2004, and the details are presented for different Centres.

BAPATLA

During the year among the accessions, highest plant height (4.86m) was recorded in Hy 95-5 followed by Hy 95-4 (4.71m), maximum spread of canopy (E-W) was recorded in the Hy-95-5 (6.44m) followed by T.No.268 (5.38m). The maximum number of bisexual flowers per panicle was recorded in BLA 39/4-1(162.25) followed by T.No.15/4 (143.50). Maximum annual nut yield per tree (3.30kg) was recorded by T.No.277 followed by T.No.12/1 (3.03kg) in the clonally multiplied germplasm block. The highest cumulative nut yield since 2001 was recorded in T.No.268 (5.69 kg/tree) followed by T.No.15/4 (5.38 kg/tree). The mean nut weight was highest for T. No. 15/4 (10.0gm) while other accessions had medium nut weight ranging between 5.40g to 6.40g (Tables 1.2 & 1.3).

Table 1.2: Growth measurements and nut yield of accessions / varieties conserved at Bapatla

Sl. No.	Accession Number	Plant Height (m)	Canopy Spread (m)		No. of bisexual flowers	Annual Nut yield/tree (Kg) (2003-04)
			E-W	N-S		
1.	T.No.268	3.96	5.38	4.36	105.00	1.88
2.	T.No.277	3.43	4.50	4.83	33.80	3.30
3.	T.No.12/1	2.80	4.84	2.24	69.80	3.03
4.	T.No.15/4	3.45	3.25	3.10	143.50	2.40
5.	Hy-95-4	4.71	4.92	5.30	78.75	2.56
6.	Hy-95-5	4.86	6.40	5.20	72.25	2.20
7.	BLA 39/4-1	3.48	4.74	4.86	162.25	2.13

Table 1.3 : Performance of promising germplasm accessions (Planted in 1996) for yield at Bapatla

Accession number	Yield during 2004 (Kg/Plant)	Cum. Yield 2001-04 (Kg/Plant)	Mean nut yield (Kg/Plant)	Mean nut weight (g)
T.No.40	1.28	4.99	1.25	5.60
T.No.268	1.88	5.69	1.42	5.40
T.No.277	3.30	4.22	1.06	5.80
T.No.3/4	1.65	4.15	1.04	6.40
T.No.4/3	1.67	5.02	1.26	6.00
T.No.8/7	1.82	4.70	1.17	6.40
T.No.9/8L	2.20	4.80	1.20	6.20
T.No.12/1	3.03	5.34	1.34	6.20
T.No.15/4	2.40	5.38	1.35	10.00
T.No.17/5	1.55	4.30	1.08	5.80
Hy-95-4	2.56	4.94	1.24	6.40
BLA39/4-1	2.13	4.61	1.15	5.60
ABT-3	2.60	4.48	1.12	5.80

BHUBANESWAR

Plantations were surveyed and eight elite types were identified, collected and vegetatively multiplied during 2003. These were planted during 2004 raising the germplasm conserved to 89. The characteristics of these types are presented in Table 1.4. Three were cluster bearing types while five were bold nut types.

Table 1.4 : Characteristics of cashew germplasm collected during 2004 at Bhubaneswar.

Sl. No.	Collection number	Place of collection	Remarks
1	V-3	Vengurla	Bold nut type
2	Bhubaneswar cluster -1	Ranasinghpur	Cluster bearing type
3	Bhubaneswar cluster-2	Ranasinghpur	Cluster bearing type
4	BH-6	Ranasinghpur	Bold nut type
5	BH-85	Ranasinghpur	Bold nut type
6	BH-105	Ranasinghpur	Bold nut type
7	Jhargram-1	Jhargram	Bold nut type
8	BPP 30/1	Bapatla	Cluster bearing type

CHINTAMANI

Out of 126 germplasm collections maintained at ARS, Chintamani, 103 germplasm accessions are yielding.

The plant height varied between 4.4 m & 6.7 m. For these high yielding varieties and the plant canopy spread was found to range between 7.7 m and 14.06 m (EW) and between 9.6 m and 14.5 m (NS) (Table 1.5). Among 103 germplasm collections which are yielding, the accessions which had highest yield of nuts for the year 2004 were 71/1ARSC (V-5) 46 kg nuts/tree, 53/3 ARSC(ME-4/4) 40 kg nuts/tree, 65/3 ARSC (5/37) 37 kg nuts/tree, 61/2 ARSC (9/88) 31.5 kg nuts/tree, 95/1 ARSC(K3C) 36.0 kg nuts/tree, 74/6 ARSC (Vengurla – 2) 31.0 kg nuts/tree and 5/1 ARSC (8/46 Taliparamba) 30.0 kg nuts/tree.

During the year under report, the grafts of the previously identified local types were made and collected two local types which are high yielding with big nut size.

Table 1.5 : Growth measurements and nut yield of accessions/ varieties conserved at Chintamani

Accession number	Plant height (m)	Canopy spread (m)		Annual nut yield/tree(kg) (2004-05)
		E –W	N –S	
5/1 ARSC (8/46Taliparamba)	4.50	10.70	10.00	30.00
53/ 3 ARSC (ME-4/4)	5.30	7.70	10.00	40.00
61/ 2 ARSC (9/88)	6.70	11.00	14.50	31.50
65/ 3 ARSC (5/37)	5.50	14.06	13.60	37.00
71/ 1 ARSC (V-5)	5.70	12.40	12.60	46.00
74/ 6 ARSC (Vengurla-2)	5.60	10.60	11.20	31.00
95/ 1 ARSC (K_3C)	4.40	10.00	9.60	36.00

Performance of promising germplasm accessions for yield at Chintamani

The promising five germplasm accessions which had high cum. Yield were 44/1 ARSC (Vengurla –5) 214.93 kg nuts/tree, 41/3 ARSC (5/37 – Manjeri) 213.59 kg/tree, 35/3 ARSC (ME 4/4) 207.80 kg nuts/tree, 2/6 ARSC (3/108 Gubbi) 200.67 kg nuts/tree and 44/5 ARSC (Vengurla-5) 183.0 kg nuts/tree, while 35/3 ARSC (ME 4/4) and 41/3 ARSC (5/37 – Manjeri) had higher mean nut weight of 6.30g and 7.18g respectively (Table 1.6).

Table 1.6 : Performance of promising germplasm accessions for yield at Chintamani

Accession Number	Year of Planting	Yield (kg) during 2004	Cum. Yield (kg)	Mean nut yield (kg)	Mean nut weight (g)
2/6 ARSC (3/108 Gubbi)	1982	24.50	200.67 (20 yrs)	10.33	4.10
35/3 ARSC (ME 4/4)	1985	40.00	207.80 (16 yrs)	12.98	6.30
41/3 ARSC (5/37-Manjeri)	1985	37.00	213.59 (16 yrs)	13.34	7.18
44/1 ARSC (Vengurla-5)	1985	46.00	214.93 (16 yrs)	13.43	4.08
44/5 ARSC (Vengurla-5)	1985	19.00	183.00 (16 yrs)	11.43	4.08

JAGDALPUR

The maximum plant height (3.58 m) and maximum stem girth (66cm) were recorded in NRC-192 followed by NRC-138 for plant height (3.13 m) and NRC-130 for plant height (2.42m). Canopy spread was found to be wider for NRC – 192 (E-W/N-S = 5.73m / 5.18m) (Table 1.7). Maximum flowering intensity /m^2 (5766.16) was found in NRC-190.

The nut yield/tree for 2004-05 was highest for NRC- 193 (2.30 Kg/tree), followed by NRC–191 (2.16 Kg/tree). The cumulative nut yield was highest in NRC- 191 (8.24 Kg) for 6 harvests. Mean nut yield was found to be highest for NRC-191 (1.37 kg) followed by NRC-137 (1.36 kg) (Table 1.7). Shelling percentage was highest in NRC- 137 (32.61%). The highest nut weight (8.83g) & apple weight (98.00g) was recorded in NRC—140.

Table 1.7 : Performance of NRCC germplasm accessions (Planted during 1996-97) for growth and yield characters at Jagdalpur

Accession/ Variety	Plant Height (m)	Canopy Spread (m)		Yield during 2004-05 (Kg/Plant)	Cum. yield (Kg/Plant)	Mean yield (Kg/plant)#	Mean nut weight (g)
		E-W	N-S				
NRC- 130	2.42	4.43	4.82	1.00	3.47	0.58	7.25
NRC- 131	2.46	4.17	4.01	1.65	5.54	0.92	7.65
NRC- 136	1.99	2.97	3.22	0.52	3.25	0.54	6.93
NRC- 137	2.79	3.83	3.90	1.91	8.16	1.36	7.10
NRC- 138	3.13	3.53	3.28	0.72	5.38	0.90	7.58
NRC- 140	2.24	4.10	3.84	1.24	2.72	0.45	8.83
NRC- 190	2.57	2.45	2.78	0.47	1.30	0.22	5.80
NRC- 191	2.77	4.36	4.64	2.16	8.24	1.37	6.30
NRC- 192	3.58	5.73	5.18	0.29	0.89	0.15	6.70
NRC- 193	2.65	5.33	4.34	2.30	5.65	0.94	6.66
SE (m)	0.14	0.31	0.24	0.23	-	-	-
CD at 5%	0.32	0.71	0.55	0.52			

Mean of 6 harvests.

JHARGRAM :

Two cashew germplasms were collected from West Midnapore District which had 7.0g and 6.4g nut weight and open and compact canopies, respectively.

JGM-38 performed better than all other accessions for yield during 2004-05 and yielded 14.70 kg nut / tree followed by JGM-74/6 (13.33kg/tree) and JGM-34/3 (12.7 kg/tree). The highest cumulative yield was recorded in JGM 34/3 (147.79 kg/tree followed by JGM-31 (132.96 kg/tree). Out of the 11 accessions which performed better, four accessions had more than 7.00g nut weight *viz.*, JGM – 16/1 (8.00g), JGM – 34/3 (7.92g), JGM-98 (7.33g.) and JGM-48/4 (7.06g.). Though JGM-19/1 had a nut weight of 5.0g and a yield of 7.52kg/tree, the shelling percentage was highest (39.25%). The second best germplasm with respect to shelling percentage was JGM-34/3 (32.32%) (Table 1.8).

The overall best performance during the current season was in case of JGM-38, which yielded 14.70kg nut/tree, having nut weight of 6.96g and shelling percentage of 28.28 (Table 1.8).

Table 1.8 : Performance of promising germplasm accessions at Jhargram.

Accession No.	Year of Planting	Yield during 2004-05 (Kg/tree)	Cum. yield (Kg/tree)	Mean nut wt (g)	Mean apple wt. (g)	Shelling %
JGM – 34/3	1984	12.70	147.79	7.92	31.00	32.32
JGM – 48/4	1983	5.00	130.63	7.06	50.00	28.04
JGM- 31	1983	7.33	132.96	6.84	32.50	29.23
JGM – 98	1986	7.50	53.55	7.33	78.00	30.40
JGM – 94	1985	8.50	75.47	6.61	40.33	30.50
JGM – 38	1985	14.70	110.06	6.96	31.00	28.28
JGM – 92	1986	6.00	73.96	6.00	52.33	30.13
JGM – 16/1	1983	6.58	111.99	8.00	35.00	29.96
JGM – 57/1	1985	8.71	104.05	6.27	42.00	25.83
JGM – 74/6	1983	13.33	128.70	6.38	48.75	28.23
JGM – 19/1	1984	7.52	105.91	5.00	25.00	39.25

MADAKKATHARA

Out of 148 accessions, collected till 2004, 108 accessions were planted at a close spacing of 4 x 4 m during 1988, while, 38 accessions were planted at normal spacing of 7.5 m x 7.5 m during 2002 and 2 accessions being planted in 2005.

Highest annual yield was recorded in V-1 (6.70 kg) followed by BPP-2 (3.50 kg), H 3-13 (3.50 kg) and H 719 (3.40 kg). H-719 had the highest cumulative yield of 29.55kg/tree (Table 1.9). The mean nut weight was maximum in case of Vapala (10.00g) followed by H-8-15 (8.90g) and K-10-1 (8.20g).

Table 1.9: Yield and yield attributes of promising germplasm accessions at Madakkathara

Accession	Year of planting	Yield during 2004(kg/tree)	Cumulative yield (kg/tree/ year) (12 years)	Mean nut yield (kg/tree/ annum)	Mean nut weight (g)
BPP-2	1990	3.50	10.92 *	1.20	4.20
V-1	1990	6.70	10.46 *	1.43	6.60
H-8-15	1989	1.00	12.31	1.12	8.90
H-9-3	1989	0.70	13.27	1.16	7.90
BLA-256/4	1989	0.90	12.66	1.13	7.50
K-10-1	1989	0.30	13.18	1.12	8.20
A-26/2	1989	1.00	17.82	1.57	6.20
Vapala	1989	2.30	17.17	1.62	10.00
H-719	1989	3.40	29.55	2.75	3.80
H-3-13	1989	3.50	19.87	1.95	5.30

* Yield for 11 years

PILICODE

Among the accessions planted in 1998, PCKC-9 (5.39 kg/tree) followed by BLM 1 (5.23 kg/tree) were found to be performing better with respect to yield and other biometric characters recorded. The dwarf type TPB-1 was used for hybridization programme with MDK-1 and ANK-1 (Table 1.10).

Table 1.10 : Biometric observations of Cashew germplasm (Planted during 1998 & 2000) at Pilicode

Accession No./Variety	Plant Height(m)	Collar Girth(cm)	Canopy Spread (m)		Bisexual flowers(%)	Yield of nuts (kg/tree)
			E-W	N-S		
PCKC-4	7.34	66.24	6.11	6.85	6.27	4.96
PCKC-8	8.14	70.50	4.65	4.74	8.46	1.95
PCKC-9	7.40	67.50	4.60	5.80	5.97	5.39
BLM-1	7.16	63.00	5.66	5.70	10.30	5.23
OCT-2	6.70	59.12	4.53	5.78	7.40	1.70
BLM 3	6.95	61.36	5.30	5.16	3.40	0.77
BLM 2	7.18	68.00	4.87	7.00	3.50	0.35
Elappara	5.00	48.00	3.00	3.25	-	-
KM-1	6.25	68.00	5.85	6.40	4.02	0.40
Kodoliparam	6.75	70.66	5.80	6.90	5.70	1.10
TPB-1	1.76	20.75	1.91	1.85	-	

VENGURLE

The germplasm accessions collected from Goa during 1994 revealed on evaluation that Balli-2 gave the highest cumulative nut yield (10.18 kg/tree). Maximum nut weight of 8.5g was recorded in germplasm accessions Baikul and Fermagudi (Table 1.11).

Table 1.11 : Performance of germplasm accession (planted in 1994) from Goa at Vengurla.

Accession	Yield (kg/tree)		Cum yield for 5 annual harvest (kg/tree)	Nut Wt. (g)	Apple Wt. (g)	Shelling
	2003	2004				
Balli-1	1.00	0.80	5.38	6.00	65.50	29
N.P.	2.15	2.07	9.16	7.50	120.00	25
Paikul	-	0.26	6.73	6.50	55.00	27
Balli-2	-	0.65	10.18	6.50	76.60	24
Baikul	0.55	0.49	8.71	8.50	73.50	29
Fermagudi	0.20	0.24	2.16	8.50	41.50	26
Dodamarg	0.5 9	1.06	6.96	7.50	71.50	27

VRIDHACHALAM

All the available 264 germplasm accessions were maintained. Eight types planted during 1999 indicated that TK 1 recorded the highest nut yield of 3.63 kg/tree followed by SL 1 (3.12 kg/tree). The nut weight was highest in KK1 (7.4 g) followed by SL 1(7.2 g) (Table 1.12).

Table 1.12: Growth Measurements and nut yield of accessions (planted in 1999) conserved at Vridhachalam

Accession number	Plant height (m)	Canopy spread (m)		Nut yield (kg/tree)	Cumulative yield (kg/tree) 2nd harvest	Mean nut weight (g)
		E-W	N-S			
VSK 1	3.29	4.44	4.66	2.84	4.64	6.80
VSK 2	2.73	4.05	3.91	2.97	4.73	7.00
SL 1	3.33	6.29	5.81	3.12	4.81	7.20
TK 1	3.78	4.95	4.66	3.63	4.91	5.70
NK 1	3.24	4.90	4.97	2.68	4.52	6.60
KK 1	3.49	4.67	4.76	2.50	4.25	7.40
PV 1	3.32	6.06	4.81	2.88	4.63	6.20
AM	3.34	5.69	5.77	2.57	4.34	6.00

Gen.3. Varietal Evaluation Trials

1. Multi Location Trial - II

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani and Jagdalpur

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

SUMMARY :

The maximum nut yield per tree was recorded in T10/19 (10.74kg) which had a cumulative yield of 36.23kg for 9 harvests at Bapatla. At Bhubaneswar H-320 and H-303 gave the annual nut yield of 9.50 and 8.70kg/tree respectively and also had the highest cumulative nut yield of 50.80kg and 47.60kg/tree respectively for 9 harvests. HY-320 and NRCC Sel-2 showed consistent performance at Chintamani by having highest yield of 26.20kg and 19.75kg/tree during 2004. H-303 (1.55kg/tree) and HY-320 (4.65kg/tree) from Vengurle were found to have highest nut yield at Jagdalpur and Madakkathara, respectively. The highest panicle count of 13.60/m^2 was recorded in M-44/3 at Vengurle and maximum number of flowering laterals per m^2 (59.20) was recorded in M-15/4 at Vridhachalam.

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 (1993 at Bapatla, 2002 at Jhargram, 1994 at Vridhachalam)

BAPATLA

During 2004, highest plant height (4.83m) and maximum stem girth (79.80cm) were recorded in the entry T.No 3/33 (Table 1.13). The mean duration of flowering was the lowest in T.No10/19 (85.0days) followed by H-320 (85.3days). The maximum number of panicles per square meter was recorded in T.No.30/1 (25.88) followed by M-44/3 (25.86).

The maximum mean annual nut yield per tree was recorded in T.No.10/19 (10.74kg) followed by H-320 (8.60 kg). The highest cumulative nut yield per tree was recorded in T.No.10/19 (36.23 kg) followed by T.No.30/1 (35.39kg) for nine annual harvests. The highest nut weight was recorded in H-367 (9.90g) followed by H-255 (9.03g) during 2004. (Table 1.14).

Table 1.13: Vegetative and flowering characters of cashew types in MLT-II at Bapatla

Variety/ Genotype	Plant height (m)	Trunk girth (cm)	Number of flowering laterals m^{-2}
T.No. 3/33	4.83	79.80	24.50
T.No.30/1	4.09	66.30	25.88
M-44/3	3.67	65.10	25.86
CD at 5%	**NS**	**NS**	**1.98**

Table 1.14: Performance of different varieties at Bapatla under MLT-II at Bapatla

Sl. No.	Variety/ Genotype	Annual Yield (kg/tree) (9^{th} harvest)	Cumulative Yield (kg/tree) (9 harvests)	Nut weight (g)	Shelling (%)
1	T.No.3/33	7.40	24.33	7.56	32.10
2	T.No.10/19	10.74	36.23	7.44	34.90
3	H-320	8.60	18.52	8.92	34.80
4	T.No. 30/1	7.75	35.39	7.52	21.20
5	H-367	6.77	17.94	9.90	24.50
6	H-255	3.85	12.40	9.03	27.20
	CD at 5%	**NS**	**--**	**0.12**	**3.00**

BHUBANESWAR:

The cashew type H-255 had maximum height (6.10m), maximum trunk girth (108cm) and the highest N-S canopy spread (10.80m), whereas M 44/3 had minimum height (2.90m), minimum trunk girth (50cm) and the lowest N-S canopy spread (4.40m) as well as E-W canopy spread (4.70m). The highest number of flowering laterals/m^2 was recorded in H-367 (26.00) followed by H-68 (25.00) and H-303 (24.00) (Table 1.15).

The highest nut yield (kg/plant) was observed in H-320 (9.50) followed by H-303 (8.70) and NRCC Sel-2 (8.00). Cumulative nut yield (kg/plant) for 9 harvests was recorded to be the highest in H-320 (50.80) followed by H-303 (47.60), BPP 30/1 (45.20), H-68 (38.00), NRCC Sel-2 (37.70) and H367 (35.30). Maximum number of nuts/panicle was observed in H-303 (4.00) as well as in M44/3 (4.00). Heaviest nut weight was observed in H-367 (9.40g) followed by H-68 (8.70g), H-255 (8.50) and H-320 (8.40). Nut weight (g) of more than 7g was also recorded in NRCC Sel-2 (7.60), NRCC Sel-1 (7.40) M 15/4 (7.30) BPP 3/33 (7.30) and H-303 (7.10). Highest apple weight was recorded in H-367 (90.00g) followed by H-255 (75.00g) and NRCC Sel-1 (65.00g). Shelling percentage was maximum in NRCC Sel-1 (32.70) followed by NRCC Sel-2 (29.80) and H-303 (29.5%) (Table 1.16).

There was no significant difference in plant height and girth of the plant under the MLT 2002 evaluation during 2004. Maximum plant height was observed in Goa-11/6 (1.40 m) and minimum in H-167 (1.00 m). The girth of plant varied from 12.17cm in H-14 to 15.17 cm in H-3/2 (Table 1.17)

Table 1.15: Vegetative & flowering characters of cashew types in MLT- II at Bhubaneswar

Sl. No.	Variety/ Genotype	Plant Height (m)	Trunk Girth (cm)	Canopy Spread (m)		No. of flowering laterals/m^2
				E-W	N – S	
1	NRCC Sel-1	5.00	8.00	8.20	8.40	20.00
2	NRCC Sel-2	4.90	79.00	8.10	8.70	21.00
3	M 44/3	2.90	50.00	4.70	4.40	22.00
4	M 15/4	4.70	93.00	8.10	8.20	20.00
5	BPP 3/33	5.40	97.00	7.90	8.50	20.00
6	BPP 10/19	5.60	97.00	9.70	10.30	20.00
7	BPP 30/1	5.20	83.00	8.60	8.20	20.00
8	BPP 3/28	5.50	99.00	10.10	9.60	16.00
9	H 303	4.90	89.00	8.70	8.90	24.00
10	H 320	5.40	92.00	9.90	8.80	20.00
11	H 255	6.10	108.00	9.70	10.80	23.00
12	H 367	4.80	88.00	9.60	9.20	26.00
13	H 68	5.20	91.00	9.60	9.20	25.00

Table 1.16: Yield and yield attributing characters of cashew types in MLT-1992 at Bhubaneswar

Sl. No.	Variety / Genotype	Nut yield (kg/plant)	Cumulative nut yield (kg/plant) 9 harvests	Number of nuts/panicle	Nut weight (g)	Apple weight (g)	Shelling (%)
1	NRCC Sel-1	4.00	17.50	2	7.40	65.00	32.70
2	NRCC Sel-2	8.00	37.70	3	7.60	50.00	29.80
3	M 44/3	2.40	19.90	4	4.90	24.00	27.90
4	M 15/4	2.00	21.10	1	7.30	63.30	28.00
5	BPP 3/33	6.00	32.90	3	7.30	49.00	27.40
6	BPP 10/19	3.50	25.60	2	5.50	60.30	27.80
7	BPP 30/1	5.30	45.20	3	5.70	38.30	26.80
8	BPP 3/28	5.90	32.20	3	6.90	57.30	29.70
9	H 303	8.70	47.60	4	7.10	42.70	29.50
10	H 320	9.50	50.80	3	8.40	58.30	28.20
11	H 255	3.20	25.70	1	8.50	75.00	27.90
12	H 367	6.40	35.30	1	9.40	90.00	28.10
13	H 68	6.30	38.00	2	8.70	42.00	28.90
SE (m) $\pm$		0.90					
C.D. 5%		2.62					

Table 1.17: Vegetative characters of cashew types under multilocation trial-III at Bhubaneshwar.

Sl. No.	Variety/ Genotype	Plant height (m)	Trunk Girth (cm)
1.	BH-6	1.20	13.17
2.	BH-85	1.30	13.07
3.	H 1597	1.30	13.83
4.	K 22-1	1.30	14.17
5.	H 662	1.10	12.83
6.	H 675	1.00	13.17
7.	H 11	1.10	14.00
8.	H 14	1.00	12.17
9.	H 3/2	1.20	15.17
10.	Goa 11/6	1.40	14.83
11.	H 2/16	1.20	13.67
F 'test'		NS	NS

CHINTAMANI :

The highest plant height (5.65m) was observed in NRCC-Sel-1 followed by NRCC-Sel-2 (40/1) (5.29m) and Hy-255 (5.25m). The least plant height was observed in TN-30/1 (4.49m) (Table 1.18).

There were no significant differences among the entries regarding the stem girth. The maximum canopy spread (E-W) was observed in Hy-255 (9.08m) followed by NRCC Sel-1 (9.04 m) and TN-3/33 (9.00 m). The least spread was noticed in entry NRCC Sel-2 (7.31 m). The highest canopy spread (N-S) was recorded in Hy-255 (9.54 m) followed by Hy-320 (9.38 m) and NRCC Sel-1 (9.37 m). The minimum spread was observed in M-44/3 (6.55 m).

The highest number of flowering laterals/m^2 were recorded in entry M-44/3 (15.50) followed by TN-3/33 (14.80) and Hy-320 (14.00). The lowest number of flowering laterals was observed in Hy-302 (5.00) (Table 1.18).

Table 1.18: Vegetative & flowering characters of cashew in MLT – II at Chintamani

Variety/ Genotype	Height of plant (m)	Girth of plant (cm)	Canopy spread (m)		No. of flowering laterals/m^2
			E —W	N —S	
Hy-68	5.10	92.05	8.65	9.12	7.00
Hy-367	4.57	85.72	8.37	8.26	12.00
Hy-302	4.55	94.08	8.93	8.84	5.00
Hy-255	5.25	95.22	9.08	9.54	8.00
Hy-320	5.23	86.08	8.81	9.38	14.00
M-44/3	4.28	72.88	7.38	6.55	15.50
M-15/4	5.16	89.94	8.98	9.03	10.25
NRCC Sel-1	5.65	90.41	9.04	9.37	8.50
NRCC Sel-2	5.29	68.58	7.31	8.06	12.00
TN-30/1	4.49	79.83	8.05	7.90	9.50
TN-3/33	5.20	91.22	9.00	8.83	14.80
TN-10/19	5.14	86.05	7.82	9.15	8.25

TN-3/28	5.08	86.42	8.34	8.87	11.00
Ullal-1	5.11	96.63	8.46	8.00	10.50
	**	NS	NS	NS	
Sem±	0.12	6.02	0.57	1.01	
CD @ 5%	0.38	-	-	-	

There was significant difference in the nut yield among the varieties/entries. Significantly, highest nut yield was recorded in the entry Hy-320 (23.62 kg/tree) followed by NRCC Sel-2 (19.75 kg/tree) and M-15/4 (19.00 kg/tree). The lowest nut yield was obtained in Hy-367 (5.69 kg/tree) (Table 1.19).

H-320 recorded highest cumulative yield for 10 harvests (56.18 kg/tree) followed by the entries NRCC Sel-2 (54.79 kg/tree) and H-302 (47.61 kg/tree). The cumulative yield was least in H-68 and TN 10/19 (17.57 kg and 22.42 kg/tree, respectively).

The variety H-255 recorded highest nut weight (8.27 g) followed by Hy-320 (7.98 g), H-367 (7.96 g), H-68 (7.51 g) and H-302 (7.34 g). Least nut weight was recorded in TN-30/1 (4.69 g) and TN-10/19 (4.81 g). The shelling percentage was highest in NRCC Sel-1 (30.70%) and least in H-68 (25.20%) (Table 1.19).

The highest number of nuts/panicle was observed in H-320 (8.00) followed by H-68 (6.00) and NRCC Sel-1 (6.00). The least number of nuts/panicle was recorded in TN-10/19 (2.00)

The highest average apple weight was recorded in H-367 (95.00g) followed by H-320 (90.00g) and H-68 (85.00g). The lowest average apple weight was observed in TN-10/19 (30.00g) (Table 1.19).

