

Identification of Prepotent Palms in West Coast Tall Coconuts Based on the Early Stages of Growth of the Progeny in the Nursery

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Abstract

Monthly observations on growth rate and seedling vigour as measured by collar girth and leaf production from the time of germination taken in 599 open pollinated progeny seedlings of 16 selected high yielding families (cultivar : West Coast Tall) indicated highly significant differences in growth rate of progenies between families. Correlations of these growth characters from the first to the ninth month from the time of germination with those of the tenth month showed that correlation was high and positive from the fifth month. This shows that it may be possible to identify palms of superior genetic value (prepotents) even from the fifth month based on these two growth characters of the progeny.

The breeding values of six families worked out for leaf production and collar girth of the progeny during the fifth and tenth months of growth in the nursery and their yield performance in the field showed that prepotent palms, whose progenies would be high yielders, have high breeding values for both these characters. Thus it may be possible to screen a large number of palms for prepotency and identify them based on these growth characters of the progenies in the nursery during the fifth month of growth. In areas where young seedlings of less than six months old are preferred for planting, it is better to select them from five months old seedlings based on these two characters, as they are genetically correlated with yield of adult palms.

Introduction

Selection is normally practised in coconut on the mother palms and in seedlings. Harland (1957) advocated the identification of high yielding mother palms on the basis of their progeny performance and suggested that it should be possible to identify prepotent high yielders from a comparative study of sufficiently large numbers of progenies from open pollinated mothers. Ninan and Pankajakshan (1961) studied the relationship between parent yield and seedling characters of progenies and found that some high yielders showed markedly superior progeny performance than others. Liyanage (1967) reported a positive and significant correla-

tion between number of leaves produced during the first 40 months and yield of copra at the age of 13-14 years. He felt that selecting seedlings on the basis of high leaf number was a quick method of isolating palms of high breeding value. Ninan, Pankajakshan, and Abdu (1964) found that differences between families in vigour and growth rate were highly significant when compared with variations within families. This indicated the possibility of identifying prepotent palms on the basis of the growth of one year old progeny in the nursery. Another quick method for identifying palms of high breeding value (Liyanage, 1969) was by selfing the palms and studying the depression in endosperm and embryo weight in relation to those of open pollinated nuts from the same palms. Satyabalan, Nampoothiri, and Mathew (1975), from their studies on the growth characters of one year old seedlings of some palms and their performance as adult palms, indicated the possibility of identifying prepotent palms in the nursery. With a view to studying the possibilities of identifying prepotent palms on the basis of progeny characters when they are 5-6 months old in the nursery, collar girth and leaf production were studied in open pollinated progenies of 16 high yielding palms of West Coast Tall variety every month from the time of germination till they were 10 months old. These two growth characters have been found to be genetically correlated with yield of adult palms (Nampoothiri, Satyabalan, and Mathew, 1975). The results of this study are presented and discussed here.

Materials and Methods

Girth at collar and leaf production in the nursery were observed at intervals of one month for ten months from their dates of germination in 599 seedlings raised from open-pollinated seednuts collected during January to May from 16 high yielding palms of West Coast Tall variety. The number of seedling progenies varied from 20 to 47. The mean annual yield of the mother palms varied between 76 and 123 nuts during the period 1956-1965. The mature nuts harvested from each palm each month were individually sown in nursery in June 1957. The date of germination of each nut was noted when the tip of the sprout just emerged out of the husk. The number of fully opened leaves and collar girth were recorded in every seedling each month from the date of germination till the seedlings were 10 months old. Data on leaf production and collar girth for each month for all the seedlings of each palm were separately worked out. Coefficients of correlation were calculated separately for total leaf production and collar girth between the first to the ninth month from the time of germination with those of the tenth month separately for each palm.

The breeding value of a palm for any character is expressed as twice the deviation of the individual progeny mean from the overall population mean for that character. The mean yield of progenies of six palms planted in 1960 was recorded. The breeding values of these palms were determined

for leaf production and collar girth to study the relationship between these growth characters during the fifth and tenth months in the nursery with their nut yields as adult palms.

Results and Discussion

Data on leaf production of the progenies of each palm during the fifth and tenth months of growth beginning from the date of germination in the nursery and their coefficients of variation are presented in Table 1. It is evident from the data that in the progenies of palms II/177, O.C. 19, 27N. 368 and 41.588, the total leaf production in fifth and tenth months are high.

The coefficients of correlation of leaf production during the first, third, fifth, seventh, and ninth months and the tenth month for all the palms are presented in Table 2. The data indicate a positive and significant correlation between total leaf production till the fifth to ninth months with that in the tenth month for all the palms. From this it is evident that seedling selection on the basis of leaf production can be made from the fifth month onwards.

Similarly, the average values of collar girth of the progenies of each palm and their CV during the fifth month and tenth month from the time of germination are presented in Table 1. The data indicate that progenies of VI/143, VII/27, X/31, O.C. 19, and 41.588 have better collar girth (more than 9 cm in the fifth month) than those of the rest. Among these, the progenies of O.C. 19 and 41.588 are the most vigorous in growth as they have the highest collar girth in the tenth month. For this growth character, the correlation between collar girth of progenies in tenth month is positive and significant with that in the fifth month onwards for all the palms (Table 3).

