J. Hortl. Sci.
Vol. 6(2):169-171, 2011

Short communication

Effect of organic manures and biofertilizers on leaf and fruit nutrient status in guava (*Psidium guajava* L.) cv. Sardar

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ABSTRACT

Pooled analysis of two-year data on nutrient status of 'Sardar' guava raised under organic manures and biofertilizers indicated that maximum leaf nitrogen (1.73%), phosphorus (0.24%), potassium (1.23%), calcium (1.96%), magnesium (0.80%); and maximum fruit nitrogen (1.12%), phosphorus (0.15%), potassium (0.94%), calcium (0.22%), magnesium (0.66%) was recorded, respectively, after fruit harvest with application of full dose of nitrogen to the plant applied through poultry manure augmented with *Azotobacter* and *Azospirillium*.

Key words: Guava (*Psidium guajava* L.), poultry manure, *Azotobacter, Azospirllum*, leaf and fruit nutrients

In Jammu and Kashmir, guava culture has shown tremendous potential as the most remunerative crop in the last decade, despite erratic climatic conditions drought-like situations, which, in turn, actually boosted the area under this crop. To standardize the method for nitrogen fertilization, an experiment was conducted during 2007-08 to determine leaf nutrient status, since the latter is an important parameter of notational management of fruit crops, in guava cv. Sardar.

The present study was conducted at Experimental Orchard, Division of Fruit Science, Faculty of Agriculture, Udheywalla, SKUAST-Jammu (latitude 32.43^{0}North and longitude 74.54^{0}East) on fifteen year old plants of guava cv. Sardar during the winter season of 2006-07 and 2007-08. Winter months here experience mild temperatures ranging from 6.5^{0}C to 21.7^{0}C. December is the coldest month, when minimum temperature falls to 4^{0}C. The farm soil was sandy-loam in texture. Initial soil status of the experimental orchard is presented in Table 1. Dose of NPK (572:207:265g tree^{-1}) for guava as recommended by SKUAST-J was applied in the experiment. A total of twelve treatments, replicated thrice, were executed in randomized block design, *viz.*, T_1 = *Azospirillium;* T_2 = 100% N tree^{-1} through FYM + *Azospirillium;* T_3 = 100% N tree^{-1} through poultry manure + *Azospirillium;* T_4 = 50 % N tree^{-1} through FYM + 50% N tree^{-1} through poultry manure; T_5 = *Azospirillium* + T_4, T_6 = *Azotobacter;* T_7 = *Azotobacter* + T_1; T_8 = *Azotobacter* + T_2; T_9 = *Azotobacter* + T_3; T_{10} = *Azotobacter* + T_4; T_{11} = *Azotobacter* + T_5; T_{12} = Absolute Control. Two organic manures (farmyard manure and poultry manure) were applied to the trees around the trunk in the first week of July. Two biofertilizers (*Azotobacter* and *Azospirillium*) with a uniform dose of 200g plant^{-1} were mixed in jiggery solution, prepared separately for each tree, and were fed to roots. Fertilizers were applied after regulating the crop for winter season by applying 1000ppm NAA at full-bloom stage in the second week of May. Observations on leaf nutrient status (N, P, K, Ca and Mg) were made by collecting twenty fully-mature leaves at bloom-stage in the month of July (before fertilizer application) and January (after fruit harvest) from each treatment, all around the trees. Washing, cleaning, drying, grinding and storing of samples was done as per the method of Chapman (1964). Digestion of leaf sample was done with one gram of leaf sample for various elements, as suggested by Piper (1966). Separate digestion was carried out for nitrogen-estimation using concentrated sulphuric acid and digestion mixture (Jackson, 1973). Observations on fruit nutrient status (N, P, K, Ca and Mg) were recorded with ten grams of fresh fruit pulp, as described by Jackson (1973). Separate digestion was carried out for estimation of other nutrients suggested by Piper (1966). Estimation of total nitrogen was in fruit and leaf was done by micro-kjeldhal method (Jackson, 1973). Total phosphorus was determined by vanadomolybdo phosphoric yellow colour method suggested by Jackson (1973). Potassium content was estimated by a Flame Photometer. Estimation of calcium and magnesium was done using an Atomic Absorption Spectrophotometer. Results of nutrient-content of leaf and fruit are presented on dry-weight basis. Data generated during the course of the study was subjected to statistical analysis prescribed by Panse and Sukhatme (2000).

