

Original Research Article

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## Effect of Biofertilizers on Growth, Yield and Fruit Quality of Guava (*Psidium guajava* L.) cv. Allahabad Safeda

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### ABSTRACT

The study on the effect of biofertilizers on growth, yield and fruit quality of guava (*Psidium guajava* L.) cv. Allahabad safeda was conducted in the guava orchard of Mr. Lakhwinder Singh, Village- Sarawan Bodla, Shri Mukatsar Sahib, Punjab in the year 2018-2019. The experiment was laid out in randomized block design with nine treatments and replicated thrice with a unit of one plant in each replication of a treatment. Different doses of biofertilizers Azotobacter @ 250 g/tree, PSB @ 200 g/tree, VAM @ 200g/tree and 75 % RDF along with control were applied on new growth flushes before flower initiation. Results revealed that maximum fruit diameter horizontal (8.86 cm), fruit diameter vertical (8.89 cm), fruit weight (227.7 g), TSS (9.03 °Brix) and fruit yield (58.60 kg/plant), total sugar (7.65 %), reducing sugar (4.28 %), non-reducing sugar (3.37 %) and ascorbic acid (180.36 mg/100g) was found in 75 % RDF + Azotobacter (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree) and minimum was found in plants under control. Minimum acidity (0.51 %) was recorded in 75 % RDF + Azotobacter (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree) and maximum was recorded in control. Hence, it could be concluded that combinations of biofertilizers in guava is found to be useful for obtaining higher yield and fruit quality.

#### Keywords

Guava,  
Azotobacter,  
VAM, PSB, Yield,  
Fruit quality

#### Article Info

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### Introduction

Guava (*Psidium guajava* L.) is one of the most important fruit crop of India. It is originated from tropical America. It covers around 3.3 % of the total area under fruit crops and contributes 3.3 % of the total fruit production in India. In India guava occupies an area of 27000 hectares with annual production of 4107000 MT. Allahabad area in U.P is reputed for the production of high quality of guava in India. In Punjab it occupies an area of 8022 hectares with annual

production of 160463 MT. In Punjab, guava is cultivated on large scale in all districts. Total area in the state is 8.2 thousand hectares. Whereas, the annual production is 180.8 thousand MT. Main guava producing districts of Punjab are Sangrur, Patiala, Amritsar, Ropar, Ferozpur, Ludhiana, Bathinda, Muktsar, Hoshiarpur and Jalandhar (Anonymous, 2018)(2). The fruit type of guava is a berry with large seed core. Guava can be considered as the 'apple of the tropics' for its high vitamin C and mineral content.

Guava is fourth important fruit of India after mango, banana and citrus. Guava is cultivated throughout the tropical and subtropical region. The major Guava producing countries are South Asian countries (Sri Lanka, Pakistan, Nepal, India, Nepal, Bangladesh) of the world (Mitra and Bose, 1985)(7). In northern India guava plant bears flower twice or sometimes thrice in a year. The spring flowering is called "AmbeBahar", June or monsoon flowering is called "MrigBahar" and third flowering which comes in October is called "Hast Bahar". AmbeBahar fruit ripen from July to September and MrigBahar fruit ripen from November to February, however, Hast Bahar fruit ripen in spring season, which also known as summer season crop. In North India including Uttar Pradesh there are two flowering season of guava April-May for rainy season and August - September for winter season crop.

Guava is a rich source of vitamin C and pectin. It contain 82.50 per cent water, 2.45 % acid, 5.40 % reducing sugar, 4.80 % non-reducing, sugar, 13.60 °Brix total soluble solids, 0.48 per cent ash and 147.34 mg vitamin C/100 gm fruit. Vitamin C content differ with cultivar, stage of maturity and season. Fruit pulp contain good amount of iron, calcium and phosphorous. These fruit are consumed either fresh or processed in the form of products like jam, jelly, juice, nectar, ready to serve (RTS) etc. Guava is such a horticultural crop, whose fruits are usually consumed fresh after harvest along with skin and pulp. Biofertilizers and bio pesticides which are microbial in origin, offer themselves as a viable alternatives for their ability to enrich the soil with beneficial microorganisms, mobilize the nutritionally important elements from non-usable to usable form through biological processes resulting in enhanced production of various fruit crops (Deyetal., 2005)(3).

