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# Influence of inorganic fertilizers, organic manures and bio-fertilizers on quality of winter season guava (*Psidium guajava* L.) cultivar "L-49" grown under system of HDP.

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**Abstract**

Eighteen-year-old plants of guava cv. 'L-49' were subjected to various treatments comprising organic manures, inorganic fertilizers and *PSB* i.e., 100, 50 and 25 per cent of recommended dose of NPK, FYM @ 75 kg per plant, vermicompost @ 10 kg per plant, *neemcake* @ 5 kg per plant, *PSB* @ 20 g per plant. In this way, total 14 treatments were used in the present study. The results revealed that all the treatments had significantly increased the quality of fruits over absolute control. Further, the application of organic manures was found significantly superior over 100 per cent recommended dose of NPK. Among the different organic manures used in the present study, the application of vermicompost @ 10 kg per plant significantly improved fruit quality in terms of TSS (14.75 %) , acidity (0.434%), ascorbic acid (207.4 mg/100 g pulp) and TSS : acid ratio (34.71) as compared to FYM @ 75 kg per plant and *neemcake* @ 5 kg per plant treatment. Among the different levels of recommended dose of NPK, the application of 50 per cent recommended dose of NPK treatment also improve the quality of fruits as compared to 25 per cent recommended dose of NPK. Similarly, the application of *PSB* @ 20 g per plant was found to be superior with respect to quality of fruits in level of significance.

**Key words:** *Guava, organic and inorganic nutrition, chemical characteristics*

## Introduction

Guava is the most important, highly productive, delicious and nutritive fruit of tropical and sub tropical regions. It is a good source of calcium and iron, fair source of phosphorus and a rich source of vitamin C and pectin. It is enjoyed both as fresh as well as in processed form. In north Indian agro-climatic conditions, guava flowers twice in a year i.e., April-May for rainy season crop and then, in August-September for winter season crop. Generally, fruit yield is more in rainy season crop as compared to winter season crop, but are poor in quality. During the last 50 years, considerable research has been done in the country on various aspects of guava cultivation such as varieties, propagation, irrigation, training and pruning etc. to increase the yield and quality of guava fruits. The production of poor quality fruits is a matter of common experience. It would therefore be worthwhile to improve the productivity of guava by nutrient management. Guava is reported to develop characteristic deficiency symptoms with reduced yield in the absence of macro nutrients N, P, K, Ca, Mg, S and the micronutrients Zn, Bo, Mn, Fe, Cu, Mo. Many of these nutrients are made available by the soil depending upon physical and chemical properties. However, in production system management, which aims to achieve targeted yield, required quantity of above mineral nutrients are desirable to be supplied. It is essential that optimum quantity of nutrients is applied with best sources, at appropriate time, to achieve targeted production. Of late, the use of organic manure along with biofertilizers and inorganic fertilizers, as a cheap source of available nutrients to plants, has resulted in beneficial effects on growth, yield and quality of various fruit crops. Wagh and Mahajan (1985) reported better growth and higher yield in 'Sardar' guava receiving N, $P_2O_5$ and $K_2O$ at 600, 300 and 300 g per plant, respectively, along with 25 kg FYM in Maharashtra conditions. Ram and Rajput (2000) recorded the maximum TSS and acidity in guava cv. 'Allahbad Safeda' by application of FYM along with *Azotobacter*. It can, therefore, conclusively be said that guava plants responds to integrated nutrient management under different agro-climatic and soil conditions in respect to yield and quality.

## Materials and methods

The studies were carried at Instructional Farm, Department of Horticulture, Rajasthan College of Agriculture, M.P.U.A.T., Udaipur during two successive years i.e. 2005-06 and 2006-07 in which 18 years old guava plants of uniform size and growth were selected. In all 56 uniform plants were selected from the guava block (6x3 m spacing) for this study. The selected plants were moderately pruned. The experiment comprised of fourteen treatment combinations consisting of inorganic fertilizers (NPK), organic manures (FYM, *neemcake* and vermicompost) and bio-fertilizer (*PSB*). The experiments were laid out in a completely randomized design with fourteen replications.

## Result and discussion

The results obtained in present investigation reveal that the application of inorganic fertilizers, organic manures and PSB had significantly improved nutritional quality of guava fruits in terms of TSS, acidity, TSS/acid ratio ascorbic acid and sugar content as compared to control (Table 1). It is further evident from the data that application of organic manure found significantly superior over inorganic fertilizers treatment. However, among various organic manure treatments, the application of vermicompost @ 10 kg per plant was found to be best treatment as compared to others with respect to nutritional quality parameters of the fruit. The maximum TSS content of 14.75 percent and minimum acidity of 0.434 percent (Table 1) were recorded due to application of vermicompost @10 kg per plant treatment. Similarly, this treatment also exhibited highest TSS /acid ratio of 34.71 (Table 1). The present results on TSS, acidity and TSS/acid ratio close accordance with those of Rathore and Dhyani (2005) in guava, who reported that application of poultry manure + vermicompost + FYM resulted in enhancement of fruit quality but has less effect on productivity. Similarly, Athani et al. (2005) recorded maximum TSS content of fruit with the application of 75 percent RDF +10 kg vermicompost followed by the treatment in situ vermiculturing @50 worms per plant and 100 percent RDF.

