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COORDINATOR'S REPORT

The All India Coordinated Spices and Cashewnut Improvement Project (AICS & CIP) was started during the Fourth Five Year Plan in 1971 with the Project Coordinator's cell at Central Plantation Crops Research Institute, Kasaragod. During the Seventh Plan, the ongoing project was bifurcated into two separate projects, one each on cashew and spices. During the same plan period the coordinator's cell for cashew was shifted to the newly established National Research Centre for Cashew, Puttur.

The All India Coordinated Research Project on cashew has eight centres and one sub center, of which four were started at the inception of AICS and CIP in the year 1971 (Bapatla-APAU; Anakkayam KAU; Vengurla KKV and Vridhachalam TNAU). One centre at Bhubaneswar (OUAT) during Fifth Plan period and two more, one each at Jhargram (BCKVV) and Chintamani (UAS) were added during Sixth Plan period. During Eighth Plan one centre at Jagdalpur and one sub centre at Pilicode were also started. The budget allocation of the project for the year 1994-95 was Rs. 49.52 lakhs (Rs. 37.14 lakhs ICAR share) and the expenditure was 31.31 lakhs (Rs. 23.48 lakhs ICAR share).

The Project's mandate 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 crop under different agroclimatic conditions.
3. Evolving cost effective and efficient pest and disease management practices.

CROP IMPROVEMENT

A total of 868 cashew germplasm accessions (Baptala - 135; Bhubaneswar - 79; Chintamani - 116; Jhargram - 127; Madakkathara - 120; Vengurla - 161 and Vridhachalam - 130) are being maintained and evaluated in different centres. During the year, 71 new collections (Bapatla 8; Bhubaneswar 4; Jhargram 9; Madakkathara 5; Pilicode 15; Vengurla 13; Vridhachalam 17) showing promising characters were added to the germplasm at different centres.

In multilocation trials, varieties collected from different centres are being evaluated. The highest yield was recorded in BPP-2/16 (7.0kg) in the first year of harvest at Bhubaneswar; H-1608 (6.3kg) and M-44/3 (6.2kg) in the fourth year of harvest at Chintamani, VTH 59/2 (8.2kg), H-2/16 (6.3kg) and VTH-30/4 (6.28kg) in the third year of harvest at Jhargram for the reported year and at Madakkathara the maximum nut yield (for six years) was recorded in H-1598 (12.2kg) and V-5 (12.1kg)

Evaluation of F_1 hybrids at Bapatla showed that three hybrids viz., Hy 4/1

(1x100), Hy 3/10 (T. No. 56 x T. No. 40) and Hy 1/7 (1x4) gave a yield of 18kg, 10kg and 10kg each respectively. A hybrid Hy 13 (M6/2xM26/1) from Vridhachalam gave a yield of 4.2kg/year and a mean yield of 4.2 kg for five years.

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 (11.3kg) compared to the control at Chintamani. Foliar application of urea with 2 per cent insecticides resulted in the maximum nut yield of 8.3kg/plant at Bhubaneswar.

In spacing trial, the maximum yield/plant, (4.0kg) and yield/block were recorded in 10m x 5m rectangular system with no thinning of plants and 6m x 6m x 6m triangular system at Jhargram centre (3.8kg.). The minimum yield (1.8kg) was recorded in 5m x 5m square system with 75 per cent thinning.

In standardization of index leaf experiment the third leaf from the top of crown showed higher values for all nutrients studied whereas, the least values were recorded in advanced fruiting stages. This is in conformity with earlier findings.

In cashew based cropping system trial at Bapatla, cluster bean and cowpea gave a yield of 1094kg/ha and 125kg/ha respectively. Whereas, horse gram and sesamum did not perform well.

CROP MANAGEMENT - B. HORTICULTURE

Soft wood grafting was found to be the most successful method for vegetative propagation of cashew. The highest percentage of graft success ranged between 71.7 to 83.0 per cent during January, February and September at Bapatla; July-September (72.0-77.9%) at Bhubaneswar; October and November (60%) at Chintamani; June, August and September (49.0 to 62.5%) at Jhargram; January, February and July (60 to 73%) at Vridhachalam.

A good graft success in top working was obtained at Bapatla (80.0%) and Bhubaneswar (73-80%) centres. In top worked trees with scions of V-4 at Vengurla, an average of 8.6kg nuts/tree and a maximum yield of 14.8kg nuts/tree was recorded.

Screening of vigorous and less vigorous cashew types at Madakkathara revealed the possibility of identifying the less vigorous from the more vigorous using morphological characters at the very seedling stage. At Vengurla, growth analysis of 17 rootstocks is in progress.

CROP PROTECTION

Spraying of monocrotophos (0.05%), endosulfan (0.05%) and carbaryl (0.1%) at flushing, panicle emergence and fruiting stages was found to be superior over other treatments in controlling tea mosquito bug at Chintamani and Bapatla centres. Whereas, spraying of monocrotophos (0.05%) at flush-

ing and endosulfan (0.05%) at flowering stage at Vengurla and endosulfan (0.05%) at flowering and carbaryl (0.1%) at fruiting at Madakkathara were found to be superior.

In the trial on control of foliage/in-florescence pests of cashew with neem products, neem cake extract (5%) at Bapatla was found to be effective.

At Bapatla and Madakkathara neem oil (5%) swabbing upto 1m height from the base of the trunk was found to be good prophylactic measure upto 90 days for stem and root borer. Neem oil + Sevidol 4g at Bhubaneswar and Sevidol 4g (50g/tree) at Jhargram were found to be effective in checking stem and root borer infestation.

In the survey of pest incidence in Andhra Pradesh, incidence of tea mosquito was confined mostly to the North Coastal districts and stem borer to coastal sandy soils. Mild to moderate incidence of tea mosquito

bug was prevalent at Bhubaneswar. In Jhargram the survey revealed leaf and blossom webber, leaf miner and inflorescence thrips were more severe than tea mosquito in cashew growing tracts of West Bengal. The important predators noticed on cashew inflorescence in unsprayed area were the spiders, mirid bugs and chrysopa larvae at Madakkathara.

Screening of germplasm to locate tolerant/resistant types to major pests of the region has been carried out. Least infestation of shoot tip caterpillar was observed in V-5 at Bhubaneswar. At Madakkathara twenty one accessions namely BZI-120, BZI-239, BZI-244, Anakkayam-1, Madakkathara-1, K-22-1, H-3-13, H-3-17, H-680, H-682, H-719, H-1596, H-1597, H-1598, H-1600, H-1602, H-1608, H-1610, M-1-2, A-26-2 and k-16-1 were found to be comparatively less susceptible to tea mosquito infestation during fourth year of planting.

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

(Baptala, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Pilicode, Vengurla and Vridhachalam)

Objective

The objective of this project is to evaluate the available germplasm and collection of accessions with desirable characters such as bold nut, cluster bearing, compact canopy and short flowering duration types and establishment of germplasm conservation blocks with clonal progenies.

Bapatla

During the period, eight more accessions were added to the existing germplasm bringing the total to 135 accessions. Among these 115 accessions were multiplied vegetatively and planted in the new orchard area and also supplied to other Research Stations (Table-1).

The released varieties from different cashew research stations were collected and planted.

Bhubaneswar

The germplasm block consists of 79 accessions which were planted from 1990 to 1994 in a phased manner with clonal planting materials. The growth and yield attributing characters of bearing plants are presented in Table-2.

The height and girth of plant were maximum in OC-7, (3.4m and 41cm). The yield/plant in the first harvest ranged from 250gm to 1200gm. Maximum yield was recorded in OC-3 (1200g) followed by OC-4, OC-15 (1100g), OC-7, OC-25 (1.0kg) per plant. Four elite types were identified during 1994-95 (Table-3).

The vegetative growth and yield per plant of the released varieties at Bhubaneswar is presented in Table-4. BPP-4 recorded the maximum height (3.33mt), followed by BPP-2 (3.31), BPP-1, (3.1) and the minimum was recorded in M-44/3.

Table 1: Description of cashew types collected at Bapatla centre

Source	No. of accn. collected	Description of types collected
Naramvarigudem	4	Cluster bearing, erect, intensive branching, medium canopy, nut weight 7.5g, yield 22kg per tree.
Chipurugudem	2	Intensive branching, compact canopy, nut weight 9g, yield 16kg per tree.
Achuthapuram	2	Medium canopy, cluster bearing, nut weight 6.5g, yielding > 20kg per tree.

Table 2: Vegetative character and yield of promising types in germplasm collection at Bhubaneswar Centre

Accession No.	Height (m)	Girth (cm)	Yield kg/plant (1995)
OC-1	2.07	27.0	0.5
OC-2	1.9	27.0	0.6
OC-3	3.0	37.0	1.2
OC-4	2.6	31.0	1.1
OC-5	1.5	26.0	0.3
OC-6	2.6	31.0	0.7
OC-7	3.35	41.0	1.0
OC-8	2.1	34.0	0.8
OC-9	2.6	25.0	0.3
OC-11	1.8	23.0	0.3
OC-12	2.6	33.0	0.6
OC-15	2.10	25.0	1.1
OC-16	1.9	29.0	0.3
OC-17	2.5	31.0	0.3
OC-19	2.3	33.3	0.3
OC-22	2.25	30.5	0.5
OC-23	2.9	34.0	0.5
OC-24	2.6	33.0	0.9
OC-25	2.4	24.0	1.0
OC-28	2.10	26.0	0.3
OC-33	2.3	26.0	0.6
OC-36	2.2	25.0	0.8
OC-38	2.3	28.5	0.4
OC-40	2.5	31.0	0.3
OC-41	2.4	27.0	0.4
OC-43	2.15	31.5	0.3

The girth of the plant varied from 20.75 to 43cm. Maximum girth was recorded in NRCC-1 (43cm) followed by BPP-1 (40cm) and the minimum in Vengurla-3 (20.75cm). The maximum yield was recorded in Madakkathara-1 (2.70kg) followed by BPP-1 (2.4kg) and BPP-4 (2.1kg) and the minimum in BPP-5 and NRCC-1 (450g/plant). The nut weight was minimum in BPP-2 (3.9g) and the maximum in V-3 (8.0g), followed by NRCC-2 (7.8g) and NRCC-1 (7.4g).

Chintamani

Out of 116 germplasm collections, 72 accessions were available for evaluation of yield and yield parameters (Table-5). The yield data of 1994 harvest showed that the accessions 3/108 Gubbi continued to give the highest nut yield of 31.1kg/tree with a cumulative yield of 100.3kg in 10 years of harvest. This was followed by Tuni 2/77 (19.7kg/tree; 68.2kg, 4/43 Wynad (16.9kg; 57.2kg), 1/64 Madhurantakam (15.7kg; 71.3kg), ME

Table 3:: Description of cashew types collected during 1994-95 at Bhubaneswar centre.

Source	No. of accn. collected	Description of material collected
Brahmagiri	1	Cluster bearing, 10-12 nuts/panicle, average nut weight 4.5g with approximate yield of 30kg/plant.
	2	Cluster bearing 15-20 nuts/panicle, average nut weight 3.5-4.0 with approximate yield of 25kg/plant.
Bhubaneswar	1	Bold nuts 12g, 4-5 nuts/cluster, yield 10kg/plant
	2	Cluster bearing, 10-12 nuts/panicle, average nut weight 6g, synchronisation of flowering, compact canopy and yield 20kg /plant.

Table 4: Vegetative character and yield performance of released cashew varieties under Bhubaneswar condition.

Variety	Year of planting	Plant height (m)	Girth (cm)	Yield/plant (kg)	Nut Weight (g)
Veng-2	1990	2.25	28.40	0.6	4.5
Veng-3	1990	2.05	20.75	0.5	8.0
BPP-1	1990	3.10	40.00	2.4	5.0
BPP-2	1990	3.31	36.50	0.7	3.9
BPP-4	1990	3.33	35.00	2.1	5.0
BPP-5	1990	2.25	31.00	0.5	5.0
BPP-6	1990	2.12	23.00	0.6	5.3
M 44/3	1990	2.10	31.00	0.7	5.0
NRCC-1	1990	2.85	43.00	0.5	7.4
NRCC-2	1990	2.5	30.00	0.6	7.8
Ullal-1	1991	2.55	34.00	0.7	6.5
Ullal-2	1991	2.4	24.25	0.6	5.6
Anakkayam-1	1991	2.15	24.50	1.3	5.6
Madakkathara-1 (BLA-39-4)	1991	2.05	25.00	2.7	6.6
Bhubaneswar-1	1990	2.80	34.25	0.9	4.6

Table 5. Yield performance of promising germplasm accessions at Chintamani centre

Accession No.	Source of collection	Year of planting	Cumulative yield for 10 years (kgs)	Yield of reporting year (1994)	Mean Nut Weight (g)	Shelling (%)	Flowering habit	Average apple Weight	Type of canopy
1/64 Madhurantakam	Ullal	1982	71.3	15.7	3.7	29.5	Early	25.0	Medium
3/108 Gubbi	Ullal	1982	100.3	31.1	3.4	28.0	Early	38.0	Medium
4/62 Alangudi	Ullal	1982	59.4	11.9	3.8	28.0	Mid	28.0	Medium
1/61 Alangudi	Ullal	1982	62.8	5.4	3.2	24.0	Mid	22.4	Medium
5/23 Coondapur	Ullal	1982	58.6	9.9	4.8	30.0	Mid	48.4	Compact
ME 4/4	Ullal	1983	76.7	13.8	5.8	30.0	Mid	27.0	Medium
2/77 Tuni	Ullal	1982	68.2	19.7	5.5	30.0	Mid	24.0	Compact
9/66 Chirala	Ullal	1982	68.3	3.7	5.3	28.0	Mid	24.0	Medium
4/43 Wynad	Ullal	1982	57.2	16.9	3.6	30.0	Mid	50.0	Medium
5/37 Manjeri	Ullal	1982	47.2	12.8	6.6	30.0	Early	35.0	Compact

4/4 (13.8kg; 76.7kg) and Manjeri (12.8kg; 47.19kg in 8 years). Among the accessions, the highest nut weight of 6.6g was recorded in 5/37 Manjeri followed by ME 4/4 (5.8g). The shelling percentage ranged from 24-30, the highest being in 5/23 Coondapur, ME 4/4, 2/77 Tuni, 4/43 Wynad and 5/37 Manjeri and the lowest in accession 1/61 Alangudi.

Jhargram

There are a total of 127 accessions maintained in germplasm conservation block for evaluation. The accessions planted during 1983, 1984 and 1985 were evaluated and yield performance of 15 promising types are given in Table-6. The type JGM 71/5 gave highest yield of 28.07kg raw nut per tree during 1994 season with a cumulative yield of 64.95kg of raw nut over a period of 7 years (upto 1994), followed by the type JGM 19/1 and JGM 72/7 which registered a yield of 19.3kg and 15.1kg of raw nut with a cumulative yield of 34.6kg and 30.4kg, respectively. The maximum mean nut weight of 7.2g was observed in JGM 68/

9 while the same was 7.1g, 6.4g and 6.2g in JGM 31/1, JGM 74/6 and JGM 71/5, respectively. The maximum shelling percentage was recorded in the accession JGM-58/12 being 35.2 per cent followed by 34.7 per cent in JGM-71/5, 34.4 percent in JGM 16/1 and 34.0 per cent in JGM-29/8.

The survey programme was undertaken to collect the cluster bearing types and other diverse material from Midnapore district. Nine elite plants were selected during April, 1993 and the scion sticks of the same were collected during October' 93 (Table-7).

Madakkathara

A total of 120 accessions collected till 1994 were planted for evaluation in the clonal germplasm conservation block. Five varieties/types were collected during the period under report. Vetore-56 and Kankadi types semidwarf, (identified as the male for hybridization programme) KTR-1-254, KTR-1-306 (from District Agricultural farm,

Table 6. Yield performance of promising germplasm accessions during 1994 at Jhargram centre

Accession	Source of collection	Year of planting	Cumulative yield for 7 years (kgs.)	Range (kg)	Yield of reporting year (1994) kg/plant	Mean Nut Weight (g)	Shelling (%)
JGM 11/4	CRS, Bhubaneswar	1983	22.6	0.5 - 12.2	12.2	5.4	32.8
JGM 16/1	CRS, Madakkathara	1983	30.8	2.2 - 10.7	10.7	5.1	34.4
JGM 17/1	CRS, Bhubaneswar	1983	33.5	1.4 - 13.4	13.4	5.7	31.8
JGM 65/8	CRS, Bhubaneswar	1983	24.3	0.9 - 11.2	11.2	4.2	28.5
JGM 66/7	CRS, Bhubaneswar	1983	40.4	0.4 - 14.1	14.1	4.1	32.7
JGM 68/9	CRS, Bhubaneswar	1983	24.3	0.1 - 10.2	10.2	7.2	31.2
JGM 71/5	CRS, Madakkathara	1983	65.0	1.3 - 28.1	28.1	6.2	34.7
JGM 74/6	CRS, Bhubaneswar	1983	25.4	1.3 - 10.9	10.9	6.4	30.0
JGM 19/1	CRS, Vengurla	1984	34.6	1.2 - 19.3	19.3	4.4	30.7
JGM 29/8	CRS, Bapatla	1984	22.7	0.6 - 10.2	10.2	5.8	34.0
JGM 31/1	CRS, Vittal	1984	18.9	1.1 - 6.9	6.9	7.1	30.5
JGM 72/7	CRS, Bapatla	1984	30.4	1.2 - 15.1	15.1	4.2	30.6
JGM 48/4	CRS, Vridhachalam	1985	27.7	0.9 - 13.3	13.3	5.7	33.6
JGM 58/12	CRS, Madakkathara	1985	21.5	1.0 - 13.5	13.5	6.0	35.2
JGM 63/10	CRS, Vittal	1985	23.4	1.3 - 9.9	9.9	4.1	30.2

Sl. No. 9-12, Cumulative yield for last six years.

Sl. No. 13-15, Cumulative yield for last five years.

Table 7: Description of germplasm collected during 1994 survey in Jhargram centre

Source of collection	No. of accessions collected	Description of types collected
Cashew plantation, Department of Forests, Govt. of West Bengal, Vill. Pindra, P.O. Pukkuria District Midnapore	2	i) Plant is 15-18 years old, plant habit is erect, spreading type, intensive branching, medium canopy, conical panicle, cluster bearing, 10-12 nuts per panicle with average nut weight 5.5g, yellow colour apple, average yield 25-30 kg/plant.
		ii) Age of plant is 14-16 years, erect type, intensive branching, medium canopy, conical panicle, cluster bearing, 10-15 nuts per panicle, nut weight 6.0g, yellow colour, roundish apple, average yield 20-25 kg/plant.
Cashew plantation, Department of Forests, Govt. of West Bengal, Vill. Kendudihi, P.O. Jarulia District Midnapore	2	i) 25-27 years old plant, erect and spreading type, medium canopy pyramidal panicle, 8-10 nuts per panicle with mean nut weight 5.0g, yellow colour apple with reddish tinge, average yield 22-25 kg/plant.

Table 7 Contd.

Source of collection	No. of accessions collected	Description of types collected
Private orchard of Sri Sudhir Krishna Mitra, Vill. Garro. P.O. Garhsalboni Dist. Midnapore	3	ii) Age of plant is 25-30 years, erect and spreading type, intensive branching, medium canopy, conical panicle, cluster bearing, 12-15 nuts per panicle, with medium nut weight 6.0g, reddish yellow medium size apple, average yield 50-65kg/plant.
		i) Plant age 25-30 years erect and spreading type, intensive branching, medium canopy, conical panicle, cluster bearing, 14-22 nuts per panicle with mean nut weight 4.5g, red colour apple, average yield 55-70kg/plant.
		ii) 22-25 years of plant, spreading type, intensive branching, sparse canopy, pyramidal panicle, 10-12 nuts per panicle with mean nut weight 7.0g, red colour medium size elongated apple, average yield 20-25kg/plant.
Private orchard of Mrs. Anamma Joh, Vill. Garro, P.O. Garhsaloboni, Dist. Midnapore	2	iii) Age of plant is 22-25 years, spreading type, intensive branching, medium canopy, pyramidal panicle, 5-8 nuts per panicle with mean nut weight 7.5g, large size (110g) yellow colour apple, average yield 15-20kg/plant.
		i) Plant 20-25 years old, erect type, intensive branching medium canopy, conical panicle, 4-5 nuts per panicle with mean nut weight 7.5g, medium size yellow colour elongated apple, average yield 15-20kg/plant.
		ii) Plant age 20-25 years, spreading type, intensive branching, conical panicle, medium canopy, 8-12 nuts per panicle with mean nut weight 6.5g yellow colour medium size apple, average yield 25-30kg/plant.
Remarks:		
	i)	All accessions are growing on red laterite soil without any improved cultural management.
	ii)	All accessions are of medium flowering type and harvesting generally completed during end of April.
	iii)	No tea mosquito incidence was observed but minimum infestation of blossom webber was noticed in accessions collected from cashew plantation of Pindra Village.

Kottarakkara) and K-1 from Kairarappatta, Palakkad districts were added to the collection. The details are given in Table-8.

The biometric and yield characters of all the accessions planted during 1988-91 were recorded. The accessions planted during 1992 and 1993 have established well. Anakkayam-1 gave the highest yield of 2.86kg/tree followed by H-1588 (1.7kg/tree) and A-26-2 (1.6kg/tree). The maximum nut weight was recorded in Brazil-239 (14.1g) followed by H-1589 (12.5g) so also the apple weight was maximum in Brazil-239 (145g) followed by in Brazil-241 (142g).

Pilicode

The project was started in 1994. The survey was conducted in Kakkadavu and Kuniya areas of Kasaragod districts and Irikkur and Mattannur area of Kannur districts during 1994-95. Forty five bold nut types of cashew were selected and described using the descriptor of which 15 were selected based on the kernel weight exceeding 2g per nut (Table-9).

Table 8: Cashew accessions collected by Madakkathara centre

Source of Collection	No. of accessions collected
Republic of Panama	14
Cashew Farm, Kottarakkara	13
CRS, Madakkathara	26
CRS Anakkayam	24
NRCC, Puttur	8
Bapatla	8
Vengurla	8
Jhargram 1	
Farmers fields in Kannur & Palghat Districts of Kerala	16
Total	120

Vengurla

A total of 161 accessions is available in the gene bank. Out of these, 80 types have already been evaluated and planted in conservation block at closer spacing (4m x 4m) and the remaining 81 types are being evaluated. The information of some promising selections are given in Table 10.

Seventy five bold types were collected from 1988 to 1993 and planted in the field. Three promising bold nut types were identified and included in the breeding programme. During the year 1994-95 scion sticks of 13 bold nut types were collected from ICAR Research Complex, Old Goa and planted in the field for further evaluation. The yield recorded during the fruiting season of 1995 in some of the promising types is given in Table-10 and Table-11.

Vridhachalam

The yield characters of the promising types in the new germplasm which were planted during 1989 are furnished in Table-12. Among the 130 types available in the

Table 9: Description of bold nut types of cashew collected during 1994-95 Pilicode sub-centre.

Source	No. of accessions	Acc. nos.	Nut wt. (g)	Kernel weight (g)	Shelling (%)	Description of type collected
Kakkadavu	6	PCKC-4	7.87	2.83	35.9	Early flowering, cluster bearing (15 nuts/bunch), medium tall and compact canopy.
		PCKC-5	9.15	2.56	27.9	Early bearing, 4 nuts/bunch, tall and sparse canopy.
		PCKC-8	8.35	2.44	29.2	Early bearing, tall and spreading.
		PCKC-9	6.72	2.12	31.5	Early and cluster bearing (15 nuts/bunch), spreading canopy.
		PCKC-12	11.16	2.88	25.8	Early, 2 nuts/bunch, compact canopy.
		PCKC-15	7.57	2.42	31.9	Early, cluster bearing and spreading canopy.
Kuniya 5		PCKP-1	12.53	3.75	29.9	Early, 1 nut/bunch, erect with sparse canopy.
		PCKP-3	7.69	2.00	26.0	Mid season, 2 nuts/bunch, bushy tree.
		PCKP-7	12.63	3.03	23.9	Mid season, 2 nuts/bunch, bushy tree.
		PCKP-8	13.01	2.70	20.7	Mid season, 2 nuts/bunch, bushy tree.
		PCKP-9	9.25	2.48	26.8	Early, 2-3 nuts/bunch, erect tree.
Kodolipram	3	KOD-1	9.98	2.59	25.9	Early, cluster bearing (12 nuts/bunch), semi erect tree.
		KOD-2	8.58	2.65	30.8	Mid season, cluster bearing, erect type.
		KOD-3	10.10	2.75	27.2	Early, 6 nuts/bunch and spreading type.
Mattannur	1	MAT-1	8.58	2.40	27.9	Mid season, 4 nuts/bunch and erect tree.

Table 10: Information on promising germplasm at Vengurla centre

Accession	Year of planting	Cumulative yield for 7 years	Yield range	Yield of reporting year 1995 kg/nut/tree	Mean Nut Weight (g)	Shelling (%)
80/2/4	1977	51.6	4.0 to 8.3	6.3	5.2	27.3
83/5/3	1977	57.7	4.4 to 10.0	4.3	6.1	27.7
87/9/2	1977	42.9	2.2 to 8.3	2.2	5.3	24.9
89/12/3	1977	63.3	3.4 to 13.3	10.6	5.3	30.7
94/17/5	1977	70.3	6.1 to 14.4	9.4	7.1	23.0
95/11/3	1977	41.9	2.2 to 10.1	2.5	6.7	23.0
96/11/5	1977	44.2	1.1 to 9.1	1.1	5.5	22.0
98/12/4	1977	70.5	2.4 to 14.7	2.4	6.3	21.0
109/22/2	1979	43.0	2.1 to 9.0	3.4	5.0	25.0
124/15/3	1979	47.8	1.3 to 9.1	6.5	6.8	29.6
126/17/2	1980	53.3	2.1 to 7.2	8.6	6.0	28.5

Table 11: Bold types identified for breeding programme at Vengurla centre (season 1994).

Accession No.	Nut wt. (g)	Shelling (%)	Av. Wt. of kernel (g)	Yield		Av. Wt. of apple (g)	Tree canopy
				1993	1994		
1	12.0	25.0	3.4	5.5	6.6	80	Medium
22	12.0	24.0	3.2	6.0	5.8	86	Medium
65	12.0	28.0	2.8	3.7	4.7	82	Medium

Table 12:: Yield parameters of promising types in the clonal germplasm at Vridhachalam centre.

Accession Number	Yield of reporting year 1994 (kg)	Mean nut weight (g)	Shelling (%)
M 9/3	0.6	5.0	29.5
M 15/4	1.0	6.2	29.5
M 17/4	0.7	4.9	28.8
M 18/4	0.9	4.8	28.5
M 21/4	0.7	4.4	29.7
M 26/4	2.0	6.0	30.0
M 33/3	1.9	7.4	25.8
M 37/3	0.5	7.0	29.8
M 44/3	1.4	6.8	28.6
M 59/3	0.8	5.4	28.9
M 60/2	0.8	4.6	28.2
ME 4/4	1.0	7.0	28.0
G. 182	0.5	5.0	28.5

clonal germplasm (1989 planting) only 13 types were found to be promising. In the fifth year, the yield of these promising types ranged from 0.5kg to 2.0kg of nuts/tree. The accession No. M 26/4 registered the highest yield followed by M 33/3 (1.9kg), M 44/3 (1.4kg), and M 15/4 (1kg). The mean nut weight was the highest in M 33/3 7.4g nut followed by M 37/3 and ME 4/4 (7g).

The shelling percentage was above 28

Table-13: Total number of germplasm types available in the new germplasm at Vridhachalam centre.

Year of planting	No. of accessions
1989	130
1994	125
Total	255

per cent in all the types. The accession No. M 26/4 registered the highest shelling percentage of 30 per cent. While M 33/3 registered the lowest shelling percentage of 25.8 per cent.

Another 108 new types were added to the already existing 130 types in the new germplasm collections. Four plants in each types were planted in the year 1993 but were completely damaged in the severe cyclone (December '93). The replanted grafts have established well.

Germplasm Collections

Seventeen new entries with high yield and bold nuts were collected from TAF CORN (Tamil Nadu Forest Plantation Corporation), Plantation at Siluvechery and Aiyur and these were included in the germplasm.

Gen. 3 : Expt. 1: Varietal Evaluation - Comparative Yield Trial in Cashew

(Chintamani)

Objective:

Comparative yield trial with elite materials from Bapatla, Vengurla was started during 1986 in order to evaluate their performance in different agro climatic regions.

