Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(6): 420-424
Received: 07-09-2019
Accepted: 09-10-2019

Amit Kumar
Ph.D. Scholar, RVSKVV, Gwalior, Madhya Pradesh, India

Manoj Kumar Kureel
Assistant Professor, RVSKVV, Gwalior, Madhya Pradesh, India

Rajesh Lekhi
Professor & Head, Department of Horticulture, RVSKVV Gwalior, Madhya Pradesh, India

DS Mandloi
Programme Assistant, RVSKVV, Gwalior, Madhya Pradesh, India

Ashok Dhakad
Ph.D. Scholar, I.A.R.I., New Delhi, India

Corresponding Author:
Amit Kumar
Ph.D. Scholar, RVSKVV, Gwalior, Madhya Pradesh, India

Impact of inorganic, organic and bio- fertilizers on growth and yield of guava (*Psidium guajava* L.) var. G -27 under Gwalior agro-climatic condition of M.P.

Amit Kumar, Manoj Kumar Kureel, Rajesh Lekhi, DS Mandloi and Ashok Dhakad

Abstract
Guava is an important fruit crop with regards to its nutritional and commercial value. Production and productivity are the prime concern of the researchers and farmers throughout the world. Looking to the cumulative toxic effects of inorganic fertilizers and chemicals used in maximising the production and productivity, Integrated Nutrient Management is an effective measure. Keeping these facts in view, an experiment was conducted at dryland horticulture farm, Sirsod, College of Agriculture, Gwalior to study the impact of inorganic, organic and bio-fertilizers on growth and yield of Guava (*Psidium guajava* L.) Var. G-27 under Gwalior agro-climatic condition of Madhya Pradesh during 2018–19 with an objective of studying the effect of inorganic, organic and bio-fertilizers on growthand yield of guava, to find out the best treatment combination of inorganic, organic and bio-fertilizers for increasing the growth and yield of guava and to find out the economic feasibility of treatments. The experiment was laid out in Randomized Block Design with 14 treatments replicated thrice. It was concluded from the experiment that treatment T_9 (75% RDF + Vermicompost (5kg) +Bio-fertilizers per plant) gave the best results as far as growth, yield and B:C ratio are concerned.

Keywords: Guava, biofertilizers, inorganic fertilizer, organic manure

Introduction
Guava (*Psidium guajava* L.) is one of the most valuable and commercial fruit crops in India. It belongs to the family Myrtaceae which comprises at least 150 genera and more than 5,650 species (Govaerts *et al.* 2008) [15]. Guava is also known as apple of the tropics and poor man’s apple. It is available throughout the year except during the summer season (May–June). Being very hardy, it gives an assured crop even with very little care. The total area, production and productivity of guava in India are about 265.00 thousand ha, 4054.00 thousand T and 15.29 MT/ha, respectively. In Madhya Pradesh, the total area, production and productivity of guava are 28.44 thousand ha, 990.00 thousand T and 34.81 MT/ha, respectively. Madhya Pradesh ranks 1st in productivity with 34.81 MT/ha, (NHB 2017–2018). Major guava producing districts in Madhya Pradesh are Indore, Khargone, Vidisha, Katni, Singrauli, Sheopur, Morena etc.

Vermicompost and bio-fertilizers are yield and fruit quality boosters as compared to application of NPK and FYM as the only source of organic matter. Significant differences in plant height, canopy spread and stem girth of guava plants were obtained in combination, where *Azotobacter*, *T. harzianum*and PSM were applied. Fruit yields and quality were higher in combination, where Vermicompost, *Azotobacter*, *T. harzianum* and PSM was applied. Fruit quality parameters *viz.* soluble solid concentration, titratable acidity, total sugars and ascorbic acid showed positive correlation with the available macro and Micronutrients in the soil. Integration of organic substrates with chemical fertilizers can have significant effect on the physical, microbiological and chemical properties of soil, which are responsible for supporting plant growth. Use of organic manures along with bio-fertilizers and crop residues is considered as a cheap source of available nutrient to plants which have beneficial effects on growth, yield and quality of various fruit crops (Shukla 2014) [25].

