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Performance of Aonla (*Emblica officinalis* gaertn.) varieties for growth and yield under semi arid region of North Gujarat

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ABSTRACT

An experiment was carried out to compare the different varieties of aonla for growth and yield at nine years during the year 2009-10 to 2017-18 under rainfed condition. The varieties viz. NA – 10, BSR – 1, NA – 6, NA-20, Goma Aishwarya (CHES-1), NA – 7, Chakaiya and Guj. Aonla – 1 were laid out in Randomized Block Design. Among these varieties significantly the highest plant height (4.68 m) and stem girth 60.50 cm per tree was found in Gujarat Aonla-1. Significantly the highest plant spread N-S (6.43 m) and E-W (6.71 m) were found in BSR-1. Significantly the highest fruit length (3.96 cm), fruit breadth (4.37 cm) fruit weight (48.63 g) and pulp weight (43.40) g/fruit was obtained in NA 20 variety. Significantly the highest number of fruits/tree (4135) was recorded in the variety BSR -1 though the highest fruit yield (63.52 kg/tree) was observed in variety NA- 7. Among these varieties the highest TSS (14.18 ^{0}brix) and acidity (3.46 %) was noted in BSR -1 but the highest ascorbic acid content i.e.477.32 mg/100g pulp was obtained in NA 7 variety. The highest fruit yield 9909 kg ha^{-1}, higher gross return (Rs. 99090), net return (Rs. 89194) and higher benefit cost ratio (9.01) were recorded in NA 7 variety under semi arid region of north Gujarat.

Key words: Aonla, varieties, growth, yield

Aonla (E*mblica officinalis* Gaertn.) belongs to the family *Euphorbiaceae,* is one of the important minor fruit crops in our country. The fruit is highly nutritious and is one of the richest source of vitamin–C. Among the fruits it tree is being grown successfully across the country in varied agroclimatic conditions in area of more than 91,000 ha area in the country with a production of 9.89 lakh MT (Annonymous,2017). It grows throughout tropical and sub-tropical parts of India. Plants have capacity for adoption in dry region and salt affected soils. It is very hardy and prolific bearer of great medicinal and nutritional significance. It is an essential ingredient of Chyvanpras and other products are preserves, pickles, candy, jelly, jam and squash. Fruits can also be dried and powdered to be used in preparation of oils, hair dyes and hair oils. In traditional medicine it is considered a health and vitality restorer (Ravindran *et al*., 2007) It can give enough income to the farmers even though the soil is alkaline, non fertile and unsuitable for many crops. Exploitation of high yielding varieties of aonla in rainfed region is important for the improvement of financial condition of the farmers hence attempt was made to evaluate the performance of growth and yield of different varieties for *semi arid region of north Gujarat*.

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MATERIALS AND METHODS

The experiment was conducted during the year 2009-10 to 2017-18 to evaluate eight varieties of aonla under semi arid region of North Gujarat

conditions to make available a suitable and stable cultivar to the farmers. North Gujarat semi arid region received 550 mm annual rainfall. The soils of the region are alluvial, light texture, loamy sand type and poor in soil fertility. To identify high yielding variety, the trial was laid out in a Randomized Block Design with eight treatments i.e. varieties v*iz.* NA – 10, BSR – 1, NA – 6, NA-20, Goma Aishwarya (CHES-1), NA – 7, Chakaiya *and* Guj. Aonla – 1 *with* four replications in rainfed condition. Raised plants at 8x8 m distance, FYM 50 kg per plant and RDF (1000:500:500 g/tree) applied in existing plantation. Training was carried out every year. Aonla yield was stabilized during 2015-16 year at the age of 7th year plantation. Observations on plant morphological characters i.e. plant height, plant stem girth, plant spread (N-S) and (E-W) and yield attributes like fruit length, fruit breadth, fruit weight, pulp weight, number of fruits per tree and fruit yield per tree were recorded at harvest. The Total Soluble Solids (TSS), ascorbic acid and acidity content of the aonla fruit juice was directly measured by using digital hand refractometers and ascorbic acid content of aonla fruit juice was determine by titration method (Ranganna,1986) using 2, 6 diclorophenol indophenols dye.

RESULTS AND DISCUSSION

The experimental data were statistically analyzed by the analysis of variance method. The data presented for growth attributes like plant height, plant stem girth, plant spread (N-S) and (E-W) of different varieties are presented in Table 1 Significantly the highest plant height 4.68 m and stem girth 60.50 cm were noted in Guj aonla-1 though the highest plant spread (N-S) 6.43 m and (E-W) 6.71 m was found in BSR-1.

