

SHORT COMMUNICATION

QUALITATIVE AND QUANTITATIVE ANALYSIS OF SEVEN CULTIVARS OF AONLA (*EMBLICA OFFICINALIS*) GROWING IN ALKALI SOILS

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Qualitative and quantitative traits of seven Aonla (*Embllica officinalis*) cultivars were investigated on 3 hectare of alkali soil in Mainpuri District. The seven Aonla cultivars viz., Balwant, Chakaiya, Kanchan, NA-7, Krishna, Banarasi and Francis grew efficiently in alkali soil (pH: 8.0-9.5) at Mainpuri District. Among them Banarasi yielded maximum fruits (102.8 kg/tree) and the weight of the fruits was also maximum (77.9 g). Average weight of fruit, length and diameter of fruit, seed, pulp content, crude fibre and ash percent differed significantly among different cultivars. There was decreasing trend in mineral contents viz., calcium, sodium, potassium and polyphenols at late harvest, while phosphorus content increased.

Key words: Alkalinity, aonla, fruit quality, nutrient content.

India has 12 million hectares of salt-affected soils out of which 7 million hectares (Gupta and Gupta 1997) of land is lying barren due to alkalinity. Mainpuri district of Uttar Pradesh alone has 66,752 hectares of alkaline wasteland (Pathak 1996).

Aonla or *Amla* the "*Kayakalp Vriksh*", is one of the most important medicinal fruit crops of India. It is a hardy tree that can be grown successfully in moist and dry tropical zone on moist loamy soil. It flourishes in alluvial soils and can be cultivated on poor and alkali soil. It has fuel energy up to 5200 kcal/kg. Fruits are used as source of Vitamin C, wood is used for making agricultural implements, green leaves and foliage are used as fodder and cut branches are used as green manure for neutralizing excessive alkalinity in soil (Singh 1989).

In the present investigations seven cultivars of *Embllica officinalis* were tested for their quality and nutritive value. In an associated village, Ishwarpur, three hectares of alkali affected partially reclaimed soil was planted with seven cultivars of Aonla viz., Balwant, Krishna, Chakaiya, Francis, Banarasi, NA-7 and Kanchan, by Auger hole drilling and Furrow-channel irrigation method (Gupta and

Gupta 1997). The pits were filled by farmyard manure, Eichhornia (dried), molasses, gypsum and biofertilizer.

Fruits of seven cultivars of 8 years old disease free trees were selected. Ten fully matured fruits were sampled in a randomized manner and washed. Pulp was separated and weight of pulp and seed was taken separately. Total soluble solids were determined by hand refractometer (0-36° Brix). Acidity was estimated by alkali titration method and expressed in terms of citric acid/100 g of flesh. Reducing and non-reducing sugars were determined by the method of Lanc and Eynon (1960) and vitamin C was estimated by A. O. A. C. (1980) method using 2, 6-dichlorophenol-indophenol dye and expressed as mg/100g of pulp. The physicochemical analysis of fruit was carried out at full maturity stage and after delayed harvesting.

The data on average yield per tree showed that cv. Banarasi yielded highest fruit yield (102.8 kg/tree) followed by Kanchan (93.0 kg/tree) and Balwant (76.5 kg/tree). NA-7 and Chakaiya were lowest yielders. Average weight of fruit was maximum in cv. Banarasi during maturity and harvest. It was followed by Francis, Balwant and NA-7. Minimum fruit weight was recorded in cv. Krishna, but it was lusturous (Table 1).

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Table 1. Physical Characteristics of Aonla Fruits

Cultivars	Yield/tree		Average wt. of fruits (g)		Fruit size (cm)				Percent seed		Percent pulp	
	No.	Wt (kg)	Maturity	Delayed harvesting	Length		Diameter		Maturity	Delayed harvesting	Maturity	Delayed harvesting
					Maturity	Delayed harvesting	Maturity	Delayed harvesting				
Balwant	3115	76.5	42.5	44.5	5.0	5.2	4.2	4.7	1.7	2.0	96.3	96.5
Banarsi	3620	102.8	65.5	77.0	5.7	7.5	6.8	6.5	1.9	2.3	98.5	98.9
Chakaiya	964	33.5	35.0	36.0	4.0	4.8	3.5	3.8	2.1	2.0	94.3	95.2
Francis	1109	34.0	46.0	52.5	4.0	4.12	3.8	3.9	2.2	2.6	96.8	97.3
Kanchan	3890	930	30.6	37.2	3.8	4.0	3.63	3.7	2.0	2.35	94.8	90.7
Krishna	1220	43.5	30.89	35.8	3.4	3.8	3.7	3.9	2.5	2.6	95.7	97.3
NA-7	905	30.8	41.8	45.2	4.2	4.4	4.2	4.38	2.5	2.8	97.5	98.5
S.E. ±	-	-	2.15	2.1	0.8	0.08	0.08	0.06	0.06	0.06	0.04	0.06
C.D. 5%	-	-	3.2	3.2	0.7	0.20	0.22	0.18	0.18	0.13	0.18	0.20