Material and Methods
The experiment was conducted at the Dry Land Horticulture Farm, Sirsod, College of Agriculture, Gwalior, (M.P.) to study the impact of inorganic, organic and bio-fertilizers on growth and yield of Guava (*Psidium guajava* L.) Var. G-27 under Gwalior agro-climatic

condition of Madhya Pradesh during 2018–19. The meteorological data were recorded during the experimental period atmeteorologicalobservatory, College of Agriculture, Gwalior. To evaluate the basic fertility level, soil samples were analyzed for physical and chemical composition of soil. The variety of guava taken under the study was Gwalior – 27. The treatments were laid in Randomized Block Design with 14 treatments Viz., TO, Control, T1, 100% RDF (150g: 100g: 150g N: P: K per plant), T2, 75% RDF + FYM (5Kg) per plant, T3, 75% RDF + Vermicompost (5kg) per plant, T4, 75% RDF + Sheep Manure (5kg) per plant, T5, 50% RDF + FYM (10kg) per plant, T6, 50% RDF + Vermicompost (10kg) per plant, T7, 50% RDF + Sheep manure (10kg) per plant, T8, 75% RDF + FYM (5kg) +Bio-fertilizers per plant, T9, 75% RDF + Vermicompost (5kg) +Bio-fertilizers per plant, T10, 75% RDF + Sheep Manure (5kg) +Bio-fertilizers per plant, T11, 50% RDF + FYM (10kg) +Bio-fertilizers per plant, T12, 50% RDF + Vermicompost (10kg) +Bio-fertilizers per plant and T13, 50% RDF + Sheep Manure (10kg) +Bio-fertilizers per plant) replicated thrice. One plant (aged 3 years) per treatment was taken for the study. The bio- fertilizers were applied @ 100 ml per plant. The data of different characters were recorded and analyzed using the method of analysis of variance as mentioned by Fisher (1954) in his book "Design of Experiment".

Results and discussion

All the growth parameters did not differ significantly initiallywhereaswhen they wererecorded at 150 days, they were found to be influenced significantly by different treatments.

