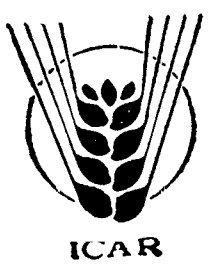
AICSCIP ANNUAL REPORT

1980-81

Project Co-ordinator
M. C. NAMBIAR



CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
KASARAGOD 670 124 KERALA

1981

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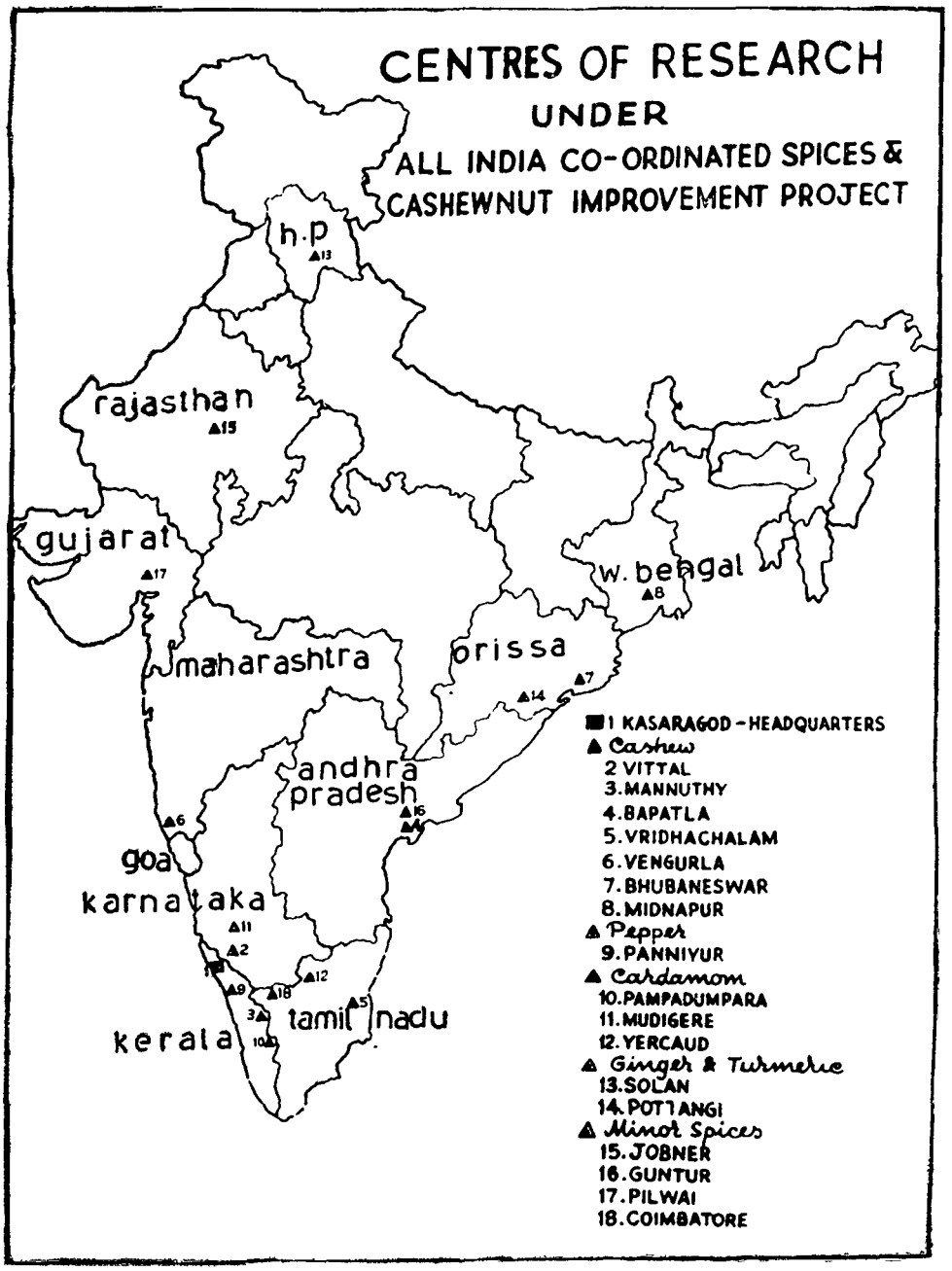
ABOUT THIS REPORT

The All India Coordinated Spices and Cashewnut Improvement Project has completed a decade of its existence and here is its tenth annual report for the year 1980-81. This report is being published on the eve of the Fifth Workshop on AICSCIP to be held on 31 October-2 November 1981 at Kerala Agricultural University Campus, Mannuthy, Trichur.

The AICSCIP of the Indian Council of Agricultural Research started functioning in 1971 with the main centre at the Central Plantation Crops Research Institute, Kasaragod, and ten co-ordinating centres in different parts of the country: Anakkayam (later shifted to Madakkathara, Kerala), Bapatla (Andhra Pradesh), Vengurla (Maharashtra), Vridhachalam (Tamil Nadu) and Vittal (Karnataka) dealing with cashew; Gonicoppal (Karnataka), Mudigere (Karnataka) and Pampadumpara (Kerala) dealing with cardamom; Panniyur (Kerala) and Vittal (Karntaka) dealing with pepper, and Solan (Himachal Pradesh) dealing with ginger and turmeric. In the Vth Plan six more centres were sanctioned, one for cashew at Bhubaneswar (Orissa), one for ginger and turmeric at Pottangi (Orissa) and four for minor spices at Guntur (Andhra Pradesh), Jobner (Rajasthan), Vijapur (Gujarat), and Coimbatore (Tamil Nadu). The new centres started functioning in 1975. In the VIth Plan, two more new centres were added, one for cashew in West Bengal and another for cardamom in Tamil Nadu. In addition new programmes were also started on cashew and pepper and condiments in Karnataka; pepper in Andhra Pradesh, and ginger and turmeric in Kerala. The new centres and new programmes have just started functioning in 1981. The details of the staff pattern and the staff in position in each of the centres are given elsewhere in this report.

Brief summaries of research results from different centres are presented experiment-wise in this report. Further details of experiment are available in the progress reports of the individual centres.


CENTRES OF RESEARCH
UNDER
ALL INDIA CO-ORDINATED SPICES &
CASHEWNUT IMPROVEMENT PROJECT
h.p
▲13
rajasthan
▲15
gujarat
▲17
maharashtra
orissa
▲14
▲7
w. bengal
▲8
andhra
pradesh
▲16
▲6
goa
karnataka
▲11
▲2
▲9
▲18
▲12
▲5
3▲
10▲
tamil nadu
kerala
■1 KASARAGOD - HEADQUARTERS
▲ Cashew
2 VITTAL
3. MANNUTHY
4. BAPATLA
5. VRIDHACHALAM
6. VENGURLA
7. BHUBANESWAR
8. MIDNAPUR
▲ Pepper
9. PANNIYUR
▲ Cardamom
10. PAMPADUMPARA
11. MUDIGERE
12. YERCAUD
▲ Ginger & Turmeric
13. SOLAN
14. POTTANGI
▲ Minor Spices
15. JOBNER
16. GUNTUR
17. PILWAI
18. COIMBATORE

ALL INDIA CO-ORDINATED SPICES AND CASHEWNUT IMPROVEMENT PROJECT

Co-ordinating centre:

1. Central Plantation Crops Research Institute
   Kasaragod 670124
   Kerala

Participating Centres :

Cashew

2. Cashew Research Station
   (Kerala Agricultural University)
   Madakkathara 680 651
   Kerala

3. Cashew Research Station
   (Andhra Pradesh Agricultural University)
   Bapatla 522 101
   Andhra Pradesh

4. Cashew Research Station
   (Konkan Krishi Vidyapeeth)
   Vengurla 416 516

5. Cashew Research Station
   (Tamil Nadu Agricultural Uuiversity)
   Vridhachalam 606 001
   Tamil Nadu

6. Central Plantation Crops Research Institute
   Regional Station
   Vittal 574 243
   Karnataka

7. Department of Horticulture
Orissa University of Agriculture & Technology
Bhubaneswar 751 003
Orissa

Cardamom

8. Regional Research Station
(University of Agricultural Sciences)
Mudigere 577 132
Karnataka

9. Cardamom Research Station
(Kerala Agricultural University)
Pampadumpara 685 553
Kerala

10. Horticultural Research Station
(Tamil Nadu Agricultural University)
Yercaud 636 602
Tamil Nadu

Pepper

11. Perper Research Station
(Kerala Agricultural University)
Panniyur 670 141
Kerala

Ginger and Turmeric

12. Department of Vegetable Crops & Floriculture
Himachal Pradesh Krishi Viswa Vidyalaya,
Solan 173 213
Himachal Pradesh

13. High Altitude Research Station
(Orissa University of Agriculture & Technology)
Pottangi 764 039
Orissa

Minor spices

14. Department of Horticulture
Tamil Nadu Agricultural University
Coimbatore 641 003

15. Department of Agricultural Botany
SKN College of Agricultural
(University of Udaipur)
Jobner 303 329
Rajasthan

16. Agricultural Research Station
(Andhra Pradesh Agricultural University)
Lam, Guntur 522 034
Andhra Pradesh

17. Agricultural Research Station
(Gujarat Agricultural University)
Pilwai 382 850
Gujarat

RESEARCH HIGHLIGHTS

This is the tenth annual report of All India Co-ordinated Spices and Cashewnut Improvement Project. In addition to the centres mentioned in the pevious annual report, this report also contains the work done in a centre for cardamom, *viz.*, Yercaud in Tamil Nadu. A summary of work done under the Project in these centres during the year 1980-81 is given below :-

Cashew

The present cashew germplasm collection at the six different centres under the AICSCIP comprises 791 accessions, of which 101 are at Madakkathara campus of KAU, Mannuthy, 179 at Bapatla, 177 at Vridhachalam, 124 at Vengurla, 163 at Vittal and 47 at Bhubaneswar. During the period under report, 19 types at Anakkayam / Madakkathara, 37 at Bapatla, 4 at Vridhachalam, 3 at Bhubaneswar, and 20 at Vengurla were reported to be high yielders. At Bapatla, one tree under the age groug of 50 years (Tree No. 71) recorded more than 50 kg and another in the age group of 25 years (4/1 Gollagudam) recorded about 40 kg nuts during the period under report.

Analysis of the yield data for the comparative yield trial at different centres confirms the results already reported, i. e. the seedling progenies of the four Vridhachalam selections (M 44/3, M 10/4, M 76/1 and M 6/1), the Anakkayam selection BLA 139-1 and Bapatla selection Tree No. 1 were significantly superior to all other entries. Among the Vridhachalam selections, seedling progenies of M 44/3 were found to be superior to other three types and gave an overall mean of 3.98 kg/tree for the last four years and an average yield of 4.90 kg/tree during the year 1980-81. The highest mean yield for the centre (7.49 kg) was recorded at Vengurla and in all the centres it recorded higher yield than the plot average. In another comparative yield trial at Anakkayam, (started in 1975) with the airlayers of high yielding trees, the hybrid H-3-17 gave the maximum mean yield (8.69 kg/tree) followed by 6.93 kg in BLA 39-4 and 6.46 kg in hybrid H-3-13.

Among the 289 hybrid progenies planted at Madakkathara during 1973, two trees (Tree No 662 of H-24 and 684 of H-23) yielded 13.93 kg and 13.40 kg, respectively. At Bapatla, among the 86 hybrid progenies, of about 25 years of age, 5 recorded more than 15 kg nuts/tree. Maximum yield of 24.8 kg was recorded in Tree No. 6/1 followed by 20.0 kg in Tree No. 10/9.

Out of the 121 cross combinations evaluated at Vengurla, eight progenies were found to be very promising. Based on the average yield for the last four years, it is seen that Tree No. 24 is the most promising one (average yield 20.38 kg/year.) The clonally propagated progeny orchards of promising hybrids 5, 11 and 19 have been established at various centres.

At Vridhachalam, nine hybrids were screened on the basis of the yield for the last four years. The nut size (4–11 g) was found to be significantly improved in all the progenies where one of the parental combinations is M 33/3.

Vegetative propagation trial carried out at Madakkathara for the last three years showed that June to September was the best period for side grafting, veneer grafting and budding. In stone grafting up to 80% success was obtained in May. Wood shavings was found to be the ideal medium for airlayering among the different media tried. In the nursery, the best medium and container for airlayers in cashew (95% establishment) was ordinary potting mixture in polythene bag. At Bapatla, like in the previous years, high percentage of success (60-92) in v neer grafting was obtained from June to February months. At Vengurla, maximum success (77.6%) in veneer grafting was obtained in September. Epicotyl grafting using 6–10 days old seedlings also was found to be successful under Vengurla condition. Up to 74% success was obtained in February and May. At Vridhachalam, 16–19% success in *in situ* budding was obtained on six months and one-year-old seedlings of M 26/1. 'T' budding was almost a failure at Bhubaneswar, whereas up to 88% success in side grafting and 76% success in soft wood grafting were obtained at at this centre. Vegetative propagation trials concluded at Vittal give the following indications: (1) up to 76% success was obtained in veneer grafting during June-November. (2) Patch budding *in situ* gave 75% success as against (41%) with root stock raised in containers. Shoots of 1.5–3.0 cm thickness was found suitable for patch budding (3) Epicotyl grafting was found promising (60%), where the grafts were to be raised in containers at close intervals, (4) Mound layering was found feasible to multiply high yielding trees by raising scion orchards at close spacing.

Analysis of the yield data in the NPK fertilizer experiment started in 1972 at Bapatla showed that there was response to N up to N_2 level for all the characters studied. In yield both N_1 (500 g/tree) and N_2 (1000 g/tree) levels were found to be significantly superior to N_0 but there was no significant difference between N_1 and N_2. Comparison of the marginal factor cost and marginal revenue revealed that it is advisable to go for higher levels of N, when the price of the produce is high above Rs. 5/kg better to adopt lower levels of N, when the price of the nuts is less (Rs 3/kg). The NPK fertilizer experiment started in 1969 at Vengurla showed that cashew responded well to Nitrogen and Phosphatic fertilizers. The combination N_3P_2 (125 kg N + 50 kg P_2O_5/ha) gave the highest yield of 1·696 kg/tree, like the previous year. In the absence of P, N showed no significant difference. At Bhubaneswar, the results indicated that the optimum dose of N was 250 g/tree under the soil and climatic conditions prevalent in that area.

In order to estimate the production of cashew, weekly observations starting from the third week of January 1981, on seven different characters, were carried out at Kasaragod. Fifth, sixth, seventh and eighth week's observations gave more than 75% ($R^2 > 75\%$) of the information about the annual yield under Kerala conditions and this can be utilised in forecasting yield.

Cardamom

The cardamom germplasm assemblage comprises 14 collections and 8 species at

Mudigere and 18 types and 14 species at Pampadumpara. At Mudigere, out of the 80 early bearing types, seven selections were screened as promising based on the performance for the last 10 years. The average yield ranged from 125 to 325 g of green capsules/clump, i. e. 75 to 200 kg dry capsules/ha. Among the 80 clonal selections, 34 recorded more yield than the plot average of 312.54 g of green capsules/plant and 12 clones recorded more than 500 g/plant. In 1980-81, maximum yield of 893 g/plant was recorded in Clone No. 722 followed by 887·5 g in Clone No. 668. Among the 77 clones planted in 1973, thirtyseven recorded more yield than the plot average of 269 g and five clones, viz., CL 746, 757, 761, 802 and 804 recorded 589, 598, 667, 701 and 694 g green capsules/plant. When stability in yield over six years (1976-81) is considered, only Clone No. 722 and 654 among the 80 clonal selections planted in 1969, and all the five high yielders among the 1973 plantings have recorded consistently higher yield. In the maximisation trial with 25 clonal selections, the three selections, *viz.*, P_1, P_3 and P_5 were selected based on their yield and associated characters. In sucker production, these clones as well as the bulk material, did not differ significantly. However, in panicle production P_1 and P_3 gave significantly more panicles per sucker (3·74 and 30·48 respectively) compared to P_5 or control.

The yield data for the diallel crosses confirm the earlier indications that the performance of combinations involving early bearing type was comparatively better. The other promising combinations are 'high yield' and 'leaf rot resistant' progenies. The maximum yield of 966 g/plant was recorded in the combination 'multiple branches' x 'Early bearing'.

The yield data for the NPK fertilizer experiment at Mudigere and Pampadumpara did not give any consistent and significant results as in the previous years.

In the field control trials against Azhukal disease with 14 treatments, plots treated with Dithane M-45, 0.3% (drenching) the percentage of capsule infection was reduced to 0.91 from 31.81. Dithane M-45 (0.25%) spraying also reduced the infection considerably (0.50% from 31.14%) For the control of thrips in cardamom, treatment consisting of eight sprayings with fenthion 0.05% from June onwards recorded the least infestation.

