Variation among different growth stages on mineral nutrient content in guava fruits

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Abstract: Guavais one of the most promising fruit crops of India and is considered to be one of the exquisite nutritionally valuable and remunerative crops. We are unaware of any report describing macro and micronutrient dynamics in fruit at different growth stages of guava. For conducting this experiment fruit of variety Allahabad Safeda, L-49, Lalit, Shweta, Arka Kiran, Salithong, Kimchu were collected at different stages like marble, seed hardening andharvest stage for estimation of primary nutrient (N, P, K), secondary nutrient (Ca, Mg) and micronutrient (Fe, Mn, Zn, Cu).As regards the availability of mineral nutrient contents of varieties did not follow definite trend. The nutrient content particularly N, and K were recorded highest at marble stage while as Mg and Ca was accumulated maximum in stone hardening stage and P, Zn, Fe, Cu, Mg, & Mn was in harvesting stage. There was least variation was observed in Mg content. Finally, it may be concluded that for the improvement of yields and quality requirement of specific mineral and nutrients is required at different growth stages.

Keywords: Guava, Pea, Marble, Seed Hardening, Micronutrient,Management.

INTRODUCTION

Guava (*Psidium guajava* L.) is known as poor man's apple or apple of tropics, which is belongs to family Myrtaceae. It is believed to have originated in an area extending from southern Mexico through parts of Central America. TheGuava is one of the most well-known edible tree fruits grown widely in more than sixty countries throughout the tropical and subtropical regions of the world. Guava cultivation in India commenced from 17^{th} century and at present ranks fourth in position after mango, banana and citrus in terms of area and production (Radha and Mathew, 2007). India is the largest guava producer in the world having production of 3916000 Metric Tonsfrom an area of 261000 Hectares (NHB Data

2017-18). The guava fruits are the best for making jelly, fruit butter, sherbets and ice-creams as these are rich in pectin. The popular varieties of guava grown in India are Sardar, Allahabad Safeda, Lalit, Pant Prabhat, Dhareedar, Arka Mridula, Khaja (Bengal Safeda ChittidarHarija). Hybrid varieties like Arka Amulya, and Kohir Safeda were also developed. It has attained a respectable place and popularity amongst the dietary list of common people in our country owing to its nutritious, deliciousness, pleasing flavour and availability for a longer period during the year at moderate price in guava, a crop grown successfully in a variety of soils with pH ranging from 5.5 to 8.0, deficiency of both major and micronutrients is reported extensively (Pathak and Pathak, 1993).The guava is widely grown in different states of India *viz;* Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal, Punjab and Assamvaried soils and climatic conditions. It is endowed with favourable qualities like hardy nature, low cost maintenance and great nutritive value as they contain many of the essential nutrients *i.e.* vitamins, minerals and other elements. The agro-climatic condition of the north eastern region of India is quite suitable for commercial cultivation of guava and the farmers are looking for diversification of fruit crops to enhance their income. Guava micronutrients play an important role in production and its deficiency leads in lowering the productivity. The guava plants also show micronutrients deficiency and could be responsible for lesser yield and quality. Nutrients like nitrogen, phosphorus and potassium play a vital role in promoting the plant vigour and productivity, whereas micronutrients like zinc, boron, copper and iron perform a specific role in the growth and development of plant, quality produces fruits and uptake of nutrients.

MATERIALS AND METHOD

The present investigation entitledwas carried out in the Department of Horticulture (Fruit & Fruit Technology), Bihar Agricultural College, Sabour during the year 2017-18. The details regarding the material used and methods adopted in the study are described below. Geographically Sabour is situated south of Ganga river in between 25.15, 40” North latitude, 87.20, 42” East longitude and at vast altitude of 45.72 meters above the mean sea level in the vast alluvial Gangetic plain of India, South of Ganga river.Sabour has semiarid, subtropical climate with hot desiccating summer and cold winter with an average annual rainfall of about 1040 mm. Most of the precipitation is usually received between the middle of June to middle of October.The experiment was laid out in Randomized Block Design (RBD) with seven treatments replicated thrice, at different growth stages (Marble stage, Seed hardening stage, Harvest stage).30, 15, 8 fruits were collected at marble stage, seed hardening stage and harvest stage respectively for mineral nutrient estimation in fruit of guava as an when attained their stage from the experimental site. Fruits from each tree replicated three times were collected. The fruit samplethoroughly washed first with tap water, then dipped in 0.1 N HCl, distilled water and finally in double distilled water. After air drying, the samples were cut in small pieces and dried in an oven at 68^{o}C till constant weight is obtained. The dried sample has been grinding in grinder and then kept in butter paper bags for chemical analysis.

Available nitrogen was estimated by using alkaline KMnO4 method as suggested by Subbaiah and Asija (1956). Available phosphorus content of the soil was extracted with sodium bicarbonate (Olsen *et al.* 1954) and the blue colour intensity was measured calorimetrically using 660 nm wavelengths (Dickman and Bray, 1940) and potassium was determined in the neutral normal ammonium acetic extract of soil through a flame photometer.Whereas available micro nutrients (Fe, Mn, Zn and Cu) in the soil sample were extracted with DTPA[(diethylenetriaminepentaacetic acid) (Lindsay and Norvell, 1978)] and was estimated using Atomic Absorption spectrophotometer.

