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RESEARCH HIGHLIGHTS 1980

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FOREWORD

The CPCRI researches on a number of crop plants as coconut, cashew, arecanut, oil palm, cacao, and spices. Research is carried out in 14 centres distributed in seven states and Union Territories. With nearly 200 scientists and 1200 employees, and an annual budget of Rs. 19 million, the CPCRI is one of the biggest of the ICAR research institutes.

"CPCRI RESEARCH HIGHLIGHTS 1980" is an attempt to highlight the important findings of the year 1980 from the wide-ranging research programmes of the Institute. This is meant to give the readers a broad idea about the important findings of the Institute for the year. We propose to bring out this publication annually in future, before March of the following year.

Being the first attempt, we are aware that this publication may be suffering from certain deficiencies. We will be grateful if you could send us your suggestions for making this publication more meaningful and useful.

I sincerely thank my colleagues Mr EV Nelliat and Dr PK Das for compiling and editing this publication. I thank also M/s Sharada Press, Mangalore for bringing out this publication in a record time.

Kasaragod,
Kerala,
1-5-1981.

NM Nayar
Director
Central Plantation Crops Research Institute

Central Plantation Crops Research Institute

RESEARCH HIGHLIGHTS 1980

COCONUT

GENETICS

Germplasm

An attempt has been made to develop a selection index for seedlings in the nursery based on mean values and CV for growth characters like height, girth leaf number, petiole length, leaf length and breadth. The procedure involves ranking of the cultivars in an ascending order of the mean values and CV. By this method the cultivars showing the best phenotypic expression (highest mean ranking) and least variability (lowest CV) would top the list.

A sample of 25 MAWA seedlings, raised from seednuts imported in 1977, were underplanted in Block D at Kasaragod. They continue to maintain superiority over the DxT hybrids for growth characters.

Breeding for high yield

The comparative performance of 14 year old Chowghat Dwarf Orange (CDO) x West Coast Tall (WCT) and WCT x CDO hybrids, planted along with WCT palms in Hill Block under unirrigated conditions and with normal fertilisation during 1979 is as under:

The data indicate that CDO × WCT hybrids are superior to WCT × CDO hybrids and WCT which is the control.

Genetical Investigations

Evaluation of multilocation trial laid out with a view to establishing correlations between seedling and adult palm characters and to use these for detection of prepotency was carried out. The families showed significant differences for total leaf production, number of functioning leaves, length of leaflet-bearing portion, total leaf length, height of trunk above fixed mark, and time taken for flowering. The families 6/23, 8/21 and 2/108 have given generally higher values for the above characters. The families 2/108 and VI/4 flowered early (67.7 months). Family IV/21 took the maximum time (93.1 months).

Seedling score for prepotency

During the year, 1030 year old progenies of 40 WCT palms were screened for prepotency based on nursery characters. The top nine families identified based on cumulative ranking method were:

1. 40/440
2. 39.2.1/174
3. 41/407
4. 41/478
5. 41/491
6. 41/448
7. OC/1
8. 8/16
9. X/26

	Yield in 1979 (nuts/tree) Mean and Range	*Approx. copra outturn kg/ tree*
1. Chowghat Dwarf Orange x West Coast Tall (obtained by artificial pollination)	124 (79 to 167)	23.0
2. Chowghat Dwarf Orange x West Coast Tall (obtained from open pollinated bunches after emasculation)	120 (61 to 163)	22.0
3. West Coast Tall x Chowghat Dwarf Orange	93 (40 to 169)	17.3
4. West Coast Tall (Control)	63 (29 to 111)	10.0

Genetics of colour and height

Seven WC Tall palms segregating for varying degrees of dwarfness showed that 3 to 50% among them were dwarf segregants. In WC Tall (OP) growth rate was comparatively high while WC Tall (selfed) showed a reduction in vigour. In Mawa hybrid seedlings, the growth rate was very high indicating enormous hybrid vigour and only 3% dwarfs were observed under imposed hybridity resulting in very high (97%) recovery of heterotic hybrids and showing 15.67 cms girth, 9.58 number of leaves and 185.25 cm height. 91.54% seedlings showed splitting in the nursery stage.

