

COCONUT HYBRIDS

K. SATYABALAN

Central Plantation Crops Research Institute, Kasaragod, Kerala

IN most of the coconut growing countries of the world, coconut research in general and coconut breeding in particular is in its infancy. This versatile palm did not receive the attention it deserved either at the hands of the Government or the scientist till the beginning of this century. Unlike in annual crops, coconut breeding is beset with problems and difficulties. The perennial nature of the palm, its height, the long interval between generations, absence of genetical purity in the breeding material, the apparent impossibility of clonal propagation, the long period of experimentation necessary to obtain results and the large area required for well laid out trials were probably factors responsible for this neglect. Thanks to the initiative and encouragement given by the then Government of Madras, the Indian Council of Agricultural Research, the erstwhile Indian Central Coconut Committee and the keen interest of the pioneering research workers, India was perhaps the only country in the world to initiate systematic research on the improvement of coconut by selection and breeding during the early twenties.

The Two Varieties. There are only two distinct varieties of coconut, Tall and Dwarf. Tall is the economic variety extensively cultivated in all coconut producing countries for its copra, oil and fibre but it is late bearing taking 6 to 7 years for initial flowering under favourable conditions. Dwarf is usually planted for tender nuts and ornamental purposes as the copra obtained from the nuts is leathery and is not commercially important. But it bears in about four years. The Dwarf variety has three distinct forms namely those producing green, orange and yellow nuts. The tall variety is highly cross pollinated in nature resulting in highly heterozygous palms; the Dwarf is predominantly self-pollinated and is believed to be reasonably homozygous.

Tall × Dwarf Hybrids

Since the desirable characters such as high yield, early bearing and better quality nuts are found to be distributed in the different varieties, attempts were made in the early 30's of this century to combine them in a hybrid by a series of intra-and inter-varietal crosses. Dr J.S. Patel who studied the hybrids was the first to report on the manifestation of hybrid vigour in coconut in 1937,

According to him, maximum vigour was obtained in the crosses between the local Tall variety as female parent and Dwarf variety was male parent. The hybrids germinated early and were vigorous in growth characterised by increased height, collar girth and more number of leaves as compared to the progenies of the female parent. Later workers confirmed the findings of Dr Patel and reported on the performance of these hybrids as adult palms. The favourable points noticed in the hybrids are earliness of bearing, high yield, earlier approach to full bearing stage and less liability for yield fluctuations. Analysis of growth habit and other characters has also indicated that the longevity of the hybrids could be expected to be of the Tall parental type. In a perennial crop like the coconut any improvement effected is likely to be of considerable advantage because of the longevity of the crop. Later studies on the per-



West Coast Tall



Dwarf Orange

formance of Tall $\times$ Dwarf hybrids produced utilising the two common dwarf forms orange and green as male parents have indicated dwarf orange to be a better male parent for the production of such promising hybrids (Table 1).

TABLE 1. PERFORMANCE OF WEST COAST TALL $\times$ DWARF HYBRIDS PLANTED IN 1956

Hybrids	Mean yield of nuts (g) (1970-74)	Mean copra content/ nut (kg)	Total copra out- turn (kg)
1. West Coast Tall $\times$ Dwarf Orange	140	197	28
2. West Coast Tall $\times$ Dwarf Green	142	135	19
3. West Coast Tall (Progenies of selected mother palms for comparison)	96	176	17

Need for Selected Parental Combinations. Further studies on the Tall $\times$ Dwarf green and Tall $\times$ Dwarf Orange hybrids obtained from the same parents of the Tall variety have shown that Tall $\times$ Dwarf Orange hybrids are superior to Tall $\times$ Dwarf Green hybrids. Nut and copra characters of the hybrids of the Tall variety with Dwarf Orange as pollen parent are found to be superior to those obtained using Dwarf green as pollen parent. The nuts obtained from hybrids raised with Dwarf orange as pollen parent are large sized with

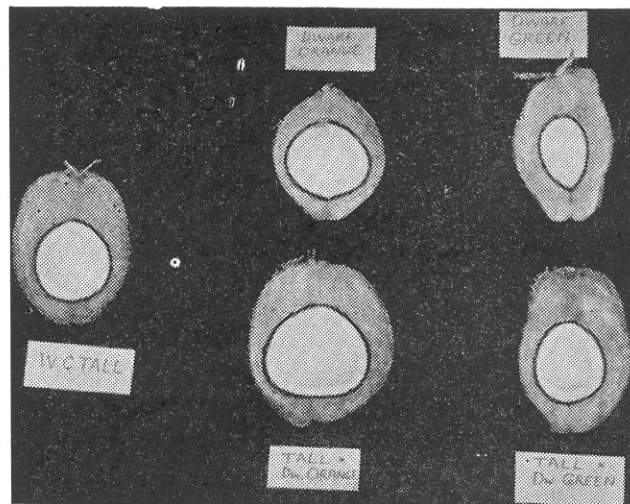
less fibre content and more of copra. The need for selection of male parents even in Dwarf Orange is obvious on the basis of economic characters as the combinations of certain Dwarf orange palms have given a better performance (Table 2).

