Original Research Article

EVALUATION OF AONLA VARIETIES FOR YIELD AND QUALITY UNDER SEMI-ARID CONDITIONS

Abstract

This study, conducted at the Horticulture College and Research Institute for Women, Trichy, during 2023, aimed to assess the evaluation of Aonla (Indian gooseberry) under arid zone conditions of Trichy, focusing on yield and quality parameters. The experiment was laid out in Completely Randomised Design (CRD) with 5 treatments as varieties and three replication. The varities are BSR 1, Krishna (NA 5), Kanchan (NA 4), NA 7, and Chakaiya. NA 7 is recommended for its high yield potential in limited spaces, aligning with the trend of high-density planting. BSR 1 excels in Total Soluble Solids, while Chakaiya stands out in acidity and ascorbic acid content. These insights guide cultivar selection for sustainable Aonla cultivation in semi-arid regions, crucial for meeting population demands.

Keywords: Aonla, varieties, yield, quality, arid zone

1. Introduction

The global population, currently at 7.87 billion, is growing at a rate of 1.03% annually and is projected to reach approximately 9.6 billion by 2050. India, with 1.38 billion people, comprises 17.5% of the world population but occupies only 2.4% of the world's surface area (Plesse, 2020). Addressing the challenge of providing stable, safe, and nutritious food to this growing population is paramount. India ranks 101st out of 116 countries on the Global Hunger Index (GHI), highlighting the urgent need to combat malnutrition, which hampers socio-economic progress. The World Health Organization (WHO) identifies hunger as a serious global issue, particularly affecting African countries and India. To tackle malnutrition comprehensively, 195 nations have committed to adopting sustainable development goals (SDGs) by 2030 (WHO, 2016). There is growing consumer awareness regarding the health benefits of fruits, driving increased demand for nutrient-dense options as part of a balanced diet, especially in light of the COVID-19 pandemic (Jaacks et al., 2021).

In India, major fruit crops such as mango, banana, citrus, guava, and apple dominate more than 72% of total fruit crop area, while indigenous fruit crops cover only 6.56% of the area but exhibit high productivity (11.47 tons/ha) (Priyanka and Kerur, 2023). Climate change exacerbates challenges by raising temperatures, UV radiation levels, and the frequency of extreme events like droughts and floods, posing significant threats to sustainable fruit

production. To ensure nutritional food security in such conditions, there's a need to explore underutilized native fruit crops resilient to climatic variations and adaptable to diverse agro-climatic conditions. Despite their nutritional value and environmental resilience, underutilized fruit crops face limitations due to inadequate research, limited variety availability, and insufficient post-harvest management practices.

Underutilized fruit crops offer therapeutic and nutritional benefits and serve as horticultural assets for ensuring food security, along with providing recreational, social, and environmental significance. These resilient species can enhance sustainable farm income in arid and semi-arid regions, including waste lands, marginal or saline soils, and rocky terrains. Their development is advancing rapidly, with increased technological adoption, extension efforts, and policy planning. However, further research and development, especially in packaging practices and superior variety cultivation, are essential. Leveraging the potential of underutilized fruit crops can significantly contribute to global malnutrition eradication efforts, particularly in arid and semi-arid regions (Meghwal et al., 2022).

Aonla, or Indian gooseberry, is a subtropical fruit grown in regions with 350-500 mm of annual rainfall, particularly in central and southern India. Known for its medicinal properties and high nutritional value, it's dubbed "Amrit Phal" or the fruit of life. A rich source of vitamin C, it also contains thiamine, riboflavin, pectin, and minerals like iron, calcium, and phosphorus. Processed aonla finds use in various forms such as chutney, candy, preserves, sauce, dried chips, tablets, jellies, and pickles (Kumar et al., 2013). Aonla is best suited for arid zone.