Use of biofertilizers and organic manures showed that the treatment comprising full dose of nitrogen, applied through poultry manure augmented with *Azotobacter* and *Azospirillium*, was more effective compared to other treatments. Pooled data in Table 2 reveals that after fruit harvest, maximum amount of leaf nitrogen (1.73 %) and fruit nitrogen (1.12 %) was recorded in the treatment comprising full-dose of nitrogen, applied through poultry manure augmented with *Azotobacter* and *Azospirillium*. Increase in leaf nitrogen status observed was partially attributed to the stimulating influence of biofertilizers on organic manure which, in turn, increases nutrient-absorption rate and translocation in the tree system. It could also be due to increased dry-matter production, and nitrogen-fixation or nitrogen assimilation by *Azotobacter* and *Azospirillium* (Singh and Singh, 2004).

Table 1. Initial status of soil in experimental orchard

Particulars	Content
A. Mechanical analysis	
Sand (%)	68.5
Silt (%)	18.5
Clay (%)	13.0
B. Chemical analysis	
pH	7.5
Electrical conductivity (dsm^{-1})	0.11
Organic carbon (%)	0.58
Available nitrogen (kg ha^{-1})	230.15
Available phosphorus (kg ha^{-1})	14.45
Available potassium (kg ha^{-1})	140.5
Available calcium (meq/100g)	6.04
Available magnesium (meq/100g)	2.65

Pooled data in Table 2 reveals that after fruit harvest, maximum content of phosphorus in leaf (0.24 %) and fruit (0.15 %) was observed with full dose of nitrogen, applied through poultry manure augmented with *Azotobacter* and *Azospirillium*. This was perhaps due to production of enzyme complexes by the biofertilizers applied, which may have solubilized the unavailable form of phosphorus and made it available to the plant (Singh *et al*, 2003).

Persual of pooled data in Table 2 also showed highest amount of phosphorus in leaf (1.23 %) and fruit (0.94 %) after fruit harvest with application of poultry manure augmented with *Azotobacter* and *Azospirillium*. This increase in leaf potassium in guava was probably due to the combined use of organic manure and biofertilizer which may have contributed to improving soil physical-properties. Inturn, the results in better rooting, and therefore, better uptake of potassium from native sources. Increase in potassium content in the present study is also in conformity with findings of Ahmad *et al* (2004).

Pooled data in Table 3 shows that after fruit harvest, highest leaf and fruit calcium content (1.96 % and 0.22 %) was observed in the treatment comprising full-dose of nitrogen given through poultry manure augmented with *Azotobacter* and *Azospirillium*. This increase in nutrients

Table 2. Effect of biofertilizers and organic manures on nitrogen, phosphorus and potassium in leaf and fruit of guava cv. Sardar on per cent dry weight basis (pooled means)

Treatment	N in Leaf		N in Fruit	P in Leaf		P in Fruit	K in Leaf		K in Fruit
	BFA	AFH		BFA	AFH		BFA	AFH	
T_1	1.82	1.60	0.99	0.20	0.20	0.08	1.16	1.17	0.85
T_2	1.84	1.68	1.06	0.21	0.21	0.10	1.16	1.19	0.89
T_3	1.84	1.69	1.09	0.21	0.22	0.11	1.17	1.20	0.90
T_4	1.82	1.58	0.97	0.20	0.19	0.08	1.16	1.16	0.85
T_5	1.84	1.66	1.04	0.20	0.21	0.10	1.16	1.18	0.87
T_6	1.82	1.60	0.98	0.20	0.19	0.08	1.16	1.17	0.86
T_7	1.82	1.61	1.02	0.21	0.21	0.10	1.16	1.18	0.87
T_8	1.85	1.70	1.10	0.21	0.23	0.12	1.18	1.21	0.91
T_9	1.86	1.73	1.12	0.21	0.24	0.15	1.19	1.23	0.94
T_{10}	1.82	1.67	1.03	0.20	0.21	0.10	1.16	1.19	0.88
T_{11}	1.86	1.71	1.11	0.21	0.23	0.12	1.18	1.22	0.91
T_{12}	1.76	1.56	0.90	0.19	0.16	0.06	1.15	1.13	0.81
CD ($P=0.05$)	0.04	0.05	0.07	NS	0.03	0.03	NS	0.03	0.04

