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EFFECT OF RESPONSE FOR OPTIMISING YIELD OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR SAFEDA THROUGH NUTRIENTS AND BIOFERTILISERS APPLICATION

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ABSTRACT

The experiment was carried out in well maintained guava orchard at Aryanagar, and CCSHAU, Hisar during rainy and winter season of 2019-20. Various combinations of treatments consisting of fertilisers, micronutrients, biofertilisers, FYM, vermicompost, mulch were applied. A total ten treatment including control with three replications were laid out in a randomized block design. Application of (RDF 75 % + $ZnSO_4$+ $MnSO_4$ + Borax + PSB + *Azotobacter*+ FYM) (T8) and (RDF 100 % + $ZnSO_4$+ $MnSO_4$ + Borax + organic mulch) (T4) were found significantly superior than other treatments with respect to fruit size and yield attributes of guava cv. Hisar Safeda. During the period of investigation , the treatments showed varied response. Superior quality fruits were found in winter season. The highest number of fruits, fruit weight, yield in kg /tree and yield q/ha,was recorded in T8 (RDF 75 % + $ZnSO_4$+ $MnSO_4$ + Borax + PSB + *Azotobacter*+ FYM) whereas fruit length and diameter was found maximum in (RDF 100 % + $ZnSO_4$+ $MnSO_4$ + Borax + organic mulch) (T4) whereas minimum were recorded in T10 control.

***Keywords*:** Guava, organic, yield, biofertiliser, fruit quality

Introduction

The fruit of the genus Guava (*Psidium guajava* L.) is commonly referred to as the "Apple of Tropics" as it grows very well in subtropical conditions. Guava is considered to be one of the most remunerative fruits due to its wide range of adaptability to climate and soils, its prolific bearer, low growing cost, captivating yields, and low desideratum for care and input. The total cultivated area of guava in India is 265 thousand hectares with an annual engenderment and productivity at 4054 thousand metric tons (MT) and 15.29 thousand metric tons respectively. Uttar Pradesh is the leading engenderer of guava with an area of 928.44 thousand metric tons and 49.53 thousand hectares, followed by the other three states of Madhya Pradesh, Bihar and Uttar Pradesh (Anonymous, 2019). The fruits are harvested in winter season are more superior to pluvial season in terms of both yield and quality. Guava trees require a balanced supply of macronutrients, including nitrogen (N), phosphorus (P), and potassium (K), as well as micronutrients such as iron (Fe), manganese (Mn), and zinc (Zn) to ascertain optimal magnification and fruit engenderment. Understanding the nutrient requisites of guava trees is crucial for prosperous cultivation, as inadequate or imbalanced nutrient supply can lead to abbreviated yields, poor fruit quality, and susceptibility to pests and diseases. Overabundance of supply or consistent utilizing inorganic fertilizers as a source of nutrients in an unbalanced amount is an issue that leads to inefficiencies in the economy, harm to the environment, and in certain cases, harm to both humans and the plants that are consumed. Because chemical fertilizers are more extravagant and have more astringent side effects, the utilization of biofertilizers to ameliorate plant magnification and productivity has expedited in recent years. Integrated nutrient management (INM) is a sustainable approach that coalesces the utilization of organic and inorganic fertilizers, along with other nutrient management practices, to optimize nutrient availability and uptake by plants. Integration of organic substrates with

mineral fertilisers can have paramount effect on the physical, microbiological, and chemical properties of soil which are indirectly responsible to fortify plant magnification (Adak *et al*., 2012). Some mundane components of integrated nutrient management for guava cultivation include the utilization of organic manures, crop, residues green manures, biofertilisers and chemical fertilisers. It is paramount to ascertain that the nutrient supply is balanced and meets the categorical requisites of guava trees at different magnification stages. The advantages of vermicompost have been attributed to the categorical requisites of guava trees at different magnification stages. The advantages of vermicompost.