The objective of the study is

1. To assess the growth, yield and quality parameters of aonla under semi-arid zone

2. Materials and methods

The current study on evaluating Aonla under semi- arid conditions aimed to examine both yield and quality parameters, including phytochemical analysis. The research was conducted at the experimental farm of the Horticulture College and Research Institute for Women in Tiruchirapalli during the year 2023 through a field experiment. The experimental design employed was a Completely Randomized Design (CRD) with five treatments representing different varieties and three replications. Each replication comprised eight plants. The study investigated the performance of five distinct treatments representing different Aonla varieties: BSR 1, Krishna (NA 5), Kanchan (NA 4), NA 7, and Chakaiya. These treatments were meticulously selected to represent a diverse range of Aonla cultivars, thereby ensuring comprehensive assessment of the crop's characteristics under arid conditions. Such a systematic

approach enhances the reliability and applicability of the findings, allowing for informed decisions regarding cultivar selection and cultivation practices.

Growth parameters such as tree height, canopy area spread, number of branches, days taken for first flowering, fruit set, number of fruits per bunch, number of fruits per tree, mean fruit weight, mean bunch weight, fruit size (including fruit length and girth), number of seeds per fruit, pulp:stone ratio, and yield per tree were recorded to assess the vegetative and reproductive performance of Aonla varieties.

For determining quality parameters, Total Soluble Solids (TSS), dry matter content, ascorbic acid, and thiamine content were analyzed. The presence of Total Soluble Solids (TSS) was determined using a Hand Refractometer, while dry matter content was calculated by subtracting the weight of dried fruit from the initial weight of fresh fruit and expressing the result as a percentage. Ascorbic acid content was estimated using the dye method, where ascorbic acid reduces a dye solution to a colorless compound, with the amount of dye consumed being equivalent to the amount of ascorbic acid present in the sample (Loeffler and Ponting, 1942).

3. Result and discussion

The evaluation of five cultivars of Aonla (Indian gooseberry) under arid conditions revealed significant variations in growth and physicochemical characteristics. Among the cultivars, NA 7, NA 4, Krishna, BSR 1, and Chakaiya, distinct differences were observed in their growth parameters. Notably, plant shape varied, with spreading observed in Chakaiya, Krishna, NA 7, and BSR 1, while the maximum plant height was recorded in Krishna (5.72 m), followed by Kanchan and NA 7. Conversely, Chakaiya exhibited the minimum plant height, indicative of the diverse genetic makeup influencing growth habits under arid conditions. Differences in growth characteristics such as plant shape, height, spread, stem girth, volume, and canopy area can be attributed to the specific climatic needs of the variety and the genetic composition of the cultivar. This observation aligns with the results reported by Kumar et al., 2011.

Table 1: Observations on Plant growth parameter in Aonla

S. No	Variety	Tree height (m)	Canopy Area (m 2)	No. Of Branches	No.Of Fruits / Bunch
1.	**BSR 1**	5.30	23.08	24	3
2.	**Krishna (NA 5)**	5.72	25.74	21	5

3.	**Kanchan (NA 4)**	5.69	15.98	19	8
4.	**NA 7**	5.56	15.59	23	3
5.	**Chakaiya**	4.90	25.74	36	4
	SEM	0.05	0.19	0.32	0.02
	CD @ 5%	0.16	0.59	0.97	0.08

In terms of fruit characteristics, a range of shapes, including flattened round, triangular, oval, and round, were observed among the cultivars. Additionally, variations in free base and fruit apex were noted, contributing to the overall diversity in fruit morphology. Notably, Chakaiya exhibited the maximum fruit weight, while BSR 1 displayed the minimum, underscoring the importance of genetic factors in determining fruit size and weight. Similarly, NA 7 showcased the maximum fruit length, highlighting the potential for selecting cultivars with desirable fruit attributes for commercial production.