TABLE 2. NUT AND COPRA CHARACTERS OF CERTAIN COMBINATIONS OF T $\times$ D

Combinations	Mean weight of husked nut (g)	Mean copra content/nut (g)	Percentage increase or decrease in copra con- tent over that of female parent
<i>Tall/female $\times$ Dwarf Orange Male</i>			
I/76 $\times$ IXE/56	514	171	+24
VIII/23 $\times$ XI/71	745	232	+41
VIII/23 $\times$ IXE/56	587	187	+13
<i>Tall female $\times$ Dwarf green male</i>			
I/76 $\times$ IXE/34	482	154	+12
I/76 $\times$ IXE/23	306	113	-18
VIII/23 $\times$ IXE/23	389	136	-17

Note: The numbers indicate the parents used in the combinations

Hybrid Vigour. Manifestation of hybrid vigour was studied in the nut and copra characters of hybrids of three combinations, West Coast Tall $\times$ Dwarf Green, West Coast Tall $\times$ Dwarf Orange and West Coast Tall $\times$ Gangabondam (Gangabondam is a green dwarf grown mainly for tender coconuts in Andhra Pradesh). Hybrid vigour does not manifest in the height of fruit (unhusked nut) in any of these. Only two hybrids, West Coast Tall $\times$ Dwarf Orange and West Coast Tall $\times$ Gangabondam showed hybrid vigour in the weight of husked nut, nut water and kernel content as compared



Nuts of parents and hybrids split open to show the internal character

with those of the female parent, West Coast Tall. The studies indicate Dwarf Orange and Gangabondam as desirable male parents.

Dwarf Female $\times$ Tall Male Hybrid

The cross Dwarf female $\times$ Tall male was not taken up for studies seriously during the earlier years as the number of dwarf palms available was only a few. A few experimental hybrids produced utilising the few dwarf green palms available in the locality planted at Nileshtar have not performed well. But the excellent performance of some natural hybrids of Dwarf Orange palms planted at the Central Plantation Crops Research Institute, Kasaragod, Kerala, during the early 40's indicated their superiority to Tall $\times$ Dwarf hybrids in yield of nuts and copra outturn. This has given the clue for the production of a large number of Dwarf Orange $\times$ Tall hybrids for establishing isolated seed gardens. The performance of natural hybrids from Dwarf Orange and of artificially produced hybrids with known male parents has indicated the need for selection of palms in both the varieties. The study has shown that better mean progeny performance could be obtained by using high grade male parents (Table 3).

TABLE 3. PERFORMANCE OF DWARF $\times$ TALL HYBRIDS

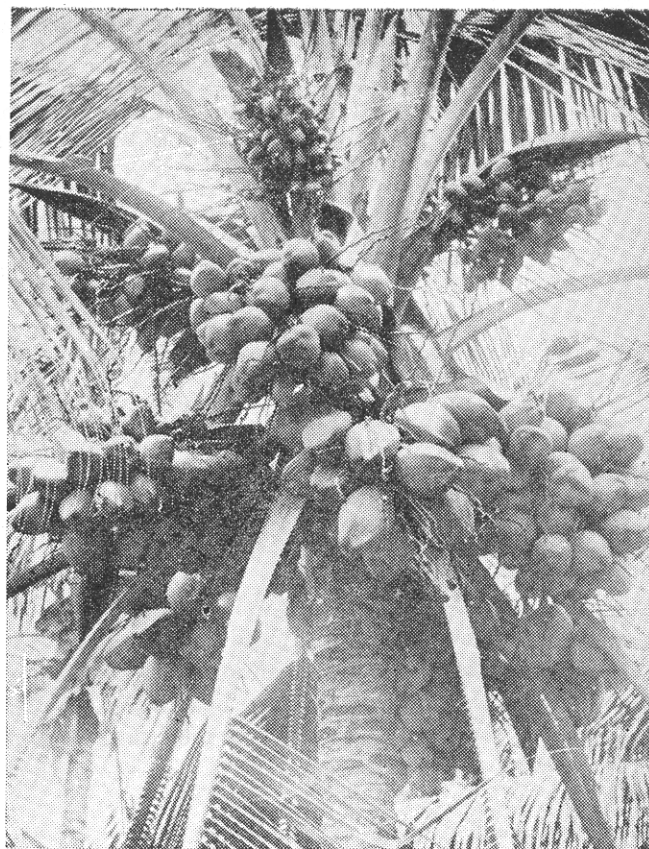
	Mean yield of nuts	Mean co- pra content per nut (g)	Total co- pra outturn (kg)
1. Dwarf Orange $\times$ Tall hybrids of different known parental combinations	107	187	20
2. Dwarf Orange $\times$ Tall hybrids obtained from open pollina- ted nuts of dwarf orange palms	104	164	17

