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COORDINATOR'S REPORT

The All India Coordinated Spices and Cashewnut Improvement Project (AICS & CIP) was started during the IV five year plan in 1971 with the Project Coordinator's cell at 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 Project Coordinator's cell of the independent cashew project was then shifted to the newly established National Research Centre for Cashew, Puttur in 1986.

The All India Coordinated Research Project on Cashew has eight centres and one sub centre of which four were started at the inception of AICS and CIP in the year 1971 [Bapatla (Acharya NG Ranga Agril.Univ. then APAU); Madakkathara (shifted from Anakkayam) (KAU); Vengurla (KKV) and Vridhachalam (TNAU)]. During V Plan period one centre at Bhubaneswar (OUAT) and in VI plan, two centres at Jhargram (BCKV) and Chintamani (UAS) were added. During VIII Plan one centre at Jagdalpur (IGAU) and a sub centre at Pilicode (KAU) were started.

The budget allocation of the Project for the year 1996-97 was Rs.34.31 lakhs (Rs.25.73 lakhs ICAR share) and the expenditure was Rs. 44.83 lakhs (Rs. 33.63 lakhs ICAR share). Out of this expenditure, a sum of Rs. 7.76 lakhs was incurred under non-recurring contingency, the revalidated amount from the allocation made in earlier financial year(s) being Rs. 6.78 lakhs.

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

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

CROP IMPROVEMENT

A total of 1003 cashew germplasm accessions (Bapatla 116; Bhubaneswar 87; Chintamani 116; Jhargram 113; Madakkathara 122; Pilicode 33; Vengurla 161 and Vridhachalam 255) are being maintained and evaluated in different centres. During the year a total of 63 new collections showing promising characters were added to the germplasm at different centres. (Bapatla 10; Bhubaneswar 9; Chintamani 25; Jhargram 2; Madakkathara 7; Pilicode 10). Thus, the total collections increased to 1066 in different centres.

The highest nut yield of 18.3 kg/tree was recorded in 5/37 Manjeri (41/3 ARSC) at Chintamani centre, followed by 16.1 kg/tree in JGM 74/6 and 15.2 kg/tree in JGM 66/7 at Jhargram centre.

In comparative yield trial at Chintamani centre highest yield of 9.3 kg/tree was recorded in Vengurla-5 followed by Bapatla-6 with an yield of 5.7 kg/tree and nut wt. of 5.6g.

In multilocation trials, varieties collected from different centres are being evaluated. In MLT-86 trial for nut yield, M 26/2 and Vengurla-5 (H-24) ranked first (6.3kg/tree) and

second (6.2kg/tree) respectively based on the mean yield over locations. The highest annual yield (13.2kg/tree) was recorded in H-1598 (Kanaka) at Madakkathara centre. Varieties VTH 59/2 (7.5kg/tree) and VTH 30/4 (6.0kg/tree) at Jhargram centre, H 2/16 (15.7kg/tree) in Bhubaneswar and M 33/3 (4.5kg/tree) in Vridhachalam centre performed well. Highest cumulative yield(56.6kg/tree) was recorded in M 26/2 followed by H-1598 (56.3kg/tree) at Madakkathara centre for six harvests.

In MLT-92 trial highest nut yield was recorded in H-320 (5.1 kg /tree) at Chintamani centre. M 15/4 at Bapatla was performing well.

In evaluation of F1 hybrids two hybrids from Bapatla viz. 3/13 (56 x 40), 3/25 (56 x M 10-4) gave an yield of 13.9 kg and 12.8 kg per tree respectively. At Vridhachalam, Hybrid-16 (M 44/3 x M 26/1) gave the highest mean yield of 5.0 kg/tree for six years and 2.7 kg/tree during the year.

CROP MANAGEMENT

A. *AGRONOMY*

In NPK trial, application of 1000g N, 250g P and 250g K ($N_2P_2K_2$) per tree per year gave the highest nut yield at Chintamani centre, whereas at Bapatla only upto 500g N, 125g P and 125g K ($N_1P_1K_1$) per tree per year yield increase was noticed.

In spacing trial, maximum yield of 70.5 kg/block (25m x 25m) (1127kg/ha) was recorded in trees planted in 6m x 6m x 6m triangular system at Jhargram centre.

In cashew based cropping system trial at Bapatla cluster bean and cowpea gave an yield of 5000 kg/ha (green pods), 4200 kg/ha and a revenue of Rs.15,000/ha and Rs.12000/ha respectively. Horsegram (234kg/ha) was found suitable in drought affected conditions at Bhubaneswar.

In on-farm trial with higher doses of fertilizers, the nut yield increased from 7.6 kg/ tree to 9.2 kg/tree to 10.7 kg/tree at Bapatla when the dose was normal, doubled and trippled, respectively.

Trial on high density planting with 625 plants/ha to study the impact of closer spacing on yield is initiated at Bapatla (BPP-5 clone), Bhubaneswar (H 2/16), Jhargram, Madakkathara and Vridhachalam centres.

B. HORTICULTURE

Screening of rootstock for dwarfing characters is being pursued at four centres in east coast and west coast.

CROP PROTECTION

Spraying of monocrotophos(0.05%), endosulfan(0.05%) and carbaryl (0.1%) at flushing, flowering and fruiting stages respectively (T-5) was found effective in controlling tea *mosquito bug at Bapatla, Chintamani, Jhargram* and Vridhachalam centres.

Skipping third spray (at fruiting stage) was found economical at Jhargram centre in the control of tea mosquito bug.

The most effective prophylactic control measure against stem and root borer was neem oil (5%) swabbing upto 1m height + application of sevidol 4G (@ 75g/tree) to the basin at three centres viz., Bapatla, Jhargram and Madakkathara. Swabbing with neem oil (5%) at two centres viz., Bapatla and Jhargram and Carbaryl (0.2%) in Mudslurry at Bhubaneswar centre were also found to act as good prophylactic control against the pest.

In the survey for pest incidence and natural enemies, no pest epidemic was found in cyclone affected east and west Godavari districts, shoot tip caterpiller, leaf and blossom webber, termites, thrips and leaf minor were found to be injurious at Jhargram centre.

The important parasites noticed were *Sympiesis sp.*, *Bracon brevicornis* and *Elasmus* on leaf miner, leaf and blossom webber and shoot tip caterillar respectively at Bhubaneswar. The important predator noticed were Greenlace wing *Chrysopa Sp.* on foliage thrips at Bhubaneswar, *Menochilus sexmaculatus, Coccinella sp., Scymnus* and spiders at Vridhachalam centre.

At Vridhachalam, a positive correlation between incidence of stem and root borer, shoot and blossom webber, TMB, Ashweevil and leafminer with rainfall and a negative correlation with temperature was recorded. The alternate hosts of TMB, Neem and Guava and of stem and root borer Moringa and Jack were severly affected at Vridhachalam centre.

Screening of germplasm to locate tolerant/ resistant types to major pests of the region was carried out. At Bhubaneswar H-1610 and OC-12 showed the least infestation to shoot tip caterillar. Six accessions were free from attack of TMB on shoots at Bhubaneswar and six accessions MAD-1, A-26-2, H-8-8, H-718, H-3-17 and T-856 at Madakkathara were found to be comparatively less susceptible to tea mosquito infestation on shoot and panicles. Over 4.51 lakh grafts of released varieties were supplied by different coordinating centres during 1996-97.

CENTRES OF
ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

■ NATIONAL RESEARCH CENTRE FOR CASHEW, PUTTUR 574 202 - HEADQUARTERS OF PROJECT COORDINATOR'S CELL

1. CASHEW RESEARCH STATION, (ANG RANGA A.U.), BAPATLA 522 101, ANDHRA PRADESH
2. CASHEW RESEARCH STATION, (OUAT), BHUBANESWAR 751 003, ORISSA
3. AGRICULTURAL RESEARCH STATION, (UAS), CHINTAMANI 563 125, KARNATAKA
4. ZONAL AGRICULTURAL RESEARCH STATION, (IGAU), JAGDALPUR 494 005, MADHYA PRADESH
5. REGIONAL RESEARCH STATION, (BCKV), JHARGRAM 721 507, WEST BENGAL
6. (a) CASHEW RESEARCH STATION, (KAU), MADAKKATHARA 680 656, KERALA
   (b) REGIONAL AGRICULTURAL RESEARCH STATION, (KAU), PILICODE 671 353, KERALA
7. REGIONAL FRUIT RESEARCH STATION, (KKV), VENGURLA 416 516, MAHARASHTRA
8. REGIONAL RESEARCH STATION, (TNAU), VRIDHACHALAM 606 001, TAMIL NADU

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

The eight coordinating centres and one sub centre are spread in the east coast, west coast and maidan tracts of the country. The centres in the east coast are located at Bapatla, Bhubaneswar, Jhargram and Vridhachalam. This zone receives low to medium rainfall ranging from 800mm to 2000 mm annually and is distributed over a period of 7-8 months from June-Dec. to January. The soil is mainly sandy, red sandy loam to red loam to laterite. The centres in the West coast are located at Madakkathara, Pilicode and Vengurla. This zone receives the maximum 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 to sandy clay loam and laterite (Oxisol). Maidan tract is characterised by evenland. The coordinating centres at Chintamani and Jagdalpur fall in this region. During the year 1996-97, the rainfall was heavy in the east coast, normal in the west coast and in maidan parts.

Project Title : Gen. 1 : Germplasm collection, maintenance and description of types.

Centres:

East Coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West Coast : Madakkathara, Pilicode, Vengurla
Maidan tracts : Chintamani

Objectives:

The main objectives of the project are to

(a) To evaluate the existing germplasm collections at different centres.

(b) To collect local germplasm with desirable characters such as high yield, cluster bearing habit, bold sized nuts, short duration of flowering etc. from different cashew growing areas and

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

1. Germplasm collection and conservation:

A total of 1003 accessions have been conserved and are being maintained in different centres (Table 1.1).

During the year 1996-97, a total of 63 collections were identified/collected by different centres (Table 1.1), thus taking the total number to 1066.

The details such as centre, source of collection, number of collections and salient features of collections are presented in Table 1.2.

ble 1.1 Cashew germplasm holding in different centres

Centre	No. of accessions existing	No. of accessions identified/collected during 1996-97	Total
st Coast Region			
patal	116	10	126
mbaneswar	87	9	96
gram	113	2	115
dhachalam	255	-	255
est Coast Region			
dakkathara	122	7	129
code	33	10	43
gurla	161	-	161
dan Region			
amani	116	25	141
Total	1003	63	1066

2. Germplasm evaluation

Evaluation of cashew germplasm at different centres has been carried out during the year 1996-97 and some of the promising accessions in different centres are presented in Tables 1.3 to 1.8.

At Bapatla centre, six accessions, namely, T.14, 1(L), 10/4, 10/8. 233 Z (L), and 6/20, were found to be promising during the year 1996. (Table 1.3). In these plants the cumulative yield of 13 harvests ranged from 214.5 to 387.3 kg/plant, the nut size was small (4.4 - 5.1g) and the shelling percentage ranged from 26.0-29.0 per cent.

At Bhubaneswar centre, the 84 accessions which were planted during 1990-96 have been evaluated. The yield data pertaining to the year 1996-97 are being tabulated by the centre.

At Jhargram, eight accessions were found to be promising during 1996-97 (Table 1.4). In these accessions the cumulative yield of ni harvests per plant ranged from 33.9 - 64.5kg a the yield during 1996-97 ranged from 7.7 16.1kg per plant. The nut size was small medium (4.2 - 6.5g) and the shelling percenta was high.

At Vridhachalam, of the 130 accessior evaluated, six accessions, namely, M 1/3, M 1(4, M 18/4, M 26/2, M 33/3 and M 44/3, wer found to be promising (Table 1.5). The cumulativ yield of three harvests ranged from 3.7-8.3 kg tree, the nut size was medium (6.8-8.2 g) and th shelling percentage was also medium (27.2 28.9%) in these accessions.

Of the 127 accessions which were plantec during 1988-97 at Madakkathara, six accession namely, accession number 25,26,27,64,73 anc 80, were found to be promising (Table 1.6). The cumulative yield of two harvests ranged from 2.9-5.3 kg/plant, the nut weight ranged from 4.8-8.2g in these accessions.

Table 1.2 Cashew germplasm identified/collected by different centres during 1996-97

Centre	Source of collection	No. of Collections	Salient features
Bapatla	Khammam and West Godavari districts	10	High yielding types
Bhubaneswar	Bahadajhola, Bhubaneswar Khurdha, Khalikote	9	High yielding, cluster bearing, small to medium sized nuts.
Jhargram	NA	2	High yielding, cluster bearing, small nuts & medium to bold nuts
Vridhachalam	-	-	
Madakkathara	Brazil and Tanzania	2	Seeds were obtained through CEPCI, Quilon
		5	From CRS Ullal
Pilicode	Kannur, Kasaragod	10	Bold nut types
Vengurla	-	-	-
Chintamani	Kolar district (Sidlaghatta and Srinivaspur taluks)	25	High yielding, medium to bold sized nuts (9-15 g)
	Total	63	

Table 1.3 Promising accessions of cashew germplasm at Bapatla during 1996-97

Accession number	Year of planting	Cumulative yield/plant in kg (1983-1996) (thirteen harvests)	Yield/plant in kg (1996)	Weight/nut (g)	Shelling percentage
T. 14	1942	352.9	20.2	5.0	26.0
1 (L)	1942	216.7	35.2	5.1	27.0
10/4	1962	387.3	31.0	5.1	29.0
10/8	1962	214.5	11.6	5.0	28.0
233 Z (L)	1962	283.3	38.8	5.0	27.0
6/20	1962	284.8	32.0	4.4	26.0

Table 1.4 Promising accessions of cashew germplasm at Jhargram during 1996-97

Accession number	Year of planting	Cumulative yield/plant in kg (nine har.)	Yield/plant in kg (1996)	Nut weight (g)	Shelling percentage (%
JGM 10/3	1983	42.7	9.3	4.8	33.3
JGM 66/7	1983	64.5	15.2	4.2	31.5
JGM 74/6	1983	59.4	16.1	6.5	29.1
JGM 29/8	1984	41.6	9.8	6.4	32.0
JGM 31/1	1984	40.1	11.1	6.9	30.2
JGM 79/5	1984	41.0	7.7	5.2	34.9
JGM 80/2	1984	60.4	14.9	4.7	33.2
JGM 58/2	1985	11.9	12.9	6.1	33.7

Table 1.5 Promising accessions of cashew germplasm at Vridhachalam during 1996-97

Accession number	Year of planting	Cumulative yield/plant in kg (1993-1996) (three harvests)	Yield/plant in kg (1996)	Weight/nut (g)	Shelling percentage
M 1/3	1989	4.3	2.7	7.2	28.9
M 10/4	1989	4.3	2.1	7.0	27.8
M 18/4	1989	3.7	2.1	8.2	28.0
M 26/2	1989	5.2	2.9	7.3	28.4
M 33/3	1989	8.3	4.0	8.2	27.2
M 44/3	1989	6.8	3.6	6.8	27.8

Table 1.6 Promising accessions of cashew germplasm at Madakkathara during 1996-97

Accession number	Year of planting	Cumulative yield/plant in kg (1994-1996) (two harvests)	Yield/plant in kg (1996)	Weight/nut (g)
25 (Vapala)	1988	5.0	2.7	8.0
26 (Anakkayam)	1988	5.1	2.5	4.8
27 (BLA 39-4)	1988	4.3	2.5	6.4
64 (K 4-2)	1989	4.2	2.2	NA
73 (H-3-9)	1989	5.3	2.7	7.2
80 (H-8-15)	1989	2.9	2.1	8.2

Table 1.7 Promising accessions of cashew germplasm at Vengurla during 1996-97

Accession number	Year of planting	Cumulative yield/plant in kg (1989-1996) (eight harvests)	Yield/plant in kg (1996)	Weight/nut (g)	Shelling percentage
83/5/3 (T.No.1)	1977	63.8	4.7	6.0	27.6
94/17/5) (Murude T.94)	1977	79.6	6.2	7.1	23.0
95/11/3 Seed farm collection No.1	1977	44.4	3.6	6.7	23.0
98/12/4 Seed farm collection No.4	1977	72.9	6.3	6.3	21.0
124/15/3 Seed farm collection No. 20	1979	54.4	5.9	6.8	29.5
126/17/2 Seed farm collection No.23	1980	61.9	11.4	6.0	28.5

At Vengurla, of the 81 accessions evaluated, six accessions namely, accession number, 83/5/3, 94/17/5, 95/11/3, 98/12/4, 124/15/3 and 126/17/2 were found to be promising (Table 1.7). The cumulative yield of eight harvests ranged from 44.4-79.6 kg/tree, the nut weight was medium (6.0-7.1g) and the shelling percentage ranged from 21.0-29.5 per cent.