Table 2: Observations on Fruit Set and Fruit characteristics in Aonla

S. No	Variety	No. of Fruits /Tree	Fruit base (Cavity at stem end)	Fruit shape	Fruit weight (g)
1.	**BSR 1**	48	Flat	Flattened round	5.89
2.	**Krishna (NA 5)**	70	Flat	Triangular	27.82
3.	**Kanchan (NA 4)**	67	Shallow	Flattened round	15.36
4.	**NA 7**	64	Flat	Oval	28.06
5.	**Chakaiya**	73	Shallow	Flattened round	35.47
	SEM	0.86	-	-	0.10
	CD @ 5%	2.60	-	-	0.32

Physicochemical analyses revealed significant differences among the cultivars in terms of Total Soluble Solids (TSS) and ascorbic acid content. BSR 1 exhibited the highest TSS, while Chakaiya displayed the maximum ascorbic acid content. These variations were attributed to both varietal characteristics and local soil and climatic conditions, emphasizing the need for

tailored agronomic practices to optimize fruit quality and nutritional value under arid environments. Variations in qualitative characteristics may stem from genetic differences among cultivars, a notion supported by observations made by Nagar et al. in 2017 regarding bael. The diversity seen in growth parameters could be attributed to specific genetic traits of the germplasm or cultivar. Increased fruit weight may be linked to genotype characteristics. Additionally, fruit weight and size could be influenced by the bearing habit and yield potential of the variety, as noted by Malshe et al. in 2016. Similar findings regarding aonla in laterite soil of West Bengal were reported by Ghosh et al. in 2013. Differences in chemical composition may be linked to varietal traits and the specific soil and climate conditions of the area, as suggested by Malshe et al. in 2016.

Table 3: Observations on Fruit characteristics in Aonla

S. No	Variety	Fruit Length (cm)	Fruit breadth (cm)	Yield /plant (kg)
1.	**BSR 1**	1.87	2.28	36.00
2.	**Krishna (NA 5)**	3.18	3.47	65.33
3.	**Kanchan (NA 4)**	2.43	2.94	90.00
4.	**NA 7**	3.31	3.43	48.67
5.	**Chakaiya**	3.28	3.70	70.00
	SEM	0.02	0.02	0.63
	CD @ 5%	0.07	0.08	1.90

Furthermore, yield assessments demonstrated varying productivity among the cultivars, with NA 7 exhibiting the highest yield per plant, followed by Chakaiya and BSR 1. Yield per unit volume and per unit canopy area were also calculated to assess fruiting intensity and suitability for increased yields under population pressure. These findings underscore the importance of varietal selection based on growth, fruit characteristics, and yield potential, while also emphasizing the need for further research to elucidate the genetic basis of observed traits and optimize agronomic practices for enhanced Aonla cultivation in arid regions.

Table 4: Observations on Fruit Quality Parameters in Aonla

S. No	Variety	TSS (Brix)	Dry matter (g)	Ascorbic acid (mg/100g)

1.	**BSR 1**	7.71	3.64	323
2.	**Krishna (NA 5)**	4.85	2.66	494
3.	**Kanchan (NA 4)**	7.34	3.45	443
4.	**NA 7**	4.09	3.72	514
5.	**Chakaiya**	4.51	2.34	567
	SEM	0.06	0.02	4.08
	CD @ 5%	0.19	0.06	12.32