The palms which showed a segregation for dwarfs under open pollination also segregated for dwarfs under selfing upto 50% (39.3B/531) while in palms 40/441 which never segregated for dwarfs in open pollination hardly segregated for dwarfs under selfing. Such non-segregating talls are important in our breeding programme since a homogeneous population can be obtained from them.

Elite palms

Seedling progenies (OP) raised from elite palms were scored for growth characteristics and hybridity, and compared with the progenies of prepotent WCT palms. Two elite palms at CPCRI, Kasaragod (WB-169 and WB-179) and one at Ezhom (Cannanore District) exhibited higher mean values than the O.P. progeny of prepotent palm, and were more uniform in growth than selfed progeny of prepotent palm.

Tissue culture

In coconut, our attempts to induce callus from seedling tissues have met with only a limited success. Though callus could be induced easily on a medium containing 2, 4-D, its maintenance and further multiplication were hampered due to tissue browning and release of polyphenols in the culture medium.

AGRONOMY

CDO×WCT hybrid (57 nuts) out yielded high yielding WCT (41 nuts) and WCT×CDO hybrid (43 nuts). High yielding WCT and WCT×CDO hybrid showed a significant increase of 11 to 12 nuts/palm when the fertiliser dose was increased from 500:500:1000 g N, P_2O_5, K_2O/palm/year to 1000:1000:2000 g N, P_2O_5.K_2O/palm/year, whereas no such increase was observed in CDO×WCT hybrid. However, the yield of CDO× WCT hybrid at the lower level (57 nuts) was much higher than the yield of the other two genotypes at the higher level (47 nuts).

Coconut palms grown under neglect gave an early and higher response to the application of double the recommended dose of fertilisers in the first one or two years. Eventhough, a severe reduction in the yield was observed during the year in all the palms, those receiving fertiliser had given a significantly higher yield than those under neglect (no fertiliser, farmers practice).

The interaction of quantity of irrigation water and frequency of irrigation (IW/CPE ratio) had a significant effect on the yield of WCT palms. Palms receiving 20 mm water/irrigation at IW/CPE ratios of 1.00 and 0.75 yielded 79 and 75 nuts respectively, as against 58-64 nuts in palms receiving other quantities and frequencies of irrigation. Though the difference in responses to fertiliser levels was not significant, the palms receiving higher levels of NPK, Mg, yielded 64 nuts/palm compared to 60 nuts at the lowest level. There was no difference in response to the appli-

cation of fertilisers in two splits and four splits (61.8 nuts in two splits and 63.6 nuts in four splits). The overall mean yield of palms receiving irrigation and fertiliser application was 63 nuts/palm/year whereas those receiving 60 mm water/irrigation yielded 37 nuts and those receiving middle level of fertiliser (750-670-1500-170 g/palm/year of N, P_2O_5, K_2O and MgO) without irrigation yielded 31 nuts/palm.

SOIL SCIENCE

Skipping phosphorus application in red sandy loam soil with high initial phosphorus status did not affect the yield of palms even after five years. The studies on the response to different sources of phosphorus (Super phosphate, Ammonium phosphate, Nitro phosphate and Rock phosphate) in laterite soils did not reveal any significant difference in yield of palms during the past five years.

Application of organic sources, viz., cattle manure, forest leaf, coconut sheddings and coconut pith along with NPK fertiliser facilitated the successful establishment of coconut seedlings in littoral sand. Cattle manure or forest leaf in combination with NPK induced early flowering.

PHYSIOLOGY

Flowering: Initiation of inflorescence primordium is usually taking place only during the months of August-November when the moisture as well as sunlight are adequate. The mobilisation of carbohydrate takes place during this period. Any adverse environmental condition during this period may perhaps be the cause for abortion of the inflorescence. It has already been reported that maximum abortion takes place of those flower primordia that are formed under stress condition. The first flowering is preceded by a high carbohydrate/nitrogen ratio in the stem reserves. The variation in the number of female flowers produced closely followed the seasonal variation in the starch and sugar reserves of the palm.

In another study, GA_3 was detected in the coconut leaf. When GA_3 was injected into the trunk of young WCT palms, flowering was preponed to the 36th leaf axil, as against the 45th leaf axil under normal conditions.