At Chintamani, of the 72 accessions evaluated, five accessions, namely, accession number 7/8, 29/1, 35/1, 38/3, and 41/3, were found to be promising (Table 1.8). The cumulative yield of twelve harvests ranged from 53.2-96.7 kg/tree, the nut size was small (5.5-6.6g) and the shelling percentage ranged from 27.0-31.0 per cent in these accessions.

Table 1.8 Promising accessions of cashew germplasm at Chintamani during 1996-97

Accession number	Year of planting	Cumulative yield/plant in kg (1985-1996) (twelve harvests)	Yield/plant in kg (1996)	Weight/nut (g)	Shelling percentage
7/8 ARSC (2/79 Tuni)	1982	71.5	1.2	5.8	29.4
29/1 ARSC (13/5 (Kodur)	1983	64.7	2.8	5.5	27.0
35/1 ARSC (ME 4/4)	1984	65.5	8.7	6.5	31.0
38/3 ARSC (Hy 2/15)	1984	53.2	8.6	6.6	30.0
41/3 ARSC (5/37 Manjeri)	1985	96.7	18.4	5.7	30.0

Project title : Gen.3 : Varietal evaluation

Three varietal trials are under evaluation at different centres.

Expt.1 : Comparative yield trial in cashew

Centre : Chintamani

Objective:

To evaluate the performance of varieties of Bapatla and Vengurla.

Design : RBD

Replication : Three

Varieties : No. of entries : 10

Bapatla entries : Bapatla-1, Bapatla-3, Bapatla 4, Bapatla-5, Bapatla-6.

Vengurla entries : Vengurla-1, Vengurla-2, Vengurla-3, Vengurla-4, Vengurla-5

Year of planting : 1986

The performance of the varieties is given in Table 1.9.

Nut yield:

Significant differences were observed among varieties for nut yield. The highest nut yield of 9.3 kg/tree was recorded in Vengurla-5 followed by Bapatla-6 (5.7 kg/tree) in seventh harvest which were significantly superior to all other varieties. Performance of other varieties was poor. The highest cumulative yield of 46.2 kg/tree was recorded in Vengurla-5 for 7 harvests which was followed by Bapatla-6 (38.5 kg/tree), Vengurla-3 (31.9 kg/tree) and Vengurla-2 (30.7 kg/tree). The same trend was also observed for the cumulative yield during previous year (for six harvests).

Nut weight:

Bapatla-3 had the highest nut weight of 6.9 g. Vengurla 3 and Vengurla-4 also showed nut weight more than 6.0 g.

Shelling percentage:

The shelling percentage of 31.0 per cent exhibited by Vengurla-3 variety appears to be much on higher side since Vengurla-3 normally has shelling percentage not more than 27 per cent.

Table 1.9 Performance of different varieties for growth characteristics, yield, nut characters at Chintamani centre in comparative yield trial during 1996-97

Sl. No.	Variety	Height (m)	Stem girth (cm)	Canopy shape	Flowering period	Nut yield (kg/tree) (7th har.)	Cumulative yield for 7 har. (kg/tree)	Nut weight (g)	Shelling %
1	Vengurla-1	6.0	78.8	Compact	Medium	1.9	26.2	4.7	28.5
2	Vengurla-2	6.3	73.7	Medium	Long	1.5	30.7	5.1	27.8
3	Vengurla-3	6.9	87.0	Sparse	Medium	2.6	31.9	6.4	31.0
4	Vengurla-4	5.6	73.8	Sparse	Medium	1.3	17.9	6.2	29.4
5	Vengurla-5	6.2	74.4	Compact	Medium	9.3	46.2	3.7	27.7
6	Bapatla-1	6.1	72.8	Compact	Medium	1.5	20.2	4.2	28.3
7	Bapatla-3	5.9	77.4	Medium	Medium	0.9	22.5	6.9	28.3
8	Bapatla-4	5.6	79.8	Medium	Long	0.9	25.1	4.7	27.4
9	Bapatla-5	5.9	72.0	Compact	Medium	3.1	28.7	5.0	27.2
10	Bapatla-6	6.5	82.6	Compact	Medium	5.7	38.5	5.6	28.6
	SEm(±)	0.28	3.25			0.48			
	CD (P=0.05)	NS	9.67			1.43			
	CV (%)	9.41	7.96			28.43			

Expt.2 : **Multilocation trial-86 with varieties from Vittal, Vridhachalam, Vengurla and Bapatla (MLT-86).**

Centres:

East Coast : Bhubaneswar, Jhargram, Vridhachalam
West Coast : Madakkathara, Vengurla
Maidan Tract : Chintamani

Objective

To evaluate the performance of high yielding varieties in different locations.

Design : RBD
Replication : 3
Varieties : No.of entries : 16 + 3
Bapatla entries : T.No.129, T.No.40, H 2/15, H 2/16.
Vengurla entries : V-2, V-3, V-4, V-5 (H 24), M 44/3
Vridhachalam entries : M 33/3, M 26/2, M 44/3
Vittal entries : VTH 30/4, VTH 59/2, M 44/3
Madakkathara entries : H 1598(Kanaka), H 1600, H 1608(Dhana), H 1610.

Note : Ullal-1 and Ullal-2 varieties were planted in place of M 26/2 and M 33/3 at Chintamani centre in 1992 as they could not be established.

Year of planting : 1986.

The trial was conducted at six centres to study the performance of high yielding varieties at six locations for yield, yield component and nut characters.

Nut yield:

Nut yield of the different varieties at six centres are presented in Table 1.10. Better yield levels were exhibited at Bhubaneswar and Madakkathara centres.

In Bhubaneswar centre H 2/16 stood first with yield of 15.7 kg/tree. In Madakkathara centre, highest annual yield of 13.2 kg/tree was recorded in H 1598 (Kanaka) among the varieties evaluated at that centre. This was followed by V-5 (H 24) with yield of 12.7 kg/tree. V-5 (H 24) was the top yielder in Vengurla centre with 6.8 kg/tree yield of nuts.

In overall mean yield, based on the performance over locations, M 26/2 and Vengurla 5 (H 24) ranked first (6.3 kg/tree) and second (6.2 kg/tree), respectively. Cumulative yield figures were available for three centres (Chintamani, Madakkathara and Vridhachalam) and same are given in Table 1.11. Cumulative yield levels (for six harvests) of varieties in Madakkathara centre were superior. Highest cumulative yield (56.6 kg/tree) was recorded in M 26/2 followed by H 1598 (56.3 kg/tree) at Madakkathara centre. M 44/3 ranked first with cumulative yield of 37.1 kg/tree for seven harvests and 19.9 kg/tree for four harvests at Chintamani and Vridhachalam centres, respectively. M 44/3 (Vridhachalam) source performed well at Madakkathara centre also with cumulative yield of 54.9 kg/tree for six harvests.

Performance of different varieties for yield/plant (kg/tree) in Multilocation Trial-86 (MLT-8 in different centres durign 1996-97

	Varieties	Bhubaneswar	Chintamani	Jhargram	Madakkathara	Vengurla	Vridhachalam	Mean
1	Vengurla-2	4.2	1.5	-	2.5	3.9	3.5	3.1
2	Vengurla-3	4.4	0.3	-	4.0	3.9	3.0	3.1
3	Vengurla-4	5.0	1.6	-	3.2	4.0	3.2	3.4
4	Vengurla-5 (H 24)	-	1.9	-	12.7	6.8	3.2	6.2
5	T.No.40	4.5	0.8	5.0	3.8	4.3	2.0	3.4
6	T.No.129	2.5	0.9	4.5	4.0	2.8	2.2	2.8
7	H 2/15	3.4	2.4	5.7	5.9	3.0	3.5	4.0
8	H 2/16	15.7	1.0	5.8	3.7	3.1	2.7	5.3
9	H 1598	7.1	0.5	4.5	13.2	5.2	2.3	5.5
10	H 1600	3.5	2.8	4.0	5.8	4.4	-	4.1
11	H 1608	8.7	1.1	3.4	10.5	4.9	2.7	5.2
12	H 1610	4.0	2.2	3.9	4.0	3.5	1.6	3.2
13	VTH 30/4	4.0	1.2	6.0	6.9	4.0	2.6	4.1
14	VTH 59/2	4.6	1.6	7.5	4.0	3.3	1.9	3.8
15	M 26/2	5.0	-	4.0	12.0	-	4.0	6.3
16	M 33/3	-	-	5.6	4.7	-	4.5	4.9
17	Anakkayam-1*	-	-	-	12.2	-	-	-
18	M 44/3 (Vittal)*	3.7	1.1	-	-	-	-	2.4
19	M 44/3 (VRI)	3.3	3.6	3.4	10.5	2.5	4.0	4.6
20	M 44/3 (Vengurla)*	-	0.9	-	-	-	-	-
	CD 5%	2.24	0.82	0.57	2.11	2.48		
	CV %		32.22					

* Not considered for interpretation

Table 1.11 Performance of different varieties for cumulative yield/plant (kg/tree) in Multilocation Trial -86 (MLT - 86) in different centre during 1996-97

Sl. No.	Varieties	Chintamani for 7 har.	Madakkathara for 6 har.	Vridhachalam for 4 har.
1	Vengurla-2	17.4	23.4	12.8
2	Vengurla-3	21.4	36.0	4.3
3	Vengurla-4	21.6	33.4	7.7
4	Vengurla-5 (H 24)	25.2	52.3	14.6
5	T.No.40	18.6	22.3	10.6
6	T.No.129	20.8	19.1	8.2
7	H 2/15	22.7	31.1	8.1
8	H 2/16	20.2	24.4	9.6
9	H 1598	22.6	56.3	7.6
10	H 1600	26.6	39.7	2.1
11	H 1608	29.3	45.2	8.8
12	H 1610	25.8	21.8	3.5
13	VTH 30/4	16.9	39.3	11.2
14	VTH 59/2	24.5	29.4	9.1
15	M 26/2	-	56.6	18.3
16	M 33/3	-	34.1	17.8
17	Anakkayam-1*	-	48.5	-
18	M 44/3 (Vittal)*	21.8	-	-
19	M 44/3 (VRI)	37.1	54.9	19.9
20	M 44/3 (Vengurla)*	15.0		

* Not considered for interpretation

The varieties identified/selected based on their yield performance (annual and cumulatie) in MLT 86 trial during 1996-97 in different centres located in the different agroclimatic zones are as under:

Sl. No.	Region	Variety	Based on performance at centres
1	East Coast	H 2/16	Bhubaneswar Jhargram
	Location Specific	M 26/2	Vridhachalam
2	West coast	H 1598 Vengurla-5 (H 24)	Madakkathara Vengurla
	Location Specific	M 26/2	Madakkathara
3	Low rainfall area (Maidan area)	M 44/3	Chintamani
4	Medium to high rainfall area	VTH 59/2 VTH 30/4 H 2/16 H 2/15	Jhargram
5	Very high rainfall	Vengurla-5 (H-24) H 1598	Vengurla Madakkathara

In Jhargram centre, H 2/16 gave much superior cumulative yield in comparison to the cumulative yield of M 26/2.

In Vridhachalam centre the yield of cashew was very poor during the reporting year because of low rainfall received and not well distributed.

Number of nuts/panicle:

At Bhubaneswar and Vridhachalam centres, highest number of nuts per panicle was recorded in M 26/2 (7.1 and 8.4 respectively) (Table 1.12).

Nut weight:

Nut weight of entries of MLT-86 were reported by four centres and the same is given in Table 1.13. At Bhubaneswar and Vridhachalam centres, highest nut weight of 8.8 g and 8.3 g, respectively was recorded by H 2/15 while at Chintamani and Madakkathara centres H 2/16 had nut weight of 7.9 g and 10.3 g respectively.

Table 1.12 Performance of different varieties for average number of nuts per panicle in Multilocati Trial-86 in different centres during 1996-97.

Sl. No.	Varieties	Bhubaneswar	Vridhachalam
1	Vengurla-2	4.4	8.0
2	Vengurla-3	7.1	5.4
3	Vengurla-4	6.6	7.2
4	Vengurla-5 (H 24)	-	7.8
5	T.No.40	4.5	7.4
6	T.No.129	2.2	6.2
7	H 2/15	1.7	6.8
8	H 2/16	6.2	4.8
9	H 1598	5.2	6.2
10	H 1600	5.2	-
11	H 1608	3.9	7.4
12	H 1610	2.7	6.8
13	VTH 30/4	2.8	7.4
14	VTH 59/2	4.2	6.8
15	M 26/2	7.1	8.4
16	M 33/3	-	7.2
17	Anakkayam-1	-	-
18	M 44/3 (Vittal)	3.8	-
19	M 44/3 (VRI)	4.5	10.2
20	M 44/3 (Vengurla)	-	-

Table 1.13 Performance of different varieties for nut weight (g) in Multilocation Trial-86 (MLT-86) in different centres during 1996-97.

Sl. No.	Varieties	Bhubaneswar	Chintamani	Madakkathara	Vridhachalam
1	Vengurla-2	5.1	4.7	7.4	6.3
2	Vengurla-3	7.7	7.8	7.3	7.2
3	Vengurla-4	7.4	4.4	9.1	7.3
4	Vengurla-5 (H 24)	-	4.0	4.2	5.9
5	T.No.40	5.0	5.1	6.2	7.4
6	T.No.129	4.4	4.1	6.2	6.7
7	H 2/15	8.8	6.3	9.9	8.3
8	H 2/16	8.2	7.9	10.3	6.3
9	H 1598	5.5	6.0	6.4	7.0
10	H 1600	7.1	6.2	7.6	-
11	H 1608	8.0	7.7	9.5	7.8
12	H 1610	8.1	6.8	9.0	6.0
13	VTH 30/4	8.7	5.3	6.0	7.1
14	VTH 59/2	6.0	4.2	8.1	7.9
15	M 26/2	4.7	-	8.3	7.2
16	M 33/3	-	-	9.0	7.4
17	Anakkayam-1	-	-	4.1	-
18	M 44/3 (Vittal)	5.0	6.0	-	-
19	M 44/3 (VRI)	5.1	4.0	4. 2	6.8
20	M 44/3 (Vengurla)	-	3.9	-	-
	CD			1.08	
	CV%				

Expt.3 : **Multilocation trial-92 with varieties from Bapatla,Vengurla, Vridhachalam, NRC Cashew, Puttur (MLT-92).**

Centres:

East Coast	:	Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West Coast	:	Madakkathara, Vengurla
Maidan tracts	:	Chintamani, Jagdalpur

Objective:

To evaluate the performance of new set of high yielding varieties in different locations.

Design : RBD
Replication : 3
Varieties : No. of entries : 13
Bapatla entries : 3/28, 3/33, 10/19, 30/1
Vengurla entries : H 68, H 255, H 303, H 320, H 367
Vridhachalam entries : M 15/4, M 44/3
NRCC, Puttur entries : VTH 107/3, VTH 40/1
Additional entries : 302, Ullal-1 (at Chintamani)

Year of planting : 1992

This trial was taken up in 1992 at six centres. In Jagdalpur centre the grafts of entries collected from Vengurla and Vridhachalam during 1994 showed heavy mortality during transportation and after planting. Grafts of entries were collected from NRCC, Puttur, Madakkathara and Bapatla and planted in 1996. This trial could not be planted in Vengurla centre for want of land. It has been proposed to plant the said trial in the ensuing monsoon season 1997 at Vengurla centre by cutting the already evaluated germplasm plot. In Jhargram centre, as some entries were missing, it has been decided to replant all the entries with same aged grafts.

As this trial is in the initial stage of plantation in all the six centres, not much data was available in this trial. Data on yield and yield component characters are reported only from Bapatla, Bhubaneswar and Chintamani centres (Table 1.14). However, growth parameters such as plant height, stem girth etc. were recorded by all the seven centres.

Growth parameters:

In Bapatla centre, highest plant height (3.3 m), stem girth (40.3 cm) were recorded in 10/19 variety. In Bhubaneswar trial, plant height was maximum (3.8 m) and stem girth was also maximum (50.8 cm) in H 255. In Chintamani trial, highest plant height (3.6 m) and highest stem girth (47.1 cm) were observed in Hy-320. In Jagdalpur centre the plant stand in most entries of NRCC, Puttur, Madakkathara and Bapatla are satisfactory. But Vengurla and Vridhachalam entries need lot of gap filling. Highest plant height (0.65 m) and highest stem girth (1.1 cm) were recorded in K-22-1 and Madakkathara-1 respectively at Jagdalpur centre. In the Jhargram centre, maximum plant height (3.5m) and stem girth (20 cm) were observed in M 44/3 variety. NRCC Sel-1 was the tallest (3.5 m plant height) and with maximum stem girth (35.9 cm) in Madakkathara centre trial. Plant height and girth of the plants were found to be the highest in M 15/4 (2.4m and 26.1cm, respectively) at Vridhachalam centre.

