Research Article

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Evaluation of coconut hybrids in rainfed conditions

P.M. Kumaran, V. Arunachalam*, K.U.K. Nampoothiri, R.V. Pillai,
M.J. Ratnambal, V. Niral and C.G.N. Nampoothiri

Division of Crop Improvement, Central Plantation Crops Research Institute (ICAR) Kasaragod 671124 Kerala, India

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Abstract

A hybrid evaluation trial with four inter varietal hybrids involving West Coast Tall and Chowghat Orange Dwarf parents had been laid out in 1972 at CPCRI, Kasaragod. The performance of these hybrids were evaluated under rainfed condition. Morphological characters related to leaf, inflorescence, fruit and fruit components were recorded in the adult palms. Apart from these, number of bunches, number of female flowers and number of nuts produced in two yielding phases (12-15 years and 16-19 years of age), cumulative and average yield on a 20-year span was also analyzed. Out of 47 characters studied, 17 were statistically significant among the hybrids. Average nut yield/palm/year of T x D (Kerasankara) hybrid was significantly higher than the other three with 64.3 nuts during initial bearing stage (12-16 years) and with 106 nuts during the prime bearing age (16-19 years of age). Dwarf x Dwarf recorded significantly higher leaf scar number per meter (47.33) whereas Tall x Tall hybrids were taller (760.79 cm) than others.

Key words: Coconut, hybrid, rainfed, reciprocals, West Coast Tall, Chowghat Orange Dwarf

Introduction

Coconut palm (*Cocos nucifera L.*) is one of the most important plantation crops of India. Genetic improvement of coconut has been effective through selection and varietal cross hybrids. Success of varietal cross hybrids in coconut is due to the advantages of early bearing and high yield. Heterosis in varietal cross hybrid (Malayan Dwarf x Niu Lekha Dwarf) has been realized as early as in 1928 by Marechal in Fiji. Patel (1937) reported hybrid vigour in West Coast Tall x Chowghat Green Dwarf for height, early germination, vigour and number of leaves. There are only two major forms available in coconut viz., tall and dwarf. Dwarf palms are normally very low (5 %) in frequency (Bourdeix, 2000). Dwarf forms are generally early bearing and autogamous in nature, fragile and susceptible to heavy winds, drought and pests. Dwarf x Tall hybrids show minimum variation between palms. The hybrid is also superior in nut yield and copra yield (Satyabalan and Vijayakumar, 1982). Review of literature published by Damodaran *et al.* (1991) and Bourdeix (2000) detail the heterosis breeding work carried out in different countries.

Material and Methods

The experiment consisted of four hybrid combinations of Tall and Dwarf forms of coconut planted under rainfed conditions in sandy loam soil in A block at CPCRI farm, Kasaragod in Northern Kerala, India, during 1972. The design employed was Completely Randomized Block Design with four replications with a plot size of six palms. Spacing adopted was square system of 7.5 m x 7.5 m planting. Regular manuring of NPK fertilizers @ 500:320:1200 g/ plant was provided along with organic manures in two split doses every year. The hybrids were made using selected Tall and Dwarf palms of homogenous population. Direct and reciprocal crosses were attempted between West Coast Tall and Chowghat Orange Dwarf as well as between selected families of Tall (Tall x Tall) and Dwarf (Dwarf x Dwarf). The four hybrid combinations studied are WCT x COD (Kerasankara), COD x WCT (Chandrasankara), COD x COD and WCT x WCT. Data pertaining to months to flowering, cumulative nut yield (20 years), annual spathe production, annual female flower production and annual nut yield were recorded. Morphological characters related

* *Corresponding author: vadivelarunachalam@yahoo.com*

to leaf, inflorescence, fruit and fruit components were also recorded in the adult palms. A total of 47 traits were used to compare the performance of hybrids. Data was subjected to statistical analysis using analysis of variance.

Results and Discussion

Mean values along with CV (coefficient of variation, %) and CD (critical difference) at 5 % level of significance obtained for each trait in different hybrids are given in Table.1. Out of 47 characters studied, 17 have shown

Table.1. Performance of hybrid coconuts under rainfed situation

Cross combination	20 years average yield	Cumulative Yield	Months to flowering	Spathes emerged per year	Female flowers / year	Nuts / year	No. of leaf scars
T x D	64.95	1298.99	94.90	7.67	186.67	90.07	28.44
D x T	41.48	829.58	87.68	6.94	168.87	73.33	35.44
D x D	29.45	588.93	75.25	5.21	112.33	46.21	47.33
T x T	45.46	909.17	90.23	6.90	155.22	66.39	21.03
Grand Mean	45.33	906.67	87.02	6.68	155.77	69.00	33.06
CV	28.40	28.39	22.35	6.18	8.32	16.10	10.34
CD	17.98	333.61	25.20	0.53	16.81	19.59	7.00

Cross combination	Weight of fruit	Weight of dehusked nut	No. of bunches	No. of nuts / bunch	No. of bunches with buttons	No. of bunches with nuts
T x D	894.00	419.09	13.00	12.08	2.23	9.38
D x T	900.13	560.13	10.50	10.60	2.85	8.20
D x D	831.56	444.54	7.58	7.68	1.85	6.03
T x T	1128.75	509.69	14.00	10.71	3.00	10.58
Grand Mean	938.61	483.36	11.27	10.27	2.48	8.55
CV	15.46	16.00	5.86	25.52	24.84	12.8
CD	187.88	NS	0.73	NS	NS	1.41

