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SEEDLING CHARACTERS RELATED TO PRECOCITY OF FLOWERING AND EARLY YIELD IN COCONUT HYBRIDS*

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ABSTRACT

An experimental trial to compare the growth and yield performance of three coconut hybrids was established during 1985. Preliminary results suggest that Malayan Yellow Dwarf x West Coast Tall (MYDXWCT) is the most precocious and has the highest yield, with the Malayan Orange Dwarf x West Coast Tall (MODxWCT) and Chowghat Orange Dwarf x West Coast Tall (CODxWCT) hybrids ranking second and third respectively. MYDxWCT is also relatively more tolerant to drought. The results establish the close relationship between seedling characters and the yield of young palms during the first two years of bearing indicating the potential of utilizing seedling growth data to predict the future yield performance of coconut hybrids.

INTRODUCTION

The first successful hybrid between the Tall and Dwarf coconuts was developed in India by Patel (1937). Since then, a large number of hybrids between the indigenous and exotic cultivars have been developed with a view to boosting up coconut yields. Field evaluation of these hybrids for yield is rather time consuming for a crop like coconut which requires at least 12-15 years of performance evaluation per generation. In order to reduce the time required for evaluation, a method to predict the yield of coconut at the seedling stage by using certain morphological characters was reported by Liyanage (1955). In oil palm also, an yield test to allow for early selection using mitochondrial activity has been reported (Kouame, 1978). Studies on growth analysis conducted in oilpalm beginning with the nursery seedlings and continued upto fruit-bearing stage, showed a positive correlation between the early growth of seedlings and their own yield as adult palms (Tan and Hardon, 1976). Based on these reports, work on evolving criteria for selection of vigorous coconut hybrids from the nursery was initiated at CPCRI during the 1980's. In the first part of this study, we reported the comparative growth rates of nursery seedlings of three hybrids, MYDxWCT, MODxWCT and COD x WCT (Shivashankar and Kasturi Bai, 1988). These seedlings were planted in the Institute farm during 1985. Since then, these plants have flowered and yielded nuts during the last two years. The initial data of flowering and yield are presented in this paper and discussed with special reference to their relationship with seedling characters.

MATERIALS AND METHODS

Fourteen seedlings each of MYD x WCT, MOD x WCT and COD x WCT were planted at CPCRI, Kasaragod in 1985 at a spacing of 7.5 m x 7.5 m and maintained with the recommended dose of fertilizers.

Leaf area and leaf dry weight were computed based on the area and dry weight of six leaflets on either side of the frond according to Ramadasan and Mathew (1987). Data on leaf production, spathe emergence, number of female flowers per bunch and nuts per bunch were collected periodically. The date of first flowering was calculated as the average number of months from planting. Total soluble protein, nitrate reductase activity and acid phosphatase activity in leaves were determined as described earlier (Shivashankar, 1991). Specific leaf weight was computed as the weight per unit area of leaf.

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* CPCRI contribution No.830

RESULTS AND DISCUSSION

Growth in the nursery

At 12 months of age in the nursery, the seedlings of MYD x WCT were clearly superior to both MOD x WCT and CODxWCT hybrids in height, girth at collar, total number of leaves produced, leaf area and shoot dry mass (Table I). We had earlier shown that in all the growth components, MYD x WCT was distinctly superior to MOD x WCT (Shivashankar and Kasturi Bai, 1988). Since seedling vigour is dependent on the rate of growth in the nursery, it was apparent that MYD x WCT exhibited higher vigour than MOD x WCT and COD x WCT.

Growth of young palms

There were marked differences in the rate of leaf production among the hybrids. MYD x WCT showed the highest rate (1.04 leaves/month) followed by COD x WCT (1.00 leaf/month) and MOD x WCT (0.83 leaf/month). At the same time, the number of functional leaves on the crown was also higher in MYD x WCT (23.8) than MOD x WCT (21.6) and COD x WCT (18.8). Leaf area and dry weight of leaves did not vary much among the hybrids. However, the total canopy area was significantly higher in MYD x WCT, which was mainly due to the larger number of leaves on its crown.

Flowering and yield

Fig.1 shows the pattern of flowering in the three hybrids. The time taken for the appearance of the first inflorescence from planting was 45 months in MYD x WCT, and about 54 months in both MOD x WCT and COD x WCT. The frequency of spathe production was higher in MYD x WCT, taking 31 days for the emergence of each spathe. The average number of spathes opening each year varied from 11.8 in MYD x WCT to 8.7 in COD x WCT. The number of female flowers per bunch and number of fruits per bunch were also higher in MYD x WCT. (Table II). These data indicated the higher yield potential of MYD x WCT hybrids.

