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Original Research Article

Effect of Integrated Nutrient Management on Quality Attributes of Guava varieties in the Rajnandgaon District of Chhattishgarh Plain

Nikhil Parihar[1*], M. S. Paikra[1] and Prachi Tamrakar[2]

[1]Department of Fruit science,
[2]Departement of F.L.A, Pt. K.L. Shukla COHRS, Rajnandgaon, IGKV Raipur, India
**Corresponding author*

A B S T R A C T

The Field-experiment entitled "Effect of integrated nutrient management on quality attributes of guava varieties in the Rajnandgaon district of Chhattishgarh plain" was carried out in the mrigbahar of 2019-20 at the Horticulture Farm, Bharregaon, under Pt. K.L. Shukla College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh. The field experiment was laid out in FRBD (Factorial randomized block design) which contain 24 treatments with 3 replications, there were two factors having 4 varieties and 6 level of INM.Most of the quality parameter like TSS (13.84 ^{0}Brix), ascorbic acid (246.71 mg/100 g) and total sugar (9.16%) were found superior in treatment combination of V_3N_3 (Shweta + 75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azotobacter).

Keywords

Guava, Meadow orchard, INM, Nutrients, Quality

Introduction

Guava (*Psidium guajava* L.) is an important subtropical & tropical fruit plant in India as well as Chhattisgarh. This comes under "Myrtaceae" family. Guava has been grown in India since the 17th century. After mango, banana and citrus it is the 4th most important fruit. The total area planted and produced by guava in India is approximately 2.51 lakh hectares and 4083,000 tons respectively. Guava production in India is 16.2 Mt / ha. Madhya Pradesh ranks first in terms of production at 37.4 Mt / ha. Guava shares 4.5 percent of the area and 3.3 percent of Indian fruit production (Anonymous, 2015). Guava is considered a tropical apple because of rich amount of (75-260 mg per 100 g^{-1} pulp), a good amount of thiamine (0.03 - 0.07 mg per 100 g^{-1} pulp) & riboflavin (0.02- 0.04 mg 100 g^{-1} pulp) (Singh *et al.*, 2003). Guava has a high amount of minerals such as phosphorus (22.5 - 40.0 mg 100 g^{-1}), calcium (10.0-30.0 mg 100 g^{-1}) and iron (0.60- 1.39 mg 100 g^{-1}) (Singh *et al.*, 2003).

It also has great pectin content (0.5-1.8%) (Adsule and Kadam, 1995). Jelly and other products are also made from fruits. Research evidence is encouraging towards the integrated use of organic + inorganic + bio-fertilizers that can improve soil productivity and crop yield with better quality (Singh *et al.*, 2011).

Materials and Methods

An experiment on "Effect of integrated nutrient management on quality attributes of guava varieties in the Rajnandgaon district of Chhattishgarh plain" was conducted during 2019-20 at Horticultural farm, Bharregaon under Pt. K.L. Shukla college of Horticulture & Research Station, Rajnandgaon. The above experiment consisted of 24 treatment combinations which include organic fertilizers (FYM and vermicompost), inorganic fertilizers and bio-fertilizers. The treatment details are as follows:

Total soluble solids (^{0}Brix)

An evenly homogeneous sample is made by mashing the fruit of each treatment after which juice was taken using muslin-cloth. This juice is used to determine Total soluble solids (^{0}Brix) T.S.S. is determine by hand refractometer (0-32^0). A drop is spread over the surface of prism. The meter when seen under the sun, reading is recorded at room temperature (A.O.A.C., 2012)

Ascorbic acid (mg / 100 g)

The test method was followed by (Ranganna 1977). Making of 3% Meta phosphoric-acid (HPO_3): Three gram bars or granule of "HPO_3" is mixed in pure distil-water for making 3% solution. Preparation of the standard solution of ascorbic acid: For making this solution hundred mg of "L-Ascorbic acid" was taken and volume was make-up by HPO_3 of 3 %. Now this solution is diluted by adding 1 ml of this solution to 10 ml by adding meta phosphoric acid of 3 %

Making of colouring-solution

In 150 ml of boiling pure distilled-water we have to add 42 mg of sodium-bicarbonate. After cooling the solution 52 mg of sodium-salt of 2,6 dichlorophenol-indophenol is added. After preparing this solution we have to store this in fridge.

Making of standard-dye

Both the solution of 5 ml was taken of standard ascorbic acid & Meta phosphoric acid by micro-burette. Now Titration was carried out by standard-ascorbic acid through dye-solution till pink-colour was visible for 15 second. 1 mg of ascorbic-acid per ml of dye was used to estimate the dye factor by following formula.

Dye-factor = 0.5 / titer-value

Sample preparation: Fruit juice sample of ten ml was taken and mixed with hundred ml of 3 per-cent HPO_3 it is that filtered.

Testing of ascorbic-acid: An aliquot of ten ml were used & titration was done with standard-dye till end point of light pink colour is obtained for few second.

