

# INHERITANCE OF NUT PRODUCTION IN COCONUT

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THE outbreeding nature of the coconut palm is expected to maintain genetic heterogeneity within each population provided the base population has sufficient genetic variability. The effectiveness of selection in such a population is dependent on the precision of the estimates of the components of genetic analysis. The available information in this crop on the identification of superior genotypes (Charles, 1961; Liyanage, 1967) shows some inconsistencies in the parent-progeny relationships for different characters and the limited utility of seedling selection for genetic improvement. Liyanage (1967) has stated that leaf production during the first 40 months of growth may be related with the breeding value for yield of the palm. Harland (1957) has felt that the low transmission of yield of the mother palms to their progenies can be due to several causes. Among the four causes listed by him, the nature of genetic variation is of significance. Since a majority of the reports are based on yield records over a short period, which is subject to considerable fluctuation within and between years (Sampson, 1923 and Patel, 1938), estimates of heritability for characters with major influence on productivity appear to be relevant. This will help in the intensification of selection effort on such traits and for selection for stability of performance of these attributes. Among the methods of estimating heritability parent-offspring regression analysis is simple and provides reliable estimates. Therefore, such an analysis of parent-progeny regression is undertaken for ten characters involving the number of bunches and spikes, production and distribution of female flowers and degree of set in a population of West Coast Tall (the common variety in Kerala) which has reached an age of consistent bearing.

## MATERIALS AND METHODS

The material consisted of 109 palms of West Coast Tall derived from twelve parents. The data were recorded on parents and progenies for one year from June, 1968 to May, 1969. The progenies from open-pollination and self-pollination were analysed separately for estimating heritability and a pooled estimate was also obtained for each of the ten characters. The parent-progeny regression was done on the standardized normal scale which would obviate to

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some extent the difficulties due to differences between the variances of parents and progenies.

These 109 palms were planted in the year 1926, 26 feet apart in the laterite soils of the Coconut Research Station, Pilicode. All these plants received uniform cultural and manurial treatment. Each of these plants received 0.34 kg. of N, 0.23 kg. of  $P_2O_5$ , and 0.68 kg. of  $K_2O$  per year in the form of ammonium sulphate, super phosphate and muriate of potash. The parents and progenies are in the age group of 60 years and 40 years respectively.

### RESULTS

The results of analysis show considerable genetic variation in the material examined. The data have revealed substantial differences in the heritability for the ten characters examined (Table 1). Since each of these characters are expected to influence yield, the nature of association between them could be responsible for the low heritability of yield and inconsistency in the results of progeny testing. The estimates from the open-pollinated populations differed from those from the selfed progenies. Such differences may be related to the magnitude of genetic variations available in the pollen for open pollination. This could, in turn, depend on the nature of divergence within a population and the relative production of pollen by the different genotypes at any given time. Therefore, the present results are applicable only to the population now under examination.

TABLE 1

*Means and heritability estimates based on parent-progeny regression in coconuts for some yield components*

	Open pollinated	Self pollinated.	Combined	Char-acter
No. Families	6	12		
No. Plants	16	93		
Parent	11.8	11.3	11.3	
Progeny	11.6	10.6	11.1	1
$h^2$	0.222	0.039	0.085	
Parent	266.7	204.4	204.4	
Progeny	241.1	267.8	262.1	2
$h^2$	0.034	0.795	0.676	
Parent	348.3	338.6	338.6	
Progeny	343.1	306.8	319.9	3
$h^2$	0.319	0.160	0.201	

TABLE I Contd.

	Open pollinated	Self pollinated	Combined	Char-acter
Parent	134.8	162.7	162.7	4
Progeny	125.4	106.0	114.3	
$h^2$	0.794	0.846	0.834	
Parent	177.8	156.4	156.4	5 ✓
Progeny	193.5	163.3	172.6	
$h^2$	0.645	0.028	0.210	
Parent	21.5	12.2	12.2	6
Progeny	16.2	20.6	19.2	
$h^2$	0.712	0.819	0.796	
Parent	14.2	7.3	7.3	7
Progeny	4.8	17.0	13.8	
$h^2$	0.712	0.924	0.893	
Parent	0.8	0.6	0.6	8
Progeny	0.7	1.0	0.9	
$h^2$	0.723	0.932	0.902	
Parent	72.3	63.3	63.3	9
Progeny	79.0	68.2	71.3	
$h^2$	0.240	0.718	0.628	
Parent	29.5	33.7	33.7	10
Progeny	33.5	28.8	30.2	
$h^2$	0.617	0.794	0.758*	

