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Performance of coconut hybrid MYD × WCT in the Brahmaputra valley region of Assam

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ABSTRACT

A long term evaluation of four coconut hybrids with a local check was conducted under rainfed conditions at the Horticultural Research Station, Kahikuchi of Assam Agricultural University. The experimental material consisted of four hybrids with different cross combinations, *viz*., WCT × COD, MYD × WCT, WCT × GBGD, COD × WCT along with AGT (Assam Green Tall) as local control planted during 1985 and evaluated for yield performance till 2003. The palms of the hybrid MYD × WCT were semi-tall, took 60 months for 50% of the palms to exhibit flowering. The results revealed that the hybrid, MYD × WCT was superior to other hybrids and local check with respect to nut yield (114.2 nuts/ palm/ year), copra out turn (3.72 tonnes/ ha/ year) and estimated oil out turn (2.53 tonnes/ ha) under rainfed conditions of Assam. Hybrid possessed higher quantity of organoleptically 'good' tender nut water (325 ml) with TSS of 6.2°Brix, 36.5 ppm of Na and 2350 ppm of K.

Key words: Coconut, hybrid, rainfed, nut yield, copra, tender nut.

INTRODUCTION

Coconut (*Cocos nucifera* L.) is one of the important plantation crops in Assam, which provides food, drink, beverage, medicine, fibre and a variety of raw materials for production of an array of products of commercial importance. Though coconut is considered to be a non-traditional crop of this region, the cultivation prevailing since time immemorial has resulted in certain well adapted ecotypes. There are two major forms available in coconut, *viz*., Tall and Dwarf. The Tall type is primarily out-crossing, while the Dwarf type is mainly self pollinating (with a few exceptions). The Tall genotypes are mostly common, commercially cultivated in all coconut growing regions of the world, while the Dwarf types are usually grown for ornamental and breeding purpose. The Tall and Dwarf types have been utilized for development of hybrids, combining the early flowering traits of dwarfs with the hardiness and high yielding characters of Tall parents and also exploitation of hybrid vigour. 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. With the discovery of hybrid vigour in coconut by Patel (7) in a cross between West Coast Tall and Chowghat Green Dwarf paved the way for the successful breeding programme in coconut all over the world. Most of the hybrid evaluations conducted involved inter-varietal crosses of Dwarf × Tall and Tall × Dwarf types and the superiority of hybrids over local tall cultivars in terms of precocity, number of nuts per ha and copra/ nut were established (Satyabalan and Vijayakumar, 9; de Taffin *et al*., 13). In order to improve the coconut yield, newer varieties and hybrids are being introduced for testing its performance under Assam conditions. The present investigation was carried out for identifying a better performing coconut hybrid for cultivation in the Brahmaputra valley region.

MATERIALS AND METHODS

The experiment was carried out at the Horticultural Research Station, Kahikuchi, Guwahati, Assam under All India Coordinated Research Project on Palms, which is situated at 26°.3' N latitude and 91°.7' E longitude with an altitude of 64.0 m above mean sea level (MSL). The average maximum temperature is 32°C in summer and 26°C in winter, while the average minimum temperature is 23°C in summer and 16°C in winter. The station enjoys a sub-tropical climate, with an annual rainfall of about 1500 mm. The soil of the experimental site was Alluvial clay-loam with a pH of 4.9, low in available nitrogen (236.0 kg/ha), medium in available phosphorus (26.0 kg/ha), medium in available potassium (162.0 kg/ha) with an organic carbon of 0.45 per cent. The experimental material consisted of four cross combinations, *viz*., West coast tall (WCT) × Chowghat orange dwarf (COD), Malayan Yellow Dwarf (MYD) × WCT, WCT × Gangabondum Dwarf (GBGD), COD × WCT which were received from ICAR-CPCRI,