By following-formula "Ascorbic-acid" can be determine.

Titre = tint factor × compound volume

$$\text{Ascorbic acid (mg/100g)} = \frac{\text{Titre} \times \text{Dye-factor} \times \text{volume made up}}{\text{Aliquot of extract taken for estimation} \times \text{Weight of sample taken for estimation}}$$

Acidity (%)

For determination of acidity of the sample known amount of filtered juice is diluted with pure distilled-water & this is titrated with standard N/10 NaOH solution by taking phenolphthalein indicator. End point is decided by seeing light pink colour for at

least 15 seconds. The acidity is denoted by per-cent. (A.O.A.C., 2012).

Total sugars (%)

For calculating total-sugar present in fruit twenty ml of fruit-juice was put into the beaker & conc. HCL (5-ml) is added. This solution was then boiled for around 5 minutes by which "non reducing" sugar can be convert to reducing-sugar. The pH was then made neutral by adding sodium-carbonate. This solution was put into hundred ml volumetric-flask and volume was make-up using distilled-water. Now this is to be transferred to a burette and titration was done by Fehling's solution A & B just like done at reducing sugar. By the following formula total sugar can be calculated and expressed as %.

Preparation of sugar chemicals (%)

Making solution of Fruit-juice: we have to crush 2 g of fruit and mixing with twenty ml of ethanol, we have to filter them using muslin-cloth & after this we obtain an even sample of guava pulp juice. This 20 ml sample was mixed thoroughly with distilled-water to make up volume by 100 ml.

Making of the Fehling-solution

Fehling's solution "A": In volumetric flask of 0.5 L crystal of copper sulphate of weight 34.63 g which was taken by using weighing balance. After this 0.5 ml of conc. H_2SO_4 and pure-distilled water was added. Then it is thoroughly mixed well so that it can be well dissolve and volume was made up to 0.5 L.

Fehling "B" solution: A volumetric Flask of 500-ml was taken & 173 g of sodium-potassium-tartarate (Rochelle-salt) & fifty g of sodium-hydroxide was added and volume make-up was done with distilled-water.

Making of (0.5%) Glucose solution: 0.5 per-cent glucose solution can be made by dissolving glucose of 0.5 g to distilled water & then volume make-up is done up to 500 ml.

$$\text{Total sugars (\%)} = \frac{0.25}{\text{Burette reading}} \times 100$$

Reducing sugar (%)

Reducing sugar content was measured by following Nelson's modifications of Somogyi's method (Somogyi, 1952) using arsenomolybdate colour forming reagent and two copper reagents 'A' and 'B'. One ml of juice (100 times diluted) was added with a mixture of 1 ml copper reagent (24 parts of copper A and 1 part of copper 'B' solution). This mixture was heated in boiling water bath in test tube and cooled, to which was added the colour forming reagent and the resulting absorbance was measured at 620 nm with Spectronic-20. The value was plotted against a standard curve prepared from glucose. The figures were expressed on percentage basis.

Results and Discussion

Total soluble solids (^{0}Brix)

Among all guava varieties V_3 (Shweta) show significantly maximum total soluble solids which was (13.00 ^{0}brix) followed by V_4 (Lalit) with total soluble solids of (12.85 ^{0}brix). Minimum total soluble solids (12.73 ^{0}brix) were recorded for V_1 (Allahabad Safeda).

Different INM have significant effect on total soluble solids however, the highest total soluble solids (13.73 ^{0}Brix) was observed in N_3 (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter), followed

by N_4 (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) with total soluble solids of (13.30 ^{0}Brix) and lowest (11.94 ^{0}Brix) in N_0 (Control).

Ascorbic acid (mg/100 g)

Among all guava varieties V_3 (Shweta) show significantly maximum ascorbic acid which was (230.54 mg/100 g) followed by V_4 (Lalit) with ascorbic acid of (226.31 mg/100 g). Minimum ascorbic acid (216.91 mg/100 g) was recorded for V_1 (Allahabad Safeda).

Different INM have significant effect on ascorbic acid however, the highest ascorbic acid (136.50 mg/100 g) was observed in N_3 (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter), followed by N_4 (75% RDF + 10 kg FYM + 2.5 kg vermicompost + 50 g Azospirillum) with ascorbic acid of (227.85 mg/100 g) and lowest (208.88 mg/100 g) in N_0 (Control).

Acidity (%)

Among all guava varieties V_4 (Lalit) show significantly maximum acidity (%) which was (0.529 %) followed by V_3 (Shweta) with acidity % of (0.510 %). Minimum acidity % (0.498) was recorded for V_2 (L-49).

Different INM have significant effect on acidity % However, the highest acidity % (0.563 %) was observed in N_0 (Control) (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter), followed by N_1 (100 % RDF) with acidity of (0.541 %) and lowest (0.422 %) in N_3 (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter).