1. Number of bunches emerged; 2. Total number of female flowers; 3. Total number of spikes; 4. Number of sterile spikes; 5. Number of spikes with one female flower; 6. Number of spikes with two female flowers; 7. Number of spikes with more than two female flowers; 8. Number of female flowers/spike; 9. Number of female flowers set (Yield as number of nuts); 10. Percentage of female flowers set.

\* $h^2=0.49$  (Lakshmanachar, 1959);  $h^2=0.48$  (Liyanage and Sakai, 1960).

The heritability estimate in the selfed progenies can be considered to be more precise due to the above reason and also due to the larger sample size under this category. These estimates are higher than those from the open pollinated progenies for number of female flowers, number of spikes with more than two female flowers per spike and number and percentage of female flowers set. The estimates from open pollinated progeny were comparatively higher for the total number of spikes, number of spikes with one female flower and number of bunches emerged while the estimate for both the groups were

comparable for the other characters. The higher estimates from the open-pollinated progenies may be due to the abortion of spadices under inbreeding. The combined estimates, may, therefore, be considered for drawing conclusion on the heritability of these characters.

The heritability for number of bunches and total number of spikes are 0.085 and 0.201 respectively which can be considered low. Since these two characters are the major yield determining components, the heritability for yield is expected to be low. Another component of yield with low heritability is the number of spikes with one female flower. The number and proportion of female flowers set are also highly heritable and comparable to that reported for the yield of nuts by Liyanage and Sakai (1960) and Lakshmanachar (1959). The high values of heritability for the number of spikes with two or more female flowers is of limited interest since earlier studies have shown that excessive female flower production is responsible for the irregular bearing habit and low set (Nambiar, Mathew and Kamalakaran, 1970).

#### DISCUSSION

The present study has indicated that the discrepancies in the results reported by previous workers in the heritability of yield in coconut are due to the absence of information on important factors influencing final yield such as pattern of production and distribution of female flowers and their setting. The low heritability for two of the major components of yield, namely, number of bunches and total number of spikes, may be responsible for the inconsistent results. These two characters are also subject to considerable variation due to seasonal and nutritional factors. Therefore, selection for these attributes under favourable environment will help in eliminating poor genotypes. Selection, likewise, for larger number of spikes with one or two female flowers will help in reducing the instability in yield. This, coupled with selection for high set which has a high heritability, can improve yield.

The results have also shown that there is considerable genetic variation available for selection in West Coast Tall. Therefore, selection for stability of the above characters with low heritability, superimposed on selection for high set can help in the improvement in yield by mass selection within this variety. Inter-mating these superior genotypes will permit the retention of genetic variation within the population.

The above data are based on material grown for over three decades. A study of the implication of selection in other varieties of exotic origin was also simultaneously started on a limited scale. A planned programme using ten such diverse groups is in progress.

Information on a complete set of crosses between six groups within West Coast Tall selected for high set, high yield, high female flower production, thick meat and big size has indicated that other factors like thickness of kernel, big nut size and high female flower production may be important in the choice

of mother palms for hybridization. Data on the possible role of substantial maternal effects and the need for choosing appropriate female parent are also available and will be published elsewhere.

#### SUMMARY

Heritability values based on parent-progeny regression for ten characters influencing the final yield of coconuts, viz., number of bunches emerged, number of spikes and female flowers produced, distribution of female flowers in spikes and number and percentage of female flowers set, have been estimated. Low heritability for number of bunches emerged, total number of spikes and spikes with one female flower and high heritability for the rest of the characters appear to be responsible for inconsistent results. Selection for large number of spikes with one or two female flowers will help in reducing the instability in yield. Since there is considerable genetic variation available for selection in the West Coast Tall, selection for stability of the above characters with low heritability, superimposed on selection for high set can help in the improvement of yield by mass selection within this variety.

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