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Effect of Integrated Nutrient Management on Morphological and Physical Parameters of Guava (*Psidium guajava* L.) cv. L-49

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Abstract

An investigation entitled "Effect of Integrated Nutrient Management on Morphological and Physical parameters of Guava (Psidium guajava L.) cv. L-49" was carried out at the Instructional cum research fruit orchard, Department of Fruit Science College of Horticulture, Mandsaur, during 2015. The experiment was laid out in Randomized Block Design (RBD) with three replications consisting eleven treatments including absolute control i.e. ***T_0*** *- Control,* ***T_1*** *-50% NPK,* ***T_2*** *-100% NPK,* ***T_3*** *-50% NPK + 10kg vermicompost,* ***T_4*** *-100%NPK+ 5kg Vermicompost,* ***T_5*** *-50%NPK + 10kg Vermicompost +150gm Azatobactor,* ***T_6*** *-100%NPK + 5kg Vermicompost +150gm Azatobactor,* ***T_7*** *-50%NPK + 10kg Vermicompost +150gm VAM,* ***T_8*** *-100%NPK + 5kg Vermicompost +150gm VAM,* ***T_9*** *-50%NPK + 10kg Vermicompost +150gm Trichoderma,* ***T_{10}*** *-100%NPK + 5kg Vermicompost +150gm Trichoderma. Results of an investigation revealed that the maximum increased in plant height (0.61 m), canopy height (0.55 m), canopy spread in N-S direction (0.57 m) and canopy spread in E-W direction (0.59 m) was observed under the T_6 and Maximum fruit length at harvest (6.68 cm), diameter at harvest (7.19 cm), volume of fruit (194.77 ml), pulp thickness (2.41 cm), pulp weight (202.47 g) and seed weight (7.41 g) was recorded under T_8.*

Key words: *INM, Guava, morphological, physical, parameters.*

Introduction

The basic concept of integrated nutrient management (INM) is the adjustment of plant nutrient supply to an optimum level for sustaining the desired crop productivity. It involves proper combination of chemical fertilizers, organic manure and biofertilizers suitable to the system of land use and ecological, social and economic conditions.

In the vermicompost, some of the secretions of the worms and the associated microbes act as growth promoters along with other nutrients. It improves physical, chemical and biological properties of soil in the long run on repeated application. The organic carbon in vermicompost releases the nutrient slowly and steadily into the system and enables the plant to absorb these nutrients.

Azotobacter is an aerobic, free living nitrogen fixer. When applied as soil application, they multiply rapidly and develop a thick population in the rhizosphere. They derive food from the organic matter present in the soil and root exudates and fix atmospheric N. The fixed nitrogen in Azotobacter cell is nitrified after its death and decay and plants can utilize this nitrogen from *Azotobacter* plasma. Besides fixing nitrogen they also secrete certain growth hormones such as IAA, GA_3 and Cytokinins which promote vegetative growth and root development.

Trichoderma strains used as biocontrol agents can act: (a) colonizing the soil and/or parts of the plant, occupying a physical space and avoiding the multiplication of the pathogens;(b) producing cell wall degrading enzymes against the pathogens; (c) producing antibiotics that can kill the pathogens; (d) promoting the plant development and (e) inducing the defensive mechanisms of the plant. *Trichoderma spp*. is the most studied

biocontrol agent against plant pathogens because of their ability to reduce the population of soil borne plant pathogens *Trichoderma spp*. has proved to be useful in the control of phytopathogens affecting different crops. *Trichoderma spp.* have shown biocontrol activity against *damping*–off and root rot diseases and have high yield of plant. Biological control of soil borne pathogens may resolve problems by introducing antagonistic fungi in the soil.

