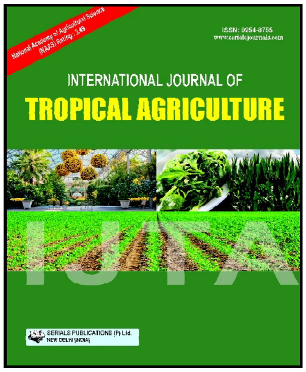

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Studies on effect of integrated nutrient management in improving yield and quality of guava (*Psidium guajava* L.) cv.L-49

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Abstract: An experiment was conducted to study the effect of integrated nutrient management on yield and quality of guava cv. L-49 at Instructional farm, Krishi Vigyan Kendra, Khargone (M.P.). The present investigation revealed that the application of 50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree +*PSB* 100 g/ tree (T_{10}) recorded maximum fruit length (7.69 cm), fruit diameter (7.76 cm) maximum number of fruits per tree (339.29), fruit weight (193.02g), yield/tree (65.47 kg) and yield/ha (182.02q) followed by T_8 and T_6. Whereas, minimum acidity (0.45%) and maximum TSS (11.39 ^{0}Brix), TSS/acid ratio (25.25), total sugars (7.05%), reducing sugars (3.97%) and non-reducing sugars (3.08%) ascorbic acid (227.37 mg/100g pulp), pectin (0.78%) were recorded in T_{10}. All the treatments were found significantly superior over control.

Key Words: Guava, L-49, INM, Yield, Quality

INTRODUCTION

'Guava (*Psidium guajava* L.) is one of the important fruit crops of tropical and sub-tropical regions of India. This hardy crop can be grown satisfactorily on marginal soil with minimum care. It is popularly known as 'Apple of Tropics' and claims to be the fourth most important fruit in area and production after mango, banana and citrus with a production of 4047.8 thousand metric tonnes from an area of 254.9 thousand hectares (2015-16) with productivity of 15.9 metric tonnes ha^{-1} (Horticultural Statistics at a Glance 2017). The area and production of guava in Madhya Pradesh is 28.44 thousand hectares and 990.00 thousand metric tonnes (2015-16) respectively

(Horticultural statistics at a Glance 2017). Guava pulp is rich source of vitamin C (75-260 mg/100 g) and pectin (0.5-1.8 %). Chemical based farming is not sustainable because of many problems such as loss of soil fertility due to excessive erosion and thereby loss of plant nutrients, surface and ground water pollution from fertilizers and sediments, impeding shortages of non-renewable resources and low farm income owing to high cost of production. In this perspective there is an increasing awareness worldwide about alternative agricultural systems known as integrated plant nutrient management, which implies the maintenance or adjustment of soil fertility and plant nutrients supply for sustaining desired crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner (Ram *et al.,* 2007). Considering economy, energy and environment, it is imperative that plant nutrients should be used effectively & judiciously by adopting proper nutrient management system to ensure high yield and to sustain the availability in soil at the optimum level for getting higher yield and quality fruit production for which nutrient management is necessary (Yadav, 1999). Use of organic manures along with biofertilizers and crop residues as cheap sources of available nutrients to plants have been resulted in beneficial effects on growth, yield and quality of various fruit crops (Katiyar *et al.* 2012). However, information is meager on this aspect under arid climatic conditions of Nimar Plains zone.

MATERIALS AND METHODS

The experiment was carried out at the Instructional farm of Krishi Vigyan Kendra, Khargone (M.P.) during two consecutive years i.e. 2016-17 and 2017-18. 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^{o}C during summer season and minimum temperature fluctuates between 6 to 10^{o}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 field was medium black having medium fertility with pH of 7.26. The soil is poor in available nitrogen (223.5 kg ha_{-1}) but 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 randomized block design in three replications. Ploughing was done to keep the soil loose and check weed growth in rows. The whole of the organic manure was applied as a basal dose on the onset of monsoon with bio-fertilizers. Therafter required doses of fertilizers were applied in two split doses in the month of July and August. 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. The guava field was kept weed free by regular manual weeding and also with the help of tractor mounted implements. Two plant of each treatment selected, marked, and kept under observations. The observations on fruit length, fruit diameter, number of fruits per plant, fruit weight, yield per plant, and yield per hectare were recorded at harvest stage. Quality parameters like acidity, total soluble solid (TSS), total sugar, reducing sugar, non-reducing sugar, ascorbic acid and pectin percentage of ripen fruits were determined by using the standard method recommended by AOAC (1990).

RESULTS AND DISCUSSION

Yield parameters

The data presented in Table 1 revealed that the maximum fruit length (7.69 cm), fruit diameter (7.76 cm), number of fruits/tree (339.29), fruit weight (193.02g), yield per tree (65.47 kg) and yield per hectare (182.02q) were obtained due to components of T_{10} followed by T_8 and T_6. It might be due to better nutritional environment created on the application of organic manure and bio fertilizers which improved the soil health by improving physico-chemical conditions and also stimulated soil microbiological activities. 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. Similar results were also reported by Singh *et al.* (2008), Sharma *et al.* (2012, Shukla *et al.* (2014) in guava. The integrated use of organic manures and bio-fertilizers along with chemical fertilizers improves physico-chemical properties of soil besides improving the efficiency of applied chemical fertilizers which helps in the betterment of yield and its other components (Dey *et. al.* 2005). The bio-fertilizers encouraged better growth and accumulate optimum dry matter with induction of growth hormones, which stimulated cell division, cell elongation, activate the photosynthesis process, similar findings were reported by Kumar *et al.* (2005), Athani *et al.* (2007) and Dwivedi *et al.* (2103) in guava

