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Nutritional status of leaves of guava orchards of western Uttar Pradesh

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ABSTRACT

Leaf samples collected from Agra and Aligarh district of Uttar Pradesh were evaluated for their nutritional status of guava leaves. Analysis of leaf samples collected from 50 guava orchards of Agra and Aligarh districts of Western Uttar Pradesh showed that the leaf samples were deficient in nitrogen, sulphur and zinc. On the other hand, P, K, Fe, Cu contents in majority of leaves were in optimum range. In orchards of Agra district, the ranges of N, P, K, Ca, Mg, Fe, Mn, Cu and Zn were 1.65 to 2.24%, 0.13 to 0.20%, 1.10 to 2.0%, 1.02 to 1.90%, 0.72 to 1.40, 0.17 to 0.30%, 160 to 240 mg kg^{-1}, 32 to 55 mg kg^{-1}, 4 to 8 mg kg^{-1} and 19 to 33 mg kg^{-1}, respectively. The corresponding ranges of these elements in orchards of Aligarh district were 1.60 to 2.20%, 0.16 to 0.26%, 1.10 to 2.20%, 1.02 to 1.90%, 0.72 to 1.44%, 0.15 to 0.24%, 150 to 240 mg kg^{-1}, 30.0 to 52.5 mg kg^{-1}, 4 to 8 mg kg^{-1} and 19 to 37.5 mg kg^{-1}. There existed relationship among various nutrients in leaves of guava orchards of both the districts.

Keywords: Leaves, nutritional status, guava orchards, Western Uttar Pradesh.

INTRODUCTION

In India, guava (Psidium guajava L.) is grown mostly in Madhya Pradesh, Uttar Pradesh and Bihar. It belongs to family Myreaceae. Guava is also known as poor man's apple because of its cheapness and easy availability to the common people. It is no way inferior to apple for its nutritive value. It is considered to be one of hardy fruits capable of growing under adverse conditions of soils and climate. It is the fourth and fifth most important fruit crop by production and area, respectively. It is a rich source of certain minerals which are necessary for human health like calcium, phosphorus and iron. It is also rich in vitamin C content and pectin. Fruits have been reported to contain 12.67% total soluble solids, 7.87% total sugar and 187.9 mg/100g ascorbic acid. The use of leaf analysis to indicate nutrient availability in fruit crops has long been accepted. The nutrient level of the plant is a reflection of the available nutrient in soil. The mineral composition of fruit plant is influenced by a number of factors such as position and age of leaf, variety, climate and management practices. Leaf is the principal site of plant metabolism and the changes in nutrient supply are reflacted in the composition of leaf. Very little information is available on nutritional aspect of guava, which could be of value in making judicious fertilizer schedule for profitable production. However, the literature on nutritional status of guava leaves in orchards of Agra and Aligarh districts of Western Uttar Pradesh is scanty and hence the present study was undertaken.

MATERIAL AND METHODS

Fifty guava orchards in the districts of Agra and Aligarh in Uttar Pradesh were surveyed. From each orchard, one tree was chosen. About 40 to 50 leaves were collected from four sides of an individual tree. Leaf samples were collected from guava plants at a height of 1.5 to 2.0 m from the ground. These samples were digested in a di-acid mixture of HNO_3: $HClO_4$ (5:1). Aliquot of this solution was used for determination of P, K, Ca, Mg, Cu and Zn. For N, the digestion was done using salicylic thiosulphate modified method of Chapman and Pratt (1982) Phosphorus was determined using vanadomolybdic acid yellow colour method by a spectrophotometer. Calcium and magnesium were determind by EDTA titration method (Jackson 1972). Micronutrient cations were determined using atomic absorption spectrophotometer.

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RESULTS AND DISCUSSION

Nutrients status of guava leaves

Nitrogen: The nitrogen content in the guava leaves varied from 1.60 to 2.24 per cent with a mean value of 1.96 per cent. In the leaf samples of Agra district, the range of variation in nitrogen content was from 1.65 to 2.24% with an average of 1.95 per cent (Table1). The corresponding range and average for Aligarh district were 1.60 to 2.20, 1.97 percent. Thus, the minimum and maximum average values of N content were recorded in orchards of Aligarh and Agra district, respectively. The nitrogen content in majority of guava orchards was in deficient range when the values were compared with the values reported by Cahoon (1970). Kumar *et al.* (1990) reported 0.95 to 1.39 per cent nitrogen in guava leaves. According to them, nitrogen was in deficient range.

