

Short Communication

Studies on physio-chemical changes during development and maturity in fruits of karonda (*Carissa carandas*)

K. K. Misra¹, S.C. Singh² and Priya Awasthi^{3*}

¹Department of Horticulture, College of Agriculture, G.B. P. U. A & T, Pantnagar, Uttarakhand, ²Krishi Vigyan Kendra, Belatal, Mahoba, U.P., ³College of Agriculture, Ganj Basoda (JNKVV, Jabalpur), Vidisha, M.P.

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Karonda (*Carissa carandas* L.) is an important minor fruit crop of India. The plants are used as hedge, orchard and ornamental purposes. The fruits are used for the preparation of number of products as chutney, pickles, jam, jelly, beverages, nakal cherry, candy and coloured wines. The quality of the fresh fruits is the expression of physio-chemical changes that occur during various phases of fruit development. Such studies are important in determining the proper harvesting time. Only meager information is available on the changes in physical parameters of developing fruits of Karonda seedlings (Uthaiiah, 1988). But the information on the physiochemical changes in developing fruits of Karonda is lacking in recently developed varieties. The investigation was therefore undertaken to find out the physio-chemical changes occurring during the development of fruits of Karonda cv. Pant Sudarshan in order to establish the maturity standard for the harvesting of Karonda fruits under *tarai* conditions of Uttarakhand.

The experiment was conducted at Horticultural Research Centre, Patharchatta, Govind Ballabh Pant University of Agriculture & Technology, Uttarakhand during fruiting season of the year 2007. The experiment was conducted on fifteen years old bush of Karonda cv. Pant Sudarshan in completely randomized design using twenty fruits per treatment per replication. The bush was divided into four parts i.e., east, west, north, south and each part was considered as a replication. The fruits were tagged two weeks (15th May) after anthesis when they appear as tiny fruits. The first observation was made on 22nd May. Thereafter, the observations were taken at weekly intervals till complete ripening stage was reached (13th week after anthesis). The observations were recorded on each date for fruit length, diameter, shape index (length/diameter), weight, volume, specific gravity (weight/volume), T.S.S., acidity and T.S.S.: acid ratio. For recording observations, fruits were picked, brought to the laboratory and washed with tap water. Fruit length and diameter were recorded with Vernier's caliper while fruit weight was recorded on electronic balance. Fruit volume was measured by water displacement method. Ten fruits were chopped into small pieces and blended into a homogenous pulp in a mortar for estimation of T.S.S. and acidity. T.S.S. of fruit juices were

determined in per cent by hand refractometer while the acidity of fruit pulp as per cent citric acid was estimated by titrating clear fruit extract against 0.1N NaOH using phenolphthaleine as indicator (Ranganna, 1986). The T.S.S. : acid ratio was determined by dividing T.S.S. with acidity.

A close examination of the data presented in Table 1 and Fig.1 showed that fruit length increased significantly upto 10th week after anthesis. Thereafter, the fruit length decreased. Fruit diameter also increased upto 11th week after anthesis. However it decreased at 12th week and remain constant at the 13th week. Bal and Singh (1978) reported a similar type of increase in ber. The mean fruit weight and volume were increased upto 11th week after anthesis and thereafter the mean fruit and volume decreased with retention of fruit on the tree. The increase in fruit size and weight can be attributed to an increase in the size of the cells and accumulation of food substances in the intercellular spaces in fruit pulp (Bollard, 1970). Similar results were also reported by Soni and Randhawa (1975) in lemon and Jawanda and Bal (1980) in ber cv. ZG-2. Data presented in Table 1 showed that specific gravity of the fruits did not differ significantly.

Data depicted in Table 1 and Fig. 2 showed that T.S.S. of the fruits increased upto 8th week after anthesis and gradually decreased upto maturity i.e. 13th week after anthesis. A decline in T.S.S. at later stage might be due to the utilization of carbohydrates and possibly the oxidation of fats and protein as the respiratory substrate in the respiration process. A close perusal of the data presented in Table1 and Fig 2 showed that acidity of the fruits gradually increased upto 8th week after anthesis and remain constant upto 10th week after anthesis and after gradually decreased upto ripening stage i.e. 13th week after anthesis. The non volatile organic acids are among the major cellular constituent undergoing changes during the ripening of fruits (Pantastico, 1975). Data presented in Table 1 showed that T.S.S. : acid ratio was decreased significantly upto 9th week after anthesis and it increased significantly from 10th week to maturity statge i.e. 13th week after anthesis.

