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Studies on the physico-chemical characteristics of aonla (*Emblica officinalis*) fruits in Chittorgarh district of Rajasthan

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Abstract

The nutritional survey conducted on aonla fruit orchards at different locations in Chittorgarh district of Rajasthan. Variation observed for quality parameters of aonla fruits in different locations. The soil nutrient status influences the quality parameters of the fruits. The average fruit weight of aonla varied from 32.71 to 38.40 g per fruit with the mean value of 35.68 g/fruit. The pooled average fruit length and fruit breadth varied 3.11 to 3.41 cm and 3.79 to 4.15 cm, respectively. The pooled stone weight varied from 1.89 to 2.05 g and pulp to stone ratio ranged from 17.30 to 18.74. The fruit yield per tree ranged from 54.88 to 71.43 kg plant^{-1}. The total soluble solids content ranged from 10.76 to 11.78° Brix and total acidity was recorded between 1.85 to 1.93 per cent. The TSS/acid ratio, ascorbic acid contents, total sugar and reducing sugars varied from 5.58 to 6.35, 411.65 to 581.50 mg/100 g pulp, 4.97 to 6.28 % and 1.71 to 2.10 %, respectively. The quality parameters is found to be directly related to soil nutrient status, hence, better nutrition is likely to improve the quality parameters of aonla fruits.

Key words: Aonla, Physico-chemical, Nutrition status, Yield.

Introduction

Aonla (*Emblica officinalis*) belonging to the family Euphorbiaceae, is a native of Central and Southern India. Aonla is one of the important fruit from Ayurvedic consideration. This fruit has little table value but it is processed in various forms and utilized in large quantities. Its importance in Ayurvedic medicine system can be ascribed to its richness in vitamin-C and some organic acids and phenolic substances. The plant is quite hardy, also grown on alkaline soil, prolific bearer giving high yield; although, it is the most neglected crop. The fruit is small, round and have hard astringent pulp. It is mainly used for making pickles, *murabba*, candy, juice, tophies, powder etc. The major aonla growing districts in Rajasthan are Ajmer, Bhilwara, Chittorgarh, Udaipur, Kota, Bundi, etc. The nutritional status of soil supplementaled with regular nutritional management plays an important role in production of quality harvest in any crop. Such basic information on aonla crop in Chittorgarh district of Rajasthan were lacking, where aonla has a great potential. To generate such preliminary information, the present study were undertaken.

Materials and Methods

Studies were conducted on healthy and vigorously growing trees of aonla at farmer's fields during 2009-10 to 2010-11 at Chittorgarh (24° 13' to 25° 13' N latitude and 74° 12' to 75° 53' E latitude). Five orchards of uniform age with same variety (Chakaiya) were selected for investigation. The fruits were harvested during December. Ten fruits were randomly collected for quality parameters (physico-chemical) analysis. Fruit TSS was measured with "Zeiss" hand refractometer. Total acidity was determined by diluting the known volume of juice and titrating the same against N/10 sodium hydroxide solution, using phenolphthalein as an indicator. It was expressed on percentage basis (A.O.A.C., 1990). TSS/Acidity ratio was estimated by dividing the total soluble solids to total acidity. The ascorbic acid (Vitamin C) content of juice was determined by diluting the known volume of juice with 3 per cent Metaphosphoric acid and titrating it against 2,6-dichlorophenol-indophenol dye solution (A.O.A.C.,1990) until a faint pink colour was obtained. The results are expressed as vitamin C in mg/100 g pulp. Total sugar content was determined using anthrone reagent method (Dubois *et al.*, 1951).To 1 ml of diluted fruit juice (100 times), 5 ml of anthrone reagent was added, then heated for 10 to 15 minutes in a water bath, cooled to room temperature and absorbance was measured at 630 nm on Spectronic-20. Reducing sugar content was measured by following 'Nelson's modification' of 'Somogyis method' (Somogyis, 1952) using arsenomolybdate colour forming reagent and two copper reagent 'A' and 'B'. The details of fruit orchards and NPK status of soil where the present study was conducted are mentioned in table 1.

