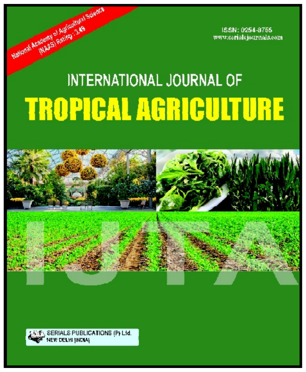

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Effect of integrated nutrient management on growth, yield and economics of guava (*Psidium guajava* L.) cv.L-49 under Nimar Plains conditions of Madhya Pradesh

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Abstract: A field experiment was conducted to study the effect of integrated nutrient management on growth, yield and economics of guava at Krishi Vigyan Kendra, Khargone (M.P.) The treatment T_{10} comprising 50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree+*PSB* 100 g/ tree gave maximum increase in plant height increment (0.70 m), canopy spread increment N-S (0.50 m), E-W (0.54 m), shoot diameter (4.15 mm), shoot length (22.63 cm), leaf width (4.19 cm), leaf length (7.12 cm) and number of leaves per shoot (21.28) followed by T_8 (50 % RDF + 50 kg FYM + *PSB* (100 gm/ tree). Maximum number of fruits per tree (339.29), fruit weight (193.02g), yield/tree (65.47kg) and yield/ha (182.02q) were recorded under the treatment T_{10} followed by T_8. All the treatments were significantly superior over control. The treatment T_{10} recorded the maximum net return Rs. 221137/ha with B: C ratio of 4.97.

Key Words: Guava, Integrated Nutrient Management, Growth, Yield, Economics

INTRODUCTION

Guava (*Psidium guajava* L.), popularly known as the apple of the tropics, is one of the widely grown fruit of tropical, sub-tropical and few pockets of arid regions of India. It belongs to the family Myrtaceae. In India, owing to its wider adaptability may be grown in diverse soils and agro-climatic regions; affordable cost of the cultivation, profuse bearing, nutritive value and ability to fetch profit, have made it very popular among the growers. In India, guava is grown over an area of 254.9 thousand hectares with production of 4047.8 thousand metric tonnes (2015-16) and productivity of 15.9 metric tonnes ha^{-1} (Horticultural Statistics at a Glance 2017). In India is mainly grown in Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal and Chhattisgarh. The area and production of guava in Madhya Pradesh is 28.44 thousand hectares and 990.00 thousand metric tonnes respectively (Horticultural statistics at a Glance 2017). Major guava producing districts in Madhya Pradesh are Indore, Khargone, Vidisha, Katni, Singrauli and Sheopur.

Imbalanced application of chemical fertilizers is a common practice of farmers which create problem of ground water and environmental contamination through leaching, volatilization, denitrification and wastage. In this perspective, there is a need to create awareness about alternate agriculture system like integrated plant nutrient management which stresses the maintenance or adjustment of soil fertility and of plant nutrients supply to an optimum level for sustaining crop productivity through optimization of advantages from all possible sources of plant nutrients in an integrated manner.

Nimar Plains is an important region in Madhya Pradesh where guava orchards are found in and around Khargone district. However, it is noticed that these orchards are declining in their productivity. There is an urgent need for an alternative nutritional package to attain long term sustainability for fruit production & quality as well as for conserving soil health and productivity through INM system in which inorganic fertilizers can be substituted with organic manures and/or biofertilizers, without reducing the yield and deteriorating the quality of fruits.