At 150 days, the maximum increase in plant height (0.56 m) was recorded with treatment T9 which was found significantly superior to rest of the treatments except T10 (0.55 m) and T8 (0.53 m). The minimum increase inplant height (0.43) was observed in T0 (control).The maximum increase inplant spread (0.52 m) were recorded in treatment T9, which was significantly superior to all of the treatments except T10 (0.51 m) and T8(0.50 m) was other treatments followed. The minimum increase inplant spread (0.42 m)was observed in T0 (control),while the maximum increase in plant spread (0.48 m) was observed in the treatment T9 which was found significantly superior to all of the treatments except T8(0.47 m) and T10 (0.47 m) followed by other treatments. The minimum increase in plant spread (0.39 m) was observed in T0 (control).The maximum increase in diameter of stem (4.55 mm) was recorded in treatment T9 which was found significantly superior to all of the treatments. It was recorded at par with T10 (4.38 mm) and T8 (4.26 mm) and followed by other treatments. The minimum increase in diameter of stem (1.84 mm) were recorded in T0 (control). The maximum increase in diameter of secondary branches (3.96 mm) was observed with treatment T9 which was significantly superior to rest of the treatments except T10 (3.83 mm) and T8 (3.67 mm). The minimum increase in diameter of secondary branches (2.08 mm) was recorded in T0 (control).The maximum increase in number of secondary branches (4.11) was noted in this treatment T9 which was significantly superior to rest of the other treatments except T10 (4.00), T8 (3.89), T1 (3.78), T12 (3.56), T13 (3.44), T3 (3.22), T11 (3.22), T4 (3.00) and T2 (2.89). The minimum increase in number of secondary branches (2.00) was noted in T0 (control). The maximum increase in number of tertiary branches (11.00) was showed with treatment T9 which was significantly superior to rest of the treatments except T10 (10.67), T8 (10.33), T1 (9.44) and T13 (9.33). The minimum increase in number of tertiary branches (7.11) at 150 days was observed in T0 (control).number of fruits per plant was significantly influenced by due to various combinations of inorganic, organic manures with and with bio-fertilizers in different treatments. The maximum average fruit weight (248.05 g) was found in the treatment T9 which was significantly superior to other treatments except T10 (244. 90 g) and T8 (241.75 g).The minimum average fruit weight (219.30 g) were recorded in T0 (control). The maximum number of fruits per plant (57.54) was found to be in this treatment T9 which was significantly superior to rest of the treatments which was at par with T10 (53.80) and T8 (52.14). The minimum number of fruits per plant (35.67) were found in T0 (control). The maximum yield per plant (14.27 kg) was recorded in the treatment T9 which was significantly superior to rest of the treatments except T10 (13.17 kg) and T8 (12.60 kg). The minimum yield per plant (7.82 kg) was recorded in T0 (control). The maximum yield per hectare (57.08 q) was recorded in the treatment T9 which was significantly superior to other treatments except T10 (52.48 q) and T8 (50.40 q). The minimum yield per hectare (31.30 q) was observed in T0 (control). Better efficiency of organic manures in combination with inorganic fertilizers might be due to the fact that organic manures would have provided the micronutrients such as zinc, iron, copper, manganese, etc., in an optimum level. These findings were supported by different scientists. The application of organic manures would have helped in the plant metabolism through the supply of such important micronutrients in the early growth phase. The favorable effect ofvermicompost on vegetative growth characters might be due to the fact that in addition to improving the various aspects of soil systems (physico-chemical and biological). it also alters various enzymatic activities in plants such as peroxidase, catalase etc. which promotes cell elongation, root and shoot growth and carbohydrate metabolism.

The positive influence of bio-fertilizers in combination of inorganic and organic on vegetative characters performance might be due to fact the application of 75% RDF and vermicompost along with bio-fertilizers (Azotobacter, PSB and Potash mobilizing bacteria). The increase in vegetative characters of plant may be attributed to increased availability of nutrients such as N, P and K in plants leading to increased formation of plant metabolites that might have helped to built up the plant tissue (Claypol, 1938) [8].

The useful effect of nitrogen is certainly the results of an increase in vegetative characters. As nitrogen is the major constituent of fertilizers applied and as it is constituent of the protein which is essential for formation of protoplasm thus affecting the cell division and cell elongation and there by more vegetative growth of guava plants. Higher supply of N made more rapid synthesis of carbohydrate, which was converted into protein and protoplasm increase the size of cells. Inoculation with Azotobacter a biological nitrogen fixer improves the nitrogen use efficiency of plant (Dutta *et al*. 2009) [11] and inoculation with PSB and Potash mobilizing bacteria improves the availability of phosphorus and potash of plant. In addition to this phosphorus plays an important role in energy transformation and potassium plays an important role in maintenance of cellular organization by regulating the permeability of cellular membrane. This might be due to release of nutrients as per the requirement at the physiological growth stage of guava plants resulted in the proper root growth. This can be supported with findings by Sharma and Sharma (1992) [24], Bhobia *et al*. (2005) [5], Khattak *et al*. (2005) [16], Naik and Hari babu (2007) [20], Dhomane *et al*.

(2011) [10], Ram *et al*. (2007) [21], Baksh *et al*. (2008) [4], Dutta *et al*. (2009) [11], Atom (2013) [3], Binepal *et al*. (2013) [6], Godage *et al*. (2013) [14], Kumar *et al*. (2017) [17] and Dwivedi & Agnihotri (2018) [12] in guava and Mahendra *et al*. (2009) [19] in ber. The productivity of any crop depends on the process of photosynthesis, which in turn depends on the chlorophyll content of leaves in plants and the magnesium is an important constituent of chlorophyll. They help inactivation of many enzymes involved in photosynthesis.