Yield attributes of average of three years aonla responses between the different treatments are presented in Table-2. Aonla variety NA-20 had maximum fruit length 3.96 cm, fruit breadth 4.37cm, fruit weight 48.63 g and pulp weight 43.40 g. Observations recorded in respect of number of fruits per tree clearly showed that the variety BSR-1 produced highest number of fruits (4135 per plant). similar results reported by Dhanumajaya Rao and K.Subramanyam(2009) .

The data presented in table -2 showed that the variety Aonla NA-7 gave significantly the highest fruit yield 63.52 kg per tree. Hence Aonla NA-7 is enhancing yield attributing and yield characters under semi arid region of North Gujarat similar results were reported by G. Lal *et al.,* (2006) also.

The data presented in table -3 shows that the fresh aonla juice contained maximum ascorbic acid 477.32 mg/100 g in NA 7 variety, acidity 2.46 % in BSR-1 and TSS 13.26 in Guj Aonla-1.Looking the economics in table 4 the Aonla NA-7 recorded higher yield 9909 kg ha^{-1}, higher gross return (Rs.99090), net return (Rs. 89194) and benefit Cost ratio (9.01).

Table 1 Growth parameters of different aonla varieties at age of nine years

Treatments	Plant height (m)	stem girth (cm)	Plant canopy (m)	
			N - S	E - W
NA – 10	3.71	49.50	5.01	4.78
BSR – 1	4.32	59.12	6.43	6.71
NA – 6	3.76	39.25	4.07	4.28
NA-20	3.93	47.37	4.58	4.48
Goma Aishwarya(CHES-1)	3.66	50.12	3.95	3.82
NA – 7	3.48	41.12	3.50	3.92
Chakaiya	4.32	46.50	4.61	4.45
Guj. Aonla – 1	4.68	60.50	5.22	5.16
S.Em. ±	0.26	2.82	0.24	0.32
C.D.at 5 %	0.75	8.30	0.72	0.96
C.V. %	12.80	11.47	10.40	13.81

Table 2 Fruit parameters of different varieties of aonla (Average of three years)

Treatments	Fruit length (cm)	Fruit breadth (cm)	fruit weight (g)	pulp weight (g)	No of fruits per tree	fruit yield (kg/tree)
NA – 10	3.15	3.46	29.43	25.08	892	27.12
BSR – 1	2.15	2.44	10.54	8.32	4135	44.10
NA – 6	3.49	4.12	34.50	31.09	592	20.46
NA-20	3.96	4.37	48.63	43.40	445	22.16
Goma Aishwarya(CHES-1)	3.77	3.95	43.70	39.84	526	23.68
NA – 7	3.88	3.94	41.93	35.19	1479	63.52
Chakaiya	3.17	3.69	33.90	30.49	602	20.93
Guj. Aonla – 1	3.13	3.37	26.35	22.64	1157	30.92
S.Em. ±	0.05	0.08	0.83	1.01	59.67	1.29
C.D.at 5 %	0.14	0.23	2.35	2.86	168.77	3.67
Y x T	NS	NS	NS	NS	NS	NS
C.V. %	5.64	7.51	9.32	11.48	18.49	15.53

Table 3 Biochemical analysis of aonla fruits of different varieties

Treatments	TSS (^{0}brix)	Acidity (%)	Ascorbic acid content (mg/100 g Pulp)
NA – 10	12.34	1.90	349.76
BSR – 1	14.18	2.46	450.15
NA – 6	13.25	2.08	428.94
NA-20	13.11	2.00	444.27
Goma Aishwarya(CHES-1)	9.28	1.91	416.22
NA – 7	10.20	2.02	477.32
Chakaiya	11.21	1.98	422.57
Guj. Aonla – 1	13.26	2.00	429.74
S.Em. ±	0.45	0.05	16.35
C.D.at 5 %	1.26	0.15	48.11
YXT	NS	NS	NS
C.V. %	17.31	7.97	8.44

Table 4 Economics of different varieties of aonla fruits

S.N.	Treatments	Yield (kg ha^{-1})	Gross return (Rs ha$^{-1)}$	Cost of Treat. (Rs ha$^{-1)}$	Net return (Rs ha$^{-1)}$	BCR
T_1	NA – 10	4230	42300	9896	32404	3.27
T_2	BSR – 1	6879	68790	9896	58894	5.95
T_3	NA – 6	3191	31910	9896	22014	2.22
T_4	NA-20	3456	34560	9896	24664	2.49
T_5	Goma Aishwarya(CHES-1)	3694	36940	9896	27044	2.73
T_6	NA – 7	9909	99090	9896	89194	9.01
T_7	Chakaiya	3265	32650	9896	22754	2.29
T_8	Guj. Aonla – 1	4823	48230	9896	38334	3.87

CONCLUSION

Aonla NA-7 in semi arid region of north Gujarat exhibited superior with respect to fruit yield, gross return and net return. Therefore, it can be identified as high yielding variety under semi arid region of North Gujarat.

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