In the seed germination studies at Mudigere, it was observed that the germination percentage was considerably reduced (17.67) in oven dried seeds when compared to fresh seeds (55.3). At Yercaud, July planting gave the highest percentage of establishment (87.92), which gradually reduced to 61.67% in November. In the three-year-old plantations close planting with a spacing of 1m on either side recorded the maximum height (208.55 cm), number of shoots (21.1) and number of panicles (8.05).

Pepper

The pepper germplasm collections maintained at Panniyur comprises 136 types which include 26 wild types and 3 cultivated types collected during 1980-81. Based on the yield data for the past 19 years, seven cultivars (Karimunda, Kottanadan, Kuthiravally, Balankotta, Cheriyakaniakadan, Kumbhakodi and Kalluvally) have been identified as promising. The studies also indicated a declining trend in yield in most of the vines after a period of ten years of regular bearing.

So far a total of 10,000 hybrid and open pollinated seedlings were raised. Screening at different stages of growth helped in identifying five promising cultures (94, 406, 354, 341 and 456). In the preliminary yield trial, culture No. 354 gave the maximum yield of 1·629 kg/vine as against 0·499 kg in Panniyur-I. The yield data for the comparative yield trial, for four years showed the superiority of the hybrid Panniyur-I over the other four cultivars. Panniyur-I recorded an average yield of 1·2 kg/vine as against 0·084 kg in Kalluvally, 0·245 kg in Balankotta, 0·836 kg Arakulam Munda and 0·952 kg in Kuthiravally. Initial observation recorded on vegetative characters and yield at Vellanikkara, Trichur indicate that growth and initial yield are better on dead standard Split application of fertilizers was found to be more beneficial than single application.

Observations recorded for the past three years (1978-80), in the pepper garden at Bandadka showed that the quick wilt incidence is positively correlated with the rainfall. Thus the incidence of the disease was maximum (4·8%) in 1978 when the maximum rainfall was received, and the least (0·9%) in 1980. In the splash traps kept at three different heights below pepper vines, the quantity of water and soil particles splashed and collected were more at 25 cm than those at 50 cm and 75 cm. The castor baits infected was also more (25%) at 25 cm This indicates the possibility of the fungus propagules being splashed along with soil particles during the rains to heights up to 50 cm In the field control trial with Bordeaux mixture, Bordeaux paste and two systemic fungicides (Ridomil and aliette), no disease incidence was recorded in plots treated with Bordeaux mixture and metalaxyl (ridomil) The results of the trials on the control of pollu disease at Panniyur showed that three application of Bordeaux mixture, one in the last week of May, second in the first week of July and third in the last week of September could effectively control the disease. Studies on spike shedding indicated that 44·5% spike shedding was due to fungi and 55·8% due to other factors.

Ginger

The germplasm assemblage of ginger includes 119 types at Solan, 25 at Kasaragod and 56 at Pottangi. At Solan, during the year 1980-81, 21 types yielded more than 500 g/plant, which works to about 20 kg/bed of $3m^2$. The maximum yield of 30 kg/$3m^2$ was recorded in Clone No. 236. Performance of the germplasm collection at Kasaragod for the last four years indicated that 6 varieties are promising under Kasaragod conditions. Wynad local gave the maximum average yield of 6.5 kg/$3m^2$ bed followed by 6.3 kg in Nadia and 6.2 kg in Burdwan. The comparative yield trial for two years also showed the superiority of these three varieties over the other. At Pottangi, the highest yielders were Wynad local (11·175 kg/$3m^2$) and Vengara selection (10.510 kg/$3m^2$). Among the 24 cultivars under preliminary yield trial, Vengara selection yielded maximum (9.35 kg/$3m^2$ bed). On comparison of yield data for different planting methods, it was noticed that raised beds and flat beds are equally good (6.514 kg and 6.908 kg/$3m^2$ bed respectively), for ginger cultivation. There is progressive increase in yield with the increase in weight of seed rhizomes used for planting.

In the fungicidal trial laid out against rhizome rot of ginger, Dithane M-45 recorded maximum yield among the five fungicides. Among the seven fungicides tried to control

storage rot of seed ginger, 69–76% recovery of healthy rhizome was obtained in the treatments with Difolatan, Dithane M-45, Benlate and Bavistin as against 41.38% in control. Storing in pits gave 68% healthy rhizomes. In the field control trial against leaf spot disease of ginger, maximum yield was obtained from Bordeaux mixture treated plots (3.19 kg from 40 plants) as against 2.9 kg in control.

Studies on the storage losses due to scales showed that the weight of the infested rhizomes was reduced by 50% during a period of 3 months. Among the six insecticides tried for the laboratory control of scales, quinalphos (0.1%) and Aldicarb 1% could eradicate the pest completely.

Under the lab-to-land programme, eight demonstration trials with a high yielding ginger type, were organised in the tribal village at Pottangi. The yield ranged from 7.5 to 30.0 tonnes/ha. This has helped to convince the tribal farmers the advantage of improved technology.

Turmeric

Among the 52 germplasm collections and 62 clonal selections at Kasaragod,Cls. No. 15B, 2A and 18A recorded higher yield (13.0 kg, 12.3 kg and 12.2 kg/3m^2 bed, respectively). At Pottangi, among the 89 entries, Cli 390 Rajapuri recorded maximum yield of 12.15 kg/3m^2 bed. Eight clones (yield ranging from 6.4 kg–7.38 kg/3m^2 bed) were identified as promising. Among the 24 cultivars under preliminary yield trial, PTS-62 recorded the maximum yield of 9·50 kg/3m^2 bed.

In the comparative yield trial Cls No. 1 gave maximum yield of 7.05 kg/3m^2 bed as against 6.5 kg during last year At Coimbatore, among the 56 accessions evaluated for yield and quality characters, accession No. 5395-1-2 gave the highest yield of 15.125 kg/5m^2. In the camparative yield trial with 12 accessions Cls. 9 recorded the highest yield of 501.6g per plant as against 364.1 g in the control.

Trial conducted at Pottangi showed that mulching definitely improved the yield in turmeric. Except black alkathene, all other mulching materials are equally good.

Coriander

The coriander germplasm collection comprised 200 entries at Jobner, 680 at Guntur, 134 at Coimbatore and 179 at Jagudan (Vajapur). At Jobner, nine entries yielded more than 5 q/ha, maximum yield of 7.80 q/ha was recorded in UD-370. At Guntur the yield/ha ranged from 167 kg in Sel. III to 1125 kg in CS. 7. At Coimbatore, the yield varied from 2.0 g to 8·0 g/plant. Among the 14 varieties compared at Guntur, CS-2 continued to record maximum yield (833 kg/ha) in the third year also. From the yield data for the last three years, it is evident that the varieties CS-2, CS-4 and P2 are highly promising (Yield ranging from 938 to 1024 kg/ha).

Under the varietal evaluation trial at Jobner, Banswara and Borkhera in Rajasthan, CS-4 gave maximum yield at the latter two places, whereas UD-374 recorded the highest yield at Jobner. The yield data for the last three years showed that UD-41 (9·12 q/ha) and UD-20 (7·41 q/ha) were the promising types under the irrigated and unirrigated conditions, respectively. The yield data for the preliminary yield trial with 39 entries for the last three years did not show any significant difference between varieties. The essential oil contant ranged from 0.03% in UD-16 to

0.20% in UD-374, UD-156, 137 and 207. Among the 24 accessions under initial evaluation at Coimbatore, five recorded an yield of more than 200 g/plot, the maximum being in No 1085 (270 g/plot of 4.5 m^2) followed by 304 (225 g). In the winter trial also, No. 1085 recorded the maximum yield (68.75 g/plot).

Among the 12 varieties under comparative yield trial at Guntur CS-2 (1167 kg/ha), CS-4 (1075 kg), C0-1 (1021 kg) and P2 (1008 kg/ha) were the high yielders. Maximum mean yield for the last three years was recorded in CS-2 (1117.2 kg/ha) followed by C0-1 (1067 kg/ha). At Jobner, the 15 entries under the trial showed significant difference in yield, the maximum being recorded in UD-374 (4 65 q/ha). Comparison of the yield data for the last four years showed that Selection UD-41 (9.51 q/ha) was the most promising one among the 15 Selections under the trial. At Jagudan, the entry 'Tamil Nadu' gave the highest yield of 12.36 q/ha which was 5.73% higher than the control. At Coimbatore, two trials were conducted, of which the trial started in June showed no significant difference between varieties, where in the latter trial the varieties differed significantly. The high yielders were S-33 (50 g/plot), culture 270 and Co-2 (48.33 g each).

Among the six entries, viz., Co. 1, CS. 2, CS. 4, CS. 5, UD. 21 and UD. 41, under comparative yield trial at the four centres, CS. 2 recorded the maximum mean yield at Guntur, Vijapur and Coimbatore.

At Jobner, in the first year (1978-79) of the NPK fertilizer experiment, a consistent increase in yield with an increase of N was noticed. But in the following years (1979-80 and 1980-81), no significant difference between treatments was noticed, At Guntur, the treatment with 30 kg N/ha recorded the maximum yield of 1200 kg, followed by 1063 kg in plots treated with 40 kg N/ha. At Jagudan, among the twelve combinations of NPK, the combination $N_{40}P_{60}K_{30}$ recorded the highest yield of 1296 kg/ha which was 60·4% higher than the control.

Cumin

The cumin collection comprised 56 entries at Jobner, 50 at Jagudan and four at Guntur. In the initial evaluation trial at Jagudan, Vijapur-5 gave significantly higher yield (581 kg/ha) which was 144% higher than the control. In the varietal trial at three locations the yield at Mandore was good, but no significant difference between varieties was noticed. The fertilizer experiments conducted at Jobner and Jagudan showed no significant response to fertilizer application. The incidence of wilt was very high at Jobner in all the experiments including germplasm; hence the low yield.

Fenugreek

The fenugreek germplasm collection consists of 100 types at Jobner, 70 at Jagudan and 48 at Guntur. At Jobner, wide range of variability was observed for different characters among the entries. The highest yield was recorded in UM-26 (11.52 q/ha) followed by 10·29 q/ha in UM-33 against 6.86 q/ha in the check NLM. Lam Selection-1 gave the maximum yield at Guntur (667 kg/ha followed by 583 kg in Gadwal. In the monsoon season of 1980, 26 accessions were subjected to evaluation at Coimbatore. Appreciable variation in plant height (range 24.6 cm to 40.1 cm), number of branches/plant (range 4.2-6.0) and

number of pods/plant (range 22-41) was noticed.

Among the 14 cultivars under the comparative yield trial at Guntur, Lam Selection-1 recorded significantly higher yield (696 kg/ha). The other high yielders were NLM (679 kg/ha) and GS-960 (667 kg/ha). At Jobner, comparison of the yield data of 10 varieties along with two local checks for the last four years revealed the superiority of NLM over other varieties. NLM recorded an average yield of 15.3 q/ha as against 12.16 kg in the local check. In another trial, six varieties were compared at four different locations. At Durgapura, Banswara and Mandore, the maximum yields were recorded in NLM, i.e. 25.08, 25.46 and 7.87 q/ha. At Jobner, the yields of NLM, UM-35, UM-34 and UM-32 were at par with each other, but higher than the check. Comparison of the yield data for the last four years showed the superiority of NLM over others. The over all mean yield was 14·37 q/ha. At Coimbatore, no significant difference was noticed between the six accessions under initial evaluation, but the 14 accessions under comparative yield trial showed significant difference in yield and associated characters. Accession No. 2336 recorded the maximum yield of 310 g/plot.

Among the eight selections of fenugreek, viz , Lam Selection-1, IC-9955, UM-5, UM-17, UM-32, UM-34 UM-35 and NL (M), under comparative yield trial at the three centres, Selection NL(M) recorded the maximum mean yield of 0·48 q/ha at Guntur and Jobner whereas Lam Selection-1 recorded maximum yield at Coimbatore.

The NPK fertilizer experiments at Jobner and Jagudan did not show any significant difference between the main effects. At Jobner, maximum yield of 15·83 q/ha was recorded in $N_{15}P_0$ kg/ha followed by 15.58 q/ha in $N_{30}P_{15}$ kg/ha. At Jagudan maximum yield of 18.40 q/ha was recorded in the combination $N_0P_{60}K_{30}$.

Fennel

Among the 14 cultivars in the germplasm collection at Guntur, Lam Selection-II and UF-31 recorded the maximum yield of 950 kg/ha each. At Jobner, among the 34 entries evaluated, 13 exceeded the check in yield. The highest grain yield of 1.88 kg/plot of 8.05 sq m. was recorded in UF. 90 followed by 1.76 kg in UF. 88 and 1.74 kg in UF. 12. The seven entries in the comparative yield trial at Jobner did not show any significant difference for any of the characters studied. As in the previous year, UF-32 recorded maximum yield (22.05 q/ha). Evaluation of five varieties along with local checks at two locations, viz., Sumerpur and Jobner also did not differ significantly in yield/ha even though UF-32 recorded the highest yield at both the locations (10.87 and 22.05 q/ha, respectively).

In the fertilizer experiment laid out at Jobner, the response of N was noticed only up to N_1 level which was significantly higher than N_0 level whereas response of P was noticed up to p_2 level. The maximum yield of 21.83 q/ha was recorded in N_2P_2 (N-30 kg/ha and P 30 kg/ha). Application of Zn + B with lower doses of N and P did not show any increase in yield, but with N_3P_2, a significant increase was observed.

PROGRESS REPORT OF AIGSCIP EXPERIMENTS

CASHEW

Experiment 1. **Germplasm collection and description of types and varieties**
(Mannuthy, Bapatla, Vengurla, Vittal, Vridhachalam and Bhubaneswar)

Under the AICSCIP, the present germplasm assemblage in cashew comprises 791 accessions, of which 101 are at Madakkathara campus of KAU, Mannuthy, 179 at Bapatla, 177 at Vridhachalam, 124 at Vengurla, 163 at Vittal and 47 at Bhubaneswar. Evaluation based upon morphological characters, yield and yield components showed substantial variability among these accessions.

Germplasm collection at Madakkathara includes 54 seedling and 47 clonal progenies. Among these, trees belonging to 65 types have flowered and started yielding by the fourth year. The morphological characters like height, girth of the stem, canopy spread *etc.* were recorded. The yield varied from 100 g to 7.2 kg/tree. The maximum yield was obtained from Tree No. 2052 (Adhour type) followed by 5.25 kg from Tree No. 1966 (Muliyar type)

At Anakkayam (KAU), 12 clonal types and 5 seedling types gave more than 10 kg nuts/tree. Among the clonal types, NLR-2-1, the highest yielder of the previous year, recorded the maximum yield (20.01 kg) during this season also. BLA-139-1, a seedling type recorded maximum yield (29.3 kg/tree) during this year also as in previous years. The performance of the promising selections is given in Table 1.

Table 1. **Yield and associated characters of the promising selections at Anakkayam.**

Type No.	Year of planting	Flowering season	Yield during 1981 (kg)	Mean yield for 8 years (1974-81) (kg)	Mean nut size (g)	Shelling percentage
[1]	[2]	[3]	[4]	[5]	[6]	[7]
a) **Clonal types**						
NLR-2-1	1964	Middle	20·01	15·658	5·50	26·08
K-19-1	1964	Late	19·02	14·940	7·80	24·90
K-10-2	1964	Late	18·06	14·585	8·50	26·96
K-25-2	1963	Late	17·30	15·212	5·60	25·78

[1]	[2]	[3]	[4]	[5]	[6]	[7]
K-10-1	1964	Late	16·75	13·817	8·62	26·14
K-12-1	1964	Late	16·30	–	5·20	–
K-28-2	1963	Late	15·46	13·446	5·70	26·29
K-19-2	1964	Middle	15·44	–	7·85	24·90
K-16-1	1963	Late	14·49	11·267	8·90	26·08
K-3-2	1963	Late	14·30	–	8·25	–
NLR-2-2	1964	Middle	14·22	11·220	5·50	24·36
K-20-1	1964	Late	14·15	–	6·50	30·01
b) Seedling types						
BLA-139-1	1963	Early	29·30	32·672	6·00	27·99
ABD-2-1	1963	Middle	20·03	–	–	–
UL-21-2	1964	Middle	14·40	–	6·80	26·70
UL-15-1	1964	Middle	14·35	–	4·90	26·70
BLA-39-4	1963	Middle	13·18	14·721	5·20	26·80
BLA-273-1	1963	Early	9·74	19·100	6·30	28·33

At Bapatla, out of the 86 trees in the old grove (50 years old), 42 trees recorded more than 20 kg nuts. The yield range in the high yielders are presented in Table 2.