A significant increase in fruit yield might be attributed to the increased number of fruits per plant, fruit size and fruit weight in guava with integrated nutrient application may be due to vigorous vegetative growth and increased chlorophyll content, which together accelerated the photosynthetic rate and thereby increased the supply of carbohydrates to plants. Similar results were observed by Athani *et al*. (2007) [2], Singh *et al*. (2008) [26], Rubee *et al*. (2011) [22], Devi *et al*. (2012) [9], Binepal *et al*. (2013) [6], Sharma *et al*. (2013) [23], Kumar *et al*. (2017) [17] and Dwivedi *et al*. (2018) [12] in guava.

The economics of treatment were recorded from every treatment. The data is presented in Table-2. The data clearly reveals that B: C ratio differed significantly due to various treatments. Treatment T9 observed maximum gross income (Rs3,13,940.00), net income (Rs 2,24,240.00) and benefit cost ratio (3.49:1) which followed by T8(3.39:1), T10(3.36:1) and T1 (3.25:1).Minimum benefit cost ratio was noticed in treatment T6 (1.84:1). Treatment T8, T9 and T10 gave the most superior quality fruits on the basis of physico-chemical parameters and organoleptic parameters with visual analysis which fetched higher price (Rs 55/kg) as compared to other treatments.

Table 1(a): Impact of inorganic, organic and bio-fertilizers on different parameters of guava plants

Treatment No	Increase in plant height (m)at 150 days	Increase in plant spread (North–South) (m) at 150 days	Increase in plant spread (East–West) (m) at 150 days	Increase in diameter of stem (mm) at 150 days
T_0	0.43	0.42	0.39	1.84
T_1	0.51	0.48	0.45	3.75
T_2	0.45	0.45	0.42	2.72
T_3	0.48	0.47	0.43	3.15
T_4	0.47	0.46	0.43	2.94
T_5	0.46	0.43	0.40	2.13
T_6	0.45	0.45	0.41	2.46
T_7	0.44	0.44	0.41	2.28
T_8	0.53	0.50	0.47	4.26
T_9	0.56	0.52	0.48	4.55
T_{10}	0.55	0.51	0.47	4.38
T_{11}	0.49	0.47	0.44	3.25
T_{12}	0.50	0.48	0.45	3.50
T_{13}	0.48	0.47	0.44	3.25
S.E m ±	0.02	0.01	0.01	0.22
CD at 5%	0.04	0.03	0.02	0.64

Table 1(b): Impact of inorganic, organic and bio-fertilizers on different parameters of guava plants

Treatment No	Increase in diameter of secondary branches (mm) at 150 days	Increase in number of secondary branches at 150 days	Increase in number of tertiary branches at 150 days	Yield per plant (kg)	Yield per hectare (q)
T_0	2.08	2.00	7.11	7.82	31.30
T_1	3.40	3.78	9.67	12.21	48.48
T_2	2.68	2.89	8.00	9.69	38.76
T_3	2.92	3.22	8.67	10.49	41.96
T_4	2.68	3.00	8.33	10.08	40.32
T_5	2.16	2.33	7.33	8.42	33.68
T_6	2.52	2.67	8.00	9.36	37.44
T_7	2.36	2.33	7.67	9.02	35.96
T_8	3.67	3.89	10.33	12.60	50.40
T_9	3.96	4.11	11.00	14.27	57.08
T_{10}	3.83	4.00	10.67	13.17	52.48
T_{11}	3.14	3.22	9.00	10.92	43.68
T_{12}	3.35	3.56	9.44	11.73	46.92
T_{13}	3.18	3.44	9.33	11.30	45.20
S.E m ±	0.19	0.43	0.60	0.65	2.22
CD at 5%	0.55	1.24	1.75	1.90	6.44

Table 2: Impact of inorganic, organic and bio-fertilizers on economics of treatments of guava plants