Girth at collar and total leaf area are the most important factors contributing to seedling vigour. In the six month old seedlings, there was higher mobilisation of sugar (48 mg glucose/g shoot) in highly vigorous seedlings compared to low vigour seedlings (19 mg glucose/g shoot). There was increased conversion of insoluble sugars also. These differences in mobilisation and storage of carbohydrates coincided with the leaf area and shoot-dry-weight of the seedlings.

PATHOLOGY

Root(wilt) disease

It was observed that terramycine tree formulation, has a compromising effect on the coconut root (wilt) disease. Disease affected palms treated with antibiotic responded favourably without further deterioration based on foliar observation while there was definite deterioration in the condition of the untreated control palms. Results are presented in Table I. A favour-

Table I. Response to Terramycin Tree Formulation by root (wilt) affected palms-Mean % incidence of disease.

Period	*Treated plams*	*Untreated palms*
1/77	24.04	23.70
1/78	23.68	30.72
1/79	20.86	31.09
12/79	22.57	32.68
7/80	21.92	33.43

Table II. Field experiment on chemical control of root (wilt) disease. (Summary of observations after 18 months of treatments)

Treatment	*No. of palms treated*	*No. of palms shownig improvement (remission of symptoms)*	*No. of palms without any change*	*No. of palms deteriorated*
Ascorbic Acid	15	6	9	NIL
Ascorbic Acid plus NAA	15	6	8	1
Phenols	15	4	9	2
Control	15	2	10	3

able response and increase in nut yield by way of masking of the symptoms has been indicated in the palms treated with ascorbic acid and naphthalene acetic acid. The data are given in Table II.

In an observational trial on mixed cropping with cacao, the yield of coconuts with irrigation has doubled over a period of three years, irrespective of the disease situation. The mean yield of the 90 palm plot was 46 nuts in 1980 compared to 22 nuts in 1977.

The fertilizer experiments on WCT planted in 1970 and CDO x WCT palms planted in 1972, continued to show the superiority of the hybrid both in terms of nut yield and susceptibility to the disease. The disease incidence was 6.5% and 35.5% and yielded 118 nuts and 50 nuts/palm in the Hybrid and Tall respectively during the year.

Preventing the spread of Root (wilt) disease

The strategy consists of eradication of disease affected palms in a belt of about 35 km from east to west on the northern border of the diseased belt, application of plant protection chemicals to the surrounding palms and surveillance. Out of 482 palms so far identified as diseased, 400 have been cut and removed, after spraying with 0.05% Carbaryl to inhibit the suspected vector, *Stephanitis typica*. The boles and the roots of the diseased palms were burnt *in situ* and the pits treated with Temik 10G. Application of Temik 10G and Bavistin was made to 1340 experimental palms in 15 m^2 of the diseased palms and hybrid seedlings planted in the vacancy.

Diagnostic biochemical test for incidence of disease and evaluation of rhizosphere mycoflora were carried out in the experimental palms which are under observation for development of visual symptoms of disease.

TECHNOLOGY

An experiment was conducted on sun drying of copra on three surfaces, viz., black painted palmyra leaf mat, jute cloth and cement flooring. Black painted palmyra leaf mat performed best among the three surfaces for drying the copra in 7 days. A cabinet type solar drier was found to be more efficient in bringing down the initial moisture content of copra from 47.25% to 6% in 5.5 days.

ARECANUT

AGRONOMY

Mulching around the base of the palm with arecanut husk @ 6 kg/palm was found to be effective in reducing the soil temperature (2-3°C) and improving the physical properties of soil. Drip irrigation improved the soil water regime by minimising the fluctuations in soil water content. It reduced weed growth in the interspace. Increase in yield to the tune of 40% was observed over that obtained in the plots irrigated by local methods.

Ten arecanut based cropping systems involving nineteen other crops have been studied in order to work out their economic viability. Under Vittal condition, highest net return of Rs. 17,915/ha/year was obtained from arecanut + ginger - chillies. This was followed by arecanut + banana (Rs. 17,730). The benefit cost ratio was highest (2.68) under the system - arecanut + paddy + finger millet - ground nut.