Drought tolerance parameters

Specific leaf weight, soluble protein and enzyme activities were measured during stress (Fig.2) Since this experimental trial was maintained under rainfed condition throughout, soil moisture stress developed during the rainless months. The activity of acid phosphatase measured during the stress was markedly higher in all the hybrids as compared to the pre-stress activity. COD x WCT recorded the highest increase (52.7%) as against 21.4% in MYD x WCT. A rapid rise in acid phosphatase activity during stress has been shown to be an indicator of drought susceptibility (Shivashankar, 1991). Contrary to this, nitrate reductase activity declined rapidly. It was significant that MYD x WCT maintained higher nitrate reductase both before and during stress which is indicative of its stability. Since nitrate reductase catalyzes the rate-limiting step in the conversion of assimilated nitrate, the higher activity of this enzyme is

Table I. Nursery growth of 12-month-old seedlings of three hybrids.

Hybrid	Height (cm)	Girth (cm)	No. of leaves	Leaf area (m^2)	Shoot dry mass (g)
MYDXWCT	164.4 (5.86)	17.8 (0.63)	9.0 (0.32)	1.011 (O.119)	197.9 (15.128)
MODXWCT	156.7 (6.92)	16.0 (0.63)	7.6 (O.25)	0.822 (O.005)	154.1 (10.659)
CODXWCT	145.4 (7.21)	13.4 (0.15)	7.0 (0.14)	0.619 (0.003)	130.7 (10.225)
C.D. (P=O.05)	1.6**	0.758**	0.23**		

Values are means of 10 replicates; figures in parentheses indicate the SE of mean
** Significant at 1%

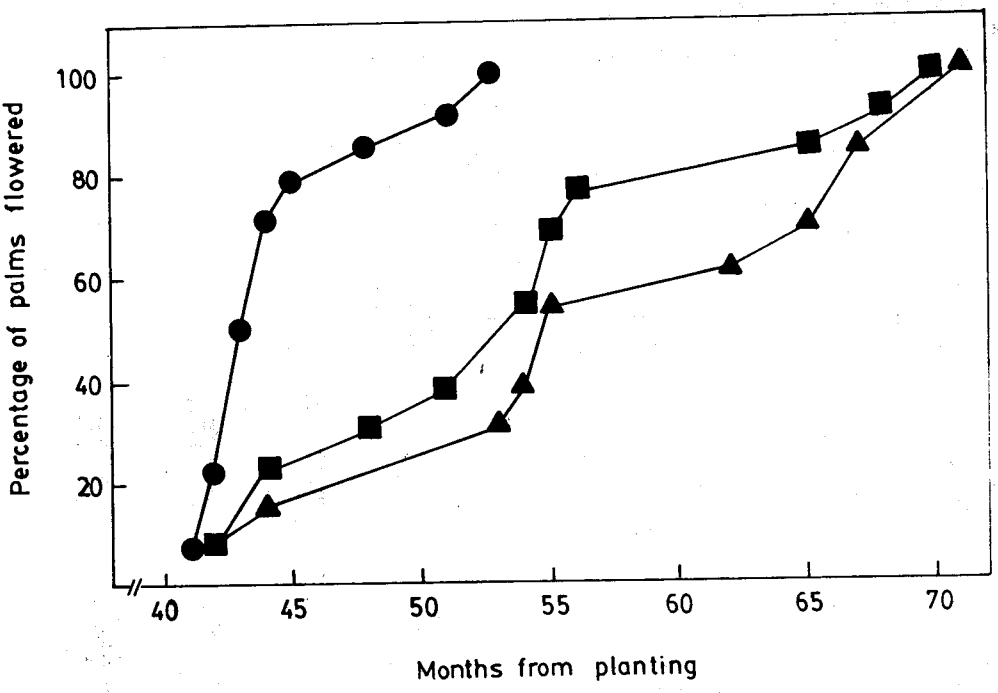

Fig 1. Pattern of flowering in hybrids ●—● MYD x WCT; ■—■ MOD x WCT; ▲—▲ COD x WCT

desirable. Changes in soluble protein and specific leaf weight also showed the drought-tolerant nature of MYD x WCT.

Relationship between seedling characters and adult palm yield

The correlation obtained between seedling characters at one year stage and their own yield as adult palms over the first two years of bearing is presented in Table III. Seedling parameters like girth at collar, total number of leaves, leaf area and shoot dry mass exhibited strongly positive and significant correlations with both female flower production and cumulative yield. Leaf area was more closely correlated with yield than other characters. Based on these correlations, equations were developed for prediction of yield using either leaf area alone or

Table II. Yield components of 6-year-old palms

Hybrid	Age at Ist flowering (months) from planting)	Frequency of spathe production (days taken for spathe emergence)	No. of female flowers per bunch	No. of bunches produced/ year	No. of nuts/ bunch	Cumulative yield of nuts (first two years of bearing)
MYD x WCT	44.7	31	20.8 (2.525)	11.8	10.6 (1.217)	291.8 (38.94)
MOD x WCT	53.9	38	14.5 (1.392)	9.6	8.8 (0.772)	136.2 (23.57)
COD x WCT	54.3	42	12.8 (2.442)	8.7	7.1 (1.774)	113.3 (45.99)

