LARGE SCALE PRODUCTION OF SUPERIOR COCONUT PLANTING MATERIAL

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Subsequent to the report of hybrid vigour in the cross between West Coast Tall and Dwarf Green by J.S. Patel in 1937, crosses involving a number of varieties have been effected both in India and elsewhere with varying success. The superiority of Tall x Dwarf hybrids has subsequently been confirmed by many workers as listed by Satyabalan, Ratnam and Kunjan (1970). From India superiority of other hybrids involving tall parents such as Laccadive Ordinary, Andaman Ordinary, Laccadive small, Cochin china and West Coast Tall and Dwarf cultivar like Gangabondam has also been reported (Kannan and Bhaskaran, 1972). Superior performance of hybrids between dwarf and tall hybrids both from Indonesia (Tammes, 1955) and India (Nampoothiri and Pillai, 1972) have also been recorded. Fremond and Lamothe (1971) have reported that under conditions prevailing in Ivory coast Malayan Dwarf x West African Tall is much superior to the local West African Tall. In spite of these reports, no attempts have been made to produce these hybrids on a commercial scale in India till recently (Marar, 1969). However, realising the importance of coconut hybrids in enhancing the yield per unit area, various Government agencies had initiated production of these hybrids since 1947. The programme which still continues involves selection of West Coast Tall (T) female parents and pollinating them with pollen of Dwarf Orange (D) employing manual labour. The man power and time involved in climbing every mother palm, bagging the inflorescence, effecting pollination, after care involved and the limited availability of mother palms are some of the factors that limit the large scale production of the hybrids in the present programme. This is also evident from the fact that using a labour force of about 25 climbers per day spread over a period of five months, the T x D seedlings produced per annum is about 30,000. In a country which has 10,78,000 ha under coconut no impact can be expected on the production of coconut from these limited number of hybrid seedlings. Large scale produc of hybrid seeds adopting modern techniques is thus imperative.

Though hybrid seed gardens for coconut have been reported from various countries, a number of important technical considerations involved in the production and utilisation of the hybrids do not seem to have been taken into account so far. These aspects have been dealt in this paper while discussing the hybrid seed production programme initiated in India by the Central Plantation Crops Research Institute, Kasaragod.

OBSERVATIONS

For an efficient exploitation of the F_1 hybrid it is necessary that there should be a high uniformity in the hybrid vigour expression by the individuals consisting the population. Ninan and Satyabalan (1963) pointed out that the dwarfs are not as homozygous as they were thought to be. Iruvappa, Sukumaran and Mathew (1972) while confirming this view have brought forward evidences from the study of F_1 progenies of West Coast Tall x Dwarf Green that talls are also heterozygous and the F_1 population will segregate depending upon the extent of heterozygosity of their tall and dwarf parents. Studies undertaken at C.P.C.R.I., Kasaragod since 1965 have given further evidences in this regard. Dwarf Orange under different systems of mating has given varying proportions of hybrids and dwarfs as judged from the colour of the seedlings in the nursery. The data are given in table 1.

Table 1

Percentage of hybrid seedlings obtained from Chowghat Dwarf Orange under different systems of mating

Year	No. of palms studied	Emasculated and left for open pollination	Pollinated with Tall	Selfed	Open pollinated without emasculation
1965	5	40 (79%)	29 (83%)	3 (11%)	5 (21%)
1969	5	49 (69%)	15 (65%)	3 (7%)	10 (52%)
1969	8	51 (77%)	38 (81%)	6 (12%)	7 (36%)
1969	16	151 (72%)	70 (62%)	4 (5%)	21 (35%)
Overall mean		73%	70%	8%	33%

It will be seen from the table that the mean percentage of hybrids obtained under emasculation and controlled pollinations are 73 and 70 respectively. The same palms under selfing gave 0% hybrids while under open pollination the percentage increased to 33. It, therefore, appears that the maximum percentage of hybrid seedlings that can be realised in a D x T production programme involving Dwarf orange x West Coast tall is about 70% if all the seedlings now classified as hybrids based on colour alone are true hybrids. Depending upon the genetic status of the parents this percentage can be expected to vary. Trials are under way to determine useful characters which can be considered simultaneously with colour change in identifying the hybrids.

Evaluation of different inter-varietal crosses and their parents has shown that certain hybrids are far superior to their parents. The results are given in Table 2.

