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Nutritional survey of aonla orchards in Sikar district of Rajasthan

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Abstract

Analysis of Aonla leaf samples showed that sulphur and manganese were found low in range whereas nitrogen, phosphorus, potassium, calcium and zinc were found low to medium in range. The magnesium, iron and copper were found in sufficient in range. The overall mean values of nitrogen, phosphorus, potassium, calcium, magnesium and sulphur were 0.842, 0.105, 0.384, 0.503, 0.387 and 0.0417 per cent, respectively whereas overall mean values of copper, manganese, zinc and iron were 9.34, 9.15, 10.04 and 120.66 mg kg^{-1}, respectively in aonla orchards.

Key workds: Aonla, nutritional survey, copper, manganese, zinc, iron.

Introduction

Aonla is an important fruit crop which has high nutritive and medicinal value. It is one of the richest source of vitamin 'C' ranging from 500 to 1500 mg/100 g pulp (Chandra and Chandra, 1997). Fruits are also rich in pectin and minerals like iron, calcium, phosphorus. The aonla has been recommended by Ayurveda for balanced diet and sound health and is important ingredient of triphala and chavanprash. Due to multipurpose uses, the demand of aonla fruits is increasing day by day. Because of wide adaptive nature, this fruit crop is mainly grown on dry land and waste land soils where major nutrients are deficient and irrigation limited. Its cultivation is now becoming quite popular in irrigated arid regions of Rajasthan, owing to its high nutritive and medicinal value and having higher productivity even in the waste land. It is also a value added horticultural crop which has bright future prospects for export, particularly to European countries. Leaf analysis is a tool for determining the nutrient requirements of fruit plants and its nutrient status is an indication of growth and productivity. Very little information is available on nutritional status of aonla fruit crop under arid irrigated conditions of Rajasthan. Therefore, the present investigation was conducted during year 2007-2008 to survey the aonla orchard with a view to gaining information about their nutrient status.

Materials and methods

Studies were conducted in eight orchards of aonla selected at different locations in Sikar district of Rajasthan. These locations are given as under:-

S.No.	Name of fruit ngrower	Village	Locatio
1.	Sh. Balbir Singh	Rashidpura	Rashidpura
2.	Shri Dana Ram	Rehnawa	Rehnawa
3.	Shri Raju Sen	Laxmangarh	Laxmangarh
4.	Shri Puran Mal Shartma	Sargoth	Sargoth
5.	Shri Roopchand Pipaliwal	Pachar	Pachar I
6.	Shri Kana Ram	Pachar	Pachar II
7.	Shri Panna Ram	Pachar	Pachar VI
8.	Govt. Nursery	Palsana	Palsana I

In each orchard, five fruit trees with uniform size and vigour were selected. The methodology for leaf sampling as described by Anonymous,1996 for aonla was followed. Composite leaf samples were taken in the month of July from the middle portion of 3-5 months old indeterminate shoots. The sample size was 50 leaves per sample and taken from all the identified five trees. These samples were washed with ordinary water containing dilute (0.2%) detergent solution for about two minutes and were then dipped into single distilled water, 0.1 N HCl and double distilled water. Samples were dried in an oven at 70° C for 24 hours and ground. The leaf samples were analysed for different nutrients. Nitrogen and phosphorus contents were determined calorimetrically by using Nesseler's reagent and Vanadomolybdophosphoric acid yellow colour method (Jackson,1967), respectively. Potassium content was estimated from digested aliquot of digestion II using flame photometer (Bhargava and Raghupati, 1993). Sulphur was estimated by turbidimetric method (Tabatabai and Bremner, 1970). Calcium and Magnesium were determined by Atomic spectro photometer (Bhargava and Raghupati, 1993) and micronutrients viz. Zn, Cu, Mn and Fe were determined from

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Table 1. Soil fertility status of aonla orchards in Sikar district

Locations/ soil properties	Rashidpura	Rehnawa	Laxmangarh	Sargoth	Pachar I	Pachar II	Pachar VI	Palsana I
Available Nitrogen kgha^{-1}	93.88	76.00	90.00	91.00	108.13	111.88	109.38	100.75
Available Phosphorous kgha^{-1}	26.95	20.87	28.81	26.47	23.59	27.36	20.12	9.92
Available Potash kgha^{-1}	120.38	112.75	117.75	115.50	130.38	145.75	143.00	123.88
Exchangeable Calcium cmol kg^{-1}	3.91	3.40	3.36	3.34	4.05	3.82	3.65	2.76
Exchangeable Magnesium cmol kg^{-1}	1.99	2.03	2.04	2.00	1.83	2.02	1.88	1.57
Available sulphur mgkg^{-1}	5.85	5.87	6.50	5.60	6.10	6.49	6.27	8.29
DTPA Extractable Fe mgkg^{-1}	2.41	4.13	3.21	3.72	4.56	5.25	6.40	5.93
DTPA Extractable Zn mgkg^{-1}	0.281	0.478	0.334	0.569	0.780	0.885	0.469	0.905
DTPA Extractable Cu mgkg^{-1}	0.149	0.153	0.154	0.139	0.265	0.300	0.412	0.341
DTPA Extractable Mn mgkg^{-1}	1.56	1.58	2.03	2.62	3.24	3.55	4.94	4.51

digested aliquot of digestion II using AAS (Lindsay and Norvell, 1978). Plant leaf nutrient parameters were tested in one way classification (Randomized Complete Block Design) with three replications.