Tr. No.	Treatment Cost Rs/ha	Total Expenditure Rs/ha	Gross Income Rs/ ha	Net Income Rs/ha	B: C Ratio
T_0	0	55000	125200.00	70200.00	2.27
T_1	4676	59676	193920.00	134244.00	3.25
T_2	7500	62500	155040.00	92540.00	2.48
T_3	15500	70500	167840.00	97340.00	2.38
T_4	11500	66500	161280.00	94780.00	2.42
T_5	10336	65336	134720.00	69384.00	2.06
T_6	26336	81336	149760.00	68424.00	1.84

T_7	18336	73336	143840.00	70504.00	1.96
T_8	26700	81700	277200.00	195500.00	3.39
T_9	34700	89700	313940.00	224240.00	3.49
T_{10}	30700	85700	288640.00	202940.00	3.36
T_{11}	29536	84536	174720.00	90184.00	2.06
T_{12}	45536	100536	187680.00	87144.00	1.86
T_{13}	37536	92536	180800.00	88264.00	1.95

Conclusion

Based on the present findings it can be concluded that treatment T_9 (75% RDF + Vermicompost (5 kg) + Bio-fertilizers per plant) showed positive and significant impact on most of the traits under investigation. Although treatmentsT_8 (75% RDF + FYM (5 kg) + Bio-fertilizers per plant) and T_{10} (75% RDF + Sheep Manure (5 kg) + Bio-fertilizers per plant) also showed promising behavior. Impact of inorganic fertilizers in addition to vermicompost and bio-fertilizers leads to best treatment among all. *Azotobacter* enhanced nitrogen levels which helped to more vegetative growth. This information would also be highly useful and helpful for farmers and researchers for selection of desirable treatment to obtain better results.