Chintamani

The trial was planted during December 1986 with ten clonal progenies of Bapatla and Vengurla in RCBD with three replications. Data on plant height, stem girth, canopy shape, flowering period and nut yield are furnished in Table-14.

No significant difference in plant height was observed among varieties studied. The varieties also did not differ significantly in their stem girth. Significant differences were observed amongst varieties in nut yield. The highest nut yield of 6.46kg/tree was recorded in Vengurla-3 which was significantly superior than all other varieties. This was followed by Vengurla-2 (5.44kg/tree). The yield of Bapatla-6, Bapatla-3, Bapatla-4 and Vengurla-5 was found on par. The lowest yield of 2.22kg/tree was recorded in Bapatla-1.

Table 14: Growth and Yield parameters of varietal evaluation - CYT in cashew at Chintamani centre.

Variety	Plant height (m)	Stem girth (cm)	Canopy shape	Yield/kg/plant	Flowering period/season
V-1	5.35	66.08	Compact	3.2	Medium
V-2	5.45	62.83	Medium	5.4	Long
V-3	5.96	69.31	Sparse	6.5	Medium
V-4	5.11	60.66	Sparse	3.4	Medium
V-5	5.74	64.66	Compact	4.0	Medium
BPP-1	5.65	62.60	Compact	2.2	Medium
BPP-6	5.52	66.43	Compact	4.6	Medium
BPP-3	5.54	66.70	Medium	4.5	Medium
BPP-4	5.81	66.67	Medium	4.2	Long
BPP-5	5.58	60.60	Compact	4.4	Medium
SEM+/-	0.24	3.07	--	0.23	--
C.D. (.05%)	NS	NS	--	0.68	--
C.V (%)	7.43	8.24		9.40	

Gen. 3 : Expt. 2 : Varietal evaluation - Multilocation trial with varieties from Vittal, Vridhachalam, Vengurla and Bapatla.

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurla, Vridhachalam and Jagdalpur)

The trial was laid out with clonal progenies. The following varieties are under evaluation in different centres:

Bapatla - T-129, T-40, H-2/15, H-2/16
 Madakkathara - H-1598, H-1600, H-1608, H-1610
 Vittal - 30/4, 59/2, 44/3
 Vengurla - V-2, V-3, V-4 V-5, M-44/3
 Vridhachalam - M-33/3, M-44/3, M-26/2

Design : RBD
 Replication : Three

Bhubaneswar

Observations on plant height, girth, canopy shape, flowering time, number of flowering shoots/sq.mt., yield per plant, nut weight, number of nuts per panicle were recorded and are presented in Table-15.

The plant height and girth varied significantly among the cultivars. Maximum plant heights was recorded in Veng-2 (4.18) followed by H 1610 (4.17m) and VTH 30/4 (4.05m) and the minimum in VTH 44/3

Table 15: Growth and yield performance of cashew varieties in multilocation trial at Bhubaneswar centre.

Variety	Height (m)	Girth (cm)	Canopy shape	Flowering time	Number of flowering panicle (sq.mt.)	Yield/kg/ plant	Nut Weight (g)	Number of nuts per panicle
1598	3.41	43.50	Compact	20.12.94	25.0	2.9	5.5	5.5
1600	3.00	43.62	Compact	30.12.94	28.0	2.6	6.1	4.3
	3.62	56.62	Compact	25.12.94	26.0	4.9	7.7	4.5
	4.17	58.37	Medium	25.01.95	21.0	2.8	8.2	5.2
29	3.31	43.75	Sparse	15.01.95	17.0	1.9	4.3	3.8
	3.31	52.25	Compact	15.12.94	30.0	2.4	4.1	4.5
	3.16	49.00	Compact	07.12.94	20.0	2.0	8.2	2.3
	3.85	57.13	Compact	07.12.94	22.0	7.0	7.6	5.6
	2.75	27.12	Compact	15.12.94	23.0	1.8	4.5	5.0
	2.82	45.62	Compact	10.12.94	32.0	2.8	4.7	5.5
44/3	2.17	33.75	Compact	25.12.94	22.0	1.8	4.5	2.5
VTH 30/4	4.05	59.12	Sparse	12.01.95	17.5	2.0	7.5	2.0
VTH 59/2	2.75	33.75	Compact	05.01.95	20.0	1.5	5.5	4.5
Veng-2	4.18	51.25	Compact	20.01.95	24.0	3.4	4.2	5.6
	3.47	47.85	Sparse	25.01.95	20.0	4.2	7.5	4.7
	3.25	39.12	Medium	26.12.94	24.0	3.6	7.2	4.4
	2.29	6.61	--	--	1.9	0.4	--	--
	4.11	14.70	--	--	4.0	0.9	--	--

(2.17m), VTH 59/2 and M 44/3 (2.75m). The maximum girth was observed in VTH 30/4 (59.12cm) followed by H 1610 (58.37cm), H2/16 (57.13cm) and the minimum in M 44/3 (27.12cm). The canopy shape was sparse in TN 129, Veng.3 and VTH 30/4 and in other cultivars it was mostly compact to medium. BPP 2/15 and 2/16 were early flowering and H 1610 and Veng.3 late flowering types. The number of flowering laterals per sq.m varied significantly. Maximum flowering laterals was recorded in M 26/2 (32.0) followed by T. No. 40 (30) and the minimum in TN 129 (17.0) and VTH 30/4 (17.5). The maximum nut yield was recorded in BPP 2/16 (7.05kg) and

was found to be significantly superior to all other varieties. Minimum nut yield was recorded in VTH 59/2 (1.45kg/plant) followed by VTH 44/3 (1.80kg). The average nut weight varied from 4.1g to 8.2g. Maximum weight was recorded in H 1610, 2/15 (8.2g) followed by H 1608 (7.7), H2/16 (7.6), Veng.3 and VTH 30/4 (7.5g). The highest number of nuts per panicle was recorded in Veng.2 and H 2/16 (5.6) and the lowest in VTH 30/4 (2.0).

Chintamani

The trial was laid out during December, 1986 with 19 varieties following RCBD with three replications. Varieties from

Table 16: Growth and yield parameters of varietal evaluation - Multilocation trial with varieties from Vittal, Vridhachalam, Vengurla and Bapatla (Chintamani centre).

Varieties	Canopy shape	Plant height (m)	Stem girth (cm)	Yield/kg/tree
H-1610	Medium	5.33	65.08	4.0
H-1600	Compact	5.32	65.25	4.0
H-1608	Medium	5.08	57.30	6.3
H-1598	Medium	5.24	57.60	3.7
TN-129	Medium	5.00	57.48	3.2
TN-40	Compact	4.78	62.18	2.5
Hyb.2/15	Compact	5.10	53.35	2.7
Hyb.2/16	Sparse	5.32	56.98	2.6
44/3 (VRI)	Compact	4.65	56.33	6.2
V-3	Sparse	4.96	59.38	1.8
V-4	Sparse	5.24	60.42	1.5
V-2	Sparse	5.23	47.67	2.3
M 44/3 (Veng.)	Compact	4.68	51.72	0.9
H-24 (Veng. 5)	Compact	5.08	55.55	4.2
44/3 (VTH-12)	Compact	4.99	53.47	2.3
M 30/4 (VTH-30)	Medium	4.91	54.53	2.9
59/2 (VTH-59)	Sparse	5.07	60.63	4.2
SEm+/-		0.11	1.13	0.32
CD (P=0.05)		NS	NS	0.92
CV (%)		8.96	8.11	16.79
NS - Non Significant				

Vridhachalam viz., 33/3 and M 26/2 could not establish and in their place, varieties Ullal-1 and Ullal-2 were planted during 1992. Data on growth and yield are furnished in Table-16.

The varieties did not differ significantly in their plant height. No significant difference was observed in stem girth among the varieties. Highest nut yield of 6.25kg/tree and 6.24kg/tree was recorded in H-1608 and M 44/3 (VRI), respectively. These two differed significantly from all other varieties. The lowest yield of 0.90kg/tree was recorded in M 44/3 obtained from Vengurla.

Jhargram

The growth parameters and yield performance were recorded and are furnished in Table-17. Significant variations were observed in plant height, girth and yield among the varieties. Vegetative growth was maxi-

imum in the variety VTH-30/4 in which a mean height of 5.06m and girth of 62.92cm were recorded followed by H-1610 (4.76m), T. No. 129 (4.62m) and VTH-59/2 (4.54m) in respect of plant height and H-1610 (60.41cm), H-1608 (59.12cm) and VTH-59/2 (57.46cm) in respect of girth. The lowest plant height of 3.02m and girth of 43.84cm was noticed in M-44/3 and M-26/2 respectively. The highest nut yield per tree was recorded in VTH-59/2 (8.17kg) followed by H-2/16 (6.35kg), VTH-30/4 (6.28kg) and M-33/3 (5.72kg). The lowest yield was observed in M-44/3 (2.96kg).

Madakkathara

Observations of plant height, stem girth (0.5m above ground), canopy shape, nut weight, apple weight and nut yield were recorded. The mean data are given in Table-18, and 19. Performance of all the varieties improved considerably during the 6th year after planting and the highest nut yield

Table 17: Growth and yield performance of varieties in multilocation trial at Jhargram centre.

Varieties	Plant height (m)	Stem girth (cm)	Canopy shape	Yield/kg/tree
H-1598	4.24	55.71	Medium	4.0
H-1600	3.67	46.34	Medium	3.3
H-1608	4.43	59.12	Compact	3.2
H-1610	4.76	60.41	Medium	3.3
T.No. 129	4.62	56.62	Medium	4.7
T.No. 40	4.07	49.97	Compact	5.2
H-2/15	4.32	54.42	Compact	5.5
H-2/16	4.15	55.15	Medium	6.3
M-33/3	4.43	52.62	Medium	5.7
M-26/2	3.37	43.84	Sparse	3.0
M-44/3	3.02	37.42	Medium	2.9
VTH-30/4	5.06	62.92	Compact	6.2
VTH-59/2	4.54	57.46	Medium	8.1
S.Em (+/-)	0.25	4.35	--	0.22
C.D. at 5%	0.78	12.70	--	0.66

Table 18: Growth and yield characters of different cashew varieties in MLT at Madakkathara centre.

Varieties	Plant height (m)	Stem girth (cm)	Canopy shape	Apple weight	Nut weight
H-1598	6.27	80.5	Compact	67.14	5.90
H-1600	5.49	82.9	Medium	84.8	10.10
H-1608	5.27	77.67	Compact	71.2	7.83
H-1610	6.15	90.8	Medium	95.3	8.25
VTH-30/4	5.27	78.86	Compact	49.8	5.72
VTH-59/2	5.8	81.8	Medium	90.0	8.13
T-129	6.01	83.83	Medium	48.8	5.67
T-40	5.35	74.25	Compact	75.75	5.38
H-2/15	5.68	84.0	Compact	74.1	7.47
H-2/16	5.7	71.2	Medium	81.67	9.35
V-2	6.0	71.14	Medium	67.2	5.43
V-3	6.45	81.67	Sparse	72.13	7.81
V-4	6.06	75.5	Medium	82.8	8.72
V-5	5.62	76.6	Compact	19.88	3.50
M-33/3	5.24	71.38	Medium	87.7	7.57
M 44/3	4.62	64.5	Compact	41.1	5.18
M-26/2	5.4	78.67	Compact	55.1	7.47
Anakkayam-1	5.47	71.62	Medium	46.8	5.43

Table 19: Yield data of MLT varieties at Madakkathara centre.

Varieties	3 YAP 1990-91	4 YAP 1991-92	5 YAP 1992-93	6 YAP 1993-94
H-1598	4.642	3.630	11.670	12.17
H-1600	2.592	4.960	11.330	8.20
H-1608	2.975	2.683	11.970	9.33
H-1610	0.558	1.775	8.167	5.13
VTH-30/4	2.025	3.275	9.833	7.60
VTH-59/2	1.842	3.583	9.170	5.27
T-129	0.870	1.790	5.900	3.03
T-40	0.908	3.167	5.230	4.50
H-2/15	1.470	1.842	6.470	7.33
H-2/16	1.496	1.708	7.867	4.80
V-2	1.275	2.833	7.267	4.27
V-3	1.658	3.000	11.520	8.73
V-4	1.312	2.575	11.830	7.53
V-5	1.458	3.177	9.000	12.10
M-33/3	1.900	3.670	11.150	7.30
M 44/3	5.475	6.808	10.700	11.20
M-26/2	3.379	6.583	14.470	10.00
Anakkayam-1	2.695	2.177	11.000	10.87

YAP :- Year after planting

(12.17kg/tree) was recorded in the variety H-1598 followed by the hybrid Vengurla V-5 (12.1kg). The varieties M-44/3, M-26/2 and Anakkayam-1 gave a nut yield of above 10kg.

Vridhachalam

The growth and yield performances of the 17 entries in the old MLT are furnished in Table-20.

The height of the trees ranged from 320cm to 455cm. The tallest trees recorded in the entry were H-1608 (455cm) followed by M-33/3 and VTH-59/2 (450cm), V-2 (445cm), V-5 (430cm) V-4 and VTH-30/4 (425cm).

The girth of the trees ranged from 51.6 to 88.0cm. The maximum girth recorded was in M-33/3 (88.0cm) followed by VTH-59/2 (77.6cm). V-2 and T.No.129 (74.0cm), VTH-

30/4 (73.4cm), V-4 (73.0cm) and H-1610 (72.2cm)

The maximum yield was recorded in the variety V-5 (3.53kg/tree) followed by V-2 (2.07kg/tree).

Jagadapur

Planting materials from Vengurla and Vridhachalam were lifted during Nov./Dec. '94. Twenty plants of each variety were collected but the survival percentage was very low.

Vengurla

1. Hy-68 (Veng. -6); 2. Hy-255; 3. Hy - 303; 4. Hy-320; 5. Hy - 367.

Vridhachalam

1. M-44/3 2. M-15/4

Table 20: Growth and yield performance of different varieties in MLT (1994) at Vridhachalam centre.

Varieties	Plant height (m)	Stem girth (cm)	Canopy shape	Yield tree-1	Flowering period
H-1598	380	68.0	Compact	Nil	Late
H-1600	385	65.5	Compact	Nil	Late
H-1608	455	66.4	Compact	Nil	Late
H-1610	400	72.2	Medium	Nil	Late
T 129	405	74.0	Compact	0.5	Early
T 40	370	60.8	Compact	0.7	Early
H 2/15	410	69.3	Compact	1.4	Mid
H 2/16	380	65.0	Compact	0.9	Mid
M 33/3	450	88.0	Medium	1.8	Early
M 44/3	360	65.2	Compact	1.4	Early
M 26/2	320	51.6	Compact	1.5	Mid
VTH 30/4	425	73.4	Medium	1.9	Mid
VTH 59/2	450	77.6	Compact	1.9	Mid
V2	445	74.0	Compact	2.1	Early
V3	400	68.4	Compact	Nil	Mid
V4	425	73.0	Compact	Nil	Mid
V5	430	69.5	Compact	3.5	Early

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

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurla and Vridhachalam)

Bapatla

The multilocation trial-92 was laid out during January 1993 by obtaining scion material and grafts of the following entries from different coordinating centres. Similarly, planting materials was supplied to different coordinating centres for laying out the new multilocation trial experiment.

Bapatla T 30/1, 3/33, 10/19 and Hy. 3/28.
 Vengurla H 68, 303, 367, 320 and 255
 Vridhachalam M 44/3 and M 15/4
 N.R.C.C 107/3 and 40/1

The growth of the trees in the above trial is satisfactory and are progressing well.

Table 21: Growth parameters of cashew entries in multilocation trial (MLT-92) at Bapatla centre.

Cashew entries	Height (m)	Girth (cm)
Bapatla		
T.No. 30/1	2.05	22.0
T.No. 3/33	1.60	14.0
T.No. 10/19	2.10	17.5
Hy. 3/28	2.25	19.0
Vengurla		
H 68	1.35	18.5
H 320	1.80	14.5
H 367	1.60	17.5
H 255	1.50	12.5
Vridhachalam		
M 44/3	1.86	17.5
M 15/4	2.15	19.0
N.R.C.C.		
107/3	2.05	23.0
40/1	1.95	18.5

The Bapatla and Vridhachalam entries have come to flowering earlier than Vengurla and N.R.C.C. varieties. The flower panicles were removed as soon as they appeared. The growth parameter were recorded and are presented in Table-21.

The maximum height was recorded in Bapatla entry H 3/28 (2.25cm) followed by Vridhachalam entry M 15/4 (2.15cm). The highest stem girth was recorded in N.R.C.C. 107/3 (23.0cm) followed by Bapatla 30/1 (22.0cm).

Bhubaneswar

The trial was laid out with clonal progenies consisting of 13 varieties replicated thrice in randomised block design. The plant height, girth, canopy spread varied significantly among the cashew types. The maximum plant height was recorded in H-230 (2.07m) followed by H-302 (2.04m), H-255 (2.02m), BPP-3/28 (2.0m) and the minimum plant height in NRCC-1 (1.05m), M-44/3 (1.16m) and M-15/4 (1.22m). The maximum girth of plant was observed in H-255 (23.35cm) followed by H-320 (21.08cm) and the minimum in NRCC-2 and M-44/3 (14.25cm). The maximum canopy spread in NS and EW direction was recorded in H-255 and the minimum in NRCC-1 (Table-22).

The maximum height was recorded in Bapatla entry H 3/28 (2.25m) followed by Vridhachalam entry M 15/4 (2.15m). The highest stem girth was recorded in N.R.C.C. 107/3 (23.0cm) followed by Bapatla 30/1 (22.0cm).

Chintamani

The trial was planted during August 1992 with three replications in R C B D. The growth parameters such as plant height, stem girth and plant spread were recorded (Table-23).

Maximum plant height (2.57m) was recorded in NRCC-1 closely followed by Ullal-1 (2.46m), TN-30/1 (2.43m), Hyb 320 (2.37m) and Hyb 302 (2.20m). The minimum plant height was recorded in M 44/3 (1.74m). The highest stem girth (30.10cm) was noticed in Ullal-1 while the least was recorded in M 15/4 (19.74cm). Both East-West and North-South plant spread differed significantly among varieties. The highest spread was recorded in Ullal-1 (3.18m E-W; 3.04m N-S) and the least was observed in M 15/4 (19.4m; 1.88m).

Jhargram

The variations were observed in re-

spect of both plant height and girth values (Table-24). Vegetative growth was maximum in the variety M-44/3 which recorded a mean height of 2.21m and girth of 16.3cm followed by H-255 (1.94m) and H-303 (1.82m) in respect of plant height and T.No. 3/33 (16.1cm) and H-255 (15.8cm) in respect of girth. The lowest height and girth were noticed in the variety H-320 (1.62m) and T. No. 30/1 (11.8cm) respectively.

Madakkathara

The softwood grafts of the recommended varieties were collected from the centres concerned the experiment was laid out during October 1993 and the plants have established well.

Vengurla

The scion sticks from all the centres

Table 22: Vegetative growth of cashew types at Bhubaneswar centre.

Varieties	Plant height (m)	Stem girth (cm)	Canopy spread	
			N.S. (m)	E.W. (m)
NRCC-1	1.05	15.50	1.30	1.19
NRCC-2	1.28	14.25	1.43	1.32
BPP-3/33	1.71	20.67	2.23	2.27
BPP-3/28	2.00	19.92	2.24	1.98
BPP-10/19	1.99	19.35	2.15	2.33
BPP-30/1	1.84	20.08	2.02	2.03
H-302	2.04	20.92	2.21	2.21
H-68	1.53	17.75	1.79	1.85
H-255	2.02	23.35	2.70	2.65
H-320	2.07	21.08	2.23	2.37
H-367	1.62	19.25	2.08	2.19
M-44/3	1.16	14.25	1.57	1.28
M-15/4	1.22	16.50	1.40	1.49
S.Em	0.21	2.09	0.28	0.25
C.D (5%)	0.43	4.30	0.58	0.51

Table 23. Growth parameters of varieties in MLT-92 at Chintamani centre.

Varieties	Plant height (m)	Stem girth (cm)	Canopy spread	
			N.S. (m)	E.W. (m)
H-68	2.17	29.00	2.72	2.68
H-367	1.97	26.42	2.70	2.78
H-302	2.20	26.28	2.66	2.74
H-255	2.30	27.91	2.74	2.56
H-320	2.37	29.00	2.59	2.76
M-44/3	1.74	21.99	2.33	2.39
M 15/4	1.77	19.74	1.94	1.88
NRCC-1(107/3)	2.57	29.05	3.06	2.99
NRCC-2(40/1)	2.11	28.58	2.87	2.98
TN-30/1	2.43	26.44	2.91	2.65
TN-3/33	2.14	26.92	2.73	2.59
TN-10/19	1.90	25.91	2.74	2.65
TN-3/78	2.09	24.25	2.04	2.25
Ullal-1	2.46	30.10	3.18	3.04
SEm±	0.14	1.68	0.22	0.22
CD (P=0.05%)	0.41	4.89	0.64	0.64
CV (%)	11.24	10.96	14.02	14.27

Table 24: Growth parameters of different cashew cultivars under new multilocation trial at Jhargram centre.

Varieties	Height (m)	Girth (cm)
T.No. 30/1	1.67	11.8
T.No. 3/33	1.78	16.1
H-303	1.82	14.2
H-255	1.94	15.8
H-320	1.62	12.6
M-44/3	2.21	16.3
NRCC-2	1.86	12.3

were collected and the grafts were prepared for planting. The trial has to be laid out after clearing of the site at Agricultural Research Sub-Centre, Mulde (Kudal).

Vridhachalam

The new multilocation trial with 13 varieties (2 from NRCC, 4 from Bapatla, 5 from Vengurla and 2 from Vridhachalam) was laid out during the year 1994. Four plants in each variety, in three replications, were planted.

Gen. 4: Hybridization and Selection

(Bapatla, Bhubaneswar, Jhargram, Madakkathara, Vengurla and Vridhachalam)

Objective

The objective of this experiment is to utilize the best yielders selected from germplasm and cross them with the parents having other desirable traits like bold nuts, cluster bearing habit and compact canopy. The F_1 progenies are to be close planted in initial selection plots and selected hybrids plants are to be clonally multiplied for yield evaluation in a multilocation trial in different centres.

Bapatla

During the period, hybridisation was carried out with the different cross combinations. (Table-25). The hybrid seedlings obtained from different cross combinations with selected parents were planted in the main field for studying their performance. The

characteristics of the parents are:

- a) BPP-5 and BPP-6 are high yielding and released varieties with nut weight of more than 5g.
- b) Hy. 2/22 is a boldnut type with nut weight of 7.5g.
- c) T. No. 1 and T. no. 273 are parents of BPP-1 and BPP-2.

The existing hybrid seedlings were evaluated and those with a mean yield potential of more than 8kgs over 12 years and nut weight more than 5g are given in Table-26. The maximum yield of 18.0kg was recorded in Hy 4/1 (1x100) followed by Hy. 3/10 (T. No. 56 x T. No. 40) and Hy. 1/7 (1x4) which gave 10kg respectively. Among the different hybrids evaluated Hy. 1/7 and 3/10 were found to be promising with good yield and high and nut weight.

Table 25: The details of hybridisation at Bapatla centre

Cross Combination			Total No. of Crosses	No. of nuts obtained	Percentage of success
BPP-5	x	Hy. 2/22	260	58	22.3
BPP-6	x	Hy. 2/22	260	52	20.0
Hy. 2/22	x	BPP-5	260	46	17.6
Hy. 2/22	x	BPP-6	300	48	16.0
BPP-1	x	BPP-5	300	80	26.6
BPP-2	x	BPP-5	300	82	27.3
BPP-2	x	T. No. 273	300	36	12.0
BPP-2	x	T. No. 273	300	62	20.6
Total			2280	464	20.3

Table 26: Evaluation of F₁ hybrids at Bapatla centre

Hybrid	Cross Combination	Mean yield for the last 10 years (kg)	Highest yield and age (kg)	Yield of 1994 (kg)	Apple Weight (g)	Nut weight (g)	Shelling percentage (%)
1/7	1 x 40	8.0	16.8 (10th year)	10.0	60.5	6.2	32
2/3	39 x 129	12.7	23.8 (10th year)	1.3	50.0	6.0	30
2/15	1 x 40	10.6	12.3 (10th year)	6.0	60.0	5.5	30
3/10	56 x 40	9.0	14.2 (10th year)	10.0	30.0	7.0	27
3/13	56 x 40	12.7	26.5 (10 year)	8.4	25.0	5.0	30
3/25	56 x M-10/4	9.9	20.5 (10th year)	5.8	45.0	5.5	33
4/1	1 x 100	8.7	16.7 (12th year)	18.0	51.0	5.0	30
5/2	1 x M-10/4	8.5	17.5 (12th year)	4.9	60.0	5.2	28

SEm ± 1.32

C. D. - 4.60

Bhubaneswar

During the year 1995 hybridisation was carried out with the cross combinations presented in Table-27. The seedlings of F₁ progenies are to be planted during 1995-96.

1. BLA-139-1 (Early type) x P-3-2 (Panama, bold nuts, less vigorous type)
2. BLA-39-4 (Medium) x P-3-2 (Panama, bold nuts, less vigorous type)
3. V-5 (Vengurla cluster bearing) x H-1591 (Bold nut)

Jhargram

The clonal material of bold nut types Vetore-56 and Kankadi from Vengurla and VTH-711 (Brazilian type) from NRCC, Puttur were collected and planted during 1992 for hybridisation programme.

During 1993-94, 27 seedlings were obtained from different cross combinations and planted in the field. The details of hybridisation are presented in Table-28.

Madakkathara

Hybridisation was started during January 1993 with available materials. The crosses made were:

During 1994-95 the hybridisation process was continued. The details are furnished in Table-29 and 30.

Table 27: Crosses used for hybridisation at Bhubaneswar centre.

Cross Combination	Total No. of Crosses made	No. of nuts obtained	Percentage of success
Bhubaneswar-1 x VTH-711/4	400	24	6.0
Bhubaneswar-1 x Kankadi	400	12	3.0
Bhubaneswar cluster-1 x VTH-711/4	120	7	5.8

Table 28: Details of hybridisation (1993-94) at Madakkathara centre

Female parent	Male parent	Number of flowers pollinted	Initial set recorded	Fruits harvested 31.3.93	% of fruit harvested	Nuts sown	Nuts germinated	% germination
BLA-139-1	x P-3-2	23	20	15	65	15	9	60
BLA-39-4	x P-3-2	85	30	17	20	17	16	94
V-5	x H-1591	19	7	3	16	3	2	67

Table 29: Details of hybridisation (1993-94) at Madakkathara centre

Female parent	Male parent	Number of flowers pollinted	Initial set recorded	Fruits harvested 31.3.93	% of fruit harvested	Nuts sown	Nuts germinated	% germination
BLA-139-1	x P-3-2	293	150	59	39	—	—	—
BLA-39-4	x P-3-2	563	400	102	26	—	—	—
V-5	x H-1591	200	125	30	24	—	—	—

Table 30: Flowering and yield characters of hybrid seedings planted during 1993 (56 No.) at Madakkathara centre.

Hybrid No.	Female parent	Male parent	Date of flowering	Yield (g)
H-5	BLA-139-1	P-3-2	1st week of November	730
H-9	BLA-139-1	P-3-2	-do-	30
H-18	V-5	H-1591	-do-	520
H-50	BLA-39-4	P-3-2	2nd week of November	50

Vengurla

During the year 1994-95, the crossing work was undertaken (Table-31 and 32). The seedlings of F-1 progenies are to be raised and the same are to be field planted.

A total of 1431 F-1 hybrid was planted during the period 1983 to 1991 and are under evaluation. The performance of 11 promising hybrids planted during 1983 and 1984 is

given in Table-33.

The cumulative yield of past nine years was maximum in Hybrids No. 255 (92.3kg) and Hybrid No. 367 (85.7kg). The hybrid No. 367 produced the highest yield (18.9kg) followed by Hybrid No. 255 (14.7kg). The hybrid No. 255, 303, 320 and 367 were included in New Multilocation Trial.

Table 31: Details of hybridization (1994-95) at Vengurla centre.