Biofertilizers are input containing microorganisms capable of mobilizing and solubilization of nutritive elements through biological processes. They are less expensive, ecofriendly and sustainable and do not require non-renewable source of energy during their production. They improve plant growth and fruit quality by producing plant hormones. They increase the fertility of the soil and make it more productive and it is a way of achieving sustainability. They are also useful as biocontrol agents since they control many plant pathogens and harmful microorganism. The beneficial effect of biofertilizers are now well established in many fruit crops like mango (Ahmad *et al.*, 2004)(1). But, scanty information is available on effect of biofertilizer on organic fruit production of guava particularly in the new alluvial zones of West Bengal. Research evidences are encourageous towards the integrated use of organic + inorganic + biofertilizers which may improve the soil productivity and crop yield with better quality (Singh *et al.*, 2011) (10).

### **Materials and Methods**

The experiment was conducted in the research farm of Mr.Lakhwinder Singh, Village-SarawanBodla, Tehsil - Malout, District - Sri Mukatsar Sahib. The research farm is situated between 30° 56' 11.90"N latitudes and 76° 18' 13.18"E longitudes and at a mean height of 279 meter above sea level. The present investigations were made on eight year old guava trees growing in the orchard. Twenty seven trees which were uniform in size & vigour and given cultural practices as per package of practices recommended by Punjab Agricultural University, Ludhiana were selected for the present study. All the treatment were applied as a last week September. During the course of studies, recommended cultural practices were followed in the experimental materials. The

experiment was laid out in Randomized Block Design (RBD) having nine treatments with three replications. Treatments consisted of T<sub>1</sub> (Control), T<sub>2</sub> (100 % RDF), T<sub>3</sub> (75 % RDF + *Azotobacter* (250 g/tree), T<sub>4</sub> (75 % RDF + PSB (200 g/tree), T<sub>5</sub> (75 % RDF + VAM (200 g/tree), T<sub>6</sub> (75 % RDF + *Azotobacter* (250 g/tree) + PSB (200 g/tree), T<sub>7</sub> (75 % RDF + *Azotobacter* (250 g/tree) + VAM (200 g/tree), T<sub>8</sub> (75 % RDF + VAM (200 g/tree) + PSB (200 g/tree), T<sub>9</sub> (75 % RDF + *Azotobacter* (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree). Before application of biofertilizers, the amount to be applied was calculated. They were applied by mixing in soil and were directly applied near the rootzone of plant.

Observations were recorded on number of days taken to produce first flowering, number of flowers plant<sup>-1</sup>, number of fruits plant<sup>-1</sup>, yield plant<sup>-1</sup> and yield ha<sup>-1</sup> total amount of fruits produced per plants were weighed and then calculated on per hectare basis in tons.

## Results and Discussion

### Vegetative growth attributes

On the basis of present investigation it is reported that the tree height, tree spread, leaf area and stem girth were increased significantly with the use of biofertilizers or in combinations. The maximum plant height increase, plant spread, leaf area and stem girth increase were recorded with the application of T<sub>9</sub> 100 % RDF + *Azotobacter* (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree) however minimum tree height increase, tree spread, leaf area and stem girth increase were recorded with the application of T<sub>1</sub> (control).

The increase in tree height might be due to the 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 the cell division and

cell elongation and there by more vegetative growth (Dutta *et al.*, 2009) (4). The other reason for increased vegetative growth may be the production of plant growth regulators by bacteria in rhizosphere, which are absorbed by the roots. Better development of root system and the possibly synthesis of plant growth hormones like IAA, GA and cytokinins and direct influence of biofertilizers might have caused increase in plant growth parameters (Gupta and Tripathi, 2012) (5). The results of present study accordance were observed the vegetative growth of guava was improved by the application of different fertilizers, organic manure and biofertilizers. The increasing of canopy volume might be due to the better nutritional environment, application of organic matter improve the soil health by improving physicochemical and biological activities of soil (Kumar *et al.*, 2017) (6) (Fig. 1 and 2; Table 1).