Phosphorus: Phosphorus content in guava leaves expressed as P, varied from 0.13 to 0.30% with a mean value of 0.20 per cent (Table 1). The average P content in the leaves was only 10.3 per cent of the average nitrogen content. Like N, P content of the leaves also showed marked variation in both the districts. The average P content in the leaves of guava orchards of Agra and Aligarh district were 0.20 and 0.21%, respectively. Indicating higher value of P in leaves collected form Aligarh district.. The phosphorus content in majority of leaves was in optimum range when compared with the standards (Cahoon 1970). The sufficiency of phosphorus in leaves might be due optimum level of available soil P of the area. According to Kumar *et al.* (1990) the phosphorus content in guava leaves ranged from 0.17 to 0.24 per cent.

Potassium: The content of potassium in the leaves showed a range of 1.10 to 2.00% with a mean value of 1.55% for Agra orchards and 1.10 to 2.00 with an average of 1.63% for Aligarh orchards (Table1). The maximum and minimum average values of K in leaves were noted in Aligarh and Agra orchards, respectively. The K content in leaves of majority of orchards was in excess range as per standards of Cahoon (1970). The higher absorption could be attributed to the higher potassium content in the soil. Kumar *et al.* (1990) also reported 0.90 to 1.46 per cent K in guava leaves.

Table1: Nutrient contents in guava leaves of different orchards of Western district

Nutrients	Agra (25 orchards)		Aligarh (25 orchards)	
	Range	Mean	Range	Mean
Nitrogen (%)	1.65 – 2.24	1.95	1.60 – 2.20	1.97
Phosphorus (%)	0.13 – 0.30	0.20	0.16 – 0.26	0.21
Potassium %	1.10 – 2.00	1.55	1.10 – 2.00	1.63
Calcium (%)	1.02 – 1.90	1.63	1.02 – 1.90	1.59
Magnesium (%)	0.72 – 1.40	1.08	0.72 – 1.44	1.08
Sulphur (%)	0.17 – 0.30	0.20	0.15 – 0.24	0.21
Iron (mg kg^{-1})	160.0– 240.0	198.3	150.0– 240.0	204.5
Manganese (mg kg^{-1})	32.0 – 55.0	41.1	30.0 – 52.5	40.5
Copper (mg kg^{-1})	4.0 – 8.0	6.3	4.0 – 8.0	6.1
Zinc (mg kg^{-1})	19.0 – 33.0	25.2	19.0 – 37.5	25.9

Calcium: The variation in the calcium content in guava leaves was from 1.02 to 1.90% with an average value of 1.61 per cent (Table 1). The average values for the leaf content of calcium of guava plants of Agra and Aligarh were 1.63 and 1.59 per cent showing the lowest value in orchards of Aligarh district. The calcium content of majority of orchards was found to be in moderate range (Cahoon 1970). Kumar *et al.* (1990) also reported 1.02 to 1.88 per cent calcium in guava leaves.

Magnesium: The magnesium content in leaf showed variation from 0.72 to 1.44% with an average value of 1.08 per cent (Table 1). In general, magnesium content did not show a marked variation in the leaves of guava orchards of both the districts. In the orchards of Agra district, the range of variation in Mg content was 0.72-1.40% having a mean value of 1.08 per cent. In Aligarh district, the range of variation in leaf Mg was 0.72-1.44% having a mean value of 1.08 per cent. The locational differences were

markedly reflected in Mg content of the leaves of various orchards.Kumar *et al.* (1990) reported 0.60 to 0.24 per cent magnesium in leaves of guava.

Sulphur: The leaves of guava orchards of Agra had the widest range of variation in sulphur content (0.17 to 0.30%). The content of S in guava leaves collected from Agra and Aligarh district ranged from 0.17 – 0.30 and 0.15 – 0.24%, respectively (Table 1). The mean values for these districts were 0.20 and 0.21 per cent, respectively. Thus, the leaves of Aligarh orchards had relatively higher average amount of sulphur than the Agra district. Majority of leaf samples (62 per cent) were deficient in sulphur (less than 0.20 per cent).

Iron: A study of the data (Table 1) showed that the iron content in the leaves varied from 150.0 to 240.0 mg kg^{-1} with a mean value of 201.4 mg kg^{-1}. The locational differences were markedly reflected in Fe content of the leaves of various orchards. The orchards of Aligarh district showed relatively higher Fe content in leaves (204.5 mg kg^{-1}) while orchards from Agra showed lower leaf Fe content. Almost all the orchards had optimum Fe content in leaves when values were compared with the critical limits (50-120 ppm) suggested by Kotur *et al.*(1997). These results are in conformity with the findings of Kumar *et al.* (1990) and Parihar *et al.* (2013) who reported similar range of Fe content in guava growing area of Haryana and Madhya Pradesh, respectively.