Intercropping enriched the nutritional status of the soil and did not in any way limit the growth of arecanut. Intercropping with betelvine and turmeric resulted in 31 and 20% increased yield of arecanut respectively over the control at Hirehalli. Similarly, there was an increase in yield of arecanut by 36% with cacao and cinnamon as mixed crops. Coffee grown under the canopy of arecanut in the maidan parts of Karnataka had no adverse effect on the main crop of arecanut.

PATHOLOGY

Bacterial leaf stripe disease incidence has been correlated with the environmental factors like temperature, rainfall, etc. The average daily temperature (maximum and minimum) when related to the disease incidence indicated that higher temperature reduces the disease incidence. When the temperature during the months of July-October prevailed on an average between 26-28°C and the minimum between 17-19°C, the disease incidence recorded was 26%. It was also noticed that when there were more than ten rainy days during the corresponding period (July-October) with an average rainfall of 130 mm during the months, the incidence was as high as 37%.

Spraying tetracycline formulations (500 ppm) at 15-20 days interval during the period from July to October (about 5-6 sprays) was found to be an effective prophylactic measure.

None of the ten proprietory chemicals tested as soil drench to control "*Ganoderma*" of arecanut was found to be effective.

Studies on yellow leaf disease revealed the association of different species of *Pythium* and *Phytophthora* in the affected roots. Application of dolomite @ 4 kg and organic manures @ 12 kg/plam/year NPK fertilizers @ 100:160:140g/palm/year did not have any ameleorative effect on the yellow leaf disease.

A field trial was initiated in 1977 to study the effect of phosphorus and lime on arecanut seedlings with respect to disease and to monitor the changes in the microbiological status of the rhizosphere and the nutrients in the plant tissue. Application of lime reduced the fungal population of the rhizosphere while it increased the total actinomycetes and bacterial population.

TECHNOLOGY

Two manually operated arecanut huskers to husk dry arecanuts have been developed. The mechanism employed in the first is shearing and pressing the husk whereas in other scissoring is used to split open the husk. The first husker can husk upto 50 kg husked nut per day

(8 hours) with an unskilled labourer. The latter one is yet to be tested.

Studies on the industrial use of arecanut leaf sheath, a waste material from arecanut plantations have brought out the possibilities of utilizing the sheaths for making 3-ply-boards (two layers of sheaths and one of wood). It is suitable for making packing cases for internal movement of tea, medicines, etc. The areca sheaths can also be used for making file boards and throw-away plates and cups. The polymerised phenols of arecanut are found useful as natural colouring matter in food and non-food substances.

BLACK PEPPER

PATHOLOGY

Soil samples were collected at monthly intervals from quick wilt (foot-rot) affected pepper plot and the soil moisture and the amount of inoculum present were assessed. No fungus could be recovered in April when the soil moisture ranged from 3.0 to 11.2%. In June-July when soil moisture ranged from 20.6 to 23.9%, the percentages of castor baits infected were 5 and 10 at 0 and 5 cm depths, rspectively. The recovery of the fungus increased to an average of 35% at the base of the vine in October.

From a study of the soil particles striking on to the vines at the basal portions at different heights, it was found that the amount of soil sticking was maximum at 25 cm height and it gradually reduced as the height increased. The infection of castor baits were 27.5% and 12.5% from the soil particles collected at 25cm and 50 cm heights, respectively. No infection of castor baits occurred from soil particles collected at 74 cm and above.

GINGER AND TURMERIC

ENTOMOLOGY

The biology, nature of damage, two collateral hosts, two predators and two natural parasites of the scale insect have been worked out. The insect has been identified as *Aspidiella hartii* CKll. and morphologically described. The scale parasites have been studied and identified as *Physicus comperei* Hayat and *Adelencyrtus moderatus* Howard. A mealy bug *Dysmicoccus brevipes* Ckll. was found cohabiting with scales. A black ant, identified as *Paratrechine* sp. found in alate and apterous forms was living in the scale and mealy bug colony symbiotically.

The life cycle studies on shoot borer, *Dichorocis punctiferalis* Gn. revealed that certain punctilious requirements had to be provided to facilitate the moth for laying eggs.