Table 1.14 Performance of different varieties for yield and yield component characters in Multilocation Trial-92 (MLT-92) at Bapatla, Bhubaneswar and Chintamani centres during 1996-97

Sl. No.	Variety	Yield (kg/tree)			Cum. yield (kg/tree)			No. of nuts/ panicle		Nut weight (g)		
		Bapatla	Chintamani	Mean	Bapatla	Chintamani	Mean	Bapatla	Bhubaneswar	Bapatla	Bhubaneswar	Chintamani
1	3/28	0.74	2.46	1.60	0.74	2.54	1.64	2.0	4.7	7.7	6.5	5.6
2	3/33	0.53	1.09	0.81	0.53	1.60	1.07	2.2	4.1	7.3	5.6	3.7
3	10/19	0.60	0.00	0.30	0.60	0.25	0.43	3.3	3.9	8.9	5.3	-
4	30/1	0.72	2.24	1.48	0.72	2.72	1.72	3.0	3.5	6.0	6.4	4.7
5	H 68	0.13	2.96	1.55	0.13	3.77	1.95	1.6	6.0	8.8	8.0	5.9
6	H 255	Neg.	2.20	1.10	Neg.	2.38	1.19	-	3.1	-	8.6	7.0
7	H 303	0.13	-	0.13	0.13	-	0.13	1.4	-	7.1	-	-
8	H 320	0.08	5.09	2.59	0.08	5.55	2.82	2.4	6.9	8.6	7.6	4.9
9	H 367	0.13	-	0.13	0.13	0.31	0.22	2.0	3.2	7.6	10.0	-
10	VTH 107/3 (NRCC Sel.1)	0.14	0.00	0.07	0.14	0.19	0.17	2.2	3.2	6.1	7.4	5.1
11	VTH 40/1 (NRCC Sel.2)	0.13	2.97	1.55	0.13	4.12	2.13	2.2	3.5	5.8	8.4	5.1
12	M 15/4	0.75	0.68	0.72	0.75	0.93	0.84	5.0	2.4	6.2	6.6	4.8
13	M 44/3	0.58	0.00	0.29	0.58	1.24	0.91	3.0	4.2	4.3	5.2	-
14	302	-	2.90	2.90	-	3.80	-	-	5.8	-	6.8	6.0
15	Ullal-1	-	0.00	0.00	-	0.33	0.33	-	-	-	-	-

Neg. = Negligible

Nut yield:

Yield data are available only from Bapatla and Chintamani centres. Bapatla yields were of lower magnitude being the first harvest. The highest nut yield was recorded in M 15/4 (0.75 kg/tree) followed by 3/28 (0.74 kg/tree) and 30/1 (0.72 kg/tree). In Chintamani centre, highest yield and highest cumulative yield were recorded in H 320 (5.09 and 5.55 kg/tree, respectively).

Number of nuts/panicle:

In Bapatla centre, maximum number of nuts per panicle was seen in M 15/4 (5.0). In Bhubaneswar centre the variety H 320 had highest number of nuts per panicle (6.9).

Nut weight:

Nut weight was equal or above 8.0 g in 10/19, H 68, H 320 varieties at Bapatla centre and in H 68, H 255, H 367 and NRCC Sel-2 varieties at Bhubaneswar centre. In Chintamani centre the nut weight, in general, was less. The highest nut weight at Chintamani centre was in H 255 (7.0 g).

Project Title: Gen.4 : Hybridization and Selection

Centres

East Coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West Coast : Madakkathara, Vengurla
Maidan tract : Chintamani

Objectives:

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

The F1 progenies are to be close planted in initial selection plots and selected hybrids are to be clonally multiplied for yield evaluation in multilocation trial in major agroclimatic conditions.

The details of hybridization programme and performance of promising hybrids at various centres of East and West coast and maidan region are as follows:

Bapatla

In addition to the specified cross combinations, the following crosses were also carried out at the centre during 1996-97 (Table 1.15).

Table 1.15 Details of hybridization made at Bapatla centre

Sl. No.	Cross combinations	Total no. of pollinations made	No. of nuts obtained	Percentage of success
1	228 x 2/22	100	6	6.0
2	273 x 71	175	19	10.8
3	71 x 273	180	20	11.1
4	6 x 40	75	3	4.0

Table 1.16 Performance of hybrids at Bapatla centre

Sl. No.	Hybrid No.	Parentage	Yield of 1996 (Kg/tree)	Cumulative yield (1984-96) (kg/ tree)	Apple wt. (g)	Nut wt. (g)	Shelling percentage
1	2/3	39 x 129	10.2	138.5	50.0	7.0	28.0
2	2/15	1 x 40	12.2	124.2	60.0	5.8	29.0
3	3./10	56 x 40	12.0	112.0	40.0	5.6	29.0
4	3/13	56 x 40	13.9	149.3	40.0	6.6	27.0
5	3/25	56 x M 10-4	12.8	117.6	41.0	5.8	30.0
6	4/1	1 x 100	12.2	117.2	40.0	4.9	29.0

In the evaluation of existing hybrid trees (1980-81) maximum yield of 13.9 kg in H 3/13 (56 x 40) and 12.8 kg in H 3/25 (56 x M 10-4) was recorded. The cumulative yield (1984-96) continued to be the highest in H 3/13 (149.3 kg) followed by in H 2/3 (138.5 kg). The highest nut weight of 7.0 g was recorded in H 2/3 (39 x 129) and highest shelling percentage of 30 per cent in H-3/25 (56 x M-10-4). (Table 1.16).

Bhubaneswar

During the year hybridization with BBSR-1 x H 2/15, BBSR-1 x GH 2/16 and BBSR-1 x VTH 711/4 was carried out with an average success of 6.8 per cent.

Jhargram

The clonal material collected from Vengurla (Vetore-56 and Kankadi) and NRC cashew (VTH 711/4 Brazilian type) is planted and hybridization work is pursued at the centre.

Vridhachalam

The performance of eight hybrid progenies planted during 1987 was evaluated in the field (Table 1.17).

The maximum (mean yield) for seven years (2.7 kg/tree), highest yield for the year 1996 (5.0 kg/tree), maximum number of flowering laterals (21.0/m2) and highest shelling percentage (31.0%) was recorded in hybrid 16 (M 44/3 x M 26/1). The other promising hybrids were H-13 (M 26/2 x M 26/1) and H-17 (M 44/3 x M 45/4) which gave mean yield of 2.7 and 1.9 kg/tree/year respectively. No tea mosquito bug incidence was recorded in any of the hybrids.

A total of 24 cross combinations using the parental lines H 2/15, H 2/16, H 1608, M 33/3, M 26/1, M 45/4, M 3/2, M 16/3, M 7/2, M 15/4, M 99/4 and M 44/3 were carried out. Due to non availability of sufficient land these hybrids are yet to be field planted.

Madakkathara

A total of 189 hybrid seedlings available from crosses made since 1993-96 are available for evaluation in the field. The highest yield was recorded in H-18 (BLA 39-4 x P-3-2) (1.1 kg/tree). The promising hybrids in terms of height, girth and canopy were H-73 (BLA 39-4 x P-3-2), H-83 (V-5 X H-1591) and hybrids 66 (BLA 39-4x P-3-2) and 83 respectively.

Vengurla

During the period crossing work with eight different combinations was carried out and 212 hybrid seedlings were obtained. A total of 1840 F1 hybrids planted between 1983-94 are under evaluation (Table 1.18). The maximum mean cumulative yield (10 years) (10.7 kg) and highest yield (1996-97) (18.5 kg) was recorded in H 255 (Vengurla - 3 x M 20/5). The hybrid nos. 255, 303, 320 and 367 have been included in MLT-92 trial. Hybrid 255 (V-3 x M-10/4) was found to be significantly superior for yield, with bold sized nuts (10 g) and good shelling percentage (30.5 per cent).

Chintamani

The 3/108 Gubbi x Vetore-56 cross was made and field planted at the centre.

Table 1.17 Performance of hybrids at Vridhachalam centre

Sl. No.	Hybrid No.	Cross combination	Mean yeild (7 yrs.) Kg/tree	Highest yield per tree (kg) (6thyear)	No. of laterals/ m^2	No. of flowering laterals/m^2	Yield of 1996 (kg)	Apple wt. (g)	Nut wt. (g)	Shellin (%)
1	H.10	M 10/4 x M 26/1	2.1	3.6	31.2	20.8	1.2	70.1	7.4	30.0
2	H.11	M 10/4 x M 45/4	1.6	2.9	20.4	10.6	0.7	62.1	6.0	28.5
3	H.12	M 10/4 x M 75/3	1.6	2.5	27.4	17.2	1.2	62.4	7.1	30.2
4	H.13	M 26/2 x M 26/1	2.7	4.5	24.2	14.8	1.9	58.3	7.9	28.4
5	H.14	M 26/2 x M 45/4	2.0	3.2	22.4	13.4	1.4	52.5	6.0	27.2
6	H.15	M 26/2 x M 75/3	1.5	2.8	18.5	14.7	1.0	49.2	5.8	28.5
7	H.16	M 44/3 x M 26/1	2.7	5.0	29.4	21.0	2.8	58.6	6.6	31.0
8	H.17	M 44/3 x M 45/4	1.9	2.6	22.4	14.0	1.9	53.4	6.9	28.5

Table 1.18 Performance of hybrids at Vengurla centre

Sl. No.	Hybrid No.	Cross combination	Mean yield (for 10 years) kg/tree	Highest yield per tree (kg)	Yield of 1996 (kg)	Nut wt. (g)	Shelling %
1	248	Vengurla-3 x M 44/3	5.9	10.4	8.7	6.2	28.0
2	255	V-3 x M-10/4	10.7	33.4	18.5	10.0	30.5
3	303	V-4 x M-10/4	6.8	12.7	3.4	9.0	27.0
4	320	M 44/3 x Vetore-56	7.3	14.8	4.7	7.4	31.6
5	367	V-4 x M 10/4	10.5	22.5	10.0	11.5	28.0
6	444	M 10/4 x Vetore-56	5.5	9.3	6.4	7.5	28.5
7	445	M 10/4 x Vetore-56	6.3	12.8	12.8	7.5	28.5
8	453	M 10/4 x Vetore-56	5.1	8.2	8.0	8.2	28.0
9	454	M 10/4 x Vetore-56	7.2	11.8	10.8	8.0	28.0
10	509	V-4 x M 44/3	6.4	9.3	6.3	6.0	29.0
11	304	V-4 x M 10/4	6.2	8.3	6.8	6.7	29.0

A. AGRONOMY

Project title: Agr.1 : NPK fertilizer experiment

Centres:

East Coast : Bapatla, Bhubaneswar, Jhargram and Vridhachalam
West Coast : Madakkathara and Vengurla
Maidan tract : Chintamani

Objective:

The main objective of this experiment is to study reponse of vegetatively propagated material of cashew to different doses of NPK fertilizers.

Design :

Three factorial confounded design with 27 treatment combinations.
Replication: Two

Treatments:

N : 0, 500 and 1000g/plant
P_2O_5 : 0, 125 and 250g/plant
K_2O : 0, 125 and 250g/plant

East coast:

Bapatla

Significant differences in tree height, girth and spread were observed between trees receiving no Nitrogen (185 cm, 25.5 cm and 234 cm respectively) and trees receiving 500 g N (221.4 cm, 30.8 cm, 302.4 cm respectively) and 1000g N (221.8 cm, 31.3 cm and 303.2 cm respectively) (Table 2.1).

Phosphorus and potassium applications had no significant effect on tree height, girth and spread (Table 2.1). However it was observed that NP interaction effect was significant on all the growth parameters (height, girth and spread).

In an observational trial it was noticed t there was increase in girth, canopy spread, number of flowering panicles/sq.m and yi tree in the case of plants receiving highest dos fertilizer (1500 g N, 375g P_2O_5 and 375 g plant) as compared to trees receiving the lo dose of fertilizers (500g N, 125g P_2O_5 and K_2O/tree) (Table 2.2).

Bhubaneswar

The plant height increased signifi with application of nitrogen, phospho potassium as compared to control. Th height was found to be directly correlated to levels. Maximum height was recorded (339 in N2 (1000 g N/Plant) followed by N1 (50 Plant) and minimum was recorded in cont (280 cm). Similarly, application of phosph 250 g/plant (P2) significantly increased over P1 & P0 levels (125 g P_2O_5 & 0g P_2 The interaction effect of NPK was not o Linear response to Nitrogen and phospho observed in the case of girth. Maxim girth was observed in N2 (39.8 cm) fol N1 (37.2) and minimum in N0 Application of P_2O_5 and K_2O did no effect on tree girth. The interaction e NK and PK and NPK did not show any variation. Spread of the plant both in W showed significant differe application of various doses

Maximum spread of the tree was recorded in N2 level (N-S 351 cm, E-W 349 cm). Application of P_2O_5, K_2O did not show any significant difference. The interaction effect of NP, NK and PK did not vary significantly. (Table 2.1).

Jhargram

New NPK trial with clonal progenies of Jhargram-1 was laid with following treatments.

N : 0, 500, 1000g/plant
P_2O_5 : 0, 125, 250g/plant
K_2O : 0, 125, 250g/plant

The trial is in initial stage.

Vridhachalam

The trial was laid out in the New block. The grafts of the cultivar VRI-2 were planted in 1996 and the first dose of fertilizers were given as per the schedule.

The pre-treatment soil samples were analysed. The available nutrients were found to be 332.4 kg N/ha, 6.97 kg P_2O_5/ha and 123.2 kg K_2O/ha.

West Coast Region

Madakkathara

The experiment was laid out in 1992 by using BLA 39-4 variety at Madakkathara. Uniform dose of fertilizers was applied for all the different levels of treatments this year for getting uniformity in growth and yield. This will continue for one year and treatments will be imposed after following the technique of confounding.

Vengurla

At Vengurla, the experiment was laid out in 1990. No significant difference in yield was observed.

Table 2.1 Effect of different levels of NPK and their interactions on growth characteristics at Bapatla and Bhubaneswar centres

Treatments		Bapatla			Bhubaneswar			
		Girth (cm)	Height (cm)	Spread (cm)	Girth (cm)	Height (cm)	Spread N-S (cm)	Spread E-W (cm)
N0	(N0)	25.5	185.4	234.0	32.8	280	302	306
N 500	(N1)	30.8	221.4	302.4	37.2	314	331	331
N 1000	(N2)	31.3	221.8	303.2	39.8	339	351	349
P0	(P0)	29.0	203.8	266.8	34.8	296	321	323
P125	(P1)	29.2	214.1	288.0	37.1	320	327	337
P250	(P2)	29.4	210.5	284.5	37.9	318	336	326
K0	(K0)	29.7	212.5	291.2	36.2	275	322	332
K125	(K1)	29.7	210.3	283.1	36.5	320	326	324
K250	(K2)	28.3	205.8	265.1	37.2	318	336	313
SEm for N,P,K		1.00	7.46	12.75	1.05	7.1	9.9	11.4
CD (5%) for N,P,K		2.93	21.70	37.20	3.04	20.6	28.8	33.2
CD for NP (5%)		5.06	37.60	64.40				
SEm for NP, NK, PK					1.82		17.2	19.8
SEm for NPK					3.15		29.8	34.3

Table 2.2 Effect of N, P and K fertilizers on growth and yield at Bapatla centre

Treatments	N (g)	P_2O_5 (g)	K_2O (g)	Girth (cm)	Canopy (cm)	No. of flowering panicle/sq.m.	Yeild/tree kg
Recommended dose	500	125	125	121.5	1003	18.5	7.6
Alternate doses	1000	250	250	133.4	1057	19.8	9.2
	1500	375	375	125.9	1066	19.6	10.7

Maidan Region

Chintamani

The experiment was laid out in 1987 at Chintamani located in Maidan Region. The grafts of the variety Ullal-1 were used in this experiment and planted at a spacing of 7.5m x 7.5m. Data on plant height, stem girth and canopy spread during 1996-97 and 1996 yield are given in Table 2.3 and nut yield per tree recorded over years from 1991-96 are presented in Table 2.4.

Plant height

No significant differences in plant height due to NPK and interactions of NP and NK was observed. Only PK influenced the plant height significantly. P_2K_2 combination resulted in maximum height of 556 cm as compared to 505 cm when P and K were not applied (P0K0 Control).

Stem girth did not differ significantly to different levels of N & K and interaction of different levels of N, P_2O_5 and K_2O. However, stem girth differed significantly to different levels of phosphorus. The stem girth increased as the level of P increased (P0-67 cm to P2-71.4 cm). (Table 2.3).

No significant differences were observed either due to different levels of N, P or their interactions on East-West tree canopy spread. Only K had significant influence on the tree spread, but, with respect to North-South K2 level recorded significantly less plant spread (807 cm) than K0 level (859 cm). The influence of K on plant spread was inversely related.