MATERIALS AND METHODS

The experiment was conducted during two consecutive years i.e. 2016-17 and 2017-18 at Instructional farm of Krishi Vigyan Kendra, Khargone (M.P.). The Khargone district comes under Nimar Plains Zone of Madhya Pradesh is situated between Latitude of 21.833525 (DMS Lat 21° 50' 0.6900" N) and longitude of 75.614990 (DMS Long 75° 36' 53.9640" E). The maximum temperature ranges from 43 to 46°C during summer season and minimum temperature fluctuates between 6 to 10°C during winter season. The average annual rainfall is 835 mm, most of which is recorded during July to September, winter and summer rains are uncommon. The soil of the experimental site was medium black and classified as *Vertisols* with pH of (7.26), low in available nitrogen (223.5 kg ha_{-1}), medium in available phosphorus (28.6 kg ha_{-1}) and available potassium (216.7 kg ha_{-1}). Experiment comprised eleven treatment combinations. T1 (without nutrient application as control), T2 (RDF 600 g: 400 g : 300 g NPK /tree), T3 (RDF + organic mulching @ 10 cm thick), T4 (50 % RDF + 50 kg FYM), T5(50 % RDF + 5 kg vermicompost), T6 (50 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree) , T7 (25 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree), T8 (50 % RDF + 50 kg FYM + *PSB* (100 gm/ tree), T9 (25 % RDF + 50 kg FYM + *PSB* (100 g/ tree), T10 (50 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)+*PSB* (100 g/ tree) and T11 (25 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree) +*PSB* (100 g/ tree) with in randomized block design with three replications. The whole of the organic manure was applied as a basal dose on the onset of monsoon along with bio-fertilizers. Then required doses of fertilizers were applied in two split doses in the month of July and August. Irrigation was given immediately after application of fertilizers. The Nitrogen was applied through Urea and DAP containing 46% and 18 % nitrogen respectively. The Phosphorus was given through Dimmonium phosphate, containing 46 per cent P_2O_5. The Potassium was given through Muriate of Potash, containing 60 percent K_2O. Bio-fertilizers i.e. *Azospirillum* and *phosphate solubilizing bacteria* (PSB) were incorporated as per schedule of treatments.

RESULTS AND DISCUSSION

Vegetative growth

The vegetative growth characters of guava cv L-49 trees have been recorded after applying INM parameters of plant height, canopy spread (E-W and N-S), shoot diameter, shoot length, leaf width, leaf length and number of leaves per plant were influenced significantly as compared to control. The treatment T_{10} recorded significant increase in the plant height increment (0.70 m), canopy spread increment N-S (0.50 m), E-W (0.54 m), shoot diameter (4.15 mm), shoot length (22.63 cm), leaf width (4.19 cm), leaf length (7.72 cm) and number of leaves per shoot (21.28) over control and other treatments (Table 1). The second and third best treatments were T_8 and T_6 respectively. The most beneficial effect of these treatments might be due to improvement in the physical, chemical and biological properties of the soil. It might have also stimulated soil micro-biological activities.

In fact, leaf is the factory for the conversion of solar energy into the chemical energy by the process of photosynthesis. The adequate supply of multinutrients resulted in their proper utilization in the process of photosynthesis due to increase in the leaf number and leaf size i.e. photosynthetic area. Thus, the increased production of photosynthates (food material) brought about increase in the vegetative growth parameters. Leaf is the principal site of plant metabolism and the changes in nutrients supply are reflected in the composition of leaf.

Table 1
Effect of integrated nutrient management on growth of guava (pooled mean of two years)

Treatments		*Plant height increment (m)*	*Canopy spread increment (m) N-S*	*Canopy spread increment (m) E-W*	*Shoot diameter (mm) at 90 days*	*Shoot length (cm) at 90 days*	*Leaf width (cm)*	*Leaf length (cm)*	*Number of leaves per shoot at 90 days*
T_1	Control (without nutrient application)	0.41	0.21	0.25	2.96	16.28	2.99	5.46	17.46
T_2	RDF 600 g: 400 g : 300 g NPK /tree	0.49	0.28	0.31	3.31	18.41	3.35	6.21	18.32
T_3	RDF + organic mulching @ 10 cm thick	0.51	0.31	0.33	3.35	18.19	3.39	6.23	18.47
T_4	50% RDF + 50 kg FYM	0.56	0.39	0.44	3.53	18.84	3.62	6.94	19.51
T_5	50% RDF + 5 kg vermicompost	0.54	0.35	0.43	3.40	18.36	3.48	6.89	19.45
T_6	50% RDF + 50 kg FYM + Azospirillium (100 g/ tree)	0.62	0.43	0.46	3.68	20.25	3.85	7.17	20.20
T_7	25% RDF + 50 kg FYM + Azospirillium (100 g/ tree)	0.52	0.33	0.38	3.32	18.26	3.43	6.44	18.96
T_8	50% RDF + 50 kg FYM + PSB (100 gm/ tree)	0.64	0.45	0.49	3.84	20.53	3.86	7.23	20.24
T_9	25 % RDF + 50 kg FYM + PSB (100 g/ tree)	0.53	0.34	0.42	3.39	18.52	3.47	6.54	19.25
T_{10}	50 % RDF + 50 kg FYM + Azospirillium (100 g/ tree)+PSB (100 g/ tree)	0.70	0.50	0.54	4.15	22.63	4.19	7.72	21.28
T_{11}	25 % RDF + 50 kg FYM + Azospirillium (100 g/ tree) +PSB (100 g/ tree)	0.58	0.42	0.45	3.57	19.41	3.79	7.03	19.91
SE(m)±		**0.02**	**0.01**	**0.01**	**0.07**	**0.46**	**0.09**	**0.13**	**0.22**
CD at 5%		**0.05**	**0.04**	**0.03**	**0.21**	**1.32**	**0.26**	**0.36**	**0.62**