Table 2. **High yielders in the old plantations of Bapatla.**

Yield range (kg)	No. of trees
20-30	12 (Tree No. 68, 27, 28, 37, 241, 270, 218A, 183, 169, 152, 161, 130)
30-40	7 (Tree No. 62, 100, 144, 228, 232, 252, 275)
40-50	2 (Tree No. 39, 129)
50-60	1 (Tree No. 71)

Among the survey collections aged about 25 years, 14 trees recorded more than 10 kg of nuts. The type 4/1 Gollagudam yielded 39·30 kg nuts. This is consistently giving very good yield for the last three years. Yield of these promising selection is given in Table 3.

Table 3. **Yield grouping of the promising cultivars about the age group of 25 years at Bapatla.**

Yield range (kg)	No. of trees
10-15	9 (3/6 Diwan cheruvu; 4/2, 4/4, 5/5 and 5/6 Gollagudem; 7/6 Rustembada; 7/8 Vetapallem; 9/5 Epurupallem and 11/6 Stuartpuram).
15-20	3 (1/5 Kodur; 3/7 and 4/9 Gollagudam)
20-30	1 (1/1 Stuartpuram)
>30	1 (4/1 Gollagudam)

The collection at Vridhachalam comprised 169 indigenous types from Tamil Nadu, Karnataka, Maharashtra, Andhra Pradesh and Kerala and eight exotic types from Singapore, Brazil, Mozambique, Nairobi, Kenya, Tanganyika and Mtwara. Inspite of the poor rainfall received during this year, 47 trees in the germplasm collection yielded. The recently released variety VRI-1 recorded 16·60 kg nuts/tree. The details of the yield grouping are given in Table 4.

Table 4. **Yield potentialities of cashew accessions at Vridhachalam.**

Source	No. of trees yielded in 1980-81	Yield (kg)			
		<3	3-5	5-10	>10
Tamil Nadu (M)	39	26	1	9	3
Karnataka (MC)	6	3	-	2	1
Andhra Pradesh (A)	2	2	-	-	-
	47	31	1	11	4

The yield/ha for the selection VRI-1 is 1452·89 kg as against the state average of 122·40 kg/ha in Tamil Nadu. The tree is medium sized with a height of 5·5 m and a canopy spread of 10·2 m x 6·3 m at the age of 15 years. The branching is intensive with 14·6% of perfect flowers. The nuts are medium sized weighing 500 g/100 nuts and a shelling percentage of 28. The apple is brownish yellow. The kernels are cream in colour with a weight of 200 g/100 kernels. This conforms to the second grade (240 w counts) recognised in the international market.

The nut and kernel characters of 38 types were studied. The details are given in Table 5.

Table 5. **Variability for nut and kernel characters of certain cashew types at Vridhachalam.**

Characters/Variability measure	Range	Mean	Standard deviation (SD)	Coefficient of variation (Percent) (CV)
100 nut weight (g)	252·0–667·0	502·9	501·3	16·2
Percentage of shell weight (g)	64·0– 75·4	68·8	15·4	3·6
Percentage of Testa by weight	1·5– 7·6	4·1	8·3	32·6
Shelling percentage (% of cleaned kernel to raw nut)	20·4– 31·6	27·1	16·0	9·6
100 kernel weight (g)	68·0–200·0	149·4	173·5	18·9

The 100 nut weight varied from 252 g to 667 g. Three types, M 1/4, 26/2 and 15/4 gave a 100 nut weight of more than 600 g, i.e. 667, 650 and 614 g respectively. No correlation was noticed between the nut weight and other parameters like percentage of shell, percentage of testa, kernel recovery or 100 kernel weight.

A maximum shelling percentage of 31·6 was recorded in Type A 20/4. The breakage percentage was the least (2·0) in VRI-1. The percentage of testa ranged from 1.5 to 7·6, and is minimum in VRI-1.

The 100 kernel weight among the 38 types ranged from 68 to 200 g, the maximum weight being in VRI-1 and M 17/1 (200 g). Studies on the association of five nut characters, *viz.*, weight of 100 nuts, shell weight, testa weight, shelling percentage and weight of 100 kernels, showed no correlation among themselves which indicated that selection should be practised independently for each character.

At Bhubaneswar, the germplasm collection was started in 1975-76. The variation in mean yield was from 0. 747 kg nuts/tree (Kerala seedling) to 5.759 kg (M. 16/3). The number of trees under different yield groups are given in the Table 6.

Table 6. **Variation in yield among the cashew germplasm collection at Bhubaneswar.**

Yield group (kg/tree)	No. of trees
< 1	4
1 - 1·9	14
2 - 2·9	14
3 - 3·9	11
4 - 4·9	1
> 5	3
Total	47

The germplasm collection at Vengurla consists of 124 types (51 clonal and 73 seedling) among which 94 types have been described morphologically. Seven types with desirable characters have been identified as promising, of which two types, Ansur-1 and WBDC-VI have been released as varieties under the names 'Vengurla-1' and 'Vengurla-2' respectively. The details regarding the promising collections are given in Table 7.

Among the germplasm, 84 trees belonging to 20 types yielded more than 10 kg nuts/tree during the period under report. The details are given in Table 8.

Table 7. **Characters of the seven promising cashew types at Vengurla.**

Type	Average yield (5 years) (kg)	Highest recorded yield	No. of nuts/ kg	Shelling %	Special features
Vengurla-1	20·197	25·172	160	31	Good for overall performance
Vengurla-2	28·680	43·340	230	33	Short flowering and fruiting phase, and high shelling percentage
Veture-56	8·010	11·265	100	25	Bold nuts
Ansur Early	7·651	9.728	290	30	Cluster bearing habit
Mysore Kotekar 1/61	12·530	15·021	320	30	,,
Midnapur Red	2·582	4·655	220	32	High shelling %
Vengurla 36/3 (WBDC V)	10·560	13·560	250	31	High shelling %

Table 8. **Range of variation in yield among the high yielding cashew trees in the germplasm collection at Vengurla.**

Yield group (kg/tree)	No. of trees	
	1981	1976–80
<10	3	25
10-15	59	43
15-20	16	15
>20	6	1
Total	84	84

During the period under report, 6 trees, viz., WBDC VI, 24/9 Ansur No.2, 24/3 Ansur No.2, 23/10 Ansur No. 1, 23/3 Ansur No. 1, and 25/7 Ansur No. 2 yielded more than 20 kg nuts/tree. The highest yield was recorded in WBDC VI (24.09 kg/tree) which was the maximum mean yielder for the period 1976-80 also.

During the year 1980-81, 12 more selections yielding 9-18 kg nuts/tree have been screened as high yielders and grafts of these trees were planted in the germplasm plot.

A total of 15 trees were selected as promising from the cashew garden of Dahanu, Thane district, on the basis of desirable characters like compact canopy, intensive branching, nut size, and number of fruits/panicle. One tree with medium growth has been identified as high yielder at Veture.

At Vittal among the 163 accessions in the germplasm, 21 yielded more than 5 kg nuts/tree. Tree No. VTH 17/1 gave the maximum yield of 16.05 kg nuts/tree.

Experiment 3: **Comparative yield trial with existing high yielders in different agroclimatic regions.**

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

This trial was laid out in 1972-73 at all the centres except Bhubaneswar, where it started in 1975. Analysis of the yield data from 1978-1981 showed that the seedling progenies of the four Vridhachalam selections (M 44/3, M 10/4, M 76/1 and M 6/1), the Anakkayam selection BLA 139-1 and the Bapatla selection Tree No. 1 were significantly superior to all other selections as far as yield was concerned. The yield data for the year 1980-81 also showed the same trend. Among the Vridhachalam selections, seedling progenies of selection M 44/3 was found to be superior to the other three, which gave an overall mean of 3·98 kg/tree for the last four years, and an average yield of 4·90 kg/tree during the year 1981. The highest mean yield for M 44/3 was 7·49 kg recorded at Vengurla and the lowest 3·04 kg at Vittal for 1981. In all the centres it recorded higher yield than the plot average. The performance of these selections at various centres are given in Table 9a and 9b.

During the year 1980-81, the plot average was maximum at Vengurla, i. e. 4·40 kg/tree followed by Bhubaneswar (3·61 kg/tree) and minimum at Madakkathara, i. e. 2·15 kg/tree. At Vridhachalam, because of the severe drought, the trees did not flower.

In another comparative yield trial, air layers of 16 high yielding trees of the Cashew Research Station, Anakkayam (KAU) have been planted in 1975 at Madakkathara and Anakkayam, to compare their performance. The hybrid H-3-17 recorded maximum mean yield (8·69 kg/tree) during the year 1980-81 followed by 6·93 kg in BLA 39-4 and 6·46 kg in hybrid H-3-13. Tree No. 1750 belonging to H-3-17 recorded the highest yield of 22·5 kg followed by 22·3 kg in Tree No. 1687 belonging to BLA 39-4.

Table 9a. **Performance of the cashew selections in Comparative yield trial at different centres during 1978-81. (Yield of nuts - kg/tree)**

Selections	Mannuthy		Bapatla		Vengurla		Vridhachalam £		Vittal		Bhubaneswar		Mean
	1981	1978-81	1981	1978-81	1981	1978-81	1980	1978-80	1981	1978-81	1981	1978-81	78-81
Vengurla													
Ansur-1	2·24	1·72	1·99	2·94	3·38	4·16	0·55	1·79	1·25	0·90	3·57	3·51	2·50
Vengurla 36/3	3·10	2·53	2·37	1·26	4·33	4·17	1·50	1·76	1·93	1·41	4·25	4·07	2·53
Vengurla 37/3	1·03	2·16	3·08	1·75	4·58	4·60	1·10	2·46V.56	1·79	1·97	3·27	3·14	2·68
Savantawadi	2·27	2·62	3·72	1·91	2·58	3·75	0·63	0·96M.1	3·35	3·05	2·65	2·46	2·46
Bapatla													
Tree No. 1	1·12	2·01	4·99	4·18	3·68	3·88	1·36	2·98	2·82	2 02	3·44	3·38	3·08
Tree No. 40	1·65	1·99	4·44	2·80	3·73	4·33	1·81	3·26	1·72	1·54	4·60	4·59	2·95
Tree No. 56	0·63	1·52	5·21	3·49	5·03	4·95	2·05	2·62	2·37	1·70	3·85	3·76	3·01
Tree No. 273	2·08	2·27	2·24	2·56	2·97	3·99	1·48	2·85	2·49	1·56	3·33	3·17	2·73
Vridhachalam													
M 10/4	1·49	2·11	5·17	3·00	5·58	6·59	1·71	2·48	3·25	2·94	3·66	3·63	3·46
M 6/1	3·16	3·06	2·85	2·45	5·17	5·18	1·01	2·93	2·43	1·95	3·99	3·99	3·26
M 44/3	3 41	3·22	4·43	2·83	7·49	7·11	2·81	3·74	3·04	2·74	*4·62	4·22	3·98
M 76/1	3·44	3·29	4·34	2·39	3·64	4·59	1·38	8·46	2·26	2·07	**4·07	3·79	3·27
Anakkayam													
K-10-2	1·95	2·91	3·60	1·91	4·32	5·06	1·21	1·30	1·34	0·98	+4·02	3·20	2·56
H-4-7	1·30	2·40	2·04	1·71	4·38	4·80	1·45	2·02	1·43	1·46	3·10	2·59	2·50
BLA 139-1	1·41	2·10	3·51	2·27	4 88	6·55	3·39	4·60	3·02	1·85	+ +2·31	2·77	3·37
BLA 256-1	2·06	2·05	2·80	2·04	4·72	4·85	1·58	2·50	2·61	1·75	@ 3·07	2·89	2·68
K-27-1	5·51	4·33											
Mean	2·15	2·44	3·55	2·47	4·40	4·92	1·56	2·61	2·32	1·87	3·61	3·45	–

* Tree No. M 1/2 instead of M 44/3

** Tree No. M 2/4 instead of T. 76/1

\+ Tree No. UL-28 instead of K 10-2

+ + Tree No. K-19/1 instead of BLA 139-1

@ Tree No. H-3-13 instead of BLA 256-1

£ Figures for 1980 are given

Table 9b. **Performance of cashew selections in Comparative yield trial (kg/nuts/tree) Table of Means**

Type	Yield (1978-81)
M 44/3	3·98
M 10/4	3·46
BLA 139/1	3·37
M 76/1	3·27
M 6/1	3·26
Tree No. 1	3·08
Tree No. 56	3·01
Tree No. 40	2·95
Tree No. 273	2·73
BLA 256/1	2·68
Vengurla 37/3	2·68
K 10/2	2·56
Vengurla 36/3	2·53
Ansur-1	2·50
H-4-7	2·50
Sawantwadi	2·46
S. E/plot = 0·69	
C. V. % = 2·94	
C. D. = 0·40	

Experiment 4: **Hybridisation and selection**

(Mādakkathara, Bapatla, Vengurla and Vridhachalam)

A total of 289 hybrid progenies including 199 progenies brought from Anakkayam and planted at Madakkathara during 1973 are under evaluation. Compared to the previous year, the yield during this year was poor due to heavy incidence of tea mosquito. Maximum yield of 13·93 kg was obtained from Tree No. 662 of H-24 closely followed by Tree No. 684 of H-23 (13·40 kg). The performance of the promising hybrids is given in Table 10.

Table 10. **Performance of the promising hybrids planted in 1973 at Madakkathara.**

Tree No.	Hybrid No.	Yield (kg/tree)
662	H-24	13·930
684	H-23	13·400
681	H-23	11·950
718	H-23	11·000
719	H-23	10·750
665	H-27	9·550
678	H-23	9·450
1590	H-21	9·000
640	H-24	8·970
647	BLA-139-1 (Selfed)	8·500
722	H-25	7·900
676	H-23	7·725
631	H-23	7·600
792	H-20	7·530
680	H-23	7·250
790	H-25	7·250
657	H-24	7·200
755	H-25	6·950
720	H-25	6·900
643	H-27	6·850

Among the hybrids planted in 1963 at Anakkayam H-4-7 recorded a maximum yield of 20·75 kg nuts during the year, followed by H-3-17 (20·36 kg).

At Bapatla, among the 86 hybrid plants of the age group of about 25 years, 26 trees recorded yield less than 5 kg, 19 trees recorded between 5–10 kg, 6 yielded between 10–15 kg and 5 trees recorded more than 15 kg nuts/tree. Yield data of the five promising hybrids is given in Table 11.

Table 11. **Yield data for the five promising hybrid trees at Bapatla.**

Tree No.	Cross combination	Yield/tree (kg)
3/1	Tree No. 39 x 50	16·20
10/4	Tree No. 273 x 259	16·60
10/7	Tree No. 273 x 252	18·15
10/9	Tree No. 273 x 252	20·00
6/1	Tree No 251 x 252	24·80

During the period under report, crosses involving eight selected parents with desirable characters like high sex ratio, shorter flowering phase, desirable plant type, high yield, sweet apple, more number of nuts/panicle and big size nuts, were effected.

At Vengurla, 1256 F_1 progenies involving 121 cross combinations were planted from 1970–1980. The progenies planted in 1970 have been studied for their sex ratio, fruitset, apple and nut characters and yield potential. The percentage of perfect flowers in these progenies varied from 3 to 43 and the fruit set from 3 to 10. Out of the 160 progenies planted in 1970, eight progenies have been found to be very promising The clonally propagated progeny orchards of promising hybrids 5, 11 and19 have been established at various research centres at Daboli. The performance of the promising hybrids as well as the different combinations are given in Tables 12a and 12b.

Table 12a. **Performance of the promising hybrids planted in 1970 at Vengurla.**

Tree No.	Crosses	Yield (kg)	
		1981	1978–81 (Mean)
5	Ansur–1 x Vetore–56	10·33	15.02
11	Midnapur Red x Vetore–56	11·75	17·67
19	Midnapur Red x Vetore–56	12·02	16·99
24	Ansur Early x Mysore Kotekar 1/61	17·97	20·38
28	Mysore Kotekar 1/61 x Ansur Early	16·73	16·37
29	Mysore Kotekar 1/61 x Ansur Early	18·36	15·52
32	Mysore Kotekar 1/61 x Vetore–56	18·81	15·24
38	WBDC V x Ansur–1	16·14	17·73
74	Midnapur Red x Ansur–1	15·01	16·34

Based on the average yield for the last four years, it is seen that Tree No. 24 is the most promising one.