Nut yield

Significant influence of N,P,K and interaction of NP and NK on nut yield was observed. In general, as the level of nutrient increased, the increase in nut yield was observed. Application of N at 1000g/tree (N2) recorded the maximum nut yield of 2.4 kg/tree which differed significantly from other two levels. Phosphorus application at 250 g/tree (P2) recorded significantly higher nut yield of 2.4 kg/tree than the other two levels. But the differences in nut yield between K levels varied significantly with K2 level (250 g/tree) recording the highest yield of 2.6 kg/tree (Table 2.3).

Cumulative nut yield upto six years as influenced by NPK and their interactions is given in Table 2.4. The data revealed that the effect of NPK and their interaction were not consistant over years. When individual nutrient effects are considered, application of 500 g N, 125 g P_2O_5 or 250g K_2O/tree/year has increased the yield

substantially over control. Among 2nd order interactions, N2P2 (4.3 kg/tree), N2K2 (4.5 kg/tree) and P2K2 (4.6 kg/tree) recorded the highest six year mean yield (Table 2.3). Among NPK interactions, the highest nutrient level i.e., application of 1000gN, 250g P_2O_5 and 250g. K_2O recorded highest mean yield (5.5 kg/tree) followed by 500:250:125g NPK (5.1 kg/tree), 500:250:250g NPK (5.0 kg/tree), 1000:125:250g of NPK (5.0 kg/tree) which were all on par (Table 2.4). When we work out economics, the application of 500g N, 250g P_2O_5 and 125g K_2O is best for getting optimum yield (5.1 kg/tree).

Table 2.3 Effect of different levels of NPK and their interactions on growth characters and yield at Chintamani centre

Treatments	Girth (cm)	Height (cm)	Spread (cm)	Nut yield (kg/tree) 1996	Mean Cum. yield kg/tree
Main effects					
N0	68.9	548	849	1.7	
N1	67.3	552	826	1.8	
N2	70.5	548	827	2.4	
P0	67.0	536	820	1.6	
P1	68.4	555	849	2.0	
P2	71.4	557	833	2.4	
K0	70.2	545	859	1.4	
K1	69.5	550	837	1.9	
K2	67.0	553	807	2.6	
Interactions					
N2P2		-			4.3
N2P2		-			4.5
P2K2		556			4.6
N1P0		-			2.2
N0K0		-			2.2
P0K0		505			2.7
SEm for N, P, K	1.04	7.0	0.115	0.13	
CD for N, P, K (p=0.05)	3.05 (P)	NS	NS	0.37	
SEm for NP/NK/PK	1.80	0.12	0.200	0.18	
CD for NP/PK (p=0.05)	NS	0.35	NS	0.52	

Table 2.4 **Effect of different combinations of NPK of nut yield of cashew in different years as well as cumulative yield (1991-96) at Chintamani centre**

Treatment combination			Yield, kg/tree						Mean of six years
N	P_2O_5	K_2O	1991	1992	1993	1994	1995	1996	
0	0	0	1.4	0.9	1.2	2.2	3.0	0.8	1.1
0	0	1	1.7	0.6	2.2	2.7	4.9	1.4	2.2
0	0	2	2.2	0.7	4.9	3.6	4.2	1.4	2.8
0	1	0	1.7	0.5	2.6	4.1	5.5	1.3	2.6
0	1	1	2.3	0.9	2.2	4.7	5.9	1.7	2.9
0	1	2	3.3	0.7	4.3	3.0	4.6	2.2	3.0
0	2	0	2.4	0.6	2.3	2.8	4.0	1.7	2.3
0	2	1	3.0	0.8	1.5	1.8	3.2	2.0	2.1
0	2	2	2.2	0.8	2.7	2.8	9.2	2.4	3.3
1	0	0	2.0	1.0	1.8	5.7	4.8	1.3	2.8
1	0	1	1.7	0.5	3.6	6.1	3.3	1.4	2.8
1	0	2	2.4	0.9	2.1	3.2	2.2	1.4	2.1
1	1	0	1.9	1.6	1.9	2.5	5.0	1.3	2.3
1	1	1	3.0	0.9	2.6	3.7	3.0	2.1	2.5
1	1	2	3.5	1.0	6.3	6.9	7.3	2.5	4.6
1	2	0	2.2	0.8	2.4	3.4	4.5	1.6	2.5
1	2	1	3.1	1.2	2.5	3.5	2.8	1.8	5.1
1	2	2	3.8	1.1	6.8	5.8	9.2	3.3	5.0
2	0	0	2.4	0.9	1.8	5.6	5.9	1.9	3.1
2	0	1	2.1	0.5	1.8	4.9	7.1	1.9	3.1
2	0	2	2.3	0.8	3.9	6.2	3.9	2.5	1.8
2	1	0	2.1	0.5	2.4	4.4	6.2	1.5	2.9
2	1	1	3.6	0.6	3.4	4.3	3.9	2.1	3.0
2	1	2	4.2	0.9	4.4	8.3	8.7	3.3	5.0
2	2	0	2.2	0.6	2.8	5.1	6.1	1.7	3.1
2	2	1	3.3	0.9	2.6	7.4	4.3	2.4	3.5
2	2	2	3.6	1.1	5.6	11.3	7.3	4.4	5.5

Pooled Analysis

SEm + -		CD (P=0.05)
Years	0.22	0.59
Treatment	0.46	1.24

Project Title: Agr.4 : Spacing trial.

Centres:

East Coast : Jhargram
West Coast : Vengurla

Objective

The main objective of this experiment is to find out the optimum plant population per unit area for maximisation of yield.

East Coast

Jhargram

The experiment details and treatments for the trial laid out are as under:

Experimental details:

Design	:	RBD
Replication	:	3
Plot size	:	25m x 25m
Area covered	:	2.25 ha
Variety	:	Red Hazari
Year of planting	:	July, 1982 (Seedling)

Spacing

1. 5m x 5m : Square with no thinning
2. 5m x 5m : Square with thinning of 50% plants (after 6 years in 1990)
3. 5m x 5m : Square with thinning of 75% plants (after 11 years)
4. 10m x 5m : Rectangular
5. 10m x 5m : Rectangular with thinning of 50% plants (after 6 years, done in 1990)
6. 10m x 10m : Square
7. 10m x 10m x 10m : Triangular
8. 8m x 8m : Square
9. 8m x 8m x 8m : Triangular
10. 6m x 6m : Square
11. 6m x 6m x 6m : Triangular
12. 5m x 5m : Square with selective thinning of 50-75% plants. During 1990, 50% plants were removed selectively.

Significant variations in respect of number of nuts per tree, yield per tree and yield per block (25m x 25m) among diffrent treatments were observed at Jhargram centre (Table 2.5). Maximum number of nuts/tree (1076) was observed in trees spaced at 10m x 5m rectangular system with no thinning followed by 8m x 8m square system (1045 respectively). The minimum number of nuts/tree was observed in 10m x 10m x 10m triangular system and 5m x 5m square with 75% thinning (558 and 562 respectively). With regard to yield/block the trees planted in 6m x 6m x 6m triangular system ranked first being 70.5 kg followed by 69.7 kg, 57.3 kg and 48.3 kg in 5m x 5m square system with no thinning, 5m x 5m square system with 75% thinning, 6m x 6m square respectively and the same was minimum (10.6 kg) under 10m x 10m square system. The maximum cumulative yield per block for last eight years (1988-96) of 416.0 kg was observed in 5m x 5m square system with no thinning while the same was 402.4 kg, 345.2 kg and 348.6 kg under 6m x 6m x 6m triangular, 6m x 6m square and 5m x 5m square system with 75 per cent thinning, respectively. The trees planted under 8m x 8m square system recorded the minimum cumulative yield per block (41.2 kg).

West Coast

Vengurla:

The experiment was laid out in July, 1990 and growth observations and yield were recorded and presented in Table 2.6. No significant differences in height and girth were observed due to different densities/unit area six years after planting. The data on average tree spread indicated that there is still sufficient space (N-S and E-W) between rows and between plants within a row in all treatments except T1, T2 and T3. Yield per hectare was maximum in treatments T1, T2 and T3 where spacing adopted was 5m x 5m. (3 times higher yield than widely spaced trees).

Table 2.5 Effect of different spacing on yield of cashew at Jhargram centre.

Sl. No.	Treatments	No. of Plants/ Block (25m x 25m)	Canopy	No. of Nuts/ Plant	Yield/ Plant (kg)	Yield/ Block (kg)	Yield kg/ha	Cumulative yield/ block (kg) (1988-1996)	Cumulative yield (kg/ha)
1.	5m x 5m Square no thinning	25	Medium	595	2.2	69.7	1116	416.0	6656
2.	5m x 5m Square 50% thinning	13	-do-	635	2.4	39.6	633	222.3	3557
3.	5m x 5m Square 75% thinning	25	-do-	562	2.0	57.3	917	348.6	5578
4.	10m x 5m rectangular	8	-do-	1076	4.3	37.9	606	227.4	3638
5.	10m x 5m rectangular	4	-do-	845	3.3	15.2	242	99.5	1593
6.	10m x 10m square	4	-do-	680	2.3	10.6	169	65.3	1045
7.	10m x 10m x 10m Triangular	7	-do-	558	2.5	17.5	280	112.9	1806
8.	8m x 8m Square	9	-do-	1045	4.4	41.2	658	41.2	658
9.	8m x 8m x 8m Triangular	12	-do-	915	3.4	44.1	705	254.5	4072
10.	6m x 6m Square	16	-do-	721	4.4	48.3	772	345.6	5530
11.	6m x 6m x 6m Triangular	22	-do-	645	2.8	70.5	1127	402.4	6438
12.	5m x 5m Square	13	-do-	598	2.4	38.7	619	237.0	3792
SEm±				15.43	0.591	2.23	35.7	4.52	72.3
C.D at 5%				32.00	1.24	4.63	74.1	9.38	150.1

Table 2.6 Spacing trial on cashewnut (Vengurla-4), growth and yield observation during 1996 season at Vengurla centre.

Sl. No.	Treatments different spacings	Average Height (m)	Average Girth (cm)	Spread (m)		Yield kg nut			Present plant population/ha.	Returns per ha. Rs.
				N-S	E-W	Per tree	Per block (50 x 50m)	Per hectare		
1.	5 x 5m with no thinning (T-1)	2.4	32	2.9	2.6	0.9	94.9	379.6	400	13286
2.	5 x 5m with 50% thinning after 6th yr. (T-2)	2.7	32	3.0	2.6	1.2	117.8	471.2	400	16492
3.	5 x 5m with 50% thinning after 6th & 75% after 11th year (T-3)	2.5	31	3.0	2.7	1.1	112.0	448.0	400	15680
4.	10 x 5m No thinning (T-4)	2.4	31	2.6	2.4	0.8	39.5	158.0	200	5530
5.	10 x 10m with 50% thinning after 6th years (T-5)	2.4	31	2.6	2.4	0.9	47.3	189.0	200	6615
6.	10 x 10m No thinning (T-6)	2.6	30	2.5	2.4	0.7	18.6	75.0	100	2607
7.	10 x 10 x 10m no thinning (T-7)	2.2	26	2.4	2.1	0.8	23.4	94.0	115	3280
8.	8 x 8m No thinning (T-8)	2.5	32	2.8	2.6	1.0	39.5	158.0	157	5525
9.	8 x 8 x 8m No thinning (T-9)	2.2	27	2.2	2.2	0.9	38.3	153.0	180	5355

Cost of cashewnut Rs. 35.0/kg.

Project Title: Agr.6 : Cashew based cropping system

Centres

East coast : Bapatla, Bhubaneswar, Vridhachalam
West Coast : Vengurla

Objectives:

Finding out suitable intercrop that can be grown in the initial years of cashew orchard.

Experimental details:

Design : RBD
Replication : Three

Annual crops identified for different centres are as follows:

Bapatla : Sesamum, cowpea, groundnut, horsegram and greengram.
Bhubaneswar : Sesamum, cucumber and other economically feasible annuals.
Madakkathara : Annuals suitable to the area, medicinal plants
Vridhachalam : Groundnut, blackgram, cowpea and red gram.

Spacing:

Main Crop - Cashew 8m x 8m
Inter crops - Annuals-10m x 5m - N/S direction

East coast

Bapatla

At Bapatla, during kharif 1996, chilli, okra, brinjal, cowpea and cluster beans were grown as intercrops in existing cashew plantation. Out of them, intercrops cluster bean and cowpea, gave highest yields of 5000 kg/ha (green pods) and 4200 kg/ha respectively. These two intercrops also gave highest returns (Rs. 15000 & Rs. 12000/ ha) followed by chillies, okra and brinjal (Table 2.7).

Bhubaneswar

The experiment was laid out with main plot and subplot treatments at Bhubaneswar. Details of the treatments are as follows.

Spacing:

Design - Split plot
No. of Main plot - 4
No. Sub-plot - 3
No. of replication - 3

Main plot treatments:

1. Cashew alone (Main crop)
2. Cashew + Sesamum
3. Cashew + Horsegram
4. Cashew + Blackgram

Sub plot treatments:

1. No additional fertilizers to intercrops.
2. Application of additional fertilizers to intercrops as per recommendation.
3. Fifty per cent of the recommended fertilizer dose to the intercrops in addition to main crop.

Table 2.7 Yield of intercrops and net returns at Bapatla centre.

Treatments (intercrops)	Yield (kg/ha)	Net returns (Rs./ha)
Cluster bean	5000	15000
Cow pea	4200	12000
Chillies	3500	10000
Okra	3000	8500
Brinjal	2500	8000

The intercrops were raised in four years old cashew plantation. The yield realised from the intercrops are presented in Table 2.8.

Table 2.8 Yield of intercrops at three levels of fertilizers at Bhubaneswar centre (kg/ha).

	Treatments	Fertilizer levels 0	1	2	Mean
1.	Sesamum	Crop failed due to drought			
2.	Horsegram	150	337	215	234
3.	Blackgram	Crop failed due to drought			

Recommended fertilizer doses (kg/ha) for intercrops at Bhubaneswar centre.

		N	P_2O_5	K_2O
1.	Sesamum	30	15	15
2.	Horsegram	12	25	0
3.	Blackgram	20	40	0

Average yield of 234 kg/ha was recorded from horsegram. Sesamum and blackgram as intercrops failed to establish due to drought situations (Table 2.8).

West Coast

Vengurla

The trial was laid out with vegetable crops namely ridge gourd, bitter gourd , bottle gourd, snake gourd, okra and cucumber as intercrops in cashew orchard in Kharif season at Vengurla. The details of yield of promising intercrops are presented in Table 2.9.

Growing the intercrops has not affected cashew yield so far. Among the intercrops ridgegourd gave highest yield of 3687 kg/ha with return of Rs.14748, followed by okra and bittergourd (Table 2.9).

Table 2.9 Yield of intercrops (kg/ha) and gross returns (Rs.) at Vengurla centre

	Intercrops	Yield kg/ha	Gross return Rs./ha
1.	Okra	2993	11,965
2.	Bitter gourd	1362	6,810
3.	Ridge gourd	3687	14,748

B. HORTICULTURE

Project Title : Hort.4 : Screening of root stocks for dwarfing characters.

Centres:

East Coast : Bapatla, Bhubaneswar
West Coast : Madakkathara, Vengurla

Objectives

The objective of the trial is to identify dwarfing characters in cashew by screening of root stocks at nursery stage based on morphological, anatomical and physiological characters like height, girth, number of stomata, bark percentage and phenolic contents. Later to take up in breeding work by resorting to selfing of the identified dwarf trees.

Bapatla

A total of six trees were identified as less vigorous trees and their growth measurements are furnished in Table 2.10.

Inbreeding by selfing is done by covering the panicles with paper bags. Selfed seeds sown to raise root stocks for studies on screening of root stocks for dwarfing character.

Bhubaneshwar

The scion sticks of the semi dwarf type (collected last year) was collected again and ten grafts were prepared for planting for raising root stocks. Inbreeding will be taken up after establishment of grafts.

Madakkathara

Among the seeds collected from ten less vigorous types and five vigorous types, two less vigorous types T.No. 2286 and Kariyarappatta were identified and planted in the fields for evaluation (Table 2.11).

The seedlings raised from Tree No. 2286 seem to be a better dwarf type than Kariyarappatta in terms of height and canopy spread. (Table 2.11).

During the reporting year 163 seeds were obtained from Kariyarapatta and seeds were not obtained from T.No.2286. The seeds were sown for raising rootstocks for grafting with the mother trees as well as vigorous trees viz. Dhana for evaluation under field conditions.