Fig 1 : Experimental Result of Yield (kg) in Aonla

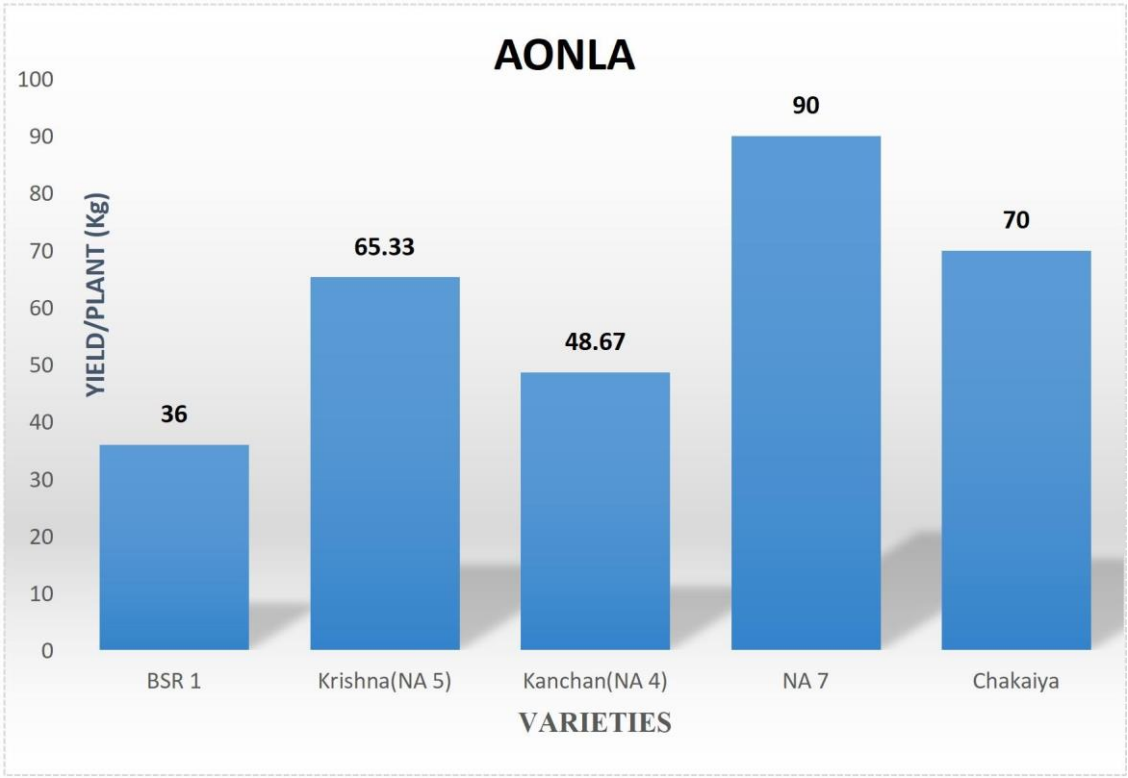
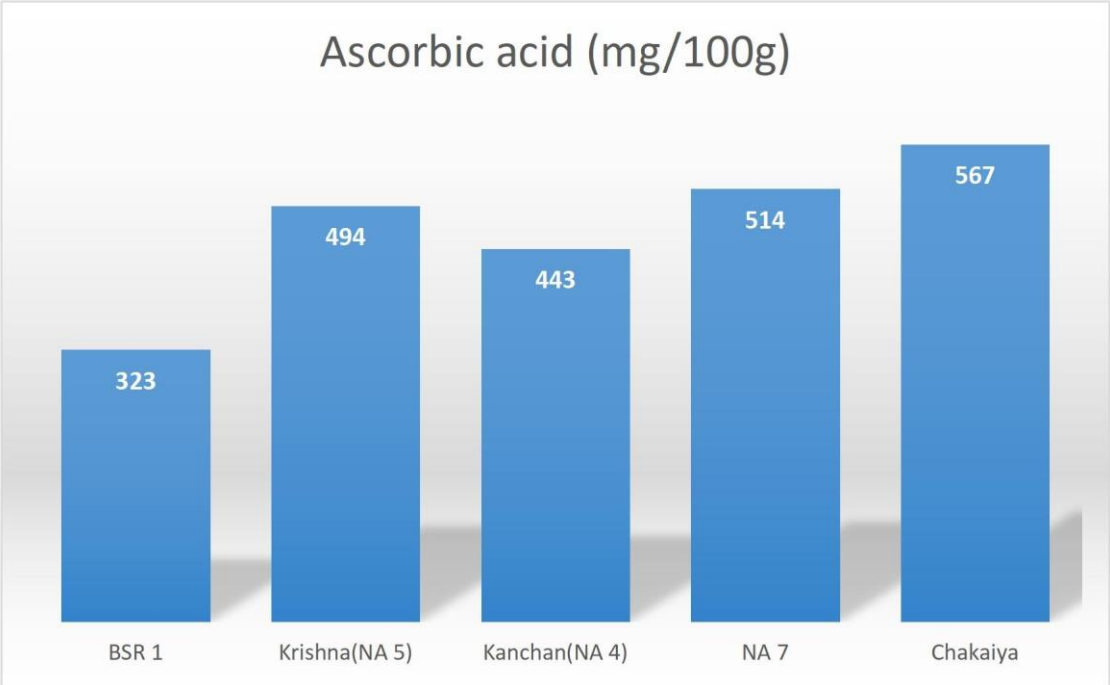


