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Yield performance and nut and copra characters of eight germplasm introductions in coconut

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ABSTRACT

The mean yield of nuts, yield attributes and nut and copra characters of 8 germplasm introductions in coconut, viz. 'San Ramon' (Philippines) and 'Borneo' (South-East Asia), 'Seychelles' (Indian Ocean), 'Zanzibar' and 'Kenya' (East Africa), 'British Solomon Islands' and 'Guam' (Pacific Islands) and 'Jamaica' (West Indies) planted during 1955–56 was studied and compared with one another and with the local 'West Coast Tall', all grown under similar conditions. The yield attributes studied were spathe production, female flower production and setting percentage. For nut and copra characters, the weight of fruit, weight of husked nut and weight of components of husked nut (like water, kernel and shell and weight of copra) were studied. The varieties showed a wide range of variation in these characters. There was not much variation in the nut and copra characters of some varieties like 'San Ramon', 'Seychelles' and 'British Solomon Islands' when compared with those in their habitats in spite of the different climatic and environmental conditions obtaining here. 'Zanzibar' and 'British Solomon Islands', besides the local 'West Coast Tall' were better in the yield of nuts. 'San Ramon', 'Zanzibar', 'Guam' and the local 'West Coast Tall' were better in copra outturn. These tall varieties have been grouped into 4 forms on the basis of the percentage of husked nut in the fruit, and the percentage of water, kernel, shell and copra in the husked nut.

In 1952 seed material from almost all the important coconut-growing countries in the world were obtained for assessment of their performance under local conditions and evaluation of their genetic potential in comparison with the local tall variety and also for screening them for their tolerance and resistance to the root (wilt) disease prevalent in south Kerala. In this paper results of a study of the performance of 8 exotic varieties along with the local 'West Coast Tall' variety planted during 1955–56 are presented. The assessment was made on the basis of the yield of nuts, copra out turn and nut and copra characters which included percentage of husked nut in fruit and percentage of the different components of husked nut like water, kernel, shell and copra in the nut. Based on the nut and copra characters, the tall varieties introduced from the different countries have been grouped into 4 forms.

MATERIALS AND METHODS

The mean yield of nuts and yield attributes like spathe production, female flower production and setting percentage during 1971–74 of 8 exotic varieties planted during 1955–56 were studied and compared with one another and with those of the local 'West Coast Tall' planted in the same plot and during the same period. Similarly, nut and copra characters like the weight of fruit (unhusked nut), weight of husked nut, weights of components of husked nut like water, kernel and shell and weight of copra/nut of the varieties were also studied. The palms were under irrigation since 1970. The varieties studied were introduced from the coconut-producing countries located in the different climatic regions of the coconut-producing tropical belt of the world. They were all tall varieties and included 'San Ramon' (Philippines) 'Borneo' (South-East Asia), 'Seychelles' (Indian

Ocean), 'Zanzibar' and 'Kenya' (East Africa), 'British Solomon Islands' and 'Guam' (West and North Pacific Islands) and 'Jamaica' (West Indies) (Fig. 1). The number of palms studied in the different varieties varied from 3 to 10 and the number of nuts from 35 to 62. The nuts studied were uniformly ripe and the copra was dried to constant weight. From the data the percentage by weight of husked nut in fruit and the percentage by weight of water, kernel and shell in husked nut were worked out. The percentage of copra weight to husked nut and the number of nuts required for a tonne of copra were calculated. The oil percentage in the copra was determined on moisture-free basis. The approximate annual outturn of copra was also worked out on the basis of mean annual yield of nuts and mean copra content/nut.

RESULTS AND DISCUSSION

Spathe production varied from 14.6 in 'San Ramon' to 11.2 in 'Seychelles', whereas it was 11.3 in the 'West Coast Tall' (Table 1). 'San Ramon' (14.6) and 'British Solomon Islands' (13.5) produced the maximum number of spathes. The female flower production varied from 210 to 620. 'Seychelles' and 'Guam' were superior to the rest as they produced 620 and 450 female flowers/palm/annum, respectively, compared with less than 400/palm/annum in other varieties. Flower setting varied from 6.1% in 'Seychelles' (which produced the maximum number of female flowers) to 34.4% in 'Kenya' (which produced the lowest number of female flowers). The local 'West Coast Tall' produced 314 female flowers, and its setting percentage was 30.4. The yield of nuts varied from 38 in 'Seychelles' to 90 in 'Zanzibar'. 'West Cost Tall' gave the maximum yield of 96 nuts. On the basis of a yield of 80 nuts/palm/annum as high yield, 'Zanzibar' and 'British Solomon Islands' proved promising but inferior to the local talls. In copra content/nut, 'San Ramon', 'Borneo', 'Jamaica' and 'Guam' proved superior (>200 g/nut). In the annual outturn of copra, 'San Ramon', 'Zanzibar' and 'Guam' were promising besides the local 'West Coast Tall' (>16 kg copra/palm/ annum). The oil content was high in 'Seychelles' and the 'West Coast Tall'. The copra of 'Seychelles' has a reputation for high oil content (Fremond *et al.*, 1966). Only 2,860 nuts were required for a tonne of copra in 'San Ramon', whereas in 'Seychelles' and 'British Solomon Islands' more than 6,000 nuts were required.