Among the different growth characters of a seedling, collar girth and number of leaves of seedling are positively correlated with yield of adult palm (Nampoothiri *et al.*, 1975). Fremont and Brunin (1966) found that rapid and early growth was associated with earliness in flowering and that the number of leaves produced in the first two years could be used to forecast the palm which would be the first to come into bearing. In the present study, progenies of palms O.C. 19 and 41.588 showed higher values for both leaf production and collar girth as early as in the fifth month of their growth. Since the progenies of these two palms are vigorous in growth as indicated by their leaf production and collar girth, they may be identified as being genetically superior (prepotents), as suggested by Harland (1957).

The breeding values of six families whose progenies are now in the bearing stage were worked out vis-a-vis leaf production and collar girth during the fifth and tenth months of growth in the nursery (Table 4). These six families include family 41.588 which has been identified from progeny studies as one of superior genetic value. Their breeding value is high for

TABLE 1. Total leaf production and collar girth during fifth and tenth months from the time of germination

Family no.	No. of seedlings	Leaf production				Collar girth			
		Fifth month		Tenth month		Fifth month		Tenth month	
		Mean	C.V. (%)	Mean	C.V. (%)	Mean	C.V. (%)	Mean	C.V. (%)
I/55	37	3.95	14.6	6.92	11.0	8.29	8.58	12.74	10.15
II/177	34	4.47	12.6	7.59	8.7	8.48	7.00	12.75	7.15
VI/143	27	3.89	21.8	6.85	13.2	9.28	14.69	13.94	18.04
VII/1	40	3.60	16.1	6.68	11.4	8.44	9.04	12.44	10.35
VII/27	20	3.95	10.0	7.05	7.2	9.14	5.74	13.82	5.76
VIII/23	37	3.57	19.3	6.54	9.9	8.69	8.63	13.25	10.25
VIII/55	42	3.71	16.1	6.52	10.8	8.72	8.82	12.83	8.15
VIII/112	42	3.64	17.0	6.31	10.2	8.53	7.28	12.55	9.26
X/11	47	3.36	18.0	6.34	9.5	8.94	8.47	13.44	7.89
X/14	45	3.60	17.2	6.56	11.1	8.92	6.04	12.95	6.90
X/26	42	3.34	19.6	6.30	11.5	8.57	9.91	12.86	11.72
X/31	23	3.74	12.0	6.70	13.1	9.60	9.59	13.83	8.84
O.C. 6	40	3.40	18.6	6.33	10.4	8.43	9.05	12.39	12.62
O.C. 19	35	4.69	14.4	7.37	11.0	10.02	10.65	14.81	12.73
27N.368	42	4.40	16.7	7.48	10.3	8.94	9.88	13.14	12.21
41.588	46	4.34	16.0	7.44	10.1	9.64	8.00	14.43	10.26
Gen. mean	(599)	3.85		6.81		8.90		13.26	

TABLE 2. Coefficients of correlation of leaf production during the first nine months with that of the tenth month

Sl. no.	Parent palm no.	No. of seedlings	Coefficient of correlation between leaf production in the 10th month and					
			1st month	3rd month	5th month	7th month	9th month	
1	I/55	37	0.3296*	0.3930*	0.4119*	0.5730**	0.7084**	
2	II/177	34	-0.1776	0.4767**	0.6214**	0.5480**	0.4658**	
3	VI/143	27	0.1408	0.7534**	0.7779**	0.7444**	0.7944**	
4	VII/1	40	0.3374*	0.5705**	0.5743**	0.5049**	0.6928**	
5	VII/27	20	-0.2518	0.5054*	0.5369*	0.6076**	0.6057**	
6	VIII/23	37	0.0605	0.3635*	0.4727**	0.5544**	0.5835**	
7	VIII/55	42	0.1813	0.4985**	0.5946**	0.6954**	0.7809**	
8	VIII/112	42	0.3414*	0.7182**	0.5444**	0.6863**	0.6259**	
9	X/11	47	0.0624	0.5075**	0.4920**	0.5893**	0.6950**	
10	X/14	45	0.2434	0.4054**	0.5071**	0.7253**	0.7185**	
11	X/26	42	0.2804	0.5158**	0.6007**	0.5905**	0.6325**	
12	X/31	23	-0.0843	0.3195	0.5990**	0.4866**	0.7446**	
13	O.C. 6	40	0.3338*	0.4553**	0.5434**	0.5981**	0.6451**	
14	O.C. 19	35	0.3227	0.5272**	0.7595**	0.6875**	0.7799**	
15	27N.368	42	-0.1601	0.4671**	0.5975**	0.6727**	0.7106**	
16	41.588	46	0.4185**	0.5543**	0.5995**	0.6351**	0.7539**	

*Significant at $P=0.05$.