Table 1.19: Yield and yield attributing characters of cashew types in MLT – II at Chintamani

Variety / Genotype	Nut yield (kg/plant)	Cum. Nut yield (kg/plant) 10 harvests	No. of nuts/panicle	Nut Weight (g)	Apple weight (g)	Shelling (%)
Hy-68	6.25	17.57	6.00	7.51	85.00	25.20
Hy-367	5.69	42.05	4.50	7.96	95.00	29.60
Hy-302	12.00	47.61	3.50	7.34	55.00	27.70
Hy-255	11.68	31.32	5.20	8.27	50.00	29.80
Hy-320	23.62	56.18	8.00	7.98	90.00	27.80
M-44/3	14.83	39.75	5.00	5.01	40.00	28.60
M-15/4	19.00	39.53	4.00	5.87	55.00	28.00
NRCC Sel-1	12.16	40.44	6.00	6.64	40.00	30.70
NRCC Sel-2	19.75	54.79	5.80	5.33	55.00	27.00
TN-30/1	15.16	43.45	3.60	4.69	60.00	29.00
TN-3/33	14.75	26.35	5.00	6.25	75.00	27.40
TN-10/19	16.00	22.42	2.00	4.81	30.00	30.00
TN-3/28	17.50	28.68	4.00	6.56	70.00	28.20
Ullal-1	14.16	28.46	5.40	6.06	35.00	29.30
	****					
Sem±	0.81					
CD @ 5%	2.36					
CV %	9.70					

JAGDALPUR

H-68 had the maximum plant height (2.68 m) and trunk girth (30.83 cm), which was found statistically on par with V-4, H-303, H-367 and NRCC Sel-1. For canopy spread, H-367 was found to have largest coverage (E-W/N-S=2.45/2.61m), which was at par with 3/33, 30/1, H-68, H-255, H-303, H-320, NRCC Sel-1 & Vengurla-4.

The variety 30/1 was significantly higher in flowering intensity/m^2 (6239.68). Number of fruits/ panicle was maximum for 30/1 (9.68) followed by H-303 (8.27), H-68 (7.13) and V-4 (6.92). [Yield (kg/tree) was markedly highest for H-303 (1.55 kg). Nut weight was significantly highest for H-255 (10.80 g), while apple weight in H-367 was the heaviest but at par with 3/28, H-68, H-320, V-4 and NRCC Sel.-1. Shelling percentage was recorded to be maximum for V-4 & VRI-1 (32.43% for both). The highest annual nut yield of 1.55kg/tree was recorded in H-303 followed 1.46kg/tree in H-68 (Table 1.20).

Table 1.20: Performance of different varieties for vegetative, flowering, yield and nut characters in MLT- II at Jagdalpur

Varieties/ Genotypes	Plant height (m)	Girth (cm)	Canopy Spread (m)		Flowering intensity/m^2	No. of fruits / panicle	Annual yield (Kg/tree)	Nut weight (g)	Shelling %
			E—W	N—S					
3/28	2.04	25.58	1.78	1.66	3953.84	5.27	0.60	7.00	30.82
3/33	2.03	22.50	1.87	2.07	2419.40	4.06	0.62	6.00	29.52
30/1	1.74	22.17	1.81	1.98	6239.68	9.68	1.07	6.40	28.37
10/19	1.99	25.08	1.93	1.75	4126.40	4.11	1.17	5.40	30.74
VRI-1	1.36	16.31	1.38	1.16	4140.40	4.68	0.48	5.60	32.43
VRI-2	1.02	14.42	0.97	1.05	4332.32	3.40	0.26	5.20	31.35
H-68	2.68	30.83	2.11	2.32	3271.76	7.13	1.46	9.20	29.75
H-255	1.84	25.08	1.90	1.85	3274.24	4.82	0.74	10.80	30.13
H-367	2.13	29.25	2.45	2.61	2749.60	5.57	0.95	10.20	28.64
H-320	1.82	27.31	2.02	2.25	2702.00	5.69	1.18	8.40	27.00
H-303	2.42	28.00	2.37	2.54	2495.00	8.27	1.55	9.00	27.56
NRCC Sel-1	2.15	23.75	1.99	1.87	1731.44	4.58	0.30	8.80	31.51
NRCC Sel-2	1.48	29.17	1.68	1.49	2300.92	6.39	0.80	10.00	31.93
V-4	2.25	27.33	2.13	2.21	2444.92	6.92	1.26	9.00	32.43
SE(m)	0.26	4.38	0.31	0.36	987.16	1.38	0.33	0.11	0.86
CD 5%	0.55	9.01	0.64	0.75	2029.60	2.85	0.67	0.24	1.76

JHARGRAM

The genotypes under MLT-II were statistically on par for plant height and girth while, there was a significant difference in canopy spread at one year age of the plants. Among the thirteen entries, highest canopy spread was recorded in T.No. 3/33 (1.98m) followed by H-255 (1.57m).

Table 1.21: Growth parameters of different varieties under MLT-II at Jhargram

Variety/ Genoytpe	Plant Height (m)	Trunk Girth (cm)	Canopy spread (m)
T.No. 10/19	1.44	8.60	1.40
T.No. 3/33	1.12	6.23	1.98
T.No. 3/28	1.21	6.83	0.99
T.No. 30/1	0.93	7.10	1.10
H – 68	1.03	6.33	0.75
H– 367	1.21	7.67	1.00
H – 303	1.04	7.17	0.83
H – 255	1.40	8.93	1.57
H – 320	1.15	6.42	1.06
M – 44/3	1.41	9.27	1.49
M – 15/4	0.70	5.33	0.68
NRCC Sel – 1	1.30	7.33	1.31
NRCC Sel – 2	1.80	6.27	0.86
S.Em (±)	0.09	0.51	0.08
CD at 5%	N.S.	N.S.	0.16
CV	11.76%	12.37%	12.28%

MADAKKATHARA

There was significant difference in tree height among the evaluated geno types. T 107/3 and HY 303 were on par with a height of 6.55 cm and 6.35 cm. The lowest height of 5.19 m was recorded in M 44/3 (Table 1.22)

Highest number of bisexual flowers was observed in T 40/1 and lowest was in HY 68. The highest number of nuts per panicle (8.0) was recorded in genotype T 107/3 and lowest number in T 3/33, Hy-68 and M 15/4 (3.0 in all genotypes) (Table 1.22).

Nut yield was highest in M 15/4 (4.90kg/tree) followed by HY 320 (4.65 kg/tree) and M 44/3 (4.34 kg/tree). T 10/19 recorded the lowest yield of 0.67 kg/tree. The mean nut weight was the highest in T 40/1 (11.76g) and recorded lowest in T 107/3 (4.17g). HY 367 recorded the highest shelling percentage of 29.15 and HY 303 the lowest of 22.87. HY 68 recorded the highest kernel weight of 2.72g and the lowest (1.60g) was recorded in T44/3; the kernel weight differed significantly.

Table 1.22 : Vegetative, flowering characters, yield and yield attributing characters of cashew types in MLT II at Madakkathara

Source	Variety	Height (m)	Girth (cm)	Canopy Spread (m)		Nut Yield (kg/tree)	Cum. Nut Yield (kg/tree)	Nut wt (g)	Shelling %	Kernel wt. (g)	No. of bisexual flowers in a panicle
				EW	NS						
Bapatla	T 30/1	6.22	90.78	4.30	2.99	1.90	16.91 (3)	8.03	26.52	1.92	3.60
	T 3/33	6.28	94.44	5.40	2.60	3.04	8.76 (6)	8.33	25.78	2.14	4.30
	T 10/19	6.05	84.74	2.01	5.02	0.67	7.96 (2)	7.40	26.24	1.94	2.30
	T 3/28	5.84	92.73	3.12	5.01	4.18	18.59 (6)	8.00	24.40	1.95	7.60
Vengurla	Hy 367	5.38	95.24	4.23	3.30	2.38	4.17 (3)	9.09	29.15	2.61	3.30
	Hy 68	6.33	91.79	3.25	3.65	3.12	14.47 (4)	9.52	26.10	2.70	2.30
	Hy 303	6.35	91.11	4.23	2.73	1.44	22.42 (3)	10.53	22.87	2.34	3.60
	Hy 255	6.46	99.92	3.25	4.44	0.94	8.99 (3)	8.00	27.30	2.17	3.30
	Hy 320	6.03	87.48	4.30	3.27	4.65	18.84 (9)	10.00	22.88	2.28	4.30
Vridhachalam	M 44/3	5.19	79.95	3.52	3.46	4.34	12.36 (7)	5.83	27.20	1.60	2.60
	M 15/4	5.96	88.52	3.42	4.48	4.90	20.77 (9)	5.56	24.75	2.48	4.30
NRCC, Puttur	T 40/1	5.96	84.95	4.11	3.07	1.15	13.50 (3)	11.76	23.09	2.72	8.00
	T 107/3	6.55	111.09	5.15	2.65	1.80	11.69 (2)	4.17	26.10	1.92	7.00
Check	H 1608	5.83	96.42	3.52	4.00	1.38	21.18 (4)	9.09	27.72	2.37	7.60

VENGURLE

It was observed that T.No.3/28 recorded maximum height (5.18 m) followed by 30/1 (5.17 m). The girth was found to be maximum (64 cm) in 30/1 and maximum canopy spread recorded by Hy No. 320 (7.63 m)

The number of panicle/sq.m. was maximum (13.16) in M 44/3. The nut yield was maximum (1.90 kg) in Hy No.303 followed by Hy. No. 367 (1.50 kg). The maximum nut wt. (10.50 g) was recorded for Hy. No. 367 and the number of fruits/panicle were maximum (13.66) in M44/3 (Table 1.23).

Table 1.23 :Growth and yield observations in MLT-II at Vengurle.

Variety/type	Height (m)	Girth (cm)	Canopy Spread (m)	Flowering panicle/ sq. m.	No. of fruits/ panicle	Yield (kg/tree)	Nut weight (g)
Hy.No.255	4.74	59.00	7.52	8.38	10.38	1.23	9.83
Hy.N0.303	3.96	47.00	4.85	9.63	12.59	1.90	9.66
Hy.No.320	4.60	62.00	7.63	8.63	8.84	0.63	9.66
Hy.No.367	3.23	44.00	5.69	9.00	11.04	1.50	10.50
T.107/3	4.80	60.00	6.56	7.66	6.85	0.57	8.83
T.40/1	3.69	44.00	5.86	11.33	8.80	0.77	8.33
M-44/3	3.40	43.00	4.43	13.16	13.66	1.19	5.16
M-15/4	3.83	40.00	4.88	8.83	9.81	1.00	7.33
10/19	4.73	61.00	6.18	9.08	10.16	0.47	6.50
3/28	5.18	56.00	5.43	7.95	6.61	0.41	6.66
3/33	4.64	53.00	6.19	9.82	7.82	0.70	6.66
30/1	5.17	64.00	6.64	7.41	9.70	0.79	6.67
SE m±	0.28	0.04	0.55	0.76	1.55	0.33	0.23
CD at 5%	0.83	0.13	1.63	2.24	N.S.	N.S.	0.70

VRIDHACHALAM

The maximum plant height (5.10m) was recorded in T.No. 10/19 and maximum stem girth (66.90cm) was recorded in NRCC Sel-1. The highest number of flowering laterals/m^2 (59.20) was noticed in M 15/4 (Table 1.24). The maximum nut yield per tree was observed in M 15/4 (VRI 4) (3.23 kg) followed by M 44/3 (3.55 kg). The cumulative yield/tree was the maximum of 17.93 kg in M 44/3 (VRI 2). The mean number of fruits per panicle was maximum in M 44/3 (VRI 2) (4.20) and single nut weight was maximum (7.80 g) in H 320 of Vengurla. The highest shelling percentage of 27.80 was observed in H 320 (Table 1.25).

Table 1.24 : Vegetative and flowering characters of cashew types in MLT-II at Vridhachalam

Cashew types	Height of plant (m)	Girth of Plant (cm)	Canopy spread (m)		No. of flowering laterals/m^2
			E-W	N-S	
BAPATLA					
T. 30/1	4.60	50.60	5.10	4.70	45.60
T. 3/33	3.90	45.35	5.00	4.90	39.90
T.10/19	5.10	60.35	6.30	6.80	40.50
T. 3/28	4.10	50.30	6.30	6.20	37.50
VENGURLA					
H 68	4.10	50.85	6.60	5.90	43.30
H 367	4.00	54.10	6.30	6.10	45.20
H 303	5.00	60.70	6.50	6.30	49.40
H 255	4.50	50.60	5.80	4.70	4.10
H 320	4.30	47.50	6.20	6.30	50.80
VRIDHACHALAM					
M 44/3	4.50	48.90	6.10	5.90	47.30
M 15/4	4.70	62.10	7.20	6.30	59.20
NRCC, PUTTUR					
NRCC Sel-1	5.00	66.90	7.20	5.50	38.30
NRCC Sel-2	4.30	50.60	6.10	5.90	40.00

Table 1.25 : Yield and Yield attributing characters of cashew types in MLT-II at Vridhachalam

Cashew types	Nut yield (Kg)	Cumulative yield (Kg/Plant)	No. of fruits / panicle	Nut weight (g)	Shelling (%)
BAPATLA					
T. 30/1	3.12	8.76	3.50	6.60	24.70
T. 3/33	2.86	8.47	2.50	6.60	24.60
T.10/19	2.93	7.71	2.20	7.00	24.80
T. 3/28	2.80	8.66	2.20	6.00	25.80
VENGURLA					
H 68	2.90	9.61	2.00	5.80	26.40
H 367	2.59	9.52	2.00	6.50	25.90
H 303	2.80	12.69	3.00	5.20	26.40
H 255	2.67	7.17	2.00	7.00	27.40
H 320	3.08	10.45	3.00	7.80	27.80
VRIDHACHALAM					
M 44/3	3.55	17.93	4.20	6.80	26.80
M 15/4	3.23	15.26	3.40	6.90	26.20
NRCC, PUTTUR					
NRCC Sel-1	2.60	6.84	2.00	6.90	27.00
NRCC Sel-2	2.52	9.90	2.00	6.80	26.80

2. Multi Location Trial – III

Centres: East Coast

Bapatla, Bhubaneshwar and Vridhachalam

West Coast

Madakkathara and Vengurla

Plains / others

Chintamani

The objectives of the project are:

To evaluate the performance of TMB tolerant accessions and promising hybrids identified.

Experimental Details :

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

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

Replications – Three

Spacing 7.5 x 7.5 m

Plot size 4 plants per plot

As this trial has been planted only in 2003, preliminary data from only one Centre is reported.

MADAKKATHARA

The trial is in the initial stage of growth and hence, only data on plant height and girth are available. Maximum height was shown by genotype H-11 (107.35 cm) followed by H-662 (100.17cm) and minimum height by H-675 (79.42 cm). Maximum girth was shown by H-32/4 (10.42 cm) and minimum in case of Dhana (5.50 cm) (Table 1.26)

Table 1.26: Height and girth of cashew genotypes under MLT-III at Madakkathara

Variety	Height (cm)	Girth (cm)
Dhana	81.17	5.50
H-11	107.35	7.72
H-32/4	94.58	10.42
H-1593	99.25	7.68
BH-6	98.42	6.45
H-662	100.17	6.80
H-675	79.42	5.67
BH-85	104.00	6.80
H-22-1	92.10	6.47
Goa 11/6	81.50	6.22
H-14	83.86	5.62

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

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Pilicode and Vengurla

Plains / others :

Chintamani and Jagdalpur

The objective of this experiment is to evaluate the performance of precocious dwarf KGN-1 in comparison to the local check variety.

Experimental Details :

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

Planting year : 2002

BAPATLA

The various growth parameters did not vary significantly between the check BPP-5 and KGN-1. However, mean internodal length was lesser in KGN-1 (16.66cm) in comparison to BPP-5 (19.33).

Table 1.27 : Vegetative characters of (KGN-1) at Bapatla

Growth parameters	KGN-1	Check (BPP-5)
Plant height (m)	1.66	1.41
Trunk girth (cm)	20.00	16.66
Canopy spread (E-W) (m)	1.96	1.51
(N-S) (m)	1.78	1.43
Average internodal length (cm)	16.66	19.33
Duration of flowering (days)	80-90	85-90

BHUBANESWAR

It is observed that KGN-1 has comparatively shorter internodal length (1.60 cm) whereas more plant height (2.00 m) and higher trunk girth (18.80 cm) than the check variety H-2 /16.

Table 1.28: Vegetative characters of KGN-1 and check Var. H 2/16 at Bhubaneswar

Growth parameters	KGN-1	H 2/16
Average plant height (m)	2.00	1.70
Average trunk girth (cm)	18.80	17.70
Average internodal length (cm)	1.60	2.20

CHINTAMANI

All the vegetative parameters were higher in KGN-1 compared to Chintamani-1 which was used as local check variety.

Table 1.29: Growth Parameters of KGN-1 and Chintamani-1 at Chintamani

Growth parameters	KGN-1	Chintamani-1
Plant height (m)	1.44	1.38
Trunk girth (cm)	14.75	13.50
Canopy spread (m) (N-S)	1.27	1.15
Canopy spread (m) (E-W)	1.19	1.04
Average Internodal Length	8.16	7.85

JHARGRAM

It was noticed that average height, girth, canopy spread and number of laterals per square meter were more in case of local check variety BLA – 39-4, as compared to KGN-1 plants while inter-nodal length was more in KGN-1.

KGN-1 flowered late as compared to BLA-39-4 and duration of flowering was also more in BLA-39-4 (average-94.125 days). Flowering intensity was similar in both the plants. Male to hermaphrodite flower ratio was slightly lower in KGN-1 (9.7:1) compared to BLA-39-4 (10.4:1) Shelling percentage was better in case of KGN-1 (27.61%) over to BLA-39-4 (26.01%) (Table 1.30).

Table 1.30: Physical parameters of KGN-1 & BLA-39-4 (planted in 2002) at Jhargram

Growth parameters	KGN-1	BLA-39-4
Mean height (m)	2.89	2.83
Mean stem girth (cm)	21.90	25.70
Canopy spread (m) (N-S)	3.10	3.27
Canopy spread (m) (E-W)	2.93	3.29
No. of flowering laterals per square meter	20.91	23.97
Duration of flowering (days)	80.17	94.13
Yield kg/tree	135.50	118.30
Cum. Yield of 2 parameters (kg/tree)	148.21	127.33
Shelling %	27.61	26.01

PILICODE

The initial observations indicated that the growth rate of variety KGN-1 was comparatively slower than that of the MDK-1 (Table 1.31)

Table 1.31: Biometrical characters of KGN-1 & MDK-1 (Planted on 2002)

Character	Ist Year		IInd Year		IIIrd Year	
	MDK-1	KGN-1	MDK-1	KGN-1	MDK-1	KGN-1
Plant height(m)	0.20	0.53	0.62	0.70	1.16	1.04
Trunk Girth(cm)	2.30	3.10	4.30	4.70	8.19	8.19
Tree spread(m) (E-W)	--	--	0.25	0.28	0.89	0.72
Tree spread(m) (N-S)	--	--	0.25	0.31	0.88	0.74
Internodal length (cm)	--	--	1.19	1.27	--	--

VENGURLE

The precocious dwarf KGN-1 had higher plant height (1.88m) in comparison to V-7 (1.15m), the internodal length was also longer (41.15m) compared to V-7 (34.50 m). Stem girth and canopy spread was also higher for KGN-1 in comparison to V-7.

Table 1.32: Growth observation of precocious dwarf cashew type and Vengurla-7 at Vengurle

Growth parameters	KGN-1	V-7
Mean Height (m)	1.88	1.15
Mean Girth (cm)	16.75	12.00
Mean Canopy spread (m) (E-W)	1.51	1.20
Mean Canopy spread (m) (N-S)	16.75	12.00
Mean Internodal length (cm)	41.15	34.50

VRIDHACHALAM

Biometrical observations on plant height, stem girth, canopy shape & internodal length indicated that the check variety VRI-2 recorded lower plant height, trunk girth and internodal length compared to KGN-1 (Table 1.33).

Table 1.33: Evaluation of precocious dwarf KGN 1 at Vridhachalam

Growth parameters	KGN-1	VRI-2
Plant height (cm)	1.28	0.97
Trunk girth (cm)	11.23	9.25
Canopy spread (cm) (N-S)	0.92	0.85
Canopy spread (cm) (E-W)	0.75	0.89
Internodal length (cm)	3.43	3.06

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

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani and Jagdalpur

The objective of this experiment is to evaluate the performance of released varieties in different locations for their suitability to that agro-climatic region.

SUMMARY:

Among the released varieties available at Bapatla, Dhana had the highest number of bisexual flowers per m^2 (351.3) while BPP-4 had the highest nut yield per tree (3.33kg/tree) in the 4^{th} harvest followed by BPP-8 (3.15kg/tree). At Jhargram NRCC-Sel-1 had highest plant height of 130cms in the 2^{nd} year while VRI-2 had the highest stem girth of 9.25cm. The precocious dwarf KGN-1 had similar vegetative characters as that of the local check variety at Bapatla (BPP-5), Bhubaneswar (H2/16), Chintamani (Chintamani-1), Jhargram (BLA-39-4), Pilicode (MDK-1), Vengurle (V-7) and Vridhachalam (VRI-2).

BAPATLA

During the year 2003-04, the variety Vengurle-5 recorded the maximum plant height (3.51m) followed by Vengurle-4 (3.50m). Whereas Vengurle-5 (57.80cm) followed by BPP-1 (55.80cm) recorded maximum stem girth. The mean maximum canopy spread was in BPP-8 (6.34m) followed by BPP-4 (5.82m). The maximum numbers of bisexual flowers was recorded in Dhana (351.3) followed by Kanaka (343.3). The highest mean nut yield per tree of 3.33 kg was recorded in BPP-4 variety followed by BPP-8 having 3.14kg in the 4^{th} harvest. And their cumulative nut yield per tree since recorded highest in BPP-9 (5.59) followed by BPP-4 (5.57) (Table 1.34).

Table 1.34 : Evaluation of released varieties at Bapatla

Variety	Plant height (m)	Stem Girth (cm)	Plant Spread (m)		Bi-Sexual flowers	Nut yield /tree (kg) (4th harvest) 2003-04	Cumulative nut yield/ tree (kg)	Nut weight (g)
			E-W	N-S			2001-04	
BPP-1	3.33	55.80	4.90	4.13	156.50	2.37	3.30	6.11
BPP-4	3.08	54.00	5.88	5.75	189.30	3.33	5.57	4.89
BPP-8	3.18	55.20	6.04	6.34	185.30	3.14	5.59	7.92
BPP-9	2.10	30.00	3.12	3.08	168.50	0.55	2.10	6.92
KANAKA	2.90	34.00	4.58	4.50	343.30	2.33	4.28	6.08
DHANA	2.10	27.00	3.08	1.76	351.30	2.10	2.90	8.11
Vengurle-4	3.50	49.80	5.05	4.63	196.00	1.34	2.55	6.65
Vengurle-5	3.51	57.80	5.58	5.28	237.00	2.93	4.95	4.81
VRI-2	3.07	41.00	6.10	6.03	158.50	2.46	5.24	5.30
Chintamani1	1.45	79.50	1.95	1.60	139.50	0.20	0.30	--
Ullal-5	2.83	36.00	4.10	4.33	120.50	1.01	1.01	5.95

JHARGRAM

Among the three varieties planted in 2003, VRI-2 had the highest plant height of 141.00cm and stem girth of 9.25cm, while both NRCC-Sel-1 and Jhargram-1 had plant height of 130.00cm (Table 1.35)

Table 1.35 : Evaluation of released varieties at Jhargram.

Variety	Year of planting	Height (cm)	Girth (cm)
BPP – 1	2004	58.00	4.50
BPP – 3	2004	75.00	5.00
BPP – 4	2004	77.00	4.50
BPP –5	2004	55.00	4.00
ULLAL – 3	2004	64.25	4.50
VENGURLA – 6	2004	68.00	4.00
VENGURLA – 4	2004	64.25	4.75
JHARGRAM – 1	2003	130.00	9.00
DHANA	2004	69.25	4.25
KANAKA	2004	72.00	4.50
BLA – 39 – 4	2004	80.50	5.25
VTH – 711/4	2004	60.00	5.00
NRCC – 2	2004	79.66	6.25
VRI – 2	2003	141.00	9.25
NRCC Sel.– 1	2003	130.00	7.33

Gen.4. Hybridization and Selection

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani

The project aims at utilizing the high yielding accessions selected from the germplasm conserved at various AICRP centres, as parents to obtain desirable traits and such as bold nut types, cluster bearing habit, compact canopy, short flowering period, late synchronized flowering and high shelling percentage.

SUMMARY:

Under hybridization trial at Bhubaneswar 616 hybrid seedlings have been planted during 2003 and 197 hybrid seedlings were planted during 2004 for further evaluation. Highest annual nut yield was obtained in A1-85 (10.20 kg/tree). At Jhargram H-10 and H-32 were found to have dwarf growth habit. At Madakkathara out of the hybrids planted during 1993 highest annual nut yield/tree was recorded in H-17 (24.60 kg), H-15 (21.70 kg) and H-7 (18.70 kg). All the highest yielding hybrids had P-3-2 as the common male parent. At Vengurla, 175 hybrid seedlings obtained from 16 cross combinations have been planted during 2004. Among the 8 hybrids evaluated at Vridhachalam H-10 had the highest annual nut yield (6.42 kg/tree) followed by H-13 (5.83 kg/tree).

BAPATLA

The total number of 47 F1 hybrid nuts were obtained from the 9 cross combinations done during the year 2004 (Table 1.36). Among the different hybrids under evaluation the F1 seedlings planted during the year 1997, 16 trees were dead due to drought and high temperatures during 2003-04. Remaining F1 trees were evaluated during the year and H-25 (F.No.3 x T 228) recorded highest nut yield of 4.50kg/tree (Table 1.37) and H-65 (T.71 X T.No.273) (4.50 kg/tree) followed by H-64 (T.No.71 X T.273) which gave 4.40kg/tree in the second harvest (Table 1.38).

Table 1.36: Details of cross combinations at Bapatla

Cross Combinations	Percent of fruit set	Cross Combinations	Percent of fruit set
BPP-8 X Ullal-4	8.00	BPP-6 X Sel-1	8.00
BPP-8 X Ullal-5	7.41	BPP-6 X Sel-2	8.42
BPP-8 X T.228	8.33	BPP-6 X Ullal-4	4.62
BPP-8 X BPP-3	7.14	BPP-6 X Ullal-5	6.67
BPP-8 X BPP-4	9.23		

Table 1.37: Performance of hybrids planted during different years at Bapatla (1997 Planting) (2003-2004)

Hybrid No	Cross combination	Year of planting	Yield/ tree(kg) (2nd harvest) (2003-04)	Cumulative yield/tree (kg) since (2003)
H-9	T 273 x T 71	1997	3.25	4.35
H-10	T 273 x T 71	1997	3.00	5.65
H-14	T 228 x T2/22	1997	3.70	3.70
H-21	T 228 x T2/22	1997	3.15	3.95
H-25	F.No.3 x T 228	1997	4.50	6.00

Table 1.38: Performance of hybrids planted during different years at Bapatla (1997 Planting) (2003-2004)

Hybrid No	Cross combination	Year of planting	Annual nut yield/ tree (kg) (2004-05)	Cumulative Nut yield /tree(kg) (2 harvests)
H-36	F.No.3 x T30/1	1997	4.50	4.50
H-64	T 71 x T 273	1997	4.40	4.50
H-65	T 71 x T 273	1997	4.50	5.15
H-69	T 71 x T 273	1997	3.60	3.60
H-71	T 71 x T 273	1997	3.40	3.85

BHUBANESWAR

From a final number of 616 seedlings have been planted in the field during August 2003 and the rest 197 nos. of seedlings were maintained in nursery and planted during 2004. The hybrid seedlings planted in the previous years are in bearing stage and the performances of certain promising hybrids amongst them have been recorded as shown in the Table 1.39.