Table 2.10 Growth characters of less vigorous dwarf cashew types at Bapatla centre

Sl. No.	Tree No.	Age	Height (m)	Girth (cm)	Spread (m)	
					E - W	N - S
1	ABP x 1	35	3.5	64	4.5	6.0
2	ABP x 2	35	5.1	124	8.5	9.5
3	ABP x 3	35	5.0	107	7.5	6.5
4	Irradiated tree 5/6	36	4.2	93	5.0	6.5
5	T.10/8	36	5.9	146	7.5	8.0
6	T.4/17	36	5.2	150	8.5	6.5

Table 2.11 Growth characters of less vigorous dwarf cashew types at Madakkathara centre

Sl No.	Variety/type		Height (m)	Girth (cm)	Spread (m)		Branches Nos.
					E - W	N - S	
1	T.No.2286	1	3.4	65	5.5	6.8	2
		2	3.4	55	3.4	5.5	3
2	Kariyarappatta	1	4.5	60	5.5	8.0	5
		2	6.1	62	6.0	8.0	4

Table 2.12 Growth characters of Brazil collections planted in 1993 at Madakkathara centre (1996-97)

Sl. No.	Accession No.	Height (m)	Girth (cm)	Spread		No. of primary branches
				E - W	N - S	
1	B2	3.7	55	4.3	4.5	2
2	B3	3.4	42	2.8	3.5	2
3	B4	5.6	50	3.0	3.8	2
4	B5	3.8	38	2.6	2.8	2
5	B6	5.4	43	4.7	5.0	2
6	B7	5.4	50	4.0	4.7	2
7	B9	2.9	35	2.7	2.5	4
8	B10	5.4	45	5.0	4.0	5
9	B11	5.4	60	3.6	4.0	2
10	B12	5.0	45	3.6	4.0	2
11	B13	3.3	25	1.2	1.5	-
12	B14	3.6	25	2.1	1.4	3
13	B15	4.3	32	2.6	2.2	2
14	B16	4.5	43	3.9	3.7	2
15	B17	3.5	40	2.6	2.5	3
16	B18	5.2	52	4.3	4.4	2
17	B19	2.6	25	1.9	2.6	-
18	B20	2.2	15	1.2	1.2	-

* Note: B1 and B8 accessions dried out

Inbreeding by selfing the two dwarf lines was taken up but no seed set was reported.

Among the twenty Brazilian collections planted in 1993, B-20 appears to be a dwarf line. (Height 2.2 m and canopy spread 1.2 m) (Table 2.12). Dwarf types from Anakkayam are to be colllected by the centre.

Vengurla

The trial was started in the year 1990 using five vigorously growing cashew types and five non vigorously growing cashew types with ten seedlings in each type.

Significant morphological and chemical characters were not noticed in the seedlings raised from nuts of dwarf trees. (Table 2.13).

Selfing of sixteen rootstocks was initiated during the reporting year and collection of nuts is being pursued.

Table 2.13 Rootstock screening of dwarfing characters in Cashew at Vengurla centre

Sl. No.	Rootstock	Height (cm)			Girth (cm)		Increase in girth
		Initial height	Height taken (1996)	Increase in height	July 1994	July 1996	
1	Vengurla-1	28	320	292	14.0	38.0	24.0
2	V-2	32	306	274	18.0	38.0	20.0
3	V-3	38	294	256	15.3	32.0	16.8
4	V-4	29	297	268	13.8	28.0	14.3
5	V-5	32	328	296	13.3	29.5	16.2
6	T.40	33	350	317	16.8	35.5	18.7
7	M 44/3	30	248	218	12.6	30.5	17.9
8	M 1600	26	366	340	13.5	39.5	26.0
9	VTH 59/2	34	325	291	13.5	36.3	22.8
10	Hy 2/16	31	324	293	15.8	35.0	19.2
11	T-129	26	282	256	16.5	29.0	12.5
12	Hy-1608	31	375	344	12.4	36.0	23.6
13	Hy-1610	37	312	275	12.4	29.0	16.6
14	VTH-30/4	34	347	313	16.0	28.5	12.5
15	M-26/2	31	244	213	13.0	20.5	07.5
16	Hy 2/15	32	317	285	13.5	34.3	20.8

Project Title: Ent.1 : Chemical control of pest complex

Objectives:

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

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

Centres:

East coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West coast : Madakkathara, Vengurla
Maidan tract : Chintamani

Treatments:

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

The insecticidal treatments were given as indicated above and the damage recorded one month after last spray is presented in Table 3.1. The most effective treatment was T5 at Jhargram (east coast), Vengurla (west coast) and Chintamani (maidan) with least incidence of 2.6, 11.8 and 1.4 per cent respectively, whereas at Madakkathara (west coast), T5 was on par with untreated control and at Chintamani T5 was on par with single spray (T2) and double spray treatments (T4, T7, T8 and T9). Treatment T7 was also found to be most effective at Madakkathara, Chintamani and Vridhachalam (east coast). In general the TMB incidence level was high at Madakkathara centre.

At Vridhachalam, Madakkathara and Vengurla, single spray treatments like T3 and T2 were found to be next best treatments. However, double spray treatments consisting of insecticide (endosulfan/carbaryl) followed by neem oil (T8 and T9) were found to be promising only at one location (Chintamani).

Table 3.1 Efficacy of insecticides against tea mosquito bug *H. antonii*

Treatments	Percentage of damaged shoots				Panicle damage score	No. of centres reported as		
	East Coast	West coast		Maidans	East coast	Most effective	Second best	Third best
	Jhargram	Madakkathara	Vengurla	Chitamani	Vridhachalam			
T1	9.9 (3.2)	skipped	18.5 (25.4)	17.9	1.5	-	2	-
T2	10.1 (3.3)	32.8	17.2 (24.5)	1.7	1.6	1	3	-
T3	11.4 (3.5)	32.9	18.4 (25.4)	48.8	1.4	-	3	1
T4	2.8 (1.8)	50.0	16.7 (24.1)	1.4	1.5	1	2	1
T5	2.6 (1.8)	43.9	11.8 (20.0)	1.4	1.3	3	1	1
T6	6.0 (2.5)	38.6	16.5 (24.0)	19.3	1.4	-	2	2
T7	7.8 (2.9)	23.2	16.2 (23.8)	1.4	1.2	3	1	-
T8	7.4 (2.8)	37.2	16.2 (23.8)	1.4	1.5	1	1	-
T9	6.6 (2.7)	30.8	15.4 (23.1)	1.6	1.4	1	2	1
T10	14.1 (3.8	51.9	31.9 (34.4)	47.7	1.8	-	-	3
CD 5%	(0.05)	14.7	(2.5)	5.4	-			

Figures in parentheses are transformed values.

Expt.2 : Control of minor pests

Centres:

East coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West coast : Madakkathara, Vengurla
Maidan tract : Chintamani

In the experiment-1, observations were also recorded on damage/incidence of various minor pests. In general, the extent of damage by various minor pests viz. leaf miner, leaf and blossom webber, shoot tip caterpillar, inflorescence thrips and apple and nut borer was very low in almost in all the centres except at Chintamani and Vengurla wherein leaf miner damage and thrips damage on nuts respectively were seen on the higher side (Table 3.2 & 3.3).

Leaf miner *(Acrocercops syngramma)*

The damage was reported from Vridhachalam, Jhargram and Chintamani and it was also least, ranging from 1.3 to 2.4 per cent in T5 treatment.

Leaf and blossom webber *(Lamida moncusalis)*

The pest damage was observed at two centres viz. Vridhachalam and Madakkathara and it was considerably lower in T5 treatment.

Table 3.2 Efficacy of insecticides against leaf miner and leaf and blossom webber

Treatments	Percentage of damage by				
	Leaf miner		Leaf and blossom webber		
	East coast		Maidan	West coast	East Coast
	Jhargram	Vridhachalam	Chintamani	Madakkathara	Vridhachalam
T1	4.0 (2.1)	1.9 (7.1)	02.6	Skipped	03.0 (10.0)
T2	5.1 (2.4)	1.9 (7.8)	31.3	02.8	05.2 (13.2)
T3	9.1 (3.1)	1.5 (7.1)	32.6	07.4	02.5 (09.1)
T4	1.9 (1.6)	1.8 (7.7)	02.6	02.0	04.1 (11.7)
T5	1.9 (1.6)	1.3 (6.4)	02.4	04.0	01.6 (07.1)
T6	5.1 (2.4)	1.5 (6.9)	02.7	03.3	02.8 (09.7)
T7	6.0 (2.6)	1.3 (6.6)	31.6	01.4	02.4 (08.9)
T8	5.2 (2.6)	1.6 (7.4)	33.1	04.3	03.9 (11.3)
T9	4.9 (2.4)	1.5 (7.0)	32.9	08.2	04.6 (12.3)
T10	13.7 (3.7)	2.8 (9.7)	31.5	11.2	10.3 (18.7)
CD 5%	(0.04)		4.26	4.74	-

Figures in parentheses are transformed values.

Shoot tip caterpillar *(Hypotima haligramma)*

The damage was seen in east coast during flushing and flowering period. However, the damage was lowest in T1 treatment at Bhubaneswar and it was negligible in T4 and T5 treatments at Bapatla.

Inflorescence thrips

This pest was noticed in all the regions during flowering and fruiting stages. At Bhubaneswar both yellow thrips *(Frankliniella schultzii)* and black thrips *(Haplothrips ceylonicus)* were found feeding on panicles. T5 treatment was found to be the most effective in reducing the population at Bhubaneswar, Madakkathara and Chintamani centres and on nuts damage at Vengurla centre.

Apple and nut borer *(Thylocoptila panerosema)*

The damage was reported only from Jhargram centre and it was least in T4 treatment followed by in T5 and T6 treatments.

Table 3.3 Efficacy of insecticides against shoot tip caterpillar, inflorescence thrips and apple and nut borer

Treatments	Percentage of damage				No./panicle		Percentage damage	
	Shoot tip caterpiller		Inflorescence thrips (Nut damage)		Inflorescence thrips		Apple and nut borer	
	East coast		West Coast		East Coast	West Coast	Maidan	East Coast
	Bapatla	Bhubaneswar	Vengurla		Bhubaneswar YT	Madakkathara	Chintamani	Jhargram
T1	5.6	0.7 (1.0)	32.0	(34.5)	0.5 (1.0)	Skipped	10.9	2.6 (1.7)
T2	2.4	6.2 (2.6)	32.4	(34.7)	0.3 (0.9)	2.7	4.7	2.3 (1.7)
T3	10.3	5.5 (2.3)	29.2	(32.7)	0.5 (1.0)	7.4	13.0	1.9 (1.6)
T4	0.0	1.3 (1.2)	31.2	(33.9)	0.2 (0.8)	6.7	3.9	0.7 (0.9)
T5	0.3	2.1 (1.3)	18.5	(25.5)	0.2 (0.8)	5.2	4.2	0.7 (1.1)
T6	3.5	4.8 (2.2)	27.5	(31.7)	0.5 (1.3)	7.4	11.5	0.9 (1.1)
T7	12.4	7.0 (2.7)	30.5	(33.5)	0.4 (1.0)	3.2	3.9	1.7 (1.5)
T8	5.3	5.9 (2.4)	28.9	(32.5)	0.4 (1.0)	8.5	3.8	1.0 (1.2)
T9	5.0	5.3 (2.3)	30.3	(33.4)	0.4 (0.9)	10.7	4.0	1.1 (1.3)
T10	6.0	11.5 (3.4)	49.0	(44.4)	2.9 (1.8)	12.4	11.8	5.0 (2.4)
CD 5%		(1.28)		(1.96)	(0.32)	2.8	2.1	(0.04)

Figures in parentheses are transformed values. YT = Yellow thrips

Expt.3 : **Control of foliage/inflorescence pests using plant products.**

Centres:

East coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West coast : Vengurla, Madakkathara
Maidan tract : Chintamani, Jagdalpur

Treatments:

T1 : Neem oil (2%)
T2 : Neem seed kernel extract (5%)
T3 : Cotton seed oil (2%)
T4 : Neem leaf extract (2%)
T5 : Monocrotophos (0.05%) - endosulfan (0.05%) followed by carbaryl (0.1%)
T6 : Commercial neem product + endosulfan (0.05%) followed by carbaryl (0.1%)
T7 : Pongamia oil (2%) followed by carbaryl (0.1%)
T8 : Control

Tea mosquito bug

Comparison of recommended spray schedule was made with various neem and pongamia based products at Madakkathara, Vengurla and Chintamani centres. In all the three centres, the extent of damage in all the treatments was of low intensity. However among all of insecticidal and botanical treatments tried, the least damage was recorded in the T5 treatment in all the three centres, and it was on par with T6 and T7 treatments at Chintamani centre (Table 3.4).

Minor pests

Some of the minor pests noticed at all three regions (viz. east coast, west coast and maidan tract) were leaf miner, leaf and blossom webber, shoot tip caterpillar and inflorescence thrips. However their intensity was at a low level (Table 3.4 & 3.5). The least damage was recorded in T5 treatments which was followed by Treatments T6 and T7. At Vengurla centre T5 treatment was best for control of inflorescence thrips damage on nuts (20.9%) followed by all other insecticidal and botanical treatments and were found to be significantly superior to all treatments. Neem seed kernel extracts (5%) (T2) was found effective against leaf miner at Bapatla and against shoot tip caterpillar at Madakkathara centre.

Table 3.4 Efficacy of certain plant products and insecticides against tea mosquito bug, leaf miner and leaf and blossom webber

Treatments	Percentage of damage								
	Tea mosquito bug			Leaf miner			Leaf and blossom webber		
	WestCoast		Maidan	East Coast	West Coast	Maidan	East Coast		West Coast
	Madakkathara	Vengurla	Chintamani	Bapatla	Madakkathara	Chintamani	Bapatla	Vridhachalam	Madakkathara
T1	14.5	18.9 (25.8)	12.5	2.5	4.2	12.9	5.7	19.1	8.8
T2	10.4	19.6 (26.2)	15.4	0.5	3.8	9.5	5.4	18.3	7.8
T3	10.7	19.3 (26.0)	Skipped	3.0	5.7	skipped	7.9	20.5	9.1
T4	12.5	16.3 (26.3)	19.1	4.0	4.7	13.5	7.9	20.2	8.3
T5	8.8	11.6 (19.9)	1.4	1.8	3.0	1.5	4.9	18.8	7.0
T6	8.9	17.1 (24.4)	1.9	2.5	3.3	10.3	7.3	17.0	7.9
T7	9.9	19.2 (26.0)	1.4	3.0	4.0	10.4	12.0	19.4	7.2
T8	14.8	29.1 (32.5)	22.9	6.0	5.2	19.9	11.0	20.7	9.3
CD	-	(3.88)	3.09	-	-	1.37	-	-	-

Figures in parentheses are transformed values.

Table 3.5 Efficacy of certain plant products and insecticides against shoot tip caterpillar and inflorescence thrips.

Treatments	Percentage of damage					No./panicle		
	Shoot tip caterpiller				Inflorescence thrips (nut damage)	Inflorescence thrips		
	East coast			West Coast	West Coast	East Coast		Maidan
	Bapatla	Bhubaneswar	Jhargram	Madakka-thara	Vengurla	Bhubaneswar (BT)	Jhargram	Chinta-mani
T1	3.0	3.5 (2.0)	1.8 (1.5)	1.4	29.5 (32.9)	1.0 (1.2)	1.4 (1.4)	6.0
T2	4.1	3.4 (1.9)	2.0 (1.6)	0.6	31.2 (34.0)	0.8 (1.1)	1.7 (1.5)	7.7
T3	10.7	6.5 (2.6)	2.5 (1.7)	0.7	30.4 (33.4)	1.0 (1.2)	1.9 (1.6)	Skipped
T4	8.5	5.5 (2.3)	2.3 (1.7)	0.7	31.9 (34.7)	1.4 (1.4)	2.0 (1.6)	7.9
T5	2.5	2.7 (1.8)	0.9 (1.2)	0.6	20.9 (27.2)	0.8 (1.1)	0.8 (1.1)	4.7
T6	2.0	3.5 (2.0)	1.2 (1.3)	1.2	27.7 (31.8)	1.4 (1.4)	1.1 (1.3)	6.6
T7	4.7	4.9 (2.3)	1.3 (1.3)	0.7	29.6 (33.0)	1.2 (1.3)	1.2 (1.3)	6.3
T8	12.8	15.8 (4.1)	7.2 (2.8)	3.5	40.5 (39.5)	3.1 (1.9)	6.5 (2.6)	12.9
CD 5%	-	(0.84)	(0.10)	-	(1.26)	(N.S)	-	-

Figures in parentheses are transformed values. BT= Black thrips

Project title : Ent.2 : Control of stem and root borer
Expt.1 : Prophylactic control trials.

Centres:

East coast : Bapatla, Bhubaneswar, Jhargram and Vridhachalam
West coast : Madakkathara, Vengurla

Objectives:

To evaluate different pesticides and neem products for their efficacy in preventing attack by stem and root borer.

