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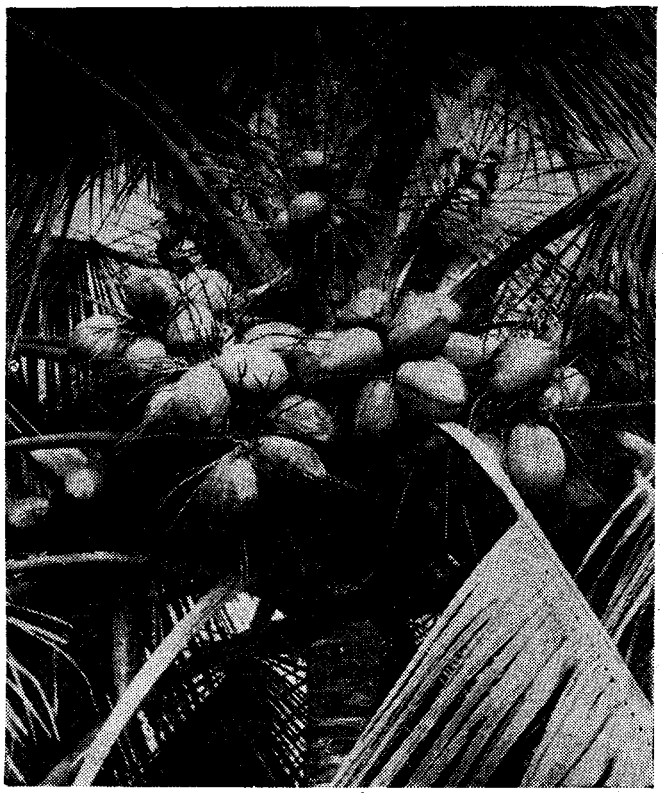

'West Coast Tall' — the local cultivar

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SUPERIOR PLANTING MATERIAL FOR GARDEN LANDS

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THE use of better seed for increased yield is very important in any crop plant. This is specially so in the garden land crops, since planting inferior material would result in continued losses to the farmer for a longer period than in the case of annual crops. As most of the garden land crops are not grown as monoculture, the varieties or hybrids should possess not only the higher yield potential but also should be compatible with various crop combinations. The work on this line is at its infancy. An attempt is made here to briefly describe certain desirable genetic materials of coconut, arecanut, cacao and pepper.

Coconut

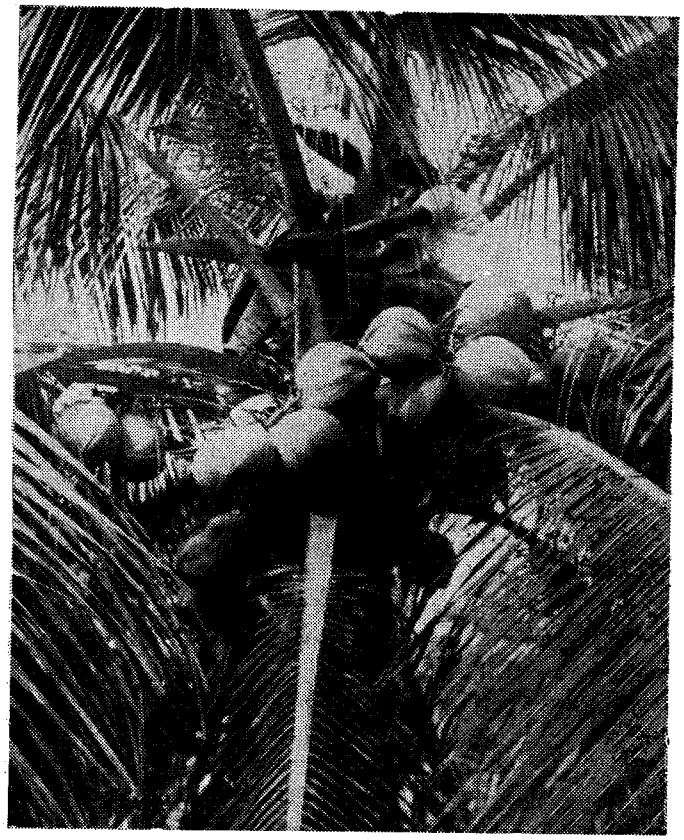
Though the conventional breeding methods in a seed-propagated perennial crop like coconut is time-consuming, it is gratifying that today a few promising cultivars and hybrids are popular among the coconut growers due to their overall advantages.