Data in Table-2 shows the influence of harvesting stage on productivity. The increase in size and weight of fruit could be attributed to the cell enlargement and accumulation of nutrients in intercellular spaces in fruit pulp (Bollard 1970). Although the seed and pulp percentage in Banarasi recorded maximum, yet on the whole there was not much difference amongst the cultivars as well as the stages of harvest.

The chemical analysis of seven cultivars of Aonla showed that the contents of polyphenol and crude fibre did not show much variation at both the stages of harvest and maturity (15th Oct. and 30th Nov.). Some mineral elements showed decreasing trend viz. calcium, potassium and sodium, as the period of harvesting was delayed for a month. However a remarkable increase in phosphorus content was observed in almost all cultivars except Francis during delayed period of harvest. The maximum phosphorus content was observed in Banarasi and Balwant (641.1 and 414.7 mg/100gm) respectively. A downward trend was observed in protein content of fruit at delayed harvesting in all the cultivars. Similar trend for the decrease in the protein content in fruit has been reported by Gupta *et al.* (1983).

Highest T. S. S. percentage was recorded (12.9) in Banarasi followed by Kanchan and Balwant (11.9 and 11.2) and lowest in NA-7. Total soluble solid content in the fruit increased with the delay in harvesting in NA-7

and Chakaiya, which might be due to the formation of more soluble sugars and other soluble compounds. However in other cultivars, there was not much change in the T. S. S. content at delayed harvesting. Acidity content in the fruit increased in all the cultivar at delayed harvesting. The maximum acidity was observed in cv. Banarasi (2.56). Decrease in reducing, non-reducing and total sugar was observed at delayed harvesting in all the cultivars. Banarasi contained maximum reducing and total sugar (5.2 and 9.9) respectively.

The highest ascorbic acid content was recorded in cv. Banarasi at both the stages of harvest (584.19 and 609.15 mg/100 gm of pulp). Increase in ascorbic acid content was observed in almost all cultivars after prolonging the period of harvesting. Singh *et al.* (1989) observed a gradual increase in ascorbic acid content up to 19th December, which significantly decreased at later stages of maturity in Banarasi and Chakaiya cultivars. On an average Banarasi possessed better quality parameters.

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EFFECT OF ALKALINITY ON AONLA

