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Comparative Studies of Physico-chemical Characteristics of Different Cultivars of Aonla (*Emblica officinalis* Gaerth.) Under Sub-tropical Condition

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ABSTRACT

An investigation was conducted in anola crop during 2022-2023 to find out variation in fruit and fruit characteristics of different Aonla (Emblica officinalis Gaerth.) cultivars. NA-6, NA-7, NA-10, Kanchan and Chakaiya were taken up under semi-arid condition of Bhai Gurdas Degree College, Sangrur, Punjab-India. The experimental findings pertaining to fruit physical yield attribute characters such as number of fruits, weight of fruit, stone and seed, length of fruit, diameter of fruit, and chemical characters such as moisture percentage, TSS, total sugar and vitamin-C content in aonla cultivars. The number of fruits per kg of aonla fruits (273) was found significantly maximum under wild cultivar, followed by NA-10 (61) and it was statistically non - significant to Chakaiya cultivar with 58.75 fruits/kg and the minimum number of fruits per kg (50.75) was recorded in NA-7 cultivar. The maximum fruit weight (22.25 g) was recorded in under Banarasi but it was statistically at par with NA-7 and Chakaiya cultivars 21.88 and 21.43 (g).

Keyword: *Banarasi, cultivar, fruit, chakaiya.*

INTRODUCTION

The Indian gooseberry *(Emblica officinalis* Gaerth L.) belongs to family Euphorbiaceae is an important indigenous and minor fruit of Indian subcontinent. Owing to hardy nature, suitability to various waste-lands, high productivity, nutritive and therapeutic value, the aonla has proved to become an important fruit. It is one of the oldest Indian fruits associated with a tradition, culture and heritage. The aonla is native to tropical South-Eastern Asia. Aonla is one of the main constituent of many ayurvedic preparations like Triphla and Chawanprash (Pant et al., 2004; Goyal et al., 2007; & Mishra et al., 2009). The commercial cultivation of aonla is expended from the home land of Uttar Pradesh to almost all over India including Maharashtra, Gujarat, Rajasthan, Madhya Pradesh, Jharkhand, Bihar, Orrisa, West-Bengal, Karnataka, Chhattisgarh, Andhra Pradesh, Haryana, and Himachal Pradesh.

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The size of fruits starts to increase from the first week of August up to end of November. Aonla is a small to medium size tree, normally reaching a height of 10-12 m; natural wild seedlings grow still higher. The trees of this fruit have two types of shoots, the indeterminate and determinate. Indeterminate shoots are longer and attain fresh growth in the season and do not bear flowers, while determinate shoots assize at the nodes of indeterminate shoots and numbers vary from 3-5 depending upon the genotype. Determinate shoots bear very small reduced, closely arranged leaves giving the impression of pinnately compound leaves. The fruits are round or oblate, indented at the base with smooth and shinning surface, 6 to 8 faded lines from base to apex give the impression of ridges and divided segments in the fruits. Fruit is light green at maturity and ripe fruit is greenish-yellow. The flesh of fruit is thick fibrous or non fibrous depending on the cultivars. The present investigation was undertaken to study the physicochemical composition of aonla varieties for product suitability.

MATERIAL AND METHODS

The studies were carried out at the main experimental farm of Department of Horticulture, Bhai Gurdas Degree College, Sangrur, Punjab-India during the year 2022-2023. The present investigation was undertaken during *Rabi* 2022- 2023 at the Agronomy Research Farm. The experiment was carried out at the Bhai Gurdas Degree College, Sangrur, agriculture farm in Sangrur, Punjab, India. The experimental site is located in Punjab between latitudes 76°-22'E and 76°-46'E, and longitudes 30°-36'N to 30°-39'N, with a mean elevation of 279 metres above sea level. The experimental site had a uniform topography and was well-drained. Sangrur's climate is typically semi-arid and subtropical, with temperature extremes in both summer and winter, low rainfall, and moderate humidity. Summer temperatures can reach 45 degrees Celsius in May and June, while winter temperatures rarely fall below 4 degrees Celsius in December and January. Sangrur's annual rainfall in 2022-2023 was 343 mm.

The experiment was carried out at the agriculture farm, Bhai Gurdas Degree College, Sangrur, Punjab-India. Geographically, experimental site located in Punjab between latitudes 76°-22'E and 76°-46'E and longitudes 30°-36'N to 30°-39'N, with a mean elevation of 279 metres above sea level. The experimental of site was uniform in topography and well-drained. The climate of Sangrur is typically semi-arid & sub tropical, characterized by extremes of temperature both in summer and winter with low rainfall and moderate humidity. Maximum temperature in summer is as high as 45 °C in May-June and minimum temperature in winter falls below 4 °C in Dec-Jan. The annual rainfall of Sangrur was 343 mm in 2022-2023.