Certain Promising Exotic and Indigenous Cultivars. The role of collection, evaluation and selection of introduced types in the improvement of crops is well recognised. At the Central Plantation Crops Research Institute, Kasaragod, 59 exotic and 32 indigenous types are under various stages of evaluation. These are being compared with the locally grown 'West Coast Tall' for economic characters like time taken for flowering, yield of nuts, copra and oil content, and for resistance to diseases and pests. Among the earlier introductions, exotic cultivars like 'Fiji', 'Philippine Ordinary', 'San Ramon' and 'S.S. Green' and indigenous ones like 'Kappadam', 'Laccadive Micro', 'Laccadive Ordinary' and 'Andaman Ordinary' have been found to be superior to the local 'West Coast Tall' in its yield of nuts and copra. Their comparative performance is presented in Table 1.

TABLE 1. COMPARISON OF EXOTIC AND INDIGENOUS INTRODUCTION WITH THE WEST COAST TALL

Name of cultivar	*Time taken for flowering (years)*	*Annual yield of nuts/palm (number)*	*Copra content/nut (g)*	*Annual copra yield/palm (kg)*
EXOTIC				
1. Fiji	4.75	112	199	23
2. Philippine Ordinary	3.92	107	214	23
3. S.S. Green	4.04	108	197	22
4. San Ramon	5.97	60	350	21
INDIGENOUS				
1. Kappadam	6.29	90	284	26
2. Laccadive Ordinary	4.81	141	160	22
3. Laccadive Micro	6.44	205	113	22
4. Andaman Ordinary	4.64	110	166	18
5. West Coast Tall	6.74	72	177	13

'Kappadam' (an indigenous collection) and 'San Ramon' (introduced from Phillippines) have big-sized nuts and hence give the highest copra content per nut whereas 'Laccadive Micro' gives very large number of nuts with a low copra content per nut. Its nuts have the maximum oil content and are well suited for ball copra because of the low quantity of water in the mature nut. When the total quantity of copra obtained from a single palm is compared, 'Laccadive Micro' and 'San Ramon' are on par. In most of the areas market transactions are generally done on the basis of the number of nuts. Under such conditions varieties like 'Laccadive Ordinary' and 'Phillippine Ordinary' with fairly larger number of medium nuts would be preferred.



'San Ramon' — big in size, few in number

Selection—an Essential Practice. It would take a few more years to produce enough planting material of proved introductions. Till then one has to select the best planting material from the locally popular cultivars and thus improve the yield to a certain extent.

From a very long time it is the practice among coconut growers to select the best palm in the garden as mother palms and to use only the selected good seedlings for planting. Generally trees giving more than 80 nuts annually are selected. Recent studies have shown that for the selection of mother palms one should also consider characters like number of inflorescences and spathes, distribution of female flowers on the spike, nut setting and weight of copra. Alternate bearing tendency, buckling of bunches, excessive shedding and susceptibility to pests and diseases will disqualify a tree from selection. Certain palms are capable of transmitting their high yield potential to their progenies irrespective of the male parent. These palms called 'prepotent palms' will be helpful in increasing the yield of plantations.

Coconut is a predominantly cross-pollinated, heterozygous crop. Hence the progenies of the same tree may show considerable variation in growth characters, yield and traits associated with yield. Therefore selection of seedlings becomes as important as mother palm selection. The criteria used for selection are number of leaves, girth at collar, and leaf splitting. From a nursery raised from selected 'West Coast Tall' palms 65 to 70 per cent good seedlings can be detained.