Cross Combination	No. of nuts collected
Vengurla-2 x Bold type No. 1	56
Vengurla-2 x Bold type No. 22	54
Vengurla-2 x Bold type No. 65	38
Vengurla-5 x Bold type No. 1	38
Vengurla-5 x Bold type No. 22	48
Vengurla-5 x Bold type No. 65	64
Vengurla-4 x Hy. No. 2/16	56
Hy. No. 2/16 x Vengurla-4	44

Table 32: Details of F₁ progenies (1994) at Vengurla centre.

Cross Combination	No. of seedlings obtained
Vengurla-2 x Bold type No. 1	92
Vengurla-2 x Bold type No. 22	68
Vengurla-2 x Bold type No. 65	103
Vengurla-5 x Bold type No. 1	54
Vengurla-5 x Bold type No. 22	52
Vengurla-5 x Bold type No. 65	40
Vengurla-4 x Hy. No. 2/16	40
Hy. No. 2/16 x Vengurla-4	40

Table 33: Performance of some promising hybrids planted in 1983 and 1984 at Vengurla centre

Hy. No.	Cross combination	Cumulative yield last 9 years (kg)	yield range (kg)	Yield of reporting year 1994 (kg)	Nut wt. (g)	Shelling (%)
248	Vengurla-3 x M-44/3	55.3	3.4 - 10.4	3.3	6.2	28.0
255	Vengurla-3 x M-10/4	92.3	2.5 - 33.4	14.6	8.0	30.5
303	Vengurla-4 x M-10/4	55.1	2.4 - 12.7	12.7	8.9	27.0
320	M-44/3 x Vetore-56	59.9	3.0 - 14.8	13.0	7.4	31.6
367	Vengurla-4 x M-10/4	85.7	1.7 - 22.5	18.9	8.3	28.0
444	M-10/4 x Vetore-56	49.0	1.5 - 9.3	6.1	7.5	28.5
445	M-10/4 x Vetore-56	58.4	1.7 - 11.8	5.0	7.5	28.5
454	M 10/4 x Vetore-56	62.1	1.7 - 11.8	10.2	8.0	28.0
453	M 10/4 x Vetore-56	43.1	1.5 - 8.2	7.5	8.2	28.0
509	Vengurla-4 x M-44/33	56.6	1.0 - 9.3	7.1	6.0	29.0
304	Vengurla-4 x M-10/4	58.9	2.5 - 8.3	3.6	6.7	29.0

Vridhachalam

During the year 1995, the hybridisation was carried out as detailed below.

The seedlings obtained were planted during the period under report in the mainfield for studying their performance. The existing hybrid seedlings were also evaluated and the promising types are presented in Table-35. The hybrid No. 13 (M-26/2xM-26/1) produced the highest mean yield of 4.2kg / tree for the past five years. The same

Table 34: Details of hybridisation at Vridhachalam centre

Cross Combination	No. of nuts obtained (no.)
VRI-2 x ME-3/2	15
VRI-2 x M-1608	10
VRI-2 x 2/15	10
VRI-2 x 33/3	16
VRI-2 x 21/6	20
M-33/3 x ME-3/2	21
M-33/3 x H-2/15	21
M-33/3 x H-2/6	26

Table 35: Performance of F₁ hybrids at Vridhachalam centre

Cross combination	Hybrid No.	Mean yield for the 5 years (kg/tree)	Highest yield and age (kg/tree)	Yield of 1994 (kg)	Apple weight (g)	Nut weight (g)	Shelling (%)	Mean score of TMB damage
M-10/4 x M-26/1	H-10	3.3	3.6 (7 years)	3.2	75.2	6.2	30.4	4.00
M-10/4 x M-45/4	H-11	2.8	2.9	2.6	64.7	5.8	29.1	3.24
M-10/4 x M-75/3	H-12	2.2	2.5	2.4	73.0	5.1	32.9	3.64
M-26/2 x M-26/1	H-13	4.2	4.5	4.2	62.8	7.3	27.4	3.15
M-26/2 x M-45/4	H-19	3.0	3.2	3.1	47.2	6.3	26.9	4.00
M-26/2 x M-75/3	H-15	2.1	2.8	2.7	46.3	7.1	28.7	3.93
M-44/4 x M-26/1	H-16	2.9	3.0	2.9	68.9	5.7	32.3	4.00
M-44/3 x M-45/4	H-17	2.1	2.6	2.6	46.0	5.8	28.3	3.84

hybrid registered the highest yield (4.2kg tree⁻¹), bold nuts (7.3g nut⁻¹) and the lowest TMB damage (3.15%) during the reporting year. The shelling percentage was the high-

est in the Hybrid No. 12 (M-10/4 x M-75/3) 32.9 per cent followed by Hybrid No. 16 (M-44/3 x M-26/1) 32.3 per cent.

Agr. 1: NPK fertilizer experiment

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurla, Vridhachalam and Jagdalpur).

Objective

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

Treatments

N : O, 500, 1000g/plant
P₂O₅ : O, 125, 250g/plant
K₂O : O, 125, 250g/plant

Design

Three factorial confounded design with 27 treatment combinations.

Replications : Two

Bapatla

Two third dose of the treatments was

Table 36 : Growth parameters in NPK experiment at Bapatla centre

Treatments	Girth (cm)	Height (m)	Spread (cm)
N ₀	13.3	100.8	114.2
N ₁	13.7	114.6	139.5
N ₂	14.2	120.5	141.7
P ₀	13.6	106.3	123.4
P ₁	13.8	115.2	133.7
P ₂	13.8	114.5	138.4
K ₀	13.4	108.8	130.4
K ₁	14.0	116.8	134.7
K ₂	13.7	110.4	130.4

SEm ± for N, P, K 0.518 5.79
C.D. for N at (5%) = 18.9
SEm ± for P, K. = 6.53

applied during the second year of experiment. Flowering panicles were removed to enhance the vegetative growth. The growth parameters like girth, height and spread were recorded and statistically analysed (Table-36).

The data indicate that the girth of plant is linearly related to NPK levels. The maximum girth of 14.2cm was recorded in N₂ (1000g/plant). The girth of plant was least (13.3cm) in N₀ level. However, the differences among the treatments were non significant.

The plant height was found to be directly correlated to NPK levels. The maximum height of 120.5cm was recorded in N₂ and the minimum was 100.8cm (N₀) levels. The differences among the treatments were statistically on par. The plant spread in N₁ and N₂ were found to be significantly increased as compared to spread in N₀ level. The differences in plant spread among the phosphorus and potash levels were non significant. The interaction effect of different factors were found to be non-significant in respect of girth, height and spread. The interaction between NxP was found to be significant as regard to the spread of canopy.

Bhubaneswar

Nitrogen was given in the form of urea, P₂O₅ in the form of single super phosphate and K₂O in the form of muriate of potash. The data on plant height, girth and nut yield per plant were recorded (Table-37-39).

Table 37: Effect of different levels of NPK and their interactions on plant height (m) at Bhubaneswar centre.

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	1.43	1.64	1.62	1.53	1.54	1.47	1.59
N ₁	1.92	2.19	2.31	2.14	2.09	2.14	2.18
N ₂	2.22	2.41	2.57	2.40	2.26	2.43	2.52
Mean	1.85	2.06	2.16		1.96	2.01	2.09
K ₀	1.83	1.95	2.17				
K ₁	1.76	2.08	2.21				
K ₂	1.98	2.13	2.18				
SEm± for N, P, K	-	-	0.033				
C.D. (5%) for N, P, K	-	-	0.096				
SEm ± for NP,NK, PK	-	-	0.057				

Table 38: Effect of different levels of NPK and their interactions on plant girth (cm) Bhubaneswar centre

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	19.50	18.83	21.83	20.05	20.17	19.33	20.67
N ₁	25.16	27.00	26.50	26.22	26.17	25.17	27.33
N ₂	26.67	27.67	29.83	28.05	28.00	28.17	28.00
Mean	23.77	24.50	26.05		24.78	24.22	25.33
K ₀	24.33	25.00	25.00				
K ₁	23.67	23.50	25.50				
K ₂	23.33	25.00	27.67				
SEm± for N, P, K	-	-	0.5				
C.D. (5%) for N, P, K	-	-	1.5				
SEm ± for NP,NK, PK	-	-	0.8				

The height of the plant increased with application of N₅₀₀ and N₁₀₀₀ g/plant. Similar trend was observed to the application of P₂O₅ and K₂O. Significant variation was observed among the treatments. The girth of plant

showed linear response to dose of Nitrogen, P₂O₅ and K₂O. Nut yield increased significantly by N, P, K fertilizer application. Application of 1000kg of N/tree recorded significantly higher yield (0.4kg) over the control.

Table 39: Effect of different levels of NPK and their interactions on yield (kg/plant) at Bhubaneswar centre

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	0.16	0.23	0.21	0.20	0.21	0.19	0.21
N ₁	0.34	0.50	0.54	0.46	0.43	0.46	0.49
N ₂	0.51	0.57	0.59	0.60	0.55	0.58	0.56
Mean	0.34	0.44	0.45		0.39	0.41	0.42
K ₀	0.34	0.42	0.43				
K ₁	0.32	0.42	0.48				
K ₂	0.36	0.46	0.44				
SEm± for N, P, K	-	-	0.01				
C.D. (5%) for N, P, K	-	-	0.02				
SEm ± for NP,NK, PK	-	-	0.01				
C.D. (5%) for NP, NK, PK	-	-	0.03				

Table 40: Effect of different levels of NPK and their interactions on plant height (m) at Chintamani centre.

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	4.98	5.34	5.41	5.24	5.20	5.38	5.15
N ₁	4.82	5.24	5.31	5.12	5.25	5.24	4.87
N ₂	5.09	5.02	5.44	5.18	5.30	5.34	4.89
Mean	4.96	5.20	5.38		5.25	5.32	4.97
K ₀	4.79	5.19	4.90				
K ₁	5.38	5.26	4.97				
K ₂	5.59	5.51	5.05				
SEm± for N, P, K	-	-	0.13				
C.D. (5%) for N, P, K	-	-	NS				
SEm ± for NP,NK, PK	-	-	0.23				
C.D. (5%) for NP, NK, PK	-	-	NS				

Chintamani

During the year of report, the fertilizer were applied during the last week of Sep-

tember 1994. The grafts of the variety Ullal-1 were used in this trial and planted at a spacing of 7.5mx7.5m.

Table 41 Effect of different levels of NPK and their interaction on stem girth (cm) Chintamani centre

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	57.71	60.96	65.38	61.35	60.21	62.79	61.13
N ₁	57.79	60.88	64.29	60.99	61.63	62.83	58.50
N ₂	60.71	62.50	63.25	62.15	61.83	64.13	60.50
Mean	58.74	61.44	64.31		61.22	63.25	60.01
K ₀	58.00	61.42	64.25				
K ₁	61.88	61.04	66.83				
K ₂	56.33	61.88	61.83				
SEm± for N	-	-	0.70				
C.D. (5%) for N	-	-	NS				
SEm ± for P/K	-	-	0.70				
C.D. (5%) for P/K	-	-	2.05				
SEm ± for NP/NK/PK	-	-	1.21				
C.D. (5%) for NP/NK/PK	-	-	NS				

Table 42 Effect of different levels of NPK and their interactions on North-South canopy spread (m) at Chintamani centre.

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	7.44	7.56	7.79	7.60	7.44	7.62	7.73
N ₁	6.97	7.66	7.88	7.50	7.32	7.76	7.43
N ₂	7.29	7.77	7.98	7.68	8.14	7.38	7.53
Mean	7.23	7.66	7.88		7.63	7.59	7.56
K ₀	7.39	7.52	7.99				
K ₁	7.38	7.67	7.70				
K ₂	6.93	7.80	7.96				
SEm± for N/P/K	-	-	2.81				
C.D. (5%) for N/P/K	-	-	NS				
SEm ± for NP/NK/PK	-	-	4.87				
C.D. (5%) for N/NK/PK	-	-	NS				

All the recommended package of practices were followed for the crop. Data on plant height, stem girth and canopy spread

during 1994-95 and the nut yield per tree recorded during 1994 are presented in Tables 40-44.

Table 43 Effect of different levels of NPK and their interactions on East-West canopy spread (m) at Chintamani centre.

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	7.58	7.43	8.16	7.72	7.53	7.77	7.87
N ₁	4.00	7.97	7.80	7.67	8.04	7.89	7.07
N ₂	7.41	7.87	8.04	7.77	8.23	7.63	7.45
Mean	7.41	7.75	8.00		7.93	7.76	7.47
K ₀	7.64	7.80	7.04				
K ₁	7.55	7.83	7.63				
K ₂	7.04	7.90	7.73				
SEm± for N/P/K	-	-	2.86				
C.D. (5%) for N/P/K	-	-	NS				
SEm ± for NP/NK/PK	-	-	4.95				
C.D. (5%) for NP/Nk/Pk	-	-	NS				

Table 44 Effect of different levels of NPK and their interactions on nut yield (kg/plant) at Chintamani centre.

	P ₀	P ₁	P ₂	Mean	K ₀	K ₁	K ₂
N ₀	2.87	3.94	2.46	3.09	3.01	3.09	3.15
N ₁	5.01	4.35	4.24	4.53	3.88	4.39	5.33
N ₂	5.53	5.68	7.94	6.38	5.03	5.52	8.60
Mean	4.47	4.66	4.88		3.98	4.34	5.69
K ₀	4.51	4.55	4.34				
K ₁	3.65	4.24	6.08				
K ₂	3.77	4.22	6.65				
SEm± for N/K	-	-	0.20				
C.D. (5%) for N/K	-	-	0.59				
SEm ± for P	-	-	0.20				
C.D. (5%) for P	-	-	NS				
SEm ± for NP/NK/PK	-	-	0.35				
C.D. (5%) for NP/NK/PK	-	-	1.02				

No significant differences in plant height and stem girth due to either main effects of NPK or their interactions were observed.

However, stem girth differed significantly at different levels of phosphorus and potassium. The stem girth increased as the level of P increased whereas such effect was only upto K_1 level in potassium. No significant difference was observed either due to different levels of N, P, K or their interactions on tree spread.

Nut yield was significantly influenced by N, K and interactions of NP, NK and PK. There was significant linear increase in yield of nuts as N levels increased from zero gram N (N_0) to 1000g N/tree/year (N_2). In respect of K though the increase was linear, no significant difference was observed between K_0 and K_1 level (125g/tree).

Among NP interaction, N_2P_2 recorded the highest nut yield of 7.94kg/tree which was followed by N_2P_1 (5.68kg/tree) and the difference between them being non significant.

In NK interactions also, the highest level of NK combination (N_2K_2) was found to be superior in recording the nut yield (8.6kg/tree) which differed significantly in all other combinations. The least yield (3.01kg/tree) was recorded in N_0K_0 , which was on par with N_0K_1 , N_0K_2 and N_1K_0 . The yield difference between N_1K_0 and N_1K_1 ; N_1K_1 , N_2K_0 and N_1K_2 ; N_2K_0 , N_1K_2 and N_2K_1 were also found on par.

In PK interaction, the highest yield of 6.65kg/tree was recorded in P_2K_2 which was closely followed by P_2K_1 (6.08kg/tree) and

the difference between them being non significant. The rest of the combinations differed significantly, from P_1K_2 and P_2K_2 . The least yield was recorded in P_0K_1 (3.65kg/tree)

Jhargram

The NPK fertilizer experiment (old NPK trial) was concluded during the year 1993. The new NPK trial with clonal progenies of Jhargram-1 is in initial stage and the gap filling is to be done during the rainy season.

Madakkathara

Observations on plant height and girth were recorded during the month of September.

The maximum height(m) was recorded in the treatment $N_2P_1K_0$ (2.5m) followed by $N_0P_0K_2$ (2.3m) and the minimum in $N_2P_2K_1$ (1.5m). The maximum girth(cm) was recorded in the treatment $N_1P_1K_0$ (23.9cm) followed by $N_0P_0K_2$ (20.7cm) and the minimum in $N_1P_0K_1$ (14.2cm).

Vengurla

This trial was initiated in July, 1990 and is at initial stage. The growth parameters i.e. height, girth and the spread were recorded in June, 1994. It was observed that treatment combinations $N_2P_1K_1$ i.e., 500g N, 125g P and 125g K per tree per year recorded the maximum height (2.03m), girth (21.0cm) and spread (1.59 N-S and 1.59m E-W).

Vridhachalam

This experiment could not be carried out since the trees in the trial plot were uprooted and damaged in the heavy cyclone (during the year 1993). Presently sufficient area is not available in the farm to take up

sh planting to conduct the experiment.
his trial is to be relaid as soon as a suitable
nd is made available for the experiment.

gdalpur

As per the proposed programme for
rst year, trial on farmers field with different

levels of NPK was taken in order to assess the
nutritional requirement for increasing the
production of existing seedling plantation in
Bastar. After conducting the trials for an-
other one more year results of best treatment
combination with respect to yield and qual-
ity is to be reported.

Agr. 3: Foliar application of urea along with insecticides

(Bhubaneswar)

Objective

The main objective of this experiment is to study the efficacy of combined spray of urea and endosulfan on the yield of cashew and control of pests.

Treatments

- T1 - Soil applications of 500, 250, 250g N, P₂O₅ and K₂O respectively per tree + endosulfan spray thrice
T2 - Soil application as above+2% urea and endosulfan spray
T3 - Soil application as above+3% urea and endosulfan spray
T4 - Soil application as above+4% urea and endosulfan spray
T5 - Soil application of 250g N, 250g P₂O₅ and K₂O respectively+2% urea and endosulfan spray.
Desig : Randomised Block Design
Replication : Four

Bhubaneswar

The various concentration of urea and

endosulfan was applied coinciding with flushing, flowering and fruiting stages. The flowering area, yield of nuts, number of nuts per plant varied significantly. Maximum flowering panicles/sq.mt. was observed in T2 (23.12) treatment followed by T3 (22.15), T4 (20.33), T1 (19.43) and the minimum in T5 (18.87) treatments. Maximum number of nuts per panicle was recorded in T2 (1894.25) and the minimum in T5 (955.75) treatments. The yield per plant increased significantly in T2 (8.260kg/plant) and minimum in T5 (4.12kg/plant) treatment. The percentage of leaf nitrogen increased after spraying in all the treatments. However, maximum percentage of nitrogen was recorded in T3 (1.78%) followed by T2 and T4 (1.74%) treatments. The percentage of incidence of shoot tip caterpillar was maximum in T4 (16.52%) followed by T3 (16.06%) and minimum in T5 (9.95%) treatments (Table - 45).

This experiment was concluded at Bapatla, Jhargram, Madakkathara and Vridhachalam during the year 1993.

Table 45: Effect of foliar application of urea and endosulfan on yield, leaf nitrogen content and incidence of shoot tip caterpillar at Bhubaneswar centre.

Treatment	No. of flower panicle/ Sqm	No. of nuts/ plants	yield kg/ plant	% of leaf nitrogen			% of shoot damaged by shoot tip caterpillar
				Before spray	After spray	At harvesting	
T1	19.4	1180.8	5.2	1.5	1.6	1.5	10.0
T2	23.1	1894.3	8.3	1.5	1.7	1.6	14.3
T3	22.2	1735.8	7.8	1.4	1.8	1.7	16.1
T4	20.3	1623.8	7.1	1.4	1.7	1.7	16.5
T5	18.8	955.8	4.1	1.4	1.6	1.5	10.0
S.Em (+/-)	1.08	65.0	0.3	—	—	—	—
C.D.(5%)	—	200.3	0.9	—	—	—	—

Agr. 4: Spacing trial in cashew

(Jhargram and Vengurla)

Objective

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

8m x 8m	: Square
6m x 6m	: Square
6m x 6m x 6m	: Triangular
5m x 5m	: Square with selective thinning of 50-75% plants. During 1990, 50% plants were removed selectively.

Jhargram

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

Experimental details

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

Treatments:

5m x 5m	: Square with no thinning
5m x 5m	: Square with thinning of 50% plants (after 6 years in 1990)
5m x 5m	: Square with thinning of 75% plant (after 11 years)
10m x 5m	: Rectangular
10m x 5m	: Rectangular with thinning of 50% plants (after 6 years, done in 1990).
10m x 10m	: Square
10m x 10m x 10m	: Triangular
8m x 8m x 8m	: Triangular

The maximum number of nuts/plant (952) and yield/plant (4.0kg) were observed in plants spaced at 10m x 5m rectangular system with no thinning followed by 8m x 8m square system (846, 3.8kg). The minimum number of nuts/plant (460) and yield/plant (1.842kg) were observed in 5m x 5m square system with 75 per cent thinning and (2kg) in 5m x 5m square system with no thinning respectively. Regarding yield per block, the trees planted in 6m x 6m x 6m triangular system yielded the maximum 56.386kg followed by 49.8kg, 49.6kg and 46kg in 6m x 6m square, 5m x 5m square with no thinning and 5m x 5m square system with 75% thinning (to be thinned) respectively and the same was minimum (8.4kg) under 10m x 10m square system. The maximum cumulative yield per block for last seven years (1988-1994) of 284.1kg was observed in 5m x 5m square system with no thinning while the same was 268.6kg, 241.4kg and 239.07kg under 6m x 6m triangular, 6m x 6m square and 5m x 5m square system with 75 per cent thinning (to be thinned)

Table 46: Effect of different spacings on yield of cashew at Jhargram centre

Treatments	No. of plants/block	Canopy	No. of nuts/plant	Yield/plant (kg)	Yield/block (kg)	Cumulative yield block 1 1994 (kg)
5m x 5m square - no thinning	25	Medium	460	2.0	49.5	284.1
5m x 5m square - 50% thinning	13	"	536	2.1	27.6	149.0
5m x 5m square - 75% thinning	25	"	498	1.8	46.0	239.0
10m x 5m rectangular	8	"	952	4.0	32.4	153.0
10m x 5m rectangular - 50% thinning	4	"	693	2.9	11.8	70.8
10m x 10m square	4	"	521	2.1	8.4	45.0
10m x 10m x 10m triangular	7	"	509	2.2	15.4	78.4
8m x 8m Square	9	"	846	3.8	34.4	205.2
8m x 8m x 8m triangular	12	"	724	2.7	33.0	169.4
6m x 6m Square	16	"	631	3.1	49.9	241.4
6m x 6m x 6m triangular	22	"	609	2.6	56.4	268.5
5m x 5m square - selective thinning	13	"	503	2.0	27.1	163.6
S.Em (+/-)	—	—	57.20	0.23	4.49	—
C.D. at 5%	—	—	167.78	1.68	13.17	—

Table 47: Spacing trial on cashewnut: growth observations recorded in 1994 season at Vengurla centre

Treatments	Average height (m)	Average girth (cm)	Canopy spread (m)	
			E-W	N-S
T1	1.83	19	1.52	1.58
T2	1.82	18	1.38	1.53
T3	1.80	18	1.46	1.60
T4	1.64	16	1.25	1.34
T5	1.78	17	1.28	1.37
T6	1.66	15	1.25	1.27
T7	1.32	12	1.30	1.07
T8	1.73	15	1.30	1.46
T9	1.35	13	1.00	1.03
SEm±	0.08	0.027	0.10	0.981
CD @5%	0.24	2.76	N.S	0.240

respectively. The trees planted under 10mx10m square system recorded the minimum cumulative yield per block (45kg) (Table-46).

Vengurla

This trial was started in July, 1990 and is at initial stage. Growth observations were recorded in 1994 (Table-47). In the treatment T-1 (5x5m with no thinning plant population 400/ha) maximum height (1.83m), girth (19cm) and spread (E-W 1.52m and N-S 1.58m) were recorded. The yield data is to be recorded from next harvesting season (1995).

Agr. 5: Standardization of index leaf in cashew

(Bapatla)

Objective:

The main objective of this experiment is to standardize the index leaf in cashew for chemical analysis and foliar diagnosis to judge the nutritional status. For this purpose, three groups of plants were selected, each group consisting of three plants. A composite leaf sample was taken from all the three plants of a group. Individual leaves of third, fourth, fifth and sixth leaves were collected starting from the top of a crown at different growth stages.

1. Before fertilizer application.
2. 15 days after fertilizer application.
3. 30 days after fertilizer application
4. 60 days after fertilizer applications
5. Before flowering
6. Flowering and nut formation
7. Advanced fruiting stage

The fertilizer dose of 500g N, 125g P₂O₅

and 125g K₂O were applied as a single dose during the month of August.

Bapatla

The percentage of nitrogen in third leaf was significantly higher than in the fifth and sixth leaves (Table-48). Although in the third and fourth leaves higher concentration of P, K, Ca and Mg were recorded but they were statistically on par with that of in fifth and sixth leaves.

The distribution of in the leaves during different stages of sampling showed a regular pattern. Leaf samples collected before fertilizer application contained relatively low amount of nutrients which increased upto fourth stage of sampling (i.e. 60 days after fertilizer application) and thereafter decreased. The lowest values of all the nutrients were noticed at advanced fruiting stage.

Table 48: Nutrient composition in different leaves of a crown at various growth stages at B Centre.

Leaf position	% N	% P	% K	% Ca	% I
Third leaf	1.9	0.3	0.7	0.4	0
Fourth leaf	1.8	0.3	0.7	0.4	0
Fifth leaf	1.7	0.2	0.6	0.3	0
Sixth leaf	1.7	0.2	0.7	0.3	0
S. Em (+/-)	0.04	-	0.03	0.02	-
C. D. (5%)	0.2	NS	NS	NS	NS
Stages					
1. Before fertilizer application	1.6	0.1	0.5	0.2	0.2
2. 15 days after fertilizer application	1.8	0.2	0.7	0.3	0.2
3. 30 days after fertilizer application	2.1	0.2	0.8	0.3	0.2
4. 60 days after fertilizer application	2.4	0.3	1.0	0.4	0.3
5. Before flowering	2.2	0.2	0.9	0.4	0.3
6. Flowering and nut formation	1.4	0.2	0.6	0.3	0.2
7. Advanced fruiting stage	1.2	0.1	0.4	0.3	0.2
S. Em (+/1)	0.1	0.1	0.1	-	-
C. D. (5%)	0.4	-	0.1	0.1	-

Agr. 6: Cashew based cropping system

(Bapatla, Bhubaneswar, Madakkathara, Vengurla and Vridhachalam)

Objective:

The objective of this experiment is to find out a suitable intercrop to be grown in the initial years of cashew orchard.

During the XI Biennial Workshop 1993 it was decided that inter cropping with perennials should be dispensed off in all the centres and only annual crops be used.

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 - Ground nut, black gram, cowpea and red gram.

Spacing

Maing Crop..... Cashew 8m x 8m

Intercrops Annuals

10m x 5m N/S direction.

Design RBD

Replication Three

Bapatla

During Kharif 1994, Blackgram, Greengram, Cowpea, Cluster bean and groundnut were sown as intercrops in cashew under rainfed conditions. An yield of 1094kg/

ha (green pods) in cluster bean and 125kg/ha in cowpea were recorded. The remaining crops failed in the early stages of crop growth due to moisture stress.

In Rabi 1994, blackgram, greengram, sesamum, mustard and horsegram were sown as intercrops. Out of these intercrops, horsegram and Sesamum gave an yield of 187.5kg/ha and 62.5kg/ha respectively.

Table 49. Yield of intercrops at Bapatla centre.

Crop	Variety	Yield (Kg/ha)
Kharif - '94		
Blackgram	LGB-20	—
Greengram	PDM-54	—
Cowpea	Pusa Phalguni	125
Clusterbean	PNB	1094
Groundnut	TMV-2	—
Rabi - '94		
Blackgram	LGB-17	—
Greengram	LGG-407	—
Sesamum	Gauri	62.5
Mustard	Varuna	—
Horsegram	Palem-1	187.5

Table 50. Yield of intercrops at Bhubaneswar centre.

Treatment	Yield of intercrop (q/ha)
1. Cashew	—
2. Cashew + sesamum	1.80
3. Cashew + horsegram	4.60

Bhubaneswar

Sesamum and horsegram were sown as intercrops in the two year old cashew plantation. The yield recorded for sesamum was 2.0 quintal/ha and for horsegram 4.6 q/ha.