References

1. Anonymous. Indian Horticulture Database, National Horticulture Board, Govt., of India, 2017-18.
2. Athani SI, Ustad AI, Prabhuraj HS, Swamy GSK, Patil PB, Kotikal YK. Influence of Vermicompost on Growth, Fruit Yield and Quality of Guava cv. Sardar. Acta Hort. 2007; 735:381-385.
3. Atom A. Effect of inorganic and bio-fertilizers on growth, yield and quality of Sardar Guava (*Psidium guajava* L.). M.Sc. Thesis, College of Agriculture, Latur, 2013.
4. Baksh H, Yadav R, Dwivedi R. Effect of INM on growth, yield attributing characters and quality of guava (*Psidium guajava* L.) *cv*. Sardar. Prog. Agri. 2008; 8(2):141-144.
5. Bhobia SK, Godara RK, Singh S, Bhatia SK, Kumar S. Effect of organic and inorganic nitrogen on yield and quality of winter season guava cv. Hisar Surkha. National guava symposium, 2005, 88-90.
6. Binepal MK, Tiwari R, Kumawat BR. Effect of Integrated nutrient management on physico-chemical parameters of guava cv. Sardar under Malwa Plateau conditions of madhya pradesh. Annals of Plant and Soil Research. 2013; 15(1):47-49.
7. Binepal MK, Tiwari R, Kumawat BR. Effect of Integrated nutrient management on physico-chemical parameters of guava cv. Sardar under Malwa Plateau conditions of madhya pradesh. Annals of Plant and Soil Research. 2013; 15(1):47-49.
8. Claypol LL. Irrigation orchards. Proc. Wash, A. Hort. Soc. 1938; 30:78-10.
9. Devi HL, Mitra SK, Poi SC. Effect of different organic and bio-fertilizer sources on guava (*Psidium guajava* L.) 'Sardar'. Acta Horticulturae. 2012; 99(5):201-208.
10. Dhomane PA, Kadam AS, Lakade SK, Gharage VR. Effect of different sources of nitrogen on growth and yield of guava (*Psidium guajava* L.) cv. Sardar. Asian J. Horti. 2011; 6(1):92-95.
11. Dutta P, Maji SB, Das BC. Studies on the Response of Bio-fertilizer on Growth and Productivity of Guava. Ind. J. Hort. 2009; 66(1):39-42.
12. Dwivedi V, Agnihotri S. Effect of Integrated Nutrient Management on Growth, Yield and Economics of Guava (*Psidium guajava* L.) cv. Allahabad Safeda. Int. J. Curr. Microbiol. App. Sci. 2018; 7(06):3449-3453.
13. Dwivedi V, Agnihotri S. Effect of Integrated Nutrient Management on Growth, Yield and Economics of Guava (*Psidium guajava* L.) cv. Allahabad Safeda. Int. J. Curr. Microbiol. App. Sci. 2018; 7(06):3449-3453.
14. Godage SS, Parekh NS, Nehete DS. Influence of bio-fertilizers and chemical fertilizers on growth, flowering and fruit characters of guava (*Psidium guajava* L.) cv. Allahabad safeda. Internat. J. agric. Sci. 2013; 9(1):309-313.
15. Govaerts R, Sobral M, Ashton P, Barrie F, Holst BK, Landrum LR *et al*. World checklist of Myrtaceae. Kew Publishing, Royal Botanic Gardens, Kew, 2008.
16. Khattak MR, Latif AB, Wazir M. Effect of different levels of nitrogen, phosphorus and potassium on the growth and yield of guava. Sarhad J. of Agri. 2005; 21(2):185-187.
17. Kumar RK, Jaganath S, Guruprasad TR. Impact of Organic, Inorganic and Bio-Fertilizers with Different Spacing on Vegetative Growth and Yield of Guava (cv. Lalit) During Summer Season, Int. J. Pure App. Bio sci. 2017; 5(1):310-319.
18. Kumar RK, Jaganath S, Guruprasad TR. Impact of Organic, Inorganic and Bio-Fertilizers with Different Spacing on Vegetative Growth and Yield of Guava (cv. Lalit) During Summer Season, Int. J. Pure App. Bio sci. 2017; 5(1):310-319.
19. Mahendra Singh HK, Singh JK. Studies on integrated nutrient management on vegetative growth, fruiting behavior and soil fertilizer status of ber (*Zizipus mauritiana* Lamk.) IV orchard cv. Banarasi Karka. The Asian J. of Hort. 2009; 4(1):230-232.
20. Naik MH, Hari Babu RS. Feasibility of Organic Farming in Guava (*Psidium guajava* L.). ActaHorti. 2007; 735:365-372.
21. Ram RA, Bhriguvanshi SR, Pathak RK. Integrated Plant Nutrient Management in Guava (*Psidium guajava* L.) cv. Sardar. Acta Horti, 2007, 735.
22. Rubee L, Dwivedi DH, Ram RB, Meena ML. Response of Organic Substrates on Growth, Yield and physiochemical Characteristics of Guava cv. Red Fleshed. Ind. J Ecol. 2011; 38(1):81-84.
23. Sharma A, Wali VK, Bakshi P, Jasrotia A. Effect of integrated nutrient management strategies on nutrient status yield and quality of guava. Indian Journal of Horticulture. 2013a; 70(3):333-339.
24. Sharma DP, Sharma RG. Effect of foliar application of NPK on growth and yield of guava (*Psidium guajava* L.). Adv. in Plant Sci. 1992; 5:313-315.
25. Shukla SK, Adak T, Singh A, Kumar K, Singh VK, Singh A. Response of guava trees (*Psidium guajava* L.) to soil applications of mineral and organic fertilizers and bio-fertilizers under conditions of low fertile soil. Journal of Horticultural Research. 2014; 22(2):105-114.
26. Singh V, Dashora LK, Karatha KM, Ahalawat TR, Barad AV. Growth, flowering, fruiting and yield of guava

(*Psidium guajava* L.) cv. 'SARDAR' grown under high-density-planting system as influenced by various organic and inorganic sources. Asian J Horti. 2008; 3(2):382-385.