Statistical analysis

The statistical methods described by Gomez and Gomez (1984) were followed to analyse and interpret the data. The experimental design was randomized block design (factorial). Each treatment comprised of a single plant and was replicated three times. The test of significance was tasted at 5 per cent probability level.

RESULTS AND DISCUSSION

Evaluation of primary nutrient

In the present investigation, it was observed that the nutrient varies at different stages and the pattern of accumulation also varies with the stages of growth. TheTable 1.1 nitrogen content in guava observed maximum at marble stage (1.28%) and reduced to 1.08 % at the seed hardening stage. However, the nitrogen content in fruit recovered to 1.17 % at harvest stage while as the phosphorous contentwas highest at harvest stages(0.16%) and followed by marble stage (0.14) and subsequently reduced phosphorous content at seed hardening stage (0.11). The potassium content recorded to be highest at the marble stage (3.21%), followed by harvest stage (3.03). This finding was in conformity with the result of Thomidis *et al.* *(*2006) who also studied seasonal variation of nutrient element in peach variety showed highest accumulation of nitrogen in the first stage of fruit formation and gradually reduced by developing fruits. Similarly, Qiu Yanping *et al*. *(*1995) also recorded nitrogen content in litchi fruit during early stage of fruit growth.

Evaluation of secondary nutrient

Calcium contentTable 1.1 in guava fruit were observed minimum (0.24%) during the marble stage. It gradually increased from seed hardening stage. However, the calcium content at harvest stage in guava is that may be due to the accumulation of Calcium in seed formation. The increasecalcium from marble to seed hardening stage might be due to continuous absorption of calcium. This result was also confirmed with the finding of Buwalda and Meeking (1990) who recorded calcium accumulation in pear varied linearly with the progress of time. Similarly, Salomao*et al.* (2006) a resulting in the lowest concentration of magnesium at marble stage. Roccuzzo *et al*. *(*2012) also observed the lower content of magnesium during the initial growth of orange tree and relatively small amount of magnesium partition to fruit.

Evaluation of micronutrient

The iron contentTable 1.2 in guava fruit, it was observed that there was no conspicuous trend for all micronutrient. The iron content at marble stage was recorded 47.21 ppm and reduced to 41.15 ppm at seed hardening stage. The maximum concentration of iron (49.29 ppm) was recorded at harvest stage. However, the manganese content was found to be the highest (6.47 ppm) at marble stage and it gradually decreased to seed hardening stage and again increased at harvest stage in the fruit. While, zinc content were also recorded highest at harvest stage (17.10 ppm) and gradually decreased from seed hardening stage .The decreasing trend of zinc content from marble to seed hardening stage might be due to its accumulation in fruit growth and development, because of the fact that the zinc content reached to the lowest level at seed hardening stage and again increased during harvest stage because its more portioning in the guava fruit. Similarly, copper content also found to be highest (3.03ppm) at marble stage and reached to the maximum at harvesting stage (3.25 ppm) while as the minimum content of copper (2.85 ppm) was recorded at seed hardening stage. Our results are in conformity with the result of Fan *et al.* (2005) reported that large amount of nutrient accumulation by apple tree was in early stage. Similarly, Clark *et al.* (1989) also reported that copper, iron, manganese reduced sharply within 8 weeks and more gradually in the subsequent 12 weeks until harvest. A study conducted by Smith *et al.* (1987) recorded copper, iron, manganese declined first and increased during the rest of season. The present findings of micronutrient accumulation in the guava fruit has also been confirmed by the finding of Kamboj *et al*.

(1987)reported that zinc content decreased with advancement of the age of leaf in cultivar of subtropical pear.

Table 1 .1: Effect of stages on macro mineral nutrient content (Nitrogen, Phosphorus, Potassium, Calcium, Magnesium) in guava fruit

Stage	**Macro nutrient (%)**				
	Primary nutrient			**Secondary nutrient**	
	Nitrogen	**Phosphorus**	**Potassium**	**Calcium**	**Magnesium**
Marble stage	1.28	0.14	3.21	0.24	0.04
Stone hardening stage	1.08	0.11	2.82	0.28	0.04
Harvest stage	1.17	0.16	3.03	0.26	0.06
SEM±	**0.082**	**-**	**0.237**	**-**	**-**
CD at 5%	**0.256**	**NS**	**0.739**	**NS**	**NS**

SEM: Standarderror of themean, CD: criticaldifference, NS: non-significant

Table 1 .2: Effect of stages on micro mineral nutrient content(Iron, Manganese, Zinc, Copper) in guava fruit

Stage	**Micronutrient (ppm)**			
	Iron	**Manganese**	**Zinc**	**Copper**
Marble stage	47.21	6.47	16.11	3.03
Stone hardening stage	41.15	5.41	12.44	2.85
Harvest stage	49.29	6.16	17.10	3.01
SEM±	**1.597**	**0.216**	**-**	**0.135**
CD at 5%	**4.977**	**0.675**	**NS**	**0.419**

SEM: Standard error of the mean, CD: critical difference, NS: non-significant

CONCLUSION

As regards the availability of mineral nutrient contents of varieties did not follow definite trend. The nutrient content particularly N, and K were recorded highest at marble stage while as Mg and Ca was accumulated maximum in stone hardening stage and P, Zn, Fe, Cu, Mg, & Mn was in harvesting stage. There was least variation was observed in Mg content. Finally, it may be concluded that for the improvement of yields and quality requirement of specific mineral and nutrients is required at different growth stages.

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