Table 12b. **Variation in yield of some promising hybrids (Planted at Vengurla)**

Cross Combination	Yield (kg/tree)	
	1981	Range
Planted in 1970		
Ansur No. 1 x Vetore-56	10·33	-
Midnapur Red x Vetore-56	11·89	11-12
Ansur Early x Mysore Kotekar 1/61	12·76	10-18
Mysore Kotekar 1/61 x Ansur Early	15·80	12-18
Mysore Kotekar 1/61 x Vetore-56	13.66	10-18
WBDC-V x Ansur No. 1	12·44	10-16
WBDC-V x Vetore-56	12·04	11-12
Midnapur Red x Ansur No. 1	14·92	14-15
Ansur No. 1 x WBDC-V	10·57	-
Ansur No. 1 x WBDC-VI	10·96	9-11
Ansur Early x Midnapur Red	11·39	-
Mysore Kotekar 1/61 x Ansur No. 1	11·01	10-13
Vetore-56 x WBDC-VI	12·51	10-14
Vetore-56 x Mysore Kotekar 1/61	17 36	-
Ansur No. 1 x Mysore Kotekar 1/61	10·74	-
Midnapur Red x Ansur Early	15·15	12-18
WBDC-VI x Ansur No. 1	10·63	10-11
Ansur No. 1 x Ansur Early	10·36	-
Planted in 1972		
Vetore-56 x WBDC-VI	6·41	-
Ansur Early x Ansur No. 1	6·88	-
WBDC-VI x Vetore-56	9·67	8-11
Ansur No. 1 x Vetore-56	4·94	4-5
Ansur No. 1 x WBDC-VI	6·44	5-7
Midnapur Red x Ansur No. 1	4·97	-
Mysore Kotekar 1/61 x Vetore-56	11·91	-
Midnapur Red x Ansur No. 1	13·06	11-14
Vetore-56 x Ansur No. 1	8·80	6-11
Ansur No. 1 x WBDC-VI	9·29	-
Midnapur Red x Vetore-56	5·89	-

Among the 237 progenies planted in 1970 and 1972, 42 progenies produced more than 10 kg nuts/tree and 9 progenies gave more than 15 kg nuts/tree. During the year 1980, 62 progenies involving three cross combinations were planted at the University Central Farm, Wakawali, Ratnagiri district.

At Vridhachalam, during the year 1980-81, due to the very poor rainfall received, the trees in the hybrid plots have not flowered. However, 9 hybrids were screened as promising on the basis of yield for the first 4 years. The performance of these hybrids is given in Table 13.

Table 13. **Yield of the promising hybrids at Vridhachalam. (Planted in 1973)**

Cross combination	Tree No.	Yield (kg/tree)
M 33/3 Selfed	3	19·16
M 26/1 x M 3/3	17	16·44
M 26/1 x M 3/3	5	14·82
M 33/3 Selfed	14	14·09
M 10/4 x M 26/1	4	12·01
M 26/1 x M 3/3	16	11·71
M 26/1 x M 3/3	2	11·13
M 33/3 x M 10/4	10	10·47
M 10/4 x M 26/1	2	10·39

It was also noticed that the nut size was significantly improved (4-11g) in all the progenies where one of the parental combinations is M33/3.

Experiment 5: **Propagation trial**

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

Vegetative propagation trials carried out at Madakkathara for the last three years showed that June to September was the best period for side grafting and budding. During the period under report, four vegetative propagation methods were tried and the results are given in Table 14.

Table 14. **Vegetative propagation trials at Madakkathara.**
(Number done for each trial in each month: 25)

Month	Percentage of establishment			
	Side grafting	Veneer grafting	Patch budding	Stone grafting
1980 July	32	48	40	40
August	36	28	48	24
September	2	0	12	4
October	16	0	12	4
November	16	0	0	8
December	0	0	0	0
1981 April	0	0	0	44
May	9	36	0	80
June	8	8	0	32

July and August months are better for sidegrafting, veneer grafting and patch budding. However, in stone grafting maximum percentage of success was obtained in May (80) followed by April (44).

The trials conducted to find out the best layering medium with five different treatments were repeated this year also. From the results it appears that wood shavings is an ideal medium for airlayering. The percentage of establishment of airlayers in different layering media is given in Table 15.

Table 15. **Establishment of airlayers in different media.** (Number tried in each case: 10)

Treatments	Percentage of Establishment
Sand + Sawdust (1:1)	30·0
Sphagnum moss	40·0
Wood shavings	42·5
Wood shavings enriched with rock phosphate	22·5
Sand + sawdust enriched with rock phosphate	20·0

In another experiment to find out the best medium and container for airlayers, earlier results indicated that coconut pith and ordinary potting mixture both in paddy straw container gave the best results. The trials in 1980-81, on the other hand showed that ordinary potting mixture in polythene bag was the best media and container for air-layers in cashew (95% establishment). The results of different treatments are given in Tablo 16.

Table 16. **Establishment of airlayers in different media and containers.**
(Number tried in each case: 5)

Containers	% establishment in different media		
	Coconut pith	Wood shavings	Ordinary potting mixture
Polythene bag	30	80	95
Coconut husk fibre container	85	85	90
Paddy straw container	75	65	90

From the data it is evident that ordinary potting mixture is the best media for airlayers in the nursery.

At Bapatla, the vegetative propagation trials were carried out in six-months-old seedlings from June 1980 to February 1981.

Earlier trails showed that during the year 1978–79, success in veneer grafting ranged from 73–85% between June-September months. In 1979-80, the success ranged from 54-92% during the same period. In patch budding, 33-66% success was obtained in the year 1978-79 and 20-62% success in 1979-80 during the months of June-September. In 1980-81, the success in veneer grafting ranged from 60-92%, maximum was recorded in November. The results of grafting and budding are given in Table 17.

Table 17. **Success in veneer grafting and patch budding at Bapatla.**
(Number tried in each case: 50)

Month		Percentage success	
		Veneer grafting	Patch budding
1980	June	60	–
	July	70	–
	August	86	–
	September	86	–
	October	86	22
	November	92	34
	December	88	18
1981	January	66	30
	February	78	16

At Vengurla. the propagation trials were started as early as 1968-69. Earlier trials showed that July-October period was congenial for veneer grafting (60-80% success in September) and July-September for side grafting (50-90% success).

During the period under report, monthly trials on veneer grafting and patch budding were undertaken from August 1980 onwards. Maximum success in veneer grafting was obtained in September and February months. The results for the year 1978-79 and 1979-80 also showed the same trend. The results of veneer grafting for the last three years are presented in Table 18.

Table 18. **Veneer grafting trials at Vengurla** (Number grafted in each month: 100)

Months	Percentage of success			Mean
	1978-79	1979-80	1980-81	
August	58	54	52	53.6
September	71	76	86	77.6
October	55	35	45	45.0
November	45	54	24	41 0
December	49	55	23	42.3
January	57	59	26	47.3
February	66	77	60	67.6
March	58	52	23	44.3
April	50	30	25	35.0
May	37	42	47	42.0
June	44	40	55	46.3

Patch budding was not so successful as veneer or side grafting. During the year under report 10-31 percent success only could be obtained from January-March.

Epicotyl grafting using 6-10 days old seedlings was found to be successful under Vengurla conditions. Up to 74% success was obtained in February and May, while 54% success was obtained in June. In general, the period from February to June was found to be congenial for epicotyl grafting.

Vegetative propagation trials were concluded at Vittal and the following are the indications:

Polythene containers of 40 x 30 cm and 300 gauge, were found quite durable to raise root stocks. A potting mixture of 2 parts of soil and 1 part each of compost and sand was found to be a suitable medium to raise root stocks. Seednuts of 5-7 g used for sowing gave root stocks suitable for grafting/budding within a period of 5-6 months.

Propagation of high yielding cashew trees by veneer grafting was found possible during June-November securing 76% success. Precuring of scion was found to be optional but not essential depending upon the development of terminal buds in the dormant shoots chosen for grafts. Dipping of scion sticks in the spray fluid of endosulfan (just before grafting) was found as a check to the pest incidence which in turn helped to secure healthy scion growth.

Upgrading of unthrifty cashew trees of 15-40 cm girth was found possible by adopting side grafting as a technique.

Shoots of 1.5 to 3 cm thickness was found suitable for patch budding during spring season. Patch budding *in situ* was found to give better success (75%) than the root stock raised in containers (41%).

Other techniques of grafting like whip and cleft grafting were also found useful to utilise the root stocks which had earlier failed to take a bud or scion shoot when grafted by veneer method.

Epicotyl grafting was found promising (60%) when the grafts were to be raised in containers at close intervals. Nearly 600 grafts were raised and distributed for demonstration purposes. The technique of airlayering, although found adoptable allround the year, the availability of high per cent of rooted shoots has been confined to February-April period.

Rooted shoots are being separated from the mother tree and the rooted portion when dipped in cowdung + urea solution, gave better survival rate than when planted without treatment. The cured airlayers gave 90% of establishment when planted in the field.

Mound layering was found feasible to multiply high yielding cashew trees by raising scion orchards at close spacing.

At Vridhachalam, *in situ* budding using the six months and one year-old seedlings of the promising selection M 26/1, were tried during the year 1980. The bud take was 19·04%, 18·86% and 16·67% during the months of December, January and February.

The propagation by cuttings was almost a failure except in June, where 36% success was reported with two-leaved soft wood cuttings. All other methods also failed to give any rooting.

At Bhubaneswar 'T' budding and side grafting were started in December 1977 and continued till June 1980. During the period 1980-81, soft wood grafting was also tried. 'T' budding was almost a failure, whereas, upto 88% success in side grafting and 76% success in soft wood grafting was obtained. The percentages of success in different propagation methods are given in Table 19.

Table 19. **Percentage of success in different propagation methods at Bhubaneswar**

Methods/ year	January	February	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
T Budding												
1977	–	–	–	–	–	–	–	.	–	–	-	20
1978	12	8	–	12	–	–	–	–	12	4	4	–
1979	–	–	–	–	–	–	16	4	16	12	–	–
Side grafting												
1977	–	–	–	–	–	–	–	–	–	–	–	28
1978	88	76	28	36	16	60	64	60	68	4	–	–
1979	8	12	–	–	–	24	64	36	70	48	–	–
Soft wood grafting												
1980	–	–	–	–	–	–	76	59	32	26	56	12
1981	–	–	–	–	16	40	-	–	–	–	–	–

Experiment 7 : **Fertilizer experiment**

(a) NPK trial in cashew

(Madakkathara, Bapatla, Vengurla, Vridhachalam and Bhubaneswar)

The trees in the fertilizer experimental trial at Madakkathara are in the eight year of orchard life. The differential doses of fertilizers were given in August 1980. The yield data recorded for the year 1980-81 did not show any significant differences between treatments.

At Bapatla, the fertilizer experiment started in 1972 and the differential doses of fertilizers were given from 1977 onwards. Analysis of the yield and associated characters for the year 1980-81 showed that there was response to N up to N_2 (1000 g/tree) level for all the characters studied (Table 20).

Table 20. **Response of cashew to NPK fertilizers at Bapatla (Yield – kg/tree)**

N levels (g/tree)	P levels (g/tree)				K levels (g/tree)		
	P_0	P_1 (200)	P_2 (400)	Mean	K_0	K_1 (500)	K_2 (1000)
N_0	2·166	2·716	1·877	2·253	1·616	2·340	2·802
N_1 (500)	3·788	4·216	4·137	4·047	4·131	3·889	4·122
N_2 (1000)	4·354	4·990	5·288	4·857	3·987	5·396	5·188
Mean	3·436	3·974	3·747	3·719	3·245	3·675	4·037
K_0	3·274	2·654	3·805				
K_1	3·694	4·290	3·641				
K_2	3·340	4·977	3·796				

SE/plot – 1·71
CV % – 45·97
CD for N – 1·16

Gen. Mean – 3·72
SE for N, P or K – 0·40

In yield, both N_1 (500 g/tree) and N_2 (1000 g/tree) levels were found to be significantly superior to N_0, but there was no significant difference between N_1 and N_2.

Table 21. **Comparison of the marginal revenue and the marginal factor cost under the NPK fertilizer experiment at Bapatla.**

N levels	Cost of urea @ Rs. 2·34/kg	MFC	Yield/ha (kg)	Income @Rs. 3/kg	Income @Rs. 5/kg	Income @Rs. 7/kg	Marginal Revenue @Rs. 3/kg	Marginal Revenue @Rs. 5/kg	Marginal Revenue @Rr. 7/kg
0	–	–	360·48	1081·44	1802·40	2523·36	–	–	–
N_1 (80 kg/ha)	411·2	–	647·52	1942·56	3237·60	4532·64	–	–	–
N_2 (160 kg/ha)	822·4	411·2	777·12	2331·36	3885·60	5439·84	388·80	648·00	907·20

The marginal revenue as well as the marginal factor cost using the two levels of N are compared in Table 21. When the price of nuts is high, i e. Rs. 5/kg or Rs. 7/kg the marginal revenue (Rs. 648/ha and Rs. 907/ha respectively) was more than the marginal factor cost of Rs. 411/ha. Hence, it is advisable to go for higher levels of N (up to N_2) when the price of the produce is high. However, when the price of the produce is less (eg: Rs. 3/kg) the marginal revenue will be lower than the marginal factor cost. Hence, there is no justification for going for higher levels of N under such a situation.

Regarding morphological characters like height of the tree and spread, N_2 level was found to be significantly superior to both N_0 and N_1, but no significant difference between N_0 and N_1. The main effects of P and K and the two factor interactions were not found to be significantly different for any of the characters studied.

The fertilizer response trial initiated at Vengurla in 1969 is in progress. Results of previous years showed that cashew responds well to nitrogen and phosphatic fertilizers. The analysis of the yield data for the year 1980-81 also confirms the earlier results; i. e. the main effect of N and P significantly increased the yield in cashew (Table 22). In the absence of P, N showed no significant difference. The combination N_3P_2 (125 kg N + 50 kg P_2O_5/ha) gave the highest yield (1·696 kg/tree) closely followed by N_2P_2 (75 kg N + 50 kg P_2O_5/ha) with 1·504 kg/tree. As in the previous years, there was no response to K application. The effect of NP interaction was also found to be significant.

Table 22. **Response of cashew to NPK fertilizers at Vengurla (kg nuts/tree)**

N levels (kg/ha)	P levels (kg/ha)			Mean	K levels (kg/ha)		
	P_0	P_1 (25)	P_2 (50)		K_0	K_1 (50)	K_2 (100)
N_1 (25)	0·252	0·466	0·824	0·514	0·663	0·303	0·576
N_2 (75)	0·399	1·504	1·486	1·130	0·966	1·534	0·889
N_3 (125)	0·157	1·257	1·696	1·037	1·049	1·002	1·060
Mean	0·269	1·076	1·335	0·893	0·893	0·947	0·841
K_0	0·124	0·895	1·660				
K_1	0·402	1·379	1·058	SE/plot - 0·5410			
K_2	0·282	0·953	1·289	SE for N, P or K - 0·1275			
				SE for NP, PK or NK - 0·2209			
				CD for N - 0·3682			
				CD for NP - 0·6378			

Another NPK fertilizer trial using Vengurla-2 was started in 1981 on a 3^3 factorial confounded design with 2 replications and a plot size of 6 plants per treatment, at the University Central Farm, Wakawali. The planting material used was inarch grafts.

At Vridhachalam, during the year 1980–81, the trees in this experiment did not put forth new flushes or flowers due to the failure of North-East monsoon.

At Bhubaneswar, the experiment was discontinued in the light of the results obtained for four years (1976-1980) on 16-year-old plants. The results indicate that the optimum dose of N was 250 g/tree under the soil and climatic conditions prevalent in that area. There was no response to P or K.

Experiment 22 : **Hormonal application to increase fruitset in cashew**
(Bapatla)

At Bapatla, no significant difference in any of the characters, *viz.* number of perfect flowers, fruit set, fruit drop and yield, was noticed by the application of hormones like IAA, IBA, NAA and Cycocel. Application of NAA 70 ppm recorded the maximum mean yield of 11·85 kg/ tree followed by 11·15 kg in IBA 50 ppm.

Experiment 54 : **Estimation of crop production of cashew**
(Kasaragod)

Studies on the prediction of yield in cashew were continued. Weekly observations on the number of shoots (X_1), number of panicles (X_2), number of nuts of all stages of maturity (X_3) in 0.5 m x 0.5 m sq. area in the canopy from four directions, N, E, S and W, the total number of nuts (all stages of maturity) in the whole canopy (X_4) and conditions of flowering (X_5), were recorded for eight weeks starting from the third week of January 1981. The average weight of nuts (X_6) and canopy area (X_7) were worked out and the actual yield of nuts (Y) in kg were obtained on the basis of individual harvest. Fifth, sixth, seventh and eighth weeks' observations on these characters gave more than 75% ($R^2 > 75\%$) of the information about the annual yield (Table 23). These observations correspond to the third, fourth, fifth and sixth weeks' observations taken during 1981 starting from the first week of February and confirm the previous years' results.