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

Treatments		*Fruit length (cm) at harvest*	*Fruit diameter (cm) at harvest*	*Number of fruits/ tree*	*Fruit weight (g)*	*Yield per tree (kg)*	*Yield per hectare (q)*
T_1	Control (Without nutrient application)	5.36	5.37	242.17	129.69	31.41	87.31
T_2	RDF 600 g: 400 g : 300 g NPK /tree	6.42	6.10	266.23	145.89	38.86	108.02
T_3	RDF + organic mulching @ 10 cm thick	6.43	6.13	273.50	147.91	40.47	112.51
T_4	50 % RDF + 50 kg FYM	6.76	6.79	294.84	160.66	47.36	131.68
T_5	50 % RDF + 5 kg vermicompost	6.73	6.75	239.94	175.37	39.72	110.42
T_6	50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree	6.91	7.06	312.02	171.29	53.47	148.64
T_7	25 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree	6.62	6.51	284.78	152.12	43.31	120.39
T_8	50 % RDF + 50 kg FYM + *PSB* 100 gm/ tree	7.07	7.08	315.50	176.50	55.71	154.87
T_9	25 % RDF + 50 kg FYM + *PSB* 100 g/ tree	6.66	6.57	285.94	154.52	44.18	122.81
T_{10}	50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree+*PSB* 100 g/ tree	7.69	7.76	339.29	193.02	65.47	182.02
T_{11}	25 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree +*PSB* 100 g/ tree	6.85	7.03	300.88	164.52	49.53	137.69
SE(m)±		0.17	0.19	5.19	3.47	1.33	3.71
CD at 5%		**0.49**	**0.54**	**14.77**	**9.88**	**3.80**	**10.56**

Quality parameters

It is evident from the data presented in Table 2 revealed that the minimum acidity (0.45%) and maximum TSS (11.39 ^{0}Brix), TSS/acid ratio (25.25), total sugars (7.05%), reducing sugars (3.97%) and non-reducing sugars (3.08%) ascorbic acid (227.37 mg/100g pulp), pectin (0.78%) were recorded with the application of 50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree + *PSB* (100 g/ tree (T_{10}) which was superior to rest of the treatments. Similar results have also been reported by Singh *et al.* (2008), Sharma *et al.* (2012) and Shukla *et al.* (2014) in guava. Application of integrated use of organic manures and bio-fertilizers along with chemical fertilizers may be attributed for better vegetative growth of the treated plants which resulted in higher quantities of photosynthates (starch, carbohydrates, etc.) and its translocation to the fruits, thus increasing the various contents of fruit resulting quality improvement reflected in chemical characters of fruit. Similar findings were also reported by Rubee *et al.* (2011) in guava, Bohane and Tiwari (2014) in Ber and Shukla *et al.* (2014) in guava.

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

Treatments		*Acidity (%)*	*Total soluble solids (0Brix)*	*TSS/ acid ratio*	*Total sugar (%)*	*Reducing sugar (%)*	*Non-reducing sugar (%)*	*Ascorbic acid content (mg/100g pulp)*	*Pectin (%)*
T_1	Control (Without nutrient application)	0.57	8.41	14.71	5.35	3.08	2.27	179.17	0.52
T_2	RDF 600 g: 400 g : 300 g NPK /tree	0.53	8.76	16.70	5.79	3.21	2.58	190.64	0.60
T_3	RDF + organic mulching @ 10 cm thick	0.51	8.86	17.28	5.80	3.27	2.53	192.11	0.62
T_4	50 % RDF + 50 kg FYM	0.51	10.20	20.15	6.42	3.65	2.77	200.67	0.68
T_5	50 % RDF + 5 kg vermicompost	0.51	9.94	19.71	6.27	3.52	2.76	196.16	0.66
T_6	50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree	0.49	10.92	22.31	6.69	3.84	2.85	215.25	0.70
T_7	25 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree	0.51	9.44	18.46	6.14	3.43	2.71	190.57	0.64
T_8	50 % RDF + 50 kg FYM + *PSB* 100 gm/ tree	0.49	11.01	22.53	6.73	3.86	2.87	217.56	0.72
T_9	25 % RDF + 50 kg FYM + *PSB* 100 g/ tree	0.51	9.85	19.48	6.16	3.41	2.75	192.65	0.66
T_{10}	50 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree+*PSB* 100 g/ tree	0.45	11.39	25.25	7.05	3.97	3.08	227.37	0.78
T_{11}	25 % RDF + 50 kg FYM + *Azospirillium* 100 g/ tree+*PSB* 100 g/ tree	0.50	10.56	21.13	6.52	3.74	2.78	205.25	0.70
SE(m)±		**0.01**	**0.08**	**0.39**	**0.05**	**0.03**	**0.04**	**2.28**	**0.01**
CD at 5%		**0.03**	**0.24**	**1.12**	**0.15**	**0.08**	**0.12**	**6.50**	**0.04**

CONCLUSION

Thus the combined use of organic manures, bio-fertilizers and chemical fertilizers has been found not only in maintaining higher productivity but also in providing stable crop yields and quality of fruits for sustainable crop production through integrated nutrient use.

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