Identification of Dwarf $\times$ Hybrids in the Nursery

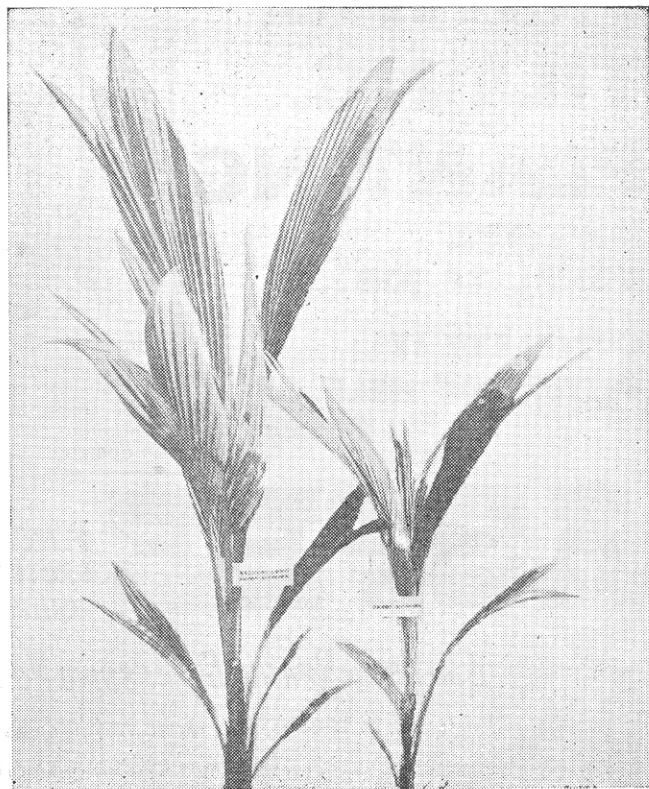
From the seedlings of Dwarf Orange nuts sown in the nursery it is possible to identify the natural hybrids easily. The hybrid seedlings are vigorous in growth as indicated by good height, collar girth and leaf production as compared to the typical dwarf seedlings. They have the reddish petiole (basal portion of the leaf) as compared to typical orange petiole of dwarf orange seedlings. A small percentage of hybrids is obtained from the nuts of Dwarf Orange. So it is possible for a cultivator to easily identify such hybrids and to use them.

Isolated Seed Gardens

Besides the hybrids Tall $\times$ Dwarf and Dwarf $\times$ Tall, the hybrids Tall $\times$ Gangabondam and Laccadive Ordinary (from the Lakshadweep Islands) $\times$ Gangabondam have also performed well at the CPCRI and the



Dwarf $\times$ Tall



Natural hybrid (left) Dwarf seedling (right)

TABLE 4. PERFORMANCE OF PROMISING HYBRIDS PLANTED AT CPCRI, KASARAGOD AND CCRS, NILESHWAR

Combinations	Time taken for flowering (in years)	Mean yield of nuts	Mean copra content/ nut (g)	Total copra outturn (kg)
1. West Coast Tall x Dwarf Orange	5.17	93	179	17
2. Dwarf Orange x West Coast Tall	5.04	107	187	20
3. West Coast Tall x Gangabondam Ordinary	5.52	90	161	15
4. Laccadive x Gangabondam (CCRS, Nileshwar)	..	111	182	20

The performance of these hybrids of a perennial crop like coconut has caught the attention of the cultivators and in its wake the demand for the hybrid seedlings has considerably increased. To meet the increasing demand

for the hybrids, isolated elite seed gardens have been set up in the Kidu Campus of the CPCRI and Aralam Central State Farm of the State Farms Corporation of India Ltd. In Kidu seed garden modern techniques for hybrid seed production are employed for hybrid seed production. Tall and Dwarf parents from selected palms are planted in alternate rows and Dwarf is emasculated to prevent selfing. The nuts obtained from the Dwarf parent will thus be hybrids. Another method in hybrid production will also be followed in this seed garden. Different dwarfs alone will be planted in large blocks and pollen collected from the required tall parent will be artificially dusted to produce the hybrids. In this garden two hybrids involving four parents West Coast Tall, Laccadive Ordinary, Dwarf Orange and Gangabondam have been attempted on an extensive scale. It is expected that this seed garden will substantially help in meeting the demand for hybrid seedlings which will eventually lead to increase in the overall production of coconut.

Coconut seed gardens are also being established in the States of Kerala, Karnataka and Tamil Nadu with the technical collaboration of the CPCRI.

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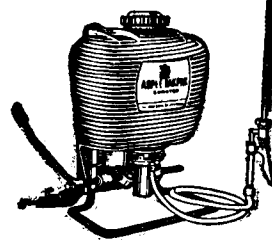
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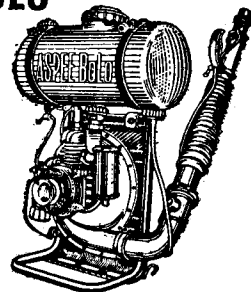
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