Materials and Methods

The present study was carried out at the *Instructional cum research fruit orchard*, College of Horticulture, Mandsaur, during 2015-16 on 10 years old guava trees of cv. L-49. The plants having uniform vigour and size were selected for the study. There were eleven treatments along with control and each treatment was replicated thrice in a Randomized Block Design. Treatments consisted of different nutrients source including control i.e. **T_0-** Control, **T_1-**50% NPK, **T_2-**100% NPK, **T_3-**50% NPK + 10kg vermicompost, **T_4-**100%NPK+ 5kg Vermicompost, **T_5-**50%NPK + 10kg Vermicompost +150gm *Azatobactor,* **T_6-**100%NPK + 5kg Vermicompost +150gm *Azatobactor,* **T_7-**50%NPK + 10kg Vermicompost +150gm VAM, **T_8-**100%NPK + 5kg Vermicompost +150gm VAM, **T_9-**50%NPK + 10kg Vermicompost +150gm *Trichoderma,* **T_{10}-**100%NPK + 5kg Vermicompost +150gm *Trichoderma*. A tree was taken as a unit for each treatment in a replication and over all 33 trees was used for the experiment. Observations were recorded on size of fruit (length and diameter of fruit in cm), canopy height (cm), canopy spread (cm), volume of fruit (cc) by water displacement method, No. of seed per fruit (Extraction of seeds was done by crushing the fruit then the seeds were washed with water and numbers of seeds were counted manually), Seed/ pulp ratio. Statistical analysis was carried out as per the standard methods.

Result and Discussion

Morphological parameters:

Results showed that the maximum increase in plant height (0.61 m), canopy height (0.55 m), canopy spread in N-S direction (0.57 m) and canopy spread in E-W direction (0.59 m) was found under the T_6 (100% NPK (recommended dose) + 5 kg vermicompost +150 g *Azatobactor*) which was superior than control as well as rest of treatments under present study. The notable improvement with respect to growth parameters with the use of biofertilizers, organic manures and inorganic fertilizers may be attributed due to sufficient availability of nitrogen, phosphorus, potassium and other essential nutrients. Under control treatment, lack of avaibility of nutrients for uptake subsequently results in poor vegetative growth and other morphological parameters.

The increase in vegetative growth of the plant by NPK attributed to the association of nitrogen in the synthesis of protoplasm and in the primary manufacture of amino acids and increased auxin activities brought about by nitrogen fertilization. As a result meristematic activities increase which in turn increase the vegetative growth.

Vermicompost have much 'finer structure' than ordinary compost and contain nutrients in forms that are readily available for plant uptake. It is rich in micro and macronutrients, vital plant promoting and humus forming substances, nitrogen fixers and humus forming micro-organism. Increase in plant growth may be due to presence of earthworm which improves the soil fertility in vermicompost treatments. The growth response of the plants for vermicompost appears more like 'hormone-induced activity' associated with the high levels of humic acids and humates in vermicompost. Humic acids enhanced 'nutrient uptake' by the plants through increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of 'root hairs'[9].

Improvement in morphological characters may be due to the Inoculation with *Azotobactor* a biological nitrogen fixer, associative symbiotic, live inside the cortical cells and xylem vessels of plant roots and

secrete growth promoting substances like gibberlic acid, IAA and cytokinins which might have lead to better root development, better transport and uptake of nutrients, improves the nitrogen use efficiency and increases leaf N content, which resulted in increasing growth parameters[8,10].

VAM fungi produces hyphae, which are microscopic tubes colonize plant roots and grow out into the soil further than root hairs. Nutrients are taken up by hyphae to the plant, which lead to a very efficient mobilization and uptake of nitrogen, potassium, magnesium, copper, zinc, boron, sulphur and other elements that are transported to the plant. The VAM hyphae also help in retaining moisture around the root zone of plants[1,6,7].

Physical parameters:

The physical characteristics of fruit are an expression of a plant's vegetative activity which was also significantly influenced by various integrated nutrient treatments. Result clearly indicated that maximum fruit length at harvest (6.68 cm), diameter at harvest (7.19 cm), volume of fruit (194.77 ml), pulp thickness (2.41 cm), pulp weight (202.47 g) and seed weight (7.41 g) was recorded under T_8 (100% NPK (recommended dose) + 5 kg vermicompost +150 g VAM) over the control. Specific gravity of fruit, number of seeds per fruit and seed/pulp ratio were not significantly influenced by integrated nutrient management (INM).

The increase in fruit length and diameter by the application of integrated nutrient treatments might be due to optimum supply of proper plant nutrients and growth hormones in right amount during the entire crop period caused vigorous vegetative development of the plants and ultimately production of more photosynthates.