Swabbing of trunk upto 1m height with neem oil (5%) and application of sevidol 4G (@ 75g/tree) (T3) during April was found to be most effective prophylactic control against stem and root borer in three centres, namely, Bapatla (0%), Jhargram (0%) and Madakkathara (8%). Neem oil (5%) (T4) was found moderately better in two centres namely, Bapatla (5.6%) and Jhargram (5%). Carbaryl (0.2%) in mudslurry (T1) resulted in lowest stem borer incidence during April at Bhubaneswar centre (8%) (Table 3.6).

It was observed that fresh pest incidence was always higher in the treatments during April month in comparison to November.

The treatments resulted in higher number of trees in early and middle stages of infestation both at Bhubaneswar and Jhargram (Table 3.7). The treatment with neem cake extract (5%) (T-5) and carbaryl swabbing (0.2%) + Sevidol 4G application (T-2) led to 2.0 per cent middle stage of infestation at Bhubaneswar. The results of Jhargram indicated no trees progressed to middle stage of infestation in carbaryl (0.2%) swabbing + Sevidol 4G application (T-2), neem oil (5%) swabbing + Sevidol 4G application (T-3), neem oil (5%) swabbing (T-4) and neem seed kernel extract (5%) swabbing (T-6). The experiment is in progress at Vengurla and Vridhachalam centres.

Table 3.6 Influence of prophylactic treatments on incidence of stem and root borer

	Percentage of freshly infested trees											
	East coast centres								West coast centres			
	Bapatla		Bhubaneswar		Jhargram		Vridhachalam		Madakkathara		Vengurla	
	Apr.	Nov.	Apr.	Nov.	Apr.	Nov.	Apr.	Nov.	Apr.	Nov.	Apr.	Nov.
T-1 Carbaryl (0.2%) in mud slurry	26.7	20.0	8.0	6.0	15.0	5.0	-	-	28.0	8.0	16.0	-
T-2 Swabbing carbaryl (0.2%) + Sevidol 4G application	6.7	6.7	12.0	10.0	5.0	-	6.0	-	12.0	4.0	-	-
T-3 Swabbing neem oil (5%) + Sevidol 4G application	0.0	5.6	-	-	0.0	0.0	14.0	-	8.0	4.0	-	-
T-4 Neem oil (5%)	5.6	5.6	12.0	10.0	5.0	5.0	18.0	-	12.0	12.0	20.0	-
T-5 Neem cake extract (5%)	-	-	16.0	12.0	20.0	15.0	-	-	24.0	20.0	20.0	-
T-6 Neem seed Kernel extract (5%)	12.5	6.3	20.0	10.0	10.0	10.0	-	-	20.0	16.0	44.0	-
T-7 Untreated control	40.0	40.0	22.0	14.0	25.0	20.0	30.0	-	32.0	32.0	32.0	-

Table 3.7 Stages of attack due to stem borer incidence under prophylactic treatments.

Prophylactic treatments	Percentage of infested trees in each stage					
	Bhubaneswar			Jhargram		
	Early	Middle	Advanced	Early	Middle	Advanced
T1 Carbaryl (2.0%) in mud slurry	0.0	0.0	0.0	10.0	5.0	-
T2 Swabbing carbaryl (0.2%) + Sevidol 4G application	4.0	2.0	-	5.0	0.0	-
T3 Swabbing Neem oil (5%)+ Sevidol 4G application	-	-	-	0.0	0.0	0.0
T4 Neem oil 5%	0.0	4.0	2.0	5.0	0.0	0.0
T5 Neem cake extract 5%	4.0	2.0	-	10.0	5.0	0.0
T6 Neem seed kernel extract 5%	2.0	2.0	2.0	10.0	0.0	0.0
T7 Untreated control	4.0	8.0	2.0	10.0	5.0	5.0

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

Centres:

East coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West coast : Madakkathara and Vengurla
Maidan tract : Chintamani, Jagdalpur

Objectives:

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

1. Cashew stem and root borer *(Plocaederus spp.)*

This pest was observed all round the year causing low to high infestation in both east and west coast centres, while severity was low in centres of maidan parts.

2. Tea mosquito bug *(Helopeltis antonii)*

The pest prevailed during October to March in majority of the centres, except Bapatla, in varying populations. East coast centres had 1.4 - 12.5 per cent incidence of the pest on shoots, and the pest varied causing 2.0 - 46.3 per cent incidence on shoots at the maidan tract, of Chintamani, during January-May (Fig.1).

3. Leaf miner *(Acrocercops syngramma)*

This pest was commonly encountered in all centres except at Vengurla and Jagdalpur wherein it was negligible. The period of occurrence was from August to February months (Fig.2). Upto 16.9% of leaves were attacked at Madakkathara and Vridhachalam, being coastal centres, while the highest damage (34.1%) occurred at Chintamani centre, which represent the plains.

4. Apple and nut borer *(Thylocoptila panerosema and Nephopteryx sp.)*

This pest was found causing low damage in west coast centres (less than 3.0% borer infested fruits), while it was higher in east coast (upto 11.6%) and maidan (upto 16.9%) parts. The period of incidence was February to July in all the centres (Fig.3).

5. Leaf and blossom webber *(Lamida moncusalis)*

This pest occurred during December-February in west coast centres, while its existence was spread over July-March in the east coast centres. With a maximum damage level of 11.4 and 18.3 percent at Madakkathara and Jhargram centres respectively. The incidence in the plains was lesser with 9.0 per cent at Chintamani during January-April (Fig.4).

6. Inflorescence thrips *(Rhyncothrips rapensis)*

These were mainly observed on the eastern coast causing 10.6 percent of panicle infestation during January to March, while this was absent in the west coast. The pest prevailed during December-June in the maidan tract, with a higher incidence of 18.1 percent.

7. Leaf thrips *(Rhiphiphorothrips cruentatus)*

The incidence of leaf thrips was low in the

west coast centres, while at east coast and maidan tracts it showed higher incidence upto 18.0 per cent at Vridhachalam and Chintamani centres.

8. Shoot tip caterpillar *(Hypotima haligramma)*

This pest is restricted to the east coast only and occurred during April to March months. Upto 22 per cent of shoots and 5.2 per cent of buds were destroyed at Bhubaneswar and Bapatla centre, respectively.

9. Leaf folder *(Caloptilea tiselea)*

This pest was restricted only to east coast region and an excessive damage of 77.0 per cent occurred at Bapatla centre. This was not noticed in maidan centre, while at west coast centre of Madakkathara it caused negligible damage during September-December.

10. Ash weevils *(Myllocerus spp)*

This pest occurred in low numbers during April-March in the east coast centres of Bapatla and Vridhachalam.

11. Aphids *(Toxoptera odinae)*

This pest was noticed only in the east coast centres, during December-March, and upto.8.2 per cent of apples were infested.

12.Leaf beetle *(Monolepta longitarsus)*

The presence of this pest was mainly during the rainy season from June to August 1996 and caused 6.9 per cent of leaf damage.

13. Hairy caterpillars *(Estigmene lactinea)*

The pest was noticed only at Vridhachalam centre on the east coast causing 15.9 per cent damage on leaves.

14. Stink bug *(Nezara virudula)*

This pest occurred at Vridhachalam centre during June-July at low densities.

15. Mealy bug *(Ferrisia virgata)*

The pest was noticed randomly during April-May, November, January and March months at Vridhachalam upto 15.0 per cent shoot infestation was noticed during March 1997.

Bionomics of natural enemies:

The occurrence of various natural enemies at different AICRP centres has been presented in Table 3.8 and details are given below:

Coccinellids

The populations of coccinellids varied between December-March months in the east coast centres, while in the centres of plains the predator was prevalent upto June. The prey mainly comprised of the aphids *(Toxoptera odinae)*. Four species of coccinellids viz. *Coccinella septumpunctata, Scymnus sp, Menochilus sexmaculatus and Veronica vincta* were reported from various centres.

Spiders

The spider predation on leaf and blossom webber, was noticed in Jhargram and Jagdalpur centres and on TMB at Chintamani centre. The presence of spiders was recorded during most part of the year, due to their general predation behaviour.

Ants

Various ant species were reported from different centres. The predation on leaf miner by *Camponotus sp.* was reported from Jhargram and Jagdalpur centres.

Parasitoids

The leaf and blossom webber was reported to be parasitised by *Bracon Sp., Elasmus sp.* and *Apanteles sp.* as well as by a tachinid parasite. The leaf folder was reported to be parasitised by an Ichneumonid at Bapatla centre.

Fig.1: Seasonal occurrence of Tea Mosquito Bug at different centres

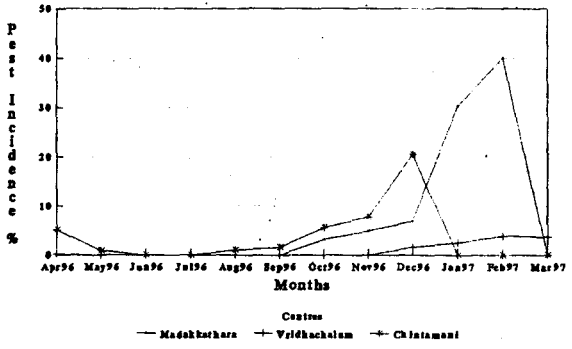

Fig.2:Seasonal occurrence of leaf miner at different centres

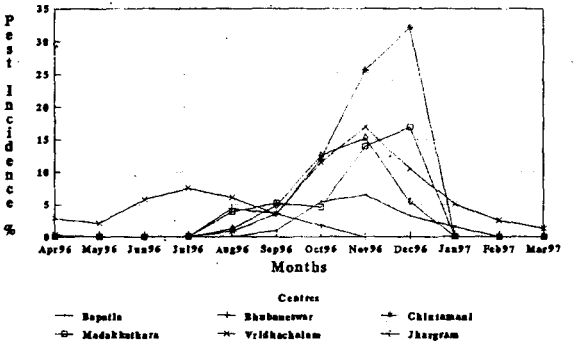

Fig.3: Seasonal occurrence of apple and nut borer at different centres

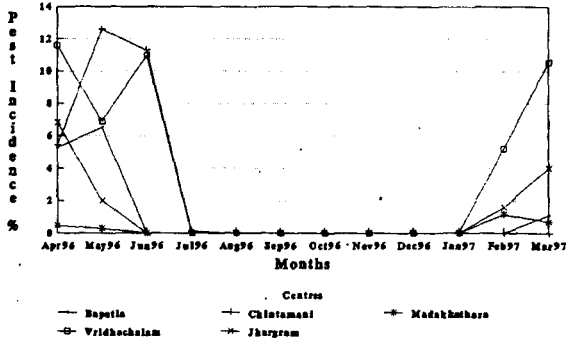

Fig.4: Seasonal occurrence of leaf and blossom webber at different centres

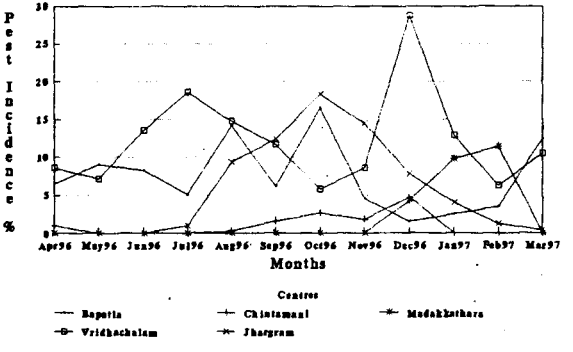

Table 3.8 Occurrence of natural enemies on cashew pests at various centres.

Natural enemies		East-Coast			West Coast		Plains	
Encountered		Bapatla	Bhubneswar	Jhargram	Vridhachalam	Madakkathara	Chintamani	Jagdalpur
1. Ladybird beetles	P	Feb.-Mar.	Dec.-Mar.	Jan.-Mar.	Apr.-Mar. (4 species)	-	Dec.-May	Feb.-Jun.
Conccinellids	H	Aphids	Aphids	Aphids	Aphids		Aphids	Aphids
2. Spiders	P	Jul.-Dec.	Apr.-Mar. (except Jun.-Jul.)	Nov.-Jan.	Apr.-Mar.	Apr.-Mar. (except July)	Oct.-Mar.	Aug.-Jan.
	H			LBW			TMB	LBW
3. Ants	P	-	Apr.-Mar.	Oct.-Dec.	-	Apr.-Mar.	-	Oct.-Apr.
	H			Leaf miner				Leaf miner
4. Chrysopids	P	Feb.-Mar.						Mar.
	H	Mealy bugs	-	-	-	-	-	-
5. Syrphids	P	-	-	-	Mar.-May	-	Dec.-May	-
	H						Aphids	
6. Preying mantids	P	-	-	Jan.-Mar.	Apr.-Jul.	-	Oct.-Apr.	Jan.-Mar.
	H			General Predators			TMB	
Parasitoids								
1. Elasmus sp.	P	Jun.-Dec.	-	-	-	-	-	-
	H	LBW				STB		
2.Bracon brevicornis	P	-	-	Oct.-Feb.	-	Oct.-Mar.	-	-
	H			LBW		LBW		
3. Apanteles spp.	P	-	-	Oct.-Feb.	-	Oct.-Mar.	-	Oct.-Feb.
	H	-	-	LBW	-	LBW	-	LBW
4. Ichneumo-nids	P	Jan.-Feb.	-	-	-	-	-	-
	H	Leaf folder						
5.Tachinid parasite	P	-	-	Nov.-Feb.	-	-	-	-
	H	-	-	LBW	-	-	-	-

P= Period of occurrence; H=Host insect on which recorded; LBW= Leaf and blossom webber; STB= Shoot tip borer; TMB= Tea mosquito bug

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

Centres:

East coast : Bapatla, Bhubaneswar, Jhargram, Vridhachalam
West coast : Madakkathara, Vengurla
Maidan tract : Chintamani

Objectives:

To identify germplasm accessions tolerant/ resistant to the pests, of regional importance.

Bapatla

The germplasm accessions in three age groups [(8 years old (Seventeen accessions), 6 years old (Thirteen accessions) and 4 years old (Thirteen accessions)] were screened against tolerance/susceptibility to the following pests: (i) *Lamida moncusalis* (ii) *Myllocerus sp.* (iii) *Hipotima haligramma* (iv) *Caloptilea tiselea* (v) *Bombetelia jacosatrix.*

Flowering pattern of the tree no. 228 (tolerant to leaf and blossom webber) and AP-19 (tolerant to apple and nut borer) was recorded in the year under report.

Bhubaneswar

A total of sixteen MLT entries and thirty four germplasm accessions were screened and evaluated for resistance against shoot tip caterpillar and tea mosquito bug (Table 3.9 and Table 3.10). Among the sixteen MLT entries H-1610 showed the least damage of 5.2 per cent shoot infestation by shoot tip caterpillar. The most susceptible entries were Vengurla 4 (30.7 percent) and V-5 (26.6 per cent). The incidence of tea mosquito bug was mild to moderate in these entries. H-1598, T.No.129, V-5, VRI-1 and VTH 59/2 were free from TMB infestation. While M 26/2 and V-2 were highly susceptible (per cent panicle damage were 57.6 and 52.2). Among the 34 germplasm accessions screened (Table 3.10) none of the accessions were found to be free from attack of shoot tip caterpillar. However, in OC-12 the least damage of 5.6 per cent (Shoot infestation) followed by OC-14 (6.1%), OC-11 (7.4%) OC-4 (8.1%) and OC-13 (8.6%) was recorded. OC-2, OC-23, OC-43, OC-47, OC-49 and OC-50 were free from attack of TMB on shoots and panicles. The accessions OC-35 (38.8%), OC-4 (32.4%) and OC-17 (25.0%) were highly susceptible to TMB attack (on panicles).

Jhargram

Germplasm accessions were screened against shoot tip caterpillar and inflorescence thrips at the centre. Though the mean incidence was very low none of them were found to be resistant to the pests.

The mean incidence of shoot tip caterpillar and thrips was 4.5 in Deepal 1; 6.9 in T.No.40; 12.4 in Red Hazari and 16.8 in T.No.16/ Jhargram-1.

Vridhachalam

The available germlasm accessions, F1 hybrids and MLT entries were screened for their tolerance to the insect pests at the centre.

In the germplasm accessions mean score of TMB damage on inflorescencee ranged from 0.3-1.2, the least score of damage was recorded in M 21/4 (0.3). (Table 3.11).

Table 3.9 Incidence of major pests of cashew in sixteen MLT entries screened for their resistance/ tolerance to the pest during 1996-97 at Bhubaneswar centre.