Vridhachalam

This experiment was laid out under rainfed conditions in an area of 1.5 acres during October '94. The annual intercrops viz., Co4 cowpea, Co6 redgram, Vamban-1, blackgram and VRI-2 groundnut were raised in the interspace of two year old VRI-2 cashew plantation. The trial was replicated thrice in a randomised block design and the mean yield recorded from the different intercrops is furnished below:

1. Co4 cowpea : 93.77kg/ha
2. Co6 redgram : 109.18kg/ha
3. Vamban-1 blackgram : 221.64kg/ha
4. VRI-2 groundnut : Nil

Due to scarcity of rains during the critical pod filling stage of growth of groundnut, the crop failed to produce any yield. The data on morphological observations of the main crop (cashew) are presented in (Table-51). The height and girth of the cashew trees were affected in the redgram field and the lowest was recorded in the control as compared to other treatments. The blackgram was found to be the best intercrop with the highest yield (221.6kg/ha) and without any deliterious effect on the main crop i.e., cashew.

Table 51. Intercropping in Cashew at Vridhachalam centre.

Treatments	Height of the tree (m)	Girth of the tree (cm)	Canopy spread	
			E-W (m)	N-S (m)
T1 (Cashew + Blackgram)	2.17	0.19	2.50	2.85
T2 (Cashew + Cowpea)	2.11	0.20	2.60	2.78
T3 (Cashew + Redgram)	1.91	0.18	2.50	2.83
T4 (Cashew + Groundnut)	2.17	0.26	2.60	2.79
T5 Control	1.79	0.18	2.81	

Hort. 1. Vegetative propagation trial

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurla and Vridhachalam).

Objective

The objective of the project is to find out suitable grafting method and the best month for cashew propagation under different agroclimatic conditions.

propagation was taken up with the objective to find out the best method and month of Vegetative propagation under Bapatla conditions.

Grafting methods tried:

1. Soft wood grafting; 2. Veneer grafting; 3. *In situ* grafting and 4. Flush grafting.

Treatments:

- A. Soft wood grafting - 45 day old root stock 90 days old scion.
B. Flush grafting - 45 day old root stock 21, 28, 35 and 42 day old scions.

Bapatla

The trial on vegetative methods of

Table 52. Percentage of success in soft wood grafting at Bapatla centre (1994-95).

Month	Soft wood grafting method			Temperature		Humidity	
	No. made	No. success	% of success	Maximum	Minimum	A.M.	P.M.
July	2000	720	36.0	34.2	25.5	74	59
August	2000	860	43.0	33.2	25.2	77	66
September	2000	1620	81.0	34.3	25.4	74	65
October	2000	680	34.0	30.5	24.0	89	83
November	2000	1005	50.2	28.3	20.9	89	81
December	2000	1050	52.5	29.3	17.2	86	65
January	2000	1560	83.0	27.9	18.1	91	71
February	2000	1628	81.5	22.8	19.5	90	70
March	2000	1520	76.0	32.0	20.5	87	68

"r" value at 5% 0.825

Table value at 5% 7 dt = 0.666

The percentage of success in soft wood grafting and flush grafting are presented in Table-52 and Table-53.

A. Soft wood grafting

The highest percentage of success was recorded in the months on January (83.0%), February (81.5%) and September (81%). The lowest percentage of success was recorded in the month of October (34%).

B. Flush grafting

Flushes of 35 and 42 day old when grafted during the months of December and January recorded the maximum percentage of success (22%-36%) (Table-52). It was also observed that under mist condition the percentage of success was higher than in partial shade.

From the above two experiments conducted, results indicate that soft wood grafting in cashew is most successful during the months of September, December and January under Bapatla conditions. The highest percentage of success in softwood grafting is attributed to the availability of well matured scion material and high humidity conditions.

Trench Method:

Vegetative method of propagation in trenches of zero energy sand humid chamber was tried even this year at the centre by digging 5m x 1m x 0.50m (LxBxH) trenches. The grafted plants were kept and the trench was covered with a white polythene sheet. The observations recorded (Table-54) indicate that the trench method was suitable for high graft

Table 53. Percentage of success in flush grafting at Bapatla Centre (1994-95)

Month	Age of the scion (days)	Under Mist		Under partial shade	
		No. made	No. success	No. made	No. success
October	21	100	9	100	11
	28	100	20	100	14
	35	100	22	100	14
	42	100	19	100	10
November	21	100	10	100	10
	28	100	12	100	16
	35	100	10	100	26
	42	100	22	100	22
December	21	100	20	100	18
	28	100	24	100	18
	35	100	34	100	24
	42	100	36	100	28
January	21	100	20	100	20
	28	100	26	100	26
	35	100	34	100	24
	42	100	22	100	28

success during February and March, which is attributed to high temperature and high humidity in the trench. It was also observed that not only well matured precured scion but, 45 day old flushes and panicles after harvest could also be used although with reduced success.

Bhubaneswar:

Soft wood grafting was carried out from

April 1994 to March 1995. The highest percentage of success was recorded in the month of July (77.9%) followed by August (73.1%) and September (72%). Minimum percentage of graft success was recorded in January (10%) and December (15%) months (Table-55).

Soft wood grafting with decapitated scions:

Softwood grafts were prepared during April, May and June by utilizing decapitated

Table 54. The graft success in trench method at Bapatla centre (1994-95).

Month	Percentage of success scion material			Weather in sand chamber	
	Matured precured scion	45 day old flushes	Panicles after harvest	2 PM	
				Humidity %	Temperature (°C)
December	68	54	-	88	30.5
January	86	60	-	93	32.0
February	87	63	48	92	25.0
March	84	65	53	90	37.5

Table 55. Vegetative propagation trial at Bhubaneswar centre (1994-95).

Month	No. of grafts made	Successful grafts	% of success	Temperature(°C)		Humidity	
				Max.	Min.	Max.	Min.
Apr.	300	126	42.0	36.4	24.7	88.5	68.0
May.	250	110	44.0	39.1	26.9	87.0	48.0
Jun.	650	290	44.6	33.5	26.0	89.0	68.0
Jul.	907	707	77.9	31.3	25.1	92.0	78.0
Aug.	1532	1121	73.1	31.0	25.0	92.0	79.0
Sep.	2600	1872	72.0	31.9	24.6	93.0	73.0
Oct.	780	374	47.9	31.6	22.9	91.0	67.0
Nov.	216	65	30.0	29.7	18.7	87.0	52.0
Dec.	120	18	15.0	29.1	13.5	86.0	34.0
Jan.	128	13	10.0	26.8	18.4	90.0	48.0
Feb.	100	30	30.0	31.8	18.7	92.0	45.0
Mar.	100	42	42.0	34.8	21.8	90.0	43.0

flower panicles. The graft success was observed after 60 days of grafting. The percentage of graft success was 39 per cent in April, 43.5 per cent in May and 48.0 per cent in June (Table-56).

Table 56. Graft success with decapitated flower, panicles at Bhubaneswar centre (1994).

Month	No. of grafts prepared	No. of grafts survived	% of success
April	200	78	39.0
May	200	87	43.5
June	200	96	48.0

Table 57. Percentage of graft success with matured scions with sprouted terminals at Bhubaneswar centre (1994).

Month	No. of grafts prepared	% of success
Sept.	100	68.0
Oct.	100	51.0
Nov.	100	35.0

Table 58. Percentage of success in soft wood grafting at Chintamani centre (1994).

Month	No. of grafts made	Successful grafts	% of success	Temperature (°C)		Humidity (%)
				Max.	Min.	
Jul.	100	30	30	29.1	20.2	67.65
Aug.	200	70	35	28.9	19.9	69.00
Sep.	500	275	55	29.9	19.7	63.65
Oct.	600	360	60	28.2	19.1	74.10
Nov.	300	180	60	25.4	15.3	74.40
Dec.	200	100	50	26.0	15.7	66.40

* Under low cost humidity chamber

** Temperature and RH given above refer to open condition

The percentage of graft success by utilizing sprouted matured scion sticks was maximum in September 68.0 per cent, followed by October 51.0 per cent and November 35.0 per cent (Table-57).

Chintamani

The success obtained in soft wood grafting furnished in Table-58. The highest percentage of graft success (60%) was obtained during October under open condition and during November in low cost humidity chamber. The least graft success was recorded in the month of July (30%).

Jhargram

a) Studies on soft wood grafting in cashew.

At the centre, from a last few years a high percentage of success in soft wood grafting was observed during June to October. As a result the trial was undertaken only during these months i.e., June to November, instead of taking round the year. This centre has already established the beneficial effect of low cost humidifier (humid chamber made of bamboo frame covered with polyethylene sheet) for soft wood grafting.

Two month old seedlings of Cv. Red Hazari were collected from Jhargram-1 variety. A good success of 49.0, 62.5 and 59.0 per cent was recorded in the months of June, August and September respectively (Table-59). The least percentage of success was observed during the month of November (17%).

b) Studies on success of *In-situ* grafting of cashew.

The programme was under taken in order to avoid the mortality problem of soft wood grafts in the field. The trial was conducted during the months of June to November, 1994 and the observations were recorded

(Table-60).

Highest establishment of 60 per cent was observed during the month of September followed by August (56%) and June (54%). The least percentage of success was observed during the month of November (10%).

Flush grafting

The experiment on flush grafting was initiated but percentage of success was success was found to be very poor.

Vengurla

The data on flush grafting at Vengurla is presented in Table-61 and indicates that

Table 59. Percentage of success in soft wood grafting at Jhargram centre (observations recorded two months after grafting) during 1994. (Age of rootstock - two months, Root stock - Red Hazari, Scion - Jhargram-1).

Month	No. of grafts made	Successful grafts	% of success	Temperature (°C)		Humidity (%)	
				Max.	Min.	Max.	Min.
Jun.	200	98	49.0	39.5	22.5	89.0	69.4
Jul.	200	79	39.5	33.5	24.0	90.5	77.8
Aug.	200	125	62.5	33.0	23.0	88.6	82.0
Sept.	200	118	59.0	34.5	21.0	89.5	70.0
Oct.	200	69	34.5	34.5	19.0	87.8	58.6
Nov.	200	34	17.0	31.5	13.0	80.6	52.4

Table 60. Percentage of success in *In-situ* grafting at Jhargram centre - 1994. (Age of rootstock - 1 year, Root stock - Red Hazari, Scion - BLA-39/4)

Month	No. of grafts made	Successful grafts	% of success	Temperature(°C)		Humidity (%)	
				Max.	Min.	Max.	Min.
Jun.	50	27	54.0	39.5	22.5	89.0	69.4
Jul.	50	23	46.0	33.5	24.0	90.5	77.8
Aug.	50	28	56.0	33.0	23.0	88.6	82.0
Sept.	50	30	60.0	34.5	21.0	89.5	70.0
Oct.	50	19	38.0	34.5	19.0	87.8	58.6
Nov.	50	5	10.0	31.5	13.0	80.6	52.4

the age of rootstock ranging between 21-35 days and scion flushes aged between 28-35 days were found to be the most suitable and recorded the maximum success. Further, it was also observed that when the rootstocks and scions of the same age were used for grafting, the maximum success under control conditions could be obtained. The humidity and temperature in the mistchamber were monitored regularly to maintain the relative humidity above 90 per cent. The maximum and minimum temperatures ranged between 31-34°C and 18-24°C, re-

spectively throughout the experimental period.

Vridhachalam

Grafting was carried out for eight months and July was found to be the best month for grafting with 73 per cent success. But, the scion availability was very low during this period. The months of January and February were found to be better with 60 and 61 per cent grafts take respectively, as the scion availability was also very high during these months (Table-62).

Table 61. Percentage of flush grafting success as influenced by age of rootstock and scion at Vengurla centre.

Age of rootstock (days)	Age of scion-flush (days)				Mean
	21	28	35	42	
14	47.00	69.67	71.00	58.00	64.20
21	76.33	77.33	78.67	66.33	74.67
28	70.67	80.68	81.67	61.33	73.59
35	58.67	69.67	83.67	63.00	68.75
42	52.00	77.33	78.67	67.67	68.92
Mean	60.93	74.95	78.74	62.37	

Table 62. Percentage of success in softwood grafting method at Vridhachalam centre (1994-95).

Month	No. of grafts made	Successful grafts	% of success	Temperature(°C)		Humidity	
				Max.	Min.	Max.	Min.
Jul.	450	330	73	35.4	26.8	79	51
Aug.	4800	2500	52	34.8	26.4	77	66
Sep.	3700	1890	51	35.1	27.6	70	67
Oct.	5200	2550	49	32.2	25.8	87	69
Nov.	2700	945	35	29.9	23.7	86	76
Dec	8000	3520	44	29.4	20.9	94	60
Jan.	8000	4800	60	30.6	21.6	84	71
Feb.	6700	4090	61	35.2	22.5	89	60

Hort. 3: Top working trial in cashew

(Bapatla, Bhubaneswar, Jhargram, Madakkathara, Vengurla and Vridhachalam)

Objective

The main objective of this experiment is to rejuvenate the unthrifty cashew trees.

Age of the top worked trees	Below 5 years 5-10 years 10-15 years 15-20 years
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Height of beheading	0.5m and 1.0m
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Bapatla

Top working was done during the months of October, November and December 1994 on 13 years old cashew trees. Beheading was done at 1.0m height in five trees, and the cut ends of the stumps were swabbed with Blitox. The scion material from BPP-6 was used for soft wood grafting and was followed on 30 day old shoots after sprouting.

Results reveal that beheading the trees during November at 1m height and grafting with scion during January with 80 per cent success, was found to be the most suitable for rejuvenation of old and unproductive cashew trees under Bapatla conditions.

Bhubaneswar

The top working trial was carried out during the months of May, June and July. 5-10 year old plants were beheaded at an height of 0.5 and 1.0m and cut ends of the plans were painted with bordeaux paste and swabbed with Lindane. The grafting operation was done on newly emerged 45 day old shoots during July, August and September. The

percentage of graft success was highest in August (80%), followed by in July (76) and in September (73)

Jhargram

Top working trial was carried out during different months in the previous years as the percentage of success was very poor, the trail was not undertaken during the year 1994.

Madakkathara

The experiment was started as an observational trial during 1988, to find out the possibility of rejuvenating unproductive cashew trees by top working with high yielding clones.

Age of the top worked trees :	(a) Between 5-10 years (b) Between 10-15 years.
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Height of beheading :	(a) 0.5m above ground level (b) 1.0m above ground level
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Season of grafting :	(a) April-June (b) September-October
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Maximum number of panicles/m² and number of nuts per panicle were noticed in Tree No. 1936 (8&9 no. respectively). The girth and spread was maximum in Tree No.

1945 beheaded at 0.5m height. Observations recorded are given in Table-63.

B. Large plot trial on top working

A large plot trial on top working consisting of 53 trees was taken up during 1991. Only 11 plants survived and others died due to stem borer attack.

The maximum height of 4.8m was recorded in Tree No. 1001 and maximum girth in Tree No. 1004 (140cm). Maximum number of panicles per sq.m was noticed in Tree No. 1001, highest number of nuts/panicle (7 nos.) was recorded in Tree No. 1004 (Table-64).

Vengurla

During the year 1988, it was found that 5-10 year old trees were suitable for rejuvenation by top working and produced good yield. During the fruiting season of 1994, ten trees (top worked) were reserved for recording the

yield. Five year old top worked trees of Vengurla-4 variety produced an average yield of 8.6kg tree with the maximum yield of 14.7kg /tree.

Vridhachalam

Top working was done during the months of August, September, October and November '94 on the 7 years old cashew trees. Beheading was done at 1m height in five trees and the cut ends of the stumps were swabbed with boredeaux paste. Regular inspection for the presence of stem borer damage was carried out and two months old shoots of the beheaded trees were used for grafting. The scion material from VRI-2 was used for the soft wood grafting.

Beheading the trees in the month of October at 1m height and grafting done during the month of November registered the highest success rate of 51.6 per cent.

Table 63. Growth parameters and flowering characters of top worked trees during 7th year after top working at Madakkathara centre.

Tree No.	Height (m)	Girth (cm)	No. of primary branches	Spread		No. of panicles sq. mt.	No. of nuts/panicle
				EW	NS		
1934	6.7	120	7	9.6	9.8	8	9
1936	**						
1945	5.1	150	5	7.9	8.1	7	8
2355	4.6	105	2	6.6	7.5	4	5
2357	4.4	95	2	7.5	6.4	7	6
2362	**						

** Died during 1994

Table 64. Growth and flowering characters of top worked trees during fourth year after top working at Madakkathara centre.

Tree No.	Height (m)	Girth (cm)	No. of primary branches	Spread		No. of panicle/sq. mt.	No. of nuts/panicle
				EW	NS		
1028	4.2	125	3	5.05	5.5	4	5
1029	*						
1034	4.2	105	3	5.9	5.9	8	5
995	4.0	120	4	5.4	6.3	5	6
1016	*						
1021	3.7	95		3.8	4.0	6	4
1042	*						
1015	3.2	110	1	3.6	3.95	4	3
1014	*						
1037	*						
1027	*						
1001	4.8	115	3	4.5	5.4	10	5
1011	3.6	110	4	4.8	4.5	5	4
999	*						
988	3.2	110	4	4.5	4.4	4	5
990	3.8	110	3	3.6	4.0	3	4
993	*						
1004	4.3	140	2	6.4	6.2	6	7
982	2.1	100	3	2.1	1.8	4	5

* Died

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

(Bapatla, Bhubaneswar, Madakkathara and Vengurla)

Objective

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.

Bapatla

Cashew trees from existing germplasm and hybrid seedlings were observed for dwarf and vigorously growing habit. The cashew seed nuts were collected from 8 less vigorous trees and raised in the nursery. The observations were collected on the growth parameters and presented in Table-65.

Bhubaneswar

The seeds collected from semitall and vigorously growing trees were collected and morphological characters were studied at nursery stage. The height of the plant varied

Table 65. Root stock screening for dwarfing character in the field at Bapatla centre.

Root stock	Height (m)	Girth (cm)
Type-1	32.0	2.5
Type-2	30.5	3.0
Type-3	31.5	2.8
Type-4	35.0	3.5
Type-5	28.5	2.5
Type-6	26.5	4.0
Type-7	24.0	3.5
Type-8	28.0	2.5

from 22.5cm to 39.0cm and the girth of the plant ranged from 0.52cm to 0.80cm (Table-66).

Madakkathara

The morphological and anatomical characters of the seedlings at nursery stage were studied during 1992-93.

The growth pattern of the less vigorous seedlings were compared with the vigorous types. Based on it, two varieties were selected and others were discarded. These varieties were further evaluated (Table-67).

The variety Kariyarappatta and the seedlings raised from seedling number 2286 were similar in appearance. These trees are

Table 66. Root stock screening for dwarfing character in the field at Bhubaneswar centre.

Root stock	Height (m)	Girth (cm)
Bhubaneswar - 1	25.00	0.71
BPT - 40	33.50	0.70
M-10/4	26.00	0.63
BPP-1	23.00	0.57
BPP-2	22.50	0.56
Vengurla-2	34.00	0.52
Vengurla-3	36.00	0.72
Vengurla-4	39.00	0.70
H-1600	25.00	0.68
H-1608	30.00	0.73
H-1610	35.00	0.76
BPP-8	33.00	0.80

in yielding stage and are to be studied further.

Vengurla

The seedlings raised from seednuts of

dwarf and vigorously growing trees were screened for morphological and anatomical characters at nursery stage. The root stock did not show much difference in height, girth, stomatal count and total phenols content. As

Table 67. Growth characters of vigorous and less vigorous cashew types in the field at Madakkathara centre.

Varieties/type	Height (m)	Girth (cm)	Spread		
			E-W	N-S	
Tree No. 2286	1	2.5	55	3.2	4.1
	2	2.0	60	3.7	4.2
Kariyarappatta	1	3.0	40	3.8	4.3
	2	2.5	35	4.2	4.6

Table 68. New Brazil collections at Madakkathara centre.

	Height (m)	Girth (cm)	Spread		No. of pr. branches
			E-W	N-S	
B1 *					
B2	2.0	30	2.0	2.5	3
B3	3.0	28	2.3	2.0	2
B4	4.0	30	1.7	1.8	—
B5	2.5	25	2.6	3.0	3
B6	3.0	30	2.5	2.0	2
B7	2.5	25	2.6	2.0	3
B8 *					
B9	1.0	15	1.2	0.5	3
B10	2.5	35	2.0	2.4	2
B11	2.0	25	2.2	1.8	2
B12	2.0	30	1.6	1.9	3
B13	2.0	10	1.0	1.0	2
B14	1.5	15	1.5	2.0	3
B15	1.5	25	1.5	1.4	2
B16	3.0	25	2.0	2.0	3
B17	2.0	25	1.3	2.3	3
B18	2.3	25	2.2	2.6	2
B19	1.3	15	1.0	1.0	2
B20		15	1.0	0.5	2

* Died

per the recommendation of Group Discussion, the grafts prepared on such rootstocks (dwarf and vigorous) were planted in the

field during August, 1992 and the growth parameters were recorded (Table-69).

Table 69. Rootstock screening for dwarfing in cashew at Vengurla centre.

<i>Root stock</i>	<i>Initial height Aug. 92 (m)</i>	<i>Height Jul. 94 (cm)</i>	<i>Increase in height (cm)</i>	<i>Girth Jul. 94 (cm)</i>
Vengurla -1	28	133	105	14.00
Vengurla-2	32	158	126	18.00
Vengurla-3	38	172	133	15.25
Vengurla-4	29	162	133	13.75
Vengurla-5	32	150	118	13.30
T-40	33	175	142	16.80
M-44/3	30	136	106	12.60
Hy. 1600	26	142	116	13.50
VTH 59/2	34	150	116	13.50
H-2/16	31	157	126	15.77
T-129	26	155	129	16.50
Hy. 1608	31	128	97	12.40
Hy. 1610	37	138	101	12.40
VTH 30/4	34	170	136	16.00
M-26/2	31	160	129	13.00
H-2/15	32	165	133	13.50

Ent. I. Chemical control of pest complex in cashew.

Objective

The objective of the trial is to find out an effective insecticide for the control of major and minor pests and to find out an alternative spray schedule for the management of tea mosquito by reducing the number of sprays and to identify the most critical sprays.

Technical programme

- T1 - Monocrotophos (0.05%) one spray at flushing stage
- T2 - Endosulfan (0.05%) one spray at flowering stage
- T3 - Carbaryl (0.10%) one spray at fruiting stage

- T4 - T1 and T2
- T5 - T1, T2 and T3
- T6 - T1 and T3
- T7 - T2 and T3
- T8 - Endosulfan 0.05% spray at flowering stage followed by neem oil 2% at fruiting stage.
- T10 - Carbaryl 0.1% spray at flowering stage followed by neem oil at fruiting stage.

- Design : RBD
- No. of trees/treatment : Two
- No. of replications : Three

Expt. 1: Control of major pests-Tea mosquito

(Chintamani, Jhargram, Madakkathara, Vengurla and Vridhachalam).

Chintamani

The incidence of tea mosquito was negligible. Only one spray at flushing was given and no significant difference among treatments in pretreatment counts was observed (Table-70). The incidence of tea mosquito was least in T5 (0.11) followed by T1 (0.12%), T6 (0.12%), and T4 (0.13%) treatments. They were on par with each other and differed significantly with other treatments 30 days after first spray. The second spray was not given. Only 15 out of 60 plants put forth panicles, as the lowest temperature during December and January was below normal. The incidence of tea mosquito, 30 days after

third spray (1994 observations), revealed that the incidence was least (0.21%), in the treatment T8 followed by T7 (0.24%), T9 (0.25%), T5 and T6 (0.26%) and were significantly superior over other treatments.

Jhargram

The modified treatments against tea mosquito were carried out at Jhargram and observations recorded at 30 days after each treatment is presented in the Table-71. The occurrence of tea mosquito was comparatively low in T5 receiving three rounds of spray i.e., one spray each at flushing, flowering and at fruiting stage which was signifi-

Table 70. Percent incidence of tea mosquito in different treatments before and 30 days after each spray at Chintamani centre.

Treatment	Pretreatment count	30 days after first spray	30 days After second spray
T1 = Monocrotophos (0.05%) one spray at flushing stage	0.33	0.12	4.25
T2 = Endosulfan (0.05%) one spray at flowering stage	0.37	1.03	2.15
T3 = Carbaryl (0.1%) one spray at fruiting stage	0.36	1.05	0.33
T4 = T1 and T2	0.37	0.13	1.17
T5 = T1, T2 and T3	0.38	0.11	0.26
T6 = T1 and T3	0.40	0.12	0.26
T7 = T2 and T3	0.32	0.82	0.24
T8 = Endosulfan (0.05%) at flowering followed by neem oil (2%) at fruiting	0.36	0.82	0.21
T9 = Carbaryl (0.1%) at flowering followed by neem oil (2%) at fruiting	0.35	0.67	0.25
T10 = Control	0.36	0.81	5.11
SEM±	0.12	0.13	0.15
CD at 5%	NS	0.39	0.46

Table 71. Incidence of Tea mosquito in different treatments at Jhargram (1993-94)

Treatment	Pre treatment count	Average percent of shoot/panicles/nut damaged 30 days after each treatment						Yield (Kg/tree)
		First spray		Second spray		Third spray		
T1	-	3.00	(0.612)	4.80	(0.763)	9.80	(1.033)	2.3 (0.5)
T2	-	3.85	(0.686)	7.45	(0.927)	11.70	(1.104)	2.5 (0.5)
T3	0.1	4.90	(0.771)	10.83	(1.073)	1.430	(1.185)	1.8 (0.5)
T4	-	0.76	(0.245)	2.10	(0.491)	3.12	(0.615)	3.5 (0.7)
T5	-	0.63	(0.212)	2.00	(0.476)	2.84	(0.584)	3.6 (0.7)
T6	-	2.75	(0.574)	3.28	(0.631)	5.36	(0.803)	3.2 (0.6)
T7	0.2	3.34	(0.638)	6.55	(0.877)	6.19	(0.855)	3.0 (0.6)
T8	-	5.93	(0.841)	12.40	(1.127)	18.74	(1.295)	1.2 (0.4)
CD 5%		0.029		0.032		0.044		0.06

Figures in parentheses indicate root transformed values

cantly superior over all other treatments. Low incidence of tea mosquito was noticed in T5 and T4 during first spray, T5, T4 and T6 treatments during second and third spray. During first spray, the mean percentage of tea mosquito incidence in T5 was 0.63 as compared to 5.93 in untreated control, 2.0 in T5 treatment and 12.40 in control during second spray and 2.84 in T5 treatment and 18.74 in control during third spray respectively. Treatment T4 was also effective against tea mosquito bug.

Maximum yield 3.6kg/tree was recorded in T5, treatment followed by 3.5kg/

tree in T4 treatment as compared to untreated control (1.2kg/tree). All the species of different predators were observed and recorded.

Madakkathara

First spray with monocrotophos (0.05%) was given during second week of November 1994 coinciding with the flushing. The second and third sprays were given with endosulfan (0.05%) and carbaryl (0.10%) at the time of panicle emergence and fruit set stages during the months of December 1993 and January 1994, respectively. Two additional treatments were also given as per the technical programme.

Tea mosquito infestation (mean percentage) recorded in the treated plots is presented in Table-72 and the mean score values are presented in Table-73.

Vengurla

The results were statistically nonsignificant thirty days after first spray (Table-74). Observations recorded after thirty days of second spray indicate that treatment T4

was significantly superior over the rest of the treatments. However, it was on par with T5 and T6 treatments. Observations recorded 30 days after third spray revealed that treatment T4 was significantly superior over rest of the treatments.

Vridhachalam

The initial trial laid out during 1993-94 as per the recommended treatments was com-

Table 72. Tea mosquito infestation in experimental plots (1993-94) at Madakkathara centre. (Percentage)

Treatments	After first spray		After second spray		After third spray		Yield (Kg/tree)
	Shoots	Panicle	Panicle	Nuts	Panicle	Nuts	
T1 Monocrotophos	12.25	10.14	20.25	22.15	28.25	25.10	3.9
T2 Endosulfan 0.05 as second spray	11.33	18.75	15.38	10.55	25.10	19.50	4.0
T3 Carbaryl 0.10% as second spray	12.83	20.10	27.15	20.55	20.85	11.55	2.9
T4 T1 & T2	9.54	12.35	10.00	8.70	17.35	15.75	4.5
T5 T1, T2 & T3	9.50	8.90	9.25	7.75	10.75	10.16	6.2
T6 T1 & T3	10.20	10.60	19.78	21.22	20.45	14.73	3.7
T7 T2 & Te	11.00	15.34	12.10	8.10	11.34	9.25	6.5
T8 Untreated control	10.75	20.40	28.90	23.12	32.85	27.50	3.0
T9 Endosulfan + neem oil	12.12	19.75	13.21	12.10	22.25	15.32	3.8
T10 Carbaryl + neem oil	11.00	21.00	14.13	10.20	16.75	17.25	4.8

Table 73. Tea mosquito infestation in experimental plots at Madakkathara centre. (mean of three replications).

