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Evaluation of *Trichoderma, Psedomonos* and biofertisol as foliar application on quality and yield of guava (*Psidium guajava*)

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Abstract

The experiment was designed in Randomized Block Design in four replications with seven treatments, i.e. T_1 - control (only water), T_2 –*Trichoderma viride* 5%, T_3-*Trichoderma viride* 10%, T_4 - *Pseudomonas* 5%, T_5 -*Pseudomonas* 10%, T_6 -biofertisol 5% and T_7 - biofertisol 10%, at Department of Horticulture, JNKVV, Jabalpur, in 8 year old guava (*Psidium guajava* L.) variety L 49, during 2020-21 and 2021-22. Foliar application of *Trichoderma* @ 10 % was most beneficial for growth, yield and quality parameters. *Trichoderma* @ 10 % recorded maximum increment in shoot length, plant height, canopy height, leaf chlorophyll Index, chlorophyll content index**,** LAI. Foliar application of 10% *Trichoderma was*also superior in yield parameter found maximum number of flowers shoot, fruit set percentage, fruit retention percentage, fruits/shoot, fruit/splant, yield/plant, fruit length, fruit width, fruit weight, fruit volume, pulp weight/fruit and pulp per cent. Total soluble solids, total sugar, and reducing sugar were recorded in *Trichoderma* 10% (T_7) and minimum acidity was recorded in foliar application of *Pseudomonas* 10% (T_5) .

Key words: Biofertilizer, Biofertisol, Pseudomonas, Trichoderma,

Guava (*Psidium guajava* L.) has gained tremendous popularity among fruit growers (Meena *et al*., 2020). The pre-harvest sprays of growth regulators and minerals are new practices adopted nowadays for higher fruit production and improved fruit quality (Dongre *et al*., 2021). Foliar nutrition coupled with growth hormone is still the way forward approach to produce nutrient dense fruit crops (Srivastava and Hota, 2020). By applying *Trichoderma* to the soil or as foliar sprays, farmers can promote healthier plant growth and reduce the need for chemical pesticides.

Similarly biofertisol is rich in nitrogen and is a source of several trace elements. Therefore, the effect of *Trichoderma,Psedomonos* and Biofertisol as foliar application on quality and yield parameters was carried out to assess the productivity of guava as influenced by foliar application of biofertilizers.

Material and Method

The Experiment was conducted at Department of Horticulture, JNKVV, Jabalpur, on 8 – year- old guava variety L 49, during 2020-21 and 2021-22. Jabalpur is situated in the "Kymore Plateau and Satpura Hills" agro climatic region of Madhya Pradesh. It falls on 23.9° North latitude and 79.58° East longitudes with an altitude of 411.8 m above the mean sea-level. The experiment was designed in randomized block design in four replications with seven treatments, i.e. T_1 - control (only water), T_2 –*Trichoderma viride* 5%, T_3-*Trichoderma viride* 10%, T_4 - Pseudomonas 5%, T_5 -Pseudomonas 10%, T_6 -biofertisol 5% and T_7 - biofertisol 10%.

Spraying was done on the tree canopy by foot sprayer. It was considered that one liter of solution is sufficient for a tree. Hence for making the one liter solution of required treatment, required quantities of biofertilizers were dissolved in water. All the treatments were sprayed at Pre-flowering and 30 days after fruit setting stage.

The data were recorded on physiological, biochemical, yield-attributing characters and economics of guava. The shoot length (cm), plant height (m), canopy height (m), chlorophyll content index, LAI and light transmission ratio (%), yield parameters (number of flowers / shoot, fruit setting (%), fruit retention (%), number of fruits / plant, yield (kg/plant), fruit length (cm), fruit width (cm), fruit weight (g), and pulp (%). TSS (°Brix), acidity (%), TSS acid ratio, ascorbic acid (mg per 100 g), total sugar (%),

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reducing sugar (%) and non-reducing sugar (%) were recorded.