Sl. No.	Cashew types	Percent shoot tip caterpillar infestation*	Percent tea mosquito infestation	
		(shoots)	Shoots	Panicles
1	BPT 2/15	14.1	19.4	6.9
2	BPT 2/16	15.0	27.3	9.1
3	H-1598	14.8	0.0	6.0
4	H-1600	10.0	1.5	0.0
5	H-1608	7.5	6.1	7.6
6	H-1610	5.2	3.0	1.5
7	M-26/2	12.6	16.7	57.6
8	T.No.40	16.3	17.2	8.6
9	T.No 129	20.0	0.0	0.0
10	V-2	15.4	12.0	52.2
11	V-3	14.0	26.1	2.9
12	V-4	30.7	2.9	0.0
13	V-5	26.6	0.0	0.0
14	VRI-1	20.5	0.0	0.0
15	VTH 30/4	13.8	6.0	1.5
16	VTH 59/2	20.6	0.0	0.0

* Mean of three observations.

All the MLT entries screened were susceptible to severe damage by shoot and blossom webber and inflorescence thrips. (Table 3.12). Least shoot tip and inflorescence caterpillar damage and least shoot and blossom webber damage was recorded in M 15/4 (25.6% and 6.5% respectively). NRCC selection-1 (107/3) and selection 2 (40/1) were completely free from leaf thrips incidence.

Laboratory screening of released varieties and TMB tolerant lines were cage screened by multiple choice test. The mean score of damage ranged from 0.3 - 1.5. The least damage was noticed in M 26/2 (0.3), VRI-2 (0.6) and M 45/4 (0.8).

Chintamani

All the accessions of Multilocational trial 86 and 92 were screened for TMB and other pests.

The least mean damage score was recorded in ME 4/4 (0.3) H-1610 (0.3), 1/64 (0.4) and H 1608 (0.6) (Table 3.13).

The accessions ME 4/4 and 1/64 even though flushed early, the damage score was least in them. Field confinement studies is to be taken up to confirm the tolerance/resistance of ME 4/4 and 1/64 accessions in the ensuing season.

Table 3.10 Incidence of major pests in some accessions screened for their resistance/tolerance at Bhubaneswar centre

Sl. No.	Accession No.	Percentage shoot tip caterpillar infestation* (Shoots)	Percentage TMB infestation	
			Shoots	Panicles
1	OC-1	20.9	4.0	0.0
2	OC-2	16.6	0.0	0.0
3	OC-3	13.3	11.6	1.4
4	OC-4	8.1	12.7	32.4
5	OC-6	14.3	4.2	0.0
6	OC-7	13.7	5.5	13.7
7	OC-8	13.2	6.9	5.5
8	OC-9	15.8	1.5	0.0
9	OC-11	7.4	6.9	0.0
10	OC-12	5.6	10.3	11.8
11	OC-13	8.6	13.3	0.0
12	OC-14	6.1	3.0	6.0
13	OC-15	20.1	4.5	18.2
14	OC-16	11.8	8.7	8.7
15	OC-17	11.2	16.7	25.0
16	OC-18	12.1	17.9	1.5
17	OC-19	10.8	6.0	0.0
18	OC-23	17.9	0.0	0.0
19	OC-24	19.5	4.4	0.0
20	OC-25	22.0	15.9	9.1
21	OC-27	23.1	7.3	0.0
22	OC-28	17.4	23.2	15.9
23	OC-29	10.0	25.4	22.4
24	OC-31	9.2	7.3	16.2
25	OC-33	19.8	2.9	0.0
26	OC-35	23.1	23.9	38.8
27	OC-38	16.3	4.6	3.1
28	OC-40	17.7	11.6	4.3
29	OC-41	19.2	1.6	0.0
30	OC-43	38.1	0.0	0.0
31	OC-44	12.4	6.0	3.0
32	OC-47	23.5	0.0	0.0
33	OC-49	15.0	0.0	0.0
34	OC-50	10.6	0.0	0.0

* Mean of three observations

Table 3.11 Screening of germplasm accessions for tolerance to TMB at Vridhachalam centre

Sl. No.	Accessions	Mean score of damage of inflorescence by Tea mosquito bug
1	M 21/4	0.2
2	NR 72	0.5
3	M 3/2	0.5
4	V-5	0.5
5	M 33/2	0.5
6	M 9/3	0.8
7	NR 57	0.3
8	G/3	0.6
9	NR 59	0.7
10	M 45/4	0.8
11	M 45/1	0.7
12	M 99/4	1.2
13	AF 188	1.2

Madakkathara

A total of 68 germplasm accessions planted in 1988-89 were analysed for TMB infestation at the centre (Table 3.14).

Thirteen varieties were found to be comparatively tolerant/less susceptible, after testing in the field for natural infestation for last four years at the centre. The promising lines were found to be MAD-1, A-26-2, H-8-7, H-8-8, H-718, H-3-17 and T-856 which were subjected to cage multiplication studies (Table 3.15).

Vengurla

The field screening of eighteen germplasm accessions against tea mosquito bug at the centre revelaed that none of them were resistant to TMB. However minimum incidence was recorded in CYT195 (16.8%) and maximum in Kankadi (37.3%) (Table 3.16).

Table 3.12 Screening of MLT-92 entries for tolerance to cashew pests (1996) at Vridhachalam centre

Sl. No.	Entries	Percent damage (mean) by		
		Shoot tip and Inflorescence caterpillar	Shoot and blossom webber	Leaf thrips
	BAPATLA			
1	30/1	67.9	8.7	19.9
2	3/33	80.2	8.0	15.2
3	10/19	70.5	13.4	2.5
4	3/28	67.9	13.2	25.4
	VENGURLA			
5	Hy. 68 (V-6)	71.8	17.9	32.2
6	Hy.255	49.3	8.6	27.2
7	Hy.303	42.7	9.0	26.8
8	Hy.320	77.9	7.1	1.3
9	Hy.367	72.0	8.5	14.2
	VRIDHACHALAM			
10	M 44/3 (VRI-2)	69.2	9.0	34.2
11	M 15/4	25.6	6.5	8.5
	NRCC, PUTTUR			
12	107/3 (S1)	61.9	9.2	-
13	40/1 (S2)	67.7	12.9	-

Table 3.13 Tea mosquito damage score in MLT accessions (on shoots) at Chintamani centre

Sl. No.	Accession Number	Tea mosquito damage score
1	Vengurla-1	3.2
2	V-2	1.2
3	V-3	0.7
4	V-4	2.5
5	V-5	1.5
6	Bapatla-1	2.2
7	Bapatla-3	2.6
8	Bapatla-4	3.5
9	Bapatla-5	3.2
10	Bapatla-6	2.3
11	H-1610	0.3
12	H-1600	2.4
13	H-1608	0.6
14	H-1598	1.6
15	TN-129	2.4
16	TN-40	2.5
17	Hyb.2/15	3.4
18	Hyb.2/16	1.6
19	Ullal-1	1.0
20	M 44/3	1.7
21	Ullal-2	1.3
22	V-3	2.2
23	V-4	2.7
24	V-2	2.0
25	M 44/3 (Ven.)	2.2
26	H-24	1.5
27	VTH-12	2.6
28	VTH-30	2.1
29	VTH-59	2.8
30	ME 4/4	0.3
31	1/64	0.4

Table 3.14 Tea mosquito infestation and yield values of less susceptible accessions at Madakkathara centre

Sl. No.	Accession	Varietal type	Mean infestation of TMB		
			Value in % (Oct-Apr. 97)	(Mean value)	Yield kg/tree) (1995-96)
1	17	Bzl.-120	23.9	(0.6)	1.5
2	18	Bzl.-239	22.8	(0.5)	1.8
3	22	Bzl.-248 (s)	24.4	(0.3)	0.8
4	25	Vapala	35.4	(0.5)	2.7
5	26	BLA 139-1	20.5	(0.5)	2.5
6	27	BLA 39-4	20.2	(0.6)	2.5
7	28	K-22-1	19.7	(0.5)	1.5
8	30	H-313	27.0	(0.6)	1.5
9	31	H-3-17	20.2	(0.6)	1.4
10	32	H-680	19.0	(0.5)	1.3
11	34	H-718	29.1	(0.7)	0.6
12	35	H-719	23.9	(0.7)	1.5
13	37	H-1588	42.1	(0.7)	0.6
14	38	H-1589	52.2	(0.5)	1.1
15	41	H-1596	30.6	(0.7)	1.3
16	42	H-1597	21.7	(0.7)	1.6
17	43	H-1598	20.9	(0.6)	1.3
18	44	H-1600	29.5	(0.3)	1.6
19	49	A-26-2	55.0	(0.6)	1.5
20	75	H-8-1	45.4	(0.6)	0.7
21	36	H-1610	22.2	(0.7)	0.7
22	47	H-856	27.5	(0.8)	0.8

Table 3.15 Mean score of TMB infestation of shoot and panicle in the field confinement studies at Madakkathara centre

Sl. No.	Varieties	Mean score of TMB infestation	
		Shoot	Panicle
1	MAD-1	0.3	0.5
2	A-26-2	0.4	0.4
3	H-8-7	1.0	0.6
4	H-8-8	0.3	0.2
5	H-5-1	0.4	0.5
6	H-1600	1.5	0.3
7	H-718	0.5	0.4
8	K-10-1	0.9	0.6
9	H-3-17	0.3	0.2
10	PU-8	1.7	0.9
11	H-8-15	1.3	0.9
12	A-6	1.2	1.0
13	T-856	0.4	0.4

Table 3.16 Screening of germplasm against TMB at Vengurla centre

Sl. No.	Variety	Tea mosquito bug	
		Average score	Percent incidence
1	CYT-211	1.4	36.4
2	CYT-176	0.8	21.1
3	CYT-56	1.2	30.5
4	CYT-200	1.3	33.2
5	CYT-195	0.6	16.8
6	CYT-144	1.3	32.4
7	CYT-119	1.3	33.6
8	Taliparamba	1.1	27.5
9	T-2/15	1.4	35.2
10	Kankadi	1.5	37.3
11	Tulas-156	0.4	34.1
12	J1	0.1	24.7
13	J2	1.5	36.5
14	J5	1.2	29.2
15	J6	1.4	30.0
16	J7	1.2	29.3
17	J15	1.4	34.0
18	H-26 (1608)	0.9	22.1

(a) HISTORY, OBJECTIVE, GROWTH AND SALIENT ACHIEVEMENTS

The All India Coordinated Spices and Cashewnut Improvement Project (AICS & CIP) was started during the fourth five Plan in 1971 in which five centres (four University centres and one ICAR- institute based centre) were identified for conducting research on cashew.

These centres were located at Bapatla(Andhra Pradesh), Vridhachalam (Tamilnadu), Anakkayam (Kerala) (later shifted to Madakkathara), Vengurla (Maharashtra) and CPCRI, Regional Station, Vittal (Karnataka).

During the fifth plan period, one centre at Bhubaneswar (Orissa) and in sixth Plan period two centres one at Jhargram (West Bengal) and another at Chintamani (Karnataka) were added. During VIII Plan period one centre at Jagdalpur (Madhya Pradesh) and a sub centre at Pilicode (Kerala) were started.

The Project Coordinator's Cell was then 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 (Vide ICAR Office order F./No.4-1/80-H&MC dated 24th September 1985). The Project Coordinator's Çell has since then shifted to National Research Centre for Cashew, Puttur in 1986.

Presently, there are eight functional coordinating centres and one sub-centre, four in the east coast viz. Bapatla, Bhubaneswar, Jhargram, Vridhachalam, three in the west coast viz. Madakkathara, Vengurla, Pilicode and one in the Maidan Parts of Karnataka-Chintamani and one in the Central India at Jagdalpur.

The objective of the Project is to give additional momentum to Cashew research for increasing production and productivity through:

1. Evolving high yielding varieties with export grade kernels, tolerant/resistant to pests and diseases.
2. Standardising agrotechniques 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 Cashewnut 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, Tamilnadu (1975); Panjim, Goa (1978); Trichur, Kerala (1981); Calicut, Kerala (1983); Trivandrum, Kerala (1985); Bhubaneswar, Orissa (1987); Coimbatore, Tamilnadu (1989); National Group discussion in lieu of X Biennial Workshop at Kasaragod, Kerala (1991); Bangalore, Karnataka (1993) and Kasaragod, Kerala (1995).

Two group discussions were also held one in horticulture at CPCRI, Regional Station, Vittal (1986) and other in entomology at Trichur (1988).

The significant achievements of the Project are summarised below:

1. A total of 26 cashew varieties are released by the various Coordinating centres for cultivation in the respective regions. Some varieties have shown wider adaptability and are therefore recommended to those areas also.

2. Fertilizer requirement of cashew crop was worked out to be 1000g N, 250g P_2O_5 and 250g K_2O per tree at Chintamani and Bhubaneswar centres and 500g N, 125g P_2O_5 and 125g K_2O per tree at Bapatla, Vengurla, Madakkathra and Vridhachalam centres.

3. Fertilizer application in circular trench of 25cm broad, 15cm depth and 1.5m away from the trunk was found to be beneficial in sandy loam, laterite and in slopy lands. However, in low rainfall zone fertilizer application in an area of 1.5m width, between 1.5m and 3.0m from the trunk and forking into the soil is found to be economical and most efficient.

4. Supplementing the soil application of NPK with foliar application of urea (2 to 4%) along with insecticides increased the yield of cashew both at east coast and west coast regions.

5. Softwood grafting technique was standardised for vegetative propagation of cashew.

6. In Intercropping trial clusterbean and cowpea at Bapatla and horsegram at Bhubaneswar were found profitable.

7. In on-farm trial with higher doses of fertilizers at Bapatla an increase in the yield from 7.6 kg/tree to 9.2 kg/tree to 18.7 kg/tree was noticed when the fertilizer dose was normal, doubled and tripled.

8. For control of TMB, spraying of monocrotophos (0.05%) at flushing, endosulfan (0.05%) at flowering and carbaryl (0.1%) at fruiting stage was found to be most effective at Bapatla, Chintamani, Jhargram and Vridhachalam centres.

9. Skipping of carbaryl (0.1%) at fruiting stage did not increase TMB incidence at Jhargram centre and hence skipping one spray was found economical.

10. Application of neem oil (5%) upto 1m height of the base of trunk or swabbing the main stem and exposed roots with neem oil (5%) + application of sevidol 4G @ 75g/tree to the basin or application of mudslurry with carbaryl (0.2%) was found effective prophylactic control measure against stem and root borer.

(b) STAFF POSITION

AT HEADQUARTER:

Project Coordinator	:	Dr. E.V.V. Bhaskara Rao
Senior Scientist	:	Dr. M. Gopalakrishna Bhat
Technical Information Officer	:	Dr.(Mrs) Uma Raghunathan
Stenographer	:	Mrs. B. Jayashri

PROJECT CENTRES:

Cashew Research Station, (Acharya NG Ranga A U), Bapatla 522 101, Andhra Pradesh.

Horticulturist	:	Dr. M.Lakshmi Narayana Reddy
Asst.Entomologist	:	Mrs. M.Rama Devi
Asst.Agronomist	:	Mr. Y.Radhakrishna
Senior Tecnical Assistant	:	Mr. B.Krishnamurthy
Jr.Technical Assistant	:	Mr. K. Ranga Rao
Grafter	:	Mr. V. Kantha Rao (from 11.6.1996)

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

Horticulturist	:	Mr. P.C. Lenka
Jr.Horticulturist	:	Dr. K.C. Mohapatra (from 9.9.1996)
Jr. Entomologist	:	Mr. L.N. Mohapatra
Sr.Technical Assistant	:	Mr. P.C. Swain
Jr.Technical Assistant	:	Mr. R.C. Routray
Grafter	:	Mr. R.K. Pradhan

Agricultural Research Station, (UAS), Chintamani 563 125, Karnataka.

Horticulturist	:	Mr. H.B. Lingaiah
Jr.Horticulturist	:	Mr. Vishnuvardhan
Jr.Entomologist	:	Mr. G.T. Thirumalaraju
Sr.Technical Assistant	:	Mr. Shivappa
Sr.Technical Assistant	:	Mr. N.Janakiraman
Grafter	:	Vacant

Zonal Agricultural Research Station, (IGAU), Jagdalpur 494 005, Madhya Pradesh.

Jr.Entomologist	:	Dr. Sanjay Sharma (from 3.7.1996)
Jr. Horticulturist	:	Vacant
Jr. Technical Assistant	:	Vacant
Grafter	:	Mr. Jagdeo(from 9.9.1996)

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

Horticulturist	:	Vacant
Jr.Horticulturist	:	Dr. S.B. Chattopadhyaya
Jr.Entomologist	:	Dr. B.Bandyopadhyay
Sr.Technical Assistant	:	Mr. S.Sarkar
Jr.Technical Assistant	:	Mrs. K.Basu
Grafter	:	Vacant

Cashew Research Station,(KAU), Madakkathara, 680 656, Kerala.