During the month of December 2022, the mature and ripe fruits of aonla cultivars were collected randomly from selected plants at the Horticultural Research Centre. The experiments were laid out in Randomized block design (RBD) with four replications. During the experimentation, the following physico-chemical characters were recorded. Ten fruits under each replication were randomly selected and tagged for recording the observations. The data were analyzed according to the procedure of analysis of randomized block design (Snedecer & Cochran, 1968). The significance of variation among the treatments was observed by applying analysis of variance (ANOVA) and critical difference (C.D.) test at 5% probability level.

RESULT AND DISCUSSION

The experiment entitled “Comparative Studies of Physico-chemical Characteristics of Different Cultivars of Aonla (*Emblica officinalis Gaerth.*) Under Sub-tropical Condition” was conducted at Bhai Gurdas Degree College, Sangrur, Punjab-India during the year 2022-23. The experimental findings pertaining to fruit physical yield attribute characters such as number of fruits, weight of fruit, stone and seed, length of fruit, diameter

of fruit, and chemical characters such as moisture percentage, TSS, total sugar and vitamin-C content in aonla cultivars. The number of fruits per kg of aonla fruits (273) was found significantly maximum under wild cultivar, followed by NA-10 (61) and it was statistically non significant to Chakaiya cultivar with 58.75 fruits/kg and the minimum number of fruits per kg (50.75) was recorded in NA-7 cultivar. The maximum fruit weight (22.25 g) was recorded in under Banarasi but it was statistically at par with NA-7 and Chakaiya cultivars 21.88 and 21.43 (g) respectively. The minimum fresh fruit weight (3.90 g) was however with noted with wild cultivar. The significantly maximum (2.05 cm) fruit length was obtained under NA-10 cultivar. Fruit length of NA-7, Banarasi were found to be statistically non significant. The minimum fruit length (0.46 cm) was recorded under Wild cultivar. The maximum fruit diameter (3.29 cm) was recorded under NA-7 and it was statistically at par with Chakaiya (3.22 cm) and fruit diameter of these cultivars was significantly higher than all other cultivars. The minimum fruit diameter was founded (0.95 cm) in Wild cultivar. The maximum moisture percentage of fruit (70.05) was recorded under NA-7 and it was statistically at par with Wild cultivar (69.84) and moisture percentage of these two cultivars was significantly higher than all other cultivars. Moisture percentage of fruits of Chakaiya and Banarasi were also found to be statistically non significant. The minimum moisture percentage of fruit (60.85) was observed under Banarasi cultivar. TSS of fruit in aonla cultivars varied from 9.26 to 14.18^0 Brix. The highest TSS content (14.18^0 Brix) was recorded under NA-7 and it was statistically at par with NA-10 (13.10^0 Brix) and TSS of fruit of this cultivars was significantly higher than all other cultivars. TSS of fruit in Banarasi, NA-7 (10.14^0 Brix) and Chakaiya (9.26^0 Brix) were also found to be statistically non significant. The minimum TSS of fruits was obtained (9.26^0 Brix) in Chakaiya cultivar. the maximum acidity of fruits (1.97 %) was found under Wild cultivar. It was statistically at par with NA-7, (1.83 %) and Chakaiya (1.78 %) cultivars. Acidity of fruits of these cultivars was significantly higher than all other cultivars. The minimum acidity was recorded (1.50 %) in NA-10 cultivar. the vitamin C content of aonla cultivars varied from 248.85 to 643.50 mg/100 g pulp and the maximum vitamin C content was recorded under Chakaiya (645.50 mg/100 g) and it was significantly higher than all other cultivars. It was followed by Banarasi (607.05 mg/100 g). Vitamin C content between NA-10 and NA-7 was found to be statistically non significant. The minimum vitamin C content (248.85 mg/100 g) was recorded with Wild cultivar and it was significantly lower than all other cultivars.