Vermicompost includes plant magnification regulating materials such as humic acid, auxin, gibberellin and cytokinin. Biofertilisers offer an economically alluring and environmentally sound modern implement for incrementing the nutrient supply to growing plants. It amends not only the nutrient uptake but withal the resistance to different soil borne pathogen and ameliorated the magnification and yield of a variety of fruits. Bioinoculant such as *Azotobacter* ameliorates soil productivity by incrementing the biological nitrogen fixation which results in better stimulation of the roots by hormonal action or decomposition of the residues. The Indian soils have a low to medium P-status which may be due to fixation within a short time of application. However research evidences are encourageous about the integrated utilization of inorganic fertilizers, biofertilizers and organic manures including crop residues, vermicompost which may amend the soil productivity and crop yield. The alimental and economical gain due to integrated nutrient management on guava has not been studied in Hisar region, hence the present work was taken up.

Material and Methods

This study was conducted in the orchard of progressive farmer. The chemical analysis was done in the laboratories of the Department of Horticulture & Soil Science, CCS Haryana Agricultural University, Hisar. The study was conducted on four year old guava trees cv. Hisar Safeda. The experimental design was Randomized Block design, where 10 treatments were replicated three times with two trees per replicate. The treatment combinations included: T1-100% RDF + $ZnSO_4$ (0.5%) + Borax (0.2%) + $MnSO_4$ (0.1%) foliar spray during flowering, T2-100% RDF + organic mulching of FYM (10cm thick), T3-75% RDF + $ZnSO_4$ (0.5%) + Borax (0.2%) + $MnSO_4$ (0.1%) + organic mulching of FYM (10cm thick),T4-100 % RDF + $ZnSO_4$ (0.5%) + Borax (0.2%) + $MnSO_4$ (0.1%) + organic mulching of FYM (10 cm thick), T5-75% RDF + PSB (100g) + 50kg FYM, T6-75% RDF + *Azotobacter* (100g) + 50kg FYM, T7-75% RDF + PSB (100g) + *Azotobacter* (100g) + 50kg FYM, T8-75% RDF + $ZnSO_4$ (0.5%) + Borax (0.2%) + $MnSO_4$ (0.1%) + PSB (100g) + *Azotobacter* (100g) + 50 kg FYM, T9-75% RDF + 50kg FYM + 5kg vermicompost, T10-100% RDF (control) (40kg FYM+800:800:400 g of NPK/tree. There were two different doses of inorganic nitrogen i.e. 800 g urea (100% RDF), 600g urea (75% RDF), two doses of phosphorus i.e. 800g SSP (100%RDF), 600g SSP (75% RDF) and two doses of potassium i.e. 400g potassium sulphate (100% RDF), 300g (75% RDF). The organic sources such as vermicompost, FYM as organic mulch (10cm thickness) were used. The whole organic manures were used as the basal dose in February. Then the necessary dose of fertilisers was applied along with the manures. The half of the inorganic fertilizer dose was used in February and the other half in July. The manure and the fertiliser were applied by removing the 30 cm top soil around the tree (leaf canopy) and the fertilisers and the FYM were evenly mixed into the soil. Then the soil was levelled. The biofertilisers (PSB, *Azotobacter*) were mixed with the FYM and the soil. Micronutrients $ZnSO_4$, $MnSO_4$ were supplied

The various growth parameters, such as number of fruits per plant, yield (kg/hectare), and fruit weight were calculated and recorded using an electronic weigh balance. The fruit length and diameter were recorded in April and July using vernier calliper.

Results and Discussion

Number of fruits, fruit weight and size

The use of organic fertilizers combined with inorganic fertilizers and micro-nutrient treatments resulted in significant improvements in fruit size and yield attribute characteristics during the rainy season and winter. Among treatments, in (table 1) maximum number of fruits (289.56) and (191.40) was observed in T8- RDF 75 % + $ZnSO_4$ + $MnSO_4$ + Borax + PSB + *Azotobacter* + FYM followed by T4-RDF 100 % + $ZnSO_4$+ $MnSO_4$+ Borax + organic mulch was found to be most significantly superior in comparison of other treatments. The guava plant's greater uptake of nutrients from the soil is evidence that major and micronutrients are always available, which is responsible for the higher production. In addition to FYM, the quality of the flowers and fruit was greatly enhanced by the use of various mixes of inorganic and micronutrients with chemical fertilizers. In the growth characteristics and development of the flowers, the use of nitrogen, phosphorus, potash, manures, and bio-