The chlorophyll index (SPAD value) in leaves was recorded at harvesting stage. Leaf chlorophyll index was estimated by using SPAD chlorophyll meter by simple clamping the meter over leafy tissue. (Gardner *et al.* 1985

Total numbers of flowers/shoot were calculated regularly and average numbers of flowers were calculated. Total fruit settings (%) on tagged shoots were counted and subsequently total number of fruits was again counted at the time of fruit maturity. The percent (%) fruit retention was calculated. At each picking, number of fruits per plant was independently recorded. The pulp percent was calculated by deducting the weight of seed and peel from total weight of fruit. Pulp was calculated by total weight of pulp divided by total weight of fruit.

To record TSS, a few drops of extracted juice were put on the surface of the refract meter's prism with the assistance of a clean glass rod to determine TSS in °Brix. Acidity (%) TSS acid ratio, ascorbic acid (mg per 100 g), total sugar %, reducing sugar % and non-reducing sugar were determined using (AOAC 1970).

Result and Discussion

There wore maximum shoot length (50.13 cm), plant height (0.47 m), canopy height (0.37 m), chlorophyll content index (37.89), leaf area index (165.92), in foliar

Table 1: Effect of biofertilizers on growth parameter of guava (mean of two years data)

Treatment		Shoot length (cm)	Plant height (m)	Canopy height (m)	Chlorophyll content index	LAI	Light transmission ratio (%)
T_1	Control (water)	37.64	0.31	0.28	31.82	115.13	15.97
T_2	Biofertisol 5%	44.52	0.34	0.28	36.32	126.06	15.33
T_3	Biofertisol 10%	45.41	0.36	0.30	36.83	138.63	15.16
T_4	*Pseudomonas* 5%	43.94	0.32	0.27	35.38	116.11	15.57
T_5	*Pseudomonas* 10%	44.55	0.35	0.29	36.51	116.68	15.17
T_6	*Trichodermaviride* 5%	48.22	0.43	0.34	36.98	132.30	14.68
T_7	*Trichodermaviride* 10%	50.13	0.47	0.37	37.89	165.92	14.45
	SEm (±)	1.034	0.013	0.007	0.369	2.600	0.097
	CD (5%)	3.072	0.038	0.020	2.031	7.725	0.288

Table 2: Effect of Biofertilizers on quality parameter of guava (mean of two years data)

Treatment		TSS (Brix)	Acidity (%)	TSS: acid ratio	Ascorbic acid (mg per 100 g)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
T_1	Control (water)	10.93	0.379	27.61	177.31	8.60	4.66	3.94
T_2	Biofertisol 5%	11.01	0.358	31.27	196.64	8.73	4.92	3.80
T_3	Biofertisol 10%	11.61	0.346	33.21	209.93	9.27	5.24	4.02
T_4	*Pseudomonas* 5%	10.93	0.363	30.46	189.56	8.75	4.81	3.94
T_5	*Pseudomonas* 10%	11.12	0.311	31.04	200.82	9.06	5.01	4.05
T_6	*Trichodermaviride* 5%	11.69	0.343	32.13	219.21	9.34	5.48	3.86
T_7	*Trichodermaviride* 10%	12.32	0.338	33.49	235.43	9.53	5.73	3.80
	SEm (±)	0.181	0.007	0.685	4.893	0.128	0.089	0.123
	C.D. (5%)	0.538	0.019	2.035	14.536	0.379	0.265	0.366

application of *Trichoderma viride* @ 10% (T_7). All growth parameters are significantly influence by foliar application of *Trichoderma viride* @ 10% (Benítez *et al.*, 2004) and closely related to Pangtu *et al. (2024)*. Application of *Trichoderma* helps to promote growth, improve nutrient availability, and induce systemic resistance against diseases, mainly phytopathogenic fungi (Pascale *et al*., 2017). Result was closely confirmed by Syam *et al* (2021) and by Devarakonda *et al.* (2020).

