

Evaluation of coconut hybrids for tender nut purpose

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ABSTRACT

Evaluation of coconut hybrids for their suitability as tender nut was undertaken. Physical, bio-chemical, organoleptic characters and mineral composition of tender coconuts of six released hybrids COD x WCT (Chandrasankara), LCT x COD (Chandralaksha), LCT x GBGD (Lakshaganga), WCT x COD (Kerasankara), WCT x GBGD (Keraganga), WCT x MYD (Kerasree) were studied with COD (Chowghat Orange Dwarf) as control. Fruits were harvested at three different stages of maturity. Quantity and quality of tender nut water and meat differed significantly among the hybrids and between the stages of maturity. The tender nuts of hybrids COD x WCT and LCT x COD weighed less but have more volume of water. TSS and pH were the maximum in the same hybrids. Total sugars, reducing sugars and amino acid contents were more in COD x WCT and LCT x COD. Minerals, such as potassium and sodium were at optimal levels in the same hybrids. Organoleptic evaluation showed that the hybrids Chandrasankara and Chandralaksha were the best for tender nut purpose as both of them ranked good for taste of water and meat at the age of 7 months during summer season.

Key words: Coconut, tender nut water, biochemical constituents.

INTRODUCTION

Tender coconut water is found to be one of the value added byproducts from coconut with vast commercial potential. It is a natural, nutritious, medicinal, mineral drink with well acceptable flavour and taste and consumed by all age groups (Rethinam and Nandakumar, 11). With the recent shift from synthetic to natural soft drinks, tender nut water is gaining popularity in traditional and export markets. As the demand is expanding more in airways, railways and highway parlours tender nut water is being pocketed in flexible polymeric pouches and aluminium beverage cans (Srivastava and Sankaran, 13; Srivastava *et al.*, 14). The quality and acceptability of the final product depend upon the initial quality of the tender nut water but the initial quality of the water is governed by the age of the nuts, variety, agro-climatic conditions and horticultural practices. However, information on the influence of these parameters is incomplete and scarce, that too mostly done in cultivars. Therefore, the present study was undertaken at CPCRI to evaluate the suitability of released hybrids for tender nut purpose based on their quantitative and qualitative characters.

MATERIALS AND METHODS

The experimental material consists of the tender nuts of six coconut hybrids released from CPCRI and Kerala Agricultural University (KAU). Nuts of different developmental stage, such as six, seven and eight

months old were harvested from the palms and 3 samples were taken at random with 3 replications during summer season. Chowghat Orange Dwarf, which was released as best tender nut cultivar, was used as control. The physical parameters, such as nut weight (g), volume of water (ml) and weight of endosperm (g) were estimated by standard methods. The total soluble solids (TSS) were recorded with Carl-Zeiss hand refractometer and pH of the coconut water was determined with digital pH meter. The nuts were assessed for their biochemical and organoleptic characters. Total sugars were estimated by the phenol-sulphuric acid method of Dubois *et al.* (3), reducing sugars by copper reagent-ammonium molybdate method (Somogyi, 12) and free amino acids by the method developed by Yapinlee and Tunekazu Takahashi (15). Minerals like potassium and sodium were also estimated using a flame photometer (Jackson, 5). Five independent tasters evaluated the tender nut water and meat organoleptically and rating was done on 1-5 scale and the ranks were classified as good, average and poor. The treatment was laid out in completely randomized block design (CRD) and the data were statistically analysed by methods of Panse and Sukhatme (8).

RESULTS AND DISCUSSION

Tender coconut water contains more sugars, vitamins and minerals and this makes the nut water tastier than other drinks. Hence these aspects were studied and the results were discussed here. For all the characters control cultivar COD performed the best. The mean nut weight among the hybrids ranged from

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1551.7 to 1667.0 g and between months it was from 1580.3 to 1621.5 g (Table. 1). Among the hybrids WCT x MYD recorded the highest nut weight during all the three developmental stages. This study showed that nut weight was more in 6-month and declined during 7 and 8 months. In tender coconut volume of water is an important economic character determining consumer's acceptability and cultivator's preference and it should not be less than 250 ml per nut. In the present study the volume of water ranged from 265.5 to 359.1 ml and among the hybrids 302.95 to 319.29 ml between developmental stages. The mean volume of nut water was higher in the 6-month-old nuts and lesser in 7 and 8 months. Large quantity of nut water was recorded in COD followed by COD x WCT in almost all the stages of development and next by LCT x COD. A number of studies have been undertaken on the volume of water of tender nut. Kamala Devi and Velayutham (7) and Jayalakshmi *et al.* (6) reported maximum amount of nut water in 6-month old tender nut. This is in agreement with the present study. Ratnambal (10) and Damodaran *et al.* (2) reported maximum nut water in 7-month old nut of the popular variety COD. These differing observations might be due to the seasonal variations or by the varietal differences. Here increase in nut weight is due to an increase in volume of water during sixth month, whereas it reduced towards maturity.

