Indian Biologist Vol. XXVI, No. 2, 1994
ISSN 0302–7554
Received on 1st July 1994

GROWTH HABIT OF SOME TALL AND DWARF CULTIVARS OF COCONUT (*COCOS NUCIFERA* LINN.) IN THE SUNDARBAN AREA OF WEST BENGAL

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Abstract

Growth in plant height and number of leaves were studied in five tall and three dwarf cultivars of coconut, *Cocos nucifera* L. within the age group of 2 years and 4.5 years is the Sundarbans area of West Bengal. Both plant height and number of leaves were highly correlated with age. Positive correlation also exists between plant height and number of leaves at different ages of the cultivars. Mean plant height and number of leaves plant^{-1} were greater in November than June each year; this seems to be the effect of change in weather (from humid warm to cold dry). Duncan's multiple range test procedure, and linear regression coefficient and correlation coefficient of different characteristics indicate that LM, WCT and LO of tall, and MDY of dwarf cultivars are the most promising ones.

Introduction

The coconut palm, *Cocos nucifera* Linn. is one of the most useful trees to mankind (Menon & Pandalai 1958). It belongs to the family Palmae. The coconut palms can be broadly classified into two groups or varieties—tall and dwarf (Thampan 1975). The tall palms being a cross pollinated plant, it has many cultivars. They attain a height of about 15 to 18 m with 25 to 40 leaves on their crown when they become fully mature. Flowering starts at the age of seven to eight years, and the life span extends from 80 to 100 years.

On the other hand, the dwarf coconuts are usually self pollinated and shorter in stature. The height of a fully grown palm rarely exceeds five meters and it bears about 25 to 30 leaves on its crown. It starts flowering in about three to four years after transplanting. They have a life span of 40 to 50 years.

For a coconut tree, plant height and number of leaves are the most important morphological characters which vary among cultivars during their entire life cycle and bear a mutual relationship. A systematic study in this respect is very rare for the Sundarban areas of West Bengal. An attempt has therefore been made to study this fact with a three-fold objectives :

i. to find out how the characters vary among cultivars at a certain specified plant age.

ii. to study the growth pattern in respect of each character over an early part of the entire life cycle &

iii. to throw some light on the adaptibility of cultivars on the basis of the characters under study.

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Table 1

Mean plant height (meter) of coconut cultivars at different age of the plants

Cultivar	No. of plants	Age – 2 yrs(J) Pl.ht. (m)	DMRT[a]	Age – 2.5 yrs(N) Pl.ht. (m)	DMRT[a]	Age – 3 yrs(J) Pl.ht. (m)	DMRT[a]	Age – 3.5 yrs(N) Pl.ht. (m)	DMRT[b]	Age – 4 yrs(J) Pl.ht. (m)	DMRT[b]	Age – 4.5 yrs(N) Pl.ht. (m)	DMRT[b]
Tall													
LM	13	1.52	bcd	2.23	cd	2.72	cd	3.54	—	4.06	—	4.99	—
WCT	30	1.61	bc	2.38	abc	2.99	abc	3.95	—	4.29	—	5.20	—
LO	16	1.84	ab	2.70	ab	3.33	ab	4.32	—	4.58	—	5.41	—
Local	18	1.52	bcd	2.12	cd	2.78	bcd	3.73	—	3.95	—	4.64	—
AO	12	2.03	a	2.76	a	3.36	a	4.18	—	4.49	—	5.08	—
Dwarf													
CDO	9	1.59	—	2.32	—	2.78	—	3.36	—	3.55	—	4.08	—
ISID	11	1.21	—	2.02	—	2.26	—	3.27	—	3.37	—	3.83	—
MDY	9	1.48	—	2.27	—	2.61	—	3.40	—	3.64	—	4.06	—

[a]Any two means having a common letter are not significantly different at the 5% level of significance.

[b]Blank (—) indicates that the mean values are not significantly different among the cultivars.

J Data collected in the 1st week of June.

N Data collected in the last week of November.

Materials and Methods

The five tall and three dwarf cultivars were selected from a large and narrow germplasm base respectively. The five tall cultivars are: Andaman ordinary (AO), Lakshadweep ordinary (LO), Lakshadweep micro (LM), West coast tall (WCT) and Local, and the dwarf cultivars are: Malayan dwarf yellow (MDY), I.S.I. dwarf (ISID) and Chowghat dwarf orange (CDO). All the cultivars were collected from Central Plantation Crops Research Institute, Kasaragod, Kerala except one tall (Local) and one dwarf (ISID) which were collected locally and Indian Statistical Institute, Calcutta respectively.

In the Sundarban areas a field of 0.76, ha was selected in the village of Manmathanagar at an altitude of almost sea level. The field consists of eight plots each of which contains four rows.