Out of the 16 promising hybrid plants planted during the year 1995, highest yield (11.00 kg/plant) as well as cumulative yield at 7 harvests (21.60 kg/plant) were recorded in A6. The individual nut weight and shelling percentage of this hybrid observed were 9.00g and 33.3% respectively.

Out of 23 nos. of promising hybrid, planted during 1997 highest nut yield (kg/plant) was observed in A1-85 (10.20) followed by A1-105 (7.50). 11 nos. of hybrid plants showed nut yield (kg/plant) in between 2.00 to 3.00 and the rest 10 plants yielded less than 2.00 kg/plant. At 5^{th} harvest highest cumulative nut yield (kg/plant) was observed in A1-85 (20.50) followed by A1-105 (16.00), A1-5 (9.50) and A1-16 (8.80). Among these four plants highest individual nut weight (gm) was recorded in A1-105 (8.80) followed by A1-16 (8.60), A1-85 (7.80) and A1-5 (7.00). In all these hybrids shelling percentage observed was more than 28%.

34 nos. of promising hybrids are observed in the hybrid block planted in the year 1998. Out of these hybrids in B2-39 highest nut yield (2.10 kg/plant) as well as cumulative nut yield at 4th harvest (4.40 kg/plant) were observed, though the nut weight became 7.60 g having shelling percentage of 27%. In the other better yielding hybrids A2-22, B2-2, B2-32, D2-9, E2-2 and E2-13 cumulative nut yield (kg/plant) at 4th harvest ranged from 3.00 to 3.40 whereas, nut yield (kg/plant) for the reporting year ranged from 0.80 to 1.80. The nut weight of these hybrids recorded was exceeding 8.00 except in A2-22 (7.40 g) and D2-9 (7.60g). The shelling percentage (%) of these hybrids observed was ranging from 28.00 to 30.80.

Among the hybrid plants planted in the year 1999, twenty nos. of promising hybrids were observed, out of which F3-13 became the most promising one showing highest nut yield (1.80 kg/plant), highest cumulative nut yield (3.00 kg/plant) at 2nd harvest, highest number of nuts/panicle (3) having better nut weight of 9.40g and shelling percentage of 27.40%. The other better performing hybrids C3-1, C3-2, E3-9, E3-20, E3-25, E3-26, F3-1, F3-6 and F3-13 showed nut yield (kg/plant) ranging from 1.00 to 1.20 and cumulative nut yield (kg/plant) at 2nd harvest ranging from 1.50 to 2.00. The nut weight (g) of these hybrids exceeds 8.00 excepting in E3-9 (7.80), E3-25 (7.80) and F3-6 (7.60).

In the hybrid block planted during the year 2000, twenty nine promising hybrid plants have been identified out of which 17 nos. of plants such as C4-2, C4-5, C4-10, C4-15, C4-30, D4-6, D4-11, D4-14, D4-20, E4-1, F4-1, F4-3, F4-6, F4-17, F4-24, F4-28 and G4-6 recorded better nut yield (kg/plant) ranging from 0.50 to 1.00.

In D4-6 highest cumulative nut yield (1.40 kg/plant) in the end harvest, as well as highest nut yield (1.00 kg/plant) for the reporting year, with a nut weight of 8.00g and higher shelling percentage of 31.10% was recorded. The highest nut weight of 10.50g was recorded in E4-1.

106 nos. of promising hybrids have been observed in the hybrid block planted during the year 2001. In the reporting year the first harvest from these plants has been recorded. Highest nut yield (kg/plant) has been observed in E5-20 (1.20) with nut weight of 8.40 g. The other better yielding plants recorded are A5-1 (1.00), D5-21 (1.00), E5-19 (1.00), E5-20 (1.20), I5-24 (1.10), L5-27 (1.10) and P5-8 (1.00). The nut weight of these better yielding hybrids ranges from 7.80 g to 9.40 g.

Table 1.39: Performance of cashew hybrids for the period 2004

Year of Planting	Hybrid No.	Cross Combinations	No. of fruits/ panicle	Yield (kg/plant)	Cumulative yield (kg/plant)	Apple Weight (g)	Nut Weight (g)	Shelling (%)
1995	7th harvest							
	A6	Bhubaneswar C-2 x VTH 711/4	3	11.00	21.60	62.00	9.00	33.30
	A9	Bhubaneswar C-2 x VTH 711/4	3	3.00	8.20	40.00	7.00	34.00
	D4	Bhubaneswar-1 x Kankadi	2	0.80	5.50	41.00	10.70	28.00
	D6	Bhubaneswar-1 x Kankadi	2	1.20	6.10	73.00	9.00	32.00
	E1	Bhubaneswar C2 x Kankadi	2	1.60	5.40	80.00	8.40	31.60
1997	5th harvest							
	A1-5	Bhubaneswar-1 x H2/16	3	2.00	9.50	52.00	7.00	30.50
	A1-16	Bhubaneswar-1 x H2/16	3	2.20	8.80	47.00	8.60	28.10
	A1-34	Bhubaneswar-1 x H2/16	3	3.00	7.40	52.00	8.00	31.00
	A1-85	Bhubaneswar-1 x H2/16	3	10.20	20.50	66.00	7.80	29.40
	A1-105	Bhubaneswar-1 x H2/16	2	7.50	16.00	68.00	8.80	28.00
1998	4th harvest							
	A2-22	M 44/3 x H 2/16	3	1.50	3.00	52.00	7.40	28.00
	B2-2	H 2/16 x M 44/3	2	1.80	3.40	50.00	8.50	29.10
	B2-32	H 2/16 x M 44/3	1	1.60	3.20	50.00	9.00	28.30
	B2-39	H 2/16 x M 44/3	4	2.10	4.40	25.00	7.60	27.00
	D2-9	M 44/3 x Kankadi	2	0.80	3.10	50.00	7.60	30.80
	E2-2	M 44/3 x H 2/15	2	1.30	3.30	48.00	8.80	28.20
	E2-13	M 44/3 x H 2/15	2	1.40	3.20	60.00	8.00	28.00
1999	2nd harvest							
	C3-1	H 2/15 x M 44/3	1	1.00	1.80	60.00	8.40	29.20
	E3-9	M 44/3 x H 2/16	3	1.00	1.50	40.00	7.80	28.20
	E3-20	M 44/3 x H 2/16	2	1.00	1.60	40.00	8.60	28.00
	E3-25	M 44/3 x H 2/16	2	1.00	1.60	55.00	7.80	29.70

	E3-26	M 44/3 x H 2/16	2	1.00	1.60	62.00	8.00	28.80
	F3-1	H 2/16 x M 44/3	2	1.20	2.00	40.00	9.20	27.00
	F3-6	H 2/16 x M 44/3	2	1.00	1.50	60.00	7.60	26.80
	F3-13	H 2/16 x M 44/3	3	1.80	3.00	58.00	9.40	27.40
2000	2^{nd} harvest							
	C4-2	M 44/3 x H 2/16	2	0.50	0.90	38.00	9.20	29.40
	C4-5	M 44/3 x H 2/16	2	0.50	0.90	30.00	7.20	28.60
	C4-10	M 44/3 x H 2/16	2	0.60	1.00	56.00	8.00	23.30
	C4-15	M 44/3 x H 2/16	2	0.60	0.90	53.00	8.00	30.20
	C4-30	M 44/3 x H 2/16	2	0.50	1.00	38.00	9.00	25.00
	D4-6	H 2/16 x M 44/3	3	1.00	1.40	40.00	8.00	31.10
	D4-11	H 2/16 x M 44/3	3	0.70	0.80	55.00	7.20	28.80
	D4-14	H 2/16 x M 44/3	3	0.60	0.80	49.00	8.40	27.10
	D4-20	H 2/16 x M 44/3	2	0.60	0.70	52.00	10.00	27.90
	E4-1	BPP 30/1 x VTH 711/4	2	0.50	0.60	48.00	10.50	28.30
	F4-1	M 44/3 x H 2/15	2	0.50	0.90	40.00	10.00	28.00
	F4-3	M 44/3 x H 2/15	2	0.50	0.60	42.00	8.60	29.30
	F4-6	M 44/3 x H 2/15	2	0.60	0.70	44.00	8.30	27.80
	F4-17	M 44/3 x H 2/15	2	0.50	0.60	30.00	9.40	30.90
	F4-24	M 44/3 x H 2/15	1	0.50	0.60	51.00	9.00	27.20
	F4-28	M 44/3 x H 2/15	2	0.60	0.80	61.00	9.00	25.10
	G4-6	M 44/3 x VTH 711/4	2	0.80	1.20	40.00	10.00	27.60
2001	1^{st} harvest							
	A5-1	H 2/16 x M 44/3	3	1.00	1.00	22.00	8.00	27.00
	D5-21	M 44/3 x H 2/15	3	1.00	1.00	74.00	8.00	30.30
	E5-19	BPP 30/1 x H 2/16	3	1.00	1.00	60.00	9.40	25.30
	E5-20	BPP 30/1 x H 2/16	4	1.20	1.20	42.00	8.40	26.40
	I5-24	Bhubaneswar-1 x H 2/16	3	1.10	1.10	64.00	7.80	28.10
	L5-27	M 44/3 x VTH 711/4	4	1.10	1.10	70.00	8.80	31.90
	P5-8	Bhubaneswar C-2 x Kankadi	3	1.00	1.00	45.00	8.00	34.00

CHINTAMANI

A total of 57 crosses have been made and a total of 666 hybrid nuts have been obtained. The seedlings raised from these hybrid nuts were planted at closer spacing for further evaluation.

JHARGRAM

Among the F_1 hybrids planted in 2002 & 2003 it was noticed that H-10, and H-32 were comparatively dwarf in nature i.e., only 1.10m and 0.95m in height in 2 years whereas, other plants were taller. Maximum height was observed in case of H-39, 49, 63 and H-64 (3.50m). The stem girth was maximum in H-64 (31.40cm) and minimum in H-10 (9.50cm).

Maximum extended canopy was noticed in case of H-30 (4.15m) during 2nd year and H-39 produced nuts having a nut weight of 7.14g. (Table 1.41)

Table 1.40: Details of crosses at Jhargram

Sl. No.	Parentage	No. of crosses	Setting %	No. of hybrid seedlings obtained
1.	BLA-39-4 X KGN-1	177	46.33	0
2.	KGN-1 x BLA-39-4	101	63.67	1
3.	H-2/15 x Red Hazari (Seedling) (Seedling)	125	52.80	26
4.	H-2/15 x BLA-39-4 (Seedling) (Seedling)	24	83.30	2
5.	H-2/15 x BLA-39-4 (Seedling) (Graft)	48	91.67	9

Table 1.41: Performance of hybrids planted during 2002 and 2003 at Jhargram

Sl. No.	Hybrid No.	Cross combination	Year of planting	Plant height (m)	Trunk Girth (cm)	Canopy spread (m)		Nut Wt. (g)	Apple Wt. (g)
						E-W	N-S		
1	H-10	KC-1 x BLA-39-4	2002	1.10	9.50	0.75	0.70	--	--
2	H-82	BLA-39-4 x Red Hazari	2003	0.95	5.00	0.80	0.85	--	--
3	H-39	Local x Dicherla-2/9	2002	2.40	21.00	3.50	3.40	7.14	65.00
4	H-63	WBDC-V x Red Hazari	2002	3.50	27.50	3.50	3.70	--	--
5	H-64	WBDC-V x Red Hazari	2002	3.50	31.50	3.60	3.65	5.85	62.72
6	H-49	WBDC-V x JGM-1	2002	3.50	27.50	3.10	3.15	--	--

MADAKKATHARA

Out of the 36 hybrids planted in1993, the highest yield was recorded in Hy-17 (24.60 kg), Hy-15 (21.70 kg), and Hy-7 (18.70 kg). Highest cumulative yield was given by H-7 (58.04 kg), H-17 (53.55 kg) and H-15 (40.04 kg). Hybrids yielding less than 10 kg were Hy – 2, 9, 14, 28, 29, 30, 31, 32, 33, 36, 37, 42, 43, 44, 51 and 52. All the high yielders had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4 (Table 1.42).

Table 1.42: Performance of hybrids planted during 1993 at Madakkathara

Hy. No.	Yield (kg/tree) 2004	Cum. yield (kg/tree)
2	5.00	20.56
7	18.70	58.04
9	3.40	14.99
14	8.05	20.95
15	21.70	40.04
17	24.60	53.55
28	9.40	16.97
29	3.20	9.27
30	6.30	13.00
31	0.40	8.58
32	7.30	23.20
33	0.30	16.95
36	6.05	21.06
37	6.80	15.30
42	5.05	15.65
43	2.30	2.30
44	0.90	1.53
51	5.55	19.82
52	3.20	17.50

Out of 23 hybrids planted in 1994, highest annual yield/ tree was recorded in H-74 (15.85 kg) with a cumulative yield of 21.60 kg, Hy 72 (9.90 kg) with a cumulative yield of 22.85 kg and H-73 (9.75 kg/tree) and cumulative yield of 24.35 kg. All the high yielders were progenies of BLA 39-4 and P-3-2 showing that these two genotypes are genetically divergent (Table 1.43).

Table 1.43: Performance of hybrids planted during 1994

Hybrid No.	Yield (kg/tree) 2004	Cum. Yield (kg/tree)	Nut wt.(g)
72	9.90	22.85	-
73	9.75	24.35	6.36
74	15.85	21.60	7.30

Out of the 24 hybrids planted during 1995, the highest annual yield was obtained in H-87 (14.75 kg/tree/year) and cumulative yield (18.75 kg/tree) and H-101 (7.40 kg/tree) and cumulative yield (9.30 kg/tree). H-87 is a hybrid between V5 and H 1591 (Table 1.44)

Table 1.44: Performance of hybrids planted during 1995

Hybrid No.	Yield (kg/tree/annum)	Cum. Yield (kg/tree)	Nut wt.(g)
87	14.75	18.75	-
101	7.40	9.30	6.85

The hybrids H 111 to H176 were planted at a closer spacing of 4 m x 4 m and thinning of weak trees was done to provide space for growth. Highest yield was in case of H-165 (1.55kg) (Table 1.45)

Table 1.45: Performance of hybrids planted during 1995 at close planting

Hy. No.	Yield (kg/tree)
111	1.15
112	0.55
117	0.65
134	1.10
165	1.55

Highest yield was from H 189 (2.20 kg/tree/year) which was a cross between BLA 139-1 and Vetore-56 (Table 1.46)

Table 1.46: Performance of hybrids planted during 1996

Hy. No.	Yield (kg/tree)
181	0.90
184	0.70
185	0.30
189	2.20

The parents identified for the crosses during 2001, were A1, V-56, Kilianthara, K-30-1, V5, K 22-1, Sulabha, MDK-1 and M 44/3. Highest yield was obtained in hybrid 12-4 (0.90 kg/tree/year).

During 2002, 135 hybrid seedlings were field planted from 20 cross combinations. The parents identified were Amrutha, Ullal-3, UN-50, Kanaka, Ullal-4, K 22-1, Anakkayam-1, KGN, VTH 711/4, NRCC Sel-2, Dhana, MDK-1, Priyanka and Sulabha. 126 cross combinations were done during 2003 out of the 846 hybrids obtained, 626 hybrids were planted at SCRS, Konni and the rest at Madakkathara. During 2004, 12 cross combinations were done and 56 hybrid seedlings were planted at Madakkathara. During 2005, 11 cross combinations were done and 48 hybrid seedlings were planted at Madakkathara.

Ten genotypes were selected based on genetic divergence studies for the crossing programme from the germplasm. Nut set was highest for NDR 2-1 x K-10-2 (14.29%) and the lowest was for H 1591 x H 1597 (1.79%) (Table 1.47)

Table 1.47 : Details of crossing programme during 2004 at Madakkathara

Cross Combinations	No. of Pollinations	% of nut set	No. of nuts germinated
H-1597 X H-1591	214	7.48	14
H-1591 X H-1597	223	1.79	4
H-1591 X K-10-2	133	3.01	4
H-1597 X H-8-1	80	3.75	2
H-1593 X H-1591	73	2.74	1

KGN-I X H-1591	120	5.00	7
NDR-2-1 X K-10-2	98	14.29	14
KGN-I X NDR-2-1	25	12.00	3
K-10-2 X NDR-2-1	10	10.00	1
KGN-I X Purple colour cashew	30	13.33	3
H-1591 X H-1600	99	5.05	5
Total	**1105**	**5.60**	**58**

PILICODE

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

Three seedlings of MDK1 x TPB1, ANK1 x TPB1, TPB1 x ANK1 and seven open pollinated seedlings of TPB-1 were obtained during 2001-2002 and field planted. During the year 2002-2003, 28 seedlings of the hybrid ANK1xTPB1, 4 hybrid seedlings of MDK1x TPB1, were field planted. During 2004-05, seednuts of 23 hybrids of ANK1x TPB1 and 13 hybrids of MDK1 x TPB-1 were obtained. The plant height was highest in TPB-1 x ANK-1 (2.13m) and the stem girth was highest for ANK-1 x TPB-1 (22.00cm) (Table 1.48).

Table 1.48 : Mean of growth characteristics of different crosses involving TPB-1 & TPB (OP) planted in 2001 at Pilicode

Hybrid	Height(m)	Girth(cm)	Tree spread(m)	
			N-S	E-W
MDK-1 X TPB-1	2.07	17.66	1.92	1.53
ANK-1 X TPB-1	2.00	22.00	2.33	2.17
TPB-1 X ANK-1	2.13	21.50	2.25	2.13
TPB-1 (OP)	0.94	13.60	1.39	1.52

VENGURLE

During the year 2003-04, 16 cross combinations were chosen for hybridization. A total of 1217 hermaphrodite flowers were crossed and 595 fruits were set, of which, 235 fruits were finally retained. 235 hybrid nuts were sown for germination from which 175 F_1 hybrid seedlings were obtained and planted for further study (Table 1.49)

Table 1.49 : Cross combinations followed during 2004-2005 at Vengurle

Cross combination	Cross combination
V-3 x M 26/2	M-26/2 x B.T.-65
V-3 x M 44/3	Hy.2/15 x B.T.-22
V-3 x Hy-1598	Hy-2/15 x B.T.-65
V-3 x Hy- 2/16	Cyt-1 x Vetore- 56
V-3 x Hy- 2/15	Vengurla-3 x Anakkayam
V-4 x Hy- 2/15	*Anacardium microcarpum* x B.T.-6

Hy- 2/15 x V-4	Hy-471 x B.T.-65
V-4 x CYT-1	Hy-471 x B.T.-22
M 26/2 x Vetore.-56	Hy-471 x B.T.-6
Cyt-1 x B.T. 22	V-5 x B.T.-1 x V-5
Cyt-1 x B.T. 65	(M 44/3 x B.T.-22) x M44/3

VRIDHACHALAM

A total of 9 cross combinations with VRI-3 as a common parent has being done which gave 193 hybrid nuts. These have been planted for future evaluation (Table 1.50).

Table 1.50 : Details of crossing programme at Vridhachalam

Cross Combinations	No. of nuts obtained during the year	Percent of fruit set
VRI 3 X KGN -1	17	9.20
VRI 3 X SL -1	22	8.80
VRI 3 X VSK – 1	21	6.70
VRI 3 X VSK – 2	24	7.50
VRI 2 X VRI 3	28	7.00
VRI 3 X PV -1	17	9.70
VRI 3 X TK-1	20	15.30
VRI 3 X VRI -2	20	4.40
VRI 3 X VRI -4	24	8.00
Total	**193**	

Totally eight hybrids were evaluated for 12 years and their performance was evaluated. Among the eight hybrids evaluated, H-10 had the highest nut yield (6.42 kg/tree) followed by H-13 (5.83 kg/tree). In terms of cumulative yield (12 years), the yield of H 10 and H 13 were higher than the others. The shelling percentage was the highest for H 12 (M 10/4 x M 75/3) (Table 1.51).

Table 1.51 : Performance of Selected F_1 Hybrids at Vridhachalam

Hybrid Number	Cross combination	Mean yield (kg/tree)	Cumulative yield (Kg/tree) for 12 years	Nut weight (g)	Shelling %	Apple weight (g)	Apple colour
H 10	M 10/4 x M 26/1	6.42	57.52	6.98	27.35	62.20	Yellow
H 11	M 10/4/ x M 45/4	5.00	37.18	6.75	26.50	64.50	Yellow
H 12	M 10/4 x M 75/3	5.57	39.44	6.73	28.10	63.20	Pinkish
H 13	M 26/2 x M 26/1	5.83	51.15	6.70	27.50	68.50	Pink
H 14	M 26/2 x M 45/4	4.56	39.90	6.68	27.50	66.50	Pink
H 15	M 26/2 x M 75/3	4.50	38.42	6.82	27.00	60.20	Red
H 16	M 44/3 x M 26/1	4.90	48.26	6.52	27.20	55.20	Yellow
H 17	M 44/3 x M 45/1	5.35	44.20	7.14	26.25	58.50	Yellow

II. CROP MANAGEMENT

Agr.1: NPK Fertilizer Experiment

Centres : East Coast :

Bapatla, Jhargram and Vridhachalam

West Coast :

Madakkathara

Plains / others :

Chintamani

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

SUMMARY:

Under NPK trials, N levels had significant influence on nut yield at Bapatla and at Vridhachalam, highest fertilizer dosage (1000g N, 250g P, 250g K) of NPK resulted in maximum nut yield. At Jhargram, N levels significantly influenced the canopy size; while at Madakkathara N, P and K levels did not have significant influence on yield.

Experimental Details :

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

BAPATLA

During the year, the N_2 level gave significant higher yield of 11.73 kg/tree over N_0 level (6.28 kg/tree). But for P and K, N_2 levels were not significant. For the first order interaction the mean annual nut yield per tree was highest in the treatment N_2P_1 (13.53 kg/ tree) followed by N_2P_2 (12.53 kg/tree) over control (5.63 kg/tree) NPK interactions were not significant (Table 2.1).

Significant differences was observed for cumulative nut yield (6years pooled data), for Nitrogen, Potash, NP, NK and PK interactions. The highest cumulative nut yield was recorded in the N_2 level (14.23 kg/tree) followed by N_1 (13.56 kg/tree) which were on par. The first order interaction in N_2P_2 gave highest cumulative yield of 15.84 kg/tree followed by N_2P_1 (15.72 kg/tree) which were on par with each other and superior over control. (Table 2.1) Among the second order interaction treatment $N_2P_1K_1$ recorded significantly highest of 20.09 kg/tree followed by $N_1P_0K_1$ with a cumulative nut yield 17.04 kg/tree.

All the growth parameters *viz.* plant height, trunk girth, canopy diameter, canopy height and canopy area showed no significant differences in all the combinations of NPK levels.

Table 2.1 : Annual Nut Yield (kg/tree) in response to N, P and K interaction during the year 2004 at Bapatla

	P_0	P_1	P_2	Mean	K_0	K_1	K_2
N_0	5.63	6.08	7.12	6.28	6.11	6.53	6.20
N_1	9.41	9.64	9.15	9.40	8.97	10.13	9.09
N_2	9.14	13.53	12.53	11.73	10.12	13.21	11.87
Mean	8.06	9.75	9.60		8.40	9.96	9.05
K_0	8.01	7.97	8.20				
K_1	8.26	11.02	9.97				
K_2	8.93	10.87	8.99				

F-Test	N	P	K	NP	NK	PK
Significance	*	NS	NS	NS	NS	NS
CD 5%	1.61			1.36		

Cumulative mean nut yield (kg/tree) of the N, P and K interactions (Pooled analysis for 6years)

	P_0	P_1	P_2	Mean	K_0	K_1	K_2
N_0	8.00	7.45	8.21	7.89	8.71	6.83	8.12
N_1	14.97	12.40	13.31	13.56	12.24	14.52	13.92
N_2	11.13	15.72	15.84	14.23	12.76	16.56	13.38
Mean	11.37	11.86	12.45		11.24	12.64	11.81
K_0	10.17	12.61	11.32				
K_1	10.86	13.47	11.23				
K_2	12.68	11.82	12.86				

F-Test	N	P	K	NP	NK	PK
Significance	*	NS	*	*	*	*
CD 5%	0.96			1.66		

On-Farm trial with higher doses of fertilizers at Bapatla

The effect of higher doses of NPK on the yield of cashew under on-farm trials, indicated that the treatment T_3 recorded the highest nut yield of 10.25 kg /tree which was on par with the treatment T_2 (9.75 kg/tree), but was higher than control (7.50kg/tree). The number of panicles per square meter was highest in T_3 treatment and T_2 than in T_1 treatment (Table 2.2).

Table 2.2 : Nut yield at different levels under on-farm trials at Bapatla

Treatment	N_2 (g/tree)	P_2O_5 (g/tree)	K_2O (g/tree)	Number of panicles / m^2	Nut yield/ tree (kg)
Recommended dose (T1)	500	125	125	13.00	7.50
Higher dose (T2)	1000	250	250	18.50	9.75
Higher dose (T3)	1500	375	375	19.50	10.25

CHINTAMANI

All the trees under this trial were limb pruned during 2004 – 2005. Observations on vegetative characters are being recorded and yield observations will be recorded during the current season.

JHARGRAM

The plants treated with $N_2P_1K_1$, i.e., 1000g nitrogen 125g phosphorus and 125g potassium had the maximum plant height (6.95m) followed by the plants receiving a fertilizer treatment of $N_1P_1K_0$ (6.53m) and $N_0P_2K_1$ (6.53m). Girth was maximum with the treatment $N_0P_1K_2$ (104.17cm). Most extended canopy was observed in the case of those plants which received only nitrogenous fertilizer ($N_1P_0K_0$) (8.95m) followed by the plants receiving nitrogen, as well as phosphorous fertilizer i.e., $N_1P_1K_0$ and the canopy diameter was 8.59m. This treatment also had positive effect and led to maximum canopy area (99.89m^2). Earliness in flowering was observed with the treatment $N_2P_2K_2$ followed by $N_1P_2K_0$ and $N_1P_2K_1$ treatments, while, duration of flowering was maximum in case of $N_1P_0K_2$ treatment (73 days). In case of nut weight, the treatments had no significant difference (Table 2.3).

Table 2.3: Effect of NPK fertilizer and their interaction on growth of cashew at Jhargram.

Treatment	Plant height (m)	Trunk girth (cm)	Mean canopy diameter (m)	Duration of flowering (days)	Mean nut wt. (g)
$N_0P_0K_0$	6.03	89.00	7.44	63	4.00
$N_0P_0K_1$	5.53	87.33	7.67	70	5.00
$N_0P_0K_2$	5.75	80.93	7.32	50	3.83
$N_0P_1K_0$	5.80	78.67	8.05	45	4.67
$N_0P_1K_1$	5.68	97.67	8.14	70	3.83
$N_0P_1K_2$	5.86	104.17	8.43	66	4.67
$N_0P_2K_0$	5.83	98.67	7.74	50	5.17
$N_0P_2K_1$	6.53	80.80	7.55	60	4.00
$N_0P_2K_2$	6.29	86.67	7.86	65	5.33
$N_1P_0K_0$	6.10	88.17	8.95	55	4.50
$N_1P_0K_1$	5.43	83.17	7.41	66	4.17
$N_1P_0K_2$	5.53	76.5	6.81	73	4.17
$N_1P_1K_0$	6.53	98.17	8.59	72	5.83
$N_1P_1K_1$	6.07	78.00	8.08	50	5.00
$N_1P_1K_2$	5.23	88.67	8.04	66	5.00
$N_1P_2K_0$	5.83	79.0	7.03	70	4.00
$N_1P_2K_1$	5.18	88.00	8.02	71	4.33
$N_1P_2K_2$	6.13	89.93	8.35	65	4.83
$N_2P_0K_0$	5.5	80.67	7.34	64	4.83
$N_2P_0K_1$	5.92	84.33	7.76	58	5.00
$N_2P_0K_2$	4.92	89.33	6.14	62	4.50

$N_2P_1K_1$	4.5	91.00	7.15	62	4.50
$N_2P_1K_1$	6.95	93.00	7.56	52	3.67
$N_2P_1K_2$	5.6	86.67	7.94	65	4.17
$N_2P_2K_0$	5.63	78.33	7.75	64	4.83
$N_2P_2K_1$	4.63	88.33	7.76	65	5.83
$N_2P_2K_2$	6.47	95.33	8.03	70	4.50
S.Em ±	0.47	5.17	0.55		0.48
C.D at 5%	0.95	10.48	1.11		N.S.