Hybrids—a Boon to Coconut Growers. There is a limit to which yield can be increased through introduction and selection. To break this barrier and combine desirable characters of different varieties, hybridisation is resorted to. In coconut, hybridisation work was started in the forties. The much popular Tall × Dwarf (T×D) hybrid is a combination of 'West Coast Tall' and 'Chowghat Dwarf Orange'. The former is the commonly cultivated variety, whereas the latter is grown only as an ornamental and for tender nuts. 'Chowghat Dwarf Orange' is not grown on an extensive scale due to its uneconomic yield and poor copra characters. But the dwarfs flower within four years whereas the talls take six to seven years for first flowering. The hybrids between these cultivars not only flower in about five years but also give higher number of nuts and copra yield. The reciprocal hybrid Dwarf × Tall (D × T)—where Dwarf is used as the female parent—has also been found to be very promising. The hybrids between 'West Coast Tall' and 'Gangabondam' (a dwarf cultivar sparsely grown in the Godavari delta of Andhra Pradesh) are also popular due to their high yield and earliness. 'Laccadive'×'Gangabondam' is another hybrid which holds out as promising. Four of the most important economic characters, namely, the time taken for first flowering, number of nuts obtained, copra content per nut as well as the copra yield of certain hybrids and their parents are presented in Table 2. Besides the high yield potential. T×D and D×T hybrids have also been found to be tolerant to the root (wilt) disease.

Because of the high yield, early flowering and disease tolerance, the demand for these hybrids has increased

'Laccadive Micro' — large number of nuts

A 'DXT' hybrid — initial years of bearing

considerably during the past few years. It has become impossible to meet this heavy demand by the conventional methods of hybrid production. The seednuts should be produced by the Research Institutes of similar agencies every year as it is not advisable to use nuts collected from the hybrids as seednuts. Isolated elite seed gardens now established by various State Governments and Research Institutes would be the ideal solution to the problem of scarcity of hybrid seednuts. In these gardens the parents are planted in alternate rows and by proper emasculation followed by natural hybridization a larger number of hybrids can be produced at a lower cost.

TABLE 2. PERFORMANCE OF CERTAIN PROMISING HYBRIDS AND THEIR PARENTS

Hybrids/parent	*Time taken for flowering (years)*	*Annual yield/palm (Nos)*	*Copra content per nut (g)*	*Annual copra yield per palm (kg)*	*Oil content (percentage)*
Tall × Dwarf	5.17	102	178	19.0	68
Dwarf × Tall	5.04	120	210	25.0	68
Tall × Gangabondam	5.52	90	193	18.0	69
West Coast Tall	6.74	72	176	13.0	70
Chowghat Dwarf Orange	3.97	74	159	11.0	55
Gangabondam	4.00	73	172	12.5	60

Arecanut

As scope for extension of area under arecanut cultivation is very limited production of cultivars or hybrids capable of producing maximum yield (wt. of nuts) per unit area under garden land conditions, (in which the crop is generally grown) is imperative. Improvements in the cultivated types of areca have been mainly brought through introductions and refinements in selection procedure for mother palms, seednuts and seedlings.

The Central Plantation Crops Research Institute, Regional Station, Vittal (Karnataka) has introduced cultivars of *Areca catechu* and related species from within the country and from Sri Lanka, Philippines, Indonesia, Singapore, Malaysia, Fiji, Solomon Islands, Mauritius, etc., right from 1957. The comparative yield trial of 17 types introduced from other countries in 1961 indicated the high yield potential of 'VTL-3' (China), 'VTL-11' (Indonesia), 'VTL-12' (Saigon), 'VTL-13' (Saigon), and 'VTL-17' (Singapore) (Table 3).

TABLE 3. YIELD OF EXOTIC INTRODUCTIONS — 1961 PLANTING

Name of cultivar	*Yield (ripe nuts) per palm per year (mean for six years)* (kg)
Singapore (VTL-17)	10.9
Indonesia-6 (VTL-11)	10.4
Saigon-1 (VTL-12)	10.0
Saigon-2 (VTL-13)	10.4
China (VTL-3)	9.5
Local (Control)	5.6

'Laccadive' X 'Gangabondam' — a heavy bearer

Among these, 'VTL-3', a semi tall and early bearing type has been released for general cultivation under the name 'Mangala'. It comes to bearing in the third year after planting as against five years taken for the local type. Among 17 indigenous cultivars collected 'Thirthahalli' and 'Mohitnagar' have been provisionally selected based on their performance in the comparative yield trial. Multi-location trials with these have been laid out in 23 centres of the arecanut growing regions of Kerala, Karnataka, and Tamil Nadu.