The soil was loam, neutral in pH (6.1), conductivity normal (E,C. 0.06 m mohs/cm), high in N (2.83% organic carbon), medium in P (25.3 kg/ha available P) but very poor in K (33.85 kg/ha).

Seed nuts of cultivars were sown in a nursery bed at the District Seed Farm, 24 Parganas(s), Manmathanagar in May 1986. One year old seedlings were transplanted in square method with a spacing of 7.6 m between palms and adjacent rows. According to availability of seedlings, the number varied from cultivar to cultivar (Table 1).

As the field was likely to be water logged during rainy season, 1 m high mounds were prepared and pits of 1 m X 1 m X 1 m size were dug and filled up with powder cowdung and surface soil up to a depth of 60 cm before planting. Fertilizers were applied from the second year of planting according to the following dosages (gm/palm) :

	June			October		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
2nd year	50	40	135	110	80	270
3rd year	110	80	270	220	160	540
4th year and onwards	170	120	400	330	200	800

During the summar months (April and May) the plants were irrigated once in four days. Data in respect of plant height and number of leaves were collected from the first week of June 1989 to last week of November 1991 at regular six months intervals. Plant height was considered from the base of the plant at ground level to the tip of the upper most leaf. Measurements were taken with a Freeman's metalled wire tape and a bamboo stich. Number of leaves were counted and the youngest leaf was marked with red enamel paint to facilitate the next counting.

Data on each of the characters under study at each age-point were analysed statistically by adopting usual analysis of variance (ANOVA) technique for both tall and dwarf cultivars separately. Duncan's Multiple Range Test (DMRT) was employed where 'F'-values were significant at 5 per cent level in ANOVA (Montgomery 1991). to test the differences among character

Table 2

Mean number of leaves per plant of coconut cultivars at different age of the plants

Cultivar	Age 2 years		Age 2.5 yrs.		Age 3 yrs.		Age 3.5 yrs.		Age 4 yrs.		Age 4.5 yrs.	
	No. of leaves	DMRT[a]	No. of leaves	DMRT[a]	No. of leaves	DMRT[a]	No. of leaves	DMRT[a]	No. of leaves	DMRT[a]	No. of leaves	DMRT[a]
Tall												
LM	7.23	—	9.2	—	8.84	abcd	10	—	10	bcd	13.92	—
WCT	7.1	—	9.5	—	8.16	cd	9.6	—	10.4	ab	14	—
LO	7.43	—	9.6	—	9.4	ab	11	—	11.56	a	14.75	—
Local	6.44	—	9.33	—	8.9	abc	10.22	—	10	bc	12.72	—
AO	6.75	—	9.3	—	9.5	a	10.3	—	9.83	bcd	13.08	—
Dwarf												
CDO	6	—	9.7	—	8.3	—	10.6	—	8	b	12.22	—
ISID	6.36	—	10	—	9.54	—	11	—	9.09	ab	12.45	—
MDY	6.33	—	10.2	—	9.1	—	12.3	—	10.8	a	13.66	—

[a] Any two means having a common letter are not significantly different at the 5% level of significance. and blank (—) indicates that the mean values are not significantly different among the cultivars.

Table 3

Cultivar wise linear regression coefficient and correlation coefficient of plant height and plant age (June '89—November 91)

Cultivar (Tall)	a	b	r
LM	—1.217	1.352 (0.054)	0.996**
WCT	—1.172	1.408 (0.064)	0.995**
AO	—0.298	1.214 (0.065)	0.994**
LO	—0.849	1.398 (0.082)	0.993**
Local	—0.969	1.259 (0.078)	0.992**
(Dwraf)			
CDO	—0.158	0.995 (0.073)	0.989**
ISID	—0.712	1.037 (0.108)	0.979**
MDY	—0.395	1.017 (0.080)	0.988**

**Significant at P = 0.01

N.B. Figures in the parentheses are the standard errors of b.

means of the cultivars. The relationships between plant height and plant age, number of leaves and plant age, and plant height and number of leaves were studied by fitting the linear regression equation (Gomez and Gomez, 1984).

Results and Discussion

It is evident that the characters under study vary between tall and dwarf cultivars. Hence, statistical technique was applied separately for each group.