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Kasaragod along with Assam Green Tall (AGT) as local check planted during 1985 and evaluated for yield performance till 2003. The details of parents are presented in Table 1. The hybrids along with control were planted under rainfed conditions in a replicated trial in a completely randomized complete block design with four replications and six palms per treatment. Spacing adopted was 7.5 m × 7.5 m with density of 175 palms per hectare. Regular manuring of NPK fertilizers @ 690:400:1050 g/ palm was provided along with organic manures in two split doses every year. Data pertaining to nut production, estimated copra out turn, tender nut traits recorded from 1994 to 2003 (ten years) was used for assessing the performance of the hybrids for nut yield. Morphological characters related to leaf, inflorescence, fruit and fruit components were also recorded in the adult palms. Data was subjected to statistical analysis using analysis of variance.

RESULTS AND DISCUSSION

In the present investigation, significant differences were observed on the number of functional leaves, length of petiole and length of leaflet bearing portion among the various cross combinations and variety (Table 2). However, annual leaf production did not differ significantly among the hybrids and variety. The hybrid MYD × WCT recorded the highest number of functional leaves (32.0) with the shortest petiole (128.6 cm) and length of leaflet bearing portion (368.2 cm). The lowest number of functional leaves (28.0) was found in WCT × GBGD, whereas maximum length of petiole (144.9 cm) and length of leaflet bearing portion (387.8 cm) were observed in Assam Green Tall. Among the hybrids, MYD × WCT significantly took 60 months for 50% of palms exhibit flowering, while AGT took 84 months for 50% flowering. Based on the flowering data recorded, the hybrid MYD × WCT was a regular bearer and commenced flowering in 46 months after planting under rain-fed conditions (Table 3). Similar results were also recorded by Jerard *et al*. (2) at ICAR-CPCRI, Kasaragod. With regard to number of inflorescences per palm and number of female flowers, the hybrid MYD × WCT showed significantly the highest values for these characters compared to other hybrids (Table 3) and was on par with Assam Green Tall. On the other hand, the lowest number of inflorescences, female flowers and bunches harvested were observed in WCT × COD.

It can be seen that fruit set percentage of various hybrids and a variety was within the range of 24.6 to 29.6. Significantly the maximum fruit set (29.6%) was obtained in MYD × WCT and the lowest (24.6%) in WCT × GBGD. The variation in fruit set percentage among the coconut hybrids was also recorded by some workers (Nair *et al*., 4; Thomas *et al*., 15). In coconut, inter-spadix overlapping of female and male

Table 1. Details of parental coconut palms in the crosses.

Genotype	Parental details
MYD × WCT	Selection from Malayan Yellow Dwarf as female parent and selection from West Coast Tall as male parent.
COD × WCT	Selection from Chowghat Orange Dwarf as female parent and selection from West Coast Tall as male parent.
WCT × GBGD	Selection from West Coast Tall as female parent and selection from Gangabondam as male parent.
WCT × COD	Selection from West Coast Tall as female parent and selection from Chowghat Orange Dwarf as male parent.
Assam Green Tall	Selection from Assam Green Tall.

Table 2. Performance of coconut hybrids under rainfed conditions.

Genotype	No. of functional leaves	Annual leaf production	Petiole length (cm)	Length of leaflet bearing portion (cm)
MYD × WCT	32.0	12.0	128.6	368.2
COD × WCT	29.6	11.2	142.9	376.4
WCT × GBGD	28.0	11.0	134.4	384.2
WCT × COD	28.8	11.6	135.1	374.7
Assam Green Tall	30.3	11.9	144.9	387.8
CD (P = 0.05)	1.12	NS	3.98	10.62

Table 3. Yield attributing characters of coconut hybrids and variety under rainfed conditions.