### Yield attributes

Significant variation in number of fruits, yield per plant and yield per hectare were recorded in plants subjected to biofertilizers in combination, where maximum number of fruits per tree, yield per tree and yield per hectare was recorded in the tree treated with T<sub>9</sub> (100 % RDF + *Azotobacter*(250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree)) however minimum number of fruits per tree, yield per tree and yield per hectare was recorded in the tree treated T<sub>2</sub> (100 % RDF). The increase in yield might be due to increased fruit set per plant, increased berry size and weight and may also be due to the fact that nitrogen fixers and phosphorous solubilizers not only increased the availability of nitrogen and phosphorous to the plants but also increased their translocation from root to flower through plant foliage (Singh and Singh, 2009) (9) (Fig.3 and Table 2).

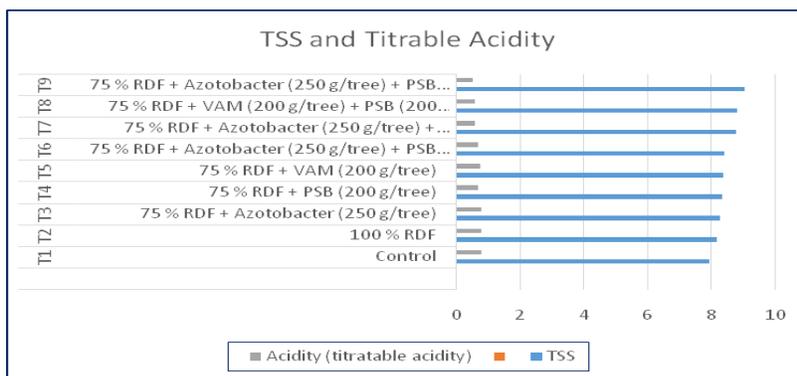
**Table.1** Effect of biofertilizers on TSS, ascorbic acid and titratable acidity of guava fruit

Sr. No.	Treatments	TSS (°Brix)	Ascorbic acid (mg/100 g)	Acidity (titratable acidity)
T <sub>1</sub>	Control	7.93	153.42	0.78
T <sub>2</sub>	100 % RDF	8.15	160.40	0.76
T <sub>3</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree)	8.25	158.93	0.78
T <sub>4</sub>	75 % RDF + PSB (200 g/tree)	8.33	169.13	0.68
T <sub>5</sub>	75 % RDF + VAM (200 g/tree)	8.36	166.89	0.73
T <sub>6</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree) + PSB (200 g/tree)	8.40	163.65	0.68
T <sub>7</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree) + VAM (200 g/tree)	8.76	176.67	0.58
T <sub>8</sub>	75 % RDF + VAM (200 g/tree) + PSB (200 g/tree)	8.78	179.96	0.57
T <sub>9</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree)	9.03	180.36	0.51
S. Em. ±	-	0.09	1.46	0.02
CD (0.05%)	-	0.28	4.38	0.07

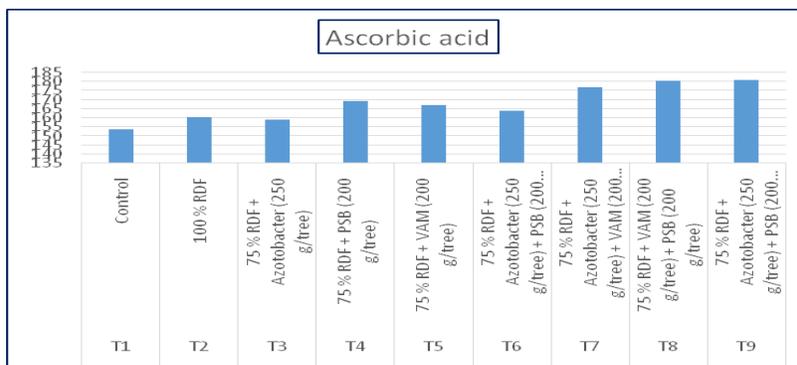
**Table.2** Effect of biofertilizers on total no. of fruits per tree fruit yield (kg/ha) and fruit yield (t/ha) of guava fruit

