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Studies on Effect of Liquid Bio fertilizers on the yield and quality of Guava (*Psidium guajava* L.) cv. Allahabad Safeda under Central Telangana Zone

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ABSTRACT: A study was conducted with the aim to study the effect of liquid biofertilizers on the fruit yield and quality of Guava with the growing demand for safe and high-quality fruits, as well as the growing emphasis on organic farming, the current study is beneficial for long-term production of guava. A Randomized Block Design with eight treatments and three replications was used to carry out the investigation. The experiment was carried out at the hamlet of Madhavapuram, Kuravi Mandal, Mahabubabad district, Telangana State as a on farm trial from 2019-20 to 2020-21 on 5 years old plants spaced 5.0 × 5.0 m apart. There were significant differences were observed among all the treatments under study. From the present investigation, it is found that the treatment T_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit) was found to be best in terms of maximum number of fruits per plant (256), fruit weight (165.50 g) and fruit yield per plant (18.42 kg). Among all treatments, T_4 (100% N + Zero P_2O_5 + 100% K_2O + Liquid PSB @ 10 ml/lit) recorded the highest TSS (15.62 %), followed by T_7 (100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB @ 10 ml/lit) (11.60 %). The use of these liquid biofertilizers in conjunction with inorganic fertilizers increases biological activity, minimize fertilizer input, improves the supply of nutritional content to the plant in appropriate proportions and boost the fruit yield and quality of guava.

Keywords: Liquid PSB, Liquid KSB, Liquid Azotobacter, TSS.

INTRODUCTION

Guava (*Psidium guajava* L.) is grown in tropical and subtropical regions of India, originated in Tropical America and belongs to the family Myrtaceae. In India, guava is cultivated in an area of 2,64,000 hectares with 40.53 lakh tonnes of production and 15.3 MT ha^{-1} of productivity. Uttar Pradesh has highest area and production. Andhra Pradesh leads in productivity (Anonymous, 2017-18). Telangana State has 2,560 ha of area with the production of 38,740 MT (Anonymous, 2017-18). Winter guava is mostly preferred in the state which gives flowering in June-July and comes to harvest during November. – December.

Soil microorganisms plays an important function in controlling organic matter breakdown and plant nutrition nutrient availability. The microorganisms will improve plant development by forming a healthy rhizosphere. The occurrence of multi-nutrient deficiencies and overall decline in productive capacity of soil has been widely reported due to non- judicious use of fertilizers (Chhonkar, 2008). The use of inorganic fertilizers not only raises production costs, but it also harms the whole biological and soil system. Apart from yield (Godage *et al*., 2013), integrated nutrient management is the best way for ensuring soil sustainability. There is no solid carrier is required for liquid bio fertilizers and they can be stored for a period of two years when compared to carrier-based bio fertilizers, which have a validity period of six months. Lodaya and Masu (2019) has been studied the effect of bio fertilizers, manures and chemical fertilizers on fruit quality and shelf life of guava (*Psidium guajava* L.) cv. Allahabad Safeda and they have reported that the soil application of 30% RDF through chemical fertilizers + 30% RDN through Poultry manure + 20 ml Bio NPK Consortium has been recorded the maximum T.S.S. (11.93 °Brix), reducing sugars (6.35%), non-reducing sugars (1.72%), total sugars (8.07%) and ascorbic acid (177.67 mg/100g^{-1} of pulp). Sandhyarani *et al.* (2022) has revealed that maximum total soluble solids (12.26°Brix), reducing sugars (4.58%), Non reducing sugars (3.54%), total sugars (8.12%), ascorbic acid (226.15 mg/100 g) and shelf life (7.64 days) with minimum acidity (0.36%) are shown by the application of B3S3- Azotobacter @ 50 g + PSB @ 50 g + Seaweed extract @ 75 g per tree. So far, there is no research has been taken up on the influence of liquid biofertilizers on guava yield and quality under the Central Telangana Zone. Keeping in view, the importance has been given for the growing demand for safe and high-quality fruits, as well as the growing emphasis on organic farming. Hence, the current study

was taken up for the benefit of sustainable production of guava.