Table 23. **Linear relationship between biometrical characters at weekly intervals with final yield.**

Weeks/Rounds	R^2	Weeks/Rounds	R^2
1	0·65**	5	0·75**
2	0·60**	6	0 84**
3	0·77**	7	0·89**
4	0·65**	8	0·89**

** Significant at P = 0·01 level

CARDAMOM

Experiment 9: **Germplasm collection and description of types and varieties.**
(Mudigere and Pampadumpara)

At Mudigere, the 26 distinct types of cardamom classified on the basis of morphological characters are being multiplied and evaluated on the basis of yield and associated characters.

In the germplasm block, the 14 collections and eight species of related genera, planted in study rows have established well. In addition, 12 high yielding clones collected from private plantations of Mudigere have been planted in the field.

The diffrent species of the three related genera *viz., Alpinea, Hedychium* and *Amomum* are being maintained and described morphologically.

1. *Alpinea neutans*

There are six plants in this species and the sucker production varied from 9-15. The inflorescence is a terminal panicle and is produced throughout the year. The pollen fertility was very low and no fruit setting was observed. The plants are highly susceptible to 'Katte' disease.

2. *Hedychium* spp.

Hedychium flavescens, H. coronarium and an unidentified sp. of *Hedychium* are being maintained in the germplasm block. The first two species flowered. The inflorescence is a terminal spike. No fruitset was noticed. All the three species are resistant to 'Katte'.

3. *Amomum* spp.

Four species of this genera are being maintained in the germplasm block.

(a) *Amomum subulatum :*

A shy producer of pseudostems. The aerial shoots dry up by December and produce fresh shoots by the onset of monsoon. Flowering and fruit setting take place during June-July; highly susceptible to diseases and pests.

(b) *Amomum cannecarpum :*

The inflorescences are produced at the base of the plants and the fruits are bigger than most of the other species. The flowering season is June-July. In this also the aerial shoot dries up during summer and fresh shoot is produced by the onset of monsoon.

(c) *Amomum muricatum :*

The aerial shoots dry up in summer and new ones are produced by the onset of monsoon. The inflorescence is produced at the base of the aerial shoot.

(d) *Amomum microstephenum :*

In this also the inflorescence is basal and flowering season is June–July.

All the *Amomum* sp. are susceptible to 'Katte' disease.

Eighteen types and 14 species were classified and planted in the field at Pampadumpara. The plants are coming up well. They are:-

1. Malabar
2. Mysore
3. Vazhuka
4. Kannielam
5. Ceylon
6. Manjarabad
7. Three high yielding clones collected from Santhampara
8. Cardamom with Pink shoot (Mini cardamom)
9. Eight selections (PV–1 to PV–8)
10. Mudigere–1
11. MBP-1 Plant with multiple branching panicle
12. MBP-2
13. Cinchona selection
14. Hema
15. Clone No.57
16. Valayar
17. Types 4, 6, 7, 17, 103 & 119
18. Plant with pink coloured base.

Related genera

1. *Amomum subulatum*
2. *A. muricatum*
3. *A. microstephenum*
4. *A. involucratum*
5. *A. hypoleucum*
6. *Aframomum melegueta*
7. *Hedychium coronarium*
8. *Hedychium flavescens*
9. *Alpinea calcarata*
10. *A. galanga*
11. *A. allugas*
12. *Costus speciosus*
13. *Curcuma amada*
14. *Caempferia galanga*

Experiment 10: **Comparative yield trial of promising types**
(Mudigere and Pampadumpara)

During the year 1967, eighty seedlings which produced panicles in the nursery stage itself at Mudigere, were isolated as early bearers and planted in a separate block. Two suckers from each plant were separated and planted in order to form a second replication.

During the year under report, 24 selections yielded more than the plot average of 190·3 g of green capsules/plant. Out of these, seven selections were screened as promising based on the performance for the last 10 years. The average yield of these selections for the last 10 years ranged from 125 to 325 g of green capsules, i. e 75-200 kg dry capusles/ha. The yield data for the promising types for the years 1979-80 and 1980-81 are given in Table 24.

Table 24. **Yield data for the high yielding selections among the early bearing types at Mudigere.**

Selection Number	Plant No.	Mean yield (g/plant)		
		1979–80	1980–81	Mean
1282	25	468·5	686·5	577·5
1288	41	874·5	727·5	801·0
1288	48	965·0	412·0	688·5
1289	53	536·0	695·0	615·5
1290	57	896·0	802·5	849·3
1291	59	583·5	594·0	588·8
1291	67	892·5	559·5	726·0

Performance of 80 clones

Among the 80 clonal selections, 34 recorded more yield than the plot average of 312·54 g of green capsules/plant and 12 clones recorded more than 500 g/plant (Table 25).

Comparison of the yield data for the last two years showed that certain high yielders of 1979-80 showed very poor performance during 1980-81. For example: Clone No. 708 gave 1433 g in 1979-80, whereas in 1980-81, it gave only 323 g.

The clonal material collected during previous years was grouped together and thus 77 clones were planted in 1974. During the period under report 31 out of these 77 clones recorded more yield than the plot average of 269 g and five clones, viz. CL-746, 757, 761, 802 and 804 recorded 589, 598, 667, 701 and 694 g green capsules/plant, respectively.

Table 25. **Yield data for the promising clonal selections among the 80 clones at Mudigere for the last two years (1979-81).**

Clone Number	No of plants	Average yield/plant (g)		Mean
		1979–80	1980–81	
[1]	[2]	[3]	[4]	[5]
652	4	599·80	525·00	562·40
654	4	1126·00	763·50	944·80
664	4	1049 50	526·50	788·00
666	4	710·50	696·30	703·40
668	4	1009·25	887·50	948·40

[1]	[2]	[3]	[4]	[5]
670	4	955·25	445·80	700·60
678	4	778·25	422·80	600·60
679	3	785·66	449·30	617·50
681	4	849·00	477·00	663·00
682	4	887·00	443·00	665·00
683	4	1188·50	459·30	824·20
687	4	746·50	549·30	647·90
691	4	876·00	261·50	568·80
692	4	775·00	549·50	662·30
696	4	1062·75	729·50	896·20
700	4	422·00	523·50	472 80
704	3	1253·66	217·00	735·30
708	4	1433·75	323·00	874·40
709	4	951·00	170·30	560·70
710	4	808·75	363·80	586·30
718	4	932·75	401·30	667·10
720	2	625·00	592·00	608·50
722	4	1467·00	803·00	1180·00
726	4	1017·75	593·00	805·40

Multilocational trial of seedling progenies

The performance of the seedling progenies of 15 promising clones under multilocational trial at Mudigere and Appangala was poor during the period under report. The plot averages was only 177.65 g. There was no significant difference among the different selections in respect of yield.

Multilocational trial of promising clones

Out of the 25 clonal selections under multilocational trial, 3 high yielding clones (P1, P3 and P5) were screened and a trial was laid out with these clones in 1979. As far as sucker production is concerned, these clones as well as the bulk material used as control did not significantly differ. However, in panicle production P1 and P3 differed significantly from P5 and bulk which showed no significant difference (Table 26).

Table 26. **Data on panicle production in the three selections under multilocational trial at Mudigere.**

Selection	Mean No. of panicles
P_1	31·74
P_3	30·48
P_5	20·98
Control	24·11
CD at 5%	7·82

Experiment 11: **Hybridization**

(Mudigere and Pampadumpara)

Diallel crosses

Analysis of the yield data for the diallel crosses involving six parental combinations at Mudigere showed that the difference in yield between crosses (including parents) are not significant. However, the yield data conform the earlier indications that the performance of combination involving early bearing type is comparatively better. The other promising combinations are 'high yield' and 'leaf rot resistant' progenies. The yield data for diallel crosses for the year 1980-81 is given in Table 27.

Table 27. **Performance of the diallel crosses at Mudigere for the year 1980-81.**
(Yield of green capsules/plant g)

	Early bearing	High yield	Long panicle	Leaf rot resistant	Bold capsule	Multiple branching	Mean
Early bearing	755	740	584	666	470	595	635
High yield	642	740	409	926	391	852	660
Long panicle	677	388	491	514	680	280	505
Leaf rot resistant	878	605	541	484	405	496	568
Bold capsule	644	369	767	532	411	434	526
Multiple branching	966	846	642	596	464	343	641
Mean	760	614	572	618	470	500	589

Intergeneric crosses

The cross combination involving Cardamom semierect x *Alpinea* recorded the maximum yield of 642·04 g/plant. The yield performance of the cross combination involving cardamom types as females and related genera as male parents are given in Table 28.

Table 28. **Yield data for the intergeneric crosses of Mudigere.**

Crosses	No. of plants	Average yield/ plant (g) (1980-81)	Average yield for the last 5 years (g/plant)
Cardamom semierect x *Alpinea*	23	642·04	313·0
Cardamom prostrate x *Alpinea*	9	629·56	352·6
Cardamom x *Amomum cannecarpum*	3	433·00	188·6
Cardamom x *Hedychium*	18	552·83	238·6
Cardamom x *Amomum microstephenum*	8	374·37	204·2
Cardamom x Assam cardamom	4	282·75	128·0
Cardamom x *Amomum muricatum*	4	344·25	202·3

At Pampadumpara, 100 seedlings each of six polycross progenies (4, 6, 7, 17, 103 and 107) have been replanted in another plot.

Experiment 12: **Manurial experiment**
(Mudigere and Pampadumpara)

The NPK fertilizer experiment was started at Mudigere in 1974 on a 3^3 confounded design with two replications. Five crops have already been harvested. The yield data for 1980-81 conform earlier results, that the results are not consistent and that the treatment difference are not significant. This may be attributed to (i) the absence of uniformity in shade and (ii) genotypic variation in the planting material used in the experiment. Hence, the experiment has to be revised by using monoclonal planting material under uniform natural shade.

At pampadumpara also, the yield data in 1980-81 showed that control is superior to all the treatments, and that there is no significant difference between treatments.

Experiment 25 : **Testing parental lines for disease resistance**
(Pampadumpara)

This work could not be taken up in the light of the recommendations of the Technical Review Committee of KALL to revise the technical programme.

Experiment 32 : **Studies on 'Azhukal' disease**
(Pampadumpara)

Field control trials with fourteen treatments (13 fungicides + one control) were conducted in 1979-80 and 1980-81. In 1979-80, the incidence of the disease was very low, but in 1980-81, 18-43 per cent of the population was infected. The third round of observation after fungicidal application showed that in plots treated with Dithane M-45 0·03% (drenching), the percentage of capsule infection was reduced to 0·91 from 31·81 (Table 29). Dithane M-45 (0.25%) spraying also reduced the infection considerably (1.50% from 31.14%).

Table 29. **Effect of fungicides on 'Azhukal' disease of cardamom at Pampadumpara.**

Treatments	% of capsule infection	
	Before treatment	Third observation after fungicidal application
1. Bordeaux mixture 1% spraying	29·16	3·69
2. Bordeaux mixture 1% drenching	21·8/	7·59
3. Bordeaux mixture 1% spraying and drenching	25·00	3·23
4. Dithane M-45, 0·25% spraying	31·14	1·50
5. Dithane M-45, 0·3% drenching	31·81	0·91
6. Dithane M-45, 0·25% spraying and drenching	41·46	7·63
7. Bayer 5072, 0·1% spraying	26·66	7·58
8. Bayer 5072, 0·3% drenching	18·68	5·28
9. Bayer 50/2, 0·1% spraying and drenching	21·21	6·80
10. Bavistin 0·3% spraying	27·65	6·59
11. Difolatan 0·3% spraying	38·77	9·54
12. Cuman 0·3% spraying	42 85	8·16
13. Cheshunt compound 0·3% drenching 10 oz. in 2 gallons	43·75	11·23
14. Control	41·17	13·74

Experiment 39: **Chemical control of cardamom thrips**
(Pampadumpara)

In order to find out the effect of skipping insecticide application after the formation of capsules, a spraying experiment was started with the insecticide fenthion (0·05%) in different frequencies (4-8 sprayings from June) at monthly intervals. In 1979-80, the least infestation was recorded in the treatment consisting of five sprayings from June, whereas in 1980-81, the least infestation was noticed in eight sprayings from June onwards. The data is presented in Table 30.

Table 30. **Thrips infestation on capsules in different treatments at Pampadumpara.**

Treatments	Mean percentage of infestation (converted to angles)	
	1979-80	1980-81
1. Eight sprayings from June (Fenthion 0·05%)	22·22	24·79
2. Seven ,,	20·86	26·92
3. Six ,,	20·43	36·77
4. Five ,,	18·90	45·38
5. Four ,,	28·92	62·23
6. Control ,,	61·24	73·69
CD	4·68	5·82

Seed germination studies in cardamom (Mudigere)

In order to compare the viability of oven dried cardamom seeds to freshly harvested ones, a trial was carried out. The seeds of the two groups were treated with 25% nitric acid for 10 minutes before sowing. Germination percentage was considerably low in oven dried seeds (17·67) when compared to fresh seeds, where the germination percentage was 55·3. Soaking the seeds in water for 24 hrs. after the nitric acid treatment enhanced the germination to an extent of 10 per cent.

Cardamom Research Station, Yercaud

This centre was included under the AICSCIP in the Sixth Plan and work under the project was initiated in 1980-81.

1. Selections

Selection No 7 gave the maximum height of 174·80cm, Selection P·3 gave the maximum number of pseudostem (47) whereas selection No. 6 gave maximum number of panicles (10·19). Further studies on yield and quality characters of different selections are in progress.

2. Planting trial

Monthwise planting trial with 'Mysore' cardamom was taken up commencing from the month of June to November for three years in order to assess the month which is good for planting at higher elevations from 1300-1500 m above sea level. It was found that July planting gave the highest percentage of establishment (87·92 per cent) followed by August, September, October and November plantings which gave 77·92, 75·42, 63·75 and 61·67 per cent, respectively. In the case of June planting the percentage of establishment was only 19·59 per cent. For better establishment there should be a minimum of 322·80 mm of rainfall and the range of maximum and minimum temperatures should be from 19·5 to 25 and from 15·5 to 17·5°C, respectively

3. Spacing trial

Cardamom was planted with a spacing of 1m, 1·5m, 2m and 2·5m. At the age of three it was found that closer spacing of 1m on either side gave the maximum height (208·85 cm), number of shoots (21·1) and number of panicles (8·05). At 2·5 m spacing, the figures were 145·90 cm, 13·30 and 1·70 respectively. Assessment of yield is in progress.

PEPPER

Experiment 13: **Germplasm collection and screening of pepper**
(Panniyur)

The germplasm collection of pepper maintained at Panniyur comprises 136 types which include 26 wild types from the natural forests of Kerala and three cultivated types collected during the period under report. Based on the yield data for the last 19 years, seven cultivars (Karimunda, Kottanadan, Kuthiravally, Balankotta, Cheriyakaniakadan, Kumbhakodi and Kalluvally) have been identified as promising. The studies also indicated a declining trend in yield in most of the vines after a period of ten years of regular bearing.

Under the replanting programme of senile vines in the germplasm colleetion started in 1979, sixtynine types were replanted during the year. The vines in the new plantation at the Kerala Agricultural University campus are coming up well and many of the plants started flowering.

Experiment 14: **Intervarietal hybridization**
(Panniyur)

Under this programme, seedlings were raised from hybrid seeds obtained from crosses between parents selected for desirable characters. Since pepper is a cross pollinated crop and clonally propagated, the possibility of exploiting the locked up variation inherent in the open pollinated seedling progenies also appears to be very high. With this object in view, open pollinated progenies were also raised from the local varieties. So far, about 10,000 such hybrid and open pollinated seedlings were raised and screened. Based on the vigour, internodal distance etc., 2000 seedlings were selected from the nursery and planted in the main field. Twohundred progenies of these have flowered and from these, based on the morphological and flowering characters, 87 cultures were selected for multiplication and further evaluation. Five of the highly promising cultures (94, 406, 354, 341 and 456) were put in a preliminary yield trial along with Panniyur-I and Karimunda. Among the plants flowered and yielded during the year 1981, Culture No. 354 gave the maximum yield (Table 31).

Table. 31. **Yield data for the promising cultures under preliminary yield trial at Panniyur.**

Culture No.	No. of plants harvested	Average yield/plant (kg)
94	5	0·117
406	7	0·155
354	9	1·629
341	3	0·047
456	3	0·180
Panniyur I	4	0·499
Karimunda	4	0·886

During the year under report, further hybridization work involving 11 parental combinations was taken up and a total of 18,155 seeds were sown in the nursery during February-March, 1981.

Experiment 15 : **Comparative yield trial**
(Panniyur)

Four local popular varieties, *viz.*, Arakulam Munda, Kalluvally, Balankotta and Kuthiravally along with the hybrid Panniyur-I were put under comparative yield trial in the year 1975. The yield data for the last four years are given in Table 32. The hybrid Panniyur-I outyielded all the other four varieties except in the year 1980-81. There is a marked reduction in yield in all the varieties during 1980-81, probably due to unfavourable climatic condition. The adverse effect is more on Panniyur-I and comparatively less on Kuthiravally. The adverse effect is reflected not only in yield, but also in the number of plants flowered during the year in each variety. During 1980-81, Kuthiravally recorded the highest figure for the number of plants flowered as well as the yield.

