COCONUT GERMPLASM AND ITS UTILIZATION IN COCONUT IMPROVEMENT

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Introduction

Coconut (Cocos mucifera L.) is one of the most useful plams in the world. Harries (1979) called the coconut "the milk bottle on the doorstep of mankind". India with 1.2 million hectares under this crop with an annual production of 6887 million nuts ranks third in the world in both area and production after Philippines and Indonesia. The original home of the coconut is still unknown. Two distinct regions, South Pacific and South America are often cited as possible centres of origin (Purseglove, 1972, Child 1974).

Coconut breeding in India is over 70 years old and several approaches which have been suggested (Haldane, 1958, Abraham and Ninan, 198, Bavappa and Nampoothiri, 1974) are in progress. As it stands the gap between the best farmers yield average (111 nuts/palm/year) and the maximum obtained in a research farm (174 nuts/plam/year) is wide enough and needs immediate steps to bridge it (Swaminathan, 1976). It is apparent that even with this level of production we are not fully exploiting the biological potential of this palm since individual palms capable of yielding over 400 nuts/year have been located even in disease affected tracts under rainfed conditions, which clearly calls for a more systematic approach in coconut improvement (Iyer, Rao & Govindankutty, 1979).

Variability:

A complete assemblage of the available variability (germplasm) is a pre-requisite for initiating a planned breeding programme in any crop. In coconut, the natural population consists of two morphological forms 'Tall' and 'Dwarf' with the former comprising about 98-99% of the populations. The talls are generally identified/named after the location of cultivation and the dwarf by the colour of the fruit. The talls are predominantly cross pollinated and hence exhibit high degree of variability in almost all characters, where as in dwarfs the variability is much less except in production of bunches, nuts and copra.

Germplasm

At present, CPCRI, Kasaragod is maintaining 62 exotic and 35 indigenous collections. The exotic collections from 22 countries comprise 52 tall, eight dwarf one semi tall and one hybrid. The indigenous collections comprises 26 tall, eight dwarf and one semi-tall types. Apart from this, recently 24 accessions (20 tall and four dwarfs) were collected from Six Pacific Ocean countries and the same have been planted at the World Coconut Germplasm Centre in Andamans. Performance of some of the promising exotic and indigenous cultivars are listed in Table-I.

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Table I: Performance of promising coconut cultivars at CPCRI, Kasaragod.

Cultivar	Bearing age	Mean nuts/ year/palm (17-20 years) No.	% over WCT	Copra nuts/ palm/year (gm)	Kg.	Oil content (%)
Exotic						
1. Fiji Tall	6	106	30.86	199.1	21.1	65.2
2. Fiji Lontonwan	8	104	22.12	210.5	22.0	66.0
3. Philippines Ordinary	5	108	33.13	196.1	21.1	66.0
4. Philippines Laguna	6	88	8.64	258.9	22.8	66.5
5. S.S.Green	6	108	33.33	186.1	20.1	67.0
6. Samoamon	6	64	..	349.6	22.4	68.0
Indigenous:						
1. Kappadam	6	90	11.11	283.5	25.5	67.00
2. Andaman Ordinary	5	94	16.05	160.2	15.2	66.00
3. Laccadive Ordinary	6	98	20.99	176.3	17.3	72.0
4. West Coast Tall	7	81	..	176.0	14.2	68.0

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Selection of mother palm and identification prepotent palms:

It has been estimated that by proper mother palm selection, the progeny could be expected to give 15 per cent more yield than the population from which the parent palm were selected. It has also been estimated that the yield improvement will be of the order 45 per cent if seed nuts are produced through controlled hand pollination between the selected mother palms (Charles, 1961).

A good mother palm is defined as the one which yields over 80 nuts/year with 12 more bunches on the crown in different stage indicating regularity in bearing, spherical or semi-spherical crown with 30 or more leaves, and over 180 g of copra/nut (or 350 g of kernel). Some of the seedling characters such as time taking for germination, number of leaves and girth at collar have significant correlation with the adult palm yield (Liyanage, 1955, Nampoothiri, Satyabalan and Jacob Mathew, 1975). Most appropriate method will be to select only such mother palms which can give uniform seedlings with high mean value for the above characters.