MATERIAL AND METHODS

A Randomized Block Design with eight treatments and three replications was used to carry out the investigation. The experiment was carried out at the Madhavapuram village, Kuravi Mandal, Mahabubabad district, Telangana State from 2019-20 to 2020-21 on 5 years old trees spaced at 5.0 × 5.0 m. The treatments consists of T_1 ((RDF (500 g N -200 g P_2O_5 - 500 g K_2O /plant) + 75 kg FYM for 5 years old plant), T_2 (Zero N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml/lit), T_3 (50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml/lit), T_4 (100% N + Zero P_2O_5+ 100% K_2O + Liquid PSB @ 10 ml/lit), T_5 (100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB @ 10 ml/lit), T_6 (100% N + 100% P_2O_5 + Zero K_2O + Liquid KSB @ 10 ml/lit), T_7 (100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB @ 10 ml/lit) and T_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit).

The first dose, half of the Nitrogen, half of the potassium and full quota of phosphotic fertilizers were applied during the month of June. Whereas in September, the remaining Nitrogen and the remaining Potassium has been applied. The liquid biofertilizers were applied twice, once in June and September (15 days after fertilizer application). The Liquid bio fertilizers solution @ 10 ml were mixed with 20 liters of water and which was applied in the basins of guava trees at field capacity.

During the course of study, all the cultural practices were followed in all the treatments as per the recommendation of recommended by Sri Konda Laxman Telangana State Horticultural University. Each treatment consists of two trees. Ten healthy fruits were randomly selected from each tree at full maturity stage to record the number of fruits per plant, fruit weight (g), yield per plant (kg) and TSS (Total Soluble Solids). Hand refractometer has been used to measure the TSS (°Brix). The test of significance among the treatment means was worked out by "F" test. The appropriate Standard Error of mean (S.Em) was calculated in each case and the Critical Difference (C.D.) at five percent level of probability was worked out to compare two treatments means where the treatment effects were significant.

RESULTS AND DISCUSSION

Number of Fruits per Tree: The highest number of fruits (256) per tree was recorded in T_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit), followed by T_7 (100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB @ 10 ml/lit) (228) and the minimum number of fruits (148) per tree was recorded in the treatment T_6 (100% N + 100% P_2O_5 + Zero K_2O + Liquid KSB @ 10 ml/lit). These results were in accordance with the findings of Singh *et al*. (2018) who reported that all the growth and yield parameters (number of flowers and fruits per plant and fruit set per cent), yield attributes were significantly influenced by the application of different treatments of integrated nutrient management during both the years and in pooled analysis.

Fruit Weight (g): Among all the treatments, T_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit) has recorded the maximum fruit weight (165.5g) and significantly outperformed the other treatments, followed byT_5 (100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB @ 10 ml/lit) (159.40),T_3 (50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml/lit) and T_7 (100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB @ 10 ml/lit) (156.28 g) while minimal fruit weight (148.1 g) was observed in T_6 (100% N + 100% P_2O_5 + Zero K_2O + Liquid KSB @ 10 ml/lit). It might be due to increased and prolonged availability of nutrients from integrated use of NPK and FYM, which ultimately resulted in rapid cell multiplication and cell elongation under sufficient nutrient supply. The results were in accordance with those reported by Godage *et al*. (2013); Dwivedi and Agnihotri (2018).

Fruit Yield per Tree (Kg): The maximum fruit yield (18.42kg) per tree was recorded on trees treated withT_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit) and which was significantly higher than all other treatments, followed by 17.58 kg recorded in T_7 (100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB @ 10 ml/lit), 17.22kg in T_1 (RDF (500 g N -200 g P_2O_5 - 500 g K_2O /plant) + 75 kg FYM for 5 years old trees) while the minimum yield was recorded inT_6 (100% N + 100% P_2O_5 + Zero K_2O + Liquid KSB @ 10 ml/lit) (12.1kg). This study was in agreement with the findings of Das *et al*. (2017) who reported that different treatments of bio fertilizers, *Azospirillum brasiliense* + AMF (Arbuscular Mycorrhizal Fungi) showed highest fruit retention (56.30%) and maximum fruit yield (41.3 kg/plant) with maximum fruit length, diameter, fruit weight and pulp weight, followed by the treatment with *Azospirillum brasilense* + *Bacillus megatherium* and Godage *et al*. (2013).