Horticulturist (Associate Professor Agronomy)	:	Dr. M. Abdul Salam
Jr.Entomologist (Asst.Professor Nematology)	:	Dr.(Mrs)Susanamma Kurien
Sr.Technical Assistant	:	Mrs. B.Suma
Jr.Technical Assistant	:	Mr. C. Aboobacker (from 6.12.1996) Mr.C.Gireesan (till 18.7.1996)
Grafter	:	Vacant Mr. P.S. Ratnakumar (till 22.7.1996)

Cashew Research Substation,(KAU), Pilicode 671 353, Kerala.

Jr.Horticulturist	:	Dr.B Jayaprakash Naik

Regional Fruit Research Station, (KKV), Vengurla 416 516, Maharashtra

Horticulturist	:	Dr. B.B. Sapkal (from 1.6.1996)
Jr.Entomologist	:	Mr. A.Y. Munj (from 4.7.1996)
Jr.Breeder	:	Mr. S.B. Deshpande
Sr.Technical Assistant	:	Mr. P.G. Dhuri (from 5.10.1996)
Jr.Technical Assistnat	:	Mr. R.L. Mayekar

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

Horticulturist	:	Dr. M.Selvarajan
Jr.Horticulturist	:	Mr. V.Lakshmanan
Jr.Entomologist	:	Mr. S.Douressamy
Sr.Technical Assistant	:	Mr. S.Manickam
Jr.Technical Assistant	:	Mr. T.Chinnadurai
Grafter	:	Mr. P.Gopalakrishnan

(c) BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 1996-97

ALLOCATION

(Rs. in lakhs)

Centre	Pay and allowances	TA	Recurring conting	Non-recuring conting	Total	ICAR Share
BAPATLA	3.987	0.10	0.60	-	4.687	3.515
BHUBANESWAR	4.021	0.10	0.60	-	4.721	3.541
CHINTAMANI	2.000	0.10	0.60	-	2.700	2.025
JAGDALPUR	1.120	0.10	0.40	0.90	2.520	1.890
JHARGRAM	1.774	0.10	0.60	-	2.474	1.855
MADAKKATHARA	4.410	0.07	0.40	-	4.880	3.660
PILICODE	0.783	0.03	0.20	-	1.013	0.760
VENGURLA	1.643	0.10	0.60	-	2.343	1.757
VRIDHACHALAM	8.273	0.10	0.60	-	8.973	6.730
Total	28.011	0.80	4.60	0.90	34.311	25.733

ACTUAL EXPENDITURE

(Rs. in lakhs)

Centre	Pay and allowances	TA	Recurring conting	Non-recuring conting	Total	ICAR Share
BAPATLA	6.00	0.10	0.59	-	6.69	5.02
BHUBANESWAR	4.92	0.10	0.60	0.85*	6.47	4.85
CHINTAMANI	4.50	0.09	0.60	-	5.19	3.89
JAGDALPUR	0.78	0.02	0.40	4.70**	5.90	4.43
JHARGRAM	2.80	0.009	0.63	2.21***	5.65	4.24
MADAKKATHARA	3.40	0.07	0.44	-	3.91	2.93
PILICODE	0.96	0.01	0.09	-	1.06	0.80
VENGURLA	3.79	0.10	0.60	-	4.49	3.37
VRIDHACHALAM	4.77	0.10	0.60	-	5.47	4.10
Total	31.92	0.599	4.55	7.76	44.83	33.63

* Revalidated amount : Rs. 0.77 lakhs ** 0.90 + part of revalidated amount *** Revalidated amount

(d) MONITORING OF PROJECT BY COORDINATOR

The programmes to be implemented in different centres was reviewed during the XII Biennial Workshop held at CPCRI Kasaragod from 14-16 October 1995.

The visit by Project Coordinator to different centres were as follows:

15 to 18-07-1996	: Madakkathara
24 to 26-07-1996	: Vengurla
09 to 10-08-1996	: Jagdalpur
17 to 19-09-1996	: Jhargram
19-09-1996 and 16-12-1996	: Bhubaneswar
12-12-1996	: Bapatla
10-03-1997	: Chintamani
14-03-1997	: Vridhachalam

During the visits to the centres, the technical programme allotted to each of the centres and the progress made was reviewed along with inspection of field experiments. University authorities were met to appraise the progress of work in the centres, filling up of vacant posts and finding solutions to the constraints of the centres, if any.

During the visit to different states, also participated in National Seminars on Cashew organised by Directorate of Cashewnut Development, Cochin at Bhubaneswar, Orissa; ICAR Research Complex Goa regarding joint cashew evaluation trial.

Attended the Project Coordinator's meeting-Divisional meeting of Horticulture of ICAR, Second Annual Conference of Project Coordinators, Mid year review meetings at Delhi.

During the visit to the centres, production and availability of grafts of the released varieties was reviewed and suggested means to increase the production of grafts.

Reports received from the centres in the Project Coordinator's Cell were critically reviewed and necessary guidelines as and when required were sent.

(e) FUNCTIONING OF EACH CENTRE

Bapatla (ANGRAU)

The centre was allotted experiments in the disciplines of crop improvement, crop management and crop protection. Multilocation varietal trial MLT-86 was discontinued at this centre. The centre collected ten high yielding new accessions from Khammam and west Godavari districts and added to its germplasm during the year under report. The survey work to continue in these districts in addition to that in Guntur district for collection of variable types. The cross 56 x 40 (H 3/13) continued to perform well for annual yield (13.9 kg/tree) and cumulative yield (1984-96) (149.3 kg/tree). Cluster bean was found to be a good intercrop with cashew. Neem oil (5%) swabbing was found effective against stem borer either alone or in combination with sevidol application to the basin.

The work of the centre should be streamlined and the performance of the centre needs improvement.

Bhubaneswar (OUAT)

The centre has collected nine high yielding and cluster bearing types. Large number of hybrid seedlings have been raised and planted in closer spacing. VTH 711/4 was crossed with Bhubaneswar-1 and also with Bhubaneswar cluster bearing type. Performance of Bapatla variety H 2/16 (BPP-8) was found to be very promising at this centre.

The centre has taken up NPK trial, yield maximisation plot (high density planting at 4m x 4m spacing) using H 2/16 grafts, as per XII Biennial Workshop recommendations. Simurba oil *(Simurba glauca)* will be tested against TMB and as well as CSRB. All the sanctioned posts are filled, all field experiments are being conducted well and performance of the centre is assessed as good.

Chintamani (UAS)

All the experiments allotted to the centre were taken up by the centre. Twenty five new accessions with high yield and medium to bold sized nuts (9-15g) were collected from Kolar district and added to the germplasm.

All the three varietal trials were conducted well and the results were reported as per the format. Vengurla-5 in comparative yield trial and M 44/3 (Vridhachalam source) in MLT-86 performed very well. NPK trial in agronomy and all entomological trials were carried out as per the technical programme approved in the XII Biennial Workshop. Centre's performance is assessed as good.

Jagdalpur (IGKV)

Jagdalpur centre was started in the year 1993. A regular junior entomologist joined the project in July'96. The multilocation varietal trial MLT-92 and entomological trials (except Ent. 2 and 4) are being pursued at the centre. Varietal trial (MLT-92) could not be planted properly because of mortality of grafts obtained from some centres. Serious and sincere efforts are required to be made by the centre in establishment of all field experiments.

Jhargram (BCKV)

The germplasm holdings at the centre are 115. The multilocation varietal trial MLT-92 has to be replanted with same aged grafts as some entries are missing in the existing trial. It was found that spacing of 6m x 6m x 6m triangular planting in a spacing trial gave highest yield of 1127 kg/ha as against the yield of 169 kg/ha at 10m x 10m square planting. The entomological trials were properly conducted.

The centre was not punctual in sending the required reports to the PC unit for compilation and several reminders had to be sent to get the reports / information. Overall performance of the centre needs improvement.

Madakkathara (KAU)

The centre is pursuing most of the trials in crop improvement, crop management and crop protection disciplines. Seed nuts from Brazil were obtained through CEPC and were added to the germplasm, thus taking the total holding to 129. In hybridization programme, BLA 139-1 was crossed with Vetore-56 and VTH 711/4. The centre has identified five centres under Kerala Agricultural University to layout demonstration plots with Priyanka grafts. Intercropping trial with medicinal plants is planned by the centre for the year 1997-98. The performance of the centre is satisfactory.

Pilicode (KAU)

The centre was started during 1994. Survey of northern districts of Kerala for germplasm collection was assigned to the centre. Presently the centre has 43 bold nut types with kernel weight of 2g or above. The performance of the centre is satisfactory.

Vengurla (KKV)

The centre has undertaken the collection of bold nut types from Maharashtra and Goa. A hybrid H-255 is performing well. Hybridization work for improvement of nut size of V-2 and V-5 was started. MLT-92 trial with be laid out at the Mulde farm in 1997-98.

In crop management, trials on NPK, spacing and intercropping with annual crops are being pursued. The treatments for one entomological trial is yet to be revised. The centre is to submit an ad-hoc project on mealy bugs in Konkan coast for the consideration of ICAR. Vengurla centre produces every year over 2 to 3 lakhs of grafts. The centre's performance is assessed as satisfactory.

Vridhachalam (TNAU)

The centre has 255 accessions in its cashew germplasm. It has been advised to discontinue the MLT-86 trial as not even ten plants per entry are available. Two new trials on intercropping with oil seeds and higher doses of fertilizers in farmers' fields are to be laid out. Treatment of carbaryl (0.2%) in mudslurry and sevidol granules was found effective as prophylactic control against stem and root borer. Entomological projects are going on well. The performance on the centre is assessed as satisfactory.

(f) PROBLEMS IN FUNCTIONING OF THE CENTRES

One of the general problems expressed by the scientists of the centres is inadequate recurring contingencies to carry out experiments / trials. However, in 1997-98 the recurring contingency has been increased from Rs. 20,000 to Rs. 40,000 per scientist. For Chintamani centre although a jeep was sanctioned in the VIII Plan budget, the Council's clearance is still awaited. A post of Junior Horticulturist at Jagdalpur centre needs to be filled up at the earliest by the University.

(g) METEOROLOGICAL DATA (1996-97)

BAPATLA

Month & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
Apr.96	33.5	26.0	72.0	69.0	9.8	1
May 96	39.9	27.2	61.0	59.0	4.6	1
Jun.96	35.8	27.2	65.0	54.0	67.9	4
Jul.96	32.7	25.7	73.0	61.0	74.8	8
Aug.96	33.0	25.5	77.0	70.0	373.1	14
Sep.96	32.8	24.9	88.0	75.0	203.5	11
Oct.96	30.5	24.2	87.0	82.0	410.2	12
Nov. 96	30.5	21.0	84.0	73.0	70.6	4
Dec.96	28.6	18.1	90.0	70.0	19.4	3
Jan.97	28.3	16.4	90.0	66.0	22.3	2
Feb.97	30.2	18.3	91.0	71.0	-	-
Mar.97	32.7	21.2	86.0	68.0	-	-

BHUBANESWAR

Month & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
Apr.96	36.9	24.5	89	45	17.2	4
May 96	37.5	26.8	87	55	41.1	5
Jun.96	34.1	25.4	90	68	134.5	14
Jul.96	32.8	25.3	92	72	141.5	16
Aug.96	30.9	25.0	93	79	227.9	25
Sep.96	33.1	25.1	93	68	67.0	8
Oct.96	31.9	23.1	93	62	109.2	9
Nov. 96	30.2	17.4	92	46	16.3	5
Dec.96	28.0	12.9	85	35	-	-
Jan.97	27.3	13.6	90	45	0.7	3
Feb.97	31.1	17.1	92	39	8.0	3
Mar.97	34.7	22.1	97	46	54.6	4

HINTAMANI

Month & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
Jan.96	27.6	12.2	70.9	34.2	0	0
Feb.96	29.5	12.1	62.2	30.4	0	0
Mar.96	33.8	15.3	53.0	24.4	0	0
Apr.96	34.15	0	70.4	40.2	62.0	2
May96	30.0	0	56.4	31.9	50.0	3
Jun.96	32.4	0	74.2	49.3	197.5	11
Jul.96	30.8	0	76.4	53.1	20.6	4
Aug.96	29.0	0	76.4	58.8	62.8	6
Sep.96	29.2	0	81.8	65.2	170.5	13
Oct.96	27.1	0	80.8	67.4	75.4	6
Nov. 96	27.0	0	71.7	62.6	10.8	2

JAGDALPUR

Month & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
Jan.96	28.5	14.6	93	29	2.6	01
Feb.96	31.1	15.2	84	16	15.6	01
Mar.96	35.6	18.7	65	12	25.8	02
Apr.96	36.1	22.5	64	22	103.3	05
May 96	39.5	26.1	50	18	2.8	00
Jun.96	32.8	24.0	77	50	133.1	06
Jul.96	29.1	23.2	90	75	468.4	17
Aug.96	28.2	22.6	93	78	244.6	22
Sep.96	30.6	22.9	92	71	188.6	12
Oct.96	29.1	20.6	90	57	37.8	05
Nov. 96	29.3	15.4	92	32	1.8	-
Dec.96	27.3	9.9	89	26	NIL	-

JHARGRAM

Month & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
Apr.96	37.5	18.6	82.6	44.0	64.4	6
May 96	39.4	21.0	84.0	47.6	31.6	8
Jun.96	38.8	22.0	88.2	65.7	155.4	11
Jul.96	35.4	23.5	90.8	71.5	286.0	16
Aug.96	35.0	23.0	91.5	76.0	310.2	19
Sep.96	35.6	22.8	90.0	71.3	224.4	18
Oct.96	30.0	22.8	86.8	66.3	172.6	8
Nov. 96	29.0	14.6	83.0	50.4	19.2	5
Dec.96	25.5	11.5	80.4	45.2	21.6	3
Jan.97	26.0	11.0	80.0	39.4	-	-
Feb.97	28.8	15.4	80.2	42.7	12.0	2
Mar.97	34.0	20.4	82.0	35.9	15.8	4

.DAKKATHARA

onth & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
:96	34.6	25.0	87	59	152.0	7
y 96	32.8	25.2	91	63	95.4	4
96	30.5	23.8	94	75	400.3	16
)6	28.8	23.1	96	83	588.1	25
.96	29.1	23.6	95	78	310.0	20
96	29.2	23.7	94	74	391.6	17
96	30.1	22.9	93	70	219.3	12
96	31.5	23.6	84	59	22.1	2
96	30.5	21.8	80	55	60.4	2
7	32.0	22.9	78	45	0	0
7	33.9	21.8	82	39	0	0
7	35.7	24.0	82	37	0	0

:ODE

th & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
5	32.9	25.3	88.2	66.2	45.9	5
6	33.2	26.0	83.6	63.0	36.6	1
5	29.5	24.0	96.1	84.3	254.4	18
	28.5	23.4	98.2	88.2	1173.8	27
6	28.5	23.8	99.4	85.6	423.5	25
5	29.4	24.1	97.6	82.1	259.7	9
5	29.6	23.0	96.6	76.1	260.2	16
96	31.3	23.0	96.6	67.9	65.4	2
5	30.7	20.3	96.0	59.5	45.6	3
	31.2	19.8	91.9	57.2	0.0	0
7	31.1	20.3	85.4	60.9	0.0	0
7	32.5	23.6	87.2	64.6	0.0	0

VENGURLA

Month & Year	Temperature (°C)		Relative humidity Percentage	Rainfall m.m	No. of rainy days
	Maximum	Minimum	Mean		
Apr.96	32.4	24.5	67.5	0	-
May 96	32.4	25.8	65.9	1.0	3
Jun.96	30.8	25.5	79.0	837.8	23
Jul.96	28.6	24.9	85.2	1043.4	29
Aug.96	28.7	24.3	84.1	403.6	31
Sep.96	30.1	25.1	83.5	94.8	19
Oct.96	31.9	25.6	77.3	382.6	10
Nov. 96	32.4	21.8	70.6	1.5	2
Dec.96	31.9	18.7	66.3	0	-
Jan.97	31.0	16.2	50.8	0	-
Feb.97	31.0	14.8	50.3	0	-
Mar.97	29.6	22.5	68.4	0	-

VRIDHACHALAM

Month & Year	Temperature (°C)		Relative humidity %		Rainfall m.m	No. of rainy days
	Maximum	Minimum	AM	PM		
Apr.96	39.3	26.3	88	55	146.5	3
May 96	40.6	28.7	79	52	60.5	2
Jun.96	36.3	26.9	84	52	213.9	11
Jul.96	34.8	25.8	84	50	6.0	1
Aug.96	34.6	25.6	84	54	161.2	9
Sep.96	34.4	25.1	84	53	160.1	10
Oct.96	32.6	24.3	84	74	127.3	12
Nov. 96	28.7	21.8	83	73	264.6	13
Dec.96	29.2	19.9	87	70	828.0	10
Jan.97	30.6	19.5	91	72	5.4	-
Feb.97	33.7	19.2	91	65	-	-
Mar.97	36.2	23.4	87	64	-	-

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