MADAKKATHARA

It was observed that application of 250g P_2O_5/ tree and 125g K_2O without N_2 recorded the maximum stem girth (141.00cm) among the levels of P and K, respectively. A decreasing trend was observed with increasing levels of K. Application of 250 g P_2O_5/ tree (8.72m) and 125 g K_2O/ tree (8.37m) recorded the maximum canopy spread both in east- west and north- south directions (Table 2.4).

The weight of individual nut showed that the direct effect of potassium was significant, while, the direct effects of N and P were non- significant. None of the N, P and K interactions were significant. Increasing levels of potassium significantly increased the nut weight and hence, the maximum nut weight was induced by 250 g K_2O/ tree (6.20 g) .

No significant effect on nut yield due to the application of graded levels of N, P or K or their interaction was observed. The nut yield showed a positive and increasing trend with increasing levels of N, P and K. Statistical analysis of the data indicated that the direct effect of N, P or K or their interactions did not significantly influence the cumulative nut yield (Table 2.5).

Table 2.4: Effect of graded levels of N, P and K on growth, yield characters and yield during 2004 at Madakkathara

Treatment	Tree height (m)	Trunk girth (cm)	Canopy spread- EW (m)	Canopy spread - NS (m)	Weight of nut (g)	Yield (kg/tree/ annum)	Cum. (kg/tree)
$N_0P_0K_0$	6.12	106	7.34	7.53	5.40	2.85	16.37
$N_0P_0K_1$	6.20	99	7.85	7.68	5.85	2.77	14.69
$N_0P_0K_2$	5.28	71	5.73	6.58	5.65	2.62	14.52
$N_0P_1K_0$	5.40	80	4.42	4.85	5.30	3.80	13.04
$N_0P_1K_1$	5.52	69	4.55	5.60	5.75	4.36	13.92
$N_0P_1K_2$	4.53	82	5.30	6.44	6.00	1.84	13.34
$N_0P_2K_0$	4.60	86	6.02	7.28	5.50.	3.47	20.78
$N_0P_2K_1$	6.43	141	8.72	8.37	5.80	4.81	29.34
$N_0P_2K_2$	5.12	83	5.28	5.57	6.10	3.58	16.74
$N_1P_0K_0$	5.93	105	7.84	7.78	5.65	1.85	16.73
$N_1P_0K_1$	5.08	82	6.27	6.33	5.85	2.93	15.05
$N_1P_0K_2$	5.42	87	4.17	3.98	6.10	2.26	18.38
$N_1P_1K_0$	4.85	78	6.60	6.42	5.50	4.31	20.06
$N_1P_1K_1$	4.65	73	5.92	5.75	5.90	1.73	12.12

$N_1P_1K_2$	5.28	106	6.93	7.17	6.20	3.72	22.44
$N_1P_2K_0$	6.12	136	7.63	7.63	5.95	1.07	15.19
$N_1P_2K_1$	6.07	93	7.37	7.52	5.95	5.18	20.69
$N_1P_2K_2$	6.23	109	8.08	8.02	6.10	5.44	23.86
$N_2P_0K_0$	4.43	88	5.63	5.02	5.60	3.69	25.34
$N_2P_0K_1$	6.58	96	6.35	8.33	6.15	1.11	20.39
$N_2P_0K_2$	6.58	95	8.28	8.33	5.95	4.75	21.01
$N_2P_1K_0$	5.72	107	4.25	4.35	5.90	2.72	20.52
$N_2P_1K_1$	6.05	113	7.18	7.73	5.85	3.53	21.11
$N_2P_1K_2$	5.42	113	6.42	7.25	5.85	4.67	17.46
$N_2P_2K_0$	5.47	67	5.07	5.32	5.45	0.46	13.98
$N_2P_2K_1$	4.80	83	6.57	6.15	5.80	4.53	18.44
$N_2P_2K_2$	6.11	79	6.46	7.23	6.20	3.96	21.19
SEm	1.06	22	4.42	4.50	0.05	1.75	3.69
CD (0.05)	NS	NS	NS	NS	NS	NS	NS

Table 2.5: Mean nut weight (g) of cashew as influenced by graded levels of N, P and K at Madakkathara

Treatments	Levels of P_2O_5				Levels of K_2O		
	P_0 (0)	P_1 (125)	P_2 (250)	Mean	K_0 (0)	K_1 (125)	K_2 (250)
Levels of N							
N_0 (0)	5.63	5.68	5.80	5.71	5.40	5.80	5.92
N_1 (500)	5.87	5.87	6.00	5.91	5.70	5.90	6.13
N_2 (1000)	5.90	5.87	5.82	5.86	5.65	5.93	6.00
Mean	5.80	5.81	5.87	5.83			
Levels of K							
K_0 (0)	5.55	5.57	5.63	5.58			
K_1 (125	5.95	5.83	5.85	5.88			
K_2 (250)	5.90	6.02	6.13	6.02			

		CD (0.05)	**SEm**			**CD (0.05)**	**SEm**
N/P	:	NS	0. 06	NP/NK/PK	:	NS	0.11
K	:	1.12	0.06	NPK	:	NS	0.05

VRIDHACHALAM

The maximum plant height (3.92m) was recorded in treatment with higher NPK (T_{27}) ($N_3P_3K_3$) i.e. 1000:250:250 g NPK/tree. However, canopy diameter (6.57m) and canopy area (25.82m^2) were the highest in T_{26} ($N_3P_2K_3$) and in T_{17} ($N_2P_3K_2$) respectively. The highest nut yield per tree was also recorded in T_{24} ($N_3P_2K_3$) (5.28 kg/tree). This treatment showed a cumulative nut yield of 9.66 kg/tree for 4 years which is the highest among all the other treatments (Table 2.6).

Table 2.6: Effect of NPK fertilizer and their interaction on growth of cashew at Vridhachalam

Tr. No.	Treatment	Plant height (m)	Trunk girth (cm)	Canopy diameter (m)	Canopy area (m^2)	Nut Yields (Kg/tree)	Cum yield kg/tree for 2 years
T_1	$N_1P_1K_1$	3.72	43.60	5.42	23.82	2.15	4.03
T_2	$N_1P_1K_2$	3.25	48.70	5.82	24.80	2.53	4.81
T_3	$N_1P_1K_3$	3.32	42.05	5.32	34.82	2.57	4.96
T_4	$N_1P_2K_1$	3.42	42.20	5.40	21.02	3.76	6.94
T_5	$N_1P_2K_2$	3.05	39.57	5.50	23.20	2.92	5.51
T_6	$N_1P_2K_3$	3.35	36.40	5.30	19.00	3.80	7.51
T_7	$N_1P_3K_1$	3.26	37.37	5.40	21.80	2.95	5.55
T_8	$N_1P_3K_2$	3.82	42.34	5.20	22.95	3.10	5.98
T_9	$N_1P_3K_3$	3.25	46.80	5.40	23.45	3.22	5.90
T_{10}	$N_2P_1K_1$	3.62	28.52	4.50	17.25	3.96	7.50
T_{11}	$N_2P_1K_2$	3.53	28.60	5.20	22.25	4.30	7.88
T_{12}	$N_2P_1K_3$	3.50	35.00	5.30	20.63	4.12	7.60
T_{13}	$N_2P_2K_1$	3.25	29.40	5.75	21.25	4.42	7.66
T_{14}	$N_2P_2K_2$	3.90	38.51	5.45	25.10	4.20	7.55
T_{15}	$N_2P_2K_3$	3.40	29.50	5.52	22.08	4.31	7.71
T_{16}	$N_2P_3K_1$	3.73	38.30	5.65	24.23	4.62	8.68
T_{17}	$N_2P_3K_2$	3.82	39.09	5.72	25.82	4.62	8.67
T_{18}	$N_2P_3K_3$	3.75	40.00	5.81	23.82	4.60	8.63
T_{19}	$N_3P_1K_1$	3.32	38.50	5.93	22.30	4.93	9.04
T_{20}	$N_3P_1K_2$	3.93	39.45	5.92	23.80	4.85	8.97
T_{21}	$N_3P_1K_3$	3.95	40.29	6.02	23.78	4.83	8.98
T_{22}	$N_3P_2K_1$	3.20	32.60	6.23	23.10	4.62	8.54
T_{23}	$N_3P_2K_2$	3.20	36.20	6.45	24.52	4.93	9.21
T_{24}	$N_3P_2K_3$	3.68	40.62	6.50	25.00	5.28	9.66
T_{25}	$N_3P_3K_1$	3.72	45.16	6.51	22.50	4.62	8.50
T_{26}	$N_3P_3K_2$	3.35	40.52	6.57	24.85	4.83	8.98
T_{27}	$N_3P_3K_3$	3.92	55.01	6.02	23.05	4.95	9.13

Agr.2: Fertilizer application in high density cashew plantations

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara, Pilicode and Vengurle

Plains / others :

Chintamani

This trial has been laid out to identify the optimum population density for cashew and suitable fertilizer doses at different high density plantings for specific regional variety.

SUMMARY:

At Bapatla, the vegetative growth parameters viz. plant height, stem girth and canopy spread were maximum in plant density of 600plants/ha with lowest fertilizer dosage of 75kg N, 25kg P and 25kg K per hectare. At Jagdalpur, highest mean nut yield/tree was recorded with 600plants/ha and 225kg N, 75kg P and 75kg K/ha which was statistically similar with 200plants/ha and 75kg N, 25kg P and 25kg K/ha. At Madakkathara, neither the tree density nor fertilizer dosages or other interactions could significantly influence the growth parameters or nut yield. At Vridhachalam, the maximum canopy spread and yield per tree were recorded in 225kg N, 75kg P and 75kg K with plant density of 200 plants/ha. But yield per unit area and per ha was maximum with 225kg N, 75kg P and 75kg K and with plant density of 600 plants/ha.

Experiment Details :

Design	:	Split plot		
Main plot : Plant density	:	S_1 200 plants/ha (10m x 5m)		
		S_2 400 plants/ha (6m x 4m)		
		S_3 600 plants/ha (5m x 4m)		
Sub-plot : Fertilizer dose/ha	:	M_1 75kg N, 25kg P_2O_5, 25kg K_2O		
		M_2 150kg N, 50kg P_2O_5, 50kg K_2O		
		M_3 225kg N, 75kg P_2O_5, 75kg K_2O		
Total area	:	2.5 ha		
Fertilizers application level	:	1^{st} year	:	$1/5^{th}$
		2^{nd} year	:	$2/5^{th}$
		3^{rd} year	:	$3/5^{th}$
		4^{th} year	:	$4/5^{th}$
		5^{th} year	:	Full dose

BAPATLA

The crop is in the initial stage of vegetative growth, and the data for growth parameters for the year 2005 is presented in the Table 2.7. The maximum plant height (2.47m) and stem girth (30.77cm) was recorded in M_1S_3. Similarly maximum canopy spread (3.10m EW and 3.10m NS) was also recorded in M_1S_3.

Table 2.7: Growth parameters in fertilizer application trials in high density plantations at Bapatla

Treatment	Plant height (m)	Plant girth (cm)	Canopy spread (m)	
			E-W	N-S
M_1S_1	1.59	28.43	2.55	2.46
M_1S_2	1.81	29.90	2.94	2.76
M_1S_3	2.47	30.77	3.10	3.10
M_2S_1	1.31	21.03	1.68	1.80
M_2S_2	1.86	25.10	2.28	2.36
M_2S_3	0.65	7.31	0.79	0.82
M_3S_1	1.45	24.73	2.11	2.13
M_3S_2	1.84	27.50	2.61	2.56
M_3S_3	1.56	19.04	1.95	1.96

BHUBANESWAR

The spread of the plant was found comparatively more in N-S direction compared to E-W direction. S_2M_3 recorded maximum spread 4.73 m followed by S_2M_2 (4.70) and minimum canopy spread in S_1M_1 (4.10m). There was no significant variation among the treatments. The mean number of flowering panicles per m^2 for spacing was recorded to be maximum in S_1 (16.44) followed by S_2 (15.97) and minimum in S_3 (14.11). The number of flowering panicles was found to decrease as the planting density increased. M_2 recorded maximum of 16.22 number of flowering panicles/ m^2 and minimum in M_3 (14.95). (Table 2.8 and 2.9). The number of flowering panicles per m^2 recorded was the lowest in 13.60 in S_3M_3 and maximum in S_1M_2 (17.10) (Table 2.10).

Maximum yield for main treatments was recorded in S_3 (2.52 kg) followed by M_2 (2.43 kg) and minimum in M_1 (2.11 kg). Significant differences in yield were recorded due to different doses of fertilizers (Table 2.9). The interaction effect of spacing and fertilizer dose on nut yield was found to be non-significant (Table 2.10).

The yield per ha was maximum in S_3 (11.96 q/ha) followed by S_2 (9.17 q/ha) and minimum in S_1 (4.77 q/ha). There was significant variation under various doses of fertilizer; M_3 recorded maximum yield (9.08 q/ha) followed by M_2 (8.97 q/ha) and minimum in M_1 (7.83 q/ha). The interaction effect recorded highest yield in S_3M_3 (12.75 q/ha) followed by S_3M_2 (12.37 q/ha) and minimum in S_1M_1 (4.05 q/ha) (Table 2.8, 2.9 and 2.10).

The leaf nitrogen percentage was maximum in S_1 (2.13%) followed by S_2 (1.96%) and S_3 (1.90%). The leaf Nitrogen percentage increased due to higher doses of fertilizer application. M_3 recorded maximum leaf Nitrogen 2.18% followed by M_2 (2.05%) and minimum in M_1 (1.75%). S_1M_3 recorded maximum leaf N (2.27%) and minimum in S_3M_1 (1.62%). The leaf P_2O_5 content increased with spacing. S_1 recorded 0.04%. P_2O_5 followed by S_2 and S_3 (0.05%). The P_2O_5 content increased with increased doses of P_2O_5 and was maximum in M_3 (0.05%) and minimum in M_1 0.03%. S_2M_3, S_3M_3 recorded maximum P_2O_5 (0.05%) and minimum in S_1M_1 (0.03%) (Table 2.11).

Maximum K_2O content was recorded in S_3 (0.41%), followed by S_2 (0.37%) and minimum in S_1 (0.33%). Mean values of K_2O percentage was recorded to be maximum in M_2 (0.46%) followed by M_3 (0.38%) and minimum in M_1 (0.26%). S_3M_2 recorded highest K_2O percentage (0.48%) followed by S_2M_2 (0.46%), S_1M_2, S_3M_3 (0.44%) and minimum in S_1M_1 (0.21%) (Table 2.11).

Table 2.8 : Effect of spacing on vegetative characters and yield of cashew variety BPP-8 at Bhubaneswar

Treatment	Plant height (m)	Girth (cm)	Spread of the plant (m)		No. of flowering panicle/m^2	Yield /plant (kg)	Yield/ha (Q)
			E – W	N – S			
S_1	3.43	36.21	4.08	4.40	16.44	2.38	4.77
S_2	3.51	35.71	4.17	4.47	15.97	2.28	9.17
S_3	3.47	35.82	4.17	4.61	14.11	2.39	11.96
F 'test'	NS	NS	NS	NS	*	NS	*
SE (m) ±	0.06	0.47	0.09	0.09	0.21	0.06	0.42
CD (5%)	-	-	-	-	1.60	-	1.47

Table 2.9 : Effect of fertilizer doses on vegetative characters and yield of BPP-8 at Bhubaneswar

Treatment	Plant height (m)	Girth (cm)	Spread of the plant (m)		No. of flowering panicle/m^2	Yield /plant (kg)	Yield/ha (Q)
			E – W	N – S			
M_1	3.35	35.65	4.06	4.29	15.35	2.11	7.83
M_2	3.47	35.89	4.13	4.60	16.22	2.43	8.97
M_3	3.58	36.12	4.22	4.67	14.95	2.52	9.08
F 'test'	NS	NS	NS	NS	*	NS	*
SE (m) ±	0.06	0.47	0.09	0.09	0.21	0.06	0.42
CD (5%)	-	-	-	-	1.60	-	1.47

Table 2.10 : Interaction effect of spacing and doses of fertilizer application on growth and yield of cashew variety BPP-8 at Bhubaneswar.

Treatment	Plant height (m)	Girth (cm)	Spread of the plant (m)		No. of flowering panicle/m^2	Yield /plant (kg)	Yield /ha (Q)
			E – W	N – S			
S_1M_1	3.34	36.03	3.97	4.10	16.00	2.03	4.05
S_1M_2	3.40	36.25	4.09	4.55	17.10	2.43	4.85
S_1M_3	3.54	36.33	4.19	4.55	16.22	2.70	5.40
S_2M_1	3.39	35.35	4.12	4.22	16.17	2.05	8.20
S_2M_2	3.53	35.67	4.16	4.70	16.70	2.40	9.70
S_2M_3	3.59	36.13	4.22	4.73	15.03	2.40	9.60
S_3M_1	3.33	35.60	4.10	4.55	13.87	2.25	11.25
S_3M_2	3.49	35.47	4.15	4.55	14.85	2.47	12.37
S_3M_3	3.59	36.12	4.25	4.67	13.60	2.45	12.75
F 'test'	NS	NS	NS	NS	NS	NS	NS
SE (m) ±	0.08	0.91	0.13	0.15	0.90	0.09	0.39
CD (5%)	-	-	-	-	-	-	-

Table 2.11: Nitrogen, Phosphorous and Potassium content (%) of cashew leaf due to the effect of spacing and levels of fertilizer and their interactions, at Bhubaneswar

	M_1	**M_2**	**M_3**	**Mean of leaf N%**
S_1	1.96	2.16	2.27	2.13
S_2	1.68	2.05	2.15	1.96
S_3	1.62	1.95	2.12	1.90
Mean of leaf N%	1.75	2.05	2.18	
	M_1	**M_2**	**M_3**	**Mean of leaf P%**
S_1	0.03	0.04	0.04	0.04
S_2	0.04	0.04	0.05	0.04
S_3	0.04	0.04	0.05	0.04
Mean of leaf P%	0.04	0.04	0.05	
	M_1	**M_2**	**M_3**	**Mean of leaf K%**
S_1	0.21	0.44	0.35	0.33
S_2	0.27	0.46	0.38	0.37
S_3	0.31	0.48	0.44	0.41
Mean of leaf K%	0.26	0.46	0.39	

CHINTAMANI

The crop is in the vegetative stage and the vegetative characters have been recorded. Among the treatments M_2S_2 recorded highest plant height (2.83m) and lowest was in M_3S_3 (2.16m). The highest plant girth was observed in M_2S_1 (31.48cm) and least was observed in M_3S_3 (23.60cm). The canopy spread in E-W direction was highest in M_3S_1 (3.44m) and lowest spread was in M_3S_2 (2.87m), whereas, in N-S direction the highest spread was noticed in M_2S_2 (4.15m) and least was in M_3S_3 (2.79m) (Table 2.12).

Table 2.12: Effect of fertilizer application and spacing on vegetative characters and yield of cashew at Chintamani

Treatment	**Plant height (m)**	**Plant girth (m)**	**Canopy spread (m)**	
			E-W	**N-S**
M_1S_1	2.42	29.68	3.42	3.56
M_1S_2	2.31	30.07	3.33	3.27
M_1S_3	2.39	29.27	3.23	3.23
M_2S_1	2.45	31.48	3.28	3.19
M_2S_2	2.83	27.64	3.12	4.15
M_2S_3	2.52	28.25	3.28	3.04
M_3S_1	2.22	26.22	3.44	3.37
M_3S_2	2.24	25.03	2.87	3.03
M_3S_3	2.16	23.60	2.96	2.79

JAGDALPUR

The plant height, girth, canopy spread, number of primary branches were found to be non significant for all the treatments. Significantly higher nut weight (6.78 g) was found under treatment M_1S_3 and it was at par with M_2S_3 & M_3S_3. The yield /tree (g) was recorded highest for M_3S_3 (440.38g/tree), which was statistically similar with M_1S_3. The yield was significantly highest for the treatment M_3S_3 (220.19 kg/ha) (Table 2.13).

Table 2.13: Morphological observations of cashew trees under ffertilizer application in high-density cashew plantations at Jagdalpur

Treatment	Plant height (m)	Girth (cm)	Canopy Spread		Nut weight (g)	Yield/ tree (g)	Yield/ ha (Kg)
			E-W	N-S			
M_1S_1	128.50	15.40	105.50	123.00	6.36	97.50	19.50
M_1S_2	121.56	18.89	121.94	119.89	6.46	143.00	28.60
M_1S_3	132.80	19.90	166.00	150.00	6.78	403.65	80.73
M_2S_1	126.53	20.48	157.33	145.25	6.36	123.50	51.38
M_2S_2	133.83	19.67	125.69	124.62	6.46	213.15	88.67
M_2S_3	108.97	17.63	120.50	116.66	6.63	362.27	150.70
M_3S_1	88.22	16.11	83.22	108.22	6.36	37.38	18.69
M_3S_2	93.63	17.47	91.37	93.33	6.46	191.75	95.88
M_3S_3	130.00	16.25	95.44	87.39	6.66	440.38	220.19
CD 5%	NS	NS	NS	NS	0.25	149.47	68.24

JHARGRAM

Significant differences in plant height, girth and canopy area were observed with respect to different doses of fertilizers and different plant densities. However, no significant variations were noticed in canopy spread and canopy height due to spacing and fertilizer application. The plants planted at spacing of 6m x 4m and 5m x 4m had already covered 25% and 30% of ground area, respectively within a span of one year.

Under 6m x 4m spacing, the plants had maximum plant height (1.65 m) at maximum fertilizer dose, while under 10m x 5m spacing, the plant height was maximum (1.55 m) with a moderate dose of fertilizers and under 5m x 4m spacing, there was a decrease in plant height with an increase in fertilizer dose. Trunk girth was maximum even under low dosage of fertilizers at 10m x 5m spacing (10.78 cm) and higher doses of fertilizer at 6m x 4m spacing (11.56 cm) and 5m x 4m spacing (11.67cm). Canopy spread was maximum under low dose of fertilizer (1.54m) at 6m x 4m spacing while it was maximum at moderate dose of fertilizer at a of spacings of 10m x 5m (1.47m) and at higher dose of fertilizer at 5m x 4m (1.41m). Canopy area, was likewise found to be maximum at lowest dosage of fertilizer at all the spacings evaluated (Table 2.14).

Table 2.14: Growth parameters of high density planting trial at Jhargram.

Treatment	Plant height (m)	Girth (cm)	Canopy Spread (m)
M_1S_1	1.48	10.78	1.36
M_1S_2	1.55	9.67	1.54
M_1S_3	1.46	10.11	1.38
M_2S_1	1.56	10.44	1.47
M_2S_2	1.62	11.11	1.42
M_2S_3	1.65	11.56	1.44
M_3S_1	1.54	11.67	1.41
M_3S_2	1.40	10.78	1.21
M_3S_3	1.38	10.22	1.27
SEm±	0.07	0.45	--
CD 5%	0.14	0.90	NS

MADAKKATHARA

Statistical analysis of the data indicated that tree densities, fertilizer doses or their interaction did not significantly influence any of the growth parameters or nut yield. There was an increasing trend in tree height with increasing densities while, there was a decreasing trend in canopy spread particularly in the EW direction.

With regard to fertilizer doses, tree height and canopy area showed a decreasing trend with increasing doses. In respect of tree girth, canopy spread (NS and EW) and canopy height, maximum values were recorded by the intermediate fertilizer dose i.e. 150: 50:50 g NPK/ ha. Among the three fertilizer doses, maximum nut yield was recorded by 75: 25: 25 kg NPK/ha.

PILICODE

The performance of the trees under the treatment S_1M_3 (4.19 kg/tree) and S_3M_1 (3.68 kg/tree) were found to be superior in terms of yield and stem girth compared to the trees receiving the treatment S_2M_2 (3.42 kg/tree) (Table 2.15).

Table 2.15: Mean of growth characteristics of cashew under fertilizer application in high density plantations at Pilicode

Treatment	Height(m)	Girth(cm)	Tree spread		Yield(kg) per plant
			E-W	N-S(m)	
S_1M_1	2.13	26.91	2.26	2.25	2.83
S_1M_2	2.14	24.25	1.99	2.08	2.47
S_1M_3	2.36	28.77	2.24	2.59	4.19
S_2M_1	2.37	27.66	2.16	4.70	2.28
S_2M_2	2.34	27.43	2.12	2.14	3.42
S_2M_3	2.20	25.76	2.02	3.54	1.90
S_3M_1	2.48	31.12	2.40	2.24	3.68
S_3M_2	2.15	24.69	2.28	2.11	2.45
S_3M_3	2.30	26.49	2.09	2.00	2.85

VENGURLA

All the growth and yield parameters recorded showed non-significant variation, for different spacings and fertilizer dosages. However, apple wt. (g) was significantly different for different spacings.

VRIDHACHALAM

The highest yield of 2.45 kg nuts per tree was recorded in M_3S_1 (200 plants/ha with 225:75:75 NPK/ha). Although the yield per tree was higher in wider spacing, yield per unit area was the highest in S_3 (5 x 4 m spacing accommodating 600 plants/ha) i.e.,1380 kg/ha in M_3S_3, which revealed that closer spacing of 5 x 4m would produce more nuts per unit area (Table 2.16)

Table 2.16: Effect of fertilizer application and spacing on vegetative characters and yield of cashew at Vridhachalam

Treatment	Plant height (m)	Plant girth (cm)	Canopy spread (m)	Nut weight (g)	Yield/ tree (kg)	Yield / ha (kg)
M_1S_1	3.60	21.60	3.12	5.80	2.12	424
M_1S_2	3.45	31.50	3.33	5.91	1.50	600
M_1S_3	2.85	19.62	3.28	5.90	1.65	990
M_2S_1	3.10	26.42	3.35	6.00	2.32	464
M_2S_2	3.25	25.30	3.82	5.90	2.10	840
M_2S_3	3.35	20.45	3.16	6.02	1.62	972
M_3S_1	3.28	29.53	3.90	6.12	2.45	490
M_3S_2	3.20	21.33	3.22	5.83	2.40	960
M_3S_3	3.50	26.58	3.81	5.92	2.30	1380

Agr.4: Expt.2 High density planting – observational trials

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

Plains / others :

Chintamani and Jagdalpur

This trial has been laid out to identify the optimum population density for cashew to maximize the returns per unit area.

SUMMARY:

At Bhubaneswar, the yield of different varieties at a spacing of 4 x 4m with recommended fertilizer dosage was 1.60 tonnes/ha in H 2-16 and was 1.75 tonnes/ha in V-4. The cumulative nut yield in [deleted] Chintamani-1 ranged between 1.00 to 8.30kg/tree from four harvests at Chintamani Centre. At Madakkathara, mean nut yield were similar in high density planting (4.50kg/tree) and normal planting (4.70kg/tree).

Experimental Details :

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

BAPATLA

The trial is in the initial stage of vegetative growth, however, the mean values of growth parameters are mentioned in Table 2.17.

Table 2.17: Effect of high density planting on growth parameters of cashew at Bapatla

Parameters	Mean	
	8m x 8m plot	4m x 4m plot
Pl. Height (m)	0.85	1.00
Trunk girth(cm)	15.50	19.50
Canopy spread E-W (m)	1.50	1.63
Canopy spread N-S (m)	1.50	2.00
Yield (kg/tree)	--	--
C. Yield (Kg/tree)	--	--

BHUBANESHWAR

The trial was laid out with variety H-2/16 and a spacing of 4m x 4m, with recommended fertilizer dosage during 1986. The plants were pruned at a height of 3m during June 2004. A yield of 1.60 t/ha was recorded in the current season. The yield in the farmers' field under high density spacing with cashew variety, Ven -4 recorded at 4th harvest was 1.75 tonnes/ha.