The minute (3 mm) larvae of *D. punctiferalis* hatched out from singly laid eggs on leaf tip, petiole etc. of turmeric and ate its way into the heart of the plant through green chlorophyll, midribs, petiole and pseudostem where it remained feeding for 15 to 18 days until fully grown. There are five larval instars. The V instar when fully developed (24 mm) prepared exit hole, puparium etc. shrinks in size, moults and becomes pupa which may be light brown to deep brown in colour. Pupal period may be for 10 to 14 days.

Following parasites and predators were found on *Dichocrocis punctiferalis* and got them identified from CIE, London.

Parasites:

(1) *Myosoma* sp. (Braconidae)
(2) *Thressa* sp. (Diptera)

(3) *Silba* sp. (,,)
(4) *Desmometopa*? m. *nigrum* (Diptera)

General predators:

(5) *Philodicus* sp. (Diptera)
(6) *Heligmoneura* sp. (Diptera)
(7) *Euborellia stali* (Earwig)
(7) *Araneus* sp. (Spider)
(9) *Micaria* sp. (Spider)
(10) *Thyene* sp. (Spider)

Another five dipteran flies were identified and found living with *D. punctiferalis* larvae on the pseudostems. Six leaf eating beetles and three storage pests were newly recorded as pests of ginger and turmeric.

PATHOLOGY

Among the different methods of storage practices tested, pit method gave minimum rotting (46%) of rhizomes as against 82% in rhizomes stored under paddy husk. *Fusarium* spp. and *Macrophomina phaseolina* were mainly responsible for the rotting during storage.

In the field trials, the plots receiving Agallol 0.25%+Oftanol (15 g/bed) recorded the highest yield of 3.1 kg per bed as against 2.2 kg in untreated control.

Leaf spot disease is caused by the fungus *Phyllosticta zingiberi* and the dormant mycelia remained viable in the field throughout the summer period (32-33°C). Spore dispersal was found directly related to the intensity of rains. The toxic principle of culture filtrate has low molecular weight and is thermostable since the toxicity was not lost even after autoclaving at 20 lb pressure. Among the fungicides tested, plots treated with Bordeaux mixture 1% gave the least disease incidence (13.5%) as against 23% in control.

In the rate of apparent photosynthesis and in the yield or rhizome as well as curcumin content, selection No. 24 was superior to the other varieties studied. 'Sugandham' was poorest in curcumin content. The highest curcumin content of 8.75% was recorded for selection No. 24 in the 16th week after planting, followed by 'Duggirala' in the 24th week.

OIL PALM

Nutritional experiment at Bharathipuram initiated during 1975 showed that N and K had significant effect on yield of oil palm on fresh fruit bunch basis. Nine *pisifera* palms (male) have been identified in a selfed population of *Tenera* x *Tenera* at Thodupuzha farm. Five high yielding *Tenera* palms at Palode Station were selfed to obtain sufficient number of *pisifera* palms.

CACAO

Fermentation and drying trials conducted have shown that by enhancing aeration during later stages of fermentation the acidity could be lowered.

A tool for harvesting cacao pods has been developed. The tool avoids climbing the tree or use of ladder. Harvesting can be done standing on the ground.

CASHEW

A screening method to eliminate cashew genotypes with high rates of fruit drop has been standardised using ethrel, an ethylene releasing chemical. The method is based on our finding that release of ethylene, a gaseous harmone, is respon-

sible for immature fruit abscission in cashew.

Epicotyl grafting, similar to the stone grafting in mango was found successful in cashew. About 50% success was achieved and the field establishment was as good as that of seedlings.

Veneer grafting *in situ* has been found to be very successful during Kharif season under Goa condition.

Application of the insecticide, Nuvacron 40 EC at 15 ml/tree absorbed in cotton wool and placed inside the live-bark after removing a flat, was found to be an excellent control of stem-cum-root borer in cashew, as compared to spray or soil application.

Cashew clone Tree No. 121 has adopted very well to the agroclimatic conditions of Andaman and Nicobar islands and has given consistently high yield (10.00 kg/tree/year). The cultivar Ansur early (7.58 kg/tree/year) and clone Tree No. 39 (7.4 kg/tree/year) are the next best among the collections.