Treatments	After first spray		After second spray		After third spray	
	Shoots	Panicle	Panicle	Nuts	Panicle	Nuts
T1	0.22	0.17	0.62	0.80	1.05	0.82
T2	0.20	0.35	0.44	0.36	0.92	0.72
T3	0.23	0.39	0.73	0.72	0.74	0.40
T4	0.16	0.26	0.29	0.31	0.59	0.56
T5	0.17	0.20	0.26	0.27	0.26	0.34
T6	0.18	0.22	0.58	0.70	0.50	0.50
T7	0.20	0.32	0.29	0.28	0.26	0.31
T8	0.23	0.42	0.65	0.77	0.79	0.99
T9	0.22	0.40	0.30	0.41	0.67	0.47
T10	0.18	0.42	0.36	0.32	0.52	0.57

pletely uprooted and damaged during December '93 cyclone. As per the suggestion of the Project Co-ordinator, fresh planting of

cashew grafts was done during the period under report and the trial is to be relaid in the ensuing year.

Table 74. Incidence of tea mosquito (*Helopeltis antonii*) in different treatment at Vengurla centre.

Treatment	Average percent shoot/panicles damaged 30 days after spray					
	First spray		Second spray		Third spray	
T1	2.26	(7.00)	2.34	(8.72)	6.44	(14.59)
T2	0.56	(2.49)	0.67	(4.69)	4.36	(11.97)
T3	0.58	(4.29)	0.87	(5.35)	5.10	(13.07)
T4	0.08	(1.34)	0.26	(2.89)	3.90	(11.38)
T5	0.25	(2.85)	0.50	(3.98)	4.44	(12.14)
T6	0.25	(2.86)	0.29	(2.09)	4.41	(12.14)
T7	1.24	(6.40)	1.33	(6.80)	4.03	(11.58)
T8	0.94	(5.40)	1.10	(5.87)	5.02	(12.95)
T9	1.79	(6.45)	1.35	(7.27)	4.49	(12.27)
T10	1.69	(7.24)	1.79	(7.79)	8.21	(16.67)
S. E. (M) +/-	1.49		0.74		0.756	
C.D. (0.05)	NS		2.19		2.24	

Figures in parentheses are arcsin values

Expt. 2: Control of minor pests.

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurala and Vridhachalam)

Bapatla

The experiment was laidout and conducted on the clonal progeny of BPP-1 and BPP-2 selected in randomised block design, replicated thrice with eight treatments.

Treatments:

- T1 - Monocrotophos (0.05%) - one spray at flushing stage
 - T2 - Endosulfan (0.05%) - one spray at flowering stage
 - T3 - Carbaryl(0.10%)onespray at fruiting stage
 - T4 - T1+T2
 - T5 - T1, T2 and T3
 - T6 - T1 and T3
 - T7 - T2 and T3
 - T8 - Control - Water spray
- No. of trees per treatment : Two

Three sprays were given in 30 days interval coinciding with flushing, pancile emergence, fruit and nut development duly recording pre-treatment counts prior to spray and post - treatment counts at 10 days interval. Data was recorded in a square of 0.25m area on each side of the tree (East, West, North and South) on the incidence of the following pests.

1. Leaf and blossom webber - *Lamida monocusalis* Wlk.
2. Leaf miner - *Acrocercops syngamma* Meyrick.

3. Weevils - *Myllocerus* sp.
4. Apple and nut borer - *Nephoteryx* sp.
5. Shoot tip and inflorescence caterpillar - *Hipotima haligramma*.

Among all the treatments, T5 coinciding the three phases of crop growth i.e., foliage, panicle emergence and fruit and nut development recorded minimum percentage infestation of *Myllocerus* sp. and *Hipotima haligramma* during juvenile phase (Table-75). Similarly *Lamida monocusalis* and *Nephoteryx* sp. were recorded to be least in T5 trees which reflected in recording maximum yield (16.5kg) (Table-76).

The necessity of three sprays at all the developmental phases was experienced. Incidence of hairy caterpillar i.e, *Metanastria hyrtica* feeding on leaves and *Euproctis sintillans* feeding on panicles and peanuts and developing nuts and apples, and mealybugs, congregating on panicle stalks and aphids on green nuts sucking sap and causing black scorches, were also recorded.

Natural enemies:

Stray incidence of *Apanteles* sp. on *Lamida monocusalis* in the month of December '94, *Chrysopa* predator on mealybugs in the month of February '95, and Coccinellid beetles on aphids on nuts during March '95 were also recorded.

Table 75: Abstract of pest incidence during 1994-95 at Bapatla centre.

Treatment	Pre-treatment count		Population of <i>Myloecerus</i> sp.		Incidence of <i>Hipotima haligramma</i>		II. Post-treatment counts after								
	I. Post-treatment count after		II. Post-treatment count after		I. Post-treatment count after		II. Post-treatment counts after								
	10 days	20 days	10 days	20 days	10 days	20 days	20 DAS	20 DAS							
	of second	30 days	10 days	% H.h.	H.h.	S.T.D.	H.h.	S.T.D.	H.h.	% of	% of	H.h.	S.T.D.	H.h.	
	third	after	after	of	spraying	spraying	spraying	spraying	spraying	spraying	spraying	spraying	spraying	spraying	
T1 Methyl parathion at flushing	1.50	—	3.60	3.50	2.20	4.50	3.00	0.54	6.31	2.85	14.50	9.40	2.08	2.52	4.00
T2 Monocrotophos 0.05% at flushing	1.50	2.00	9.20	7.50	3.20	5.00	5.00	2.90	8.63	7.63	10.55	10.80	5.35	4.91	3.00
T3 at fruiting															
Carbaryl 0.1%	2.30	3.70	7.50	6.50	6.80	7.50	10.20	4.00	13.25	6.26	10.42	8.50	3.72	3.72	2.55
T4 T1 + T2	0.80	1.80	2.70	4.70	1.80	1.50	2.00	1.80	4.66	3.81	12.49	11.50	4.23	4.20	3.50
T5 T1 + T2 + T3	7.00	3.70	4.30	9.23	10.33	1.80	5.30	2.30	10.25	8.53	8.40	12.50	2.84	2.84	3.50
T6 T1 + T3	1.70	1.00	8.30	7.30	8.50	3.30	12.00	1.85	10.55	7.52	10.82	10.50	5.07	6.50	3.20
T7 T2 + T3	2.30	1.00	8.70	9.00	8.50	3.30	12.00	5.33	8.50	6.30	10.8	11.81	2.52	2.52	3.00
T8 Control	5.00	3.00	13.23	15.00	13.00	7.20	13.0	4.22	9.50	9.50	10.8	15.10	5.14	6.15	7.00

(*T1 treatment not as per workshop recommendations)

H.h. : *Hipotima haligramma*
 S.T.D. : Shoot tips damaged
 D.A.S. : Days after spray

Table 76. Abstract of pest incidence in fruiting season at Bapatla centre.

Treatment	Pretreatment count	Mean % of damaged nuts by leaf and blossom webber		Mean % of damaged nuts by apple and nut borer	Yield Kg/tree
		Second spray	Third spray	After third spray	
T1 Monocrotophos (0.5%) of flushing	1.00	1.20	5.00	6.71	16.1
T2 Endosulfan 0.05% at flowering	2.00	1.96	3.55	8.81	10.5
T3 Carbaryl 0.1% at fruiting	3.10	2.80	2.75	5.74	14.6
T4 T1 + T2	1.00	1.24	1.50	12.50	15.2
T5 T1 + T2 + T3	8.50	4.44	5.25	5.50	16.5
T6 T1 + T3	4.50	5.11	5.00	10.71	11.9
T7 T2 + T3	2.50	2.75	2.80	12.70	16.2
T8 Control (Water spray)	6.50	10.06	11.07	16.71	10.9

Among all the treatments, T5 treated trees (i.e., the trees which received three sprays coinciding with phases of flushing, panicle emergence and peak time of nut development with monocrotophos twice and carbaryl as third spray), recorded the least incidence of major pests and maximum yield proving the efficacy and necessity of three sprays.

As previous and current results revealed the parasitisation of *Lamida monocusalis*, a major pest, upto 50 per cent, commencing from July to December, the first spray can be taken up by December-January to get an effective control over the pest and thus encouraging natural enemies too.

Bhubaneswar

All the treatments were carried out during December '94, February '95 coincid-

ing with flushing, flowering and fruiting stage of the crop respectively. Except shoot tip borer and inflorescence thrips, the incidence of other pests was negligible. The percentage incidence of shoot tip borer before and 30 days after first and second spray is presented in Table-77. The data revealed that the percent shoot infestation by shoot tip borer varied from 8.13 to 15.92 prior to imposition of treatment. During post treatment period all the treatments schedules recorded significantly lower shoot infestation compared to control at 30 days after first spray. Least incidence of shoot tip borer was recorded in T1 (1.73%) followed by T6 (1.96%) and T5 (2.32%) treatments which received first spray with monocrotophos. The damage due to shoot tip borer after second and third spray was negligible possibly due to its low population build up.

Table 77. Effect of different insecticides on shoot tip borer incidence at Bhubaneswar.

Treatment	* % shoot infestation by shoot tip borer			
	Pre-treatment count	30 days after first spray	30 days after second spray	
T1	14.71 (3.74)	1.73 (1.54)	0.69 (1.00)	
T2	12.85 (3.62)	6.05 (2.54)	0.00 (0.70)	
T3	8.13 (2.90)	3.60 (1.97)	0.75 (1.00)	
T4	15.92 (3.97)	2.83 (1.62)	0.72 (1.01)	
T5	14.27 (3.82)	2.32 (1.54)	0.83 (1.04)	
T6	12.25 (3.47)	1.96 (1.56)	0.75 (1.00)	
T7	14.82 (3.86)	3.54 (1.97)	2.25 (1.52)	
T8	11.43 (3.39)	4.02 (1.92)	1.48 (1.20)	
T9	13.62 (3.71)	3.06 (1.87)	0.72 (1.01)	
T10	13.02 (3.65)	9.82 (3.20)	3.43 (1.73)	
"F" test	NS	Sig.	NS	
SEm	—	0.46	—	
C.D. (0.05)	—	0.96	—	

* Mean of three replications

Figures in parentheses are $\sqrt{x + 0.5}$ transformed means

The incidence of inflorescence thrips (yellow thrips and black thrips) after second and third spray was recorded (Table-78). The population of yellow thrips was non-significant among the treatments at 30 days after first, second and third spray. All the treatments showed a reduction in yellow thrips population after third spray over the pre-treatment count. The treatment T5 which received two sprays at flushing and flowering stage experienced the least population (1.4 no./inflorescence) of yellow thrips as compared to control (3.66 no./inflorescence) at 30 days after second spray. Significant difference in the population of black thrips was observed among the treatments at 30 days after third spray. Lowest population of black thrips 1.91 no./inflorescence was observed in T5.

The natural enemies observed in the experiments were spiders (unidentified), mirid bugs (unidentified), lady bird beetle (*Verania discolor* F., *Verania cincta* Gorh. and *Menochilus sexmaculata* F.). Among the pollinators black ants (*Camponotus* sp.) were predominant. The effect of different treatments on the population of spiders (irrespective of species) is presented in Table-79. The population of spiders per quadrant was significant only at 30 days after first spray. Maximum population of spiders was observed in T10 (control) after each spray indicating the influence of the insecticidal treatment on spider population.

Chintamani

The treatments did not differ significantly in pretreatment observations with re-

Table 78. Effect of different insecticides on inflorescence thrips incidence at Bhubaneswar

Treatment	* Mean thrips population/inflorescence				
	Pre-treatment count (Before second spray)	30 days after second spray		30 days after third spray	
	YT	YT	BT	YT	BT
T1	2.09 (1.60)	1.58 (1.38)	1.16 (1.23)	1.25 (1.31)	3.33 (1.93)
T2	1.45 (1.38)	1.91 (1.53)	1.54 (1.33)	1.21 (0.09)	3.24 (1.91)
T3	1.41 (1.33)	2.25 (1.64)	0.83 (1.07)	0.87 (0.08)	2.04 (1.57)
T4	1.83 (1.50)	1.52 (1.38)	2.12 (1.56)	0.83 (1.11)	3.91 (2.09)
T5	1.29 (1.31)	1.41 (1.46)	1.29 (1.32)	0.37 (0.91)	1.91 (1.54)
T6	1.95 (1.56)	1.87 (1.52)	2.66 (1.76)	1.16 (1.25)	2.87 (1.83)
T7	1.45 (1.39)	1.49 (1.39)	0.99 (1.17)	1.08 (1.19)	2.83 (1.81)
T8	1.75 (1.49)	1.99 (1.55)	1.33 (1.28)	1.24 (1.30)	2.87 (1.81)
T9	1.32 (1.26)	1.87 (1.49)	1.37 (1.27)	1.20 (1.30)	2.62 (1.75)
T10	1.41 (1.36)	3.66 (2.03)	2.87 (1.80)	1.95 (1.56)	5.20 (2.38)
"F"	NS	NS	NS	NS	Sig.
SE m	—	—	—	—	0.20
C.D. (0.05)	—	—	—	—	0.42

* Mean of three replications

Figures in parentheses are $\sqrt{x+0.5}$ transformed means

YT - Yellow thrips, *Frankliniella schultzi* Trybom.

ET - Black thrips, *Haplothrips ceylonicus* Schumtz.

Table 79. Effect of different insecticides on spider population at Bhubaneswar centre.

Treatment	* % shoot infestation by shoot tip borer			
	Pre-treatment count	30 days after first spray	30 days after second spray	30 days after third spray
T1	0.04 (0.72)	0.20 (0.83)	0.41 (0.94)	0.62 (1.05)
T2	0.04 (0.72)	0.12 (0.78)	0.29 (0.88)	0.74 (1.10)
T3	0.08 (0.75)	0.20 (0.83)	0.37 (0.93)	0.37 (0.92)
T4	0.08 (0.75)	0.08 (0.75)	0.58 (1.02)	0.58 (1.17)
T5	0.16 (0.80)	0.20 (0.83)	0.41 (0.94)	0.33 (0.90)
T6	0.24 (0.85)	0.20 (0.83)	0.54 (1.01)	0.33 (0.90)
T7	0.20 (0.83)	0.54 (1.01)	0.41 (0.94)	0.45 (0.97)
T8	0.04 (0.72)	0.20 (0.83)	0.45 (0.96)	0.58 (1.03)
T9	0.04 (0.72)	0.12 (0.78)	0.33 (0.70)	0.37 (0.92)
T10	0.16 (0.80)	0.58 (1.03)	0.66 (1.07)	0.75 (1.11)
"F" test	NS	Sig.	NS	NS
SEm	—	0.06	—	—
C.D. (0.05)	—	0.13	—	—

* Mean of three replications

Figures in parentheses are $\sqrt{x+0.5}$ transformed means

spect to leaf miner. The least incidence of leaf miner (0.29%) was noticed in T5 and T1 treatments followed by T6 (0.31) and T4 (0.35) treatments and differed significantly with all other treatments. The incidence of leaf thrips was least in T1 and T6 (0.28 no./leaf) followed by T5 and T4 (0.29%) treatments and were on par with each other and differed significantly with all the other treatments 30 days after first spray. Since most of the trees did not flower during the year, the second spray was not given. The inflorescence thrips population was least in T9 (0.28 no./panicle) followed by T8 (29.0), T7 (0.30), T6 (0.37) and

T5 (0.40) treatments and differed significantly with other treatments (Table-80).

Jhargram

The trial was conducted at Jhargram with eight modified treatments. The effectiveness of the treatments was assessed by the percentage of damage after each treatment. The incidence of leaf and blossom webber and leaf minor and apple and nut borer was comparatively low in T5 followed by T4 and T6 treatments. The mean incidence of leaf minor was least in T4 and T1 (1.09) followed by T5 (1.10) and T6 (1.12) treat-

Table 80. Incidence of minor pests in different treatments before and 30 days after each spray at Chintamani centre.

Treatments	Pre-treatment		30 days after first spray		3 days after third spray	
	Leaf Miner (%)	Leaf thrips No./leaf (%)	Leaf Miner (%)	Leaf thrips No./leaf (%)	Inflorescence thrips / panicle	
T1 = Monocrotophos (0.05%) one spray at flushing stage	2.88		2.53	0.29	0.28	6.17
T2 = Endosulfan (0.05%) one spray of flowering stage	2.83		2.60	6.26	4.61	4.29
T3 = Carbaryl (0.1%) one spray at fruiting stage	2.86		2.51	6.60	4.95	0.47
T4 = T1 and T2	3.00		2.48	0.35	0.29	4.69
T5 = T1, T2 and T3	2.65		2.52	0.29	0.29	4.69
T6 = T1 and T3	2.77		2.71	0.31	0.28	0.37
T7 = T2 and T3	2.98		2.46	6.68	4.93	0.30
T8 = Endosulfan (0.05%) at flowering followed by neem oil (2%) at fruiting	2.85		2.27	6.40	5.04	0.29
T9 = Carbaryl (.01% at flowering followed by neem oil (2%) at fruiting	2.87		2.71	6.05	5.21	0.28
T10 = Control	2.89		2.56	6.36	4.99	5.80
SEM (+/-)	0.41		0.56	0.31	0.33	0.47
CD (0.05)	NS		NS	0.92	0.98	1.41

Table 81. Incidence of minor pests in different treatments (Average percent) at Jhargram centre (1993-94).

Treatments	Pre-treatment count (mean score)		After first spray		After second spray			Yield (Kg/tree)
	Leaf Miner	Leaf & Blossom Webber	Leaf Miner	Leaf Blossom Webber	Leaf Miner	Leaf & Blossom Webber	Apple & nut borer	
T1	-	-	1.09 (0.320)	1.18 (0.338)	4.27 (0.721)	6.17 (0.855)	5.23 (0.794)	2.0
T2	-	-	12.04 (1.115)	2.85 (0.585)	5.98 (0.841)	4.28 (0.693)	4.00 (0.699)	2.2
T3	-	-	12.86 (1.146)	5.68 (0.838)	9.04 (1.002)	9.76 (1.032)	1.90 (0.462)	1.9
T4	-	-	1.09 (0.319)	1.09 (0.320)	1.86 (0.955)	1.84 (0.417)	0.66 (0.220)	3.2
T5	0.2	-	1.10 (0.322)	1.29 (0.342)	1.79 (0.456)	1.90 (0.462)	0.53 (0.185)	3.2
T6	-	-	1.12 (0.324)	1.26 (0.354)	4.05 (0.706)	5.95 (0.842)	0.99 (0.299)	3.1
T7	-	-	10.82 (1.072)	5.92 (0.840)	6.00 (0.845)	7.50 (0.930)	1.16 (0.339)	2.9
T8	-	-	13.03 (1.147)	8.97 (1.078)	10.45 (1.059)	10.37 (1.056)	6.43 (0.871)	1.8
CD at 5%			0.046	0.032	0.039	0.057	0.021	0.1

Figures in parentheses indicate root transformed values.

Table 82. Occurrence of miner pests in experimental plots at Madakkathara centre.

Treatments	Pre-treatment count			After 1st spray		After 2nd spray			After 3rd spray		
	Leaf miner		Leaf roller	Leaf miner		Leaf roller shoots	Blossom Webber	Thrips mean number	Mean score	Thrips mean score	Mean score
	Shoot infestation (%)	Leaves infested (%)		Shoots	Leaves						
T1	11.67	31.67	4.44	4.50	15.75	3.80	8.75	12.20	0.36	14.52	0.33
T2	8.33	15.00	6.00	26.26	25.40	10.00	3.25	4.75	0.13	10.33	0.30
T3	12.33	20.56	6.33	28.10	30.00	8.20	9.25	9.50	0.26	7.20	0.18
T4	8.33	15.00	4.75	5.00	18.20	3.25	4.15	5.10	0.15	9.54	0.26
T5	17.33	23.33	11.74	3.85	19.55	4.00	3.52	4.88	0.15	5.15	0.13
T6	10.00	16.67	6.36	4.00	15.75	2.75	5.50	13.63	0.59	7.00	0.21
T7	7.33	18.33	8.33	23.55	30.23	7.52	2.85	4.10	0.12	4.75	0.16
T8	8.93	13.33	5.42	27.45	32.35	8.00	9.13	14.25	0.50	14.90	0.36
T9	8.92	21.67	8.00	24.75	28.90	6.95	4.13	5.00	0.16	11.43	0.25
T10	11.67	21.67	5.11	25.00	30.00	8.55	3.95	4.33	0.14	10.66	0.25

Table 83. Occurrence of natural enemies (mean number of quadrant) at Madakkathara centre.

Treat- ments	Pre-count		After first spray				After second spray				After third spray			
	Ants	Spi- ders	Ants	Spi- ders	Mirid bugs	Chry sopa	Ants	Spi- ders	Mirid bugs	Chry sopa	Ants	Spi- ders	Mirid bugs	Chry sopa
T1	1.50	0.75	1.00	0.75	1.33	0.50	2.50	2.50	3.65	0.70	2.75	2.00	2.75	2.00
T2	0.75	0.50	2.50	2.75	1.75	0.75	1.25	1.20	2.00	1.55	1.75	2.20	1.50	1.60
T3	1.25	1.50	2.75	2.80	1.86	1.25	3.00	3.50	4.00	2.00	1.20	1.50	2.25	1.00
T4	0.75	1.00	1.15	0.80	1.25	1.00	0.88	0.90	2.10	0.80	2.35	2.00	1.75	2.50
T5	1.33	1.75	1.00	0.70	1.30	0.00	1.00	1.00	2.30	1.00	0.75	1.25	1.00	1.50
T6	1.25	1.00	0.70	0.75	0.98	0.25	2.50	1.60	3.00	2.10	1.00	1.25	1.25	1.40
T7	1.00	2.00	2.00	1.55	1.80	0.70	1.25	1.50	2.25	1.25	0.80	0.90	1.10	1.50
T8	1.50	0.75	3.17	3.00	2.50	1.10	3.75	3.62	4.20	2.75	3.30	2.75	3.25	3.00
T9	1.00	1.25	2.15	3.15	2.00	1.00	2.25	1.70	1.80	1.45	2.00	1.00	1.60	1.25
T10	0.75	1.00	2.25	2.85	1.92	0.75	1.75	1.00	2.25	1.20	1.50	0.75	1.54	1.00

ments during the first and T5 (1.79), T9 (1.86) during second spray, and so also in the incidence of leaf and blossom webber was least in T4 treatment.

Maximum yield per tree was recorded in T5 (3.25kg) and in T4 treatments as compared to the untreated control (1.7kg/tree) (Table-81).

Madakkathara

Observations on the incidence of tea mosquito, other minor pests viz., leaf miner, leaf roller, blossom webber, natural enemies and beneficial insects were recorded one day before spraying and one month after each spray. All the species of ants and spiders present at the time of observation were counted in each quadrant.

The population of minor pests viz., leaf miner, leaf roller, blossom webber and flower thrips was assessed in the treated and untreated plots (Table-82). The variations in the natural enemy population in treated and

Table 84. Incidence of flower-thrips on cashewnut at different stages at Vengurla centre.

Treatment	Average nut surface damaged at		
	Peanut stage	Pebble stage	Matured stage
T1	19.92 (24.52)	20.35 (26.82)	20.23 (26.73)
T2	18.67 (25.62)	20.39 (26.85)	22.11 (28.06)
T3	19.96 (24.32)	17.06 (24.40)	16.60 (24.07)
T4	16.44 (23.91)	17.39 (24.68)	15.49 (23.18)
T5	16.37 (23.86)	12.10 (20.39)	12.38 (20.61)
T6	17.60 (24.80)	14.59 (22.44)	11.74 (20.06)
T7	15.85 (23.45)	11.60 (19.94)	12.14 (20.38)
T8	17.30 (24.60)	14.99 (22.79)	13.53 (21.31)
T9	16.93 (24.30)	17.70 (24.90)	14.71 (22.52)
T10	23.10 (28.75)	25.25 (30.18)	25.78 (30.51)
S.E.+/ C.D. 5%	-0.177 0.52	0.166 0.49	0.49 1.45

Figures in parentheses are arcsin values.

untreated plots were recorded. (Table-83).

Vengurla

The observations on flower thrips were recorded in each quadrant at peanut stage, pebble stage and matured nuts in 0-4 scale as given below

- 0 - No damage
- 1 - 1-25 percent surface area damaged
- 2 - 26-50 percent surface area damaged
- 3 - 51-75 percent surface area damaged
- 4 - 76-100 percent surface area damaged

Results were statistically significant at all the three stages. At peanut stage and pebble stage treatment T7 was significantly superior to rest of the treatments and at par with T5 and T4 (Table-84). The observations recorded on matured nuts indicated that treatment T6 was significantly superior over rest of the treatments and was at par with T7 and T5.

Vridhachalam

Fresh planting of cashew grafts was taken up to relay this trial.

Expt. 3: Control of foliage/inflorescence pests

(Bapatla, Vengurla and Vridhachalam)

Objective

To find out the effect of natural neem products on the control of foliage and inflorescence pests.

Treatments: Eight

- T1 - Neem oil (2%) spray
- T2 - Neem seed kernel extract (5%) spray
- T3 - Neem cake extract (5%) spray.
- T4 - Neem leaf extract (2%) spray.
- T5 - Monocrotophos, endosulfan, carbaryl.
- T6 - Commercial neem products + endosulfan (0.5%) + carbaryl (1%).
- T7 - Pongamia oil + carbaryl) (1%)
- T8 - Control.

(T6 and T7 treatments as per the XI Biennial Workshop recommendation)

Design : RBD
Replications : Three
No of trees : Two per treatment

Bapatla

Maximum reduction in the percentage of damaged nuts by *Lamida monocusalis* and

Nephoteryx sp. was recorded in the trees treated with neem cake extract (5%).

Neem leaf extract (2%) exhibited poor repellent action towards pest incidence of fruit borer. Two per cent Neem cake extract treated trees recorded maximum yield (24.7kg) followed by insecticidal treated trees (23.9kg) and Neem seed kernel extract (5%) (22.3kg).

Vengurla

Flower thrips

The observations recorded on flower thrips at peanut stage, pebble stage and matured nuts are presented in Table-86. The results were non-significant at pea nut stage. The incidence recorded at pebble stage and matured nuts stage revealed that the treatment T5 (spray schedule) was significantly superior over rest of the treatments.

Vridhachalam

Fresh planting of cashew grafts have been taken up to relay-this trial.

Table 85: Abstract of pests in fruiting phase at Bapatla centre.

Treatments	Pre-treatmental counts			Post - treatmental counts			% Nuts damaged by			Yield kg per tree
	% Laterals damaged by H.h.	Population lateral of H.h./lateral	Weevils population lateral	% Laterals damaged by H.h.	Population lateral of H.h./lateral	Weevils population lateral	Leaf Webber	Apple and Nut Borer		
*T1 = Kaoline swabbing	8.43	1.00	0.50	8.00	1.00	5.00	2.50	3.62	21.3	
T2 = Neem Seed kernel extract 5% spray	8.17	2.00	1.00	7.05	0.09	1.00	2.52	5.22	22.3	
T3 = Neem Cake extract 5% spray	13.50	2.50	1.10	7.23	0.05	1.00	2.20	1.52	24.8	
T4 = Neem leaf extract 2%	6.25	0.05	0.50	7.50	0.50	0.50	5.10	5.50	11.4	
T5 = Monocrotophos, and carbaryl	7.77	3.50	0.05	6.23	2.25	0.05	2.10	6.20	23.9	
T8 = Control (T1, T6, T7 not included)	8.54	2.00	0.06	13.35	0.14	1.06	5.45	8.26	10.5	

* Not as per recommendation.

H.h. : *Hipotima haligramma*

Table 86. Incidence of flower thrips at Vengurla centre.