Table 2

Performance of certain promising hybrids and their parents

Hybrid/ Parent	Time taken for flowering (in years)		Annual yield of nuts per palm		Weight of copra per nut (in grams)		Copra yield per palm (in kg)	
	Mean	C.V.%	Mean	C.V.%	Mean	C.V.%	Mean	C.V.%
Tall x Dwarf orange	5.17	23.98	101.8	26.13	177.86	18.29	18.76	36.67
Dwarf orange x Tall (W.C.D.)	5.04	30.44	130.2	18.81	209.76	6.88	26.98	16.01
Laccadive ordinary x Cangabondam	-	-	109.0	-	171.00	-	18.63	-
West Coast Tall	6.74	23.11	71.9	28.71	176.6	15.57	12.69	27.04
*Laccadive ordinary	-	-	78.0	-	180.5	-	14.07	-
Dwarf orange	3.97	10.76	74.2	9.10	158.60	7.03	10.72	9.71
Cangabondam	4.00	35.35	73.0	12.59	181.85	0.58	13.27	12.96

*Kuman and Bhaskaran (1972)

From the table it can be seen that Dwarf orange x Tall hybrid is superior to the locally cultivated West Coast tall (Fig. 1). It will also be seen that Laccadive ordinary, one of the varieties, is also superior to West Coast tall. Hybrid involving this parent and Gangabondam (a dwarf variety from Andhra Pradesh) has recorded 59.8% more yield than the local West Coast tall in a trial conducted at the C.C.R.S., Nileshwar (Kannan and Bhaskaran, 1972). Field tolerance of Dwarf orange x Tall and their reciprocal hybrid to the root (wilt) disease of coconut has also been reported (Rawther and Pillai, 1972).

In view of the proved superiority of the Dwarf orange x Tall and Laccadive ordinary x Gangabondam crosses, the hybrid seed garden has been planned to produce only these two hybrids. In the tall parents (West Coast tall and Laccadive ordinary), palms giving 30 per cent or more yield than the garden mean were selected as mother palms and their seedlings were raised. The selected dwarfs are selfed and typical dwarf seedlings are selected from the nursery. The talls (West Coast tall and Laccadive ordinary) were planted in two separate blocks of about 50 ha each in rows aligned in north-south direction. The two dwarfs (Chowghat dwarf orange and Gangabondam) were similarly planted in adjoining rows six meters away from the concerned talls. The spacing within the row (both for tall and dwarf) was five meters. The dwarfs were staggered such that they are in the centre of the talls. Spacing between the double hedge is nine meters (Figs. 2 and 3).

The seedlings of the four parents were screened for all characters showing high heritability and correlation with yield. The unselected plants of the tall parent will be emasculated to prevent their participation in the natural crossing. All the dwarfs will be emasculated to permit pollination only with tall parent. Seednuts will be gathered from the dwarf plants for dwarf x tall and from selected talls for tall x tall. Obviously Tall x Dwarf and Laccadive x Gangabondam hybrids can also be produced from this garden by designing the emasculation programme accordingly. Approximately half million nuts each in hybrids and the tall cultivars will be available from the garden annually when the palms come to full bearing. A breeding programme to effect improvement of the planting material in two stages involving the above principles is given in Fig.4.

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DISCUSSION

Improvement of coconut through conventional breeding procedures is time consuming. It will, therefore, be advantageous to pool different methods and adopt them simultaneously for obtaining quick genetic advancement. This has also been realised by coconut workers elsewhere and coconut improvement blocks with multipronged approaches have already been established (Fremond and Lamothe, 1971). The advantage of selecting high yielding mother palms has been confirmed from the results of Liyanage (1967). It has also been shown that the general combining ability of the higher yield groups is considerable for yield and some of the yield attributes (Nambiar and Nambiar, 1970). In the present seed production programme methods adopted for improving the genetic base of the parents (by screening individual palms for characters of high heritability and correlation with yield) and reducing heterozygosity (by selfing so as to realise both uniformity and higher heteriotic effect in the F_1 population) should prove useful. However, until homozygous parental lines are developed selection of the F_1 plants at the seedling stage will have to be continued. Colour markers wherever available and additional biochemical and physiological markers will have to be identified for the correct selection of hybrids. Work on this aspect in progress at this Institute can be expected to give useful results (CPCRI, 1971).