RICE

A dose of 80 kg N + 60 kg P_2O/ha was found to be optimum for the variety 'Annapurna' and application in three splits i.e., 50% at transplanting, 25% at tillering and 25% at boot-leaf stage proved the best. The variety Jaya responded significantly upto 120 kg N+80 kg P_2O_2+80 kg K_2O/ha.

Weed control in transplanted rice with 'Machete' granules @ 20 kg/ha was found to be economical as compared to manual weeding.

The incidence of 'Gall-midge' could be controlled through (*a*) selection of resistant varieties like CR 94-721-1 and CR 94-721-3; (*b*) planting early viz. early June and (*c*) nursery application of Furdan 3 G @ 2.5 kg/600 sq. m.+root-dipping of seedlings with Dursban @ 200 ml in 200 litres of water for 12 hours.

DAIRY CATTLE

In Goa major reproductive problems of dairy cattle like *true anoestrus conditions*, *sub-fertility*, *repeater* cows and *Retained Placenta* have been successfully tackled through proper diagnosis and treatment.

PIGS

Cross-breeding in pigs with Yorkshire boar and local sows have been successfully done. The performance of cross-breed, with regard to litter size and heavier piglets at birth had shown encouraging results.

POULTRY

The production performance of HH260 poultry birds, introduced through a Franchise, was found to be excellent in both Government and private farms. Its major characteristics are early maturity, high egg production and low feed intake.

One of the highly infections diseases of Poultry namely 'Infectious Coriza', in high rainfall areas was effectively controlled with cheap homeopathic drug 'Pulsatilla' and herbal preparation 'Septilin' than the conventional treatments.

ECONOMICS

The growth rates in the production of pepper for the period 1970-79 were estimated in respect of five major pepper producing countries and by using these estimates the projections in pepper production for 1985 and 2000 AD were worked out. The country-wise growth rates and projected figures are as follows :-

Country	Compound growth rate per annum (%)	Projected Production ('000 tonnes)	
		1985	2000 *AD*
India	1.84	33.5	43.8
Indonesia	2.70	35.1	52.4
Malaysia	2.76	39.2	59.0
Brazil	12.30	70.5	401.4
Madagascar	1.92	6.1	8.2

The cost of production of ginger under average condition of Kerala was estimated at about Rs. 1000/- per tonne of fresh ginger and Rs. 4000/- tone of dry ginger.

An analysis of wholesale price of ginger in Calicut market indicated that the price had been fluctuating violently during the last decade. The price of dry ginger abruptly dropped by 59% in 1971-72 and declined further by another 7% in 1972-73 from the 1970-71 level. Thereafter it started raising, but remained sufficiently below the 1970-71 level upto 1975-76. Again in 1976-77 and in the subsequent year, the wholesale price of ginger registered a rise by more than 60% over the 1970-71 level and then declined. The 1979-80 price was found to be 44% below the 1970-71 price. The wholesale price of Indian ginger being dependent upon the world market, the period of high prices for ginger in Calicut market obviously coincides with the peak period of export.

STATISTICS

For field experiments on ginger, a plot of 3-4 beds of size 1m x 1m coloumn-wise and six lines of 5 plants each were found to be the best, based on a uniformity trial data.

Valid application of tests of significance in the analysis of variance requires the assumption that experimental errors are normally distributed. Examination of yield data of coconut for individual years revealed that the distribution is awlays positively skewed and leptokurtic. Square root transformations of the form $\sqrt{x+3/8}$ and $\sqrt{x}+\sqrt{x+1}$ were found to reduce the skewness and kurtosis. Pooling the data for consecutive years also resulted in bringing the data to near normality.

In the case of arecanuts also yield data follows a positively skewed distribution. Transformation of the form $\sqrt{x+2/3}$ was found to normalise the distribution.

A study carried out for two years showed that by taking single spot observation anytime during the peak period of flowering (spread over about a month), yield forecast can be made with reasonably high precision (R^2 0.90).

A study of the variations is the wholesale prices of coconuts and coconut products in Kerala revealed that while the inter-district variations in the prices of copra and coconut oil remained more or less steady over the years, the variations in the prices of coconuts were found to increase. This was due to the concentration of oil mills in Trichur and Ernakulam districts and the demand for husk in Central and South Kerala.