fertilizers to manufacture amino acid functions as a precursor to polyamine and a secondary messenger. Phytohormones, which are produced in plants as a result of the application of chemical and biological fertilizers, have been shown to have an impact on the synthesis of this amino acid by Dey *et al.* (2005) Goswami *et al.* (2012), Surage *et al.* (2017) and Dwivedi *et al.* (2018) also reported similar results in guava. The application of straw mulch improved fruit production characteristics and hastened fruit growth by increasing the availability of nutrients and food material transportation said by Singh *et al*. (2006) and Samant (2017) and on pomegranates corroborated this observation. The winter season saw a higher maximum fruit weight record than the rainy season. Maximum fruit weight (85.16) and (105.05g) was found in T8 (RDF 75 % + $ZnSO_4$+ $MnSO_4$+ Borax + PSB + *Azotobacter* + FYM) respectively in rainy and winter season. The addition of organic nutrients increased the fruit's average weight because photosynthates went from source to sink more quickly, as indicated by the growth hormones that the nutrients released or produced. Similar effects were seen in Yadav *et al.* (2011). In table 2, fruit length and diameter was observed maximum in T4 (RDF 100 % + $ZnSO_4$+ $MnSO_4$+ Borax + organic mulch) which was at par with T7, T8 treatments recorded significantly. The increased production of food ingredients was aided by nitrogen, which is then transferred into fruit-bearing regions where it causes a rise in fruit size and weight. Similar results were found by Godage *et al*. (2013) and Singh *et al*. (2018) and however, minimum number of fruits and weight were recorded under the treatment of control T10-(100% RDF).

Table 1: Effect of nutrients and biofertilisers on number of fruits and fruit weight of guava (*Psidium guajava* L.) cv. Hisar Safeda

Treatments	Number of fruits		Fruit weight	
	Rainy	Winter	Rainy	Winter
T_1-RDF 100 % +$ZnSO_4$+$MnSO_4$ + Borax	220.79	130.04	79.00	98.29
T_2-RDF 100 % +organic mulch	213.20	121.63	76.14	92.84
T_3-RDF 75 % + $ZnSO_4$+$MnSO_4$ + Borax + organic mulch	210.25	118.74	74.85	86.61
T_4-RDF 100 % + $ZnSO_4$+$MnSO_4$ + Borax + organic mulch	227.22	135.19	81.07	100.14
T_5-RDF 75 % + PSB + FYM	207.59	118.37	72.63	81.72
T_6- RDF 75 % + *Azotobacter*+ FYM	210.25	120.65	75.49	89.04
T_7- RDF 75 % +PSB+ *Azotobacter*+ FYM	225.02	134.15	80.38	99.05
T_8- RDF 75 % + $ZnSO_4$+$MnSO_4$ + Borax + PSB + *Azotobacter*+ FYM	289.56	191.40	85.16	105.05
T_9- RDF 75 % + FYM + vermicompost	208.76	118.09	73.32	86.01
T_{10}- RDF 100 %(Control)	169.00	105.77	70.21	77.32
CD at 5%	4.5	4.08	0.66	0.82

Table 2: Effect of nutrients and biofertilisers on fruit length and fruit diameter of guava (*Psidium guajava* L.) cv. Hisar Safeda

Treatments	Fruit length		Fruit diameter	
	Rainy	Winter	Rainy	Winter
T1-RDF 100 % + $ZnSO_4$+$MnSO_4$ + Borax	7.03	8.28	6.72	7.03
T2-RDF 100 % +organic mulch	6.80	8.07	6.69	6.88
T3-RDF 75 % + $ZnSO_4$+$MnSO_4$ + Borax + organic mulch	6.61	7.88	6.42	6.76
T4-RDF 100 % + $ZnSO_4$+$MnSO_4$ + Borax + organic mulch	7.56	8.79	7.31	7.51
T5-RDF 75 % + PSB + FYM	6.45	7.66	6.27	6.61
T6- RDF 75 % + *Azotobacter*+ FYM	6.67	7.90	6.43	6.78
T7- RDF 75 % +PSB+ *Azotobacter*+ FYM	7.27	8.23	7.18	7.29
T8- RDF 75 % + $ZnSO_4$+$MnSO_4$ + Borax + PSB + *Azotobacter*+ FYM	7.28	8.61	7.25	7.35
T9- RDF 75 % + FYM + vermicompost	6.47	7.70	6.38	6.71
T10- RDF 100 %(Control)	6.08	7.18	6.11	6.40
CD at 5%	0.52	0.48	0.54	0.41