BFA: Before fertilizer application
AFH: After fruit harvest
NS: Non-significant

Table 3. Effect of biofertilizers and organic manures on calcium and magnesium in leaf and fruit of guava cv. Sardar on per cent dry weight basis (pooled means)

Treatment	Ca in Leaf		Ca in	Mg in Leaf		Mg in
	BFA	AFH	Fruit	BFA	AFH	Fruit
T_1	1.88	1.89	0.16	0.75	0.72	0.60
T_2	1.90	1.93	0.18	0.76	0.77	0.63
T_3	1.90	1.94	0.18	0.77	0.78	0.64
T_4	1.85	1.85	0.14	0.73	0.68	0.59
T_5	1.89	1.92	0.17	0.75	0.76	0.62
T_6	1.87	1.87	0.15	0.75	0.71	0.60
T_7	1.87	1.90	0.17	0.75	0.74	0.61
T_8	1.91	1.94	0.20	0.77	0.79	0.65
T_9	1.91	1.96	0.22	0.78	0.80	0.66
T_{10}	1.89	1.91	0.17	0.76	0.75	0.62
T_{11}	1.90	1.95	0.21	0.77	0.79	0.65
T_{12}	1.80	1.77	0.12	0.76	0.63	0.58
CD ($P=0.05$)	0.05	0.04	0.04	N.S	0.06	0.03

BFA: Before fertilizer application
AFH: After fruit harvest
N.S: Non-significant

was, may be, due to production of enzyme complexes by nitrogenfixers and which solubilized the unavailable form of nutrient elements and made them available (Narayan *et al*, 2004).

Persual of pooled data in Table 3 shows that after fruit harvest, maximum content of leaf magnesium (0.80%) and fruit magnesium (0.66%) was seen with the treatment comprising full-dose of nitrogen applied through poultry manure, augmented with *Azotobacter* and *Azospirillium.* It was observed that *Azotobacter* helped increase length of the main root and the number of secondary roots in guava, which enhanced uptake of the mineral element as a result of better translocation to leaves for growth and development of the fruit (Rana, 2001).

The present study thus reveals a positive response of organic manure, along with biofertilizers, on nutrient status of winter-season guava. In conclusion, our results show that a full dose of nitrogen in the form of poultry manure, augmented with *Azotobacter* and *Azospirillium*, plays a vital role in improving leaf and fruit nutrient status of guava.

REFERENCES

Ahmad, A.F., Saxena, S.K., Sharma. R.R. and Singh, S.K. 2004. Effect of *Azotobacter chroococcum* on nutrient uptake in 'Amarpali mango' under high density planting. *Ind. J. Hort.*, **61**:348-349

Chapman, H.D. 1964. Suggested foliar-sampling and handling techniques for determining the nutrient status of some field horticultural and plantation crops. *Ind. J. Hort.*, **21**:97-119

Jackson, M.L. 1973. *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd., New Delhi, 498p

Morton, J.F. 1987. *Fruits of warm climates*. Creative Res. Syst. Inc., pp 91-102

Narayan, R., Magray, G.H, Ahmed, N. and Samanta, A. 2004. Effect of organic manures on nutrient uptake and quality of capsicum (*Capsicum annum* var. Grossum L.) *The Hort. J.*, **17**:141-144

Panse, V.G. and Sukhatme, P.V. 2000. Statistical methods for agricultural workers. ICAR, New Delhi, p108

Piper, C.S. 1966. *Soil and Plant Analysis*. Hans Publishers, Bombay, pp 40-51

Rana, R.K. 2001. Studies on the influence of nitrogen fixers and plant bioregulators on growth, yield and quality of strawberry cv. Chandler. Ph.D. thesis, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan

Singh, A. and Singh, R.P. 2004. Effect of bio- and chemical fertilizers on nutrient status of olive trees. *Haryana J. Hort. Sci*., **33**:27-29

Singh, A., Patel, R.K. and Singh, R.P. 2003. Correlation studies of chemical fertilizers and biofertilizers with growth, yield and nutrient status of olive trees (*Olea europea*). *Ind. J. Hill Farming*, **16**:99-100

(MS Received 10 December 2010, Revised 6 July 2011)