The nutrient combinations accelerate the metabolic activities of the plant. Nitrogen positively influenced the vegetative growth of the plant, manufacturing greater amount of food materials and the same when translocated into the fruit bearing areas leading to enhancement in weight and size of the fruits. Phosphorus plays an important role in photosynthesis and accumulation of food material and Potassium in carbohydrate & protein synthesis and in the regulation of water relations. It may also act as a catalyst in the formation of more complex substances and in the acceleration of enzymatic activities which ultimately leads to improvement in physical characters of the fruit[2,3].

Improvement in plant growth and yield attributes *i.e.* physical character of fruits on account of vermicompost application might have been attributed to the translocation of nutrients from soil to the plants and enhanced supply of macro & micro-nutrients during entire growing season. Vermicompost also improves microbial distribution and moisture retention capacity in soil that results in greater enzymatic (phosphatase & urease) activities which improves the growth parameters ultimately might have reflected in increased fruit weight and other physical characters of fruits[4].

The various positive effects of biofertilizers on yield and fruit weight may be due to the fact that biofertilizers encouraged better growth and accumulates optimum dry matter with induction of growth hormones, which stimulated cell division, cell elongation, activate the photosynthesis process, enhances translocation of water and nutrients, growth and development of roots as well as energy transformation which in turn causes increase in number and weight of the fruits and other physical characters[3,5].

VAM fungi to interact with other soil microbes like the free-living nitrogen fixers and phosphate solubilisers to improve their efficiency for the biochemical cycling of elements and supply the host plants with their nutrients requirements[1].

Conclusion: It is concluded that soil application of integrated nutrients had significantly improved the morphological and physical attributes guava. Soil placement of 100% NPK (recommended dose) + 5 kg vermicompost +150 g *Azatobactor*) (T_6) and 100% NPK (recommended dose) + 5 kg vermicompost +150 g VAM (T_8) were superior in term of improvement of morphological and physical characters of the guava cv. L-49 under the present study.

Table 1 Effect of integrated nutrients on morphological and physical parameters of guava

Treatment	Plant height (m)	Canopy height (m)	Canopy spread		Volume of fruit (ml)	Specific gravity	Fruit length (cm)	Fruit diameter (cm)	Pulp thickness (cm)	Number of seed per fruit	Pulp weight (g)	Seed/pulp ratio
			E-W	N-S								
T_0	0.41	0.42	0.46	0.45	151.88	0.99	6.20	5.70	2.21	232.69	144.48	0.039
T_1	0.44	0.43	0.48	0.46	163.79	0.99	6.28	5.72	2.22	241.75	156.16	0.037
T_2	0.46	0.44	0.49	0.46	165.52	0.98	6.29	5.81	2.28	247.31	156.84	0.041
T_3	0.47	0.44	0.50	0.47	167.48	0.97	6.33	5.84	2.29	247.37	156.99	0.041
T_4	0.50	0.46	0.51	0.48	171.62	1.00	6.40	5.85	2.34	249.33	162.96	0.041
T_5	0.57	0.54	0.57	0.56	181.42	1.01	6.52	6.18	2.37	282.06	176.56	0.039
T_6	0.61	0.55	0.59	0.57	187.03	1.04	6.63	6.37	2.39	292.69	188.40	0.038
T_7	0.53	0.53	0.55	0.54	189.68	1.04	6.68	6.42	2.40	303.38	190.99	0.037
T_8	0.55	0.53	0.56	0.55	194.77	1.07	7.19	6.68	2.41	319.36	202.47	0.036
T_9	0.51	0.47	0.52	0.48	172.45	1.05	6.43	5.87	2.35	255.91	173.58	0.038
T_{10}	0.51	0.52	0.54	0.53	178.16	1.00	6.48	5.94	2.36	261.92	171.60	0.039
S Em ±	0.009	0.01	0.009	0.01	8.21	0.05	0.15	0.18	0.04	18.39	5.10	0.002
C.D. at 5%	3.33	0.04	0.02	0.02	24.23	0.17	0.46	0.55	0.13	54.26	15.06	0.006

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