Mean performance of cultivars for number of fruits per kg and weight of fresh fruits in aonla

Cultivar	No. of fruits/kg	Wt. of fresh fruits (gm)
NA-7	50.75	21.88
NA-10	61.00	16.90
Banarasi	54.25	22.25
Chakaiya	58.75	21.43
Wild	273.00	3.90
S.Em±	1.65	0.44
C.D. at 5%	5.10	1.36

Mean performance of cultivars for average fruit length and diameter of aonla

Cultivars	Average fruit length (cm)	Average fruit diameter (cm)
NA-7	1.74	3.29
NA-10	2.05	2.58
Banarasi	1.69	2.27
Chakaiya	1.64	3.22
Wild	0.46	0.95
S.Em±	0.03	0.06
C.D. at 5%	0.08	0.19

Mean performance of cultivars for moisture percentage and TSS of aonla fruits

Cultivars	Moisture %	Total soluble solids (^{0} Brix)
NA-7	70.05	10.14
NA-10	64.41	13.10
Banarasi	60.85	10.58
Chakaiya	62.10	9.26
Wild	69.84	14.18
S.Em±	1.10	0.42
C.D. at 5%	3.37	1.30

Mean performance of cultivars for titratable acidity percentage and vitamin C of aonla fruits

Cultivars	Acidity (%)	Vitamin-C (mg/100g)
NA-7	1.83	516.80
NA-10	1.50	532.43
Banarasi	1.70	607.05
Chakaiya	1.78	643.50
Wild	1.97	248.85
S.Em±	0.06	10.51
C.D. at 5%	0.20	32.39

The minimum number of aonla fruit (50.75) was found in the NA-7, while maximum number of fruit (273.00) was found in the Wild cultivar. It might be due to morphological and varietal characteristics variation in fruit characters of different cultivars. These results are in close conformity with findings of (Maholiya et al., 2014) four aonla cultivars namely Kanchan, Krishna, Chakaiya and NA-7 under Parbhani, Maharashtra conditions. Rao and subramanyam (2009) reported that the cultivar NA-6 had maximum number of fruits (954) as compare to other aonla cultivars. Similar finding were reported in Banarasi cultivar while comparing four varieties on aonla viz. Banarasi, Chakaiya, NA-7 and Desi (Singh *et al.*, 2012) Almost Similar finding have been reported by (Singh & Arora, 1967) in Banarasi and desi cultivar.

Maholiya et al. (2014) in NA-7 cultivar in Parbhani, Maharashtra conditions. Kumar and Singh (2002) found that the fruit weight varied from 29.50 g to 64.40 g in ten aonla cultivars evaluated under Uttar Pradesh conditions. Shrivastava et al. (1997), observed fruit weight in the range of 26.91 g to 50.55 g in various aonla genotypes in India. Aulakh et al. (1997). found highest fruit weight in Chakaiya (30.80 g) under kandi area of Punjab. (Ranote et al., 2002) in Francis cultivar, (Ghosh et al., 2013) in Neelum cultivar and (Nayak et al., 2012) in Kanchan cultivar. (Supe et al., 1997) had done work on the physico-chemical analysis of different aonla cultivars under Maharashtra conditions

and found significant variation in fruit weight. Singh et al. (2004). Jaiswal et al. (2007) also reported variability in fruit weight of different cultivars of aonla in Faizabad, U.P. India. Patel et al. (2009) also reported significant variation in fruit weight of two local selections, two hybrids and three cultivated varieties of aonla at Gujarat. Singh et al. (2009) evaluate the 8 different aonla cultivars in Raipur, Chhattisgarh, India and reported variability in fruit weight at maturity stage.

Supe et al. (1997) had done work on the physico-chemical analysis of different aonla cultivars under Maharashtra conditions and found significant variation in fruit length. Among all cultivars the maximum diameter of aonla fruit (3.29 cm) was found in the NA-7 cultivar, while the minimum diameter of fruit (0.95 cm) was recorded in the wild cultivar. Similar finding were reported by Maholiya et al. (2014) at Parbhani, Maharashtra conditions in NA-7 cultivar while comparing four varieties on aonla viz. Kanchan, Chakaiya, Krishna and NA-7 cultivars. Ghosh et al. (2013) reported significant variation in fruit breadth of seven aonla cultivars at Paschim Medinipur, West Bengal.

Singh et al. (1984). According to Supe et al. (1997) the delay in harvesting increased the ascorbic acid content in aonla fruits. Singh et al. (2004) had done the work on evaluation of aonla varieties for fruit processing at Faizabad, U.P. to evaluate the suitability of aonla cultivars and found variability in ascorbic acid. Kumar and Singh (2002) recorded that the Vitamin C content ranged from 305.70 mg/100 gm pulp in NA-6 to 700 mg/100 gm pulp in Chakaiya among ten cultivars evaluated at Faizabad U.P. conditions.

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Author Contribution
All authors have participated in critically revising of the entire manuscript and approval of the final manuscript.

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