Table 32. **Comparative yield trial of pepper at Panniyur (Yield kg/plant)**

Variety	1977-78		1978-79		1979-80		1980-81		Average
	No. of plants flowered	Yield	No. of plants flowered	Yield	No. of plants flowered	Yield	No. of plants flowered	Yield	
Panniyur-I	45	0·518	52	1·403	56	2·746	31	0·133	1·200
Arakulam Munda	36	0·157	39	1·445	38	1·615	7	0·126	0·836
Kalluvally	1	0·020	4	0·070	16	0·098	8	0·147	0·084
Balankotta	-	-	1	0·020	17	0·464	15	0·252	0·245
Kuthiravally	14	0·285	35	0·970	44	1·686	45	0·867	0·952
Mean		0·245		0·782		1·322		0·305	

Experiment 16: **Trial on dead and live standards for pepper**
(Panniyur)

A manurial *cum* standard trial was laid out at Vellanikkara, Main campus of the Agricultural University, during the year 1976. The data on vegetative, flowering and yield characters so far collected, indicate that the dead standards are better than the live standards for growing pepper. It also indicates, as in previous years, that split application of fertilizers is more beneficial to the vines than single dose.

Experiment 17: **Fertilizer experiment on pepper**
(Panniyur)

This experiment was concluded in 1980 and the pooled analysis of the data for six years was presented in the annual report for 1979-80.

Experiment 35: **Quick wilt and slow wilt diseases of pepper**
(Kasaragod and Panniyur)

In the pepper garden in Bandadka, where observations on quick wilt incidence was being recorded since 1974, the disease incidence in 1980 was 0·9% as against 1·34% in 1979 and 4·8% in 1978. As in the previous years observations are being recorded at weekly intervals on soil temperature at 5, 15 and 30 cm depths in the pepper garden, in addition to recording ambient temperature, relative humidity and rainfall.

During the rainy season in 1981, splash traps (Waller, 1972) were kept at the base of the pepper vines in quick wilt-affected

Bandadka. The traps were set vertically on poles at various heights, viz., 25, 50 and 75 cm from ground level. The water collected in the bottle below was tested for the presence of *Phytophthora* using castor baits. At 25 cm, the quantity of water and soil particles splashed and collected in the bottle were more than those ar 50 cm heights. No soil particle was caught at 75 cm. The castor baits infected was also more (25%) at 25 cm as against 50 cm (5%) and 75 cm (0%). The results indicate the possibility of the fungus propagules being splashed along with soil particles during the rains and are more concentrated at lower levels.

Field control trials were laid at Bandadka during 1980 June using Bordeaux mixture and Bordeaux paste and two systemic fungicides (metalaxyl 500 ppm and Aluminium tris o-ethyl phosphate 1000 ppm). The systemic fungicides and Bordeaux mixture were applied as foliar spray along with soil drench in June, August and October. There were three replications with 40 Plants per plot. While plots treated with Bordeaux mixture and metalaxyl did not show incidence of the disease, the plot treated with the second systemic fungicide had 5% disease incidence, as against 2·3% in control.

During 1981 monsoon season, fresh field trials have been laid out using newer fungicides, viz., Terrazol and Daconil which are reported to be effective against *Phytophthora*. The other treatments include metalaxyl, Aliette and Bordeaux mixture, which were included in last year's trial also. The trial is in progress.

At Panniyur, studies on the etiology and ecology of the disease indicate that a combination of low temperature and high humidity favours the incidence of the disease.

Experiment 41 : **Control of pollu disease of pepper**
(Panniyur)

In order to fix the correct time and number of applications of the fungicides for the control of fungal 'Pollu', a trial was started in 1979-80 with Bordeaux mixture. The results showed that three fungicidal applications, one in the last week of May, second in first week of July and third in the last week of September, could effectively control the disease.

Studies on spike shedding

Studies made during the year under report to assess the extent of spike shedding due to diseases and other factors revealed that 44·2% spike shedding was due to fungi and 55 8%, due to other factors.

GINGER AND TURMERIC

Experiment 18: **Germplasm collection and evaluation of ginger**
(Solan, Kasaragod and Pottangi)

One hundred and nineteen types maintained at Solan have been evaluated for their yield and associated characters. During the season 1980-81, twentyone types yielded more than 500 g/clump which works to 20 kg/ bed of $3m^2$, and the maximum yield recorded was in Clone No. 236 (30 kg/$3m^2$). The yield data for these clones are presented in Table 33.

Table 33. **Performance of some of the promising clones of ginger at Solan.**

Accession No.	Plant height (cm)	No. of shoots/plant	Mean yield (g/plant)
447	58	9	500
50	85	14	500
236	75	11	750
370	74	10	500
129	65	17	500
55	75	11	500
37 I	70	9	600
Raggarh	83	8	500
Pangola	93	13	500
304	79	10	500
15	61	8	500
477	50	10	600
43	73	8	500
212 I	82	12	500
607 I	80	11	600
506	74	7	500
53	59	14	500
646	91	10	500
600	82	12	500
641	83	8	500
639	80	13	500

In a replicated trial with 25 ginger cultivars at Kasaragod, cultivars Burdwan, Jamaica, Rio-de-Janeiro, Bahreica and Wynad local recorded 7.65, 7.55, 7.35, 6.70 and 6.60 kg/bed of $3m^2$, respectively. Analysis of the yield data for the comparative yield trial for the last two years showed that cultivars Wynad local, Nadia and Burdwan are promising under the rainfed conditions at Kasaragod (Table 34).

Table 34. **Yield data for the comparative yield trial for the last two years at Kasaragod.**

Cultivars	Mean yield/bed of $3m^2$ (kg)		
	1980	1981	Mean
Burdwan	5·142	5·030	5·086
Jamaica	4·162	4·080	4·346
Nadia	4·536	5·960	5·218
Rio-de-janeiro	3·856	3 690	3·773
Wynad local	5·277	5·800	5·539
Taffingiva	NT	6·160	-
Bhola-ada	,,	4·680	-
Bajpai	,,	4·600	-
Bahreica	,,	4·850	-
Maran	3·343	NT	-
CV%	21·06	21·88	NT - Not tested
CD	1·25	1·40	

Average yield for the germplasm collections for the last four years also showed that the cultivars Wynad local, Nadia and Burdwan occupy the first three positions among the 25 cultivars tried under the rainfed conditions at Kasaragod (Table 35).

Table 35. **Performance of the high yielders in the germplasm at Kasaragod.**

Cultivars	Average yield ($3m^2$ bed) (kg)				
	1978	1979	1980	1981	Mean
Wynad local	6·4	9·0	4·1	6·6	6·5
Burdwan	6·0	6·5	4·7	7·7	6·2
Taffingiva	4·0	9·2	5·2	4·4	5·7
Nadia	5·0	7·3	4·8	6·0	6·3
Rio-de-janeiro	5·9	6·9	3·6	6·7	5·8
Jamaica	3·0	6·9	4·8	7·6	5·6

At Pottangi, 56 collections were evaluated in a replicated trial. The highest yielders were Wynad local (11·175 kg/3m² bed) and Vengara selection (10·510 kg/ 3m² bed). Maximum recovery of dry ginger was obtained from PGS-6 (36·3%). Eighteen promising types were multiplied for trial in the cultivators' field.

Among the 24 cultivars evaluated under preliminary yield trial, Vengara selection yielded maximum (9·35 kg/ 3m² bed) followed by Kuruppampadi (8·303 kg) and PGS-9 (6·183 kg).

Experiment 19 : **Manurial *cum* seed rate trial in ginger**
(Pottangi)

During the period under report, three methods of planting with three different size of seed materials were tried in two varieties, Rio-de-janeiro and Kuruppampadi Table 36.

Table 36. **Performance of ginger under different methods of planting at Pottangi.**

Treatment	Yield (1980-81 - kg/3m²)		
	Rio-de-janeiro	Kuruppampadi	Mean
Seed size 10-14 g			
Raised bed	2·886	4·466	3·676
Flat bed	5·996	5·750	5·858
Ridge	3·516	2·083	2·799
Mean	4·123	4·099	4·111
Seed size 15-19 g			
Raised bed	8·200	6·083	7·142
Flat bed	6·833	6·833	6·033
Ridge	4·167	1·200	2·684
Mean	6·400	4·705	5·553
Seed size 20-24 g			
Raised bed	7·800	9·650	8·725
Flat bed	8·966	7·100	8·033
Ridge	3·600	6·589	3·309
Mean	6·789	6·589	6·689
Mean - Raised bed	6·514		
Flat bed	6·908		
Ridge	2·931		

Maximum yield of 9·650kg/3m² bed was obtained in Kuruppampadi with 20-24 g seed material in raised beds. On comparison of the yield data for different planting methods, it was noticed that the raised beds and flat beds are equally good (6·514 kg and 6·908 kg/ bed of 3m², respectively) for ginger cultivation. There is progressive increase in yield with the increase in weight of seed rhizome used. The difference, however, is not very appreciable.

The trials on the effected of mulches on ginger started in 1979-80 was continued this season also. As in the previous year, no significant difference was noticed between different mulching treatments.

Experiment 20: **Germplasm collection and evaluation of turmeric**
(Kasaragod, Solan, Pottangi and Coimbatore)

Among the 52 turmeric germplasm collections at Kasaragod, cultivar Ethumukula gave the maximum yield of 8.30 kg/bed of 3m² followed by 7.9 kg in Cll 322 Vontimitta. *Curcuma amada* yielded 14.5 kg and the Indonesian type 12.0 kg/3m² bed. Among the 62 clonal selections, the high yielders were Cls No. 15B, 2A, and 18A (13.0 kg, 12.3 kg and 12.2 kg/3m² bed, respectively) The comparative yield trial with five promising selections (Cls No. 1C, 2A, 3D, 15B and 21A) did not show any significant difference.

At Pottangi, among the 89 entries of turmeric, Cli 390 Rajapuri recorded maximum yield of 12.150 kg/ 3m² bed. Evaluation of 62 high yielding clones in a replicated trial showed that 8 clones were promising (yield ranging from 6.40 to 7.38 kg/3m² bed). Maximum yield of 7.38 kg was recorded in PTS-38 and PTS-35. Maximum recovery of dry turmeric (24.2%) was obtained from PTS-24. Among the 24 cultivars under preliminary yield trial, maximum yield was obtained from PTS-62 (9.50 kg/3m² bed). However, maximum recovery of dry turmeric per bed was obtained from PTS-38 (2.393 kg).

In the comparative yield trial with five promising selections received from Kasaragod, Cls No. 1 gave the maximum yield (7.050 kg/ 3m²) as against Cls No. 3 during last year with 6.54 kg/3m² bed.

Fiftysix accessions were evaluated for yield and quality characters at Coimbatore. Accession No. 5395-1-2 gave the highest plot yield (15·125 kg / 5m²). In the comparative yield trial with 12 accessions, Cls. 9 recorded the highest yield per plant, viz., 501·6 g as against 364·1 g in Erode local (control).

Experiment 21: **Fertilizer experiment in turmeric**
(Solan and Pottangi)

In the NPK fertilizer experiment at Solan and Pottangi, the treatment differences were not significant. This is in conformity with the results obtained in the previous two years.

In another trial at Pottangi with 15 combinations of three levels of manure maximum yield (5·250, kg/2m² bed) was recorded in the combination M4F2 (7·2 kg

FYM as basal dressing, 2·5 kg green leaves/ $2m^2$ as mulch combined with 60 kg N, 30 kg P_2O_5 and 90 kg K_2O). However, no significant results could be noticed between different treatments.

In the mulching trials, the results obtained was in conformity with the previous year's observations, and it was found that mulching definitely improved the yield in turmeric. Except black alkathene, all other mulching materials were equally good (Table 37).

Table 37. **Performance of turmeric at Pottangi under different mulches.**

Treatments	Yield (kg/$3m^2$ bed)			
	1978-79	1979-80	1980-81	Mean
Weat straw	7·25	-	-	-
Grass mulch	-	6·72	5·53	6·13
Mango leaf	5·78	5·69	5·93	5·80
Eucalyptus leaf	5·55	5·09	5·78	5·47
Glyricidia leaf	5·52	6·20	5·76	5·83
Sal leaf	4·78	7·14	5·19	5·70
Black alkathene	3·15	3·49	4·18	3·61
Control	3·15	3·77	3·85	3·59

Demonstration of improved methods of cultivation of ginger in Tribal village at Pottangi (Orissa)

Under the Lab-to-Land programme, eight demonstration trials with a high yielding ginger type were organised in the tribal village. The seed material and fertilizar were supplied free and the crop was raised under the direct supervision of the project staff. The yield ranged from 75-300 q/ha. This has helped to convince the tribal farmers about the advantage of improved technology.

Experiment 36: **Rhizome rot of ginger and turmeric**
(Kasaragod)

In the fungicidal trial laid out at Kasaragod, during 1980-81, using five fungicides Dithane M-45 gave the highest yield of 3·21 kg per bed of $3m^2$ followed by 2·52 kg in Agallol treated plot as against 1·77 kg in untreated control.

Among the seven fungicides tried for controlling the rhizome rot of seed ginger during storage, Difolatan, Dithane M-45, Benlate and Bavistin were more effective. The percentage recovery of healthy rhizomes was 69-76 as against 41·38 in untreated control. The duration of fungicidal dip treatment (half-an-hour/one hour) had no significant effect on the extent of storage rot. The recovery of healthy rhizomes was maximum (68%) when seed ginger was stored in pits with sand or leaves of *Glycosmis pentaphylla*. Initial level of infection up to 20 per cent in the stored seeds resulted in considerable damage compared to lower levels of infection. Studies on the mycoflora of seed ginger revealed the frequent latent infection of the apparently healthy rhizomes by species of *Fusarium* and *Aspergillus niger* which are found to be associated with storage rot. *Macrophomina phaseolina* caused dry rot in storage

Experiment 38: **Biology and bionomics of insect pests of spices**
(Kasaragod)

In order to find out the storage losses due to scales (*Aspidiella hartii* Ckll.), a storage trial with four ginger cultivars, viz., Wynad local, Nadia, Jamaica, and Bhola-ada was initiated. One kg each of the above cultivars were stored in 12 pots and inoculated with 200 g of infested rhizomes. Two pots were not inoculated and kept as control. Monthly observation recorded for three consecutive months showed that all the pots including the control were equally infested by the scales. The weight of the rhizomes were reduced by less than 50%. Almost all the buds were found to be damaged by the scales.

A laboratory control trial was carried out using six insecticides, i. e., Malathion 0·05%, Malathion 0·1%, Aldioarb (Temik) 1%, Dimethoate (Rogor) 0·1%. Quinalphos (Ekalux) 0·1% and Monoorotophos (Nuvacron) 0·1%. The infested rhizomes were dipped in insecticidal solution for five minutes. Among the treatments, Quinalphos (0·1%) and Aldicarb 1% could eradicate the pest, and did not show any symptom of scale infestation. The other insecticides reduced the population, but could not eradicate the pest completely.

Experiment 40: **Leaf spot disease of ginger**
(Kasaragod)

In the field control trials against leaf spot disease of ginger laid out during 1980-81, using three fungicides, 1% Bordeaux mixture gave the highest yield of 3·19 kg per plot of 40 plants as against 2·9 kg in control.

In June 1981, a field control trial has been laid out using four fungicides, viz., Bordeaux mixture 1%, Dithane M-45 1·2%, Difolatan 0·2% and TOPSIN-M 0·1%. The trials are in progress.

MINOR SPICES

CORIANDER

Experiment 42: **Germplasm collection, maintenance and selection**
(Jobner and Vijapur)

At Jobner 200 entries of coriander were evaluated in an RBD with 3 replications. The yield was comparatively poor this year. Only 9 entries yielded more than 5 q/ha. Maximum yield of 7.80 q/ha was recorded in UD-370. The biometrical variations among the different entries are given in Table 38.