Genotype	No. of inflorescences/ palm	No. of female flowers/ palm	No. of bunches harvested	Fruit set (%)	Months to 50% flowering
MYD × WCT	11.9	386.0	8.7	29.6	60
COD × WCT	11.1	341.2	7.9	26.0	68
WCT × GBGD	11.0	327.6	7.6	24.6	72
WCT × COD	10.6	326.4	7.1	25.8	71
Assam Green Tall	11.8	378.0	8.2	27.8	84
CD (P = 0.05)	0.41	19.7	NS	1.67	7.33

phases are an important factor in fruit set along with cross-pollination from nearby palms carried by agents like wind, insects etc. (Henderson, 1). The highest values for all the morphological and yield attributing characters observed in the hybrid MYD × WCT can be attributed due to the heterotic effect of the hybrid (Rao and Koyamu, 8; Swaminathan and Nambiar, 12; Kumaran *et al*., 3; Jerard *et al*., 2).

In the present study, the average nut yield recorded over ten years from 1994 to 2003 and the estimated mean copra yield of hybrids and AGT (check) are given in Table 4. The average nut yield over ten years among the hybrids ranged from 80.6 nuts per palm per year (WCT × GBGD) to 114.2 nuts per palm per year (MYD × WCT). The local control (AGT) recorded 105 nuts per palm per year. The hybrid MYD × WCT performed significantly better than other hybrids and AGT in respect of nut yield and this hybrid also recorded the highest values for copra content (186.0 g), copra yield (21.24 kg/palm), copra out turn (3.72 tonnes/ha), oil content (68.0%) and oil yield (2.53 tonnes /ha) compared to other hybrids and local control (Table 4). The high yielding potential of MYD × WCT has also been reported by Jerard *et al.* (2). The oil extracted from the copra of this hybrid was reported to have 45.4 per cent lauric acid (Naresh Kumar *et al*., 6). The better performance of the hybrid MYD × WCT might be attributed to the WCT's performance as a pollen parent or specific combining ability of MYD × WCT. The hybrid MYD × WCT was reported to exhibit higher level of drought tolerance owing to the different physiological and biochemical traits, epicuticular wax content and also VAM association (Voleti *et al*., 16, Thomas *et al*., 14; Shivasankar and Kasturi Bai, 11; Shivasankar and Chempakam, 10). It was reported that this hybrid exhibited six to seven-fold increase in stomatal resistance during severe stress as compared to pre-stress, thus checking the transpirational loss of water. Maintenance of water balance through effective stomatal regulation and wax content coupled with the activities of the stress response enzymes indicate the drought tolerance nature of the hybrid MYD × WCT. A positive relationship of vesicular arbuscular mycorrhiza (VAM) colonization was reported with stomatal resistance and leaf water potential, the two characters directly associated with drought tolerance (Thomas *et al*., 14). Comparison of VAM colonization pattern during and after stress revealed the superiority of MYD × WCT over the hybrid COD × WCT (Chandra Sankara) in harbouring highest level of VAM colonization in roots during stress period. The relative drought tolerant nature of WCT × COD hybrid was reported earlier, in comparison with COD × WCT by Kumaran *et al.* (3). An earlier study has indicated Gangabondam Green Dwarf (GBGD) to be a good general combiner and LCT × GBGD as good specific combiner (Nampoothiri *et al*., 5). The

Table 4. Mean yield performance of coconut hybrids and a variety over ten years (1994 to 2003) under rainfed conditions.

Genotype	Nut yield (No. of nuts/palm/yr)	Copra content (g /fruit)	Copra yield (kg /palm)	Copra out turn (tonnes/ ha)	Oil content in copra (%)	Oil yield (tonnes/ ha)
MYD × WCT	114.2	186	21.24	3.72	68.0	2.53
COD × WCT	88.7	178	15.79	2.76	66.7	1.84
WCT × GBGD	80.6	182.5	14.71	2.57	66.0	1.70
WCT × COD	84.2	175.6	14.79	2.59	67.2	1.74
Assam Green Tall	105.0	164.5	17.27	3.02	65.0	1.96
CD (P = 0.05)	9.07	8.01	3.10	0.41	NS	0.24

tender nut traits of the hybrid MYD × WCT (Table 5) showed its potential for tender nut purpose. The average quantity of tender nut water was 325 ml. Based on the organoleptic test; the tender nut water was classified as 'good' in taste with a TSS of 6.2°Brix. The tender nut water had 36.5 ppm of Na and 2350 ppm of K content.