EXTENSION

A subject matter traning-cum-discussion seminar on Plantation Crops Production Technology was conducted for officers of the development departments of the States. Training on different aspects of the cultivation of varous plantation crops was imparted to extension workers of various states.

Officials sponsored by UNDP/FAO Sri Lanka and by the Government of Malaysia were trained in the recent advances in the management of coconut and other plantation crops as per their requirements.

The following extension pamphlets were brought out in English during 1980:

(1) Coconut Bunch Support
(2) A knife for harvesting cacao and small drier for cacao beans
(3) Promising coconut cultivars and hybrids

The operational Research Project staff made 510 farm visits and gave technical advice on preparing farm plans for increasing crop and livestock production. Two hundred and thirty farmers kept constant contact with the Operational Research Project office during the year for getting technical guidance in agriculture and animal husbandry.

Lab-to-Land Programme

The Lab-to-Land programme launched in June, 1979 as a part of the ICAR Golden Jubilee Celebration was continued. Under the programme, the Institute adopted 388 farm families distributed among 10 of its stations against a target of 400 farm families.

During 1980, 10967 selected coconut seedlings were distributed.

ALL INDIA COORDINATED SPICES AND CASHEWNUT IMPROVEMENT PROJECT:

Cardamom

Out of the 77 clones under evaluation at Mudigere, four clones recorded more than 500 g green capsules / plant, the maximum being 773 g from clone No. 802. At Pampadumpara type No. 17 continued to give the highest yield in comparative yield trial.

Among the eight insecticides tried against cardamom thrips at Pampadumpara, four insecticides viz. quinalphos 1.5%, carbaryl 10%, methyl parathion 2% and phosalone 4% were found to be effective in controlling thrips when dusted.

Pepper

In the comparative yield trial at Panniyur, Panniyur-I recorded the highest yield (1.01 kg/palm) as against 0.78 kg in Arakulam Munda and 0.47 kg in Kuthiravally. In the fertilizer experiment the plants receiving fertilizers in split doses showed better growth and early flowering. Foliar yellowing in nematode infested pepper garden was reduced by 26% through phenamiphos treatment.

Ginger

Among the 119 ginger collections evaluated for yield at Solan, 15 recorded more than 600g/plant. Maximum recorded yield was 925 g/plant (IC 26798)

Turmeric

At Pattangi, 75 collections were evaluated and the highest yield of 7.6 kg/3m^2 bed was recorded in 316 Gorakhpur.

Cashew

The comparative yield trial with the seedling progenies of 16 selections at different centres showed that the Bapatla types, Tree No. 1, 56, 273, SCH 3/3, EPM 9/8 and hybrids 2/11 and 2/12 performed well at Bapatla and the Anakkayam type and hybrid (K-20-12 and H-4-7) at Mannuthy.

In the manurial experiment at Bhubaneswar N showed significant effect of yield upto N_2 level (500g/plant), but there was no response to P and K.

ALL INDIA COORDINATED COCONUT AND ARECANUT IMPROVEMENT PROJECT

Fertilizer trial on coconut at Ratnagiri has shown that NK interaction was signi-

ficant on the yield of nuts. N_2K_1 (750g N and 450g K_2O) and N_2K_2 (750g N and 900g K_2O) gave high yields of 98.3 nuts and 94.5 nuts, respectively, compared to 9.7 nuts/plam/year in No K_1 (No N and 450g K_2O) combination. In the inter and mixed cropping trials at Veppankulam, the yield of the main crop of coconut increased wherever intercrop was raised. The intercrops raised were cacao, pineapple, banana and NB 21 grass. At Nileshwar, double row planting of cacao in coconut gardens was found to be more profitable than single row planting of cocoa as the former gave an yield of 70 nuts and 1000 pods of cacao while the latter gave 74 coconuts and only 452 pods of cacao. In the plots where no cacao was planted the yield of coconut was 70 nuts. This also indicates that mixed cropping with cacao does not affect the yield of coconut. At Veppankulam, irrigation to Tall x Dwarf hybrids once in 10 days substantially increased the yield of nuts per palm compared to no irrigation. Application of fertilizer treatment of N_2 P_1K_1 (900g N 160g P_2O_2 and 600g K_2O) with irrigation once in 10 days gave the maximum yield of 131 nuts/palm.