From five to sixth month onwards the solid endosperm or the meat start developing as a thin gelatinous layer. But at seventh month the meat developed little thicker, tasty with good flavour. And so the weight of meat was measured in 7-month-old nuts and the values recorded were 112.3, 110.4, 65.3, 65.0, 108.6, 79.6, 116.0 g in COD x WCT, LCT x COD, LCT x GBGD, WCT x COD, WCT x GBGD, WCT x MYD and COD respectively. COD recorded the maximum of 116 g of endosperm and among the hybrids COD x WCT recorded a maximum endosperm weight of 112.3

g followed by LCT x COD (110.4 g). Ganesamurthy *et al.* (4) also reported that weight of tender endosperm was high in 7 months old nuts compared to 5 and 6 months old nuts in accordance with the present results. High TSS was recorded in the hybrids COD x WCT (6.58%) and LCT x COD (6.51%). TSS increased from 6th month to 8th month of development. A report from UAS, Bangalore revealed that the nut with high volume of water contained abundant amounts of sugars and minerals recording high TSS in cultivars (Chikkasubbanna *et al.*, 1), which agreed with the present results. The pH of tender nut water was high in the same hybrids and it increased towards maturity. Slowly increasing TSS and pH values towards maturity indicated the gradual loss of acidity and added sugariness in water.

Total sugars are the main biochemical constituents of nut water responsible for the sweet taste and showed significant difference among the hybrids and between months. In the present study in all the three stages of nut development total sugar content of tender nut water was high in COD and among the hybrids COD x WCT it recorded the highest (5.99 g/100 ml) followed by LCT x COD (5.72 g/100 ml) (Table 2). Poduval *et al.* (9) reported that in some cultivars and hybrids the total sugar content increased continuously upto 8th month. Rethinam and Nandakumar (11) have observed that the quantity of total sugars in tender coconut is found to vary from variety to variety and from place to place even at same maturity which was confirmed in this study. Mean reducing sugar content was the highest in control cultivar (COD) and among the hybrids it was the highest in LCT x COD (3.74 g/100 ml) followed by COD x WCT (3.70 g/100 ml) and the 7-month-old nuts showed more reducing sugars in agreement with the earlier report of Poduval *et al.* (9).

High free amino acids content was obtained from COD nut and among the hybrids tested it was in LCT x

Table 1. Physical parameters of tender nut and water of some coconut hybrids.

Sl. No.	Hybrid	Weight of nut (g)				Volume of water (ml)				PH			
		6	7	8	Mean	6	7	8	Mean	6	7	8	Mean
1	COD x WCT	1584.5	1550.3	1520.3	1551.7	354.1	346.6	341.0	347.2	4.87	5.28	5.97	5.37
2	LCT x COD	1577.3	1569.9	1549.7	1565.6	346.5	340.7	330.8	339.4	4.65	5.10	5.77	5.17
3	LCT x GBGD	1613.6	1597.4	1579.1	1596.7	273.5	266.0	256.9	265.5	4.37	4.78	5.07	4.74
4	WCT x COD	1649.1	1630.3	1591.8	1623.7	313.6	298.4	291.4	301.1	4.63	4.92	5.20	4.92
5	WCT x GBGD	1668.2	1652.8	1637.6	1652.9	296.9	290.8	282.9	290.2	4.60	4.95	5.25	4.93
6	WCT x MYD	1687.6	1670.8	1642.7	1667.0	282.0	277.5	268.6	276.0	4.35	4.93	5.35	4.87
7	COD (Control)	1570.4	1555.1	1540.6	1555.4	368.3	359.1	349.1	358.8	5.32	5.77	6.12	5.73
	CD (P = 0.05%)	A = 8.733		B = 24.56		12.75	8.34			0.15	0.10		

A = Hybrid, B = Month

Table 2. Biochemical characteristics of tender nut water of coconut gybrids.