Cross combination	Weight of copra	Height	Girth	No. of leaves	Length of petiole	Length of leaf bearing portion	Number of leaflets
T x D	147.20	671.67	72.08	29.29	116.88	362.25	112.29
D x T	190.45	566.45	68.50	28.10	116.30	372.70	108.45
D x D	132.10	394.73	63.68	25.03	108.75	329.79	93.02
T x T	157.28	760.79	75.58	32.21	120.79	384.13	114.46
Grand Mean	156.76	598.41	69.96	28.66	115.68	362.22	107.05
CV	14.59	9.5	4.63	13.20	7.95	6.38	4.76
CD	NS	73.65	4.20	NS	NS	29.93	6.62

Cross combination	Female flowers / year 2002	Nuts / year 2002	No. of leaf scars
T x D	186.67	90.07	28.44
D x T	168.87	73.33	35.44
D x D	112.33	46.21	47.33
T x T	155.22	66.39	21.03
Grand Mean	155.77	69.00	33.06
CV	8.32	16.10	10.34
CD	16.81	19.59	7.00

	Yield (12-15 years of age)			Yield (16-19 years of age)		
Cross combination	Number of bunches	Female Flowers	Number of nuts	Number of bunches	Female Flowers	Number of nuts
T x D	8.0	158.0	64.3	8.9	224.9	106.0
D x T	6.0	118.0	38.0	7.3	161.9	69.9
T x T	8.7	138.1	42.2	8.9	174.7	64.9
D x D	6.6	108.3	36.7	7.7	142.2	59.3
Mean	7.3	130.6	45.3	8.2	175.9	75.0
CV	12.03	15.01	23.30	11.43	15.19	19.31
CD	1.36	NS	NS	NS	29.51	22.99

statistically significant difference between hybrids. Difference between hybrids were insignificant for characters such as husk (%), thickness of husk at three points, length and breadth of fruit, thickness and weight of kernel, shell, volume of water, weight of shell with kernel, copra weight, number of leaves, length of petiole, length and breadth of leaflet, length of inflorescence stalk, number and length of spikelets and number of female flowers etc. Tall x Dwarf recorded significantly higher cumulative nut yield, average nut yield, number of spathes emerged per year and average annual female flower production. Dwarf x Dwarf palm recorded significantly higher number of leaf scars per meter (47.33). Tall x Tall were taller palms than the others (760.79 cm) giving the highest number of bunches (14.0) with biggest fruits (1128.75 g). Early bearing and intermediate fruit size are observed in Tall x Dwarf hybrids (Tammes, 1955). Our study also reveals similar results. Dwarf x Tall hybrid performed well in a dry climate with supplemented irrigation giving a copra yield of 4.1 to 4.3 t/year in research station and 3.4 to 3.6 t/year in commercial plantings (Daniel *et al.*, 1991). Since most of the studies are on Dwarf x Tall hybrids alone, we are unable to relate the results of our findings. Dwarf x Tall hybrid proved as better planting material over local tall variety in terms of precocity, number of nuts per ha and copra/nut (de Taffin *et al.*, 1991). They found that the performance of D x T hybrid is better in sandy and deep soils. Girth of the stem is one important trait, which differed between the hybrids. This trait is a discriminating trait between the dwarf and tall forms as well as an easy way to measure growth as shown by Rognon and Boutin (1988).

Liyanage and Luntungan (1978) considered the four types of coconut (Dwarf, Tall, Tall x Tall and Dwarf x Tall) seedlings for planting in small holdings of Indonesia. They do not advocate the use of Dwarf x Tall hybrids for growing throughout the country due to differences in soil and climatic conditions and inputs to be provided by farmer. Dwarf x Tall combination could be a boost in input intensive situations. Tall x Dwarf could be a good alternative for marginal input deficit situations. This hypothesis has been confirmed by our results in rainfed situations in this study.

Harries (1974) found JT x MD (Jamaican Tall x Malayan Dwarf) to perform better (82 nuts /palm /year) than its reciprocal (MD x JT) (74.6 nuts/palm/year) after nine years of planting. But such a difference is not noticed between hybrids of Panama Tall and Malayan Dwarf with its reciprocal. There is a need to study the mitochondrial activity to understand these differences as observed in oil palm by Kouame (1978).

Bourdeix *et al.* (1991) also found such differences in hybrids differing in crossing direction. But such a difference was noticed only in the initial years of bearing. Tall x Dwarf hybrid has definite disadvantage in large-scale seed production due to the climbing requirement to effect emasculation and pollination on a Tall female parent. Geographic origin of the parent also has impact on the performance of hybrids. Pacific varieties were not found to be good as parents in evolving hybrids for upland soils of Thailand (Dootson *et al.*, 1988).

Tall x Tall hybrids were evaluated at different locations (Davis *et al.*, 1985) for assessing copra outturn from unit area. Our studies indicate that the Tall x Tall hybrids possess a favourable combination of many desirable traits for enhancing copra output per unit area viz., increase in number of bunches and fruit size with medium nut yield. We did not get much variation in copra content per nut due to the hybrid type. Although the study is based on a single Tall parent, we may obtain similar or better results with other tall varieties too. As seen in our results, T x T hybrid may grow very tall and thus need to be evaluated to reduce the height to avoid harvesting constraints. Tall x dwarf is a suitable hybrid in a rainfed situation.

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