Table 2. Chemical Characteristics Of Seven Cultivars Of *Embluca Officinalis*

Cultivar	Ash (%)	Poly phenol (%)	Crude fibre (%)	Phosphorus (mg/100g)	Sodium (mg/100g)	Potassium (mg/100g)	Calcium (mg/100g)	Protein (%)	Moisture of pulp (%)	T.S.S. (%)	Acidity	Sugars	Ascorbic acid mg/100g		
											Red	N.R.S.	Total		
Balwant															
15 Oct.	2.6 ±0.43	2.0 ±0.32	5.6 ±0.31	800.7 ±0.20	152 ±4.12	635 ±4.69	425 ±2.54	3.5 ±0.35	86.00 ±3.02	11.0 ±0.79	2.35 ±0.04	2.60 ±0.34	3.80 ±0.35	6.4 ±0.53	300.13 ±1.32
30 Nov.	3.4 ±0.45	2.5 ±0.41	5.8 ±0.31	1214.8 ±1.54	145 ±4.12	750 ±6.44	620 ±6.67	3.6 ±0.35	87.80 ±0.31	11.2 ±0.79	3.19 ±0.64	1.82 ±0.11	2.57 ±0.03	4.39 ±0.07	384.26 ±0.61
Banarasi															
15 Oct.	2.8 ±0.27	2.4 ±0.35	6.2 ±0.41	1335.4 ±0.51	126 ±3.08	825 ±3.00	725 ±3.67	3.7 ±0.20	88.80 ±0.78	12.6 ±0.29	2.15 ±0.04	5.20 ±0.31	5.70 ±0.29	9.9 ±0.92	584.1 ±0.16
30 Nov.	3.6 ±0.31	2.5 ±0.62	6.4 ±0.46	1976.5 ±1.03	172 ±1.87	1150 ±7.07	900 ±15.81	4.2 ±0.21	89.40 ±0.40	12.9 ±0.26	2.56 ±0.03	3.13 ±0.03	4.66 ±0.03	7.79 ±0.06	609.1 ±0.71
Kanchan															
15 Oct.	2.2 ±0.37	2.8 ±0.19	7.1 ±0.46	1232.5 ±0.41	146 ±4.53	827 ±2.91	512 ±7.38	2.55 ±0.12	88.05 ±0.71	11.0 ±0.79	1.18 ±0.06	2.30 ±0.04	1.28 ±0.02	3.58 ±0.03	283.92 ±0.46
30 Nov.	3.1 ±0.20	2.4 ±0.20	7.0 ±0.31	1239.5 ±0.71	106 ±1.58	751 ±0.71	681 ±1.41	1.94 ±0.04	85.97 ±0.43	11.9 ±0.16	2.38 ±0.04	1.30 ±0.10	0.13 ±0.01	1.43 ±0.04	309.98 ±0.40
Krishna															
15 Oct.	2.5 ±0.22	1.8 ±0.10	6.8 ±0.24	1171.7 ±0.46	138 ±1.58	927 ±1.58	423 ±1.58	3.14 ±0.07	87.38 ±0.34	10.1 ±0.29	1.31 ±0.26	2.70 ±0.10	1.19 ±0.03	3.89 ±0.06	417.00 ±1.58
30 Nov.	2.5 ±0.16	1.9 ±0.38	7.1 ±0.20	1283.9 ±0.33	141 ±1.00	802 ±1.58	424 ±2.00	2.85 ±0.04	88.05 ±0.3	9.9 ±0.16	2.1 ±0.26	1.20 ±0.12	0.49 ±0.02	1.69 ±0.01	585.20 ±1.05
Chakaiya															
15 Oct.	2.3 ±0.20	2.40 ±0.14	7 ±0.16	1171.9 ±0.43	159 ±1.58	1000 ±1.58	697 ±2.12	1.76 ±0.11	87.53 ±0.11	7.5 ±0.01	1.21 ±0.11	0.89 ±0.01	0.87 ±0.01	2.08 ±0.02	425.28 ±0.01
30 Nov.	2.4 ±0.19	2.30 ±0.07	8.6 ±0.14	1343.9 ±0.43	194 ±1.58	800 ±1.58	686 ±1.58	1.50 ±0.06	88.34 ±0.51	9.7 ±0.44	1.87 ±0.09	0.32 ±0.02	0.35 ±0.01	0.67 ±0.02	463.45 ±0.03
NA-7															
15 Oct.	2.2 ±0.12	2.20 ±0.20	6.6 ±0.20	1185.6 ±0.22	142 ±1.22	951 ±0.71	965 ±1.22	3.43 ±0.21	88.21 ±0.28	6.7 ±0.19	1.11 ±0.02	2.27 ±0.02	0.31 ±0.02	2.58 ±0.02	253.72 ±0.03
30 Nov.	2.2 ±0.16	1.98 ±0.01	6.8 ±0.26	1304 ±0.14	154 ±1.00	802 ±1.22	796 ±1.22	3.28 ±0.36	88.69 ±0.22	8.0 ±0.05	1.97 ±0.09	0.78 ±0.01	0.26 ±0.01	1.04 ±0.02	331.59 ±0.01
Francis															
15 Oct.	2.7 ±0.20	2.20 ±0.10	7.6 ±0.10	1268 ±0.72	141 ±1.00	872 ±2.45	512 ±1.22	0.33 ±0.23	87.15 ±0.21	9.6 ±0.43	1.11 ±0.02	1.12 ±0.02	1.40 ±0.02	2.52 ±0.02	277.64 ±0.05
30 Nov.	2.1 ±0.10	2.50 ±0.21	7.4 ±0.10	1261.8 ±0.39	116 ±0.67	606 ±0.07	423 ±0.50	0.14 ±0.06	88.61 ±0.86	9.4 ±0.42	2.15 ±0.12	1.17 ±0.02	1.17 ±0.04	1.35 ±0.02	430.32 ±0.01

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