It is now well known that total replacement of any adapted variety with a new hybrid or a selection can bring about pest and disease hazards. This will be all the more relevant in the case of a perennial crop like coconut where any devastation will have far reaching effects on the economy. It is therefore necessary that the replacement of the existing local variety is taken up with more than one hybrid or variety. In the present seed production programme the ratio of tall and dwarf parents has been maintained at 1:1, so that production of seednuts from the tall parents and hybrids will be almost in equal proportion. Seeds from the two parents and the two hybrids will enable to maintain a superior and diverse genetic base at the field level. The double hedge primarily accommodates larger number of palms per unit area thus enabling production of larger number of seednuts. It may also help to have a better artificial

in pollination between tall and dwarf parents by virtue of their proximity.

Screening of the palms for characters having high correlation with yield, high heritability, etc. will eliminate genotypically poor plants both in the dwarf and tall parents. If the poor performance of plants is due to inbreeding effect (Haldane, 1958) the resulting hybrids involving two poor parents are likely to show very high heterotic vigour. Elimination of poor plants under such a situation will not be advantageous. This aspect is being looked into.

In addition to the proper selection of mother palms, screening the progenies at different stages of growth for characters of high heritability correlation, etc. and emasculating the undesirable palms when they come to flowering so as to prevent their participation in the pollination will improve the yield potential of the nuts obtained from the tall parents.

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COCONUT RESEARCH IN NIGERIA

A BRIEF NOTE ON DEPUTATION OF DR. K.U.K.NAMPOOTHIRI TO NIGERIA

During the 5½ years of my stay in Nigeria (Nov. 1975 to March'81), a coconut substation was established at Badagry, Lagos State. Major breeding and agronomy trials like germplasm collection, progeny testing, hybrid evaluation, commercial hybrid seed production through seed gardens, manurial and irrigation trials, nursery studies and intercropping experiments were initiated. Research projects in other disciplines are being taken up at the main Institute till necessary infrastructure is developed at the new substation.

A comprehensive prospection of coconut cultivars in five states indicated that though coconut is not indigenous to Nigeria, considerable variation has accrued since its introduction into the country. The bulk of the coconut population consists of talls, while only a few yellow dwarfs and green dwarfs are grown for ornamental purposes. Green dwarfs were the earliest to flower but had the poorest nut composition. Very good Nigerian tall palms yielding upto 177 nuts per year as well as those giving 350g of copra/nut could be located, indicating the scope for individual palm selection within the present day Nigerian coconut population. Progeny testing of palms from various locations is underway. The gene pool under NIFOR consists of 28 exotic and 42 indigenous cultivars.

The coconut hybrids (Nigerian Tall x Nigerian Dwarf Green) flowered in 66 months on an average compared to 95 months needed for talls to flower. The nut yields in certain hybrid palms were as high as 121 nuts in the eighth year. Hybrids involving Malayan Yellow Dwarf, Malayan Red Dwarf, Nigerian Green Dwarf and Nigerian Tall have been planted for evaluation.

Detailed floral biology of six exotic and four indigenous cultivars was studies. The percentage of crossing in Nigerian talls was more than in those from India and Sri Lanka. Selfing intensity was very high (above 80%) in dwarf palms. Information on male and female phases and nut-set was also gathered. The Nigerian and Malayan dwarfs were characterized by bigger pollen, longer pollen tube, low pollen sterility and higher nut set compared to Nigerian tall. Pollen germination in the T x D hybrid was fairly high (69.5%).

A 30 ha. seed garden, for the production of T x D and D x T hybrids was expected to commence production by 1985. Considering the high demand for ornamental types, seed blocks of Malayan Yellow Dwarf, Malayan Green Dwarf, Nigerian Green Dwarf and Cameroon Green Dwarf were also established. There is an encouraging awareness of the prospects of coconut cultivation among the Nigerian farmers and NIFOR has responded by increasing its research activity on the crop in various disciplines.

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BIOLOGICAL CONTROL ACTIVITIES OF RHINOCEROS BEETLE

PHILIPPINES:-

In line with the implementation of the National Coconut Productivity Program (NCPP), the green muscardine fungus (GMF) *(Metarhizium anisopliae)* a biological control agent against the rhinoceros beetle, is currently being mass produced by the Crop Protection Division of the Davao Research Centre.

Evaluation of the different substrates to grow the fungus is also being done. Some of the substrates being tested are corn kernels, cassava, corn stalk soaked in coconut water, corn cobs soaked in coconut water, and napier grass stalk. *(PCA-CETC Newsletter Vol. iv, No. 1).*