The present findings corroborate with those of Athani *et al.,* (2007b), Naik and Babu (2007), Ram *et al.,* (2007), Ram and Pathak (2007), Kumar *et al.,* (2007), Dutta *et al.,* (2009), Patel *et al.,* (2009), Shukla *et al.,* (2009), Dwivedi *et al.,* (2010), Dwivedi (2013) and Agnihotri *et al.,* (2013) who found that vermicompost with FYM and inorganic fertilizers resulted increase in the vegetative growth.

Yield parameters

It is evident from the data presented in Table 2 that the highest value for fruits/tree (339.29), fruit weight (193.02g), yield per tree (65.47kg) and yield per hectare (182.02q) were due to components of T_{10} followed by T_8 and T6. It might be due to better nutritional environment due to application of organic matter and bio fertilizers which improved the soil health by improving physico-chemical conditions and also stimulated soil microbiological activity. Ram *et al.,* (2007) found that application of different fertilizers, organic manures and biofertilizer improved the vegetative growth, number of fruits and yield of guava cv. Sardar. The similar effect was found by Monga *et al.,* (2002), Agnihotri *et al.,* (2013) and Dwivedi (2013).The results of long-term fertilizer experiments suggested that neither organic manures alone nor exclusive application of chemical fertilizers could achieve the yield sustainability at a high order under modern farming where the nutrient turnover in the soil plant system is quite high (Prabhu *et.al.* 2002).

Economics

Data presented in Table 3 revealed that the economics of different treatments were significantly influenced by their components i.e. organic manures, inorganic fertilizes, biofertilizers and their combinations. The maximum net profit per hectare was obtained from T_{10} (Rs. 221137/ha), followed by T_8 (Rs. 184405/ha) and T_6 (Rs. 176103/

Table 2
Effect of integrated nutrient management on yield of guava (pooled mean of two years)

	Treatments	*Number of fruits/tree*	*Fruit weight (g)*	*Yield per tree (kg)*	*Yield per hectare (q)*
T_1	Control (Without nutrient application)	242.17	129.69	31.41	87.31
T_2	RDF 600 g: 400 g : 300 g NPK /tree	266.23	145.89	38.86	108.02
T_3	RDF + organic mulching @ 10 cm thick	273.50	147.91	40.47	112.51
T_4	50 % RDF + 50 kg FYM	294.84	160.66	47.36	131.68
T_5	50 % RDF + 5 kg vermicompost	289.52	156.75	45.37	126.12
T_6	50 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)	312.02	171.29	53.47	148.64
T_7	25 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)	284.78	152.12	43.31	120.39
T_8	50 % RDF + 50 kg FYM + *PSB* (100 gm/ tree)	315.50	176.50	55.71	154.87
T_9	25 % RDF + 50 kg FYM + *PSB* (100 g/ tree)	285.94	154.52	44.18	122.81
T_{10}	50 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)+ *PSB* (100 g/ tree)	339.29	193.02	65.47	182.02
T_{11}	25 % RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)+ *PSB* (100 g/ tree)	300.88	164.52	49.53	137.69
	SE(m)±	**5.19**	**3.47**	**1.33**	**3.71**
	CD at 5%	**14.77**	**9.88**	**3.80**	**10.56**

Table 3
Economics of the different treatments (average of two years)