Table 38. **Biometrical variation in coriander types evaluated under germplasm at Jobner.**

Characters	Range	G. Mean	S.E.	CV%
Days to 50% flowering	74·3 - 111·33	86·7	8·8	10·2
Plant height (cm)	33·5 - 74·0	46·4	10·1	21·8
Branches per plant	3·6 - 6·6	4·7	0·8	15·9
Effective branches/plant	2·8 - 6·6	4·3	0·8	17·9
Umbels per plant	8·3 - 18·6	12·1	3·2	26·5
Umbellets per plant	26·5 - 90·8	47·4	13·8	29·1
Grains per umbellets	3·8 - 6·7	4·9	0·8	15·6
Days to maturity	109·7 - 182·3	125·7	11·3	9·0
Grain yield per plot (g)	105·7 - 223·7	164·8	34·2	20·8
Grain yield per ha (q)	2·9 - 7·8	4·6	0·9	20·7

At Guntur, 680 collections including single plant selections were evaluated for morphological as well as yield characters. Data on biometrical charcters showed that the variability was more in plant height (40 cm in Anantapur collection 271 to 88 cm in C.S.5),

number of primary branches (2 in Sel. III (UDP) and 11 in MS. 1), number of secondary branches (5 in CS. 5 and 31 in Sel. II (UDP), number of umbels/plant (5 in CS-5 and 45 in UD 164), number of umbellets/umbel (3 in MS-1 to 8 in CS-106), number of fruits/umbel (5 in MS-1 to 47 in UD-164) and yield/ha (167 kg/ha in Sel. III to 1125 kg/ha in CS. 7 (Table 39).

Table 39. **Biometrical variation in coriander types evaluated under germplasm at Guntur.**

Character	Range	G. Mean	S.E.	C.V.%
Plant height (cm) final	40 - 88	56·94	7·53	12·91
No. of primary branches	2 - 11	5·44	0·75	13·79
No. of secondary branches	5 - 31	13·51	4·65	34·44
Days to 50% flowering	40 - 57	47·79	3·22	6·90
Total duration (in days)	76 - 100	84·70	4·70	5·55
No. of umbels/plant	5 - 45	14·52	5·02	34·57
No. of umbellets/umbel	3 - 8	5·65	0·99	17·52
No. of fruits/umbel	5 - 47	17·80	6·07	34·10
No. of fruits/plant	48 - 360	144·35	62·64	43·39
Yield (kg/ha)	167 - 1125	153·68	65·45	42·59

A total of 179 collections were maintained at Jagudan (recenty transferred from Vijapur).

At Coimbatore, 134 accessions (including twelve new ones added during the year) were evaluated for the various biometric traits. The accessions varied widely for all the characters studied. The height of the plants varied from 32·8 cm to 68·0 cm, number of primary branches from 2·8 to 8·0 secondary branches 5·2 to 26·2 and yield/plant from 2·0 g to 8·0 g.

Experiment 43 : **Varietal trial in coriander**
(Guntur, Coimbatore and Jobner)

Fourteen varieties were compared in a replicated trial at Guntur, among which variety CS-2 continued to record maximum yield (833 kg/ha) in the third year also. CS-4 and P-2 were the other high yielders which recorded 826 kg and 805 kg/ha (Table 40).

Table 40. **Initial evaluation of selections of coriander at Guntur.**

Variety	Days to maturity	Plant height (cm)	No. of umbels/ plant	No. of umbellets/ umbel	No. of mericarps/ plant	Yield/ ha (kg)
C.S. 2	96	67	19	5	136	833
C.S. 4	99	61	10	7	107	826
P-2	100	65	20	5	106	806
Composite	90	55	15	3	141	736
Kothur	98	55	16	4	86	743
NPJ. 324	90	56	15	5	96	701
Ananthapur-22	87	52	13	5	98	667
A.S. 18	85	60	14	5	100	583
A S. 20	90	59	20	6	92	625
C.S. 5	93	58	13	5	83	778
Sel. V	89	66	11	5	105	736
P-4	95	55	12	6	94	757
Kuruganipalli	84	47	13	5	93	549
Guntur Local	94	61	18	5	95	694

From the yield data for the last three years, it is evident that the varieties CS-2, CS-4 and P-2 are highly promising (Table 41).

Table 41. **Yield data for the promising three coriander strains at Guntur.**

Strains	Yield (kg/ha)			
	1978-79	1979-80	1980-81	Mean
CS-2	1224·62	1014·88	833·00	1024·17
CS-4	1209·75	982·15	826·00	1005·96
P-2	1037·14	970·24	806·00	937·79
Mean	1157·17	989·09	821·67	

At Jobner, the varietal evaluation trial was conducted at two places (Banswara and Borkhera), in addition to Jobner. The local variety of each location was included as control in the respective locations. The earliest flowering variety CS-4 gave the maximum yield in both the places - Banswara and Borkhera (8.70 q and 6·58 q/ha), whereas UD-374 gave the highest yield at Jobner (4·65 q/ha).

The yield data for the last three years is given in Table 42. Even though there is no consistency in varieties evaluated over locations, four varieties - UD-1, UD-20, UD-21 and UD-41 were found to be promising at two important locations, viz., *Borkhera and Jobner. Under irrigated* conditions at Jobner, the highest mean yield was recorded for UD-41 (9·12 q/ha) whereas under unirrigated conditions at Borkhera, UD-20 (7·41 q/ha) gave the maximum yield.

In the preliminary yield trial with 39 entries selected from the germplasm on the basis of their performance over 2-3 years, along with six checks, no significant difference in yield was noticed. The performance of all the entries was poor. Maximum yield of 350 g/plot of 4·8m² was recorded in the check UD-374, followed by UD-149 (302·5 g/plot). The essential oil content ranged from 0·03% in UD-16 to 0·20% in UD-374, UD-156, 137 and 207.

At Coimbatore, 24 accessions were evaluated under initial evaluation and it was observed that there was no significant variations in morphological traits among the accessions. But the yield/plot varied significantly. (125 g/plot of 4·5m² to 270 g). Five accessions recorded an yield more than 200 g/plot, the maximum being in Accession No. 1085 (270 g) followed by 354 (225 g).

In the winter trial sown in December 1981 also, the variation in yield/plant as well as per plot was significant. The maximum yield/plot was recorded in No. 1085 (68·75 g) which was the highest yielder in the June sowing also.

Experiment 44 : **Comprative yield trial in coriander**

(Coimbatore, Guntur, Jobner and Vijapur)

At Guntur, the trial was initiated in 1975-76. Yield data showed that the promising selections are MS-1, CS-2 and CS-4 from APAU, P-3 (GAU) and Co-1 (TNAU). Selection 360 from IARI is a late maturing type (130 days) whereas CS-6 and MS-3 from APAU, are early maturing types (84 and 85 days, respectively).

During the period under report, the maximum yielders were CS-2 (1167 kg/ha), CS-4 (1075 kg), Co-1 (1021 kg) and P-2 (1008 kg/ha). The performance of the promising selections for the last three years is given in Table 43.

Table 42. **Performance of coriander varieties at different locations in Rajasthan.**

Variety	Yield (q/ha) at different locations								
	Banswara			Borkhera			Jobner		
	78–79	79–80	80–81	78–79	79–80	80–81	78–79	79–80	80–81
UD-1	16·05	3·99	3·26	13·98	4·73	3·22	8·27	7·16	2·45
UD-20	17·49	5·38	7·25	13·16	3·11	5·97	10·005	7·56	2·02
UD-21	18·24	4·95	3·17	12·38	3·14	4·97	11·32	6·30	2·38
UD-41	16·99	3·73	3·53	10·62	3·06	3·36	13·87	10·80	2·68
UD-373	–	–	3·53	–	–	5·50	–	–	2·85
UD-374	–	–	1.81	–	–	3·61	–	–	4·65
PS-360	13·12	2·13	3·99	13·41	3·06	4·33	–	9·83	2·45
CS-4	–	–	8·70	–	–	6·58	–	3·36	3·12
CO-1	–	–	3·90	–	–	3·78	–	3·03	1·92
RC-1	10·78	1·56	–	3·73	2·03	–	9·25	4·15	–
Local (check)	–	5·56	3·62	–	3·59	5 89	5·95	3·91	2·22
CD (5%)	NS	3·11	0·12	NS	1·40	1·31	1·83	2·32	1·17

Table 43. **Performance of the high yielders under comparative yield trial at Guntur**

Variety	Yield (kg/ha)			
	1978-79	1979-80	1980-81	Mean
CS-2	1187.42	997.03	1167.0	1117.2
CS-4		970.24	1075.0	1022.6
Co-1	1223.14	956.85	1021.0	1067.0
MS-1	1160.22	952.38	863.0	991.0
P-2	1123.44	940.48	1008.0	1024.0
P-3	1182.96	867.56	800.0	950.2

Maximum mean yield for the last three years was recorded in CS-2 (1117.2 kg/ha) followed by Co-1 (1067 kg/ha).

At Jobner, the trial consisted of 15 entries, 6 from Rajasthan (UD-1, UD-20, UD-21, UD-41, UD-373 and UD-374), 5 from Andhra Pradesh (CS-2, CS-4, CS 5- CS-6 and CS-7), two from Tamil Nadu (Co-1 and Culture-2), one from Gujarat (GAU-1) and one from IARI (Pusa-360). Except for umbels per plant, the entries showed significant difference for all the characters. The yield was comparatively poor for all the varieties during this season. The highest yield of 4.65 q/ha was obtained for UD-374 followed by GAU-1 (3.20 q/ha) and CS-4 (3.12 q/ha). Comparison of the yield data for the last four years showed that the Selection UD-41 was the most promising one among the 15 selections under trial (Table 44).

Table 44. **Yield data of promising coriander selections under comparative yield trial at Jobner.**

Selection	(Yield q/ha)				
	1977-78	1978-79	1979-80	1980-81	Mean
UD-1	-	8·27	7·16	2·45	5·92
UD-20	8·05	10·05	7·56	2·02	6·92
UD-21	7·23	11·32	6·38	2 38	6·83
UD-41	10·68	13·87	10·80	2·67	9·51
Pusa-360	8·62	-	9·83	2·45	6·97
GAU-1	-	10·13	6·73	3·20	6·68
Local check	7·56	5·95	3·91	2·22	4·91

At Jagudan (Vijapur), among the seven cultures tried under comparative yield trial, no significant difference was observed. In another trial with 8 cultures also, no significant difference was noticed among the cultures. However, the entry Tamil Nadu (TMV) gave the highest yield of 12.36 q/ha which was 5.73% higher than the control.

Under comparative yield trial, two experiments were conducted at Coimbatore, one sown in June 1980, and another in January 1981. In the former, no significant variation was noted either in morpholcgical or in yield characters. In the latter trial S. 33 gave the maximum yield of 50 g/plot followed by Culture No. 270 and CS-2 (48.33 g/plot each) (Table 45).

Table 45. **Comparative yield trial in coriander at Coimbatore**

Plot size: 9 sq. m. Date of sowing: January 1981

Accession	Height of plant (cm)	No. of primary branches	No. of secondary branches	No. of umbels/ plant	No. of umbellets/ umbel	Seed weight/ 5 plants	Plant yield (g)
VP-1	43·40	5·00	14·20	21·40	5·13	8·33	16·67
S-33	41·93	5·20	15·53	21·73	4·93	15·33	50·00
VD-20	42·57	5·20	14·53	21·67	4·87	7·67	24·33
VD-21	42·00	5·87	15·20	22·07	4·93	12 67	28·33
VD-41	41·53	5·87	15·20	22·57	5·27	8·67	29·67
CS-2	39·20	5·47	15·06	23·47	5·10	13·33	48·33
CS-4	43·13	4·87	13·60	22·13	5·07	14·33	36·67
CS-5	41·93	4·73	11·60	18·87	4·80	14·00	35·00
CS-6	38·70	4·80	14·00	20·47	4·70	13·00	25·00
Culture-270	46·50	5·33	15·20	22·47	4 97	17·33	48·33
GAU-1	36·77	3·47	11·06	17·93	4·43	9·00	28·33
MD-4	38·23	3·67	9·27	17·20	4·50	10·00	20·38
CO-1	37·00	4·20	12·40	20·40	4·67	12·33	27·00
CD (5%)	5·42	1·05	3·23	NS	NS	2·82	12·94

Experiment 59: **Response of coriander to fertilizers**

(Jobner, Jagudan (Vijapur) and Guntur)

At Jobner, this is the third year of the experiment. In the first year, the different treatments showed significant differences regarding the parameters like umbels/plant, umbellets/plant and yield. The yield was found to increase consistently with the increase in N doses. But in the second as well as third year (1979-80 and 1980-81), no significant difference was noticed in any of the characters studied except umbels/plant in 1980-81.

In the light of the soil analysis of the Agricultural Research Station, Lam, Guntur, the fertilizer experiment was restricted to N only. During the period under report, three levels of N [20, 30 and 40 kg N/ha] were tried along with the control. The treatment 30 kg N/ha recorded the maximum yield of 1200 kg, followed by 1063 kg in 40 kg N/ha.

At Jagudan [Vijapur], the fertilizer experiment consisted of twelve combinations of four levels of N [0, 20, 40 and 60 kg/ha], three levels of P_2O_5 [0, 30 and 60 kg/ha], and one level of K_2O (30 kg/ha). As in the previous years, the difference in yield due to various treatments was found to be significant. During the period under report, the treatment combination of $N_{40}P_{60}K_{30}$ gave the highest yield of 1296 kg/ha which was 60.4% higher than the control.

CUMIN

Experiment 47: **Germpalsm collection, maintenance and selection**
(Guntur, Jobner and Jagudan (Vijapur))

The cumin collection comprised 56 entries at Jobner, 50 at Jagudan and 4 at Guntur. The incidence of wilt was very severe (13-83%) at Jobner. The powdery mildew incidence was also high. Hence the yield was very low. However, the biometrical variations in the available germplasm are given in Table 46.

Table 46. **Biometrical variation in cumin types evaluated under germplasm at Jobner.**

Character	Range	G. Mean	S. E.	C.V. %
Plant height (cm)	16·0 - 25·9	20·2	1·9	9·7
Primary branches/plant	1·6 - 3·4	2·6	0·3	13·2
Umbels/plant	1·6 - 9·8	7·1	1·4	20·2
Umbellets/plant	14·8 - 34·5	23·6	3·2	13·7
Grain weight/10 plant (g)	1 4 - 10·9	4·6	1·7	37·5
Wilt	13·3 - 83·3	46·5	15·9	34·3

At Guntur also, the performance of the four collections was very poor.

In the initial evaluation trial with seven cultures at Jagudan, the difference in yield was found to be significant. Vijapur-5 gave the highest yield [581·0 kg/ha] which was 144% higher than the control.

The comparative yield trial with 8 entries at Jobner failed due to wilt infection The varietal trial with 6 varieties at three locations, viz., Mandore, Sumerpur and Jobner showed significant difference between varieties at Sumerpur. However, the yield was very low at this location. At Mandore, the yield was good, but there was no significant difference between varieties. At Jobner, the crop failed due to severe attack of wilt. The data on yield and associated characters at two centres are given in Table 47.

Table 47. **Varietal trial of cumin at Jobner.**

Entry	Location	Days to 50% flowering	Days to 50% maturity	Plant height (cm)	Yield/10 plants (g)	Yield (q/ha)
RS - 1	Mandore	72	94	35·2	42·5	5·88
	Sumerpur	71	114	38·0	27·0	1·20
MC - 43	Mandore	71	95	35·4	46·3	5·38
	Sumerpur	71	115	38·0	28·0	1·14
UC - 19	Mandore	72	95	36·2	41·3	5·18
	Sumerpur	70	115	40·0	27·0	1·23
UC - 192	Mandore	70	98	33·4	43·8	5·41
	Sumerpur	70	115	37·0	25·0	1·20
UC - 194	Mandore	72	96	36·0	38·8	6·00
	Sumerpur	69	113	39·0	35·0	2·16
UC - 196	Mandore	72	95	34·3	33·8	5·63
	Sumerpur	69	113	35 0	31·0	1·77
Local	Mandore	71	95	36·2	31·8	3·50
	Sumerpur	69	114	37·0	28·0	1·15
CD (5%)	Mandore	5·63	NS	1·84	6.588	NS
SEm ±	Mandore	2·29	1·03	0·75	2·687	0·691

Experiment 48: **Response of cumin to fertilizers**
(Jobner and Jagudan (Vijapur)

The fertilizer trial at Jobner consisted of 12 combinations of four levels of N (0, 15 30 and 45 kg N/ha) and three levels of P (0, 15 and 30 kg P_2O_5/ha) with six additional treatments consisting of combinations of N and P with Zn, B or Zn + B. Analysis of yield and associated characters showed no significant difference between treatments. At Jagudan, four levels of N (0, 15, 30 and 45 kg/ha) and three levels of P_2O_5 (0, 15 and 30 kg/ha) were tested, but there was no significant difference between treatments. However, the highest yield of 300 kg/ha was recorded in $N_{15}P_{15}$.

FENUGREEK

Experiment 46 : **Germplasm collection, maintenance and selection in fenugreek**
(Guntur, Coimbatore, Jobner and Jagudan (Vijapur)

The fenugreek germplasm collection consists of 100 types at Jobner, 70 at Jagudan and 48 at Guntur.

At Jobner, wide range of variability was noticed for different characters among the entries. Thirty entries surpassed the check NLM in yield. The highest yield was recorded in UM-26 [11·52 q/ha] followed by 10·29 q/ha in UM-33, against 6·86 q/ha in the check NLM. The variations in different characters are given in Table 48.