Yield parameters

Among different treatment combinations, treatment T8 (RDF 75 % + $ZnSO_4$ + $MnSO_4$ + Borax + PSB + *Azotobacter* + FYM) containing had positive influence on yield per plant and per hectare (Table 3). Higher yield (kg / tree) and fruit yield per tree (q/ha) was obtained in rainy season than in winter season. This treatment recorded significantly maximum fruit

yield per plant (24.66g) and (20.11g), fruit yield per hectare (136.86 q/ha) and (111.59 q/ha) respectively in rainy and winter season. The combined application of RDF and FYM increased the number and size of leaves during vegetative growth, which in turn increased photosynthetic area and increased the accumulation of carbohydrates required for the plant's reproductive growth. This resulted in the production of more flowers, an increase in fruit set, and an increase in yield under the treatment of T8 followed by T4. The present findings are in accordance with the reports of Sharma *et al*. (2004) and Atom *et al.* (2013). It might be due to better nutritional environment, application of organic matter improve the soil health by improving physico-chemical and biological activities (Schnitzer, 1991) and bio-fertilizers enhancing the rate of mineralization and availability of the nutrients which further enhance the growth of the plants and thereby yield Kumar *et al*.(2017), Sahoo and Singh *et al*. (2005). However, minimum yield (kg/tree), yield (quintal/hectare), were found was observed in the treatment T10-RDF 100% (Control).

Table 3: Effect of nutrients and biofertilisers on Yield kg/tree and Yield q/ha of guava (*Psidium guajava* L.) cv. Hisar Safeda

Treatments	Yield kg/tree		Yield q/ha	
	Rainy	Winter	Rainy	Winter
T1-RDF 100 % + $ZnSO_4$+$MnSO_4$ + Borax	17.44	12.78	96.80	70.94
T2-RDF 100 % +organic mulch	16.23	11.29	90.10	62.68
T3-RDF 75 % + $ZnSO_4$+$MnSO_4$ + Borax + organic mulch	15.74	10.28	87.34	57.08
T4-RDF 100 % + $ZnSO_4$+$MnSO_4$ + Borax + organic mulch	18.42	13.54	102.23	75.13
T5-RDF 75 % + PSB + FYM	15.08	9.67	83.68	53.69
T6- RDF 75 % + *Azotobacter*+ FYM	15.87	10.74	88.09	59.62
T7- RDF 75 % +PSB+ *Azotobacter*+ FYM	18.09	13.29	100.38	73.75
T8- RDF 75 % + $ZnSO_4$+$MnSO_4$ + Borax + PSB + *Azotobacter*+ FYM	24.66	20.11	136.86	111.59
T9- RDF 75 % + FYM + vermicompost	15.31	10.16	84.95	56.37
T10- RDF 100 %(Control)	11.87	8.18	65.85	45.39
CD at 5%	1.88	1.68	5.19	4.53

Conclusion

Thus, on the basis of results, summarized above it can be concluded that application of 75% RDF + $ZnSO_4$ (0.5%) + Borax (0.2%) + $MnSO_4$ (0.1%) + PSB (100g)+ *Azotobacter* (100g) + 50 kg FYM. were proved to be the best for improving the yield attributes of guava (*Psidium guajava* L.) cv. Hisar Safeda . Number of fruits, fruit weight, fruit yield (kg/tree) and fruit yield (q/ha) differed significantly with different treatments applications. During rainy and winter season maximum number of fruits (289.56and 191.40), fruit weight (85.16g and 105.05g), yield of (24.66 and 20.11 kg per tree) and yield of (136.86 and 111.59 q/ha) were produced in T8 (75% RDF + $ZnSO_4$ (0.5%) + Borax (0.2%) + $MnSO_4$ (0.1%) + PSB (100g)+ *Azotobacter* (100g) + 50 kg FYM). Fruit length and diameter was found maximum in (T4) (RDF 100 % + $ZnSO_4$+ $MnSO_4$ + Borax + organic mulch). Rainy season fruits produced more number of fruits and yield than in winter season. Winter season fruits had maximum fruit weight.

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