Results and discussion

Data on the determination of macro and micronutrients status of aonla orchards in Sikar district are presented in Table 1. The range and mean values of N, P, K, Ca, Mg, S, Cu, Zn, Mn and Fe contents of the aonla leaves showed that there were wide variations for these nutrients amogst the different orchards studied.

The nitrogen content of aonla leaves ranged between 0.458 to 1.568 per cent with mean value 0.842 per cent. The minimum nitrogen content (0.458%) was obtained at the orchard of Rehnawa, while maximum value (1.568%) was obtained at the orchard of Pachar-II. Analysis of aonla leaf samples revealed that 88 per cent leaf samples were found low and 12 per cent leaf samples were found sufficient in nitrogen content. The low concentrations of nitrogen could be attributed to low nitrogen status of soils (88.63 to 106.13 kg ha^{-1}), poor organic matter (0.098 to 0.136 per cent), high pH (8.21 to 8.67) and inadequate application of nitrogen. The results of present investigations are in accordance with those reported by Bhatnagar *et al.*, (2001), Bhatnagar and Chandra (2006 and 2007) and Rohitash (2007).

The content of phosphorus in aonla leaves ranged from 0.141 to 0.184 per cent with mean value 0.165 per cent. The maximum phosphorus content (0.184%) was obtained at the orchard of Laxmangarh, while minimum content (0.41%) was obtained at the orchard of Palsana-I. The evaluation of aonla leaf samples showed that 50 per cent leaf samples were found low and remaining 50 per cent leaf samples were found sufficient in phosphorus content. The variation in phosphorus content of aonla fruit crop is in accordance to the available phosphorus status of the orchard soils (21.49 to 25.56 kg ha^{-1}) and proper uptake and utilisation by the plant tissues. The present findings are in conformity with the findings of Reddy *et al.* (1991), Bhatnagar and Chandra (2006 and 2007).

The potassium content of aonla leaves ranged from 0.210 to 0.580 per cent with mean value 0.384 per cent. The maximum potassium content (0.580%) was obtained at the orchard of Pachar-II, while minimum content (0.210%) was obtained at the orchard of Rehnawa. Analysis of aonla leaf samples revealed that 37 per cent leaf samples were found low and 63 per cent leaf samples were found sufficient in potassium content. The fair potassium content in aonla leaves might be due to medium potassium staus of orchard soils (113.38 to 139.00 kg $^{ha-1}$). The present find-

Table 2. Macro and Micronutrient contents (oven dry basis) in leaf samples of Aonla collected from orchards in Sikar District

Location	Macronutrients (%)						Micronutrients (mg kg^{-1})			
	N	P	K	Ca	Mg	S	Cu	Mn	Zn	Fe
Rashidpura	0.742	0.181	0.330	0.630	0.398	0.0376	7.44	5.85	6.24	83.71
Rehnawa	0.458	0.157	0.210	0.430	0.426	0.0396	8.49	9.67	9.53	107.57
Laxmangarh	0.500	0.184	0.260	0.390	0.466	0.0408	9.20	6.21	8.40	92.56
Sargoth	0.576	0.180	0.300	0.350	0.472	0.0356	5.72	6.69	11.18	101.64
Pachar – I	0.968	0.158	0.520	0.810	0.32	0.0425	10.01	10.11	11.54	125.53
Pachar – II	1.568	0.167	0.580	0.590	0.364	0.0459	11.10	10.58	11.94	145.28
Pachar – VI	1.054	0.150	0.480	0.530	0.358	0.0459	11.48	12.46	8.84	158.32
Palsana – I	0.872	0.141	0.390	0.290	0.294	0.0459	11.25	11.60	12.62	150.69
Mean	0.842	0.165	0.384	0.503	0.387	0.0417	9.34	9.15	10.04	120.66
Range	0.458 to 1.568	0.141 to 0.184	0.210 to 0.580	0.290 to 0.81(	0.294 to 0.472	0.0356 to 0.0459	5.72 to 11.48	5.85 to 12.4(	6.24 to 12.62	83.71 to 158.3
SEm ±	0.083	0.003	0.035	0.027	0.019	0.0011	0.50	0.54	0.55	5.95
CD (5%)	0.238	0.009	0.101	0.078	0.056	0.0031	1.45	1.55	1.60	17.15
Low (%)	88	50	37	50	-	100	-	100	13	-
Sufficient (%)	12	50	63	50	100	-	100	-	37	100
High (%)	-	-	-	-	-	-	-	-	-	-

ings are in conformity with the findings of Reddy *et al.* (1991), Bhatnagar *et al.*, (2001) and Bhatnagar and Chandra (2006 and 2007).