The concept of prepotency used by Animal breeders for selection of pedigree bulls (Lush-1949) can be usefully extended to coconut where each tree represents a gene complex. A prepotent palm would be one where the gene combinations tend to cohere and do not recombine, thus resulting in the 'enblock' transmission of parental characters to the progeny even under random mating leading to some sort of functional homozygosity (Clausen and Hiesey, 1958, Muntsing, 1963). It can also be defined as the ability of the female parent irrespective of the male parent to transmit the high yielding capacity to the progenies. It has now become possible to identify prepotent mother palms rapidly based on progeny performance for use in breeding.

Exploitation of hybrid vigour:

A new dimension coconut improvement was added with the discovery by Patel (1937) of that hybrids made between Tall female and Dwarf male (West Coast Tall x Chowghat Green Dwarf) showed greater vigour, higher production potential and early bearing character. Subsequent researches have confirmed the heterotic effects to the 'inter-varietal' and intra-varietal' crosses and differential heterotic effects were noticed when different dwarf male parents were used. (Satyabalan et al, 1969 and 1970). This result clearly indicated the need for the selection of individual palms with in a cultivar in both Tall and Dwarf parents.

The report of Rao and Koyamu (1955) that the 'Offtype' seedlings in Dwarf nurseries gave regular, early bearing and high yield, lead to the initiation of researches in D x T hybrids. Satyabalan (1956) reported these 'Offtypes' as the Natural Crosses of Dwarf (NCD) and they showed early and prolific bearing habit. These progenies were superior to both

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Tall and T x D hybrids in bunch production, yield of nuts as well as copra outturn. These types (NCD) were later found to be similar to the experimentally produced Dwarf x Tall hybrids. The performance of some of the hybrids and their parents at Kasaragod under rainfed and good management is given in Table 2.

Table 2: Comparative performance of coconut hybrids and parents at CPCRI, Kasaragod.

Cross parents	No.of palms	Mean yield of nuts/palm/ year (19 - 22 years)	% over WCT	Copra Nut/ Palm/year. (gm)	(Kg.)	% over WCT
COD x WCT (Chandra Sankara)	12	113	39.5	215	24.2	70.42
WCT x COD	10	98	21.3	198	24.7	73.94
LO x GB (Laksha Ganga)	20	148	82.8	195	28.8	102.8
LO x COD (Chandra Laksha)	21	102	26.4	195	19.9	40.1
LO	11	116	43.3	172	19.9	40.1
WCT	12	81	..	176	14.2	..
COD	13	58	..	152	8.8	..
GB*	8	30	..	164	4.9	..

* Planted in 1972.

One of the attractive features of D X T hybrid was (in addition to its higher yield potential) the case in selection of hybrid seedlings in nursery. The seedlings showing increased vigour comparable to the talls can be selected as hybrids. In addition to vigour the change in ~~selected as hybrids~~. petiole colour (other than orange/yellow) is an important criteria for selection. Commercial production of X D x T hybrids is much earlier than the production of T x D.

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In seedling progenies of D x T combinations, recovery of heterotic seedlings ranged from 20% to nearly 100% in different dwarf used as female, probably due to differential combining ability of the dwarfs. Since the degree of homozygosity varies as much in dwarfs as in the prepotent talls it is possible that by judiceous chace of good combining dwarfs and prepotent talls one can ensure a reasonable high recovery (about 80%) of heterotic hybrid seedlings. This is of vital importance in planning an elite seed garden for mass production of hybrids.

Pollination.

For the production of superior hybrids efficient pollination technique is a pre-requisite. In coconut breeding this involves (i) emasculation (removal of all the male flowers before the anthesis) (ii) pollen processing (collection of male flowers on 7-8 days after opening of the spathe: drying of crushed male flowers at 40°C for 24 hrs/drying in fluidbed drier for 4 hrs.) and (iii) pollination (dusting of pollen on the receptive stigma and bagging). In a garden where the Tall and Dwarf cultivars are interplanted bagging is not necessary. Care should be taken to emasculate the poor/unwanted tall parents.

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