The morphological traits of the parental and hybrid palms are shown in Table 6. The palms of this hybrid are semi-tall without prominent bole and attain an average height of 6.15 m at 18 years after planting. The colour of the petiole was green and bears green

Table 5. Tender nut traits of hybrid MYD × WCT.

Parameter	MYD × WCT
Tender nut weight (g)	1798.6
Volume of water (ml)	325.0
TSS (°Brix)	6.20
Total sugars (g/100 ml)	6.50
Amino acids (mg/100 ml)	1.90
Sodium (ppm)	36.5
Potassium (ppm)	2350.0

Table 6. Morphological and fruit component traits of coconut hybrid MYD × WCT compared with parental palms.

Parameter	Female parent MYD	Male parent WCT	Hybrid MYD × WCT
Age of palm (years)	22	26	18
Category	Dwarf	Tall	Semi Tall
Crown shape	Circular	Circular	Circular
Presence of ball	Absent	Present	Absent
Plant height (cm) at 18 years	376.8	750.3	615.0
Girth of trunk (cm)	62.9	79.3	69.7
Total No. of leaves	31	36	32
Petiole length (cm)	109.9	136.9	128.6
Length of leaflet bearing portion (cm)	326.1	421.1	368.2
No. of leaflets	90	122	96
Leaflet length (cm)	105	122	117.0
Leaflet breadth (cm)	4.68	5.9	5.30
No. of leaf scars on 1 m length	33.5	15.2	22.0
Length of 10 internodes (cm)	31.0	51.5	41.5
Age at 50% flowering (months)	66	98	60
Inflorescence length (cm)	81.1	105	89.6
Length of spikelet bearing portion (cm)	42.8	47.4	44.0
Stalk length (cm)	38.5	57.6	51.7
Spikelet length (cm)	30.9	40.1	41.0
No. of spikelets in the inflorescence	39.5	37.67	42.5
No. of female flowers	22.5	18.8	32.4
No. of inflorescences on the crown	10.0	12.0	11.9
Fruit colour and shape	Yellow, Oval	Green, Oval	Green, Oval
Fruit length (cm)	18.3	25.9	22.5
Fruit breadth (cm)	14.5	14.5	15.2
Fruit weight (g)	565.0	1196.12	980.0
Thickness of husk (cm)	2.0	3.0	2.1
Shape of husked fruit	Round	Round	Round
Weight of husked fruit (g)	382.11	566.38	641.5
Per cent of husk to whole fruit	32.37	52.31	34.5
Kernel thickness (cm)	1.2	1.2	1.5
Kernel weight per fruit (g)	244.9	283.0	278.0
Copra weight per fruit (g)	129.0	178.0	186.0

coloured, oval fruits and the husked fruits are round in shape. The palms of the female parent are dwarf with yellow colour petiole take 66 months for 50% of the palms to bear flower under rainfed conditions, fruits are bright yellow. The palms of the male parent were tall, bear green fruits and take 98 months for 50% of the palms to bear flower under rainfed conditions. The hybrid palms exhibited desirable values for weight of fruit, fruit yield, kernel weight and copra content besides many morphological traits such as earliness of flowering, shorter petiole length and higher number of female flowers.

Thus, from this study it can be concluded that, the hybrid MYD × WCT is suitable for cultivation in Assam as well as adjoining states. The hybrid is precocious in bearing, comes to bear at the age of 46 months, semi-tall type, high yielder (114.2 nuts/ palm/ year) also offers an excellent potential for tender nut use. Potential of the hybrid under rainfed situation due to its drought tolerance character suggests its suitability to Brahmaputra valley region of Assam where coconut is predominantly being cultivated under rainfed conditions.

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