CHINTAMANI

Under this trial, with Chintamani-1, the plant height ranged from 2.00 - 3.70 m whereas, stem girth ranged from 16–35 cm. The canopy spread in E-W direction was 2.40 –3.85 m and in N-S direction was 2.55-4.10 m. The nut yield/tree ranged from 0.40-1.50 kg/tree during 2004 and the cumulative nut yield from four harvests ranged from 1.00-3.80 kg/tree (Table 2.18).

Table 2.18: Effect of high density planting on growth parameters of cashew at Chintamani

Parameter	Maximum	Minimum	Mean
Pl. height (m)	3.70	2.00	2.85
Stem girth (m)	35.00	16.00	25.50
Canopy spread (m) E-W	3.85	2.40	3.13
Canopy spread (m) N-S	4.10	2.55	3.33
Yield (kg/tree)	1.50	0.40	0.95
Cum. Yield (kg/tree) (in 4 harvests)	3.80	1.00	2.40

MADAKKATHARA

The result indicated that there was not much variation in growth parameters *viz.*, tree height, trunk girth, canopy spread and yield per tree under normal and high density planting systems during the eighth year of planting (Table 2.19).

Table 2.19: Effect of high density planting on growth parameters and yield of cashew at Madakkathara

Parameters	Mean in high density planting	Normal planting
Tree height (m)	6.75	6.80
Trunk girth (cm)	77.50	79.00
Canopy spread - NS (m)	7.35	7.40
Canopy spread - EW (m)	7.10	7.14
Yield (kg/tree/annum)	4.50	4.70
Cumulative yield (kg/ tree.) in 5 harvests	15.43	16.27

VENGURLE

The growth observations regarding plant height, stem girth and canopy have been recorded in this trial. Due to severe incidence of TMB, the nut yield was very low (Table 2.20).

Table 2.20: High density planting in cashew (V-7) growth observation (season 2004)

Row * No.	Mean Plant Height (m)	Mean Stem Girth (cm)	Mean Canopy Diameter (m)	Mean Canopy Height (m)	Mean Canopy Area (m^2)
1.	5.68	60.55	5.24	4.82	117.46
2.	5.46	59.91	4.83	4.79	102.92
3.	5.77	55.42	4.94	4.17	100.54
4.	5.51	55.58	4.66	4.20	92.08
5.	5.74	56.17	4.87	4.13	97.42
6.	5.81	59.33	4.94	4.19	100.86
7.	5.57	57.92	4.73	4.22	94.47
8.	5.50	51.82	4.43	4.21	85.60
9.	6.62	69.36	7.46	5.34	218.56
10.	6.70	64.20	6.92	5.35	189.27
Mean	**5.83**	**59.00**	**5.30**	**4.54**	**119.91**

* Each row having twelve grafts

Agr.3: Drip irrigation trial

Centres : East Coast :

Vridhachalam

West Coast :

Vengurle

Plains / others :

Chintamani

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

Experimental Details :

Treatments : 5

T1 : No Irrigation

T2 : Irrigation 20% of cumulative pan evaporation.

T3 : Irrigation 40% of cumulative pan evaporation.

T4 : Irrigation 60% of cumulative pan evaporation.

T5 : Irrigation 80% of cumulative pan evaporation.

Spacing = 7 x 7m

Planting material = Softwood grafts

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

CHINTAMANI

Due to unavoidable situation during 2003 (due to failure of tube well), the trial could not be initiated during 2003 and 2004, the treatments will be imposed during 2005.

VENGURLE

The plant height, stem girth, canopy diameter, canopy height, canopy area, nut wt., apple wt. as well as yield did not vary significantly amongst all the levels of irrigation and also with the unirrigated check (Table 2.21)

Table 2.21: Effect of drip irrigation on growth and yield of cashew at Vengurle

Treatments	Mean Plant Height (m)	Mean Trunk Girth (cm)	Mean Canopy Diameter (m)	Mean Canopy Height (cm)	Mean Canopy Area (m^2)	Mean Nut wt. (g)	Mean Apple weight (g)	Mean Yield (kg/ plant)
T_1	3.93	52.03	6.14	3.29	137.67	9.00	74.50	1.31
T_2	3.86	55.02	6.27	3.18	141.35	9.25	80.75	1.38
T_3	4.01	53.03	5.98	3.22	127.29	9.00	79.00	1.65
T_4	4.11	49.35	5.94	3.07	133.62	9.12	78.00	1.36
T_5	4.00	51.02	6.08	3.35	134.23	9.37	81.75	1.79
Se m±	0.18	2.03	0.18	0.12	8.24	0.15	2.70	0.23
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Agr.6: Intercropping in Cashew

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

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

SUMMARY:

At Bapatla, net profit was Rs.13,650/- per ha in case of black gram and Rs.13,000/- per ha in case of green gram when additional fertilizer was applied to the inter crops with cashew as per recommendation. Maximum net returns were obtained from brinjal (Rs.5,200/ha) at Bhubaneswar, however, Cost : Benefit ratio was highest for chillies 1:2.28 but was least in case of brinjal 1:1.35. At Jhargram, highest net profit was obtained in case of pigeon pea (Upas-120) (Rs.21,382/- per ha) wherein 50 per cent of recommended fertilizer was applied to the intercrops. The highest cost benefit ratio (1:5.11 to 1:6.63) was also noticed in case of pigeon pea at Jhargram. Tapioca, cucumber and groundnut led to highest net profits of Rs.23,834/- per ha, Rs.33,659/- per ha and Rs.16,188- per ha at Madakkathara, Vengurle and Vridhachalam, respectively.

Experimental Details :

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

BAPATLA

During the year in the intercropping trial, the growth performance of main crop (cashew) was recorded with the mean plant height of 3.51 m, stem girth 55.4cm, canopy spread (E-W) 6.48m and canopy spread (N-S) 6.66m.

In green gram, the treatments F_1, F_2 and F_0 recorded the mean grain yield of 150, 97 and 75 kg/ha respectively. In black gram, F_1, F_2 and F_0 recorded the mean grain yield of 165, 108, and 75kg/ha respectively. The net profits/ha and cost benefit ratio were highest in case of F_1 level of fertilizer for both green gram (Rs.13,000/- per ha and 1 : 1.11 respectively) and black gram (Rs.13,650/- per ha and 1:1.10 respectively) (Table 2.22)

Table 2.22: Yield and net returns of intercrops at Bapatla

TREATMENTS	Mean Yield from intercrops per ha (kg)	Total returns from intercrops/ ha (Rs)	Mean Yield of main crop per ha (Q) per tree (kg)	Total returns from main crop/ha (Rs)	Net profits/ha (Rs)	C:B ratio
T_1 Cashew+Green gram+F-0	75	2100/-	5.10	17400/-	6700/-	1 : 0.63
T_2 Cashew+Green gram+F-1	150	3400/-	7.10	24700/-	13000/-	1 : 1.11
T_3 Cashew+Green gram+F-2	97	2800/-	6.00	20800/-	9500/-	1 : 0.84
T_4 Cashew+Black gram+F-0	75	2400/-	5.00	17400/-	6600/-	1 : 0.61
T_5 Cashew+Black gram+F-1	165	4800/-	7.05	25950/-	13650/-	1 : 1.10
T_6 Cashew+Black gram+F-2	108	3200/-	6.05	21350/-	10050/-	1 : 0.89
T_7 Cashew (Sole crop)	--	--	4.70	14,100/-	6600/-	1 : 0.88

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

BHUBANESWAR

It was found that the plant height, stem girth and spread of the plant were minimum in cashew alone.

The yield and returns from inter-crops revealed that maximum net return was obtained from brinjal (Rs.5200/- per ha) followed by chilli (Rs.4340/- per ha), bhindi (Rs.3980/- per ha), pumpkin (Rs.3960/- per ha) and cowpea (Rs.3125/- per ha). Cost : Benefit ratio was highest for chilli (1 : 2.28) and was least in case of brinjal (1:1.35) (Table 2.23).

Table 2.23: Vegetative characters of main crop cashew and Yield & returns from inter-crops at Bhubaneswar

Treatment	Plant Height (m)	Stem Girth (cm)	Spread (m)		Yield/ ha (55%area) (Kg)	Expenditure (Rs)	Total return (Rs)	Net return (Rs)	C:B Ratio
			N-S	E-W					
T_1 Cashew + Brinjal	1.80	14.00	1.80	2.00	106.00	16000	21200	5200	1:1.35
T_2 Cashew + Chilli	1.90	15.00	2.20	1.90	38.70	3400	7740	4340	1:2.28
T_3 Cashew + Cowpea	1.90	15.00	2.10	2.00	25.50	5800	8925	3125	1:1.53
T_4 Cashew + Bhindi	1.80	12.00	1.50	1.60	46.90	5400	9380	3980	1:1.74
T_5 Cashew + Pumpkin	1.50	12.00	1.50	1.60	81.60	4200	8160	3960	1:1.94
T_6 Cashew alone	1.40	10.00	1.25	1.40	Nil	Nil	Nil	Nil	

JHARGRAM

Among the four crops viz., groundnut, black gram, green gram evaluated as intercrops, pigeon pea and groundnut were found to yield more than the other two crops.

Highest net profit was obtained in the case of pigeon pea at highest dosage of fertilizer (Rs.21,383/- per ha) which was closely followed by moderate and lower doses of fertilizer of pigeon pea. The highest cost benefit ratio was also similarly noticed in case of pigeon pea (1 : 5.11 to 1 : 6.63). As an intercrop under cashew plantation, pigeon pea (Upas – 120) was found to be the best suitable crop with maximum profit (Table 2.24).

There was an increase in soil carbon content from 0.09% to 0.18% by intercropping with pulses under cashew plantation.

Table 2.24 : Performance of inter crops in cashew plantation at Jhargram.

Treatment		Yield from inter crop Ha (Q)	Total returns Rs/ha	Net Profit Rs/ha	Cost Benefit
Groundnut	F_0	5.85	11704.00	3270.00	1 : 1.39
	F_1	6.31	12627.00	2276.67	1 : 1.22
	F_2	7.46	14920.00	2870.00	1 : 1.24
Black gram	F_0	3.10	6193.33	4946.33	1 : 4.96
	F_1	3.62	7240.00	5319.00	1 : 3.77
	F_2	3.98	7960.00	4123.00	1 : 2.07
Green gram	F_0	2.38	4760.00	2900.00	1 : 2.56
	F_1	2.91	5826.67	3792.60	1 : 2.86
	F_2	3.09	6186.67	2236.67	1 : 1.57
Pigeon pea	F_0	4.96	12391.67	9965.67	1 : 5.11
	F_1	6.84	17091.67	13991.67	1 : 5.51
	F_2	10.07	25183.00	21383.00	1 : 6.63
	SEm±	1.023	2184.23		
	C.D. at 5%	2.17	4630.57		

MADAKKATHARA

The results indicated that the returns from inter crop, net profit and C: B ratio was higher with tapioca (Rs.44,310/- per ha, Rs.23,834/- per ha and 1 : 2.16 respectively). Lower yield and higher cultivation cost for colocasia led to lesser profits (Table 2.25).

Table 2.25 : Economics of intercropping in cashew at Madakkathara

Name of intercrop	Tuber mean yield		Cost of cultivation (Rs.)	Total return from intercrop (Rs. / ha)	Net profit (Rs. /ha)	C: B ratio
	(Kg/ plot of 22.68 m^2)	t / ha *				
Colocasia	21.20	8.17	24570	40850	16280	1:1.66
Tapioca	32.85	12.66	20476	44310	23834	1:2.16

* Area planted with inter crops/ha : 8742/m^2

Price of colocasia: Rs. 5.00/kg Price of tapioca: Rs. 3.50 /kg

VENGURLE

The net returns from intercropping of cucumber was the highest (Rs.33,659/- per ha) which resulted in C:B ratio of 1 : 3.17. The other crops *viz.* ridge gourd, snake gourd, bitter gourd, bottle gourd and cucumber also led to a C:B ratio of more than 1:2.0 (Table 2.26).

Table 2.26: Performance of intercrops in cashew plantation at Vengurle.

Intercrop	Yield kg/ ha	Total returns Rs./ ha	Net profit Rs./ha	C : B Ratio
Snake gourd	47.88	33514.50	19939.90	1:2.46
Ridge gourd	48.64	34047.90	21793.00	1:2.77
Bitter gourd	32.31	25848.50	13666.10	1:2.12
Bottle gourd	56.71	28355.00	16245.50	1:2.34
Cucumber	70.23	49160.50	33658.70	1:3.17
SEm(±)	**0.82**			
C.D. at 5%	**2.53**			

VRIDHACHALAM

Groundnut performed better as an intercrop in cashew in terms of total returns (Rs. 16,188/- per hectare) whereas, the highest cost benefit ratio for black gram (1:2.1) which revealed black gram as a suitable intercrop for cashew (Table 2.27).

Table 2.27: Performance of different intercrops in cashew at Vridhachalam

Sl. No.	Treatments	Yield from intercrops		Total cost of intercrops (Rs./ha)	Total returns from intercrops/ha (Rs)	Net profit (Rs./ha)	C:B ratio
		Plot yield (16 M^2) (kg)	Hectare yield (kg)				
T_1	Cashew + Black gram	1.60	1000.50	5850.00	18000.00	12150.00	1 : 2.1
T_2	Cashew + Gingerly	0.45	281.25	4200.00	5343.75	1143.75	1 : 0.27
T_3	Cashew + Green gram	0.80	500.00	5450.00	8000.00	2550.00	1 : 0.46
T_4	Cashew + Groundnut	2.50	1562.50	13500.00	29687.50	16187.50	1 : 1.19

III. CROP PROTECTION

Ent. 1: Chemical Control of pest complex in cashew

1. Control of major pest: Tea mosquito bug, *Helopeltis antonii* and 2. Control of minor pests

Centres : East Coast :

Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

Plains / others :

Chintamani and Jagdalpur

The objective of this project is to identify an effective insecticidal spray schedule for managing the tea mosquito bug (TMB) and other minor pests of cashew. The project also aims at testing the alternate chemicals in comparison with standard insecticidal spray schedule against insect pests of cashew.

SUMMARY:

At Vengurle, application of endosulfan at flowering (T_8) followed by neem oil at fruiting was superior over control and was at par with carbaryl spray at fruiting(T_3); monocrotophos spray at flushing (T_1) as well as monocrotophos spray at flushing and carbaryl spray at fruiting (T_6). Damage by thrips at peanut stage, pebble stage and mature nut stage was significantly lowest in the recommended spray schedule.

Treatment details:

T_1 = Monocrotophos (0.05%) one spray at flushing
T_2 = Endosulfan (0.05%) one spray at flowering
T_3 = Carbaryl (0.1%) one spray at fruiting
T_4 = T_1 and T_2
T_5 = T_1, T_2 and T_3
T_6 = T_1 and T_3
T_7 = T_2 and T_3
T_8 = Endosulfan (0.05%) at flowering followed by neem oil (2%) at fruiting
T_9 = Carbaryl (0.1%) at flowering stage followed by neem oil (2%) at fruiting
T_{10} = Control

VENGURLE

The mean percent shoots / panicles damaged was least in treatment T_8 i.e. endosulfan 0.05% at flowering followed by neem oil 2% at fruiting stage (19.47%) which was superior over control (33.29%) and at par with T_3 (21.03%), T_6 (22.33%) and T_1 (22.54%) treatment (Table 3.1).

Table 3.1 : Incidence of tea mosquito bug in different treatments at Vengurle

Treatment	Average per cent shoots/ panicles damaged 30 days after.		
	I spray	II spray	III spray
T_1	8.99 (17.45)	18.10 (25.17)	22.54 (28.33)
T_2	17.03 (24.16)	20.31 (27.43)	23.48 (28.82)
T_3	8.85 (17.18)	18.83 (25.68)	21.03 (27.22)
T_4	9.34 (17.80)	14.65 (22.46)	21.24 (27.41)
T_5	10.52 (18.87)	18.23 (25.24)	19.93 (26.43)
T_6	8.86 (17.29)	18.10 (24.96)	22.33 (28.19)
T_7	11.07 (19.30)	18.56 (25.47)	23.94 (29.17)
T_8	8.45 (16.86)	15.39 (23.09)	19.47 (26.20)
T_9	9.79 (18.15)	18.78 (25.66)	23.65 (29.07)
T_{10}	18.66 (25.58)	29.77 (33.05)	33.29 (35.23)
S.E.±	1.48	1.43	1.52
C.D. at 5%	4.39	4.26	4.51

Figures in parenthesis are arc sine values

Control of minor pests : Foliage and inflorescence thrips.

The damage by thrips on nut surface at peanut stage was significantly the lowest in T_5 (6.66%) and was on par with T_2 (8.33%) and T_8 (12.00%). At pebble stage, the treatment T_5 (17.33%) was significantly superior over rest of the treatments except T_3 and T_4, which were at par with each other. The recommended spray schedule (T_5) resulted in minimum damage on mature nut surface (15.66%) indicating its efficacy in checking thrips damage (Table 3.2).

Table 3.2 : Incidence of inflorescence thrips on nut surface at Vengurle

Treatment	Average nut surface damaged at		
	Pea nut stage	Pebble nut stage	Matured nut stage
T_1	11.33 (19.67)	22.33 (28.20)	22.66 (28.43)
T_2	8.33 (16.74)	21.66 (27.73)	22.00 (25.96)
T_3	8.33 (16.77)	19.66 (26.32)	19.33 (26.07)
T_4	12.33 (20.56)	23.33 (26.85)	22.33 (28.20)
T_5	6.66 (14.93)	17.33 (24.60)	15.66 (23.32)
T_6	11.33 (19.65)	24.66 (27.77)	26.00 (30.77)
T_7	9.66 (18.05)	25.66 (28.43)	23.00 (26.65)
T_8	12.00 (20.29)	26.33 (30.88)	22.33 (31.52)
T_9	13.00 (21.12)	26.33 (30.87)	25.33 (30.22)
T_{10}	13.33 (21.08)	32.00 (34.44)	31.00 (33.62)
S.E.±	1.07	1.23	0.74
C.D. at 5%	3.18	3.66	2.21

Figures in parenthesis are arc sine values.

VRIDHACHALAM

Based on the mean reduction in the TMB incidence, T_5 i.e. standard spray schedule was found to be the best treatment (Table 3.3).

The incidence of shoot webber and leaf miner was also least in standard spray (T_5) (3.25% and 3.66% respectively) followed by T_6. The mean nut yield was also found to be the highest in case of T_5 (6.3 kg/tree).

Table 3.3 : Efficacy of different insecticides against Tea mosquito bug and incidence of TMB in different treatments at Vridhachalam

Treatment	30 days after 1st spray		30 days after 2nd spray		30 days after 3rd spray		Yield (kg/ tree)
	% damaged shoots	Damage score	% damaged shoots	Damage score	% damaged shoots	Damage score	
T_1	5.83	1.20	8.40	1.40	14.60	2.10	4.20
T_2	5.80	1.40	8.25	1.70	12.35	1.90	3.90
T_3	16.40	2.00	18.90	2.10	15.20	2.25	3.80
T_4	5.30	1.80	4.76	1.30	3.90	0.75	5.00
T_5	5.00	1.20	2.45	1.00	0.00	0.00	6.30
T_6	5.80	1.30	7.39	1.20	4.60	0.65	5.20
T_7	12.60	1.45	6.90	1.20	4.20	0.80	4.80
T_8	5.75	2.00	6.30	1.80	7.95	0.90	4.10
T_9	13.25	2.00	18.00	1.90	11.70	1.10	3.80
T_{10}	16.50	2.75	18.75	2.80	29.00	3.30	3.40
	2.15	2.10	2.00	2.00	2.85	2.36	0.63

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

Centres : East Coast :

Bapatla, Bhubaneshwar and Vridhachalam

West Coast :

Madakkathara and Vengurle

Plains / others :

Chintamani and Jagdalpur

The project aims at identifying the effective insecticide amongst the newer synthetic insecticides, which are safer as well as economically feasible for managing the pests of cashew.

SUMMARY:

The new insecticides chlorpyriphos, triazophos, L-cyhalothrin and profenophos were found to be on par with each other and also with the recommended spray schedule in checking incidence of minor pests at Bapatla and Bhubaneswar. Incidence of leaf caterpillar, leaf folder was similar in case of recommended spray schedule and newer insecticides with the exception of chlorpyriphos at Jhargram wherein, recommended spray schedule was the most effective treatment against other minor pests. The recommended spray schedule resulted in minimum damage score of TMB on shoots and panicles which was similar to L-cyhalothrin at Madakkathara. Triazophos was significantly superior in reducing TMB damage at Vengurle, while profenophos was more effective and comparable with standard spray schedule at Vridhachalam.

Experimental details:

T_1	=	Recommended sprays for the region	T_4	=	L-cyhalothrin 0.003%
T_2	=	Chlorpyriphos 0.05%	T_5	=	Profenophos 0.05%
T_3	=	Triazophos 0.1%	T_6	=	Control

BAPATLA

All the new insecticides evaluated and the recommended spray schedule were on par with each other, in keeping the pest population of leaf and blossom webber and the shoot tip caterpillar under check. The damage by these two pests, leaf & blossom webber & shoot tip caterpillar ranged between 0.07 to 0.21 percent and between 0.14 to 0.21 percent, respectively and were lower than, untreated check for the above two pests at 30 days after 3rd spray (Table 3.4).

The nut damage by apple and nut borer (1.90 to 3.10 percent) had no significant difference among the new insecticides and with the recommended spray schedule.

Table 3.4 : Damage due to minor pests under newer insecticides at Bapatla

Treatment	Leaf and blossom damaged shoots (%) at		Shoot tip caterpillar damaged shoots (%) at		Apple and nut borer damaged nuts at 30 days after 3rd spray (%)	Thrips damage grade at 30 days after 3rd spray (0-4 scale)
	Before spraying	30 days after 3rd spray	Before spraying	30 days after 3rd spray		
Endosulfan 0.05% at flowering and carbaryl 0.1% at nut development stage	0.21	0.07 a	1.77	0.21 a	2.80 a	0.46 a
Chlorpyriphos 0.05% (2 sprays)	0.21	0.14 a	1.72	0.14 a	3.10 a	0.43 a
Triazophos 0.1% (2 sprays)	0.28	0.14 a	1.20	0.14 a	2.56 a	0.48 a
L- Cyhalothrin 0.003% (2 sprays)	0.34	0.07 a	1.10	0.21 a	2.39 a	0.51 a
Profenophos 0.05% (2 sprays)	0.21	0.21 a	1.32	0.21 a	1.90 a	0.49 a
Un treated control	0.41	0.41 b	1.37	0.82 b	6.49 b	0.70 b

Figures followed by same alphabet (s) are not differing significantly as per " t " test at 5% level
1st spraying was not given due to very low pest load during flushing.

BHUBANESWAR

The treatment T_4 (L-cyhalothrin) showed the lowest percentage of infestation by shoot tip caterpillar (*Hypatima haligramma*) (7.69%), which was at par with the other chemicals after second spray (Table 3.5).

Infestation by apple and nut borer was significantly reduced to a range of 0.75 per cent to 1.74 per cent, 30 days after 3rd spray, as compared to untreated check (4.29%) and L-cyhalothrin (T_4) was most effective in reducing the pest.

Incidence of the inflorescence thrips (*Frankliniella schultzei* & *Haplothrips ceylonicus* Sch.) 30 days after 3rd spray, was within the range of 0.11 to 0.21, which was significantly lower as compared to untreated check (0.39%). All the treatments had lower natural enemy count and pollinator count in comparison to control (Table 3.6).

Table 3.5 : Effect of different new chemicals on different insect pests of cashew at Bhubaneswar

Treatment	Mean nos. of shoots damaged (%) due to shoot tip caterpillar		Apple and nut borer damaged nuts at 30 days after 3rd spray %	Mean damage grade due to thrips 30 days after 3rd spray %	Yield kg/tree
	Before spray	30 days after 2nd spray			
T_1	9.93 (3.06)	0.80 $(1.04)^a$	1.42 $(1.24)^a$	0.17 $(0.81)^a$	2.85
T_2	8.34 (2.94)	0.96 $(1.11)^a$	1.74 $(1.29)^a$	0.21 $(0.83)^a$	2.72
T_3	7.89 (2.82)	0.96 $(1.08)^a$	1.43 $(1.27)^a$	0.20 $(0.83)^a$	2.84
T_4	7.69 (2.65)	0.64 $(0.97)^a$	0.75 $(1.00)^a$	0.11 $(0.78)^a$	3.04
T_5	9.61 (2.99)	1.12 $(1.15)^a$	1.25 $(1.65)^a$	0.21 $(0.81)^a$	2.79
T_6	9.29 (2.99)	3.37 $(1.87)^b$	4.29 $(2.14)^b$	0.39 $(0.94)^b$	2.68

Table 3.6 : Effect of different new chemicals on natural enemies/ pollinators at Bhubaneswar

Treatment	Mean no. of natural enemies /pollinators in 52 inflorescence 30 days after 3rd spray during 2004			
	Spiders	Black ants	Lady bird beetle	Mirid bug
T_1	1.25^a	3.17^a	0.66^a	0.92^a
T_2	0.67^a	2.67^a	0.42^a	0.66^a
T_3	0.83^a	2.83^a	0.50^a	0.75^a
T_4	0.58^a	2.50^a	0.33^a	0.42^a
T_5	0.67^a	2.58^a	0.58^a	0.58^a
T_6	2.17^b	5.17^b	1.67^b	2.08^b

CHINTAMANI

All the treatments were effective and recorded less than 2.0 per cent incidence while T_6 (control) recorded more than 3.0 per cent incidence after third spray. The treatments T_1 [monocrotophos (0.05%), carbaryl (0.1%) and carbaryl (0.1%)] and T_4 [Lambda cyhalothrin (0.003%)] were found most effective in checking TMB infestation in cashew (Table 3.7).

Table 3.7 : Effect of different new chemicals on different insect pests of cashew at Chintamani

Treatment	Percent incidence of TMB on shoot and inflorescence				Yield Kg/Tree
	Pre-Treatment	30 DA I spray	30 DA II spray	30 DA III spray	
T_1	53.38	07.09	01.30	1.94	_
T_2	44.33	21.11	01.39	1.78	_
T_3	47.30	37.07	04.04	1.50	2.04
T_4	35.24	09.90	01.17	1.34	_
T_5	45.28	20.00	06.78	1.48	1.73
T_6	34.93	16.17	03.10	3.79	0.37
SEm+	17.65	9.75	0.59	0.24	Not analysed
CD@ 5%	_	NS	1.82	0.75	_

JAGDALPUR

The percent incidence of TMB damage on shoot 30 days after second spray, was nil in T_5 which is on par with T_4 (0.65%) and T_3 (0.62%) and on panicle was also lesser at 30 days after second spray in T_5 (0.29%) followed by T_3 (0.37%) and T_1 (0.64%) (Table 3.8).

Leaf caterpillar damage was minimum in T_3 (triazophos) (9.29%) followed by T_5 (profenophos) (18.67%) and the damage by leaf folder was minimum in T_4 (*L-cylohethrin sp.*) (0.78%) and T_5 (profenophos) (1.56%) on 30 days after the third spray. Mean damage by thrips at 30 days after 3rd spray was the least (0.91) in T_4 treatment (Table 3.9).

The mean nut yield was the highest (2.50 kg/tree) in case of T_3 (triazophos) which was on par with T_4 (*L-cyhalothrin sp.*) (1.43 kg/tree) and significantly different from other treated and untreated check (Table 3.8).

Table 3.8 : Efficacy of different new chemical against major pest of cashew at Jagdalpur 2004-05.