Sl. No.	Hybrid	TSS (%)				Total sugars (g/100 ml)				Reducing sugars (g/100 ml)			
		6	7	8	Mean	6	7	8	Mean	6	7	8	Mean
1	COD x WCT	5.93	6.60	7.22	6.58	5.41	6.08	6.48	5.99	3.38	3.82	3.91	3.70
2	LCT x COD	5.85	6.43	7.25	6.51	4.78	6.07	6.32	5.72	3.35	3.88	3.99	3.74
3	LCT x GBGD	5.58	6.18	6.63	6.13	4.31	4.91	5.30	4.84	2.85	3.34	3.33	3.18
4	WCT x COD	5.55	6.19	6.85	6.19	4.60	5.08	5.48	5.05	3.34	3.47	3.37	3.39
5	WCT x GBGD	5.38	5.85	6.50	5.91	4.80	5.23	5.47	5.16	3.20	3.67	3.42	3.43
6	WCT x MYD	5.37	6.05	6.33	5.92	5.15	5.44	5.83	5.47	3.09	3.30	3.13	3.18
7	COD (Control)	6.10	7.02	7.48	6.87	5.80	6.38	6.57	6.25	3.77	4.21	3.90	3.96
CD (P = 0.05%)		A = 0.181 B = 0.119				0.219				0.144 0.214 0.139			

A = Hybrid, B = Month

COD (1.76 mg/100 ml) followed by COD x WCT (1.70 mg/100 ml). Total free amino acid content was less in initial stages of development, which however increased with nut maturity, and in most of the hybrids maximum content was found in the 7 months old nut.

The proportion of potassium and sodium contents in tender nut water were important for its effects on kidney and urinary tract functions. Generally less to optimal levels of sodium and potassium contents were preferred for the best tender nuts. In this study COD x WCT and LCT x COD recorded minimum sodium and potassium contents and were considered as the best. Sodium content was maximum during sixth month stage and decreased towards maturity in all the hybrids whereas potassium is more during sixth month and increased towards maturity (Table. 3).

Organoleptic evaluation conducted with different tasters concluded that taste of tender nut water was observed to be good in 7 and 8 months old nuts and meat at 7 months. Ratnambal (10) also reported good taste of 7 months old nut water. So if the consumer preference is for more water 6 months old nuts are

preferable. If to relish the meat and good water 7 months old nuts are suitable, whereas at 8th month stage even though water is sweeter, quantity of water is less and endosperm is little harder to eat.

From this study it was concluded that composition of tender coconut water significantly differed depending on the variety and maturity of the nut during the season of observation, i.e. summer. For the use of coconut water as a drink the nuts should be harvested when the volume of water, sugars and nutrients in the water is the highest. In that way tender nuts of COD x WCT and LCT x COD were handy with lesser weighing nuts, but advantageous with more volume of water and meaty solid endosperm at 7th month. TSS, total sugars, reducing sugars and mineral contents also showed a considerable increase in these two hybrids at this stage. These significant characteristics might be due to the involvement of COD as one of the parents in these hybrid combinations. With all the above said quantitative and qualitative characteristics the hybrids COD x WCT (Chandrasankara) and LCT x COD (Chandralaksha) released from CPCRI proved to be

Table 3. Mineral contents in tender nut water of coconut hybrids.

Sl. No.	Hybrid	Amino acid (mg/100 ml)				Sodium (ppm)				Potassium (ppm)			
		6	7	8	Mean	6	7	8	Mean	6	7	8	Mean
1	COD x WCT	1.73	1.87	1.61	1.73	24.92	23.30	23.08	23.77	2234	2018	2326	2193
2	LCT x COD	1.69	1.91	1.69	1.76	25.30	23.43	22.75	23.83	2224	2102	2353	2226
3	LCT x GBGD	1.39	1.61	1.51	1.51	33.23	31.65	30.42	31.77	2405	2311	2621	2445
4	WCT x COD	1.28	1.63	1.46	1.45	31.70	30.33	29.63	30.56	2556	2536	2758	2617
5	WCT x GBGD	1.35	1.67	1.51	1.51	29.15	27.52	26.32	27.66	2497	2602	2840	2646
6	WCT x MYD	1.42	1.82	1.54	1.59	26.93	25.85	24.63	25.81	2550	2712	2908	2723
7	COD (Control)	1.74	2.21	2.10	2.02	25.13	23.32	22.80	23.75	1994	2092	2353	2146
CD (P = 0.05%)		A = 0.15 B = 0.099				1.076 0.704				77.26 50.58			

COD = Chowghat Organge Dwarf, WCT = West Coast Tall, LCT = Laccadive Tall, GBGD = Gangabondam Green Dwarf and MYD = Malayan Yellow Dwarf.

A = Hybrid, B = Month

the best not only for yield but for tender nut purpose also.

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