Table 48. **Biometrical variation in Fenugreek types evaluated under germplasm at Jobner.**

Character	Range	G. Mean	S. E.	C. V. %
Days to 50% flowering	61·0 – 79·4	67·8	5.7	8·5
Plant height (cm)	33·5 – 49·4	42·3	3·8	9·1
Primary branches/plant	3·8 – 7·4	4·8	0·8	15·8
Effective branches/plant	2·8 – 5·4	3·8	0·6	15·2
Pods/plant	15·7 – 29·9	22·9	3·6	15·7
Grains/pod	12·1 – 17·0	15·2	1·3	8·5
Pod length (cm)	8·5 – 10·9	9·9	0·5	5·0
Grain yield/plant (g)	1·5 – 4·8	3·0	0·6	21·5
Straw yield/plant (g)	3·1 – 7·9	5.5	1·0	19·2
1000 grians weight(g)	9·5 – 14·2	11·6	1·1	9·7
Grain weight (g)	82·9 – 552·9	390·2	51·2	13·1
Grain yield/ha (q)	5·9 – 11·5	8·2	1·0	12·5

Lam selection-1 gave maximum yield at Guntur (667 kg/ha) followed by 583 kg in Gadwal.

In the monsoon season of 1980, twentysix accessions were subjected to evaluation at Coimbatore. Appreciable variations were noticed in the traits like plant height (range : 24·6–40·1 cm), number of branches/plant (range : 4·2–6·0) and number of pods/plant (range : 22–41).

Experiment 51 : **Comparative yield trial in fenugreek**
(Guntur, Coimbatore and Jobner)

At Guntur, among the 14 cultivars compared, Pusa Early bunching variety of IARI was the earliest with a duration of 62 days. Varietal difference was noticed among the different varieties as far as yield was concerned (Table 49.)

Table 49. **Anova table for the 14 varieties under comparative yield trial at Guntur.**

Source	df.	M. S. S.	'F' ratio
Replication	2		
Varieties	13	0·002097	4·97*
Error	26	0·000422	
G. M. 525 kg		C. D. 146 kg	
S. Em. 50 kg		C. V. % 16·67	

Lam selection-1 recorded the highest yield of 696 kg/ha followed by NLM (679 kg/ha) and CS-960 (667 kg/ha).

At Jobner, comparison of the yield data of 10 varieties along with two local checks for the last four years revealed the superiority of NLM over other varieties. Table 50 shows the yield of different fenugreek varieties under comparative yield trial.

Table 50. **Yield data for the fenugreek varieties under comparative yield trial at Jobner for the last four years.**

Varieties	Yield (q/ha)				
	1977-78	1978-79	1979-80	1980-81	Mean
UM-5	6.08	15.37	16.42	12.67	12.64
UM-17	3.74	15.71	17.20	11.62	12.07
UM-32	8.00	16.22	14.35	13.60	13 04
UM-34	6.06	17.57	19.87	13.95	14.06
UM-35	8.55	16.63	14.81	14.52	13.63
Lam S-1	-	15.18	11.90	12.17	13.38
CO-112	-	14.10	12.76	11.70	12·85
CO-2336	-	12.85	11.22	13·40	12.47
IC-9955	-	15.14	11.27	10.37	12.25
NLM	9.69	19.67	17.67	14.17	15.30
Local (Bobas)	-	12.62	16.95	10.88	14.82
Local check	6.76	11.31	16.37	14.50	12.16
CD (5%)	3.37	3.38	2.20	2.20	

In another trial, six varieties were compared at four different locations, Durgapura, Mandore, Jobner and Banswara, along with the local varieties as check. At Durgapura and Banswara, the performance of the crop was very good and NLM recorded the maximum yield of 25.08 and 25.46 q/ha, respectively. At Mandore, the yield was poor, maximum being 7.87 q/ha in NLM. At Jobner also the varieties showed good performance, the yields of NLM, MU-35, UM-34 and UM-32 were at par with each other, but higher than the check.

Table 51 **Yield data for the fenugreek varieties for the last four years at six different locations under comparative yield trial (Yield in q/ha)**

Varieties	Durgapura			Mandore	Jobner				Banswara				Borkhera		Sumerpur	Mean
	1978-79	1979-80	1980-81	1980-81	1977-78	1978-79	1979-80	1980-81	1977-78	1978-79	1979-80	1980-81	1977-78	1978-79	1979-80	
UM-5	13·50	11·37	21·00	6·63	6·08	15·37	16·42	12·67	10·13	12·71	10·00	16·85	9·17	10·76	11·37	12·27
UM-17	14·08	10·84	22·08	5·33	3·74	15·71	12·20	11·62	11·63	17·81	8·54	14·01	11·90	7·62	13·02	12·34
UM-32	12·63	9·20	20·75	4·88	8·00	12·22	14·35	13·60	3·00	14·27	3·75	11·14	8·23	9·57	6·87	10·70
UM-34	14·16	11·89	21·25	5·88	6·06	17·57	19·87	13·95	9·50	13·22	8·43	11·14	13·87	11·60	9·64	12·54
UM-35	8·94	8·33	22·33	6·50	8·55	16·63	14·81	14·52	–	11·46	4·58	19·12	11·84	–	7·73	11·95
NLM	12·60	12·58	25·08	7·87	9·69	19·67	17·67	14·17	9·63	19·17	8·33	25·46	12·97	9·10	11·63	14·37
Check	–	8·85	14·80	5·94	–	11·31	16·37	10·88	–	–	11·67	12·33	–	–	11·63	11·97
CD (5%)	2·82	1·87	2·99	0·726	3·37	3·30	2·28	NS	2·50	2·89	2·83	2·75	NS	NS	NS	–

Comparison of the yied data for the last four years showed the superiority of NLM over other varieties not only in yield, but also in the stability. Table 51 shows the performance of these varieties for the last four years at different locations. The overall mean yield was maximum for NLM, i. e. 14·37 q/ha.

At Coimbatore, the initial evaluation trial carried out with six accessions as well as that conducted in January 1981 with seven accessions did not show any significant difference in yield between variteties.

Under the comparative yield trial, 14 accessions were tested in a replicated trial in June 1981. The accessionsshowed significant difference in yield and associated characters. Accession No. 2336 recorded the maximum yield of 310 g/plot, which was the highest. yielder in 1979-80 also. The yield and associated characters are given in Table 52. The trial was repeated in winter season, but no significant difference could be obtained.

Table 52. **Comparative yield trial in Fenugreek at Coimbatore.**

Plot size: 6 sq. m. Month of sowing: June 1980

Type	Height of plant (cm)	No. of branches/ plant	No of pods/ plant	Seed weight/ plant (g)	Mean seed weight/plot (g)	
					1980-81	1979-80
381	37·4	2·7	14·8	12·0	206·6	360·0
382	38·6	3·0	11·6	10·0	192·6	286·6
385	38·9	3·9	13·8	11·3	230·0	240·0
2313	36·7	2·6	11·2	7·6	216·6	336·6
2333	38·4	3·3	14·8	10·6	216·6	320·0
2336	46·8	5·2	18·8	19·0	310·0	464·0
Lam-1	38·2	3·2	14·6	10·3	218·3	271·6
VJ-1	39·8	3·1	13·2	9·6	176·3	331·6
NL (M)	34·3	2·5	12·5	8·6	173·3	218·3
VM-5	31·3	2·3	9·7	6·3	61·6	125·0
VM-17	35·0	3·5	13·0	9·3	126·6	148·3
VM-32	33·9	3·0	11·3	5·6	121·6	178·3
VM-34	33·6	3·9	15·6	10·0	110·0	148·3
VM-35	32·6	3·2	14·5	9·6	106·6	111·6
CD (5%)	–	0·48	–	6·05	15·58	–

Experiment 53 · **Response of fenugreek to fertilizers**
(Jobner and Jagudan (Vijapur))

At Jobner, four levels of N and 3 levels of P (without Zn and B) were tried in 1979-80 and 1980-81. None of the main effects was found significant in both the years. However, the N x P interaction was found to give significantly higher yield/ha. In 1980-81, the maximum yield was recorded in N_1P_0, i.e. (N_{15} P_0 kg/ha), 15.83 q/ha followed by 15.58 q/ha in N_2P_1 ($N_{30}P_{15}$ kg/ha) and 15.16 q/ha in N_3P_1 ($N_{45}P_{15}$) and N_0P_0.

At Jagudan, the treatments did not show any significant response to yield. Maximum yield of 18.40 q/ha was noticed in the combination $N_0P_{60}K_{30}$.

FENNEL

Experiment 49 : **Germplasm collection, maintenance and selection in fennel**
(Guntur and Jobner)

The data on vegetative and yield characters were recorded for the 14 cultivars in the germplasm collection at Guntur. Lam Selection-II and UF-31 recorded the maximum yield of 950 kg/ha each Table 53.

Table 53. **Data on vegetative and yield characters of fennel germplasm at Guntur.**

Variety	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of umbels/ plant	Yield/ ha (kg)
S-7-9	154	160	10	32	850
PF-35	152	145	13	49	908
UF-31	153	135	11	52	950
UF-32	152	139	8	40	808
Mass selection	153	150	20	24	700
Guntur	152	144	13	38	833
Guntakal-I	152	162	12	29	850
Guntakal-II	152	166	13	19	767
Gujarat	155	150	17	21	767
Giddalur-I	153	162	8	20	867
Giddalur-II	152	162	10	20	758
Lam Sel. I	142	145	20	34	908
Local	152	153	9	14	683
Lam Sel. II	152	154	10	30	950

At Jobner, 34 entries were evaluated against a check variety UF-32. Among these, 13 entries exceeded the check in grain yield. The highest grain yield of 1·85 kg/plot of 8 sq.m. was recorded in UF-90 followed by 1·76 kg in UF-88 and 1·74 kg in UF-12. The variation in yield and associated characters are given in Table 54.

Table 54. **Biometrical variation in Fennel types evaluated under germplasm at Jobner.**

Charecter	Range	Gen. Mean	S E	C V. %
Days to 50% flowering	116·0 - 121 0	118·1	2·4	2·0
Days to maturity	181·5 - 186·2	183·4	1·3	0.7
Height up to main umbel (cm)	81·7 - 121·0	100 3	10·8	10·8
Total plant height (cm)	100·0 - 129·7	112·9	8·8	7·8
Primary branches/plant	6·0 - 7·4	6·5	0 4	6·6
Umbels/plant	14·6 - 25·4	19·8	2·9	14·7
Umbellets/plant	154·6 - 293·8	217·5	31·7	14·5
Grains/umbellet	11·6 - 16·4	13·5	1·4	10·4
Grain yield/plot (kg)	1·1 - 1·8	1·5	0·03	12·1

The seven entries in the comparative yield trial at Jobner did not show any significant difference for any of the characters studied. UF-32, as in the previous years recorded maximum yield (22·05 q/ha). Comparison of the yield data for the last four years (1978-81) also showed no significant difference between varieties (Table 55).

Table 55. **Yield data for the fennel varieties under Comparative yield trail at Jobner.**

Variety	Yield (q/ha)				
	1977-78	1978-79	1979-80	1980-81	Mean
[1]	[2]	[3]	[4]	[5]	[6]
UF-31	9·50	4 07	22·35	20·30	14·24
UF-32	14·80	8·59	23·09	22·05	17·14

[1]	[2]	[3]	[4]	[5]	[6]
S-7-9	11·90	3·99	25·19	20 83	15·50
PF 35	14·00	3·84	25·81	20·93	16·17
Mass Sel. I	15·90	6·01	22·35	21·40	16·41
Mass Sel II	-	3·08	24·51	21·45	17·00
Mass Sel. III	-	3·81	26·95	18·73	16·53
Local check	-	-	-	17·41	-

Evaluation of five varieties along with local checks at two locations, viz., Sumerpur and Jobner also did not differ significantly in yield/ha, even though UF-32 recorded the highest yield at both the locations (10·87 and 22·05 q/ha, respectively). Comparison of the yield data for the last four years in these two locations also showed no significant difference between varieties.

Experiment 50: **Response of fennel to fertilizers** (Jobner)

The fertilizer trial with 12 combinations of four levels of N (0, 15, 30 and 45 kg N/ha) and three levels of P (0, 15 and 30 kg P_2O_5/ ha) along with three additional treatments of Zn + B with each of N_0P_0, N_1P_1, and N_3P_2 was continued this year also The response of N was noticed only up to N_1 level, which was significantly higher than the N_0 level, whereas response of P was noticed upto P_2 level (Table 56).

Table 56. **Response of fennel to N and P fertilizers at Jobner.** (Yield: q/ha)

P levels (kg/ha)	N levels (kg/ha)				
	N_0	N_1 (15)	N_2 (30)	N_3 (45)	Mean
P_0	14·10	16·46	16·26	18·85	16·42
P_1 (15)	14·46	19 86	13·53	17·50	16·34
P_2 (30)	15·00	18 83	21·83	21·48	19·29
Mean	14·52	18·38	17·21	19·28	

Application of Zn + B with lower doses of N and P did not show any increase in yield, but with N_3P_2, a significant increase was observed.

AICSCIP STAFF STRENGTH, PERSONNEL AND BUDGET

Sanctioned staff strength	Personnel (in position)	Budget (1980-81) (Rs.)
Cashew Research Station, Madakkathara		80,000
Horticulturist	PG Veeraraghavan	
Junior Entomologist	Vacant	
Senior Research Assistant	TE George	
Cashew Research Station, Bapatla		101,000
Assistant Breeder	N Subba Rao	
Assistant Agronomist	S Ankiah	
Assistant Entomologist	M Ramadevi	
Senior Research Asst.	1 R Srihari Babu	
	2 P Radhakrishnamurthy	
Cashew Research Station, Vengurla		65,000
Horticulturist	Vacant	
Junior Horticulturist	DP Sawke	
Junior Entomologist	Vacant	
Cashew Research Station, Vridhachalam		77,000
Horticulturist	Seemanthini Ramadas	
Jr. Agronomist	D Veeraraghavathatham	
Junior Entomologist	Vacant	
Senior Research Asst.	1 P Rajendran	
	2 B Sampathkumar	
Regional Research Station, Mudigere		134,000
Breeder	Vacant	
Agronomist (Horticulture)	GS Sulikere	
Plant Pathologist	Vacant	
Junior Plant Physiologist	,,	
Junior Entomologist	,,	
Cardamom Research Station, Pampadumpara		116,000
Plant Pathologist	L Rema Devi	
Breeder	Vacant	
Agronomist	Vacant	
Junior Entomologist	Vacant	

Pepper Research Station, Panniyur		111,000
Nematologist	Vacant	
Junior Breeder	K Sivan Pillai	
Junior Pathologist	PK Unnikrishnan Nair	
Junior Agronomist	Vacant	
Senior Research Asst.	KP Momootty	
Himachal Pradesh Krishi Viswa Vidyalaya, Solan		86,000
Breeder	UK Kohli (addl. charge)	
Junior Pathologist	Vacant	
Junior Biochemist	Vacant	
Orissa University of Agriculture & Technology, Bhubaneswar		112,000
Agronomist (Horticulture)	SN Mishra	
Junior Entomologist	Vacant	
High Altitude Research Station, Pottangi (OUAT)		101,000
Breeder	Vacant	
Junior Breeder	DC Mohanty	
Senior Research Asstt.	YN Sarma	
Tamil Nadu Agriculture University, Coimbatore		55,000
Breeder	R Arumugam	
Junior Pathologist	Vacant	
Senior Research Asst.	S Sayed	
SKN College of Agriculture, Jobner		103,000
Breeder	RK Sharma	
Junior Agronomist	DS Bhati	
Junior Pathologist	LG Bhatnagar	
Junior Biochemist	Vacant	
Senior Research Asst.	JP Loyal	
Agriculture Research Station, Guntur		62,000
Horticulturist	Vacant	
Assistant Horticulturist	T Srirama Rao	
Junior Pathologist	Vacant	
Agricultural Research Station, Vijapur		57,000
Pathologist	Vacant	
Junior Breeder	BT Kachhadia	
Senior Research Asst.	Vacant	

ERRATA

Page	Column	Table	Line	Printed as	To read as
7	2	–	10	are	is
11	2	–	9	Daboli	Dapoli
14	2	–	Last	Tablo	Table
18	1	–	2	Eight	eighth
29	2	–	1	KALL	KAU
32	2	–	5	Colleetion	Collection
34	2	–	Last	wilt - affected Bandadka	Wilt - affected garden at Bandadka
35	1	–	8	ar	at
39	2	–	3	effected	effect
40	–	37	1	Weat	Wheat
41	2	–	15	Aldioarb	Aldicarb
41	2	–	16	Monoorotophos	Monocrotophos