Treatment	Percent incidence of TMB (Tea mosquito bug)		Yield Kg/tree
	In shoot 30 days after II[nd] Spray	In Panicle 30days after II[nd] Spray	
T-1: Monocrotophos 0.05% at flushing, Endosulfan 0.05% at flowering and Carbaryl 0.1% at fruiting stage.	1.06 (5.58)	0.64 (3.91)	1.34
T-2 : Chloropyriphos 0.05%	2.24 (8.29)	2.42 (8.48)	1.35
T-3 : Triazphos 0.1%	0.62 (3.02)	0.37 (2.90)	2.50
T-4 : L-cyhalothrin 0.003%	0.65 (3.53)	3.31 (8.42)	1.43
T-5 : Profenophos 0.05%	0.00	0.27 (1.93)	1.35
T-6 : Unsprayed check	3.13 (9.78)	4.84 (12.59)	0.75
CD at 5%	(4.35)	(5.84)	1.25

* Figures in parenthesis are angular transformed values

Table 3.9 : Damage due to minor pests under newer insecticides and Effect of new chemicals against minor insect pest of cashew at Jagdalpur

Treatment	Percent incidence of minor pest of Cashew		Thrips Mean damage grade in Nuts at 30 days after 3[rd] spray (0-4 scale) in Nuts	% Leaf Miner damage at 30 DAS after II[nd] spray
	% Leaf Caterpillar damage at 30 DAS after III[rd] spray	% Leaf Folder damage at 30 DAS after III[rd] spray		
T-1: Monocrotophos 0.05% at flushing, Endosulfan 0.05% at flowering and Carbaryl 0.1% at fruiting stage.	19.81 (25.70)	1.88 (6.73)	1.17	0.93 (4.41)
T-2 : Chlorpyriphos 0.05%	23.77 (29.03)	3.75 (11.07)	1.02	1.58 (5.96)
T-3 : Triazophos 0.1%	9.29 (17.38)	2.70 (9.13)	1.02	0.47 (2.69)
T-4 : L-cyhalothrin 0.003%	22.77 (27.82)	0.78 (3.53)	0.91	5.26 (12.76)
T-5 : Profenophos 0.05%	18.67 (24.46)	1.56 (6.06)	0.95	3.91 (11.12)
T-6 : Unsprayed check	26.25 (30.68)	6.62 (14.35)	1.77	6.13 (13.82)
CD at 5%	(11.52)	(5.96)	0.54	(6.60)

* Figures in parenthesis are angular transformed values

JHARGRAM

The recommended spray schedule (T_1) was the most effective treatment which recorded minimum damage by minor pests and also recorded the highest mean nut yield (5.27 kg/tree). Profenophos (T_5) was more effective than the other newer insecticides tested and recorded 8.12 per cent damage by shoot tip caterpillar after third round of spray. The least thrips damage score (0.10) was recorded by T_5 and was followed by T_1 (0.12) (Table 3.10).

Table 3.10 : Evaluation of some chemicals for control of TMB and other pests at Jhargram

Treatment	% ANB damage	Thrips damage score	% Leaf miner damage	% STC damage		% LBW damage		Mean nut Yield (Kg / tree)
				Before spray	After third spray	Before spray	After third spray	
T_1	0.5a (4.05)	0.12	3.8a (11.24)	7.12 (15.46)	7.92a (16.33)	6.82a (15.13)	2.10a (8.33)	5.27
T_2	0.8a (5.13)	0.20	8.1b (16.54)	6.76a (15.05)	8.82b (17.31)	7.12a (15.46)	4.70b (12.52)	4.84
T_3	0.6a (4.44)	0.26	7.6b (16.00)	7.32a (15.69)	9.86c (18.25)	5.70a (13.81)	4.80b (12.66)	4.63
T_4	0.7a (4.80)	0.24	7.2b (15.56)	6.86a (15.16)	11.52d (14.83)	7.35a (15.73)	4.25b (11.90)	4.28
T_5	0.8a (5.13)	0.10	4.2a (11.83)	8.20a (16.69)	8.12a (16.56)	6.60a (14.89)	2.40a (8.91)	5.05
T_6	3.2b (10.31)	0.35	14.6c (22.46)	7.12a (15.46)	14.82e (22.64)	7.25a (15.62)	16.30c (23.81)	2.76

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

MADAKKATHARA

The minimum damage score due to TMB on shoots (0.15) and panicles (0.15) was noticed in T_1 which led to the maximum mean nut yield of 5.05 kg/tree. L-cyhalothrin was the next best treatment in reducing damage score of shoot (1.16), while, chlorpyriphos was the next best in case of damage score on panicles (1.15) (Table 3.11).

Table 3.11 : Efficacy of different treatments at Madakkathara

Treatments	Damage score on shoots at 30 days after 3rd spray	Damage score on panicles at 30 days after 3rd spray	Nut yield (kg/tree/ Annum)
T-1	0.15	0.15	5.05
T-2	0.17	0.15	3.86
T-3	0.22	0.22	4.29
T-4	0.16	0.17	4.39
T-5	0.17	0.16	4.46
T-6	0.23	0.19	3.9
Mean	0.18	0.17	NS

Figures are mean of four replicates

Means followed by common alphabets are not significantly different among themselves by DMRT

Post-spraying observations regarding percentage infestation by leaf miner (LM), leaf & blossom webbers (LBW), shoot tip caterpillars (STC) and nut borers (NB) revealed no significant variations among the treatments. The treatment effect was non-significant in comparison to control (Table 3.12).

VENGURLE

All the treatments significantly reduced TMB incidence in comparison to control. Triazophos (0.01%) was significantly superior over rest of the treatments leading to a minimum damage of 19.41 per cent at 30 days after the third spray (Table 3.13). The treatment T_3 (Triazophos 0.01%) was found to be significantly superior in reducing incidence of thrips.

Table 3.13 : Incidence of tea mosquito bug & flower thrips in various treatments at Vengurle

Treatment details	Per cent incidence by TMB in 30 days after 3rd spray	Per cent incidence by flower thrips in 30 days after 3rd spray
T_1	26.80 (31.16)	22.75 (28.48)
T_2	23.64 (29.06)	20.75 (27.09)
T_3	19.41 (26.08)	19.50 (26.20)
T_4	24.60 (29.70)	20.50 (26.92)
T_5	30.38 (33.41)	27.00 (30.98)
S.E.±	0.48	0.38
C.D. at 5%	1.48	1.16

VRIDHACHALAM

The recommended spray schedule (T_1) was most effective in controlling TMB and other minor pests and was on par with profenophos (T_5). The highest mean nut yield of 6.60 kg/tree was obtained in recommended spray schedule which was followed by profenophos (6.20 kg/tree) (Table 3.14).

Table 3.12 : Efficacy of different chemicals against minor pests of cashew at Madakkathara

Treatments/ details	30 days after each spraying (pest infestation in percentage)				
	Leaf miner at 3rd spray	Leaf & blossom webbers at 3rd spray	Shoot tip caterpillars at 3rd spray	Apple and nut borers at 3rd spray	Thrips damage (0-4 scale)
T-1	38.86	10.09	9.85	9.12	0.79
T-2	39.97	14.41	11.77	7.90	0.86
T-3	42.31	13.69	10.57	8.33	0.88
T-4	39.87	13.93	13.69	9.55	0.94
T-5	41.84	12.73	12.25	8.87	0.99
T-6	37.72	13.98	12.25	8.40	1.28
F-test	NS	NS	NS	NS	NS
CD (0.05)	--	--	--	--	--

Figures are mean of four replicates

Table 3.14 : Efficacy of different new chemical against Tea mosquito bug (TMB) and other minor pests at Vridhachalam

Treatment/ details	Per cent damage by TMB in 30 days after 3rd spray	TMB scoring in 30 days after 3rd spray	30 days after 3rd spray		Apple and nut borer damaged nuts at 30 days after 3rd spray (%)	Mean Nut Yield (kg/tree)
			Leaf miner damaged leaves 30 days after 3rd spray	Leaf and blossom damaged shoots (%)		
T_1 Monocrotophos (0.05% at flushing, Endosulfan 0.05% at flowering and Carbaryl 01% at fruiting	0.00	0.00	2.40	5.90	0.60	6.60
T_2 Chlorpyriphos 0.05% (2 sprays)	4.10	0.96	4.20	7.75	0.95	5.80
T_3 Triazophos 0.1% (2 sprays)	3.80	1.00	4.80	8.90	1.10	5.40
T_4 Ethofenprox 0.015% (2 sprays)	2.60	1.15	4.75	8.75	1.00	5.20
T_5 Profenophos 0.05% (2 sprays)	1.80	0.85	3.35	6.38	0.80	6.20
T_6 Untreated control	21.70	3.15	7.80	10.40	1.60	3.60

Ent. 2: Control of cashew stem and root borer

1. Prophylactic control trial

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

The objective of this trial is to evaluate different pesticides and neem products for prophylactic control of the cashew stem and root borer incidence.

SUMMARY:

Swabbing with neem oil 5 per cent thrice during Oct-Nov., Jan-Feb., and Apr-May was the most effective prophylactic treatment recorded at Bapatla, Bhubaneswar, Jhargram, Vengurle and Vridhachalam. At Jagdalpur and Madakkathara, application of *Metarhizium anisopliae* spawn + neem cake resulted in the maximum duration without infestation by the pest.

Treatment

Experimental details:

T1 : Swabbing neem oil 5% once during October – November
T2 : Swabbing neem oil 5% twice during October – November and January-February
T3 : Swabbing neem oil 5% thrice during October-November, January-February and April-May.
T4 : Application of *Metarhizium anisopliae* spawn 250g/tree + 500g neem cake
T5 : Application of *Beauveria bassiana* spawn 250g/tree + 500g neem cake

BAPATLA

Application of neem oil 5 percent thrice (T_3) at an interval of three months during Oct-Nov, Jan-Feb and Apr-May recorded nil infestation of cashew stem and root borer up to 210 days from the first application.

The application of spawn of entomopathogenic fungi *viz; Metarrhizium anisopliae* and *Beauveria bassiana* resulted in 30.00 and 35.00 percent infestation within 92 and 94 days respectively and was on par with the control (Table 3.15).

Table 3.15 : Efficacy of prophylactic treatments on incidence of cashew stem and root borer at Bapatla

Treatment	Mean duration free from pest attack (days)	Per cent incidence of CSRB
T1: Swabbing neem oil 5% once during Oct- Nov	108	25.00
T2: Swabbing neem oil 5% twice during Oct- Nov & Jan-Feb	160	30.00
T3: Swabbing neem oil 5% thrice during Oct- Nov, Jan-Feb & Apr-May	210	0.00
T4: Application of *Metarrhizium anisopliae* Spawn 250g + neem cake 500 g./ tree	92	30.00
T5: Application of *Beauveria bessiana* Spawn 250g + neem cake 500 g./ tree	94	35.00
T6: Un treated control	105	35.00

BHUBANESWAR

Application of neem oil (5%) thrice i.e. during Oct., Jan. & April reduced the infestation of CSRB to 3.33 per cent. Also, application of neem oil (5%) twice during October and January reduced the pest infestation to 6.67per cent (Table 3.16). Application of spawn of entomopathogenic fungi was not effective and led to 10 per cent infestation.

Table 3.16 : Prophylactic control of cashew stem and root borer (CSRB) at Bhubaneswar

Treatments	% infestation
T_1 – Swabbing neem oil 5% once during October-November	13.30
T_2 – Swabbing neem oil 5% twice during October-November and January-February	6.67
T_3 – Swabbing neem oil thrice during Oct-Nov, Jan-Feb and Apr-May	3.33
T_4 – Application of *Metarrhizium anisopliae* spawn 250g/tree + 500g neem cake	10.00
T_5 – Application of *Beuveria bassiana* spawn 250g/tree + 500g neem cake	13.30
T_6 – Untreated check	23.30

JAGDALPUR

Application of *Metarhizium anisopliae* spawn 250g/tree + 500g neem cake (T_4) was most effective treatment with least infested trees (12.50%) which were free from pest incidence up to 260 days (Table 3.17).

Table 3.17 : Infestation levels of CSRB in different prophylactic treatments at Jagdalpur

Treatment	No. of trees treated	No. of trees infested	% Infestation
T1 : Swabbing neem oil 5% once during Oct-Nov.	17	12	70.59
T2 : Swabbing neem oil 5% twice during Oct-Nov., Jan-Feb.	17	13	76.47
T3 : Swabbing neem oil 5% thrice during Oct-Nov., Jan-Feb & Apr.- May	17	10	58.82
T4 : Application of *Metarhizium anisopliae* spawn 250g/tree + 500g neem Cake.	16	2	12.50
T5 : Application of *Beauveria bassiana* spawn 250g/tree + 500g neem cake.	15	5	33.33
T6 : Untreated check	18	15	83.33

JHARGRAM

The minimum incidence of CSRB was noticed in T_3 (i.e. swabbing of neem oil 5% thrice) which also had the longest mean duration free from pest attack (220.50 days). This was followed by T_2 (i.e. swabbing of neem oil 5% twice) which resulted in 198.20 days of pest free period. Untreated check had fresh pest incidence within 25.30 days (Table 3.18).

Table 3.18 : Effect of prophylatic treatment on CSRB incidence at Jhargram

Treatments	Mean duration free from pest attack (days)
T_1 – Swabbing neem oil 5% once during October-November	170.00
T_2 – Swabbing neem oil 5% twice during October-November and January-February	198.20
T_3 – Swabbing neem oil 5% thrice during Oct-Nov, Jan-Feb and Apr-May	220.50
T_4 – Application of *Metarrhizium anisopliae* spawn 250g/tree + 500g neem cake	160.30
T_5 – Application of Beauveria bassiana spawn 250gm/tree + 500gm neem cake	150.20
T_6 – Untreated check	25.30

C = Collar S = Stem R = root

MADAKKATHARA

The percentage infestation varied between 6.67 to 46.67 in different treatments. In untreated check, maximum infestation (46.67%) was recorded. The mean pest free duration in different treatments varied between 81 to 150 days and was maximum in T_4 i.e. application of *Metarrhizium anisopliae* spawn + 500g neem cake, which also had minimum percentage incidence of the pest (6.67%) (Table 3.19).

Table 3.19: Infestation of cashew stem and root borer in different prophylactic treatments at Madakkathara

Treatments	Number of trees		Mean duration (days) free from attack	% Infestation
	Treated	Infested		
T-1: Swabbing neem oil 5% once during Nov - Dec	15	5	90	33.34
T-2: Swabbing neem oil 5% twice during Nov – Dec and Feb – March	15	4	90	26.67
T-3: Swabbing neem oil 5% thrice during Nov – Dec, Feb – March and April – May	15	7	81	46.67
T-4: Application of *Metarhizium anisopliae* + 500g neem cake	15	1	150	6.67
T-5: Application of *Beauveria bassiana* + 500g neem cake	15	5	106	33.34
T-6: Untreated check (grub-extraction only)	15	7	81	46.67

VENGURLA

Swabbing neem oil 5% thrice could prevent incidence of CSRB for a maximum mean duration of 171.27 days while in untreated check pest incidence occurred within a mean duration of 108.90 days (Table 3.20).

Table 3.20 : Effect of prophylactic treatments on incidence of cashew stem and root borer at Vengurla

Treatment details	Mean duration (in days) free from the pest attack
T_1 – Swabbing neem oil 5% during Oct – Nov	167.20
T_2 – Swabbing neem oil 5% during Oct – Nov., Jan – Feb.	161.00
T_3 – Swabbing neem oil 5% during Oct – Nov., Jan – Feb and April – May	171.27

T_4 – Application of *Metarrhizium anisopliae* spawn 250gm/tree + 500gm neem cake	Not evaluated
T_5 – Application of *Beauveria bassiana* spawn 250gm/tree + 500gm neem cake	Not evaluated
T_6 – Untreated check	108.90

VRIDHACHALAM

Among the prophylactic treatments tried, swabbing neem oil 5% thrice was the most effective treatment which led to a minimum of 5.0 per cent pest incidence. Swabbing neem oil (5%) twice was found to be the next best treatment having 10.00 per cent pest incidence and maximum duration free from pest attack (138 days) (Table 3.21).

Table 3.21 : Incidence of CSRB in prophylactic trials at Vridhachalam

Treatment details	Mean duration free from pest attack	Percent attack
T_1 – Swabbing neem oil 5% during Oct – Nov	120	15.00
T_2 – Swabbing neem oil 5% during Oct – Nov., Jan – Feb.	138	10.00
T_3 – Swabbing neem oil 5% during Oct – Nov., Jan – Feb and April – May	120	5.00
T_4 – Application of *Metarrhizium anisopliae* spawn 250gm/tree + 500gm neem cake	110	15.00
T_5 – Application of *Beauveria bassiana* spawn 250gm/tree + 500gm neem cake	97	15.00
T_6 – Untreated check	85	20.00

Note : C = Collar region R = Root region S = Stem region

2. Curative control trial

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

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

SUMMARY:

Lindane 0.2% having 66.67 per cent of treated trees without reinfestation at Bapatla, chlorpyriphos 0.2% having 85.00 per cent of treated trees without reinfestation at Bhubaneswar and carbaryl 1.0% having cent per cent of treated trees without reinfestation at Chintamani and Jhargram were found to be the most effective insecticides for post extraction prophylaxis. At Jagdalpur, carbaryl and chlorpyriphos lead to 40 per cent of treated trees without reinfestation; while at Vengurle, chlorpyriphos and lindane led to cent per cent of trees without reinfestation, which were the most effective post extraction prophylaxis treatments. However, at Madakkathara no definite trend was observed among the treatments.

Treatment for evaluation :

T_1 = Carbaryl (1%)
T_2 = Chlorpyriphos (0.2%)
T_3 = Monocrotophos (0.2%)
T_4 = Lindane (0.2%)
T_5 = *Metarrhizium anisopliae* fungus spawn 250gm/tree + 500gm neem cake
T_6 = Control (only removal of CSRB grubs)

BAPATLA

Lindane (0.2%) led to maximum number of trees without reinfestation (66.67) followed by carbaryl (1.0%) (58.33%). However, even under untreated check 41.67 per cent of trees had no reinfestation (Table 3.22). Reinfestation was maximum (36.67%) when the percentage bark circumference damaged exceeded 75 per cent (Table 3.23).

Table 3.22 : Efficacy of certain curative control treatments against cashew stem and root borer at Bapatla

Treatment	% trees without reinfestation/ persistant attack
Carbaryl 1.0%	58.33
Chlorpyriphos 0.2%	50.00
Monocrotophos 0.2%	50.00
Lindane 0.2%	66.67
Un treated check	41.67

Table 3.23 : Physical parameters of cashew trees reinfested/ uninfested by cashew stem and root borer after curative treatment at Bapatla

Parameters		No. of trees in each category	
		Without re-infestation	With re-infestation / persistant infestation
Stem girth (cm.)	< 60	---	---
	60-80	---	---
	80-100	---	---
	> 100	32 (53.33)	28 (46.67)
Age (Years)	< 5	---	---
	5-10	---	---
	10-15	---	---
	> 15	32 (53.33)	28 (46.67)
% Bark circumference damaged	< 25	26	3
	25-50	4 (6.67)	2 (3.33)
	50-75	2 (3.33)	1 (1.67)
	> 75	---	22 (36.67)
Zone	C+R	2 (3.33)	19 (31.67)
	C+S	5 (8.33)	7 (11.67)
	R	---	---
	S	25 (41.67)	---
	C+R+S	---	2 (3.33)
Canopy yellowing	a)Yellowed	2 (3.33)	23 (38.33)
	b) Not yellowed	30 (50.00)	---

Note : Total no. of trees treated = 60

BHUBANESWAR

Chlorpyriphos (T_2) treatment induced maximum recovery (85%) while application of *M. anisopliae* spawn (T_5) caused minimum recovery (55%). However, in untreated check, wherein only extraction of grubs was done, 40 per cent of the treated trees could recover (Table 3.24).

The recovery was better, when the treatment is imposed at an early stage of infestation and when the bark circumference damaged was less than 50 per cent. The trees attacked in collar or stem zone showed less reinfestation (2 trees) as compared to those having root infestation (40 trees) (Table 3.25).

Table 3.24 : Infestation of CSRB under curative control trial at Bhubaneswar

Treatments	% of trees without reinfestation
T_1 Carbaryl (1%)	65.00
T2 Chlorpyriphos (0.2%)	85.00
T3 Monocrotophos (0.2%)	75.00
T_4 Lindane (0.2%)	70.00
T_5 Application of *Metarrhizium anisopliae* fungus spawn @250gm /tree+ 500 gm neem cake	55.00
T_6 Untreated check	40.00

Table 3.25 : Physical parameters of treated trees under curative control trial at Bhubaneswar

Physical parameters of trees observed			
		No. of trees in each category	
		Without reinfestation	With reinfestation
Stem girth (in cm)	<60	60	4
	60-80	18	**42**
	80-100	-	
Age (years)	5-10	12	2
	10-15	62	32
	>15	4	8
Zone of attack	C+R	18	10
	C+S	20	2
	R	-	-
	S	-	-
	C+R+S	40	30
Canopy yellowing	Yellowed	-	-
	No yellowing	78	42

JAGDALPUR

Carbaryl (1.0%) and chlorpyriphos (0.2%) had higher percentage of trees without reinfestation (40.0% each) in comparison to other treatments (Table 3.26).

Table 3.26 : Efficacy of certain insecticides as curative control against CSRB at Jagdalpur

Treatment	No. of trees treated	% of trees without attack out of total trees treated
T1 : Carbaryl (1.0%)	10	40.00
T2 : Chlorpyriphos (0.2%)	10	40.00
T3 : Monocrotophos (0.2%)	10	30.00
T4 : Lindane (0.2%)	10	30.00
T5 : Untreated check (only removal of CSRB grubs adopted)	10	10.00

JHARGRAM

Carbaryl (1%) and chlorpyriphos (0.2%) had the highest percentage of trees without reinfestation, being 100.00 and 83.30 respectively (Table 3.27). The level of reinfestation was higher in untreated check (83.40).

Table 3.27 : Efficacy of curative treatments against CSRB at Jhargram

Treatments	% trees without reinfestation / persistent attack	% bark circumference damaged in physical parameters of trees treated
T_1 : Carbaryl (1%)	100.00	23 – 39
T_2 : Chlorpyriphos (0.2%)	83.30	32 – 43
T_3 : Monocrotophos (0.2%)	50.00	29 – 41
T_4 : Lindane (0.2%)	50.00	30 – 46
T_5 : Untreated check (only grub extraction)	16.60	28 – 41
T_6 : Treated check (Swabbing neem oil 5% during Oct – Nov, Jan – Feb and April – May)	66.60	30 – 45

Note: No. of trees treated = 6

MADAKKATHARA

Post-extraction prophylaxis with carbaryl, chlorpyriphos, monocrotophos, lindane, untreated check (T-5, only grub-extraction) and the treated check (T-6) showed no definite trend. Chlorpyriphos (0.2%) was found to be most effective, with 91.43 per cent of trees without re-infestation (Table-3.28)

Table 3.28 : Efficacy of different insecticides for curative control against CSRB (post prophylaxis treatments)

Treatments		Percentage trees without re-infestation/ persistent attack
T-1	Carbaryl (1%)	80.00
T-2	Chlorpyriphos (0.2%)	91.43
T-3	Monocrotophos (0.2%)	71.43
T-4	Lindane (0.2%)	85.71
T-5	Untreated check (grub-extraction only)	82.85
T-6	Treated check (neem oil 5% swabbing + 75g Sevidol 8%/tree)	85.71

VENGURLE

Cent per cent of infested trees treated with chlorpyriphos (0.2%) and lindane (0.2%) after grub removal, were without reinfestation. In 60% of trees wherein in only CSRB grubs were removed no reinfestation or persistent attack was observed (Table-3.29)

Trees having stem girth more than 100cm diameter were preferred for infestation by CSRB. The trees above 15 years were more prone to attack by CSRB. The maximum re-infested trees were recorded to have 25 – 50 per cent bark circumference damage. Maximum attack was observed in C + R and C +S region (Table 3.30)

Table 3.29 : Efficacy of curative treatments against Cashew Stem and Root Borer (CSRB) at Vengurla

Treatment	% of trees without reinfestation / persistent attack
T1-Carbaryl (1%)	90
T2-Chlorpyriphos (0.2%)	100
T3-Monocrotophos (0.2%)	80
T4-Lindane (0.2%)	100
T5-Control	60

Table 3.30: Physical parameters of treated trees with & without reinfestation by CSRB at Vengurla

Physical Parameters		No. of trees in each category	
		with re-infestation	without re-infestation
Stem girth (cm)	<60	8	2
	60-80	8	-
	80-100	7	-
	>100	20	5
	Total	**43**	**7**
Age (in yrs)	<5	15	2
	5-10	5	-
	10-15	-	-
	>15	23	5
	Total	**43**	**7**
% bark circumference damaged	<25	16	2
	25-50	24	2
	50-75	3	1
	>75	-	2
	Total	**43**	**7**
Zone of attack	C+R	20	3
	C+S	8	-
	R	3	1
	S	5	1
	C+R+S	7	2
	Total	**43**	**7**
Canopy yellowing	Yellowing	-	-
	No Yellowing	50	-
	Total	**50**	**-**

VRIDHACHALAM

Maximum control of CSRB in infested trees (86.00%) was observed with T_3 i.e. root feeding of monocrotophos followed by T_2 chlorpyriphos (0.2%) (75.0%); T_1 carbaryl (1.0%) (69.0%) and T_4 lindane (0.2%) (64.0%) which were on par with each other (Table 3.31).

Table 3.31: Efficacy of certain curative treatments against CSRB at Vridhachalam

Treatment details		No. of trees treated	No. of trees without re-infestation	% of trees without re-infestation
T_1 -	Carbaryl 1%	13	9	69.00
T_2 -	Chlorpyriphos (0.2%)	12	9	75.00
T_3 -	Monocrotophos (0.2%) Root feeding	14	12	86.00
T_4 -	Lindane (0.2%)	14	9	64.00
T_5 -	*Metarrhizium anisopliae* fungus spawn 250 gm/tree + 500 gm neem cake	10	5	50.00
T_6 -	Untreated control	10	0.00	0.00

Ent.3: Bioecology of pests of regional importance and survey of pest complex and natural enemies

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

Plains / others :

Chintamani and Jagdalpur

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

SUMMARY:

At Bapatla the activity of leaf and blossom webber was negatively and significantly influenced by relative humidity; leaf miner activity was significantly and negatively influenced by maximum and minimum temperature. The number of rainy days significantly and positively influenced the population of leaf miner. At Bhubaneswar, the important local pests viz., shoot tip caterpillar and leaf and blossom webber did not show any significant correlation with any weather parameters. At Jagdalpur, the maximum temperature had a positive influence on TMB damage. Relative humidity and rainfall had significant and negative influence on thrips incidence. At Madakkathara, only the minimum temperature significantly and negatively influences the TMB population. At Vridhachalam, relative humidity (evening) significantly and positively influenced leaf and blossom webber, leaf miner, shoot tip caterpillar and leaf folder damage.

BAPATLA

Both maximum temperature (r = 0.47) and minimum temperature (r = 0.48) exercised significant positive influence where as, the relative humidity (m) (r = -0.49) and relative humidity (e) (r = -0.33) were found to have significant negative influence on the activity of leaf and blossom webber (Table 3.32).

Both maximum temperature (r = -0.43) and the minimum temperature (r = -0.44) exercised significant negative influence on the activity of leaf folder, whereas the relative humidity (m) (r = 0.44) exercised a positive influence. Only the number of rainy days (r = 0.27) exercised a significant positive influence on population of leaf miner (Table 3.32).

The minimum temperature (r = -0.37), relative humidity (e) (r = 0.27), rain fall (r = -0.30) and the rainy days (r = -0.34) (Table 3.32) were found to exercise a significant negative influence.

The incidence of leaf thrips reached up to 28.00 thrips per 10 leaves with higher activity during summer months. The abiotic factors, maximum temperature (r = 0.78) and minimum temperature (r = 0.70) exercised significant positive influence, where as,

the relative humidity (m) (r = -0.79) and relative humidity (e) (r = -0.35) exercised significant negative influence.

A significant negative influence on the activity of inflorescence thrips was recorded due to the rainfall (r = -0.31) and number of rainy days (r = -0.38) (Table 3.32).