Treatment	Average nut surface damaged at		
	Peanut stage	Pebble stage	Matured stage
T-1 Neem oil 2%	22.62 (28.40)	38.71 (32.39)	31.74 (34.38)
T-2 Neem seed kernal extract 5%	27.92 (31.94)	28.79 (32.47)	33.45 (35.34)
T-3 Neem cake extract 5%	22.61 (28.38)	26.89 (31.24)	29.12 (32.67)
T-4 Neem leaf extract 2%	30.24 (33.37)	26.00 (30.66)	32.11 (34.11)
T-5 Spray schedule	24.70 (29.81)	19.52 (26.25)	18.79 (25.69)
T-6 Endosulfan 0.05% followed by carbaryl 0.1%	25.52 (30.34)	25.59 (30.40)	28.03 (31.97)
T-7 Pongamia oil 2% followed by carbaryl 0.5%	26.36 (27.56)	26.14 (30.72)	28.53 (32.29)
T-8 Control	26.97 (31.31)	30.43 (33.50)	30.90 (33.79)
S. Em+/-	1.22	0.49	0.42
C.D. 5%	NS	1.48	1.27

Figures in parentheses are arcsin values.

Table 87: Effect of prophylactic treatments on stem borer (1994-95) at Jhargram centre.

Treatment	Total no. of trees treated	No. of trees having stem borer eggs before treatment	No. of trees infested after treatment	Percentage infestation after treatment	Stage of infestation in infested trees									
					Nov '93	Apr '94	Nov '93	Apr '94	Nov '93	Apr '94	Nov '93	Apr '94		
T1 Kaoline paste	20	2	3	1	3	5	15	2	10	1	5	—	—	—
T8 Neem Oil (5%)+20 Sevidol (45g)	20	1	4	—	1	—	5	1	5	—	—	—	—	—
T4 Neem cake extract (5%)	20	2	4	1	2	5	10	2	10	1	5	—	—	—
T5 Neem seed extract (5%)	20	2	5	1	1	5	5	1	5	—	—	—	—	—
Sevidol (4G) + carbaryl (0.1%)	20	1	4	—	—	—	—	—	—	—	—	—	—	—
T9 Control	20	2	4	2	4	10	20	4	20	3	15	—	—	—

(T2, T3, T6, T7 treatments not included)

Ent. 2: Control of stem and root borer

Expt. 1: Prophylactic control trial.

(Bapatla, Bhubaneswar, Jhargram, Madakkathara, Vengurla and Vridhachalam)

Objective

To workout an effective prophylactic control measure against cashew stem and root borer. *Placaederus ferrugineus*.

Treatments : Nine

- T1 - Kaoline swabbing
 - T2 - Sevidol 4G
 - T3 - Neem oil (5%) swabbing
 - T4 - Neem cake extract (5%)
 - T5 - Neem seed kernel extract (5%)
 - T6 - Endosulfan 0.05% followed by carbaryl (1%).
 - T7 - Neem cake 3kg/tree basin
 - T8 - Neem oil (5%) swabbing on tree trunk and Sevidol 75g/tree basin.
 - T9 - Control.
- (T7 and T8 as per XI Biennial Workshop recommendation).

Replication: Two

Bapatla

Among all the treatments tried, neem oil (5%) swabbing on the uninfested trunk acted as the best repellent keeping away the borer attack upto 90 days, no trees were susceptible to fresh borer attack. Neem seed kernel extract (5%) also fared well in exhibiting repellent action upto 90 days next to neem oil swabbing. The experiment was not conducted as per the guidelines given in workshop recommendations.

Bhubaneswar

The treatments were applied during May, 1994 and November, 1994. Before carrying out the treatments, the collar region and exposed roots of the trees were cleaned. Observations were recorded regarding the incidence of stem and root borer after the treatments at monthly interval. After six months of first round of application of treatments, it was noticed that the infestation by stem and root borer was least in T6 and T7 (8.00%) followed by T1 (10%) treatment. After four months of second round of application, it was observed that the infestation of stem and root borer was minimum in T7 (neem oil + Sevidol) as compared to other treatments. Maximum infestation was noticed in untreated control throughout the period of observations.

Jhargram

The treatments were applied during the third week of November, 1993 and third week of April, 1994. The trees were selected in blocks having 2-3 borer infested trees. Twenty trees were selected per treatment and percentage of infestation were recorded at 30 days interval of the treatment.

No infestation was observed on the blocks treated with Sevidol 4G. The incidence of root and stem borer was negligible

in the trees treated with neem oil (5%) and neem seed kernel extract (5%) as compared to untreated control. Sevedol 4G was found to be more effective in preventing stem and root borer than other treatments (Table-87).

Madakkathara

Eighteen year old trees of the CYT (seedlings) were selected and eight blocks were demarcated. The area under each block consisted of about 50-60 trees. Twenty five healthy and uninfested trees were selected for the treatment in each block and experiment trees were selected in such a way that a minimum of five trees and a maximum of ten trees already affected by stem and root borer were present in the plot, which might serve as the source of infestation. Each treatment block was seperated from the other by atleast two rows of trees around. Before the application of treatments the tree trunk upto one metre height and the exposed roots were cleared by using a coir brush to dislodge the termite galleries, stem borer eggs and grubs if any. Stem portion was treated upto a height of 1m above ground level and on exposed roots by using a coir brush. First round of application was given during May 1994. The second application was given dur-

ing last week of November 1994. Observations were recorded at monthly intervals and noted the oviposition, presence of grubs etc. on treated and untreated trees in each block.

Stem borer infestation could be noticed in almost all the treatments during June to November period and the infestation was minimum in the control. After that the infestation was cleared and again treatments were applied.

During the second half (December-May) it was found that neem oil application 5 per cent on collar portion upto 1m/height and on exposed roots and stem prevents the stem and root borer attack for three months.

Vengurla

The treatments (T1-T8) were applied in a block of 25 trees in which 2-4 trees were already infested by the pest. The treatments were applied to exposed roots at collar region and on trunk upto 1m heighth. The observations were being recorded.

Vridhachalam

The trials have been relaid by planting fresh cashew grafts.

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

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurla, Vridhachalam and Jagdalpur)

Objective

To find out the impact of ecological factors ie., temperature, relative humidity and rainfall on initiation of pest infestation, build up and out break of major pests in a particular region along with the survey of pests and natural enemies.

Bapatla

Surveys of plantations located in Muttayapalem, Karlapalem, Nandirajuthots, private plantations of farmers and plantations of Cashew Research Station, Bapatla were taken up from December '94 to March '95 at fortnightly intervals in about 20 trees in each block. Major pests recorded in the plantations during surveys are listed below:

1. Sandy soils closer to sea are more prone to infestation by tree borer *Plocaederus ferrugineus* L., in old plantations beyond 25-30 years age.
2. Plantations in high altitude areas of north coastal districts with more relative humidity are more susceptible to infestation by Tea Mosquito-*Helopeltis antonii*.
3. Blackening of tender developing nuts leading to immature fruit was recorded in February-March months which is probably due to fungus-prevailing during days of heavy due.
4. Weather parameters were correlated with, major pest incidence during 1987

to 1990, which holds good in predicting different pest initiation.

5. Indiscriminate and improper use of pesticides in certain areas also led to pest outbreak which needs to have vigilance.
6. Consolidated result of surveys suggest that the plant protection measures in concise manner duly preserve the natural enemies in certain parts thus leading to economise spray and get good yields.

Bhubaneswar

The extent of insect pest infestation and their seasonal incidence at Bhubaneswar was recorded from twelve selected cashew trees under unsprayed condition throughout the year (April '94 to March '95) and the data is presented in Table-89.

(a) Stem and root borer, *Plocaederus ferrugineus* M

Though its incidence was not observed from the selected 12 trees, but its incidence was recorded from other older trees. Maximum incidence of stem and root borer was noticed during May and its occurrence in the field was noticed throughout the year.

(b) Tea mosquito, *Helopeltis antonii* Sign.

The incidence of tea mosquito was not observed at Ranasinghpur plantation. However sporadic incidence of the pest was no-

Table 88. Survey of cashew pests in different plantations surrounding Bapatla from December '94 to March '94 at Bapatla centre

Location	Common name	Scientific name	Percent infestation	Intensity of attack
Bapatla - Cashew Research Station	1. Stem and root borer	<i>Plocaederus ferrugineus</i> L	5%	Moderate
	2. Leaf and blossom webber on foliage	<i>Lamida monocusalis</i>	1 to 2%	Low
	3. Leaf miner	<i>Acrocercops syngamma</i>	1 to 2%	Low
	4. Weevils	<i>Myloccerus</i> sp.	2 to 3%	Low
	5. Apple and nut borer	<i>Nephopteryx</i> sp.	6 to 10%	Moderate
	6. Leaf & blossom webber (on panicle and nuts)	<i>Lamida monocusalis</i> Walker	4 to 5%	Low
	7. Aphids	<i>Toxoptera odinae</i>	0.5% to 2%	Moderate
Stray incidence of Mealybugs and hairy caterpillars were recorded.				
Muttayapalem plantations	1. Shoot tip caterpillar	<i>Hipotima haligramma</i>	1 - 2%	Low
	2. Stem & root borer	<i>Plocaederus ferrugineus</i> L.	5%	Moderate
	3. Apple and nut borer	<i>Nephopteryx</i> sp.	10 - 15%	High
	4. Flower thrips and day thrips	<i>Rhyncothrips rapensis</i>	0.1 - 1%	Low
	5. Leaf folders	<i>Captilea tissealea</i>	Negligible	—
Stray incidence of Mealy bugs and aphids were observed in the month of March.				
Karlapalem- Nandaya- palem	1. Stem & root borer	<i>Plocaederus ferugineus</i> L.	1 - 3%	Low
	2. Leaf and blossom webber - both on foliage and nuts	<i>Lamida monocusalis</i> (on leaves)	1 - 2%	Low
	3. Apple and nut borer	<i>Nephopteryx</i> sp.	15-20%	High
Karalapalem (Private plantation)	1. Stem & root borer	<i>Plocaederus ferrugineus</i> L.	5 - 10%	High
	2. Leaf and blossom webber in - nuts	<i>Lamida monocusalis</i> (on leaves)	1 - 2%	Low
	3. Apple and nut borer	<i>Nephopteryx</i> sp.	10-15%	High
	4. Shoot tip caterpillar	<i>Hipotima haligramma</i>	0.5 - 1%	Low

ticed in some cashew trees at Bhubaneswar.

(c) **Shoot tip caterpillar**, *Hipotima haligramma* Mey.

Shoot tip caterpillar, a major pest of cashew at this centre was active in the field

throughout the year except during summer month (May to June). The peak incidence of this pest (a maximum of 37.3 per cent shoot infestation) was recorded during second fortnight of October coinciding with post monsoon flushes. Thereafter, the infestation de-

Table 89. Seasonal occurrence of major pests of cashew at Bhubaneswar during 1994-95 (Mean of 12 trees)

Month	F o r t night	Shoot tip caterpillar (% shoot in- festation)	Leaf miner (% infestation)		Leaf beetle (% infestation)		Inlorescence thrips		Apple and nut borer (% nuts affected)	
			Laterals affected	Leaves affected	Laterals affected	Leaves affected	No./ panicle			
							Yellow thrips	Black thrips		
Apr.	I	9.66	—	—	—	—	—	—	2.08	
	II	9.58	—	—	—	—	—	—	5.09	
May.	I	3.30	—	—	—	—	—	—	4.16	
	II	—	—	—	—	—	—	—	—	
Jun.	I	—	—	—	—	—	—	—	—	
	II	5.04	—	—	8.27	25.03	—	—	—	
Jul.	I	5.87	—	—	6.51	23.33	—	—	—	
	II	6.92	—	—	1.85	3.08	—	—	—	
Aug.	I	9.00	—	—	—	—	—	—	—	
	II	8.67	2.40	1.26	—	—	—	—	—	
Sep.	I	11.35	4.98	4.70	—	—	—	—	—	
	II	9.88	5.28	5.33	—	—	—	—	—	
Oct.	I	20.48	1.34	2.86	—	—	—	—	—	
	II	37.30	3.75	1.16	—	—	—	—	—	
Nov.	I	27.30	7.26	6.05	—	—	—	—	—	
	II	16.86	5.36	6.21	—	—	—	—	—	
Dec.	I	10.17	5.25	4.59	—	—	—	—	—	
	II	11.48	—	—	—	—	—	—	—	
Jan.	I	9.18	—	—	—	—	—	—	—	
	II	3.00	—	—	—	—	1.56	—	—	
Feb.	I	—	—	—	—	—	2.18	0.14	—	
	II	—	—	—	—	—	1.20	2.50	—	
Mar.	I	—	—	—	—	—	1.02	5.31	—	
	II	—	—	—	—	—	0.72	3.89	4.92	

creased possibly due to prevailing low temperature. Again during March its population build up was noticed infesting both shoots, apples and nuts.

(d) **Leaf miner *Acrocercops syngamma* M.**
Leaf miner infestation was observed

from second fortnight of August to first fortnight of December. The peak period of incidence (a maximum of 7.26% lateral with 6.05% leaves infestation) was noticed during first fortnight of November. On an average 3.5 larvae (irrespective of instars) per infested leaf was observed during its peak incidence.

(e) **Leaf beetle, *Monolepta longitarsus* Jac.**

The incidence of the leaf feeding chrysomelid beetle was observed for a brief period during June and July just after the onset of south west monsoon. The peak incidence (a maximum of 8.27% laterals with 25.03% leaves infestation) was noticed during second fortnight of June. Thereafter its activity in the field declined.

(f) **Inflorescence thrips**

Two species of thrips were found attacking the inflorescence, they are:-

(i) **Yellow thrips, *Frankliniella schultzei* Trybom.**

Its incidence was observed during January to March with peak incidence during first fortnight of February (2.18 Nos. per inflorescence).

(ii) **Black thrips, *Haplothrips ceylonicus* Schumtz.**

The activity of black thrips in the field was observed from February to March. Peak period of its activity (5.31 nos./Inflorescence) was noticed during first fortnight of March. Its activity declined after cessation of flowering.

(g) **Apple and nut borer (unidentified)**

Its incidence was noticed during March to May. Maximum apple infestation (5.09%) was recorded during second fortnight of April and thereafter the pest vanished from the fields after May.

(h) **Leaf and blossom webber, *Lamida monocusalis* Walk**

Incidence of leaf and blossom webber was only observed in cashew plants of 1 to 1.5mt height during March to June. The peak activity of the pest was noticed during second fortnight of April. Its activity was drasti-

cally reduced after onset of south west monsoon.

Besides the above mentioned pests other minor pests like leaf beetle (*Microserica quadrinotata* M.), foliage thrips (*Rhipiphorothrips cruentatus* Hood.), brown aphid (*Toxaptera ordiniae* Vd. G.), mealy bugs (*Ferrisia virgata* Kel.), hairy caterpillar (unidentified), leaf weevils (*Apion tumidium* G. *Myllocerus discolor* and *Peltotracheins pubes* F.), bark borer (*Indarbela tetraonis* Mo.), flower beetle (unidentified) and grasshopper (*Chrotogonus* sp.) were also noticed. But their extent of damage was negligible.

Natural enemies

The larval stages of shoot tip borer, leaf and blossom webber and leaf miner were collected from the field and reared in the laboratory for its parasitization study. The extent of parasitization study. The extent of parasitization by the pests is presented in Table-90. The study indicated that on an average shoot tip borer, leaf and blossom webber and leaf miner were parasitized to an extent of 31.42, 6.97 and 3.14 per cent respectively. Leaf miner was found to be heavily parasitized (51%) by *Sympiesis* sp. (Eulophidae:Hymenoptera) during October. Leaf and blossom webber was parasitized by *Bracon brevicornis* (Braconidae:Hymenoptera) to an extent of 12 per cent during May. Parasites collected from shoot tip borer and leaf miner were sent for identification to NRCC.

The other predators present in cashew ecosystem were the spiders (unidentified), lady bird beetle (*Verania discolor* F., *Verania cincta* Gorb. and *Menochilos sexmaculata* F.), black ant (*Camponotus* sp.) praying mantis, mirid bugs (unidentified) and rober fly. The population of spiders, lady bird beetle and black ants were maximum during the flowering period (Table-91).

Table 90: Natural parasitization of insect pests of cashew at Bhubaneswar (1994-95)

Month	Percent parasitization		
	Leaf miner	Leaf & Blossom webber	Shoot tip borer
Apr.	—	4.76	—
May	—	12.00	—
Jun.	—	—	—
Jul.	—	—	—
Aug.	2.00	—	2.00
Sep.	29.00	—	3.00
Oct.	51.00	—	5.00
Nov.	28.00	—	2.00
Dec.	—	—	—
Jan.	—	—	—
Feb.	—	—	—
Mar.	—	4.00	—
Mean percent parasitization	31.42	6.97	3.14
Remarks	Unidentified parasite as <i>Sympiesis</i> sp.	Parasite identified as <i>Bracon brevicornes</i>	Unidentified parasite

Survey of cashew pests and its natural enemies:

Survey of insect pests of cashew and its natural enemies were carried out in the plantations in Khurda. Ganjam, Nayagarh and Puri district during March '95. The important insects pests, natural enemies and pollinators in each locality are presented in Table 92.

CHINTAMANI

During the year seasonal occurrence of major pests of the region were studied and presented in Table - 93. The over all population of all the major pests was low during the year compared to the previous year. The

pests were:

1. Tea mosquito, *Helopeltis antonii* S.
2. Leaf miner, *Conopomorpha syngamma* M.
3. Leaf and blossom webber, *Lamida monocusalis* Walk
4. Leaf thrips, *Selenothrips rubrocinctus* G.
Rhipiphorothrips cruentatus H.
Retithrips syriacens G.
5. Inflorescence thrips, *Scirtothrips dorsalis* G.
Rhynchothrips raoensis G.
6. Fruit and nut borer, *Thylecoptila panerosema* M.

Table 91: Seasonal occurrence of natural enemies (predators) and pollinators at Bhubaneswar centre (1994-95).

Month	Fortnight	Mean number per quadrant			
		Spiders	Lady bird beetle	Ants	Mirid bugs
Apr.	I	0.29	—	0.79	—
	II	0.20	—	0.50	—
May	I	—	—	—	—
	II	—	—	0.31	—
Jun.	I	—	—	1.22	—
	II	—	—	—	—
Jul.	I	—	—	—	—
	II	0.06	—	0.16	—
Aug.	I	0.02	—	0.18	—
	II	0.04	—	0.41	—
Sep.	I	0.12	—	0.27	—
	II	0.10	—	0.16	—
Oct.	I	0.14	—	0.18	—
	II	0.10	—	0.47	—
Nov.	I	0.20	—	0.81	—
	II	0.21	—	0.47	—
Dec.	I	0.14	—	0.41	—
	II	0.17	—	0.62	—
Jan.	I	0.27	—	0.58	—
	II	0.43	0.12	0.54	—
Feb.	I	0.72	0.14	0.62	0.10
	II	0.62	0.23	0.77	0.16
Mar.	I	0.89	0.20	1.68	0.20
	II	1.02	0.06	1.14	0.18

1. Tea mosquito

The incidence of tea mosquito was first noticed in the first fortnight of July and reached the maximum (14.36%) during the first fortnight of November and there after drastic reduction was noticed due to very low temperatures during November-January. Unlike previous years, the population of tea mosquito was low on neem and guava fruits. Two spider species were observed

to feed on nymphs of tea mosquito.

2. Leaf miner

The incidence of leaf miner started in the second fortnight of July and reached the maximum (16.68%) during the first fortnight of November and decreased thereafter. The population of leaf miner was low, two Braconid parasites were noticed parasitizing larva of leaf miner. The per cent incidence was 5.7.

Table 92: Survey of cashew pests in different plantations in Orissa during flowering stages in the month of March '95 at Bhubaneswar centre

Location	Common name	Scientific name	Percent infestation	Intensity of attack	Stage of crop
Khurda district (Pitapalli, Lahanga, Jankia Gobindapur, Tangi, Manibandha Hazi, Kalibati)	Stem and root borer	<i>Plocaederus ferrugineus</i> L.	6.50 - 12.00 (Trees)	Moderate	Flowering
	Inflorescence thrips (Black thrips)	<i>Haplothrips ceylonicus</i> Schuntz.	5.20 - 10.70 (per infl.)	Low to moderate	Flowering
	Inflorescence thrips (Yellow thrips)	<i>Franklinella schultzei</i> Trybom	3.75 - 6.25 (per infl.)	Low	Flowering
	Brown aphid	<i>Toxoptera ordinae</i> Vd. G.	6.25 - 9.67 (infl.)	Low	Flowering
	Leaf weevil	<i>Apion tumidum</i> G.	0.10 - 0.20 (nos./infl.)	Low	Flowering
	Bank eating caterpillar	<i>Inderbela tetraonis</i> No.	2.00 - 3.00 (Tree)	Low	Flowering
	Mealy bugs	<i>Ferrisia vigrata</i> (Kll.)		Low	Flowering
	Spiders, lady bird beetle, Black ant, mirid bug, House fly				
	Stem and root borer	<i>Plocaederus ferrugineus</i> L.	8.0 - 20.00 (Trees)	Moderate	Flowering/ Fruiting
	Puri district Konark, Brahmagiri (Aliaput) Natia, Hasinpura, Baliharchandi (Kathuarada)	Tea mosquito	<i>Helopeltis antonii</i> Sign.	20.02 - 49.99(P) 5.62 - 28.39(S)	Low to Moderate
Shoot tip borer		<i>Hypotima haligramma</i> Mey.	6.69 - 11.69 (S)	Low	Flowering
Leaf miner		<i>Acrocercops syngamma</i> M. (Lat)	3.12 - 5.62 (Lat)	Low	Flowering

Table 92 Contd....

Location	Common name	Scientific name	Percent infestation	Intensity of attack	Stage of crop	
Natural enemies	Foliage thrips	<i>Selenothrips rubrocinctus</i>	6.75 - 10.25 (per leaf)	Moderate	Flowering/ fruiting	
	Inflorescence thrips (Yellow thrips)	<i>Frankliniella schultzei</i>	3.5 - 5.25 (Nos./infl.)	Low	Flowering/ fruiting	
	Inflorescence thrips (Black thrips)	<i>Haplothrips ceylonicus</i>	4.75 - 9.25 (Nos./infl.)	Low	flowering fruiting	
	Termite	<i>Odontotermes</i> sp.	2.00 - 6.00 (Trees)	Low	flowering fruiting	
	Bark eating caterpillar	<i>Indarbela tetraonis</i> M.	1.00 - 2.00 (Trees)	Low	flowering/ fruiting	
	Spiders, lady bird beetle, Black ant, House fly.					
	Ganjam district (Khalikote, Brajnaraayanpur Rambha)	Stem and root borer	<i>Plocaederus ferrugineus</i> L.	4.00 - 16.00 (Trees)	Low	Flowering
		Inflorescence thrips (Black thrips)	<i>Haplothrips ceylonicus</i>	7.50 - 9.50	Low	Flowering
		Inflorescence thrips (Yellow thrips)	<i>Frankliniella schultzei</i>	1.50 - 3.50 (Nos./Infl.)	Low	Flowering
		Leaf weevil G.	<i>Apion tumidum</i> G.	0.10 - 0.20 (Nos.Infl.)	Low	Flowering
Bark eating caterpillar		<i>Indarbela tetraonis</i> No.	1.00 - 3.00 (shoots)	Low	Flowering	
Leaf Miner		<i>Acrocercops syngamma</i> M.	2.20 - 3.10 (Lat.)	Low	Flowering	
Shoot tip borer		<i>Hypatima haligramma</i> Mey.	3.50 - 7.50 (Shoots)	Low	Flowering	

Location	Common name	Scientific name	Percent infestation	Intensity of attack	Stage of crop	
Natural enemies	Tea mosquito	<i>Helopeltis antonii</i> Sig.	22.58-68.42 (P) 6.28-19.35 (S)	Low to Moderate	Flowering	
	Foliage thrips	<i>Selenothrips rubrocinctus</i> Giard	7.75-10.25 (Nos./leaf)	Low	Flowering	
	Spiders, mirid bug, Black ant and red ant					
	Nayagarh district (Krushna-chandrapura, Daspalla, Kotagarh, Ranpur, Karudapalli)	Stem and root borer	<i>Plocaederus ferrugineus</i> L.	4.00 - 8.00	Low	Flowering
		Inflorescence thrips (Black thrips)	<i>Haplothrips ceylonicus</i> Schumtz.	2.25 - 5.00 (Nos. Infl.)	Low	Flowering
		Inflorescence thrips (Yellow thrips)	<i>Frankliniella schultzei</i> Trybom	3.00 - 4.25 (Nos./Infl.)	Low	Flowering
		Bark borer	<i>Inderbela tetraonis</i> No.	1.00 - 3.00 (Trees)	Low	Flowering/ Fruiting
		Leaf Miner	<i>Acrocercops syngamma</i> M. (Lat.)	1.25 - 2.75 (Lat.)	Low	Flowering/ Fruiting
		Shoot tip borer	<i>Hyattima haligramma</i> Mey. (Shoots)	3.25 - 5.25 (Shoots)	Low	Flowering/ Fruiting
		Tea mosquito	<i>Helopeltis antonii</i> Sig.	12.58-21.73 (S) 4.19-22.22 (P)	Low	Flowering
Foliage thrips		<i>Selenothrips rubrocinctus</i> Giard	3.00 - 3.25 (Nos./leaf)	Low	Flowering	
Apple and nut borer		Unidentified	1.00-3.00 (Apples)	Low	Flowering/ fruiting	
Natural enemies		Spiders, mirid bug, and Black ants				

3. **Leaf and blossom webber** : The incidence of leaf and blossom webber was very low and it started from the second fortnight of July. The incidence was maximum during the first fortnight of November (9.42 per cent) and thereafter gradual reduction was observed. There was no incidence of the pest in older plantations during the year. One Braconid parasite on larva was noticed.

4. Leaf thrips

The population build up of the pest started from the second fortnight of July and reached maximum during second fortnight of September (14.36%). Thereafter drastic reduction was noticed because of heavy rains in October and followed by severe cold temperatures during December and January. No parasites or predators were noticed.

Table 93: Seasonal occurrence of major pests of Chintamani region.

Months	Fortnight	Tea Mosquito incidence (%)	Leaf miner incidence (%)	Leaf & Blossom Webber incidence (%)	Leaf Thrips no./leaf	Inflorence thrips no./panicle	Fruit nut borer incidence (%)
Jan.	I	0.38	1.03	2.62	3.03	—	—
	II	1.26	0.36	4.63	1.32	0.39	—
Feb.	I	1.83	0.11	4.96	1.41	3.60	—
	II	1.64	—	5.32	0.18	6.38	—
Mar.	I	1.74	—	6.86	—	6.67	—
	II	1.08	—	4.32	—	6.71	—
Apr.	I	2.31	—	2.08	—	6.98	0.38
	II	0.32	—	0.71	—	9.38	0.98
May	I	0.10	—	—	—	12.36	3.96
	II	—	—	—	—	3.46	6.86
Jun.	I	—	—	—	—	—	7.38
	II	—	—	—	—	—	0.64
Jul.	I	0.08	—	—	—	—	—
	II	0.92	0.36	0.18	0.74	—	—
Aug.	I	0.98	0.64	0.41	1.84	—	—
	II	1.14	1.83	0.62	3.86	—	—
Sep.	I	2.84	3.36	0.89	8.98	—	—
	II	4.94	5.98	2.89	10.68	—	—
Oct.	I	8.98	11.36	3.62	14.36	—	—
	II	13.08	12.84	8.36	3.98	—	—
Nov.	I	14.36	16.68	9.42	2.63	—	—
	II	3.88	10.36	7.36	3.11	—	—
Dec.	I	2.36	3.38	6.21	2.96	—	—
	II	1.42	2.02	3.31	3.68	—	—

Table 94: Cashew pests and their intensity in maidan parts of Karnataka (Chintamani centre).

Name of the pest		Scientific name	Month of occurrence	Intensity
Common name				
Tea mosquito	<i>Helopeltis antonii</i> S.	Through out the year	Low to moderate	
Leaf minor	<i>Conopomorpha syngamma</i> M.	Jul. - Feb.	-do-	
Leaf and blossom webber	<i>Lamida monocusalis</i> Walk.	Jul. - Apr.	Low	
Leaf thrips	<i>Selenothrips rubrocinctus</i> G.	Jul. - Feb.	Low to moderate	
	<i>Rhipiphorotherips cruentatus</i> H			
Inflorescence thrips	<i>Scirtothrips dorsalis</i> G. <i>raeonsis</i> G.	July to Feb	-do-	
Fruit and nut borer	<i>Nephopteryx</i> spp.	Jan. - May	Moderate to high	
	<i>Thylocoptila panerosma</i> M.	Jan. - May	Low to moderate	
Termites	<i>Odontotermis obesis</i> Ramb.	Through out the year	Low to moderate	
Leaf weevils	<i>Myllocerus discolor</i> B.	Through out the year	-do-	
Shoot tip borer	<i>Hypotima haligramma</i> M.	Aug. Nov.	Low	
Aphid	<i>Toxoptera odinae</i> C.	March to June	Low to moderate	
Coreid bug	<i>Anoplocnemis phaseana</i> Fab	Apr. - June	Low	
Cetoniid beetle	<i>Heterohinus elegans</i> Fab	Apr. - June	Low	

5. Inflorescence thrips

As the flowering was delayed during the year, the incidence of the pest started only in the second fortnight of January and reached maximum in April the second fortnight (12.46%) and it vanished after the second fortnight of May.

