



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2020; 9(12): 101-104
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www.thepharmajournal.com
Received: 12-10-2020
Accepted: 19-11-2020

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Effect of integrated nutrient management on growth of guava varieties in the Rajnandgaon district of Chhattisgarh plain

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Abstract

The Field-experiment titled "Effect of integrated nutrient management on growth of guava varieties in the Rajnandgaon district of Chhattisgarh plain" was carried out in the mrig-bahar of 2019-20 at the Horticulture Farm, Bharregaon, under Pt. K.L. Shukla College of Horticulture and research station, Rajnandgaon, Chhattisgarh.

The field experiment-laid was FRBD (Factorial randomized block design) which contain 24 treatment with 3 replication, There were two factor contains 4 varieties and 6 level of INM.

The objective was to study the effect of organic manures, inorganic fertilizers, biofertilizers and their combinations on growth of guava in ultra-high density for Chhattisgarh plain.

The result revealed that all the growth parameter like plant height, trunk girth, canopy spread (N-S), (E-W) were found superior in the treatment combination of V_4N_3 (Lalit + 75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azotobacter).

Keywords: Guava, INM, growth, azotobacter, nutrients

Introduction

Guava (*Psidium guajava* L.) is one of the important fruits of the tropical and subtropical areas of the world. It belongs to the "Myrtaceae" family. Guava has been grown in India since 17th century. It is the fourth essential fruit after Mango, Banana and Citrus. The total area cultivated and produced by guava in India is approximately 2.51 lakh hectares and 4083,000 tons respectively.

Increase in the fruit productivity removes large quantities of essential nutrients from the soil and the soil has started to be severely depleted, leading to a downward trend in soil fertility and lower quality fruit production. The continued use of inorganic fertilizers as a source of plant nutrients disproportionately, will lead to consequent serious damage to the environment and, in certain situations, harms the plants themselves and also consumers (Shanker *et al.*, 2002).

The integration of organic substrates with chemical fertilizers can have a significant effect on the physical, microbiological and chemical properties of the soil, which are responsible for supporting plant growth. The use of organic fertilizers together with bio-fertilizers and crop residues is considered as an economic source of nutrients available for plants that have beneficial effects on the growth, yield and quality of various fruit crops (Katiyar *et al.*, 2012).

Material and Method

The detailed study was conducted at the Horticulture Farm, Bharregaon which works under Pt. K.L. Shukla. College of Horticulture and Research Station, Rajnandgaon district of Chhattisgarh state during the year' 2019-2020. The district is situated at distance of 85 km away from Indira Gandhi Agriculture University, Raipur. This district is situated in the North-Eastern part of Chhattisgarh and lies at 20°07' N and 22°29' N Latitude and 80°23' E' and 81°24'E Longitude with an altitude of 330.71 meter above the mean sea level. It comes under dry moist sub-humid region and has an annual average rainfall of 953mm. The maximum temperature goes as high as 45.9 °C during the summer and minimum temperature as low as 16 °C during the winter season.

Experimental details

The above experiment consisted of 24 treatment combinations which include organic fertilizers (FYM and vermicompost),

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inorganic fertilizers and bio-fertilizers. The following treatment combinations have been used. The details of the treatments are as follows:

Table 1: Factor A: Varieties: 4 levels

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	Allahabad safeda + 75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azospirillum
N ₅	Allahabad safeda + 75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm PSB

Observation

- 1. Plant height (cm):** Plant height can be measured by using measuring scale. It can be measured from lowest point crown to highest point of canopy. Plant height is express in centimeter.
- 2. Girth of the primary branch (cm):** the circumference of the primary branch was measured with the help of a vernier caliper and was expressed in cm.
- 3. Canopy spread (N-S):** The canopy extension was measured in a north-south direction by using a measuring scale and the mean canopy extension was expressed in meters in the direction (N-S).
- 4. Canopy spread (E-W):** The canopy extension was measured in the east-west with the help of a measuring scale and the mean canopy extension was calculated in meters in the (E-W) direction.

Result and Discussion

Plant height

Among all guava varieties V₄ (Lalit) show significantly maximum plant height which was (244.5 cm) followed by V₃ (Shweta) with plant height of (239.2 cm). Minimum plant height (230.8 cm) was recorded for V₁ (Allahabad Safeda). This result where found similar with paikra *et al.*, (2015) [3].