Table 3.32 : Correlation of weather parameters with the pests of regional importance at Bapatla

Weather Parameters	Lbw	Anb	Lm	Stc	Lt	It	Lf
Maximum temperature ºC	0.47*	0.16	0.03	-0.07	0.78*	0.15	-0.43*
Minimum temperature ºC	0.48*	0.22	0.15	-0.37*	0.70*	0.07	-0.44*
Relative humidity(m) (%)	-0.49*	-0.21	0.01	0.15	-0.79*	-0.18	0.44*
Relative humidity (e) (%)	-0.33*	0.10	0.20	-0.27*	-0.35*	-0.06	0.11
Rainfall	-0.11	-0.13	0.19	-0.30*	-0.15	-0.31*	-0.16
Rainy days	-0.05	-0.15	0.27*	-0.34*	-0.16	-0.38*	-0.20

Lbw: Leaf and blossom webber **Anb**: Apple and nut borer Lm: Leaf miner **Stc**: Shoot tip caterpillar
Lf: Leaf folder **Lt:** Leaf thrips **It**: Inflorescence thrips.
*** Significant at 0.05 level**

BHUBANESWAR

The cashew stem and root borer, had positive significant correlation with maximum temperature (r = 0.48) and negative significant correlation with evening RH (r = 0.60), rainfall (r = 0.36) and rainy days (-0.40) (Table 3.33).

The Shoot tip caterpillar (*Hypotima haligramma)* population indicated that no weather parameter was significantly correlated with the pest.

The yellow thrips (*Frankliniella schultzei* T.) had significant positive correlation (r = 0.61) with morning RH, whereas, negative correlation (r = -0.82) with evening RH, was observed. No significant correlation existed with incidence of black thrips (*Haplothrips ceylonicus* Sch.), for any abiotic parameter.

The leaf miner (*Acrocerops syngramma* M.) activity was significantly and positively correlated with maximum temperature (r = 0.48) as well as minimum temperature (r = 0.42) (Table 3.33).

Natural enemies

Studies on field parasitisation of major pests of regional importance of cashew indicated maximum parasitation of shoot tip caterpillar (20%) by *Elasmus* sp. leaf and blossom webber (12%) by *Bracon brevicornis* and leaf miner (30%) by *Sympiesis* sp were observed. (Table 3.34)

Table 3.33 : Correlation of weather parameters with the pests of regional importance at Bhubaneswar

Name of the insect pest	Temperature		Relative Humidity		Rainfall	Rainy days
	MAX. X_1	MIN. X_2	AM X_3	PM X_4	X_5	X_6
Shoot tip caterpillar (Y_1)	0.29	0.13	0.18	-0.10	-0.04	-0.25
Yellow thrips (Y_2)	0.20	-0.09	0.61*	-0.82*	-0.21	-0.26
Black thrips (Y_3)	0.20	0.27	0.05	0.23	-0.29	-0.18
Leaf miner (Y_4)	0.48*	0.42	-0.06	0.26	0.15	-0.09
Apple and nut borer (Y_5)	-0.09	-0.37	0.24	0.31	0.47	0.30
Leaf Beetle (Y_6)	0.42	0.21	0.15	-0.0019	0.24	-0.29
Leaf Folder (Y_7)	-0.07	0.22	-0.18	0.07	-0.27	-0.23
Leaf and Blossom Webber (Y_8)	0.53	0.38	-0.06	-0.45	-0.41	-0.23
Cashew Stem and Root Borer (CSRB) (Y_9)	0.48*	-0.19	-0.07	0.60	-0.36*	-0.40*

* = 'r' at 5% level of significance

** = 'r' at 1% level of significance

Table 3.34 : Occurrence of natural enemies of cashew pests on different locations at Bhubaneswar.

Sl. No.		Natural enemies	Host insect	Stage affected	Period of occurrence	Intensity (%)
I.		***Parasitoid***				
	1.	*Bracon brevicornis*	Leaf and blossom webber	Larva	April 2nd fortnight to 1st week of June	12%
	2.	*Elasmus* sp.	Shoot tip caterpillar	Larva	Sept-Nov.	20%
	3.	*Sympiesis sp.*	Leaf miner	Larva	August	30%
II.		***Predaters***				
	1.	*Spiders*			Round the year	2-3 per 52 leader shoot
		Argeopes sp			Except May-June	
		Oxypes sp.				
	2.	Lady bird beetles	Mealy bugs		January to March	1-2 per 52 leader shoots
		Verania cinta				
		Monochilus sexmaculata				
	3.	Black ants			Round the year	2-10/ 52 leader shoots
		Componotus sp.				
	4.	Mirid bug			January to March	1-3/ 52 leader shoots
III		***Fungi***				
	1.	*Metarrhizium anisopliae*	Cashew stem and root borer	Grub / pupa	July to October	

CHINTAMANI

Various insect pest species occur on cashew in this region, however, tea mosquito bug and cashew stem and root borer cause yield losses and population reduction respectively (Table 3.35).

The leaf miner *(Acrocercops syngramma)* infestation was more on the stray flushes available through out the year and the damage never assumed pest status. The fruit and nut borer (*Thylecoptila panerosema*) infestation was severe during June-July on late maturing fruits (2 – 60 percent). The damage was more on the apple than on the nut. Leaf and blossom webber (*Lamida moncusalis*) was more serious on young plants of 3-5 years during May to September; *Vespa* spp. predated on larvae of this pest. Natural enemies occurring in cashew ecosystem is given in Table 3.36.

Table 3.35 : Seasonal occurrence of pests of regional importance at Chintamani

Common Name	Scientific name	Period of Occurrence
Tea mosquito	*Helopeltis antonii*	October – March
Stem and root borer	*Plocaederus ferrugineus*	Throughout the year
Leaf miner	*Acrocercops syngramma*	September –March
Leaf and blossom webber	*Lamida moncusalis*	August – April
Leaf thrips	*Rhipiphorothrips cruentatus*	July – February
Leaf thrips	*Selenothrips rubrocinctus*	July – February
Inflorescence thrips	*Scirtothrips dorsalis*	December – May
Inflorescence thrips	*Rhynchothrips raoensis*	December – May
Shoot tip caterpillar	*Hypotima haligramma*	October – January
Fruit and nut borer	*Thylecoptila panerosema*	February – July
Leaf weevils	*Mylocerus discolor*	February – July
Mealy bug		April -June
Termites	*Odentotermus obesus*	April -June
Aphids	*Toxoptera odinae*	November – May
Blister beetle	*Zonabris pustulata*	February – June

Table 3.36 : Occurrence of natural enemies of cashew pests at Chintamani

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

JAGDALPUR

Cashew stem and root borer incidence was seen round the year, but its activity as indicated by the external symptoms, was higher during February-March. The abiotic factors, minimum temperature and relative humidity (morning) had significantly negative correlation (r = -0.56 & -0.54) on the activity of CSRB (Table 3.37).

The damage of TMB was observed from December to June and damage ranged between 0.04-9.13 percent in leaf, 0.02-6.53 percent in shoot and 1.80-2.34 percent in panicle. The relative humidity (evening) had significant negative influence (r = -0.51) on shoot damage by TMB while relative humidity (morning) had significant negative influence (r = -0.77) on panicle damage by TMB. The peak activity of leaf caterpillar was recorded during July month where infestation ranged from 4.15 to 57.72 per cent leaf damage. The No. of rainy days were positively correlated (r = 0.53) with leaf damage (Table 3.37).

The activity of leaf folder had a peak incidence during April. No weather parameter was correlated with population of this pest. The activities of thrips were noticed round the year, with maximum incidence during April. The relative humidity (evening) and rainfall had significant negative influence (r = -0.59 and -0.54, respectively) on thrips incidence (Table 3.37).

During the field surveys, the leaf caterpillars were found to be predated by spiders and leaf thrips were generally predated by *Brumus spp* throughout the year.

Table 3.37 : Correlation of weather parameters with the pests of regional importance at Jagdalpur

Weather Parameters	Correlation coefficient values (r) of pests of regional importance							
	Leaf Caterpillar	Leaf Folder	Leaf Miner	Thrips	CSRB attack	TMB		
						Leaf	Shoot	Panicle
Max. Temp °C	-0.30	0.26	-0.41	0.36	0.01	0.10	0.59*	0.77**
Min. Temp °C	0.18	-0.11	-0.41	-0.18	-0.56*	-0.39	-0.06	0.23
R. H. (m) %	-0.0001	-0.12	0.23	-0.27	0.05	0.07	-0.46	-0.77**
R. H. (e) %	0.33	-0.34	-0.10	-0.59*	-0.45	-0.38	-0.51*	-0.32
Rainfall	0.48	-0.45	-0.16	-0.54*	-0.54*	-0.39	-0.36	-0.21
Rainy Days	0.53*	-0.44	-0.19	-0.47	-0.50	-0.33	-0.43	-0.30

- * - Value of 'r' significant at 5% level.
- * * - Value of 'r' significant at 1% level.

JHARGRAM

Cashew stem and root borer (*Plocaederus ferrugineus)* is a very serious pest of the region causing severe damage in the neglected plantations and occurs throughout the year. Leaf and blossom webber (*Lamida moncusalis)* is also serious in this region, with pest population coinciding with the new flushing during November to December. Severe damage to the new growing shoot tips by Shoot tip Caterpillar (*Hypotima haligramma),* has been observed, during December – February.

Leaf thrips (*Selenothrips rubrocinctus, Scirtothrips dorsalis & Rhynchothrips raoensis)* appear in November and reach a peak in February, reduce gradually thereafter. Inflorescence thrips appeared with the panicle initiation with a peak in February – March. Incidence of Tea mosquito bug (*Helopeltis antonii)* was very low in all the areas, but sporadic and minimal incidence was noticed from November upto March. Termites (*Odentotermus obesus)* occurred all round the year, except during monsoon season and caused moderate damage to plants of all age groups, by feeding on bark (Table 3.38).

Spiders, black ants, coccinellids and braconids formed the natural enemy complex. Spiders were prevalent across the year and the other natural enemies coincided with flushing and reproductive phase of the plants.

Table 3.38 : Population dynamics of pests of regional importance at Jhargram

Month	Mean damage score of TMB / 52 Shoots	% LBW damage	% ANB damage	% Leaf miner damage	% STC damage	Mean no. of leaf thrips / 10 leaves	Mean no. of inflorescence thrips / 10 panicle	% LF damage shoots
Jan	0.30	4.60	0.00	14.40	17.20	38.40	42.80	2.64
Feb	0.20	2.10	0.00	8.30	16.20	134.20	145.20	1.50
Mar	0.00	0.00	1.20	2.60	2.20	106.20	120.20	0.80
Apr	0.00	0.00	3.40	1.20	0.00	5.30	61.50	0.00
May	0.00	0.00	2.70	0.00	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug	0.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0.00	4.60	0.00	1.60	0.00	0.00	0.00	0.00
Oct	0.00	14.30	0.00	6.20	2.30	0.00	0.00	0.00
Nov	0.00	17.50	0.00	10.30	4.30	6.20	12.50	3.24
Dec	0.40	19.40	0.00	17.30	16.80	17.80	26.30	5.30

MADAKKATHARA

Damage by tea mosquito bug, was maximum in October for flushes (0.22%), maximum for panicles (0.34%) and nuts (0.23%) in December. Leaf miner was observed throughout the season (0.50 – 40.50%), thrips were recorded at low level (0 – 1.06 damage score) (Table 3.39).

Red/weaver ant (*Oecophylla smargdina*) colonies were observed in Sept – Oct, black ants in December – January (Table 3.40).

Table 3.39: Bio-ecology of pests of regional importance, pest complex and natural enemies in cashew at Madakkathara

Month of observations	TMB mean damage score			Leaf blossom webber (% shoot damage)	Apple & Nut borer (% of apples damaged)	Leaf Miner (5 mined leaves) on five damaged laterals	Thrips damage on 100 nuts/apples (0-4 scale)
	Flushes	Panicles	Nuts				
Apr. 04	0.00	0.00	0.00	---	---	---	---
May 04	0.00	0.00	0.00	---	---	---	---
Jun. 04	0.00	0.00	0.00	---	---	---	---
Jul. 04	0.00	0.00	0.00	---	---	---	---
Aug. 04	0.00	0.00	0.00	0.00	0.00	0.50	---
Sep. 04	0.16	0.00	0.00	0.00	0.00	5.60	0.00
Oct. 04	0.22	0.23	0.09	0.00	2.53	22.70	0.00
Nov. 04	0.02	0.03	0.00	0.00	0.00	40.50	0.74
Dec. 04	0.07	0.34	0.23	0.00	5.57	36.20	0.97

Jan. 05	0.09	0.10	0.00	0.00	1.88	35.40	1.06
Feb. 05	0.00	0.02	0.12	0.00	3.02	38.30	0.00
Mar. 05	0.00	0.00	0.00	0.00	4.87	20.90	0.00
Apr. 05	--	--	--	0.00	1.58	18.80	0.00

Table 3.40 : Natural enemies in cashew (Nos. per 52 shoots) at Madakkathara

Months of observation	Ants	Spiders	Coccids	Remarks
Apr 04	10.85	NR	NR	
May 04	5.83	NR	NR	
Jun 04	9.10	NR	NR	
Jul 04	4.58	NR	NR	
Aug 04	4.80	NR	NR	
Sep 04	6.13	1.24	0.55	Red ant colony
Oct 04	13.59	1.49	0.44	Red ant colony
Nov 04	7.35	0.44	0.06	
Dec 04	2.66	1.23	0.00	Black ants
Jan 05	2.75	2.38	0.13	Black ants
Feb 05	3.19	1.64	0.13	
Mar 05	1.66	2.15	0.00	

Each month's observation is mean of data compiled for 4 weeks
NR – Not recorded

Correlation studies of abiotic factors with TMB :

Amongst the abiotic factors, only minimum temperature was found negatively and significantly correlated with the TMB population (Table 3.41).

Table 3.41 : Simple linear correlation between TMB population and weather parameters at Madakkathara (2004-05)

Max temp (^{o}C)	Min temp (^{o}C)	RH (morning) (%)	RH (afternoon) (%)	Sunshine hours (h)	Rain (mm)	Days (d)
0.51	-0.62 *	-0.26	-0.12	0.13	0.35	0.04

* Significant at 5% level

VENGURLE

Incidence of TMB, was at a peak during Feb (26.71%) and reduced to a low level in June (2.92%). In case of leaf miner, the incidence started simultaneously with new flushes during May (1.21%). The incidence of thrips started from January (16.10%) which reached a peak in March (20.38%). Apple and nut borer, incidence started during January (7.02%) with the setting of apples and nuts. Infestation level was maximum during April (12.03%) (Table 3.42).

Table 3.42 : Seasonal abundance of pests of regional importance at Vengurle

Months	TMB %	Leaf miner %	Apple & nut borer %	Inflo. thrips %	Aphids %
Jan. 04	23.92	7.22	7.02	16.10	2.30
Feb. 04	26.71	6.36	8.27	18.21	3.18
Mar. 04	17.74	6.18	11.44	20.38	1.46
Apr. 04	14.02	5.74	12.03	15.97	-
May 04	10.08	-	-	14.58	-
June 04	2.92	6.03	-	-	-
Jul. 04	3.12	8.17	-	-	-
Aug. 04	5.23	9.36	-	-	-
Sept. 04	8.68	10.64	-	-	-
Oct. 04	10.16	12.51	-	-	-
Nov. 04	11.97	11.80	-	-	-
Dec. 04	12.23	10.67	-	8.93	-

VRIDHACHALAM

Maximum TMB damage (39.50%) occurred during the second fortnight of February. Leaf miner (*Acrocercops syngramma*) was found from first fortnight of July to the end of January with a maximum of 20.00 % leaf damage during first fortnight of November. Leaf and blossom webber *(Lamida moncusalis*) was found from June to March and apple & nut borer incidence was noticed from second fortnight of January-March. The details of natural enemies occurring on different cashew pests are presented in Table. 3.44.

Table 3.43 : Correlation of weather parameters with the pests of regional importance at Vridhachalam

Weather parameters	Regional pests				
	Lbw	Anb	Lm	Stc	Lf
Maximum temperature ^{0}C	-0.86**	-0.64*	-0.21^{NS}	-0.21^{NS}	-0.20^{NS}
Minimum temperature ^{0}C	-0.64*	-0.47^{NS}	0.04^{NS}	0.68^{NS}	0.69^{NS}
Relative Humidity (M) (%)	0.74**	0.79^{NS}	0.13^{NS}	0.14^{NS}	0.13^{NS}
Relative humidity (E) (%)	0.87**	0.57^{NS}	0.72*	0.72*	0.71*
Rainfall	0.77**	0.66^{NS}	0.73*	0.72*	0.73*

Lbw: Leaf and blossom webber; Anb: Apple and nut borer; Lm – Leaf miner
Stc – Shoot tip caterpillar; Lf: Leaf folder

M- Morning; E – Evening

Table 3.44: Occurrence of Natural Enemies of Cashew Pests at Vridhachalam

Sl. No	Natural enemies	Host insect	Period of occurrence	Intensity range (%)
I	***Parasitoids***			
1	*Cotesia* sp (*Apanteles* sp)	Green leaf folder	Nov-Jan	9.60-22.40
2	*Brachymeria* sp	Diamond hairy caterpillar	Sep-Jan	1.80-6.70
II	***Predators***			
3	*Scymnus* sp	Mealy bugs	Jan-Feb	1.50-7.00
4	*Chryroperla carnea*	Mealy bugs and thrips	Sep-Feb	2.00-18.60
5	Preying Mantids	Caterpillars and moths	Round the year	0.60-3.20
6	Spiders	Caterpillars and moths	Round the year	0.80-5.30
III	***Entomopathogenic fungi***			
7	*Metarihizum anisopliae*	Stem and root borer	Aug-Feb	6.80-23.00
8	*Beauveria bassiana*	Stem and root borer	Aug-Feb	3.50-20.60

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

Centres : East Coast :

Bapatla, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurle

Plains / others :

Chintamani

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

SUMMARY:

At Bapatla, all the entries were found on par with each other in their susceptibility to shoot tip caterpillar. An increase of 7.3 per cent in the number of nuts was recorded due to application of boron at Bhubaneswar. At Jagdalpur, inflorescence thrips were not observed in CARS-3. The lowest incidence of leaf and blossom webber was recorded on Vengurle – 5 (6.8%)and lowest damage by shoot tip caterpillar in M-26/1 (7.4%) at Jhargram.

BAPATLA

Two entries, (30/1 and ABT-1) in Regional Cashew Field Gene Bank (RCFGB) recorded higher incidence of leaf and blossom webber, while all other 51 entries were on par with each other.

The incidence of shoot tip caterpillar varied from 0.76 to 1.93 percent among the germplasm entries screened. All the entries were found on par with each other in their susceptibility to shoot tip caterpillar, except T.No.3/7, T.No.228, T.No.2/5, Hy.94-T-4 in which the incidence was relatively higher.

BHUBANESHWAR :

In the trials on incidence of inflorescence thrips, on an average, 16 nuts per panicle were harvested from the insecticide treated panicles whereas, 14.9 nuts per panicle were harvested from untreated panicles. The damage score was 0.89 in insecticide treated panicles whereas, a damage score of 2.57 was recorded in the panicles in untreated check (Table 3.45).

Table 3.45 : Effect of monocrotophos on inflorescence thrips at Bhubaneswar

Mean no. of nuts/ panicle in treated panicle	16.00
Damaged nuts (score value)/panicle in treated panicles	0.89
Mean no. of nuts in control/ panicle	14.90
Damaged no (score value) of nuts/panicle in control	2.57
% no. of nuts increased over control	7.05

Application of borax @ 0.50 kg/tree, after application of fertilizer revealed that on an average 5.20 kg of nuts could be harvested per tree from boron applied trees as against 4.90 kg

nuts per tree from trees in control plot. An increase of 7.30 per cent in the number of nuts was due to application of boron. The mean number of thrips per panicle was 4.60 in boron applied trees as against 4.90 in control plot trees (Table 3.46).

Table 3.46 : Effect of boron on inflorescence thrips during 2003-04 at Bhubaneswar.

Mean of thrips/ panicle in Boron applied	4.60
Yield in kg of nuts/ tree in boron applied trees	5.20
Mean of no. of thrips per panicle in untreated control	5.20
Mean no. of nuts/ tree in control	4.90
% increase of nuts in boron applied trees as against control panicle	7.30

JAGDALPUR

A total of 18 cashew germplasm accessions were screened for their susceptibility to different pests. Incidence of TMB was not noticed on H-3/33 and on locally collected germplasm CARS-3, 4, 5 and 6. Lowest incidence of leaf caterpillar was recorded on VRI-2 (6.19% leaf damage). Inflorescence thrips population was not observed in CARS-3 and 4 while lowest thrips population was recorded on H-3/33, H-3/28 and Vengurle-4 (Table 3.47).

Table 3.47 : Incidence of tea mosquito bug, leaf caterpillar and inflorescence thrips on cashew germplasm at Jagdalpur

Accession No.	TMB mean damage score 0-4 scale in 52 leader shoots			Leaf Caterpillar (% leaf damaged) 52 leader shoots	Inflorescence thrips (mean No. per 10 panicle)
	Shoot	Panicle	Nut		
H-3/28	0.20	0.11	0.00	10.05	2.54
H-320	0.00	0.29	0.67	10.49	9.37
H-30/1	0.08	0.10	0.16	7.19	5.44
H-68	0.06	0.13	0.22	12.54	6.29
H-303	0.26	0.02	0.01	6.63	4.39
H-10/19	0.28	0.24	0.00	16.80	8.28
Sel-1	0.00	0.06	0.00	14.53	4.92
Sel-2	0.11	0.14	0.00	11.42	14.93
H-255	0.54	0.25	0.00	9.37	4.22
H-367	0.00	0.05	0.00	10.55	10.20
H-3/33	0.00	0.00	0.00	9.70	1.98
VRI-2	0.00	0.07	0.00	6.19	12.20
VRI-1	0.00	0.19	0.00	13.33	5.83
V-4	0.02	0.10	0.00	9.05	3.73
CARS-3	0.00	0.00	0.00	7.50	0.00
CARS-4	0.00	0.00	0.00	13.87	0.00
CARS-5	0.00	0.00	0.00	14.71	7.52
CARS-6	0.00	0.00	0.00	7.00	6.98

JHARGRAM

None of the accessions were found tolerant / resistant to any major pests of the region. Damage by shoot tip caterpillar was lowest in M-26/1 (7.40%) (Table 3.48)

Table 3.48 : Incidence of different pests on the germplasms screened for tolerance / resistance at Jhargram.

Accession	Mean % leaf and blossom webber damage / 52 shoots	Inflorescence thrips damage score on nuts / apples	Mean % shoot tip caterpillar damage / 52 shoots
Ansur – 1	12.30	0.12	8.30
Jhargram - 1	13.30	0.09	7.20
M – 4/2	9.80	0.06	11.60
A – 7/2	7.20	0.13	9.50
M – 17/4	7.50	0.17	10.30
M – 3/3	8.60	0.12	9.30
K – 27/1	9.40	0.07	10.50
M – 26/1	11.20	0.06	7.40
M – 76/1	8.00	0.11	7.90
Vengurle – 2	8.50	0.15	10.80
A – S/4	10.40	0.13	11.50
Vengurle 36/3	11.40	0.12	12.40
H – 1608	10.20	0.08	9.50
H – 4 – 7	8.10	0.06	14.50
Ullal – 1	7.60	0.15	12.80
Ullal – 2	8.30	0.20	17.20
VTH – 30	11.30	0.18	12.90
VTH – 59	7.60	0.13	14.40
V – 5	6.80	0.14	10.60
JGM – 47/6	8.20	0.11	11.30
Red Hazari	10.20	0.09	14.50
DC – 5	9.50	0.08	16.20
BLA – 39 – 4	7.60	0.13	10.60
JMG –74/6	8.60	0.19	9.20

MADAKKATHARA

TMB damage score varied among the different germplasm accessions. The leaf miner infestation was severe through out the germplasm collections irrespective of genotypes over the entire cropping season.

VENGURLE :

The damage of TMB was low (12.89%) in the variety V-8 followed by V-1 (16.05%), V-6 (17.99%). The maximum percent damage of TMB was recorded in germplasm 30/1(28.30%) (Table 3.49).

Table 3.49 : Incidence of TMB on different varieties at Vengurla

Varieties	TMB (% damage)		Varieties	TMB (% damage)
V-1	16.05		Hy-320	20.23
V-2	19.55		Hy-303	21.98
V-3	22.55		30/1	28.30
V-4	23.66		3/33	27.80
V-5	21.24		10/19	26.80
V-6	17.99		3/28	22.67
V-7	22.89		Puttur-1	23.35
V-8	12.89		Puttur-2	21.35
M-44/3	24.40		15/4	23.00

VRIDHACHALAM

The MLT entries (17 nos.) and 8 hybrids produced at this centre were screened against TMB. Lowest incidence of TMB was observed in H 17 (2.20 score) followed by H 11 (2.50) and H 14 (2.70). The mean damage score due to TMB infestation in various MLT entries ranged from 1.80 – 2.90 (Table 3.50 & 3.51)

Table 3.50 Screening of MLT entries against major pests of cashew at Vridhachalam

MLT entries	TMB damage score	Blossom Webber (%)	Leaf miner (%) damage	Nut borer (%) damage
H 1598	2.10	17.20	9.40	2.50
H 1600	2.30	19.40	9.70	2.00
H 1608	1.80	12.60	6.30	1.30
H 1610	2.70	13.80	10.50	0.80
H 129	2.60	14.60	9.40	1.50
H 40	2.40	16.20	8.50	2.70
H 2/15	2.30	13.50	7.60	3.20
H 2/16	2.40	13.60	9.40	4.90
H 33/3	2.60	14.20	9.00	2.00
H 44/3	2.80	13.80	8.50	3.60
M 26/2	2.40	18.60	8.40	2.20
VTH 30/4	2.10	13.30	7.00	3.60
VTH 59/2	1.90	13.00	6.80	1.20
V 2	2.90	19.50	8.50	1.70
V 3	2.30	21.20	9.40	1.40
V 4	2.00	18.60	7.60	1.70
V 5	2.20	14.50	8.90	1.60

Table 3.51 : Screening of F_1 hybrids for tolerance to cashew pests at Vridhachalam

Hybrid	Cross combinations	Percent damage			Yield (kg/tree)
		TMB	Shoot webber	Leaf miner	
H 10	M 10/4 x M 26/1	3.40	18.40	11.30	6.42
H 11	M 10/4/ x M 45/4	2.50	10.50	9.40	5.00
H 12	M 10/4 x M 75/3	3.20	16.20	12.70	5.57
H 13	M 26/2 x M 26/1	3.40	14.70	10.60	5.83
H 14	M 26/2 x M 45/4	2.70	11.30	9.80	4.56
H 15	M 26/2 x M 75/3	2.90	14.60	18.50	4.50
H 16	M 44/3 x M 26/1	2.40	14.70	12.20	4.90
H 17	M 44/3 x M 45/1	2.20	10.30	10.80	5.35

1. HISTORY, OBJECTIVES, GROWTH AND SALIENT ACHIEVEMENTS

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

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

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

The headquarters of the independent cashew project was shifted to National Research Centre for Cashew, Puttur in 1986. Presently, there are eight coordinating Centres and one sub Centre, four in the East Coast viz., Bapatla. Bhubaneswar, Jhargram, Vridhachalam, three in the West Coast viz., Madakkathara, 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 increase production and productivity through:

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

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

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

ACHIEVEMENTS :

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

- Since its inception, a total of 27 high yielding cashew varieties have been developed and released to the farmers by different centres of AICRP Cashew.
- Collected local germplasm materials with desirable characters such as high yield, cluster bearing habit, bold sized nuts, short duration of flowering, off season flowering types from different cashew growing regions and are being vegetatively multiplied and field planted in different centres.
- Number of cashew accessions so far collected and conserved by the Coordinating Centres in Regional Cashew Field Gene Bank comes to 1274.
- Multi-location Trials of cashew have been laid out at different centres to study the yield and other parameters of varieties developed and its suitability at different regions.
- Standardized the vegetative method of propagation of cashew along with NRCC.
- Spacing trials were conducted. The planting density of 156 trees/ha was recommended.
- A package of practices has been developed for fertilizer application, spacing and thinning. Application of 500g N; 125g P_2O_5 and K_2O each per tree per year was found to be suitable.
- Intercropping with ginger, turmeric, cluster bean, black gram, horse gram, ground nut, vegetables and medicinal plants with cashew as main crop during the initial stage of orchard development were evaluated and recommended for the economic upliftment of farmers at different locations.
- Effective spray schedule for the management of tea mosquito bug and other minor pests of cashew has been devised. Monocrotophos (0.05%) at flushing and carbaryl (0.1%) at flowering and fruiting were found effective in controlling these pests.
- For the control of Cashew Stem and Root Borer (CSRB) infestation, swabbing of neem oil (5%) up to one meter height of trunk twice in a year along with soil application of Sevidol (4G) 75g/tree found to be effective in many centres. Phytosanitation was found to reduce the spread of CSRB.
- Screening of germplasm is being carried out to locate tolerant/resistant types or less susceptible to TMB and other major pests of the respective region.
- The centres have also been producing quality-planting materials for the respective regions to meet the requirement of farmers and developmental agencies.
- Developed close linkages of Centres of AICRP Cashew with State Departments of Agriculture and Horticulture, Directorate of Cashewnut & Cocoa Development (DCCD), Krishi Vigyan Kendras (KVKs) and Cashew Corporations for laying out demonstration plots in farmers' fields. Regularly cashew field days and training programmes for the benefit of farmers / development agencies are being conducted by all the Centres.