'San Ramon' and 'Borneo' produced very large nuts with less husk (Table 2). The copra content/nut of 'San Ramon' and 'Borneo' were 349.6 g and 259.6 g respectively. In the rest, it varied from 148.0 g

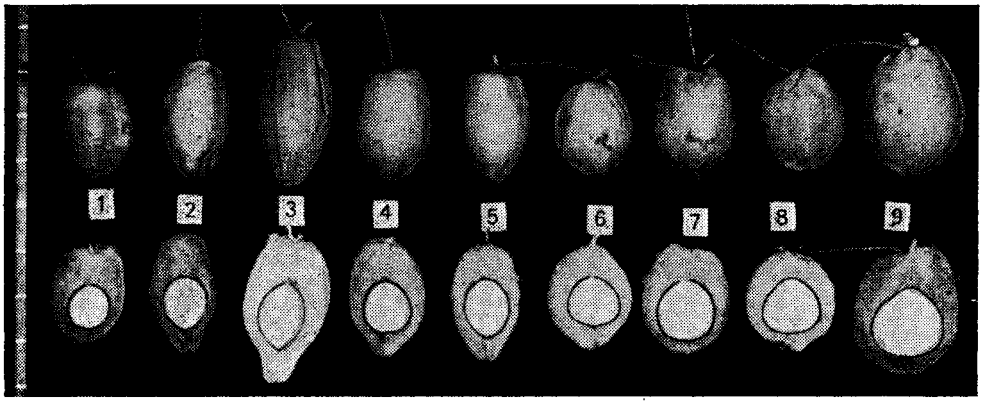

Fig. 1. Coconut varieties. 1, 'West Coast Tall'; 2, 'Seychelles'; 3, 'Guam'; 4, 'Kenya'; 5, 'Zanzibar'; 6, 'British Solomon Islands'; 7, Jamaica'; 8, 'Borneo' and 9, 'San Ramon' (Philippines).

Table 1. Yield of nuts, yield attributes, copra outturn and oil percentage of different varieties of coconut

Variety	No. of palms studied	No. of spathes	No. of female flowers	Setting %	Yield of nuts	Mean copra/ nut (g)	Annual outturn of copra (kg)	Oil % in copra	Nuts required for a tonne of copra
		(.....mean of 1971–74.....)							
'San Ramon'	7	14.6	366.5	15.1	55.2	349.6	19.30	68.0	2,860
'Borneo'	6	11.8	276.2	19.6	54.1	259.6	14.04	66.0	3,852
'Seychelles'	6	11.2	620.0	6.1	38.0	148.0	5.62	70.0	6,757
'Kenya'	5	12.2	210.1	34.4	72.3	183.9	13.30	66.0	5,438
'Zanzibar'	3	12.5	351.5	25.7	90.4	182.8	16.53	69.0	5,430
'British Solomon Islands'	4	13.5	358.2	23.5	84.0	152.0	12.77	67.0	6,579
'Guam'	6	11.9	449.2	16.8	75.6	215.1	16.26	64.0	4,649
'Jamaica'	6	12.3	342.1	13.7	46.9	216.2	10.14	68.0	4,625
'West Coast Tall' (local)	10	11.3	314.2	30.4	95.5	176.3	16.24	70.0	5,672

Table 2. Fruit analysis of different varieties of coconut

Variety	No. of nuts studied	Fruit weight (g)	Husked nut		Water % in husked nut	Kernel % in husked nut	Shell % in husked nut	Copra % in husked nut
			Weight (%)	% in fruit				
'San Ramon'	52	2,091.0	1,407.4	67.3	34.5	45.7	19.8	24.9
'Borneo'	62	1,518.0	981.4	64.7	30.3	48.3	21.4	26.5
'Seychelles'	52	882.6	420.2	47.6	11.6	58.9	29.5	35.2
'Kenya'	56	922.5	585.3	63.4	20.6	54.6	24.8	31.4
'Zanzibar'	35	884.9	546.3	61.7	19.9	54.7	25.4	33.5
'British Solomon Islands'	59	807.3	461.9	57.2	17.7	57.8	24.5	32.9
'Guam'	40	1,100.8	663.3	60.3	22.9	55.7	21.4	32.4
'Jamaica'	37	1,310.0	717.9	54.8	23.4	49.0	27.6	30.1
'West Coast Tall' (local)	39	915.1	480.0	52.5	12.9	57.7	27.4	36.7