**Significant at $P=0.01$.

TABLE 3. Coefficients of correlation for girth at collar during the first nine months with that of the tenth month

Sl. no.	Parent palm no.	Coefficients of correlation between girth at collar in the 10th month and		
		5th month	7th month	9th month
1	I/55	0.6219**	0.7975**	0.9594**
2	II/177	0.7138**	0.7218**	0.8022**
3	VI/143	0.8406**	0.9026**	0.9755**
4	VII/1	0.7123**	0.6314**	0.8564**
5	VII/27	0.6386**	0.6459**	0.7649**
6	VIII/23	0.8449**	0.7781**	0.9561**
7	VIII/55	0.6984**	0.7844**	0.9310**
8	VIII/112	0.4467**	0.5785**	0.8161**
9	X/11	0.7715**	0.7103**	0.8959**
10	X/14	0.3175*	0.3833**	0.7026**
11	X/26	0.7603**	0.8629**	0.9147**
12	X/31	0.6844**	0.8060**	0.9425**
13	O.C.6	0.7538**	0.7227**	0.9648**
14	O.C.19	0.8714**	0.9116**	0.9720**
15	27N.368	0.4323**	0.4122**	0.4571**
16	41.588	0.7255**	0.8021**	0.9445**

*Significant at $P=0.05$.

**Significant at $P=0.01$.

both the characters and their progenies show high yields. Liyanage (1967) has also reported an association between leaf production of progeny during the first 40 months of their growth and the breeding value of the parent. In our study, we have found that both leaf production and collar girth should be considered for identifying mother palms of superior breeding values. These palms of superior breeding values can be identified on the basis of growth characters of their progeny in the fifth month of their growth in the nursery. This way, it would be easier to screen large numbers of palms for prepotency.

In most of the countries where coconut is grown and also in some states in India, the practice is to plant young seedlings which are 4-6 months old. Foale (1965) has also indicated the need for transplanting 4-5 month old seedlings to prevent a severe setback in growth which occurs when aged seedlings are transplanted and has also stressed the need for selecting them on the basis of vigorous growth characters at that stage. Our study has shown that it is possible to select seedlings during the fifth month after germination on the basis of growth characters like collar girth and leaf production.

TABLE 4. Data on the performance of progenies of six palms and their breeding values

Sl. no.	Parent no.	No. of progenies	Breeding values					
			Yield of nuts		Leaf production		Girth at collar	
			Mean	C.V.(%)	Fifth month	Tenth month	Fifth month	Tenth month
1	II/177	2	67.0	87.6	1.30	1.58	-0.80	-0.92
2	41.588	3	97.1	5.7	0.90	1.18	1.40	2.28
3	I/55	4	56.9	73.6	0.30	0.18	-1.20	-1.12
4	VIII/55	4	71.4	8.6	0.30	-0.62	-0.40	-0.92
5	X/14	4	76.8	23.1	-0.50	-0.42	0	-0.52
6	VII/1	2	62.8	11.8	-0.50	-0.22	-1.10	-1.72

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Discussions

Asana : It might be useful to study two parameters :

(i) Measurement of adenylic energy might indicate significant differences in seedling vigour;

(ii) Measurement of $^{14}\text{CO}_2$ uptake by leaves of seedlings may also be taken up. This measurement has shown some promise in oil palm seedlings selection.

Louis : Did you compare the seedlings of all the parent palms on their yield performance before determining their prepotency ?

Satyabalan : The yield performance of the progenies of only six palms has been studied so far.

Narasimhayya : Basic definition of prepotency should take the CV of the progenies according to Lush, and not CA alone. So, your first selected plant having 87.2% CV may not be prepotent.

Satyabalan : The first palm is not a prepotent one. Only palm nos. 41/588 and O.C. 19 are prepotent. The data on the performance of the progenies of 41/588 only are available.

Venkateswaran : (i) Does prepotency imply high concentrations of dominant genes ?

(ii) Is it not necessary to study the relationship of yield itself with growth measurements for each month ?

(iii) Is it not necessary to fix the month which gives the highest correlation with yield ?

(iv) How is the seedling age calculated ?

Satyabalan : (i) Prepotency has been taken as the general combining ability. It is possible that it represents the cumulative action of favourable dominant genes.

(ii) and (iii) Such a study is being undertaken.

(iv) From the date of germination.

Shanthamallaiiah : Won't seedling vigour as expressed by dry matter production be a more valid criterion as compared to all your other characters ?

Satyabalan : Certainly. But that would be a destructive and time consuming method.

Manthiriratne : I presume that your heritability value of 40% was for number of nuts. In Sri Lanka we had obtained a high heritability value of 95% for weight of husked nuts. Is this not a better index ?

Satyabalan : There is a relationship between number of nuts and weight of copra. Therefore, number of nuts by itself is a good index. This is the subject of another paper at the Symposium.

Sriram : (i) I understand that elitism exists in plants. But I would like to know whether in the opinion of the authors prepotency is due to dominant genes or the combining ability of the parents (known or unknown).

(ii) How were the seedlings grown-in individual bags or in nursery ?

Satyabalan : (i) It is presumably due to en block transmission of favourable dominant genes to the progeny.

(ii) They were grown in the nursery.