Results and Discussion

The data on quality parameters (physico- chemical characteristics) of aonla fruit are presented in table 2 to 5. The

results clearly indicated the extent of variation observed for all the morphological and chemical characteristics of aonla fruit from different orchards. The perusal of pooled data presented in table 2 indicated that average fruit length varied from 3.11 to 3.41 cm with mean value of 3.24 cm. The maximum fruit length (3.41 cm) was recorded at the orchard of Gangrar I while; minimum fruit length (3.11 cm) was recorded at Aonwalheda II. The average fruit breadth varied from 3.79 to 4.15 cm with the mean value of 3.98 cm (Table 2). The highest fruit breadth (4.15 cm) was recorded at Gangrar I while; minimum fruit breadth (3.79 cm) was recorded at Aonwalheda II (Table 2). It is evident that average fruit weight of aonla varied from 32.71 to 38.40 g per fruit with the mean value of 35.68 g/fruit. The maximum fruit weight (38.40 g per fruit) was recorded at Gangrar I while, minimum fruit weight (32.71g per fruit) was recorded at Aonwalheda II (Table 2). The pooled data revealed that average stone weight of aonla varied from 1.89 to 2.05 g per fruit with the mean value of 1.97 (Table 3). The maximum seed weight (2.05 g per fruit) was recorded of Gangrar I while, minimum stone weight (1.89 g per fruit) was recorded at Aonwalheda II. It is apparent from pooled data (Table 3) that average pulp: stone ratio of aonla fruit varied from 17.30 to 18.74 per fruit with the mean value of 18.10. The maximum pulp: stone ratio (18.74 per fruit) was recorded at the orchard of Gangrar I while, minimum pulp: seed (17.30 per fruit) was recorded at Aonwalheda II. The average yield of aonla fruit varied from 54.88 to 71.43 kg plant^{-1} with the mean value of 61.20 kg plant^{-1} (Table 3). The maximum yield (71.43 kg plant^{-1}) was recorded at the orchard of Gangrar I while; minimum yield (54.88 kg plant^{-1}) was recorded at Aonwalheda II. Significant differences were recorded in the physical characteristics among different orchards of study area. Similar variations in these parameters were reported by Mehta *et al.* (2002) at Hisar and Rohitash (2007) at Bikaner in aonla fruit. Application of adequate quantity of manure and fertilizers and adoption of appropriate management practices might have created the difference in physico chemical characteristics and fruit yield of aonla plants. Proper management of orchards is essential for obtaining quality fruits and yield. Rajan *et al.* (2005) reported that application of nitrogen significantly improved the fruit weight in aonla.

It is obvious from pooled data (Table 4) that average total soluble solids of aonla fruit varied from 10.76° Brix to 11.78° Brix with the mean value of 11.40° Brix. The maximum total soluble solids (11.78° Brix) were recorded at the orchard of Gangrar I while, minimum total soluble solids (10.76° Brix) was recorded at peepalipal. The average total acidity of aonla fruit varied from 1.85 to 1.93 % with the mean value of 1.89 % (Table 4). The minimum total acidity (1.85 %) was recorded at the orchard of Bhiliyakhedi I while; maximum total acidity (1.93) was recorded at Peepalipal. Average TSS/Acidity ratio of aonla fruit varied from 5.58 to 6.35 with the mean value of 6.04. The maximum TSS/Acidity ratio (6.35) was recorded at the orchard of Bhiliyakhedi I while, minimum TSS/Acidity ratio (5.58) was recorded at Peepalipal (Table 4). It is obvious from pooled data (Table 5) that average ascorbic acid of aonla fruit varied from 411.65 to 581.50 mg/100 g pulp with the mean value of 511.59 mg/100 ml pulp. The maximum ascorbic acid (581.50 mg/100 g pulp) were recorded at the orchard of Gangrar I while, minimum ascorbic acid (411.65 mg/100 g pulp) was recorded at Peepalipal. Average reducing sugar of aonla fruit varied from 1.71 to 2.10 % with the mean value of 1.92 %. The maximum reducing sugar (2.10%) was recorded at the orchard of Gangrar I while, minimum reducing sugar (1.71 %) was recorded at Peepalipal (Table 5). It is clear from

Table 1. Soil nutritional status of different orchards location at Chittorgarh district

S.No.	Name of fruit grower	Location	Soil Nutritional Status		
			N (kg/ha)	P (kg/ha)	K (kg/ha)
1.	Sh. Kan Singh Rathore	Gangrar I	409.29	18.93	350.52
2.	Sh. Jagdish Kumar Teli	Aonwalheda I	396.69	17.32	201.09
3.	Sh. Nirmal Kumar Joshi	Samelpura	295.83	18.19	222.51
4.	Smt. Ratan Devi Khavya	Peepalipal	353.46	15.86	270.82
5.	Smt. Usha Sisodia	Bhiliyakhedi I	378.24	19.56	261.34

Table 2. Physical characteristics of aonla fruits cv. Chakaiya at different orchards of Chittorgarh district