Shukla *et. al*., 2014 also found that application of Azotobacter + PSM + *T. harzianum* + organic mulching significantly influenced plant height, stem girth, canopy spread in both directions, i.e. north–south and east–west. Sajeesh *et al.* (2015) found maximum plant height in potato and Uddin *et al.* (2015) by application of *Trichoderma* spp. Sani *et al.* (2020) reported that application of *Trichoderma* and biochar with half dose of N-P-K significantly resulted in greatest plant height, branches/plant, number of leaves, root and shoot dry matter weight in tomato.

Uddin *et al.* (2015) and Nagata *et al.* (2005) recorded maximum chlorophyll percentage in tomato by the application of *Trichoderma*. *Trichoderma* produced auxins that are able to stimulate plant growth and root development (Contreras-Cornejo *et al*., 2009). The increase in tree height might be due to production of more chlorophyll content with inoculation of nitrogen fixers. The reason of increase in growth characters is constituent of the protein which is essential for formation of protoplasm thus affecting cell division and cell elongation and thereby more vegetative growth (Dutta *et al*., 2009).

The maximum number of flower/shoot (5.49), fruit setting (68.22%) , fruit retention (71.77%), fruits/plant (98.95) , yield/plant (22.59 kg), maximum fruit length (6.87 cm), fruit width (7.12 cm), fruit weight (227.98 g, pulp weight/ fruit (219.75 g), pulp (96.39 %) were recorded under *Trichodermaviride* 10% (T_7) and it was significantly superior.

Numerous studies have shown that use of *Trichoderma* sp. may promote primary or secondary plant metabolism and boosts crop yield (Rouphael *et al*., 2017). The phyto-stimulatory effect of it has several direct and indirect impacts on plants, including release of substances with auxin activity, small peptides, organic acids, which appear to improve root system architecture and assimilation of nutrients, thereby improving plant growth and productivity (Hermosa *et al.,* 2012; and Rouphael *et al*., 2017). Application of it to plants activates secondary metabolites that help to promote growth, improve nutrient availability, and induce systemic resistance against diseases, mainly phytopathogenic fungi (Pascale *et al*., 2017). Molla *et al*., 2012 found *Trichoderma* improve the quality of tomato fruit.

The result partially supported to those of Uddian *et. al.* (2015). Shukla *et al.* (2014) summarized that application of Azotobacter + PSM + *T. harzianum*+ organic mulching significant increase in fruit yield, fruit weight, fruit length and fruit diameter. Biofertilizers as in (50% recommended dose of fertilizer + 25 kg FYM + 250 g *Trichoderma* + 250 g *Pseudomonas*) encouraged better growth and accumulated optimum dry matter with the induction of growth hormones, which stimulated cell division, cell elongation; activated photosynthesis process, as well as energy transformation which in turn caused increase in physical qualities of fruits. Sani *et.al.* (2020) found half dose of NPK with combined application of *Trichoderma* and biochar showed highest number of flower clusters /plant, number of fruit / cluster, number of fruit / plant, the weight of individual fruit and yield /plant.

The highest increase in TSS (12.32 °Brix), TSS:acid ratio (33.49), ascorbic acid (235.43 mg/100g), total sugar (9.53 %), reducing sugar (5.73%) were recorded in Trichoderma 10% (T_7). It was significantly superior over rest of the treatments. This finding supported Lal *et al.* (2017).

The foliar application of Pseudomonas 10% (T_5) recorded minimum acidity (0.311%) and maximum non-reducing sugar (4.05%) which was significant among all the treatments. Similar result were found by Singh *et. al*., (2020).

Conclusion

The foliar application of *Trichoderma* @ 10 % recorded maximum increment in shoot length, plant height, canopy height, leaf chlorophyll Index and chlorophyll content index**,** LAI. It also gave maximum number of flower/shoot, fruit setting (%), fruit retention (%), fruit /shoot , fruits / plant , yield / plant, fruit length, fruit width, fruit weight, fruit volume, pulp weight per fruit, pulp per cent.

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