in 'Seychelles' to 216.2 g in 'Jamaica'. The fruits in 'San Ramon' and 'Borneo' had less husk and the nuts had a low ratio of endosperm with high weights and ratios of water to husked nut. According to Whitehead (1966) low ratios of endosperm to nut were often coupled with high weights and ratios of water to nuts, thin endosperm and low percentage of husk to fruit in samples from 'Rotuma', 'Bahia', 'Rennel' 'Madang' and 'Karkar' and in some samples from Bougainvilla and New Britain. The nut size in 'San Ramon' was possibly genetically determined and not solely an effect of environment as in the case of 'Rennel' palms established at Yandina (British Solomon Islands) and 'Rotuma' palms growing in Taveuni (Fiji Island), as pointed out by Whitehead (1966). In Philippines, Copeland (1921) reported that 'San Ramon' produced very large nuts and that 3,270 nuts are needed to produce a tonne of copra. Since the size of the nut is very large the number of

Table 3. Comparison of fruit analysis data of coconut varieties studied with those reported by other workers

Country	Variety	Weight of fruit	% of husked nut in fruit	Water %	Kernel %	Shell %	Copra %	R=kernel / fruit, less water	Authors
Form I									
Philippines	'San Ramon'	2,091.6 g	67.3	34.5	45.7	19.8	24.9	0.40	Present study
Borneo	'Borneo'	1,518.0 g	64.7	30.3	48.3	21.4	26.5	0.39	Present study
Form II									
Jamaica	'Jamaica'	1,310.0 g	54.8	23.4	49.0	27.6	30.1	0.31	Present study
	'Jamaica'	1.7 kg	42.9	20.5	50.4	29.3	31.4		Harries (1971)
Form III									
Guam	'Guam'	1,100.8 g	60.3	22.9	55.7	21.4	32.4	0.39	Present study
East Africa	'Kenya'	922.5 g	63.4	20.6	54.6	24.8	31.4	0.40	Present study
	'Zanzibar'	884.9 g	61.7	19.9	54.7	25.4	33.5	0.39	Present study
British Solomon Islands	'British Solomon Islands'	807.3 g	57.2	17.7	57.8	24.5	32.9	0.37	Present study
Form IV									
Seychelles	'Seychelles'	882.6 g	47.6	11.6	58.9	29.5	35.2	0.30	Present study
	'Seychelles'	1,048.0 g	45.9	13.9	57.6	28.5		0.28	Durocher Yvon (1953)
India	'West Coast Tall'	915.1 g	52.5	12.9	57.7	29.4	36.7	0.33	Present study

nuts produced by a palm/annum in such varieties is low, and in such large nuts the percentage of copra to husked nut is low.

'Seychelles' produced oblong nuts which had more husk than others. The nut was small and the copra content was the lowest (148.0 g). The percentage ratio of shell in husked nut was also high. According to Durocher-Yvon (1953) the fruit of 'Seychelles' is oblong, and the nut is small and situated right at the bottom of the fruit near the pointed end. Early nut fall is the rule with this variety (Table 1). Sauer (1967) also mentioned the morphological peculiarities of the 'Seychelles' coconuts such as thick husk and deciduous nature of the ripe fruit.

The nut and copra characters of 'Kenya' and 'Zanzibar' were more or less similar. Both had less husk than 'British Solomon Islands', 'Jamaica', 'Guam', 'Seychelles' and 'West Coast Tall'. Also there was not much difference in the copra content of the nut. 'British Solomon Islands' yielded small nuts, the copra content of a nut being only 152 g. Whitehead (1966) also reported that the local tall of 'Solomon Islands' in Gudalcanal and in the Russel Islands had a low production of copra/nut. 'Guam' from the Pacific had a low husk content as well as shell content in the nut. The fruit of 'Jamaica' from West Indies had a high husk content as well as water and shell content.

Data on fruit analysis of the varieties in India and data reported from their habitats by other workers are presented in Table 3. There was not much variation in the nut and copra characters of 'Jamaica' and 'Seychelles' in spite of the differences in climatic and environmental factors. Based on the data gathered and available from literature, the tall varieties studied can be grouped into 4 forms as indicated in Table 3.

The relationship $R = \frac{\text{Kernel}}{\text{Fruit, less water}}$

which indicates the useful fraction of the fruit (de Nuce de Lamothe and Rognon, 1975) worked out and given in Table 3 indicates that the amount of kernel is high in nuts of the 'San Ramon', 'Kenya', 'Borneo',

'Zanzibar' and 'Guam' and low in those of 'Seychelles', 'Jamaica', 'West Coast Tall' and 'British Solomon Islands'. But the copra outturn is high in 'San Ramon' because of its high kernel content/nut though the yield of nuts is low. In 'Zanzibar', 'Guam' and 'West Coast Tall' the copra outturn is high mainly because of the high yield of nuts.

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