Fig 2 : Experimental result of Ascorbic acid (mg/100g) in Aonla



4. Conclusion

The assessment of Aonla cultivars in semi-arid conditions in Trichy identified NA 7 as a prime option due to its high yield potential per unit canopy area and volume, which aligns with contemporary agricultural methods. The research underscores the necessity of selecting cultivars well-suited to limited land availability and growing population demands. Furthermore, qualitative parameters singled out BSR 1 for its outstanding Total Soluble Solids (TSS), while Chakaiya exhibited elevated levels of acidity and ascorbic acid content. These conclusions highlight the importance of tailored cultivar selection for sustainable Aonla cultivation in arid regions, thereby contributing to both food security and agricultural productivity.

5. References

1. Ghosh, S. N., Roy, S., & Bera, B. (2013). Study on performance of aonla cultivars in laterite soil of West Bengal. *Journal of Crop and Weed*, *9*(2), 36-38.
2. Jaacks, L. M., Veluguri, D., Serupally, R., Roy, A., Prabhakaran, P., & Ramanjaneyulu, G. V. (2021). Impact of the COVID-19 pandemic on agricultural production, livelihoods, and food security in India: baseline results of a phone survey. *Food security*, *13*(5), 1323-1339.
3. Kumar, M., Singh, S., & Yadav, V. K. (2013). Arid fruits: Post harvest handling and processing. *Book chapter in Emerging*.

4. Kumar, S., Chithiraichelvan, R., & Karunakaran, G. (2011). Performance of aonla cultivars for yield and physico-chemical properties under Coorg conditions. *Indian Journal of Horticulture*, *68*(2), 268-269.
5. Loeffler, H. J., & Ponting, J. D. (1942). Ascorbic acid. *Industrial & Engineering Chemistry Analytical Edition*, *14*(11), 846-849.
6. Malshe, K. V., Salvi, B. R., & Gawankar, M. S. (2016). Evaluation of different varieties of Aonla (Emblica officinalis Gaertn) under hard lateritic rocky conditions of South konkan coastal zone of Maharashtra. *New Agriculturist*, *27*(1), 135-138.
7. Meghwal, P. R., Singh, A., & Singh, D. (2022). Underutilized fruits and vegetables in hot arid regions of India: status and prospects: a review. *Agricultural Reviews*, *43*(1), 38-45.
8. Nagar, S., Kumar, M., Kumatkar, R. B., Sharma, J. R., & Singh, S. (2017). Evaluation of bael (Aegle marmelos Corr.) germplasms for seed and qualitative characters under semi-arid conditions of Haryana. *Int. J. Pure App. Biosci*, *5*(3), 436-442.
9. Plesse, M. (2020). *Global food and water security in 2050: Demographic change and increased demand*. Future Directions International.
10. Priyanka, T., & Kerur, N. M. (2023). Growth and instability in area, production and productivity of major fresh fruits and vegetables in India. *The Pharma Innovation Journal*, *12*(9), 1484-1488.
11. World Health Organization. (2016). *The double burden of malnutrition: policy brief* (No. WHO/NMH/NHD/17.3). World Health Organization.