Plant height

Mean plant height and DMRT of different cultivars of coconut at six months interval are presented in Table 1. I it is observed that there are significant variations in plant height among the tall cultivars whereas in dwarf cultivars variation is insignificant during the early stages of growth (2-3 years). In order to find out the best tall cultivar, means were compared by using DMRT procedure. It reveals that though beyond 3 years, there is no significant difference in tallness, AO and LO are tallest at par in the early ages on one hand, and on the otherhand LM and Local are shorter than them. WCT occupies an intermediate position. LO becomes numerically tallest beyond three years. AO comes next in order of merit. However,

Table 4

Cultivar wise linear regression coefficient and correlation coefficient of number of leaves and plant age (June '89—November '91)

Cultivar (Tall)	a	b	r
LM	2.991	2.114 (0.552)	0.886*
WCT	2.617	2.208 (0.622)	0.871*
AO	3.471	1.945 (0.483)	0.895*
LO	2.437	2.518 (0.416)	0.949**
Local	3.151	1.984 (0.453)	0.909*
(Dwarf)			
CDO	3.880	1.617 (0.840)	0.693 N.S.
ISID	4.320	1.667 (0.706)	0.763 N.S.
MDY	2.663	2.380 (0.672)	0.871*

*Significant at P=0.05; **Significant at P=0.01; N.S., not significant

N.B. Figures within parentheses are the standard errors of b.

both AO and LO may have some potentiality in tallness which is further to be observed in the rest of the life cycle. Among the dwarf cultivars both CDO and MDY are taller than other cultivar.

Number of leaves

Significant variation in mean number of leaves per plant is observed both in tall (at 3 and 4 years age) and dwarf (at 4 years age) cultivars (Table 2). It is interesting to note that among the tall cultivars, LO and AO are at par having highest number of leaves whereas WCT has the lowest. Beyond the age of three years, AO has lesser number of leaves and LO has the highest which are at par with WCT. In dwarf cultivars at the age of four years, MDY and CDO differ significantly while ISID occupies inter-mediate position in having the number of leaves. The maximum mean number of leaves at the age of 4.5 years, occurs in LO (14.75) and WCT (14) in tall and MDY (13.66) in dwarf.

Plant height versus number of leaves

Considering both plant height and number of leaves it may be suggested that LM, WCT and LO of tall, and MDY of dwarf cultivars are the most promising ones. Generally the early growth chara-

Table 5

Linear regression coefficient (a,b) and correlation coefficient (r) of plant height and number of leaves per plant

Period	a	b	r
		Tall	
June 1989	4.52	1.46 (1.468)	0.453**
November 1989	6.64	1.16 (1.593)	0.448*
June 1990	6.09	0.90 (1.337)	0.478**
November 1990	5.0	1.28 (1.493)	0.666**
June 1991	4.32	1.47 (1.968)	0.585**
November 1991	5.99	1.52 (2.585)	0.483**
		Dwarf	
June 1989	4.27	1.38 (1.332)	0.457*
November 1989	6.92	1.43 (1.521)	0.619**
June 1990	6.81	0.87 (1.701)	0.405*
November 1990	3.32	2.38 (2.387)	0.697**
June 1991	4.21	1.44 (2.455)	0.407*
November 1991	7.29	1.28 (2.355)	0.427*

**Significant at P=0.01; *Significant at P=0.05

N.B. Figures given in the parentheses are the standard errors of b.

cteristics like plant height, number of leaves, girth at collar etc. have a positive association with the productivity of adult coconut palms (Nair, 1991).

The correlation coefficient between plant age and plant height are highly significant (Table 3). This is indicative of the best fit of linear increase of plant height over the time period of 2 to 4 years. The positiveness of 'b' values indicates that the lines have upward slope. The 'b' values also indicate that cultivars have more than 1 and less than 1.4 meter growth rate in respect of tallness for tall, and dwarf cultivars have 'b' values of almost equal

one. The growth rates are maximum for LM, WCT & LO cultivars.

Table 4 shows the correlation coefficients between plant age and number of leaves are significant for each cultivar. Only exceptions are CDO and ISID. Thus for all other cultivars the increase in number of leaves follow lines law well. All the 'b' values are positive and thus the fitted lines have upward slopes. The growth rates in case of all the cultivars are almost two in number, which means that for unit increase in plant age, there are two leaves to be added. In case of tall cultivars, the rate of increase is maximum for LO, whereas in dwarf cultivars MDY is maximum.

All correlation coefficients between plant height and number of leaves are significant (Table 5). Thus it is evident that with the increase in height, the number of leaves increases linearly, Among the tall cultivars, increase in number of leaves for 1 meter increase in height decreases gradually in June 1990 and then increases upto November 1991. On the otherhand, among the dwarf cultivars, there is a gradual decrease in June 1990 and goes up to November 1990, and then decreases at the end of November 1991. The cultivars show growth rate less than 1 m. in June 1990 for both tall and dwarf cultivars. The greatest increase (2.38) occurs in November 1990 for dwarf cultivars for 1 m. height increase. The intercept of number of leaves vary between 4 and 7 over the time period for tall as well as dwarf cultivars. Furthermore, from Table 1 and 2, it is evident that the increase in plant height and number of leaves is considerably more in November than June each year. This indicates that rainy season (June-October) and warm weather has a positive role on palm growth. On the otherhand, from November to April, there exists a long spell of dry and cold weather which inhibits growth.

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