Total Soluble Solids (TSS) (%): Among all treatments, T_4 (100% N + Zero P_2O_5 + 100% K_2O + Liquid PSB @ 10 ml/lit) recorded the highest TSS (15.62 %), followed by 11.60 in T_7 (100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB @ 10 ml/lit), 11.07 in T_2 (Zero N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml/lit) and the lowest of 9.93 was recorded in T_5 (100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB @ 10 ml/lit). The increase in these yield and quality attributing characters due to application of balanced nutrients. The application made higher nutrients available to plant and leads to higher accumulation of net photosynthesis per tree with combined dose of NPK and FYM along with the treatment T_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit). Thus, better proliferation of roots and uptake of nutrients has enhanced the fruit setting. These results are in agreement with the findings of Binepal *et al*. (2013); Choudhary *et al*. (2017); Kumar *et al*. (2019); Sandhyarani *et al*. (2022); Singh *et al*. (2020).

Table 1: Effect of Liquid Bio fertilizers on the yield and quality of Guava (*Psidium guajava* L.) cv. Allahabad Safeda under Central Telangana Zone.

Tr. No.	Treatment Details	No. of Fruits /Tree			Fruit Weight (g)			Yield/ Tree (kg)			Total Soluble Solids (%)		
		2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
T_1	RDF (500 g N -200 g P_2O_5 - 500 g K_2O /plant + 75 kg FYM for 5 years old tree.	154.0	214.0	184.0	173.50	135.33	154.41	11.9	22.54	17.22	11.90	22.54	9.83
T_2	Zero N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter @ 10 ml/lit.	163.0	156.0	160.0	175.60	116.66	146.13	10.5	15.91	13.20	10.50	15.91	11.07
T_3	50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter @ 10 ml/lit.	146.0	164.0	155.0	170.20	142.36	156.28	10.1	16.91	13.50	10.10	16.91	10.30
T_4	100% N + Zero P_2O_5 + 100% K_2O + Liquid Phosphorus Solubilizing Bacteria (PSB) @ 10 ml/lit.	198.0	170.0	158.0	171.80	137.43	154.61	11.7	18.38	15.62	11.70	18.38	15.62
T_5	100% N + 50% P_2O_5 + 100% K_2O + Liquid Phosphorus Solubilizing Bacteria (PSB) @ 10 ml/lit.	121.0	195.0	158.0	179.50	139.33	159.41	11.0	20.24	15.62	11.00	20.24	9.93
T_6	100% N + 100% P_2O_5 + Zero K_2O + Liquid Potassium Solubilizing Bacteria (KSB) @ 10 ml/lit.	135.0	160.0	148.0	156.50	139.70	148.10	8.3	16.02	12.16	8.30	16.02	10.07
T_7	100% N + 100% P_2O_5 + 50% K_2O + Liquid Potassium Solubilizing Bacteria (KSB) @ 10 ml/lit.	194.0	261.0	228.0	168.50	144.03	156.20	11.7	23.47	17.58	11.70	23.47	11.60
T_8	50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid Phosphorus Solubilizing Bacteria @ 10 ml/lit + Liquid Potassium Solubilizing Bacteria @ 10 ml/lit.	222.0	290.0	256.0	183.60	147.40	165.50	12.9	23.95	18.42	12.90	23.95	10.27
	C.D.	5.45	46.96	26.205	2.567	1.17	1.8685	0.355	2.67	1.5125	0.355	2.67	0.91
	SE(m)	1.78	15.33	8.555	0.838	0.383	0.6105	0.116	0.87	0.493	0.116	0.87	0.29
	SE(d)	2.517	21.68	12.0985	1.186	0.541	0.8635	0.164	1.23	0.697	0.164	1.23	0.42
	C.V.	1.849	13.19	7.5195	0.842	0.481	0.6615	1.821	7.67	4.7455	1.821	7.67	4.94

CONCLUSIONS

It is concluded that the treatment T_8 (50% RDF + Liquid Azotobacter @ 10 ml/lit + Liquid PSB @ 10 ml/lit + Liquid KSB @ 10 ml/lit) per tree was found to be best in terms of maximum Number of Fruits per plant (256), Fruit Weight (165.50 g) and Fruit Yield per plant (18.42 kg) while the treatment T_4 (100% N + Zero P_2O_5 + 100% K_2O + Liquid PSB @ 10 ml/lit) recorded the highest TSS (15.62 %).

FUTURE SCOPE

Effect of combination of liquid biofertilizers on yield and quality of guava under different planting systems need to be studied. Similar studies have to be conducted in different varieties of guava apart from Allahabad safeda. The experiment should be repeated in other locations and different soil types to confirm the findings of the present investigation in the Telangana State.

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Conflict of Interest. None.

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