Treatments		*Cost of cultivation / ha in Rs*	*Gross return/ha in Rs*	*Net return/ ha in Rs*	*B:C Ratio*
T_1	Control (Without nutrient application)	27486	106296	78810	3.87
T_2	RDF 600 g: 400 g : 300 g NPK /tree	39620	164565	124945	4.15
T_3	RDF + organic mulching @ 10 cm thick	40712	172605	131893	4.24
T_4	50 % of RDF + 50 kg FYM	43897	199620	155723	4.55
T_5	50 % of RDF + 5 kg vermicompost	43304	190725	147421	4.40
T_6	50 % of RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)	48927	225030	176103	4.60
T_7	25 % of RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)	43584	182475	138891	4.19
T_8	50 % of RDF + 50 kg FYM + *PSB* (100 gm/ tree)	49520	233925	184405	4.72
T_9	25 % of RDF + 50 kg FYM + *PSB* (100 g/ tree)	43809	185850	142041	4.24
T_{10}	50 % of RDF + 50 kg FYM + *Azospirillium* (100 g/ tree)+ *PSB* (100 g/ tree)	55718	276855	221137	4.97
T_{11}	25 % of RDF + 50 kg FYM + *Azospirillium* (100 g/ tree) + *PSB* (100 g/ tree)	48620	207975	159355	4.28

ha) while it was least under T_1 control (Rs. 78810/ ha). Benefit: Cost ratios were also in the higher range in these treatments. The higher income was due to higher fruit yield in these treatments. Shukla *et al.,* (2009) observed that the combined application of 50 per cent dose of recommended NPK + 50 kg FYM + 250 g *Azotobactor* gave significantly higher net returns/ha with higher B: C ratio. Similar findings have been reported by Athani *et al.,* (2007), Dwivedi *et al.,* (2010) and Binepal *et al.,* (2013).

CONCLUSION

The results of present experiment on integrated nutrient management of guava cv. L-49 showed that the application of 50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree+*PSB* 100 g/ tree was the most appropriate integrated nutrient dose under agro-climatic conditions of Nimar Plains for obtaining maximum growth, yield and net returns of guava.

REFERENCES

Agnihotri A, Tiwari, R. and Singh, O.P. (2013). Effect of crop regulators on growth, yield and quality of guava. *Annals of Plant and Soil Research*. **15(1)**: 54-57.

Anon. (2017). Horticultural Statistics at a Glance 2017. Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India. *http://www.agricoop.nic.in/statistics/publication-reports*

Athani, S.I., Ustad, A.I., Praburaj, H.S., Swamy, G.S.K., Patil, P.B .and Kotikal, Y.K. (2007b). Influence of vermicompost on growth, fruit yield and quality of guava cv. Sardar. *Acta Horticulture (ISHS)*. **735**: 386-388.

Binepal, M.K., Tiwari, R. and Kumawat, B.R. (2013). Effect of integrated nutrient management on physio-chemical parameters of guava under Malwa plateau conditions of Madhya Pradesh. *Annals of Plant and Soil Research*. **15(1)**: 47-49.

Dutta, P. Moji, S.B. and Das, B.S. (2009). Studies on the response of biofertilizer on growth and productivity of guava. *Indian Journal of Horticulture*. **66(1)**: 39-42.

Dwivedi, D.H., Rubee, L. and Ram, R, B. (2010). Effect of biofertilizers and organic manures on yield and quality of guava cv. Red fleshed. *The Scientific Temper*. **193**: 193-198.

Dwivedi, V. (2013). Effect of integrated nutrient management on yield, quality and economics of guava. *Annals of Plant and Soil Research*. **15(2)**: 149-151.

Monga, .PK., Kumar, H., Vij, V.K. and Aulakh, P.S. (2002). Effect of NPK on yield and fruit quality of sweet orange cv. Jobba. *Indian Journal of Horticulturae* . **59(4)**: 378-381.

Naik, M.H. and Sri Hari Babu, R. (2007). Feasibility of organic farming in guava (*Psidium guajava* L.). *Acta Horticulturae (ISHS)*. **735**: 365-372.

Prabu, T., Narwadkar, P.R., Sajindranath, A.K. and Rathod, N.G. (2002). Integrated nutrient management in coriander. *South Indian Hort.* **50:** 680-684.

Ram RA and Pathak RK. (2007 b). Integration of organic farming practices for sustainable production of guava. A case study. *Acta Horticulturae (ISHS)*.**735**: 357-363.

Ram, R.A., Bhringuvanshi, S.R., Garg, N. and Pathak, R.K. (2007a). Studies on organic production of guava (*Psidium guava* L.) cv. Allahabad Safeda. *Acta Horticulturae (ISHS)*. **735**: 373-379.

Shukla, A.K., Sarolia, D.K., Kumari, B., Kaushik, R.A., Mahawere, L.N. and Bairwa, H.L. (2009). Evaluation of substrate dynamics for integrated nutrient management under high density planting of guava cv. Sardar. *Indian Journal of Horticulture***. 66(4)**: 461-463.