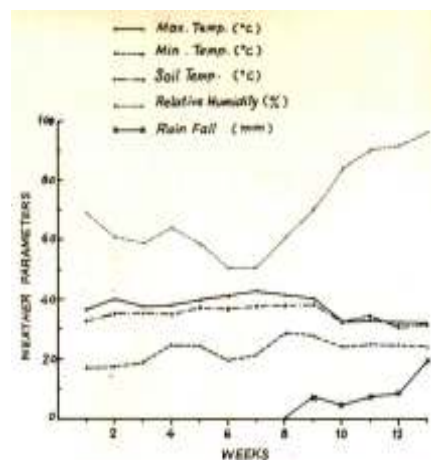
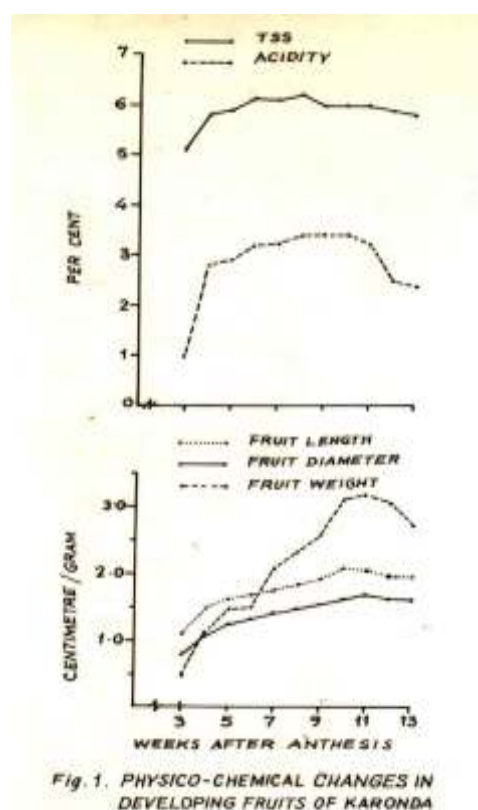
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*Corresponding author's email:
awasthi_5@rediffmail.com

Table 1. Physico-chemical changes in developing fruits of Karonda cv. Pant Sudarshan

Weeks after anthesis	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (gm)	Fruit volume (ml)	Specific gravity	T.S.S. (%)	Acidity (%)	T.S.S./Acidity ratio
3	1.11	0.78	0.45	0.43	1.05	5.10 (13.10)	1.00 (5.70)	5.10
4	1.45	1.08	1.12	1.07	1.05	5.80 (13.90)	2.80 (9.60)	2.07
5	1.63	1.24	1.47	1.43	1.03	5.90 (14.10)	2.90 (9.90)	2.03
6	1.70	1.33	1.48	1.45	1.02	6.10 (14.30)	3.20 (10.40)	1.91
7	1.78	1.43	2.07	2.05	1.01	6.10 (14.30)	3.30 (10.50)	1.85
8	1.85	1.49	2.31	2.26	1.02	6.20 (14.40)	3.40 (10.60)	1.82
9	1.91	1.53	2.58	2.55	1.01	6.00 (14.20)	3.40 (10.60)	1.77
10	2.10	1.64	3.10	3.07	1.01	6.00 (14.20)	3.40 (10.60)	1.77
11	2.07	1.68	3.17	3.14	1.01	6.00 (14.20)	3.30 (10.50)	1.82
12	1.98	1.61	3.04	2.98	1.02	5.90 (14.10)	2.50 (9.20)	2.36
13	1.96	1.61	2.73	2.66	1.03	5.80 (13.90)	2.40 (8.90)	2.42
S.Em.±	0.05	0.04	0.09	0.08	0.06	(0.20)	(0.10)	0.03
C.D. at 5%	0.17	0.12	0.28	0.27	NS	(0.50)	(0.30)	0.13



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