6. Fruit and nut borer

The incidence of the pest started only in the first fortnight of April and reached the maximum (7.38%) in the second fortnight of May and thereafter drastic reduction was observed and it vanished after the second fortnight of June. The incidence of the pest was very severe in off season bearing plants.

Survey of pest complex and natural enemies

Because of lack of mobility, the survey was conducted only in October i.e., at flushing stage. Only 12 species were recorded attacking cashew with 3 parasites and two predators. The pests, parasites and predators observed are presented in Tables 94 and 95.

JHARGRAM

Bio-ecology of pests of cashew were studied during 1994-95. Incidence of different major and minor pests of this region were recorded at 30 days interval time.

Tea mosquito

Tea mosquito infestation was very low during October '93 (Table-96) population of this pest was found to increase gradually then. Maximum incidence was recorded during October and existed on the plants upto May, 1994. The mean incidence of this pest was 1.8 per cent during October which was low as compared to the previous year.

Leaf and blossom webber

The population was noticed during July (2.8%) and it increased very rapidly to 20.3 per cent during September '94 and thereafter gradual reduction of population was observed. The percent infestation were 16.9, 20.3 and 13.0 during September, October and November respectively.

Table 95: Parasites and predators recorded on pests of Cashew at Chintamani centre

Name of the parasite/ predator	Host	Percent parasitization	Month of occurrence
<i>Brecon brevicornis</i>	<i>Lamida moncusalis</i>	2 to 6	Aug. - Oct.
<i>Apanteles</i> sp.	<i>Lamida moncusalis</i>	0.5 to 3	Aug. - Oct.
Hymenopteran parasite (Unidentified)	<i>Conopomorpha syngamma</i>	1 to 4	Aug. - Nov.
<i>Menochilus sexmaculata</i>	<i>Toxoptera odinae</i>		March - June
Spider	<i>Helopeltis antonii</i>		Aug. - Nov.

Table 96: Correlation of weather parameters and occurrence of cashew pests at Jhargam (1994-95)

Months	Total rainfall (mm)	No. of rainy days	Temperature °C		Relative Humidity %		Percentage of damage				
			Max.	Min.	Max.	Min.	Tea mosquito	Leaf & blossom webber	Leaf Miner	Thrips (inflorescence)	Apple & nut borer
Apr.	115.8	8	38.0	18.5	84.5	49.3	6.5	—	—	—	—
May.	93.4	7	39.0	23.5	83.7	45.0	4.8	—	—	—	—
Jun.	362.2	20	39.5	22.5	89.0	69.4	—	—	—	—	—
Jul.	519.4	25	33.5	24.0	90.5	77.8	—	2.8	—	—	—
Aug.	340.6	26	33.0	23.0	88.6	82.0	—	9.6	2.0	—	—
Sep.	252.0	15	34.5	21.0	89.5	70.0	—	16.9	10.8	—	—
Oct.	68.6	5	34.5	19.0	87.8	58.6	1.8	20.3	16.6	—	—
Nov.	2.2	3	31.5	13.0	80.6	52.4	6.5	13.0	8.5	—	—
Dec.	—	—	26.8	9.6	82.4	52.7	9.8	5.0	3.3	—	—
Jan.	28.0	4	26.5	7.5	84.2	33.0	12.6	4.3	—	3.5	—
Feb.	2.2	1	31.5	19.0	76.2	47.6	10.0	2.8	—	13.3	2.5
Mar.	1.4	1	39.0	16.5	74.7	31.2	6.8	1.0	—	1.4	4.0

Table 97: Survey of pest complex in different plantations at Jhargam.

Location	Scientific name	% infestation	Intensity
Midnapore East:			
Depal, Contai, Digha	<i>Plocaederus ferrugineus</i>	7.4 - 18.2	Moderate to high
	<i>Helopeltis antonii</i>	1.0 - 4.5	Low
	<i>Lamida moncusalis</i>	8.3 - 23.5	Moderate to high
	<i>Rhipiphorothrips cruentatus</i>	1.8 - 12.1	Low to moderate
	<i>Inderbela tetraonis</i>	3.5 - 5.0	Low
	<i>Planococcus citri</i>	4.3 - 14.6	Low to moderate
	<i>Conodomdiptia synoramma</i>	2.0 - 9.00	Low to moderate
Midnapore West:			
Gadro, Pukuria, Bikash Bharati, Gadro	<i>Plocaederus ferrugineus</i>	5.0 - 14.5	Moderate to high
	<i>Helopeltis antonii</i>	3.9 - 16.0	Moderate to high
	<i>Ondontotermis obesus</i>	6.5 - 18.0	Moderate to high
	<i>Lamida moncusalis</i>	5.5 - 18.3	Moderate to high
	<i>Conopondiptia synorama</i>	2.0 - 4.5	Low
	<i>Rhipiphorothrips cruentatus</i>	2.8 - 12.2	Low to moderate
Bankura:			
Simlipal	<i>Plocaederus ferrugineus</i>	1.0 - 2.0	Low
	<i>Helopeltis antonii</i>	1.5 - 3.3	Low
	<i>Ondontotermis obesus</i>	5.0 - 10.0	Moderate
	<i>Lamida moncusalis</i>	4.0 - 13.5	Low to moderate
	<i>Rhipiphorothrips cruentatus</i>	2.0 - 10.6	Low to moderate

Table 98: Survey of pest complex in different plantations at Jhargram centre.

Common name	Scientific name	Month of occurrence	Intensity
Tea mosquitio	<i>Helopeltis antonii</i>	Oct. - Apr.	Moderate to high
Stem and root borer	<i>Placaederus ferrugineus</i>	Throughout the year	Moderate to high
Shoot and blossom webber	<i>Lamida monocusalis</i>	Jul. - Mar.	Moderate to high
Leaf miner	<i>Conopomdiptia synoramma</i>	Aug. - Feb.	Moderate
Thrips	<i>Rhipiphorothrips cruentatus</i>	Jan. - Apr.	Low to moderate
Bark borer	<i>Inderbela tetraonis</i>	Oct. - Mar.	Low
Shoot tip caterpillar	<i>Hypotima haligramma</i>	Oct. - Mar.	Low to moderate
Termite	<i>Odontotermis obesus</i>	Oct. - May	Moderate
Apple and nut borer	<i>Nephoteryx</i> sp.	Feb. - May	Low
Hairy caterpillar	<i>Estigmene lactinea</i>	Oct. - Feb.	Low
Leaf beetles	<i>Myllocerus discolor</i>	Jul. - Dec.	Low
Weevil	<i>Apion amplum</i>	Aug. - Nov.	Low
Leaf twisting weevil	<i>Apoderus tranquebaricus</i>	Aug. - Nov.	Low
Aphid	<i>Toxoptera odinae</i>	Dec. - Mar.	Low
Leaf folder	<i>Caloptilia tiselaea</i>	Jul. - Feb.	Low
Chafer beetles	<i>Holotrichis serata</i>	Feb. - Apr.	Low
Black ant	<i>Camponotus</i> sp.	Through out the year	Low
Red ant	<i>Oecophylla smaragdina</i>	Through out the year	Low
Gundhi bug	<i>Leptocorisa acuta</i>	Oct. - Mar.	Low
Mites	<i>Oligonychus acuta</i>	Oct. - Apr.	Low
Memracid bug	<i>Leptocentrus</i> sp.	Oct. - Apr.	Low
Pentatomid bug	<i>Nezara viridulacata</i>	Dec. - Mar.	Low
Slug caterpillar	<i>Latoia lepida</i>	Nov. - Feb.	Low
Semi looper	<i>Thallasodes quadriaris</i>	Nov. - Feb.	Low
Caterpillar	<i>Metanastria hyrtaca</i>	Oct. - Feb.	Low
Grasshoppers (3)	Unidentified	Jul. - Feb.	Low
Mealy bugs	<i>Planococcus citri</i>	Jan. - May	Low to moderate
Coreid bugs (2)	Unidentified	Nov. - Apr.	Low

Table 98 (Contd.). Natural enemies of cashew pests at Jhargram centre.

Parasite/Predators	Host	Month	Intensity
<i>Bracon brevicornis</i>	Shoot and blossom webber	Oct. - Feb.	Moderate
<i>Apanteles</i> sp.	-do-	Oct. - Feb.	Low
Tachinid parasite	-do-	Nov. - Feb.	Low
Black ant	Leaf miner	Oct. - Dec.	Low
Coccinellid beetle (3)	Aphid	Jan. - Mar.	Low
Spider (6) (Unidentified)	Shoot and blossom webber	Nov. - Jan.	Moderate

Leaf miner

Incidence of this pest could be recorded during the post monsoon flushes. Population of leaf miner was noticed during August and was available before flowering started during the month of March. Maximum population was recorded during October.

Apple and nut borer

Incidence of apple and nut borer was recorded during the month of February - March coinciding with the reproductive phase of the plants and existed only 2 to 3 months in this region.

Inflorescence thrips

Population build up of thrips was noticed during January and it increased upto March followed by a rapid decline. The incidence of this pest recorded ranged from 1.4 to 13.5 per cent in the plantations.

Survey of pest complex and natural enemies

Survey were conducted in the different parts of West Bengal. Population of different pest were recorded in the districts of Midnapur (East), Midnapur (West), Bankura and Purulia. Plantation of state cashew farm, Digha were also visited.

Different species of pests were recorded to occur during the different seasons in the area mentioned above. Important parasite and predators were recorded during the seasons, it was noticed that about 8.7 and 6.6 per cent of the population of shoot and blossom webber and leaf miner were parasitized by the braconid parasite.

MADAKKATHARA

Tea mosquito infestation on shoots ranged from 1.3 to 15.19 per cent during April and December. But no infestation could be noticed on panicle and nuts during the same period except in April (4.04%). Tea mosquito infestation was maximum on panicle and nuts during January 1995 (47.65 and 24.53 per cent) Table-99.

Leaf miner infestation ranged from 2.71 to 14.41 per cent on shoots and 1.68 to 23.83 on leaves from October to February 1995. Leaf roller infestation was comparatively low during regular flushing season, but was maximum in January 1995 (18.33%). The infestation of blossom webber, thrips apple, nut and apple borer was low (Table-100).

The natural enemies and other agents noticed in the unsprayed area were ants,

Table 99: Monthly occurrence of tea mosquito at Madakkathara centre (1994-95).

Months	Shoots		Panicle		Nuts	
	%	Mean score	%	Mean score	%	Mean score
Apr.	*	*	*	*	4.04	0.14
May.	—	—	—	—	—	—
Jun.	—	—	—	—	—	—
Jul.	5.21	0.17	—	—	—	—
Aug.	6.70	0.22	—	—	—	—
Sep.	—	—	—	—	—	—
Oct.	2.27	0.06	—	—	—	—
Nov.	1.30	0.03	—	—	—	—
Dec.	15.19	0.18	10.12	0.23	—	—
Jan.	—	—	47.65	0.55	24.53	0.35
Feb.	—	—	22.39	0.61	13.33	0.46
Mar.	—	—	13.46	0.48	6.23	0.20

* No fresh infestation

Table 100: Seasonal occurrence of minor pests (mean of 12 observations) at Madakkathara centre (1994-95).

Months	Leaf miner		Leaf roller (%)	Blossom webber (%)	Thrips % nuts affected	Mean score	Apple & nut borer
	Shoots (%)	Leaves (%)					
Apr.	—	—	—	—	4.44	0.12	2.15
May.	—	—	—	—	—	—	—
Jun.	—	—	—	—	—	—	—
Jul.	—	—	—	—	—	—	—
Aug.	—	—	—	—	—	—	—
Sep.	—	—	—	—	—	—	—
Oct.	2.71	6.67	—	—	—	—	—
Nov.	3.17	10.00	—	—	—	—	—
Dec.	14.41	23.83	—	—	—	—	—
Jan.	7.69	10.97	18.33	5.00	24.81	0.28	—
Feb.	6.59	1.68	0.08	1.13	—	—	—
Mar.	—	—	—	5.28	—	—	—

Table 101: Seasonal occurrence of natural enemies and other agents at Madakkathara cente (1994-95).

Months	Ants	Spiders	Mirid bugs	Chrysopa	Honey bees. flies and wasps
Apr.	0.85	0.96	0.54	0.35	—
May.	0.81	0.81	—	—	—
Jun.	0.79	0.52	—	—	—
Jul.	0.60	0.40	—	—	—
Aug.	0.88	0.88	—	—	—
Sep.	0.60	0.65	—	—	—
Oct.	0.92	0.42	—	—	—
Nov.	1.02	0.96	—	—	—
Dec.	—	—	—	—	—
Jan.	2.25	0.50	—	—	—
Feb.	0.83	0.50	—	—	—
Mar.	1.06	0.83	—	—	—

spiders, mirid bugs, chrysopa, honey bees, flies and wasps (Table-102).

VENGURLA

The survey of pests infesting cashewnut crop in Sindhudurg district and its seasonal distribution for 1994-95 is given in Table-102.

VRIDHACHALAM

Periodical surveys were made during 1994-95 in different places of South Arcot, Vallalar, Chinglepet, Villupuram Ramasamy Padayatchiar, Trichy and Pudhukottai districts. Throughout the year, the incidence of Tea mosquito bug was noticed at all plantations in different districts.

Survey of pest complex and natural enemies

During incidence of 1994-95, tea mosquito bug, shoot tip and inflorescence caterpillar, stem and root borer, apple and nut borer, shoot and blossom webber, leaf miner, leaf folder, ash weevil, aphids mealy bugs

was recorded. Damage due to stem and root borer (3.7-40.5%) was recorded through out the year. From the time of flowering to fruiting period shoot and blossom webber (35.5% to 67.85%), tea mosquito bug (55.6%), leaf miner (25.35% to 40.55%) and apple and nut borer (10.25% to 25.65%) were recorded. During the period of observation the coccinellid predator on aphids, mealy bugs and syrphids on aphids were observed. Spiders were also noticed throughout the year. Hymenopteran parasite viz., *Bracon* sp. was noticed on shoot and blossom webber (Table-103).

JAGDALPUR

Survey was conducted in different parts of Bastar, Lohandiguda and Darbha blocks for accessing pest complex in cashew plantations during 1993-94. The distribution of insect associated with this crop during different parts of the year was not uniform and most of the insects recorded were of minor importance as the intensity of attack

Table 102: Survey of pests of cashew at Sindhudurg district (Vengurla centre).

Name of the pest		Month of occurrence	Intensity
Common name	Scientific name		
Tea mosquito	<i>Helopeltis antonii</i> S.	Aug. - Nov. Dec. - Mar.	Low Severe
Stem and root borer	<i>Plocaederus ferrugineus</i>	Through out the year	Low
Leaf cutting weevils	<i>Deporaus marginatus</i>	Jul. - Aug.	Low
Leaf eating beetles	<i>Monolepta</i> Sp.	Jul. - Aug.	Low
	<i>Coenobius</i> sp.	Jul. - Aug.	Low
Leaf miner	<i>Acrocercops syngamma</i>	Jul. - Dec. - Jan.	Low
Aphids	<i>Toxaptera odinae</i>	Nov. - Feb.	Low
Web-worm	<i>Orthaga exvinacea</i>	Sept. - Nov.	Low
Flower thrips	<i>Rhipiphorothrips</i>	Dec. - Mar.	Moderate
Hairy caterpillar	—	Nov. - Jun.	Low
Apple and nut borer	<i>Nephopteryx</i> Sp.	Jan. - Apr.	Low
Mealy bugs	<i>Ferrisia virgate</i>	Feb. - Mar.	Low

Table 103: Bioecology and survey of major pests of cashew in different districts of Tamil Nadu during the period 1994-95.

Common name	Scientific name	Month of occurrence	Intensity (%)
Tea mosquito	<i>Helopeltis antonii</i>	Through out the year	55.60 - 95.00
Apple and nut borer	<i>Thylocoptila panerosoma</i>	Mar. - Jun.	10.25 - 26.65
Stem and root borer	<i>Plocaederus ferrugineus</i>	Through out the year	3.74 - 40.50
Flower thrips	<i>Selenothrips</i>	Jan. - Sept.	12 per leaf
Flower thrips	<i>Scirtothrips</i> sp	Mar. - May	18 per panicle
Shoot and blossom webber	<i>Orthoga exavinacea</i>	Sept. - Mar.	35.50 - 67.25
Ash weevil	<i>Myllocerus</i> sp	Sept. - Dec.	3.75 - 12.30
Leaf miner	<i>Conopomorpha syngamma</i>	Nov. - Mar.	25.35 - 40.55
Aphids	<i>Toxaptera odonii</i>	Nov. - Mar.	10.55 - 25.35
Mealy bug	<i>Ferrisia virgate</i>	Dec. - Mar.	15.45 - 23.50
Slug caterpillar	<i>Latoia lepida</i>	Dec. - Mar.	13.35 - 20.55
Natural enemies			
Coccinellid predator	<i>Menochilus sexmaculatus</i>	Oct. - Mar.	3/shoot
Spider	<i>Oxyopes</i> sp.	Through out the year	1/shoot
Syrphids	<i>Syrphus</i> sp.	Oct. - Mar.	3/panicle
Hymenopteran parasite	<i>Apantelese</i> sp	Dec. - Mar.	25.50
Bracon sp. on shoot and blossom webber			

was very low. However tea mosquito bug was quite active from November to March and intensity of this pest was moderate. The other important insects recorded were aphids, plant bugs, leaf weevil, termite and hairy caterpillars (Table-104).

Field trial was conducted on the

chemical control of tea mosquito bug at farmers field in village kudakanar during 1994-95. The experiments were framed as per schedule layout of NRCC (Puttur). The results of the trial is under progress.

Incidence of root and shoot borer, nut borer and bark eating caterpillar were also recorded.

Table 104: List of insects associated with cashew in Bastar Plateau Zone at Jagdalpur centre.

Common name	Scientific name	Plant parts being damaged	Intensity
Tea mosquito	<i>Helopeltis antonii</i>	Drying of inflorescence and tender parts	Low
Plant bug	<i>Coptosoma spp.</i>	Tender parts.	Low
Aphid	<i>Aphis spp.</i>	Sucking the sap from the tender parts	Low
Red cotton bug	<i>Dysdercus cingulatus</i>	Tender foliage	Low
Gundhi bug	<i>Leptocoris acuta</i>	Not damaging	Very low
Termite	<i>Microcerotermes pakistenicus</i> Akhatar	Bark	Moderate to severe
Green plant bug	<i>Nezara viridula</i>	Tender parts	Very low
Leaf weevil	<i>Peltotrachelus sp.</i> <i>Myllocerus spp.</i>	Foliage Foliage	Very low Very low
Root grub	<i>Holotrichia consanguinea</i> B. <i>Holotrichia serrata</i>	Roots Roots	Very low Very low
Tussoc, (Hairy caterpillar) moth	<i>Euproctis lunata</i> W.	Tender parts and inflorescence	Low
Lepidoptera moth	<i>Euchromia ploymena</i> Linn (Lepidopter : Syntomiidae).	Foliage	Very low
Praying mantides	<i>Mantis religiosa</i> *	Not damaging	Low
Lady bird beetle	<i>Coccinella septempunctata</i> (Coleopetera: Coccinellidae)	Not damaging	Low
Leaf weevil	<i>Apion spp.</i>	Apical	Low
Grass hopper	<i>Crotogonus spp.</i>	Not damaging	Low
Bark eating caterpillar	<i>Indarbela tetraonis</i>	Superficial tissue portion stalk.	Moderate
Leaf and blossom webber	<i>Lamida monocusalis</i> W.	Tender leaves and blossom	Moderate
Stem and root borer	<i>Plocaederus ferrugineus</i>	Killing the tree throughout	Low
Leaf miner	<i>Acrocercops syngamma</i> M.	Mine through tender leaves	Moderate

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

(Bapatla, Bhubaneswar, Chintamani, Jhargram, Madakkathara, Vengurla and Vridhachalam).

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

BHUBANESWAR

Sixteen MLT entries were screened for resistance against the shoot tip borer, *Hypatima haligramma* Mey., the major pest of cashew at Bhubaneswar under field condition. The type Veng-5 showed the lowest damage of 16.58 per cent shoot infestation followed by VTH-30/4 (18.86%) and BPT-129 (19.47%). The type VTH-59/2, BPT-2/16 and BPT-40 were highly susceptible (the per cent shoot infestation ranged from 31.17 to 35.25 per cent). The remaining types were moderately susceptible (shoot infestation varied between 20-30%).

CHINTAMANI

The experiment was not carried out due to very low populations of major pests, non uniform distribution of pests of the region and non flowering due to variations in climate.

JHARGRAM

Germplasm types were screened against tea mosquito, thrips and shoot tip caterpillar and none of them were found to be resistant against tea mosquito bug. The mean incidence of tea mosquito thrips and shoot tip caterpillar was 6.8 to 7.5, 4.2 to 11.9 and 3.8 to 10.7 respectively. The mean incidence of thrips and shoot tip caterpillar

was very low.

MADAKKATHARA

All the accessions planted during 1988 (Acc. Nos. 15 to 50) and 1989 (Acc. 51 to 82) were observed for tea mosquito infestation at monthly intervals on regular flushes during 1993-94. Tea mosquito infestation was very high during January - February 1994 and hence the yield was generally poor. Those accessions which recorded a mean infestation of less than 25 per cent (from October - April) and produced a yield of more than 700 g/tree are given in Table-105.

Based on the last two years observations, the following varieties/types are considered to be comparatively tolerant/less susceptible with a mean yield of 700g/tree. The varieties are Madakkathara-1, H-3-17, H-718, H-1600, A-26-2, A-6-1, PU-8, K-10-1, H-8-1, H-8-7, H-8-8 and H-8-15. Highest mean yields of 2.9kg and 1.7kg were recorded in accessions BLA-139-1 and H-1588.

VENGURLA

In the field screening the observations were recorded from 0.5 x 0.5 sq m marked area of the canopy on all the four sides during the peak period of incidence of tea mosquito. None of the entries were found to be resistant against the pest (Table 106).

Table 105: Tea mosquito infestation and yield on less susceptible accessions at Madakkathara centre.

Accession No.	Varieties/types	Mean infestation		Yield Kg/tree
		Percentage (Oct.-Apr.)	Mean score	
17	Brazil-120	28.10	0.66	1.2
25	Vapala	18.21	0.34	1.3
29	BLA-1391-1	17.85	0.44	2.9
27	Madakkathara-1	16.25	0.27	1.3
29	NDR-2-1	20.28	0.36	1.4
30	H-3-13	19.34	0.19	1.0
31	H-3-17	13.34	0.28	0.7
34	H-718	19.50	0.30	0.8
37	H-1588	21.67	0.31	1.6
44	H-1600	17.62	0.83	1.2
46	H-1608	24.88	0.17	0.9
49	A-26-2	19.00	0.36	1.6
51	A-6-1	17.77	0.21	1.3
56	Pu-7	20.08	0.17	1.1
57	Pu-8	18.19	0.26	0.8
65	K-10-1	16.63	0.19	0.9
70	K-19-2	26.83	0.31	0.8
73	H-3-9	27.45	0.47	1.1
75	H-8-1	16.02	0.36	1.3
76	H-8-6	20.28	0.33	0.7
77	H-8-7	19.82	0.32	1.0
78	H-8-8	12.04	0.17	1.1
80	H-8-15	14.31	0.24	0.7
81	H-9-3	23.78	0.35	0.7

VRIDHACHALAM

The seven year old (Planted during 1987) F_1 hybrids of high yielding and tea mosquito field tolerant types were screened against the natural incidence of tea mosquito bug, shoot and blossom webber, aphids, mealy bugs and leaf thrips. All the 17 MLT entries and available new germplasm types were also screened for their tolerance to insect pests. (Table-107 and 108). All the eight F_1 hybrids had the infestation of tea mosquito

bug and the mean percent damage and mean score of damage due to tea mosquito bug ranged from 32.51 to 65.84 and 3.15 to 4.00 respectively.

All the F_1 hybrids showed the incidence of shoot and blossom webber, aphids, mealybugs and leaf thrips. The mean percent damage by the shoot and blossom webber ranged from 29.52 to 63.54, mean percent damage of shoots per quadrant by aphids

Table 106: Screening of the germplasm against tea mosquito (Vengurla centre).

Type	Average score	Percent incidence
Tulas	0.50	11.42
H-26 (16-98)	0.66	16.51
CYT-176	0.29	7.35
J-3	1.11	27.84
J-2	0.49	12.30
J-5	0.43	10.70
J-6	0.63	14.83
H-26 (1608)	0.24	6.00
J-15	0.41	13.40
CYT-195	0.18	4.62
Taliparamba	0.27	6.77
H-2/16	0.68	17.10
H-2/15	0.50	12.28
T-129	0.74	18.50
J-1	0.32	8.13
Kolgaon	0.81	20.39
Kanakadi	0.40	12.05

and mealy bugs ranged from 2.5 to 23.5 and 2.58 to 45.20 respectively. The mean percent damage of leaves per quadrant by the leaf

Table 107: Relative damage potential due to tea mosquito bug on F₁ hybrids at Vridhachalam centre.

Crosses	Tea mosquito incidence	
	Mean percent	Mean score of damage
M 10/4 x M 26/1	65.84	4.00
M 10/4 x M 45/4	39.42	3.24
M 10/4 x M 75/3	43.54	3.64
M 26/2 x M 26/4	32.51	3.15
M 26/2 x M 45/4	63.27	4.00
M 26/2 x M 75/3	62.15	3.93
M 44/3 x M 26/1	55.33	4.00
M 44/3 x M 45/4	45.18	3.84

thrips ranged between 8.56 and 42.56 (Table 108).

The incidence of tea mosquito bug, shoot and blossom webber, aphids, mealy bug and thrips was found on all the MLT entries (Table 109). The mean percent damage of tea mosquito bug ranged from 28.42 to 75.18 and the mean percent damage of shoot

Table 108: Screening of F₁ hybrids against shoot and blossom webber, aphids, mealy bugs and leaf thrips at Vridhachalam centre.

Crosses	Mean percent damage per quadrant - shoot and blossom webber	Mean percent damage shoots per quadrant		Mean percent damage of leaves per quadrant by Thrips
		Aphids	Mealy bugs	
M 10/4 x M 26/1	52.24	3.56	2.58	16.58
M 10/4 x M 45/4	63.24	2.56	45.20	15.24
M 10/4 x M 75/3	55.36	11.32	18.38	8.56
M 44/3 x M 26/1	35.26	5.42	8.26	42.56
M 26/1 x M 45/4	63.54	10.28	15.12	25.32
M 26/1 x M 75/3	46.28	15.24	7.56	12.20
M 44/3 x M 75/3	29.52	8.52	25.32	32.46
M 44/3 x M 45/4	42.38	23.54	3.52	24.82

and blossom webber, aphids, mealy bugs 2.24 to 26.25 respectively, and thrips damage ranged from 20.15 to 52.27, 2.48 to 30.18 and ranged between 3.24 and 25.24.

Table 109: Screening of MLT entries against tea mosquito bug, shoot and blossom webber, aphids, mealybugs and leaf thrips.