The maximum plant height of guava variety lalit might be due to varietal-character of genetic-makeup or also might be due to "better-adaptability" in climatic-condition this finding was found similar with Singh *et al.*, (2016) [1, 5, 6].

Different INM shows significant effect on plant-height. However, the highest plant-height (243.9 cm) was observed in N₃ (75% RDF + 10 kg FYM + 2.5 kg vermicompost + 50 g Azotobacter), followed by N₄ (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) with plant height of (243.9 cm) and lowest (220.1 cm) in N₀ (Control).

The release of plant growth hormones (IAA) resultant in enhancement of plant height and increase in nutrient availability in the rhizosphere and rhizoplane. The biofertilizers (Azotobacter sp.) used in the experiment had positive effect for IAA production. The increased plant height might be due to balanced inorganic fertilizer and organic fertilizer along with azotobacter significantly uplift the nitrogen-availability because of capacity to fix large amount

of atmospheric nitrogen which ultimately led to production of more photosynthates resulted into high increase in plant height, similar finding where obtained by Sharma *et al.*, (2017) [4].

Interaction effect of integrated nutrient management and varieties are presented in table 4 resulted in significant effects on plant height. Further, highest plant height was observed (263.7 cm) in V₄N₃ (Lalit + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azotobacter) followed by V₄N₄ (Lalit + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) (250.3 cm) and minimum (212.3 cm) in V₁N₀ (Allahabad Safeda + Control).

Table 3: Effect of different INM and guava varieties on plant height

Treatment		Plant height (cm)
Factor A. Varieties (4 Level)		
V ₁	Allahabad Safeda	230.8
V ₂	L-49	235.7
V ₃	Shweta	239.2
V ₄	Lalit	244.5
S. Em.		0.699
C.D at 5%		1.997
Factor B. INM (6 Level)		
N ₀	Control	220.1
N ₁	100% RDF	237.7
N ₂	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Trichoderma	232.7
N ₃	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azotobacter	250.3
N ₄	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azospirillum	243.9
N ₅	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm PSB	240.7
S. Em.		0.857
C.D at 5%		2.446

Table 4: Interaction effect of different INM and guava varieties on plant height (cm)

	N ₀	N ₁	N ₂	N ₃	N ₄	N ₅
V ₁	212.3	234	225.7	240.3	237.3	235
V ₂	218.7	236.3	231	247.3	242.7	238.3
V ₃	222.3	241	235.7	250	245.3	241
V ₄	227	239.3	238.3	263.7	250.3	248.3
S. Em.	1.713					
C.D at 5%	4.892					
C.V. (%)	1.249					

Trunk girth

Among all guava varieties V₄ (Lalit) show significantly maximum trunk-girth which was (7.002 cm) followed by V₃ (Shweta) with trunk-girth of (6.894 cm). Minimum trunk-girth (6.699 cm) was recorded for V₁ (Allahabad Safeda). This result where found similar with Gurjar *et al.*, (2015) [1].

The maximum trunk girth of guava variety lalit might be due to varietal-character of genetic-makeup or also might be due to "better-adaptability" in climatic-condition this finding was found similar with Paikra *et al.*, (2015) [3].

Different INM have significant effect on trunk girth. However, the highest trunk-girth (7.278 cm) was observed in N₃ (75% RDF + 10 kg FYM + 2.5 kg vermicompost + 50 g Azotobacter), followed by N₄ (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) with trunk girth of (6.977 cm) and lowest (6.480 cm) in N₀ (Control).

The inoculation of nitrogen fixers causes the production of

more chlorophyll content which result in increase in trunk girth. The production of plant growth regulators in rhiosphere by bacteria which are absorbed by the roots may be the other reason for vegetative growth. Therefore the increased biological nitrogen fixation may be due to increase in vegetative growth, this finding was found similar Mishra *et al.*, (2011) [2].

Interaction effect of integrated nutrient management and varieties presented in table 6 resulted significant effect on trunk girth. Further, highest trunk girth was observed (7.470 cm) in V₄N₃ (Lalit + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azotobacter) followed by V₃N₃ (shweta + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azotobacter) (7.303 cm) and minimum (6.347 cm) in V₁N₀ (Allahabad Safeda + Control).