Values in parentheses indicate the S.E. of mean

all the seedling characters, and are given below:

$Y = -301.20 + 12.05\ G + 6.10\ N + 0.95\ A - 0.76\ SDM$ ($R^2 = 0.58$)

OR

$Y = -212.51 + 0.48A$ ($R^2 = 0.54$)

Where, G = Girth at collar (cm)
N = Number of leaves
A = Total leaf area (cm^2)
SDM = Shoot dry mass (g)
Y = Cumulative yield

The higher rate of growth and vigour of MYD x WCT hybrids in the nursery was maintained the same after planting in the field. This was expected, as MYD x WCT was characterized by a higher CGR and NAR at the seedling stage which was further carried over. The rapid rate of leaf production and the maintenance of a larger canopy area in MYD x WCT throughout the growth phase, combined with its ability to tolerate drought better than the other two hybrids are important desirable traits required to achieve higher productivity. The MYD x WCT hybrid is definitely more precocious than MOD x WCT and COD x WCT. The higher rate of spathe production and the number of female flowers per bunch show that MYD x WCT has the potential to out-yield other two hybrids. The yield data of MYD x WCT although influenced by the precocity of flowering, does, in fact, prove that it is a superior yielder. These data conclusively establish the close correlation between seedling characters and their own yield during the first two years of bearing. Since the early yields are subject to high variation, further evaluation of yield data of these palms upto the time of yield stabilization is needed in order to confirm the present results and utilize seedling parameters for rapid evaluation of hybrids.

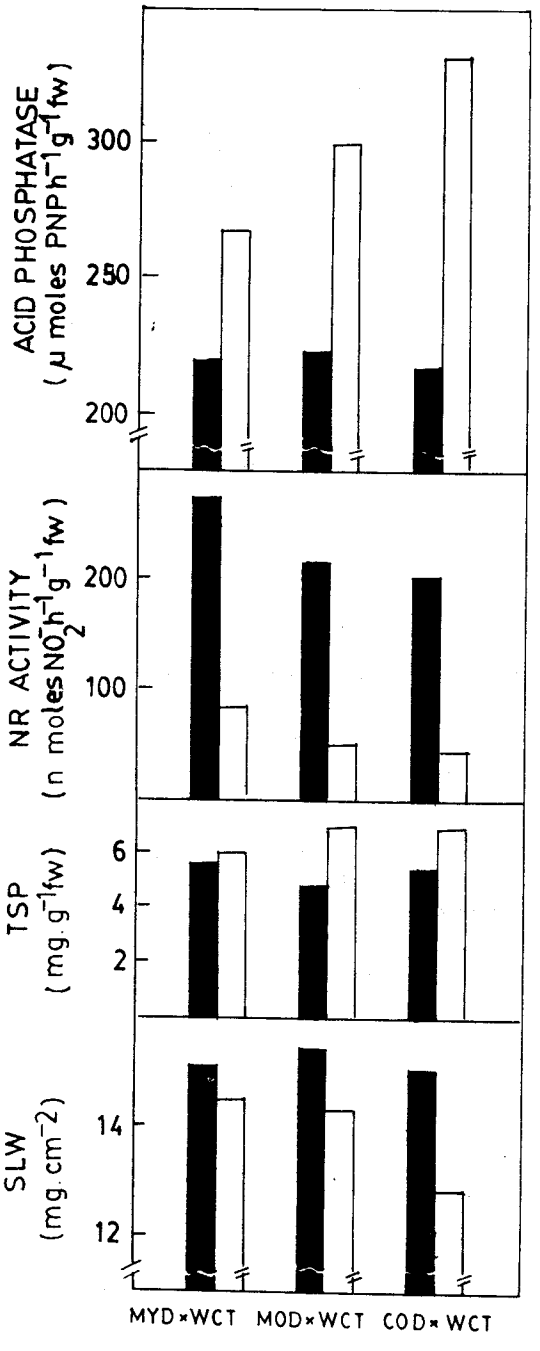

Fig. 2 Biochemical components during and before stress

■—■ Pre - stress

□—□ Stress

Table III. Correlation between one-year-old seedling characters and adult palm yield over the first two years of bearing.

One-year-old seedling character	6-year-old palms	
	Cumulative yield	Female flower production
Girth	0.6463**	0.6946**
No. of leaves	0.5485**	0.6116**
Leaf area	0.7333**	0.8247**
Shoot dry mass	0.6185**	0.7151**

** Significant at 1%

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DISCUSSION

REMANY GOPALAKRISHNAN : The characteristic of root system has not been taken int account in this study. The farmers often raise the doubt whether the root characteristic has direct impact on yield characteristics. As such it would be better to include this aspect also in the continuing programme so that the data could be disseminated to farmers.

S. SHIVASHANKAR : A well developed deep rooted system in coconut is known to impart tolerance to drought conditions. Hence it is necessary to study the rooting pattern and the water uptake characteristics hybrids under field conditions.