Selection. Heritability for number of nuts in arecanut is very low (0.20) and hence no improvement could be achieved by a selection giving emphasis to this character. Among various characters analysed, age at first bearing alone was found to have high heritability and correlation with yield. It was established that number of leaves at the time of planting, girth at collar one year after planting and number of nodes two years after planting have high heritability and positive genotypic and phenotypic correlation with yield. The negative correlation between these three characters and age at first bearing shows that exercising selection of seedlings for the above characters will aid in bringing down the age at first bearing in the population. When the seedlings with five leaves and above at the time of planting, 20 cm and above girth at collar one year after planting and four nodes and above two year after planting are selected. Late-bearing plants are totally eliminated.

Besides the mother palm selection and seedling selection standards mentioned above, a modified mass pedigree selection was initiated in arecanut with the primary objective of attaining increased yield. The seednuts from the finally selected palms will be bulked and distributed.

Hybridization in arecanut has been taken up with the objective of combining high yield, regular bearing, large fruit size, short stature, early bearing, better quality and resistance to mites.

Cacao

Though cacao was introduced into India as early as in 1973, we at present import cocoa raw material to the tune of 769 tonnes valued at Rs 33 lakhs. With the increasing demand for cocoa powder, chocolate and confectionary there is added consumption potential. As the scope of the import of cacao beans has been restricted, more reliance will have to be placed on the indigenous material.

There are two varieties of cacao—'Criollo' and 'Forestero'. Though 'Criollos' were planted on a large scale in the earlier years, it was later realised that 'Forestero' would perform better under the Indian conditions. The cacao breeding activities were mainly confined to the assemblage of material from different sources. The Central Plantation Crops Research Institute has assembled more than 150 types and hybrids from West Indies, Malaysia and Nigeria. Among the hybrids those involving I 195, ICS 60, snd ICS 45 have been found to be promising.

Pepper 'Panniyur 1'

The major objectives of cacao breeding are to develop varieties which bear early but have an effective economic life span, and possess resistance to drought, diseases, pests and wind damage.

Pepper

India is a major pepper producing and exporting country. The export earning during 1974-75 was 34.4 million rupees. But unfortunately adequate attention was not given to develop proper agro-techniques of the crops. Pepper cultivation in India is mostly confined to Kerala, Karnataka and parts of Tamil Nadu. More than 70 varieties are under cultivation. Kalluvalli, Balankotta, Karinkotta, Cheriakodi, Uthirankotta, Cheriakaniakadan, Karimunda, Narayakodi, Kottanadan, and Perumkodi are some of the varieties commonly cultivated in the Kerala region. In Karnataka, Balemalligessara, Doddigya, Uddakare, Motakare, Kodathurakare and Mortiga are the popular varieties.

A hybrid, 'Panniyur-1' was evolved at the Pepper Research Station, Panniyur, Kerala . Its parents are 'Uthirankotta', a north Kerala variety (female) and 'Cheriakaniakadan' a popular south Kerala variety. It combines all the desirable qualities of the two parents, and can give 3-4 times the yield of other varieties (Table 4). It also begins to yield from the second year of planting and possesses a wide adaptability.

TABLE 4. PERFORMANCE OF 'PANNIYUR-I' HYBRID PEPPER

Characteristics	*Panniyur-I*	*Kalluvally (local popular variety)*
Mean yield for the past five years	7.331 kg (green)	1.751 kg (green)
Mean length of the spike	16.2 cm	10.8 cm
Mean number of berries per spike	98	65
Percentag of bi-sexual flowers	87.7	53.4
Weight of 100 green berries	16.8 g	12.4 g
Volume of 100 green berrie	17.0 cc	12.0 cc
Percentage of dryage	32.8	31.4

Since the monoculture of coconut and arecanut may not give sufficient income to the small farmer, crop diversification programmes have attained importance. Several crop combinations have been found to be successful and therefore the breeders have now to evolve varieties suitable for such high intensity cropping programmes any of the combinations that the cultivator chooses for his garden.

A medium-yielding pepper variety which flowers and yields under low light intensities would be preferable to a high-yielding variety which fails in shade. On other side varieties or hybrids of the main crops (coconut and arecanut) which have less canopy and thus permit more light penetration to the ground will have to be made available.