Table 5: Influence of different INM and guava varieties on trunk girth (cm)

Treatment		Trunk girth (cm)
Factor A. Varieties (4 Level)		
V ₁	Allahabad Safeda	6.699
V ₂	L-49	6.796
V ₃	Shweta	6.894
V ₄	Lalit	7.002
S. Em.		0.003
C.D at 5%		0.008
Factor B. INM (6 Level)		
N ₀	Control	6.480
N ₁	100% RDF	6.777
N ₂	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Trichoderma	6.672
N ₃	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azotobacter	7.298
N ₄	75% RDF + 10 kg FYM+ 2.5kg vermicompost + 50 gm Azospirillum	6.977
N ₅	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm PSB	6.883
S. Em.		0.003
C.D at 5%		0.010

Table 6: Interaction effect of different INM and guava varieties on trunk girth (cm)

	N ₀	N ₁	N ₂	N ₃	N ₄	N ₅
V ₁	6.347	6.637	6.503	7.160	6.830	6.720
V ₂	6.443	6.730	6.617	7.260	6.907	6.817
V ₃	6.500	6.833	6.733	7.303	7.047	6.947
V ₄	6.630	6.907	6.833	7.470	7.123	7.047
S. Em.	0.007					
C.D at 5%	0.019					
C.V. (%)	0.176					

Canopy spread N-S

Among all guava varieties V₄ (Lalit) show significantly maximum canopy spread (N-S) which was (1.244 m) followed by V₃ (Shweta) with canopy spread (N-S) of (1.212 m). Minimum canopy spread N-S (1.169 m) was recorded for V₁ (Allahabad Safeda). This result where found similar with Paikra *et al.*, (2015) [3].

This might be due to genotypic in association with various physiological phenomena *viz.* photosynthetic efficiency, rate of translocation of photosynthates from source to sink and photo-respiration that takes place in the plant body. The finding was similar to Singh *et al.*, (2013) [1,5,6].

Different INM have significant effect on canopy spread (N-S) however, the highest canopy spread (N-S) (1.311 m) was

observed in N₃ (75% RDF + 10 kg FYM +2.5 kg vermicompost +50 g Azotobacter), followed by N₄ (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) with Canopy spread (N-S) of (1.251 m) and lowest (1.107m) in N₀ (Control).

The improvement of soil health melioration of physico-chemical and biological activities might be due to better nutritional environment and application of organic matter which was similar to that of Singh *et al.*, (2003) [1,5,6].

Interaction effect of integrated nutrient management and varieties presented in Table 8 resulted significant effect on canopy spread (N-S). Further, highest canopy spread (N-S) was observed (1.357 m) in V₄N₃ (Lalit + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azotobacter) followed by V₃N₃ (shweta + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azotobacter) (1.337 m) and minimum (1.043 m) in V₁N₀ (Allahabad Safeda + Control).

Table 7: Influence of different INM and guava Varieties on canopy spread (N-S) (m)

Treatment		Canopy spread (N-S)
Factor A. Varieties (4 Level)		
V ₁	Allahabad Safeda	1.169
V ₂	L-49	1.196
V ₃	Shweta	1.212
V ₄	Lalit	1.244
S. Em.		
C.D at 5%		
Factor B. INM (6 Level)		
N ₀	Control	1.107
N ₁	100% RDF	1.217
N ₂	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Trichoderma	1.154
N ₃	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azotobacter	1.311
N ₄	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azospirillum	1.251
N ₅	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm PSB	1.192
S. Em.		0.003
C.D at 5%		0.019

Table 8: Interaction effect of different INM and guava varieties on canopy spread (N-S) (m)

	N ₀	N ₁	N ₂	N ₃	N ₄	N ₅
V ₁	1.043	1.170	1.113	1.260	1.227	1.200
V ₂	1.090	1.207	1.133	1.290	1.243	1.213
V ₃	1.133	1.227	1.167	1.337	1.247	1.160
V ₄	1.160	1.263	1.203	1.357	1.287	1.193
S. Em.	0.006					
C.D at 5%	0.016					
C.V. (%)	0.825					

Canopy spread (E-W)

Among all Guava varieties V₄ (Lalit) show significantly Maximum Canopy spread (E-W) which was (1.443 m) followed by V₃ (Shweta) with Canopy spread (E-W) of (1.431 m). Minimum Canopy spread (1.369 m) was recorded for V₁ (Allahabad safeda). This result where found similar with Paikra *et al.*, (2015) [3].