Salient achievements of the Project during 2004-05 :

a) Thirty one germplasm accessions have been collected and conserved in Regional Cashew Field Gene Banks (RCFGB) in different AICRP cashew centres during the year bringing the total conserved to a total of 1274 cashew accessions till date.

b) H-68 performed the best at Bhubaneswar and yielded 38 kg/tree in the 9th harvest.

c) Under hybridization trials, 813 seed nuts at Bhubaneswar, 666 seed nuts at Chintamani, and 193 seed nuts at Vridhachalam have been obtained and 175 seedlings have been planted at Vengurle.

d) Positive influence of Nitrogen on nut yield was recorded from Bapatla in the highest dose of 1000:250:250g NPK / tree, while positive influence of increased doses of fertilizers was observed in other centres.

e) Under intercropping trials green gram and black gram had the highest C:B ratio (>1: 1.10) at Bapatla, while chillies had C:B ratio of 1: 2.30 and cucumber had a C:B ratio of 1: 3.10 at Bhubaneswar and Vengurle respectively.

f) Lamda-cyhalothrin and profenophos were found to be most promising in effectively reducing the total pest incidence in cashew.

g) During the current year a total of 78 demonstration plots have been laid out to demonstrate the soil and water conservation technology in addition to the other crop production methods.

h) Campaigns on plant protection and cashew production technology were organized by different centres.

i) Over 4 lakh cashew grafts were produced under this project and distributed to government and non government agencies as well as to the cashew cultivators.

2. TRANSFER OF TECHNOLOGY :

During the year, a total of 4,13,511 grafts were produced and distributed to several government and non-government organizations as well as to cashew cultivators. The centre wise production of cashew grafts is as follows:

Centre	**No. of grafts produced**
Bapatla	10221
Bhubaneswar	40000
Chintamani	20000
Jagdalpur	16250
Jhargram	3500
Madakkathara	6554
Pilicode	10000
Vengurle	84970
Vridhachalam	222016
TOTAL	**4,13,511**

BAPATLA :

Scientists of this centre imparted training to cashew farmers from different parts of the state through 12 training programmes. Also, the technical know-how on cashew cultivation was disseminated through radio talks and TV programmes. Poondala village has been adopted to enhance the rural economy for a holistic approach by imparting technical know-how on agriculture, horticulture and animal husbandry.

BHUBANESWAR :

During the year 10 demonstration plots have been laid out for cashew production technology and 17 plant protection campaigns have been conducted at eight districts which had participation of tribals and women . In collaboration with the OSCDC Ltd., scientists of this centre were involved in one trainer's training programme and 8 district level farmers' training programme.

CHINTAMANI:

The centre has monitored 46 demonstration / model cashew orchards. Also field visits and technical advice on cashew cultivation were undertaken by the scientists of various disciplines.

JAGDALPUR :

Training on Cashew Production Technology was imparted to farmers and field staff of Horticulture and Agriculture Departments. A total of 8 training programmes on cashew cultivation were conducted of which 4 training programmes were organized by SGCA&RS and the remaining by Horticulture and Agriculture Departments.

JHARGRAM :

During the year, 4 demonstration plots were established. Training programmes were organised by the centre on graft production and cultivation. Also, scientists of this centre participated in collaborative farmer's training programme with Govt. and Department of Agricultural Marketing, Govt. of West Bengal to impart training on different aspects of cashew cultivation in different locations of West Midnapore district.

MADAKKATHARA :

A total of 6 farmers' seminars on cashew cultivation, cashew apple processing and scientist – farmers interface were held in Pandikkad, Kannadi and Madakkathara. Training on cashew graft production, cashew plantation management and cashew apple utilization were organized at CRS, Madakkathara in which a total of 372 trainees participated. Radio talk on "Recent trends in cashew cultivation " was broadcast from AIR, Thrissur in which Scientists of this centre participated.

PILICODE :

Four demonstration plots involving soil and water conservation measures have been laid out during this year. Eleven training programmes / seminars were conducted in different locations of Kasargod, Kannur and Kozhikode districts, on cashew nursery management, plant protection in cashew, home scale processing of cashew apple and nuts and other cashew cultivation practices.

VENGURLE :

A total of 32 method demonstrations on "Softwood grafting in cashew" were organized at this station and 1,268 farmers (46 female and 1222 male) participated. Five training programmes on cashew apple processing were conducted and a total of 181 persons were trained. On 22nd March 2005, the state level cashew exhibition cum seminar was organized at this station in collaboration with the Directorate of Cashewnut and Cocoa Development, Kochi.

Under the DCCD project, 19 high density planting demonstrations were laid by the centre and required number of cashew grafts of improved varieties were provided by the centre for these plots.

VRIDHACHALAM :

A total of 29 demonstration plots involving recommended cashew production technology were laid out by this Centre. Cashew field day was conducted for the benefit of farmers of Cuddalore District.

3. STAFF POSITION

HEADQUARTERS

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

PROJECT CENTRES

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

Horticulturist	:	Dr. P. Shesha Reddy
Asstt. Horticulturist	:	Mr. B. Prasanna Kumar
Asstt. Entomologist	:	Mr. Ghouse Mohammed
Sr. Technical Assistant	:	Mr. B. Krishna Murthy
Jr. Technical Assistant	:	Mr. K. Ranga Rao
Grafter	:	Mr. V. Kantha Rao

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

Horticulturist	:	Dr. P.C. Lenka
Jr. Horticulturist	:	Dr. K.C. Mohapatra
Jr. Entomologist	:	Mr. R. N. Mohapatra
Sr. Technical Assistant	:	Mr. P.C. Swain
Jr. Technical Assistant	:	Mr. K.B. Pani
Grafter	:	Vacant

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

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

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

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

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

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

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

Horticulturist	:	Dr. PS John (upto 18.08.2004) / Dr. Jose Mathew (from 18.08.2004)
Jr. Breeder	:	Dr. Mareen Abraham
Jr. Entomologist	:	Dr. Susannamma Kurien (upto 24.08.2004)/ Dr. G.K. Mohapatro (from 24.08.2004)
Sr. Technical Assistant	:	Mrs. Ancy Joseph / Dr. Mini C
Jr. Technical Assistant	:	Mr. M.K. Manoj
Grafter	:	Vacant

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

Jr. Horticulturist	:	Dr. B. Jayaprakasha Naik
Jr. Technical Assistant	:	Vacant

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

Horticulturist	:	Dr. B.B. Sapkal
Jr. Breeder	:	Mr. R.C. Gajbhiye
Jr. Entomologist	:	Mr. V.N. Jalgaonkar
Sr. Technical Assistant	:	Mr. R.D. Sawale
Jr. Technical Assistant	:	Mr. R.L. Mayekar

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

Horticulturist	:	Dr. S. Jeeva
Jr. Horticulturist	:	Dr. M. S. Aneesa Rani
Jr. Entomologist	:	Dr. V.Ambethgar
Sr. Technical Assistant	:	Mr. S. Manickam
Jr. Technical Assistant	:	Mr. S. Alagarsamy
Grafter	:	Mr. G. Gopalakrishnan

4. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2004-05

Allocation **(Rs. In lakhs)**

Centre	Details of sanctioned provision					ICAR share	State share
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total		
Bapatla	12.45	0.30	2.40	7.40	22.55	16.91	5.64
Bhubaneshwar	11.35	0.30	2.40	2.00	16.05	12.04	4.01
Chintamani	12.43	0.30	2.40	2.00	17.13	12.85	4.28
Jagdalpur	3.80	0.20	1.60	0.67	6.27	4.70	1.57
Jhargram	6.55	0.30	2.40	--	9.25	6.94	2.31
Madakkathara	13.30	0.30	2.40	2.67	18.67	14.00	4.67
Pilicode	4.00	0.10	0.80	--	4.90	3.67	1.23
Vengurle	8.23	0.30	2.40	--	10.93	8.20	2.73
Vridhachalam	11.55	0.30	2.40	--	14.25	10.69	3.56
Total	**83.66**	**2.40**	**19.20**	**14.74**	**120.00**	**90.00**	**30.00**

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

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	12.71	0.17	2.40	5.01	20.29	15.22
Bhubaneshwar	12.43	0.30	1.85	0.32	14.90	11.17
Chintamani	12.66	0.11	2.40	2.00	17.17	12.88
Jagdalpur	3.80	0.14	1.60	0.41	5.95	4.46
Jhargram	5.94	0.14	2.40	--	8.48	6.36
Madakkathara	13.71	0.25	2.33	2.67	18.96	14.22
Pilicode	4.30	0.05	0.54	--	4.89	3.67
Vengurla	8.23	0.30	2.31	--	10.84	8.13
Vridhachalam	10.63	0.30	2.38	--	13.31	9.98
Total	**84.41**	**1.76**	**18.21**	**10.41**	**114.79**	**86.09**

5. MONITORING OF PROJECT BY PROJECT COORDINATOR

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

Date	Place
22 – 23 June 2004	RRS, Vridhachalam
22 Jan. 2005	CRS, Bapatla
25 – 26 Feb. 2005	CRS, Madakkathara
7 Mar. 2005	RFRS, Vengurle

During the visit to these centres the technical programmes allotted to each of the above centres and progress made were reviewed. Inspected the field experiments of on-going projects and gave suggestions and guidelines, wherever found necessary. University authorities were met and impediments in implementing some of the programmes were also discussed. Progress of other centres of AICRP on Cashew was monitored by regular correspondence and telephonic conversation.

6. FUNCTIONING OF EACH CENTRE

BAPATLA

The centre has been established during 1971. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently three projects in Crop Improvement; four in Crop Management and four in Crop Protection are being carried out. All the Scientists attended the zonal level research and extension advisory council meeting of Krishna – Godavari Zone organized at Ongole during April 2004 and also participated in the execution cum farmers' meet organized at LAM, Guntur. The Horticulturist has attended the district level meeting of Agricultural Advisory and Technology Transfer Centre of Guntur.

BHUBANESWAR

The centre has been established in 1975. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently three projects in Crop Improvement; four in Crop Management and four in Crop Protection are being carried out. The Scientists attended two Farmers' Training Programmes organized by Orissa State Cashew Development Corporation regarding Cashew Production Technology. Entomologist of this Centre participated in the Plant protection campaign organized at Panaspada, Brahmagiri Puri District, Kochila – Nuagaon, Cuttack district and Duburi, Jajpur district. The Scientists have participated as resource persons to train Women's Self-help Group at Khurda, Nayagarh. A one day seminar on "Prospects of Pre and Post Harvest Management of Cashewnut in Orissa" funded by DCCD, two Cashew Field Days were organized at Khurda and Dhenkanal. Horticulturists of this Centre were involved in identification of senile cashew plantations of OSCDC for replanting programme.

CHINTAMANI

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

JAGDALPUR

The centre has been established in 1993. At present there are two scientists working under the posts of Jr. Horticulturist and Jr. Entomologist under the project. Presently there are three projects in Crop Improvement, one in Crop Management and four in Crop Protection, which are allotted to the centre. The Scientists of this Centre are associated with Integrated Horticulture Development Programme and in training programmes on Cashew Production Technology. Scientists of this centre were involved in the eight training programmes organized by SGCA&RS and other departments for imparting knowledge about cashew cultivation in Bastar Region.

JHARGRAM

The centre has been established in 1982. At present there are two scientists working under the project in the posts of Junior Horticulturist and Junior Entomologist. One post of Horticulturist is lying vacant. Presently three projects in Crop Improvement; four in Crop Management and four in Crop Protection are being carried out. Scientists of this Centre have participated in Collaborative Farmers Training Programme with Government and Department of Agricultural Marketing.

MADAKKATHARA

The centre has been established in 1972. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; four in Crop Management and four in Crop Protection are being carried out. This centre is involved in imparting training on different aspects of cashew cultivation with emphasis on cashew apple procession. Three trainings on cashew apple processing were organized during February 2005 for training the unemployed youth entrepreneurs and women regarding utilization of cashew apple. Training on cashew graft production and recent advances in cashew plantation management were also conducted by the centre. Scientists of this centre participated in six farmers' seminar organized by Department of Horticulture, local village panchayats and by CRS, Madakkathara.

PILICODE

The centre has been established in 1993. At present there is one scientist working under the project in the post of Junior Horticulturist. Presently two projects, one in Crop Improvement and one in Crop Management. Twelve training programmes/seminars on various aspects of cashew production technology, plant protection in cashew and home scale processing of cashew nut were organized in collaboration with Department of Agriculture in various taluks of

Kasaragod, Kozhikode and Kannanur district. The scientist also attended different workshops/symposia which were organized regarding cashew or other plantation crops.

VENGURLE

The centre has been established in 1970. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; five in Crop Management and four in Crop Protection are being carried out.

VRIDHACHALAM

The centre has been established in 1971. At present three scientists are working as Horticulturist, Junior Horticulturist and Junior Entomologist. Presently three projects in Crop Improvement; four in Crop Management and four in Crop Protection are being carried out. Three trainings on cashew cultivation aspects were imparted to farmers in collaboration with State Horticulture Department in Cuddalore and Nagapatinam districts. Also, under Farmers' Participatory Demonstration cum Training Scheme, 50 farmers from Cuddalore and Ariyalor region were trained on different aspects of cashew cultivation.

7. PROBLEMS IN FUNCTIONING OF THE CENTRES

BAPATLA

Acharya N.G. Ranga Agricultural University has been requested to implement the recommendation of QRT (1997-2001) on shifting the location of Cashew Research Station in phased manner from Bapatla to College of Agriculture, Srikakulam where infrastructure facilities are available since red soil region of northern districts of Andhra Pradesh represents the major cashew growing area (Srikakulam, Vijayanagaram, Vishakapatnam, West Godavari and East Godavari districts of AP).

BHUBANESWAR

The Audit Utilization Certificate from the Statutory Auditors/Government Auditors for the past several years is pending. In spite of several requests made to the Comptroller of Orissa University of Agriculture & Technology and Cashew Research Station, Bhubaneswar to expedite the submission of AUCs from the appropriate auditors it is not complied with. Hence OUAT authorities have to take action in this regard and treat it on Top Priority.

CHINTAMANI

The problem of flowering in cashew in NPK fertilizer experimental plot is now solved on following limb pruning of grown up trees so that excess canopy is removed and each cashew plant gets adequate sunlight which is very critical for getting required C : N Ratio in order to achieve normal flowering. The drip irrigation treatments need to be imposed as the new tube well has been dug and adequate water is available for drip irrigation. Cashew graft production has to be increased at this centre.

JAGDALPUR

The Multilocation varietal trials are laid in water logged fields. Hence the drainage system for Multilocation Trials has to be improved so that the normal growth of cashew plants is ensured. The production of cashew grafts has to be increased in the centre and state of Chattisgarh. Bastar region of Chattisgarh has about 40,000ha land which is suitable for bringing under cashew and unless nursery activity in the state is increased cashew cultivation cannot spread fast in the state. The post of Senior Technical Assistant is lying vacant for quite long time and it should be filled at Jagdalpur Centre of AICRP Cashew by IGAU at the earliest.

JHARGRAM

The post of Horticulturist is vacant for long time. The centre and the University authorities were requested to fill the post. But so far it has not been done. The cashew graft production at the centre needs to be increased and also nursery activities in the state of West Bengal should be enhanced so that cashew area in the state of West Bengal can be pushed up.

MADAKKATHARA

An Assistant Professor in the scale of pay of Rs.8,000 – 13600 is working against the post of Senior Technical Assistant. Hence the expenditure incurred is more than the scale of pay of sanctioned post. Hence, the University has to take immediate action to fill up the post of

Senior Technical Assistant with a person of the same scale of pay of the sanctioned post. Authorities of Kerala Agricultural University have been requested several times to do the needful.

PILICODE

A Post of Junior Assistant is lying vacant in the centre. It has to be filled by the Kerala Agricultural University (KAU) so that the Jr. Horticulturist gets the required technical assistance in implementing the technical programme of AICRP-Cashew. As per the recommendation of QRT (1997-2001) additional land of 8ha area need to be made available to the centre by KAU in addition to the existing 7ha land. It was brought to the knowledge of the authorities of KAU but it has not been implemented yet. Non-descript cashew trees present in the new germplasm block need to be urgently removed for which the permission from KAU need to be obtained by the centre.

VENGURLE

Audit Utilization Certificate from the Government Auditors/ Statutory Auditors for the past several years is pending. Inspite of several requests made to Dr. B.S. Konkan Krishi Vidyapeeth / RFRS, Vengurle submission of AUCs from Govt. Auditors is not complied with. This needs to be expedited by University authorities.

VRIDHACHALAM

The centre has to take action to lay out Drip Irrigation experiment immediately.

8. METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2004

BAPATLA

Month & Year	Mean Max. Temp. (ºC)	Mean Min Temp. (ºC)	RH (%)		Rain fall (mm)	No. of Rainy days
			(m)	(e)		
Jan-04	29.09	17.10	94.3	68.0	2.7	1
Feb-04	30.80	18.20	86.0	60.0.	--	--
Mar-04	33.00	21.50	84.0	65.0	--	--
Apr-04	34.20	26.90	71.0	71.0	16.1	1
May-04	36.10	26.60	70.0	60.0	83.4	6
June-04	36.30	26.50	68.0	57.0	103.2	6
July-04	33.60	25.20	79.0	69.0	185.1	9
Aug-04	35.90	26.00	65.0	49.0	29.2	4
Sept-04	34.00	24.60	78.4	65.4	122.6	8
Oct-04	28.40	23.20	90.0	87.0	140.8	6
Nov-04	30.30	20.10	90.0	74.0	31.4	2
Dec-04	30.10	17.10	93.0	69.0	--	--
TOTAL:					**714.50**	**43**

BHUBHANESWAR

Month & Year	Temp (ºC)		RH (%)		Rainfall (mm)
	Max	Min	AM	PM	
	X1	X2	X3	X4	X5
Jan-04	28.08	14.28	82.58	57.68	0.00
Feb-04	30.28	16.15	90.68	43.25	0.00
Mar-04	36.46	21.58	92.36	39.48	0.008
Apr-04	36.85	25.00	89.95	54.23	88.90
May-04	38.62	26.72	88.14	49.26	42.90
June-04	36.63	26.73	86.05	53.45	133.40
July-04	32.78	25.58	91.68	74.75	246.50
Aug-04	31.46	24.98	93.42	78.08	318.70
Sept-04	32.38	20.20	92.13	73.68	164.40
Oct-04	32.20	22.64	92.02	63.36	205.00
Nov-04	31.30	17.08	91.33	36.55	0.00
Dec-04	29.30	14.60	91.78	38.58	0.00

CHINTAMANI

Month& year	Temperature (^{o}C)		Relative humidity (%)		Rain fall (mm)	No. of rainy days
	Maximum	Minimum	8.30am	3.30pm		
Jan-04	27.80	-	82.93	64.66	7.0	1
Feb-04	30.30	-	77.40	51.93	0.0	0
Mar-04	34.60	-	66.74	34.41	10.50	1
Apr-04	30.00	-	55.20	36.76	25.50	3
May-04	31.10	-	59.77	45.90	70.90	9
June-04	29.80	-	65.00	46.13	20.60	2
July-04	28.80	-	76.00	55.70	107.70	6
Aug-04	28.80	-	70.32	51.67	10.70	1
Sep-04	27.50	-	72.93	54.03	193.50	5
Oct-04	28.20	-	75.90	53.54	46.63	3
Nov-04	25.70	-	84.50	57.50	21.20	3
Dec-04	25.20	-	76.25	30.06	0.0	0

JAGADALPUR

Month & Year	Max. Temp (^{o}C)	Min. Temp (^{o}C)	Relative Humidity I (AM)	Relative Humidity II (PM)	Rainfall mms
Apr-04	35.94	22.76	84.6	32.4	6.34
May-04	35.48	23.08	73.75	49.5	15.05
June-04	30.74	22.26	82.4	62.6	79.68
July-04	27.63	22.25	91	71.75	86.98
Aug-04	25	21.73	94	83.25	78.5
Sept-04	29.68	21.92	92.2	70.2	51.64
Oct-04	29.23	19.08	93.5	65.75	37.85
Nov-04	27.18	12.46	92.4	44.4	1.52
Dec-04	25.98	7.73	91.5	27	0.0
Jan-05	27.28	10.28	94.5	33.5	4.15
Feb-05	29.63	12.85	93	40.5	5.85
Mar-05	33.5	16.68	82.4	36.2	2.28

JHARGRAM

Month & Year	Temp (°C)		RH%		Total rain (mm)	No. of rainy days
	Max	Min	Max	Min		
Jan-04	22.8	11.1	76.3	41.3	16.3	2
Feb-04	22.7	12.2	77.8	43.2	8.3	2
Mar-04	30.8	23.1	78.2	51.6	34.3	4
Apr-04	36.7	22.5	76.5	52.3	48.9	6
May-04	37.2	24.8	79.2	48.4	35.2	6
June-04	38.5	25.8	89.3	53.4	120.5	11
July-04	35.3	23.2	91.8	72.6	320.8	21
Aug-04	36.2	22.6	92.4	78.2	340.1	23
Sept-04	36.3	23.8	87.5	78.5	220.5	21
Oct-04	29.2	22.7	81.2	59.6	152.8	13
Nov-04	28.1	18.3	75.3	50.2	29.6	3
Dec-04	24.1	12.4	72.2	44.2	22.5	3

MADAKKATHARA

Month & Year	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	8.30 am	3.30 pm		
Apr-04	34.8	25.2	84	54	60.2	6
May-04	30.4	23.6	92	75	578.7	21
June-04	29.6	23.1	93	76	786.0	24
July-04	29.3	23.0	94	75	369.6	24
Aug-04	29.5	23.1	92	73	386.9	14
Sept-04	30.8	23.6	91	69	208.8	10
Oct-04	31.4	23.4	85	65	424.7	9
Nov-04	31.1	23.6	74	57	71.7	3
Dec-04	32.1	22.6	68	43	0.0	0
Jan-05	33.2	22.6	16.5	15.2	7.6	1.0
Feb-05	35.1	22.3	16.4	13.6	0.0	0.0
Mar-05	35.7	24.6	21.4	17.8	0.0	0.0

PILICODE

Month & year	Temperate (0 C)		Relative humidity (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
Apr-04	33.2	25.6	85	63	60.6	4
May-04	30.4	24.1	91	79	945.21	21
June-04	29.4	23.7	93	80	909	27
July-04	29.2	23.6	95	79	455.6	22
Aug-04	28.9	23.3	96	79	722.3	23
Sept-04	30.1	23.4	94	73	135	7
Oct-04	31.1	23.3	93	72	254.9	10
Nov-04	32	22.2	92	60	129.6	7
Dec-04	32.5	18.7	90	49	000.0	Nil
Jan-05	32.1	20.6	91	57	000.0	Nil
Feb-05	32.6	20.7	89	53	000.0	Nil
Mar-05	32.9	23.1	88	59	000.0	Nil

VENGURLE

Month & Year	Temperature (^{0}C)		Humidity (%)		Rain fall (mm)	No. of Rainy days
	Max.	Min.	AM	PM		
Jan-04	31.4	16.7	85.2	53.7	-	-
Feb-04	32.1	17.8	86.2	53.6	-	-
Mar-04	32.8	22.5	87.3	64.4	-	-
Apr-04	33.2	23.4	75.5	63.8	-	-
May-04	32.7	25.3	81.0	72.6	184.8	22
June-04	30.3	25.7	83.2	79.9	937.2	27
July-04	29.6	24.0	87.7	82.0	977.0	35
Aug-04	29.6	24.0	86.5	78.7	350.4	27
Sept-04	30.2	23.5	88.4	78.9	187.8	25
Oct-04	32.6	22.2	82.7	67.3	88.80	8
Nov-04	33.3	19.2	84.5	58.2	37.2	6
Dec-04	32.7	15.4	82.8	52.4	-	-
Total	--	--	--	--	2762.8	150

VRIDHACHALAM

Month & Year	Temperature (^{0}C)		Relative Humidity (%)		Total rainfall (mm)	No. of rainy days
	Maximum	Minimum	A.M.	P.M.		
Jan-04	31.0	23.5	79.5	5.89	-	-
Feb-04	34.6	33.4	66.8	46.5	-	-
Mar-04	37.3	27.9	71.8	62.5	-	-
Apr-04	39.9	28.9	87.0	87.0	4.00	1
May-04	36.9	28.5	87.5	75.8	476.7	13
June-04	37.8	27.7	84.6	68.1	35.2	3
July-04	36.9	27.9	82.5	71.6	48.4	5
Aug-04	37.6	27.9	83.9	56.7	86.6	6
Sept-04	36.1	26.7	89.6	75.4	239.7	11
Oct-04	33.4	26.3	90.4	83.3	686.5	13
Nov-04	30.8	26.2	89.1	77.6	135.8	8
Dec-04	31.4	26.8	87.2	70.5	-	-

9. RESEARCH PUBLICATIONS

BAPATLA

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Technical publication on "Scientific cultivation of cashew" (In Malayalam) by John, P.S, Mini, C., Susanamma, K. and Mareen, A.

Technical publication on "Cashew Nursery" by Mini C and Jose Mathew (In Malayalam)

Technical publication on 'Improved Cashew varieties' by Mareen Abraham and Jose Mathew (In Malayalam)

VENGURLE

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S.K. Godase, N Jalgaonkar, S.R. Bhole, P.R. Shivpuje, S.S. Dhane, S.S. Gurav, K.V. Malshe, J.N. Chaudhari and M.B. Nikam "Evaluation of neem products and Entomopathogenic fungi for control of cashew stem and root borer (CSRB) Plocaederus Ferruginens". Presented in National Symposium on sustainable plant protection strategies health and environmental concerned held on 15 – 17th October 2005 at Dr. B.S. Konkan Krishi Vidhyapeeth, Dapoli.

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Boldnut and big apple variety. Vengurla-8 The Cashew April – June 2005 Vol XIX No.2 R.C. Gajbhiye B.B. Sapkal, B.P. Patil

Gajbhiye R.C., Sapkal B.B., Patil B.P. and Jalgaonkar V.N. 200.. Effect of growth regulators on fruitset and yield of cashew (*Anacardium occidentale* L.)……..

Sapkal B.B., Dr. B.P. Patil, Prof. R.C. Gajbhiye 200……. Home / small scale processing of cashew – Problems and prospects …….

Patil B.P., B.B. Sapkal, R.C. Gajbhiye and Jalgaonkar V.N. 200..... Agro-Ecological system in the state technologies available for adoption with special reference to combating drought…….

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Chandelkar A.B. (Soil Scientist), Patil B.P., Sapkal B.B. 200……..Present status and future prospects of organic farming in cashew plantation……..

Jalgaonkar V.N., Sapkal B.B., Gajbhiye R.C. and Patil B.P. 200…….
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Awards

Dr. V. Ambethgar, Junior Entomologist has been nominated for "Scientist of the Year Award – 2004" by National Environmental Science Academy, New Delhi.

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