Location of the orchard	Fruit length (cm)			Fruit breadth (cm)			Fruit weight (g)		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Gangrar I	3.34	3.48	3.41	4.09	4.21	4.15	38.34	38.45	38.40
Aonwalheda II	3.06	3.16	3.11	3.72	3.86	3.79	32.69	32.72	32.71
Samalpura	3.17	3.31	3.24	3.89	4.07	3.98	35.26	36.15	35.71
Peepalipal	3.09	3.23	3.16	3.99	3.85	3.92	34.83	35.12	34.98
Bhiliyakhedi I	3.22	3.36	3.29	3.98	4.14	4.06	36.52	36.72	36.62
Mean	3.18	3.31	3.24	3.93	4.03	3.98	35.53	35.83	35.68
	0.069	0.074	0.0504	0.082	0.082	0.058	0.561	0.585	0.405
CD at 5 %	0.195	0.211	0.142	0.232	0.233	0.162	1.597	1.665	1.138

Table 3. Physical characteristics and yield of aonla fruits cv. Chakaiya at different orchards of Chittorgarh district

Location of the orchard	Stone weight (g)			Pulp : Stone ratio			Yield (Kg^{-1})		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Gangrar I	2.02	2.08	2.05	18.99	18.49	18.74	69.53	73.33	71.43
Aonwalheda II	1.86	1.92	1.89	17.57	17.03	17.30	51.78	57.97	54.88
Samalpura	1.93	1.99	1.96	18.26	18.16	18.21	57.22	61.19	59.21
Peepalipal	1.98	1.90	1.94	17.57	18.47	18.02	56.70	60.26	58.48
Bhiliyakhedi I	1.97	2.05	2.01	18.52	17.90	18.21	60.89	63.11	62.00
Mean	1.95	1.98	1.97	18.18	18.01	18.09	59.22	63.17	61.20
SEm±	0.037	0.023	0.0218	0.263	0.314	0.2048	3.997	2.543	2.369
CD at 5 %	0.106	0.065	0.0612	0.749	0.896	0.5758	11.386	7.244	6.656

Table 4. Chemical characteristics of aonla fruits cv. Chakaiya at different orchards of Chittorgarh district

Location of the orchard	T.S.S (^{0}B)			Total acidity (%)			TSS/Acidity ratio		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Gangrar I	11.87	11.69	11.78	1.88	1.86	1.87	6.31	6.28	6.30
Aonwalheda II	10.87	11.25	11.06	1.93	1.89	1.91	5.63	5.95	5.79
Samalpura	11.57	11.74	11.66	1.90	1.86	1.88	6.09	6.32	6.20
Peepalipal	10.58	10.94	10.76	1.92	1.94	1.93	5.51	5.64	5.58
Bhiliyakhedi I	11.82	11.67	11.75	1.84	1.86	1.85	6.42	6.27	6.35
Mean	11.34	11.46	11.40	1.89	1.88	1.89	5.99	6.09	6.04
	0.172	0.126	0.107	0.021	0.021	0.015	0.089	0.087	0.062
CD at 5 %	0.488	0.359	0.299	0.058	0.058	0.041	0.254	0.248	0.175

Table 5. Chemical characteristics of aonla fruits cv. Chakaiya at different orchards of Chittorgarh district

Location of the orchard	Ascorbic acid (mg/100 ml pulp)			Reducing sugar (%)			Total sugar (%)		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Gangrar I	583.42	578.57	580.99	2.05	2.13	2.09	6.25	6.31	6.28
Aonwalheda II	423.17	435.39	429.28	1.77	1.89	1.83	4.90	5.04	4.97
Samalpura	564.63	570.88	567.76	1.86	1.92	1.89	6.04	6.10	6.07
Peepalipal	514.45	526.66	520.55	1.68	1.74	1.71	5.68	5.76	5.72
Bhiliyakhedi I	412.56	410.74	411.65	2.01	2.09	2.05	5.92	6.02	5.97
Mean	499.65	504.45	502.05	1.87	1.95	1.91	5.76	5.85	5.80
	5.897	5.635	4.078	0.062	0.065	0.045	0.078	0.065	0.051
CD at 5 %	16.797	16.051	11.458	0.177	0.186	0.127	0.223	0.184	0.143

pooled data (Table 5) that average total sugar of aonla fruit varied from 4.97 to 6.28 % with the mean value of 5.80 %. The maximum total sugar (6.28 %) was recorded at the orchard of Gangrar I while, minimum total sugar (4.97 %) was recorded at Aonwalheda II. Variability in chemical parameters might be due to the variation in nutrient status of the orchards. These chemical parameters are directly related with nutrients status of plant. Srivastava and Singh (1997) reported that TSS varied from 8 to 14 per cent in germplasm survey of aonla at Faizabad. Rohitash (2007) also reported that PNP TSS varied from 8.50° Brix to 9.50 ° Brix in fruit from aonla orchards at Bikaner district. Rajan *et al.* (2005) reported that application of nitrogen significantly improve the TSS and ascorbic acid content in fruit of aonla.

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