Various physiological phenomenon from source to sink *viz.* Rate of translocation of phytosynthates, photosynthetic efficiency and photo-respiration which occurs in plant body might be due to genotypic in association. This finding was similar to singh *et al.*, (2013) [1,5,6].

Different INM have significant effect on Canopy spread (E-W) However, the highest Canopy spread (E-W) (1.418 m) was observed in N₃ (75% RDF + 10 kg FYM + 2.5 kg vermicompost + 50 g Azetobactor), followed by N₄ (75% RDF + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azospirillum) with Canopy spread (E-W) of (1.466) and lowest (1.393) in N₀ (Control).

The improvement of soil health was due to melioration of physico-chemical and biological activities which may be due to better nutritional environment and application of organic matter the finding was similar to that of Singh *et al.*, (2013) [1, 5, 6].

Table 10 revealed interaction effect of integrated nutrient management and varieties presented in resulted significant effect on Canopy spread (E-W). Further, Highest Canopy spread (E-W) was observed (1.557 m) in V₄N₃ (Lalit + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azetobactor) followed by V₃N₃ (shweta + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azotobactor) (1.523 m) and minimum (1.243 m) in V₁N₀ (Allahabad safeda + Control).

Table 9: Influence of different INM and guava varieties on canopy spread (E-W)

Treatment		Plant canopy spread (E-W)
Factor A. Varieties (4 Level)		
V ₁	Allahabad safeda	1.369
V ₂	L-49	1.398
V ₃	Shweta	1.431
V ₄	Lalit	1.443
S. Em.		0.003
C.D at 5%		0.008
Factor B. INM (6 Level)		
N ₀	Control	1.305
N ₁	100% RDF	1.393
N ₂	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Tricoderma	1.366
N ₃	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azetobactor	1.514
N ₄	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azospirillum	1.466
N ₅	75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm PSB	1.418
S. Em.		0.003
C.D at 5%		0.009

Table 10: Interaction effect of different INM and guava varieties on canopy spread (E-W)

	N ₀	N ₁	N ₂	N ₃	N ₄	N ₅
V ₁	1.243	1.370	1.317	1.473	1.420	1.390
V ₂	1.303	1.370	1.353	1.503	1.450	1.410
V ₃	1.333	1.407	1.383	1.523	1.490	1.447
V ₄	1.340	1.423	1.410	1.557	1.503	1.427
S. Em.	0.007					
C.D at 5%	0.019					
C.V. (%)	0.811					

Conclusion

Vegetative growth parameter i.e. Plant-height, Trunk girth, Canopy spread (N-S) and Canopy spread (E-W) resulted significant increase by various variety. Among varieties V₄ (Lalit) resulted significantly maximum Plant height(2.445 m), Trunk girth (7.002 m), Canopy spread (N-S)(1.244 m), Canopy spread (E-W)(1.443 m) which was also closely followed by V₃ (Shweta), V₂ (L-49) and V₁ (Allahabad

safeda) resulted to minimum vegetative growth parameter during field experiment conducted on 2019-2020.

Between various INM treatment N₃ (75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azetobactor) resulted significantly maximum (2.503 m) Plant height, Trunk girth (7.298 cm), Canopy spread (N-S) (1.311 m), Canopy spread (E-W)(1.514 m) which was also closely followed by N₄ (75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Azospirillum), N₅ (75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm PSB), N₁ (100% RDF), N₂(75% RDF + 10 kg FYM + 2.5kg vermicompost + 50 gm Tricoderma) and N₀ (Control) resulted to minimum vegetative growth parameter during field experiment conducted on 2019-2020.

Interaction of treatment combination between various varieties and INM resulted significantly maximum Plant height (263.7 cm), Trunk girth (7.47 cm), Canopy spread (N-S) (1.357 cm), Canopy spread (E-W) (1.55 cm) from V₄N₃ (Lalit + 75% + 10 kg FYM + 2.5 kg Vermicompost + 50 g Azetobactor) were else Minimum result were obtained from V₁N₀ (Allahabad safeda + Control).

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