MLT entries	Tea mosquito bug incidence		Mean percent damage of shoots/quadrant			Mean percent damage of leaves per quadrant thrips
	Percent damage	Mean score of damage	Shoot & blossom webber	Aphids	Mealy bug	
H 1598	42.39	3.54	33.63	5.27	26.25	3.99
H 1600	45.39	3.98	46.24	5.33	3.24	15.22
H 1608	49.12	3.54	52.27	8.12	15.18	25.24
H 1610	56.21	4.00	40.66	2.54	8.33	14.24
T 129	63.24	4.00	22.18	12.33	13.12	10.54
T 40	32.18	3.42	30.63	11.36	6.24	11.12
H 2/15	36.12	3.57	31.03	13.24	12.12	10.24
H 2/16	55.16	4.00	32.81	13.24	3.66	9.15
M 33/3	57.42	3.96	31.15	12.42	5.18	10.66
M 44/3	49.27	3.54	20.15	30.18	2.24	4.54
M 26/2	75.18	4.00	25.24	5.15	5.84	6.24
VTH 30/4	28.42	3.24	38.18	23.12	9.24	15.24
VTH 59/2	29.54	2.51	24.00	14.15	3.27	7.00
V2	35.18	3.81	31.03	2.48	3.18	3.24
V3	56.12	4.00	30.12	10.24	12.33	18.15
V4	33.96	3.72	33.33	19.15	5.24	12.18
V5	62.54	4.00	24.24	20.18	10.27	5.18

(a) HISTORY, OBJECTIVES, GROWTH AND SALIENT ACHIEVEMENTS

The All India Coordinated Spices and Cashewnut Improvement Project was started during the Fourth Five Year 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), Vengurla (Maharashtra) and CPCRI regional station Vittal (Karnataka). During the Fifth Plan period, one more centre at Bhubaneswar (Orissa) and in Sixth Plan period two centres one at Jhargram (West Bengal) and another at Chintamani (Karnataka) were added. During the Eight Plan period a new centre was started at Jagdalpur (Madhya Pradesh) under Indira Gandhi Krishi Viswavidyalaya and a sub centre at Pilicode (Kerala) of Madakkathara centre.

The Project Coordinator's cell was located at Central Plantation Crops Research Institute, Kasaragod.

During the Seventh Plan period the project was bifurcated into (i) All India Coordinated Cashew Improvement Project (ii) All India Coordinated Spices Improvement project (Vide ICAR office order F. No. 4-1/80-H & MC dated 24 September 1985). The Project Coordinator's cell has since then shifted to National Research Centre for Cashew-Puttur.

In all, there are eight functional coordinating centres - four in the East Coast viz. Bapatla, Bhubaneswar, Jhargram,

Vridhachalam; three in the West Coast - Madakkathara, Vengurla, Pilicode and one in the Maidan parts of Karnataka - Chintamani and one in Central India at Jagdalpur.

The project objective is to give additional thrust 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. Standardizing agrotechniques for the crop under different agroclimatic conditions. and
3. Evolving cost effective and efficient pest and disease management practices.

The first workshop of AICSICIP 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 in the workshops held in 1972 (Trivandrum, Kerala); 1975 (Coimbatore, Tamilnadu); 1978 (Panjim Goa); 1981 (Trichur, Kerala); 1983 (Calicut, Kerala); 1985 (Trivandrum, Kerala), 1987 (Bhubaneswar, Orissa); 1989 (Coimbatore, Tamilnadu); 1978 (Panjim, Goa); 1981 (Trichur, Kerala); 1983 (Calicut, Kerala); 1991 National Group discussion (in lieu of X Biennial Workshop) Kasaragod, Kerala and 1993 (Bangalore, Karnataka).

Two group discussions were also held one in horticulture and another in entomology during 1986 and 1988 at CPCRI, Regional Station Vittal and Trichur respectively.

The significant achievements of the project are summarised below:

1. A total of 24 varieties are released by various coordinating centres for cultivation in the respective regions.
2. For commercial multiplication of elite cashew varieties, soft wood grafting is standardised with a success percentage ranging from 60 to 83 (Bapatla, Bhubaneswar, Jhargram, Vengurla and Vridhachalam). Zero energy sand humid chambers (trench method) for grafting during dry period resulted in maximum success (86-88 percent) at Bapatla centre.
3. Top working for upgrading genetically inferior and old plants using soft wood grafting technique was carried out with a success percent ranging from 37.5-80 in all the centres (except Chintamani).
4. Fertilizer requirement of cashew crop was worked out to be 500g N, 125g P₂O₅ and 125g K₂O (Bapatla, Vengurla, Madakkathara and Vridhachalam). The experiment on seedling progenies was concluded at Jhargram centre.
5. In old NPK trial, maximum yield per plant was recorded when soil application of 300g nitrogen, 200g of phosphorus and 600g potassium was taken up. This experiment has been concluded this year at Jhargram.
6. Fertilizer application in circular trench of 25cm broad, 50cm depth and 1.5m 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 1.5 and 3.0m from the trunk and forking into the soil is found to be economical and the most efficient.
7. Foliar application of urea along with insecticides experiment was concluded at Bapatla and Vridhachalam centres.
8. At Vengurla a new manurial trial planted in 1990 with V-4 grafts is showing satisfactory growth. Spacing trial with V-4 grafts was planted at Dapoli.
9. Intercropping with perennials is dispensed with, instead annuals are being tried at all the centres except at Madakkathara centre.
10. 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 the most effective. (Bapatla, Bhubaneswar and Jhargram).
11. Kaoline swabbing and application of sevidol (75g/tree) (twice in a year) + neem oil (5%) was an effective prophylactic control measure for stem and root borer (Bapatla, Bhubaneswar, Jhargram, Madakkathara and Vridhachalam).
12. Survey for pest collection at Bapatla centre revealed that cashew plantations at high altitudes of North Coastal Andhra were more prone to TMB infestation and fungus than its counterparts in South.
13. At Vengurla flower thrips infestation was found to be severe at pea nut stage.

(b) STAFF POSITION

Project Coordinator

Dr. EVV Bhaskara Rao
(14-11-94 onwards)

Technical Information
Officer

Dr. (Miss.) Uma Jayaraman
(from 21-7-93)

Stenographer

Mr. V. Ahamed Bava
(upto 16-9-94)

PROJECT CENTRES

Cashew Research Station, Bapatla 522101 (APAU), Andhra Pradesh

Horticulturist

Dr K. Pampapathy

Asst. Entomologist

Mrs. M. Rama Devi

Asst. Agronomist

Mr. Y. Radhakrishna

Sr. Technical Assistant

Mr. Rama Rao

(sub assistant)

(from 9-3-83)

Jr. Technical Assistant

Sri. K. Ranga Rao

(sub assistant)

(from 3-9-92)

Attender

Sri. G. Jaya Rao

(Grafter)

(Expired on 21-2-95)

Cashew Research Station, Bhubaneswar 751003, (OUAT) Orissa

Horticulturist

Mr. P.C. Lenka

Jr. Entomologist

Mr. L.N. Mohapatra

Sr. Technical Assistant

Mr. P.C. Swain

Jr. Technical Assistant

Mr. P.C. Routray

Jr. Horticulturist

Vacant

Grafter

Vacant

Agricultural Research Station, Chintamani 563125 (UAS) Karnataka

Horticulturist (Agron.)

Mr. K.S. Krishnappa
(23-4-90 to 16-5-94)

Dr. H.B. Lingaiah
(from 16-5-94)

Jr. Horticulturist

Sri. V. Shankaranarayana
(from 22-7-92 to 28-5-93)

(Vacant)

Jr. Entomologist

Sri. G.T. Thirumalaraju

Sr. Technical Assistant

Mr. T.N. Venkatesha Gowda

Mr. V.L. Madhuprasad
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Mr. Shivappa
(15-2-95)

Grafter

Vacant

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Jr. Horticulturist	Dr. Jitesh Kumar Hore
Jr. Entomologist	Dr. B. Bandopadhyay
Sr. Technical Assistant	Vacant
Jr. Technical Assistant	Mr. S. Dutta Roy (6-12-89 to 5-4-95) Sri. S.K. Rakshit (25-11-94 to 5-4-95) Sri. S. Sarkar (5-4-95) Smt. K. Basu (27-4-95) Vacant
Grafter	Vacant

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Assoc. Professor	Dr. M. Abdul Salam (1-2-95) Dr. P.A. Joseph (from 7-10-93 to 22-02-94) Smt. K.E. Usha (from 22-02-94 to 31-1-95)
Asst. Professor (Ent.)	Dr. S. Pathummal Beevi (4-5-89 to 1-1-95) Smt. Lyla K.R. (02-1-95 to 31-3-95)
Sr. Technical Assistant	Smt. B. Suma (Assoc. Professor) (1-3-94)
Jr. Technical Assistant	Mr. C. Gireesan

Regional Agricultural Station, Pilicode

Asst. Professor	Dr. B. Jayaprakash Naik
Associates	Prof. S. Sukumaran Naik
Asst. Professor	Dr. M.P. Giridharan

Regional Fruit Research Station, Vengurla 416516 (KKV) Maharashtra

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Jr. Entomologist	Mr. S.K. Godse (Study leave) Mr. R.R. Lad

Jr. Breeder
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Jr. Horticulturist

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(from 9-6-93)
Mr. Nanda Kumar
(from 23-6-94)
Mr. S. Douressamy
(30-1-95)

Sr. Technical Assistant
Jr. Technical Assistant

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Mr. S. Manickam
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(from 3-6-94)

Grafter

Vacant

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Dr. Anuj Bhatnagar
Dr. O.P. Awasthi
Dr. N. Shukla

Jr. Technical Assistant
Grafter

Vacant
Vacant

**ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW
BUDGETORY PROVISION AND ACTUAL EXPENDITURE DURING 1994-95**

(Rs. in Lakhs)

Centre	Pay & Allow.	T.A.	Recurring	Non-recurring contingency Total	ICAR	share
ALLOCATION						
Bapatla	4.47	0.10	0.60	0.85	6.02	4.52
Bhubaneswar	3.36	0.10	0.60	0.85	4.91	3.68
Chintamani	3.26	0.10	0.60	5.19	9.15	6.86
Jhargram	3.38	0.10	0.60	3.19	7.27	5.45
Madakkathara	2.88	0.07	0.40	0.85	4.20	3.15
Pilicode	0.44	0.03	0.20	—	0.67	0.50
Sub-Centre						
Vengurla	3.22	0.10	0.60	1.55	5.47	4.10
Vridhachalam	3.54	0.10	0.60	1.55	5.79	4.35
Jagdalspur	2.14	0.10	0.40	3.40	6.04	4.53
Total	26.69	0.80	4.60	17.43	49.52	37.14

ACTUAL EXPENDITURE

Bapatla	3.54	0.06	0.60	0.33	4.53	3.40
Bhubaneswar	2.87	0.10	0.60	0.45	4.02	3.02
Chintamani	2.97	0.10	0.60	3.19	7.00	5.25
	0.14*					
Jhargram	1.92	0.08	0.34	—	2.34	1.76
Madakkathara	2.40	0.08	0.61	1.10	4.23	3.17
Pilicode	0.76	0.02	0.06	—	0.84	0.63
Vengurla	2.42	0.09	0.60	—	3.11	2.33
Vridhachalam	3.76	0.10	0.60	0.16	4.62	3.46
Jagdalspur	—	0.10	0.51	0.01	0.62	0.46
Total	20.78	0.73	4.52	5.28	31.31	23.48

Retirement benefit

(d) MONITORING OF PROJECT BY COORDINATOR

The programmes to be implemented in different centres was reviewed during the XI Biennial Workshop held at UAS Hebbal, Bangalore during 18-20 Aug. 1993.

University authorities were met during the visit of centres to appraise the progress of work in the centres, discussions were held regarding regularising the posting of Dr. H.B. Lingaiah to the grade of Horticulture so that he can continue at Chintamani centre to ensure the continuity of project implementation. At Chintamani to construct a mist chamber with the propagation shed and necessary proposal to be sent to Project Coordinator for obtaining Council's concurrence.

During the visit to different states, also visited the Corporation/Departmental plantations, for identifying the constraints for production in plantations and imparted necessary technical advice/expertise to overcome the problems. During the visit to the centres, production and availability of grafts of the released varieties was reviewed and on basis of the collected data, the supply of grafts to different development departments to be taken up.

(e) FUNCTIONING OF EACH CENTRE BAPATLA (APAU)

The centre was allotted technical programmes in Crop Improvement consisting of germplasm collection and evaluation, multilocation trials with varieties from Vittal, Vridhachalam, Vengurla and Bapatla along with hybridization programme. Centre has 135 germplasm collections of which 115

accessions were clonally multiplied and planted in conservation block. Centre has also collected all the released varieties for assessing their performance under Bapatla conditions. Varietal evaluation trial planted with accessions from Vittal, Vridhachalam, Vengurla and Bapatla is in progress and the grafts have come to flowering. In Hybridization programme with released varieties namely, BPP-5 and BPP-6 using Hybrid 2/22, T.No. 273 as donor parents, the hybrids were planted in the main field and evaluated. In Crop Management, new NPK experiment with higher doses of nitrogen was planted during the year. Experiment on foliar application was concluded. Standardization of index leaf was also carried out. In cashew based cropping system, trial with annuals is in progress. Bapatla centre has developed a "trench-method" for higher success in softwood grafting. A new nursery scheme was started under the financial sanction of State Directorate of Horticulture. During the year, 52,000 grafts were produced at this centre under the revolving fund scheme and new nursery scheme.

A fresh trial on high density population (625 plants/ha.) with regular fertilizer application was not taken up.

Top working trial is also in progress. In crop protection, all the five experiments were carried out. Neem oil 5% swabbing on the trunk was found to be a promising prophylactic control method for the control of stem and root borers. Overall performance of the centre is assessed as satisfactory.

BHUBANESWAR (OUAT)

Centre was allotted with trials in Crop Improvement consisting of germplasm and varietal evaluation. A total of 76 accessions are maintained in the germplasm bank. Centre has also collected all the released varieties and planted for evaluation under Bhubaneswar conditions. Four new accessions having cluster bearing habit with more than ten fruits per panicle were collected and added to the germplasm. In multilocation trial with 13 varieties from Bapatla, Vengurla, Vridhachalam and NRCC, all the plants are established. Maximum mortality was observed in M-15/4. In hybridization programme, centre has made 300 crosses with the combination of Bhubaneswar-1 x VTH-711/4. In Crop Management, NPK experiment with grafts of Bhubaneswar-1 the plants are responding to the treatments and observations are being carried out. A fresh trial using grafted plants (625 plants/ha) in high density population with regular fertilizer application was not taken up by the centre. In the cashew based cropping system trial with annuals the performance was found to be low. In vegetative propagation, centre has produced 4500 grafts during the current year. Centre has also implemented all the technical programmes in crop protection trials. Two training programmes on vegetative propagation of cashew was conducted and cashew day was celebrated with publication of a souvenir on the occasion. The centre's performance has been assessed as satisfactory.

CHINTAMANI (UAS)

During the year the centre has collected two accessions with large apple and

bold nut types bringing the total germplasm accessions to 116 at the centre. Comparative yield trial evaluation of Bapatla and Vengurla varieties is in progress. In the Multilocation Trial the grafts of M-44/3 of Vridhachalam are performing well. These can be used as mother plants for establishing scion bank of M-44/3 at the centre. The gap filling in Multilocation Trial '93 was not possible as decided in the XI Biennial Workshop as other plants have already reached fruiting stage.

During the year 1200 grafts could be produced on the onfarm with higher dose of nitrogen with the grafts of recommended varieties. The same was supplied to the farmers on cost.

A fresh trial on high density population (625 plants/ha) with regular fertilizer application was not taken up.

The NPK experiment is in progress. The experimental data is to be subjected to co-variance analysis using the yield data of 1991 as the base year. In entomology experiments the data on beneficial insects are being recorded. The centre's performance during the year is satisfactory.

JHARGRAM (BCKVV)

In germplasm survey, nine elite plants identified during 1992 were collected during the year from Midnapore district. The total germplasm available at this centre is 127. In varietal evaluation trial, accessions from Madakkathara and Bapatla have performed better. In Crop Management, NPK experiment with Jhargram-1 variety has been laid out. This is the only centre where in NP

and NK interactions were reported to be significant in the earlier NPK trial with seedling progenies. A fresh trial on high density population (625 plants/ha) using regular fertilizer application was not taken up. In Soft wood grafting, good success was reported during the month of June, August and September. However, with low cost humidity chamber reasonably good success was reported during the months of August, September and October. Centre has also standardized insitu grafting. Top working trial is in progress at this centre. However, success reported was very poor. All the experiments in Crop protections were carried out. Centre has also reported the efficacy of neem oil and sevidol 4G in the prophylactic treatment against stem and root borer. In the survey of pest complex for predators and parasites forty species of insects/pests have been recorded to occur during different seasons. Centre's performance is assessed as satisfactory.

MADAKKATHARA (KAU)

A total of 120 accessions are being maintained in the germplasm block of this centre. During the year 45 high yielding types collected from Kannur and Kasaragod districts were added to the germplasm holding by Pilicode sub centre.

In the varietal evaluation trial, Hybrid 1610 had a vigorous growth. Highest yield was recorded in Hybrid 1608, released as "DHANA" in the XI Biennial Workshop.

Crosses involving BLA-139-1 with Vetore-56, VTH-711/4 and kankady type as (bold nut donor sources) were identified for the centre. Crossing with Panama introduc-

tions was taken up during the current year. In Crop Management a manurial trial with grafts of BLA-39-4 was laid out during the year. But fresh trial using grafted plants (625 plants/ha) in high density population with regular fertilizer application was not taken up. Centre has established a polyhouse for taking up large scale vegetative propagation. During the year 69,565 grafts were produced at this centre. Scion bank with released varieties was also established to support large scale graft production. Centre has implemented all the technical programmes in Crop Protection. Centre is yet to initiate intercropping trials.

Significant research reporting of the centre is that the second and third sprays at the time of flowering and fruiting are the crucial ones in the effective control of losses due to Tea mosquito bug.

In the prophylactic control trial for the control of stem and root borer preliminary results indicate the efficacy of neem oil extract and neem cake extract. Centre has enumerated beneficial insects (pollinators) visiting the trees during the flowering and fruiting season. Centre's performance is assessed as satisfactory.

VENGURLA (KKV)

The centre's priority in germplasm collection and evaluation is the collection of bold nut types. So far 75 bold nut types have been collected and planted in the fields. During 1993-94 fruiting season 13 bold nut types were added to the germplasm. The total accessions available at this centre are 161 out of which 80 accessions are planted in the conservation block.

In the hybridization programme Vengurla centre has to improve the nut size of V-2 and V-5 by crossing with No. 1, 22 and 65, H.No. 2/16 has also bold nuts, the same was utilized in crossing experiments.

In the MLT planted in 1987, Madakkathara accessions 1598 and 1608 are performing well, studies to score the incidence of tea mosquito bug in all the accessions is to be under taken along with studies on flowering intensity from 1sq. m. on all the four sides of the canopy. A fresh trial using grafted plants (625 plants/ha) in density population with regular fertilizer application was not taken up. In the top worked trees on an average 8.6kg nuts/tree and maximum yield of 14.76 kg/tree in the sixth year after top working was recorded. Intercropping with vegetables like ridge gourd, cow pea is being under taken. In the new manurial trial planted in 1990 with V-4 grafts, the growth of the plant is satisfactory. Spacing trial with V-4 grafts was planted in Dapoli. In the chemical control of pest complex trial, spraying of monocrotophos and endosulfan at an interval of 30 days was found to be significantly superior.

In the trial on control of foliage and inflorescence pests with neem products, regular spray schedule with chemicals was found to be superior over all the neem products. At the centre the post of Junior Entomologist has fallen vacant as the incumbent has proceeded on study leave. The centre is sanctioned an additional post of Senior Technical Assistant. The centre's performance is assessed as good.

VRIDHACHALAM (TNAU)

At Vridhachalam 255 accessions are being maintained in the germplasm conservation block. M-26/4 was found to be the highest yielder in the germplasm accessions. Centre has also collected released varieties and planted for evaluation under Vridhachalam conditions. In the varietal evaluation multilocation trial with varieties from Vittal, Vridhachalam, Vengurla and Bapatla, V-5 variety was found to be the best. At Vridhachalam 145 F₁ hybrids of different cross combination are being evaluated. Centre has also crossed M-10/4 with tea mosquito bug tolerant types identified earlier and the same are being evaluated. During the current year M-33/3 was crossed with Hybrid 2/15, H-2/16, ME-3/2, which are identified as donor parents for bold nut size. H-13 (M 26/2 x M 26/1) gave the highest mean yield and registered the lowest tea mosquito damage; while highest shelling percentage was recorded in H-12 (M 10/4 x M 75/3). In Crop Management, a new trial with VRI-2 grafts was planted but, a fresh trial on high density population (625 plants/ha) with regular fertilizer application is yet to be taken up. Centre has also standardized vegetative propagation and taken up large scale multiplication of grafts. During the current year 17,385 grafts were produced for supplying to different agencies. In crop protection all the trials allotted to the centre are in progress.

In the screening of germplasm, type 45/4 and 26/4 were found to be less susceptible under field confinement screening. During the current year all three scientists working in the center were transferred causing some disruption in the continuity

of the work. Currently all the scientists are in position and the work is in progress. However due to severe cyclonic storms a number of cashew trees were uprooted. Therefore a number of experiments are to be relaid. Centre's performance needs improvement to reestablish the experiments.

JAGDALPUR (IGKVV)

At Jagdalpur in the year 1993 the survey of pest complex in the forest plantations of cashew already available in Jagdalpur was carried out. TMB was active during November - March. Important pests recorded were aphids, plant bugs, leaf weevil, termite and hairy caterpillar. Field trial on chemical control of TMB was carried out during 1994-95. Incidence of Root and Shoot borer, nut borer and bark eating caterpillar was also recorded. In the year 1994, for the Multilocation Trial - 92 with entries from Bapatla, Vridhachalam, NRCC, Vengurla and Madakkathara grafts from Vengurla and Vridhachalam were collected but the mortality rate was high. In Crop Management, NPK experiment trial on farmers' field with different levels of NPK has been undertaken. The centres performance is assessed as

satisfactory.

PILICODE (Subcentre, KAU)

The project was started in 1994. The sub centre was allotted the technical programmes in Crop Improvement consisting of germplasm collection and evaluation of bold nut types of cashew, multiplication of the released variety Dhana and drip irrigation in cashew. Forty five bold nut types of cashew have been collected and 15 were selected. The centres performance is assessed as satisfactory.

(f) PROBLEMS IN FUNCTIONING DURING THE YEAR

At Bhubaneswar centre there is no fencing around the farm and Irrigation facilities during the summer season are inadequate for the nursery. There is no vehicle to carry out the survey work of the project.

At Chintamani the council's permission for the purchase of the vehicle is yet to be obtained. Though Rs. 2.00 lakhs has been sanctioned in the Eighth Plan EFC. The vehicle is a must to survey the maidan parts for collection of germplasm.

(g)

METEROLOGICAL DATA (1994-95)

BAPATLA

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	32.6	25.5	72.7	68.9	—	—
May.	37.9	28.2	68.0	61.0	0.6	1
Jun.	37.7	27.6	62.0	51.0	57.3	6
Jul.	34.2	25.5	74.0	59.0	118.6	11
Aug.	33.2	25.3	77.0	66.0	89.5	11
Sep.	34.3	25.4	74.0	65.0	78.0	7
Oct.	30.5	24.0	89.0	83.0	365.5	18
Nov.	28.3	20.9	89.0	81.0	430.7	10
Dec.	29.3	17.2	86.0	65.0	0.2	—
Jan.	27.9	18.1	91.0	71.0	138.3	10
Feb.	29.8	19.7	91.0	73.0	—	—
Mar.	32.4	21.3	83.0	66.0	—	—

BHUBANESWAR

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	36.4	24.7	88.5	68.0	21.9	7
May.	39.1	26.9	87.0	48.0	17.9	4
Jun.	33.5	26.0	89.0	68.0	168.9	15
Jul.	31.3	25.1	92.0	78.0	238.0	27
Aug.	31.0	25.0	92.0	79.0	489.3	20
Sep.	31.9	24.6	93.0	73.0	251.7	16
Oct.	31.6	22.9	91.0	67.0	149.3	10
Nov.	29.7	18.7	87.0	52.0	5.6	3
Dec.	29.1	13.5	86.0	34.0	—	—
Jan.	26.8	18.4	90.0	48.0	32.0	5
Feb.	31.8	18.7	92.0	45.0	52.5	4
Mar.	34.8	21.8	90.0	43.0	21.6	2

CHINTAMANI

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	3.8	20.2	59.7	37.3	14.6	2
May.	34.3	22.1	43.2	25.8	51.4	7
Jun.	30.7	20.5	38.7	34.7	46.4	4
Jul.	29.1	20.2	77.6	57.7	64.4	6
Aug.	28.9	19.9	79.8	58.2	58.9	7
Sep.	29.9	19.7	72.2	55.1	38.8	3
Oct.	28.2	19.1	82.2	66.0	150.0	14
Nov.	25.4	15.3	85.8	63.0	9.3	1
Dec.	26.0	13.7	78.5	54.3	2.8	1

JHARGRAM

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	38.0	18.5	84.5	49.3	115.8	8
May.	39.0	23.5	83.7	45.0	93.4	7
Jun.	39.5	22.5	89.0	69.4	362.2	20
Jul.	33.5	24.0	90.5	77.8	519.4	25
Aug.	33.0	23.0	88.6	82.0	340.6	26
Sep.	34.5	21.0	89.5	70.0	252.0	15
Oct.	34.5	19.0	87.8	58.6	68.6	5
Nov.	31.5	13.0	80.6	52.7	2.2	3
Dec.	26.8	9.6	82.4	52.7	—	—
Jan.	26.5	7.5	84.2	53.0	28.0	4
Feb.	31.5	19.0	76.2	47.6	2.2	1
Mar.	39.0	16.5	74.7	31.5	1.4	1

MADAKKATHARA

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	(Mean)			
Apr.	34.9	24.4	74		165.2	10
May.	33.6	24.7	75		124.2	7
Jun.	28.9	22.9	90		955.1	27
Jul.	28.6	22.4	91		1002.1	29
Aug.	30.0	22.8	85		509.2	20
Sep.	31.8	23.2	78		240.5	8
Oct.	32.3	22.7	80		358.2	20
Nov.	31.8	23.3	68		125.3	5
Dec.	32.2	22.2	58		—	—
Jan.	32.9	22.4	59		—	—
Feb.	35.4	23.4	60		0.5	—
Mar.	37.6	23.8	60		2.8	—

VENGURLA

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	33.20	23.93	73.8	67.3	53.0	2
May.	32.56	25.36	72.2	70.8	67.0	1
Jun.	29.45	24.88	83.5	82.8	748.0	27
Jul.	29.38	24.75	86.8	85.0	682.0	29
Aug.	28.96	24.40	86.4	83.2	471.0	30
Sep.	29.88	22.50	86.3	76.0	103.6	18
Oct.	31.66	22.82	86.3	80.6	204.4	19
Nov.	32.58	19.78	78.0	71.5	60.2	6
Dec.	32.25	15.30	73.5	56.3	0.0	—
Jan.	30.93	15.67	77.5	55.5	01.0	2
Feb.	31.74	17.48	78.4	56.4	0.0	—
Mar.	31.71	20.22	73.5	52.0	0.0	—

VRIDHACHALAM

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	35.9	29.0	75.0	44.0	0.0	—
May.	38.3	28.1	73.0	45.0	21.2	2
Jun.	37.4	29.0	74.0	41.0	29.0	3
Jul.	35.4	26.8	79.0	51.0	81.6	8
Aug.	34.8	26.4	77.0	66.0	162.7	8
Sep.	35.1	27.6	70.0	67.0	90.1	4
Oct.	32.2	25.8	87.0	69.0	182.1	12
Nov.	29.3	23.7	86.0	76.0	294.3	12
Dec.	29.4	20.9	94.0	60.0	55.3	4
Jan.	30.6	21.6	84.0	71.0	10.4	2
Feb.	35.2	22.5	89.0	60.0	0.0	—
Mar.	38.1	24.9	75.0	56.0	7.5	—

JAGDALPUR

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr.	36.1	21.9	63.0	23.0	21.8	2
May.	37.9	23.0	65.0	28.0	57.8	4
Jun.	32.0	23.2	79.0	57.0	84.4	10
Jul.	27.0	21.1	92.0	79.0	456.2	22
Aug.	26.5	20.8	93.0	79.0	301.8	19
Sep.	28.3	20.5	93.0	73.0	185.0	8
Oct.	29.9	18.8	95.0	56.0	149.6	4
Nov.	27.1	12.8	93.0	41.0	15.6	1
Dec.	26.4	5.7	93.0	25.0	0.0	—
Jan.	24.8	9.6	93.0	43.0	54.3	3
Feb.	30.0	12.7	89.0	24.0	0.0	—
Mar.	33.5	16.3	75.0	27.0	21.3	2

(i) RESEARCH PUBLICATIONS BY CENTRES

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