Sr. No.	Treatments	Total no. of fruits (per tree)	Fruit yield (kg/tree)	Fruit yield (t/ha)
T <sub>1</sub>	Control	160.67	26.29	4.11
T <sub>2</sub>	100 % RDF	189.67	34.51	5.39
T <sub>3</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree)	190.00	34.61	5.41
T <sub>4</sub>	75 % RDF + PSB (200 g/tree)	194.33	34.83	5.44
T <sub>5</sub>	75 % RDF + VAM (200 g/tree)	227.33	42.65	6.66
T <sub>6</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree) + PSB (200 g/tree)	231.00	45.35	7.09
T <sub>7</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree) + VAM (200 g/tree)	228.67	49.19	7.69
T <sub>8</sub>	75 % RDF + VAM (200 g/tree) + PSB (200 g/tree)	251.00	54.24	8.48
T <sub>9</sub>	75 % RDF + <i>Azotobacter</i> (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree)	257.33	58.60	9.16
S. Em. ±	-	8.84	1.67	0.26
CD (0.05%)	-	26.50	5.00	0.78

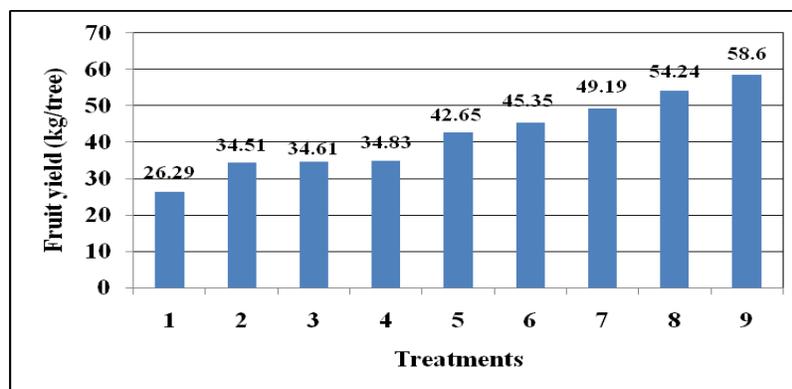
**Fig.1** Effect of biofertilizers on TSS and titratable acidity of guava fruit



**Fig.2** Effect of biofertilizers on ascorbic acid of guava fruit



**Fig.3** Effect of biofertilizers on fruit yield (kg/tree) of guava



**Fruit quality attributes**

In the present investigation it is reported that the fruit diameter were increase significantly with the application of biofertilizers. The maximum fruit diameter was recorded in treatment T<sub>9</sub> (100 % RDF + *Azotobacter* (250

g/tree) + PSB (200 g/tree) + VAM (200 g/tree)) however minimum fruit diameter was recorded with the application of T<sub>1</sub> (control). Biofertilizer is considered as a significant source of different micronutrients which play an important role in regulation of length and diameter of guava by enhancing metabolic

activities in plant cells (Sharma *et al.*, 2013)(8). The combined application of biofertilizers increase fruit diameter due to high rate of photosynthesis results in higher carbohydrate accumulation in fruit (Singh *et al.*, 2003) (11). Total soluble solid, ascorbic acid, total sugar, reducing sugar and non-reducing sugar were increased significantly with the application of biofertilizers. The maximum total soluble solid, ascorbic acid, total sugar, reducing sugar and non-reducing sugar were obtained with the application of T<sub>9</sub> (100 % RDF + *Azotobacter* (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree)) however minimum total soluble solid, ascorbic acid and non-reducing sugar were obtained with the application of T<sub>1</sub> (control). The minimum tritritable acidity were obtained with the application of T<sub>9</sub> [100 % RDF + *Azotobacter* (250 g/tree) + PSB (200 g/tree) + VAM (200 g/tree)] however, maximum tritritable acidity were obtained with the application of T<sub>1</sub> (control).

Nitrogen stimulates the functioning of number of enzymes in the physiological processes, which might have improved the total increase in total soluble solid content of the fruits. The highest mean values for total sugars could be attributed to the involvement of nitrogen in various energy sources like amino acids and amino sugars. Improved TSS and sugar contents of guava fruit with the application of biofertilizers and organic manure was also reported by Dey *et al.*, (2005)(3).

On the basis of results obtained from various treatments, it can be concluded that the application of treatment T<sub>9</sub>(75 % RDF + PSB (200 g/tree) + *Azotobacter* (250 g/tree) + VAM (200 g/tree) gave best results in quality and yield parameters which was at par with treatment T<sub>8</sub>(75 % RDF + PSB (200 g/tree) + VAM (200 g/tree). So far as the treatment T<sub>9</sub>(75 % RDF + PSB (200 g/tree) + *Azotobacter* (250 g/tree) + VAM (200 g/tree)

showed better growth as compare to other treatments.

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