The calcium content of aonla leaves varied between 0.290 to 0.810 per cent with mean value 0.503 per cent. The maximum calcium content (0.810%) was obtained at the orchard of Pachar-I, while minimum content (0.290%) was obtained at the orchard of Palsana-I. Analysis of aonla leaf samples revealed that 50 per cent leaf samples were found low and remaining 50 per cent leaf samples were found sufficient in calcium content. Sufficient calcium content in leaves may be due to presence of high amount of calcium (2.59-4.29 cmol kg^{-1}) in orchard soils, whereas low calcium content in some of the orchards could be due to low irrigation frequency, because the movement of calcium in plant is facilitated by higher amount of available water in the soil. These results of present study are in confirmation with those reported by Rohitash (2007) in aonla.

The magnesium content of aonla leaves varied between 0.294 to 0.472 percent with mean value 0.387 per cent. The maximum magnesium content (0.472%) was obtained at the orchard of Sargoth, while minimum content (0.294%) was obtained at the orchard of Palsana-I. Analysis of aonla leaf samples revealed that all the leaf samples were found sufficient in magnesium content. The results are in conformity with the finding of Kumawat (2005) in ber orchards in Jaipur district and Rohitash (2007) in aonla.

The sulphur content of aonla leaves varied between 0.0356 to 0.0459 percent with mean value 0.0417 per cent. The maximum sulphur content (0.0459%) was obtained at the orchard of Palsana-I, Pachar-II and Pachar-IV while minimum content (0.0356%) was obtained at the orchard of Sargoth. The data shows that all the leaf samples were found low in sulphur content. The low content of sulphur in leaves of various fruit trees could be due to low sulphur status of soil (5.99 to 6.91 mg kg^{-1}) of the studied orchards. The results of present study are in conformity with the findings of Gathala *et al.* (2004) in pomegranate and Rajkumar (2004) in ber and pomegranate.

The copper content of aonla leaves varied between 5.72 to 11.48 mg kg^{-1} with mean value 9.34 mg kg^{-1}. The maximum copper content (11.48.mg kg^{-1}) was obtained at the orchard of Pachar-VI, while minimum content (5.72 mg kg^{-1}) was obtained at the orchard of Sargoth. Analysis of aonla leaf samples revealed that all the leaf samples were found sufficient in copper content. The variations in copper content of leaves could be explained in accordance to the availability of nutrients in soil, variation in pH and or-

ganic carbon status. Similar findings were also reported by Sharma and Mahajan (1990), Bhatnagar *et al.*, (2001), Gathala *et al.* (2004), Bhatnagar and Chandra (2006 and 2007) and Rohitash (2007).

The manganese content of aonla leaves varied between 5.85 to 12.46 mg kg-1 with mean value 9.15 mg kg-1. The maximum manganese content (12.46 mg kg-1) was obtained at the orchard of Pachar-VI, while minimum content (5.85 mg kg-1) was obtained at the orchard of Rashidpura. The analysis of aonla leaf samples showed that all the leaf samples were found low in manganese content. The location wise variations in manganese content of all fruit crops studied could be explained in accordance to the availability of nufrients in soil, variation in pH and organic carbon status. Similar findings were reported by Bhatnagar *et al.*, (2001), Bhatnagar and Chandra (2006 and 2007) and Rohitash (2007).

The zinc content of aonla leaves varied between 6.24 to 12.62 mg kg^{-1} with mean value 10.04 mg kg^{-1}. The maximum zinc content (12.62 mg kg^{-1}) was obtained at the orchard of Palsana-I, while minimum content (6.24 mg kg^{-1}) was obtained at the orchard of Rashidpura. Analysis of aonla leaf samples revealed that 13 per cent leaf samples were found low and 87 per cent leaf samples were found sufficient in zinc content. The location wise variations in zinc content of all the taken fruit crops studied could be explained in accordance to the availability of nutrients in soil, variation in pH and organic carbon status. The result of study is in accordance to those reported by Bhatnagar and Chandra (2006) and Rohitash (2007).

The iron content of aonla leaves varied between 83.71 to 158.32 mg kg^{-1} with mean value 120.66 mg kg^{-1}. The maximum iron content (158.32 mg kg^{-1}) was obtained in the orchard Pachar-VI, while minimum content (83.71 mg kg^{-1}) was obtained in the orchard at Rashidpura. Analysis of aonla leaf samples revealed that all the leaf samples were found sufficient in iron content. The location wise variations in iron content of all the taken fruit crops studied could be explained in accordance to the availability of nutrients in soil, variation in pH and organic carbon status. Similar results were reported by Bhatnagar and Chandra (2006 and 2007) and Rohitash (2007).

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