Manganese: The leaf Mn content varied from 30.0 to 55.0 mg kg^{-1} with a mean value of 40.8 mg kg^{-1}. The average Mn content in leaves of orchards of Agra and Aligarh were 41.1 and 40.5 mg kg^{-1} showing higher value of Mn content in Agra orchards. The lowest mean values of Mn content in leaves were recorded in orchards of Aligarh district. Kumar *et al.* (1990) reported 30-65 ppm Mn content in various cultivars of guava. Most of the leaf samples collected from different orchards was in the optimum range as per standards of Kotur *et al.* (1997).

Copper: The variation in the copper content in leaves was from 4.0 to 8.0 mg kg^{-1} with an average value of 6.2 mg kg^{-1} (Table 1). The range of copper in the leaves of Agra orchards varied from 4.0 to 8.0 mg kg^{-1} with an average of 6.3 mg kg^{-1}. In Aligarh orchards, the range of variation was 4.0 to 8.0 mg kg^{-1} having a mean value of 6.1 mg kg^{-1}. The locational difference gave rise to different values for the copper content of the leaves of various orchards. The orchards of Agra district showed higher average for leaf copper while orchards from Aligarh showed relatively lower values. Kumar *et al.* (1990) reported 4.0 to 14.0 ppm copper in leaves of guava cultivars.

Zinc: The leaf Zn content varied from 19.0 to 37.5 mg kg^{-1} with a mean value of 25.6 mg kg^{-1} (Table 1). The content of Zn in leaves, in general, showed a marked difference in orchards of both the districts. The average values of Zn in the orchards of Agra and Aligarh were 25.2 and 25.9 mg kg^{-1}, respectively indicating higher value in Aligarh orchards. The ranges of Zn content in leaves of guava orchards of these districts were 19.0 to 33.0 and 19.0 to 37.5 mg kg^{-1}, respectively (Table 1). The locational differences controlled the Zn content of the plants to an appreciable extent and Zn content in the orchards of Agra was relatively low. Kumar *et al.* (1990) reported 13.0 to 35.0 ppm Zn in guava cultivars. Majority of leaf samples (60 per cent) were deficient in zinc content (Parihar *et al.* 2013).

Inter-relationship among nutrients in leaves

Nitrogen content in the leaves was positively correlated with Zn and Mg and negatively correlated with P (Table 2). Since N and Mg are constituents of chlorophyll positive correlation of these two elements with Zn is well understandable. Phosphorus content in the leaf showed significant negative correlation with N, Ca, Mg and Zn and positive one with K. The leaf potassium showed significant negative relationship with Ca and Mn and positive one with S. Calcium was found to be significantly and positively related with Mg, S, Fe and Mn and negatively with P and K. Magnesium content also showed negative relationship with P and positive with S and Mn. Unlike Ca, it was correlated significantly with Zn in positive manner. Sulphur content showed positive and significant relationship with N, K, Ca and Mg and negative one with Fe, Mn and Zn.

Table 2: Correlation coefficients among different nutrient contents of guava leaves

	N	P	K	Ca	Mg	S	Fe	Mn	Cu
P	-0.34••								
K	-0.27	0.41							
Ca	0.08	-0.36••	-0.40••						
Mg	0.33••	-0.27••	-0.19•	0.35••					
S	0.30••	-0.18•	0.28••	0.26••	0.36••				
Fe	-0.27••	0.06	-0.23•	0.36••	0.11	-0.17•			
Mn	0.15•	-0.11	-0.38••	0.25••	0.46••	-0.21•	0.28••		
Cu	-0.12	0.02	-0.07	0.03	0.08	-0.09	0.25••	0.11	
Zn	0.49••	-0.38••	-0.11	0.08	0.32••	-0.20•	-0.13	0.28••	0.01

• *Significant at 5 % level,* •• *Significant at 1 % level*

Among micronutrients, iron was found to bear positive correlations with Mn and Cu, and Mn was positively correlated with zinc in addition to Fe. Copper was correlated only with Fe positively. So far zinc is concerned; it is significantly and positively correlated with N, Mg and Mn and negatively with P (Saharan *et al.* 2003)

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