Total sugar (%)

Among all guava varieties V_3 (Shweta) show significantly maximum total sugar which was (8.74 %) followed by V_4 (Lalit) with total sugar of (8.58 %). Minimum total sugar (8.40 %) was recorded for V_1 (Allahabad Safeda). Different INM have significant effect on total sugar However, the highest total sugar (8.98 %) was observed in N_3 (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter), followed by N_4 (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) with total sugar of (8.74 %) and lowest (8.23 %) in N_0 (Control).

Reducing sugar (%)

Among all guava varieties V_4 (Lalit) show significantly maximum reducing sugar which was (4.49 %) followed by V_1 (Allahabad Safeda) with reducing sugar of (4.46 %) minimum reducing sugar (4.39 %) was recorded for V_3 (Shweta).

Different INM have significant effect on reducing sugar however, the highest reducing sugar (4.71 %) was observed in N_3 (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter), followed by N_5 (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g VAM) with reducing sugar of (4.57 %) and lowest (4.26 %) in N_0 (Control) (Table-1).

The accumulation of more carbohydrates into fruits and enhancement of utilization of nutrients was due to phenotypic and genetic constituents which might be responsible for development of high quality traits. This finding is similar to Mehta *et al.,* (2018). Increase in physicochemical parameters of fruits might be on account of influential role of bio-fertilizer in higher nitrogen fixation and uptake of nitrogen thereby stimulating the catalytic activity number of enzymes in the physiological processes and increasing production of sugars that ultimately increase the total soluble solid, sugar content of the fruits, This finding where found similar to that of Das *et al.,* (2017).

Table.1 Factor A: Varieties: 4

V_1	Allahabad Safeda
V_2	L-49
V_3	Shweta
V_4	Lalit

Table.2 Factor- B : INM : 6 levels

N_0	Control
N_1	100% RDF
N_2	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Trichoderma
N_3	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azotobacter
N_4	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azospirillum
N_5	75% RDF+ 10 kg FYM+ 2.5kg vermicompost + 50 gm PSB

Table.3 Effect of varieties and INM on quality attributes of guava

Treatment		TSS ^{0}Brix	Ascorbic acid mg/100 g	Acidity (%)	Total sugar (%)	Reducing sugar (%)
Factor A. Varieties (4 Varieties)						
V_1	Allahabad Safeda	12.73	216.91	0.507	8.40	4.46
V_2	L-49	12.75	220.31	0.498	8.51	4.435
V_3	Shweta	**13.00**	**230.54**	**0.510**	**8.74**	4.39
V_4	Lalit	12.85	226.31	0.529	8.58	**4.49**
S. Em.		0.022	0.333	0.002	0.006	0.007
C.D at 5 %		0.064	0.408	0.006	0.017	0.021
Factor B. INM (6 Level)						
N_0	Control	11.94	208.88	0.563	8.23	4.26
N_1	100% RDF	12.35	220.42	0.541	8.34	4.34
N_2	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gmTrichoderma	12.51	222.14	0.527	8.42	4.28
N_3	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gmAzotobacter	**13.73**	**236.50**	**0.422**	**8.98**	**4.71**
N_4	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gmAzospirillum	13.30	227.85	0.476	8.74	4.53
N_5	75% RDF+ 10 kg FYM+ 2.5kg vermicompost + 50 gm PSB	13.17	225.34	0.491	8.63	4.57
S. Em.		0.027	0.408	0.003	0.007	0.009
C.D at 5 %		0.078	1.164	0.007	0.021	0.026

Quality attributes like TSS, ascorbic acid, acidity, total sugar, reducing sugar were significantly influenced by guava variety.

Maximum TSS was recorded in V_3 (Shweta) 13.00 ^{0}Brix while minimum in V_1 (Allahabad Safeda) 12.73 ^{0}Birx, Maximum ascorbic acid was recorded in V_3 (Shweta) 230.54 mg/100 g while minimum in V_1 (Allahabad Safeda), maximum acidity was recorded in V_4 (Lalit) 0.529% while minimum in V_2 (L-49), maximum total sugar was recorded in V_3 (Shweta) 8.741 % while minimum in V_1 (Allahabad Safeda) 8.44 %, Maximum reducing sugar was recorded in V_4 (Lalit) 4.49 %, Minimum reducing sugar was recorded in V_3 (Shweta) 4.39 %.

Quality attribute like TSS, ascorbic acid, acidity, total sugar, reducing sugar were significantly influenced by INM.

Maximum TSS (13.735^0 Brix) was recorded in N_3 (75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azotobacter) while minimum TSS (11.94^0 Brix) in N_0 (Control), Maximum Ascorbic acid (236.50 mg/100 g) was recorded in N_3 (75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azotobacter) while minimum ascorbic acid (208.883 mg/100 g) in N_0 (control).

Maximum total sugar (8.982 %) was recorded in N_3 (75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azotobacter) while minimum total sugar (8.403 %) in N_0 (Control).

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