The application of inorganic fertilizer at different levels also significantly influenced the TSS, acidity and TSS/acid ratio. The higher TSS content of 15.11 percent (Table 1) lowest acidity of 0.396 percent (Table 1) and maximum TSS /acid ratio 38.38 (Table 1) were recorded due to application of 50 percent recommended dose of NPK treatment. As compared to lowest TSS (13.80 percent) (Table 1), highest acidity and minimum TSS/acid ratio (27.97) (Table 1) at 25 percent recommended dose of NPK treatment. The improvement in fruit quality by an increase in TSS content of fruits might have been due to beneficial role of nutrients on the process of photosynthesis which ultimately led to the accumulation of large amount of carbohydrates and there by increase TSS content of fruits. The acidity of guava fruit significantly decreased with the application of nutrients might be due to increase in sugar content with the application of nutrients. Wahid et al. (1991) reported that nitrogen treatments improved fruit quality by increasing the TSS, sugar, ascorbic acid and decreasing acidity of fruits. The upsurges in TSS, TSS/ acid and decrease in acidity of guava fruits due to application of NPK have also been reported by Rathore and Dhyani (2005) in guava. The results obtained by Mitra and Bose (1985) in guava are also in accordance with present findings.

Similarly, the application of PSB had significantly increased TSS and TSS/acid ratio and decreased acidity of fruit The maximum TSS of 14.72 percent (Table 1), minimum acidity of 0.429 percent (Table 1) and highest TSS /acid ratio of 35.10 (Table 1) were recorded at the application of *PSB* @ 20 g per plant which were significantly higher than without *PSB* treatment. The beneficial effect of *PSB* on fruit quality with respect to TSS and acidity might be due to phosphate solubilising bacteria that solubilise the insoluble forms of phosphorus and make them available to the plants. The mechanism of

Details of the treatments are as follow:

| S. No. | Treatments | Notation |
|---|---|---|
| 1. | Absolute control | $T_0$ |
| 2. | Recommended dose of NPK (500:200:500 g/plant) | $T_1$ |
| 3. | FYM 75 kg + 50% recommended NPK (250:100:250 g/plant) | $T_2$ |
| 4. | FYM 75 kg + 50% recommended NPK (250:100:250 g/plant) + *PSB* (20 g/plant) | $T_3$ |
| 5. | FYM 75 kg + 25% recommended NPK (125:50:125 g/plant) | $T_4$ |
| 6. | FYM 75 kg + 25% recommended NPK (125:50:125 g/plant) + *PSB* (20 g/plant) | $T_5$ |
| 7. | *Neemcake* 5 kg + 50% recommended NPK (250:100:250 g /plant) | $T_6$ |
| 8. | *Neemcake* 5 kg + 50% recommended NPK(250:100:250 g /plant) + *PSB* (20 g/plant) | $T_7$ |
| 9. | *Neemcake* 5 kg + 25% recommended NPK (125:50:125 g/plant) | $T_8$ |
| 10. | *Neemcake* 5 kg + 25% recommended NPK (125:50:125 g/plant) + *PSB* (20 g/plant) | $T_9$ |
| 11. | Vermicompost 10 kg + 50% recommended NPK(250:100:250 g /plant) | $T_{10}$ |
| 12. | Vermicompost 10kg+50% recommended NPK(250:100:250 g/plant)+*PSB*(20 g/plant) | $T_{11}$ |
| 13. | Vermicompost 10 kg + 25% recommended NPK (125:50:125 g/plant) | $T_{12}$ |
| 14. | Vermicompost 10 kg + 25% recommended NPK (125:50:125 g/plant) + *PSB* (20 g/plant) | $T_{13}$ |

stabilization appears to be acid metal reaction and thus dissolution and chelation of metal and release of phosphorus. These are also known to produce acids, vitamins growth promoting substances like IAA, GA3 etc. which might have improved the quality of fruits (Kashyap et al., 2004)

The application of organic manure had significantly increased the ascorbic acid content of the guava fruit (Table 1). Among the various organic manure treatments the maximum ascorbic acid (207.4mg/100g pulp) (Table 1) was recorded for vermicompost @ 10 kg per plant treatment followed by FYM @ 75 kg per plant (200.8mg/100g pulp) (Table 1). Where as, the minimum ascorbic acid content of 196.5 mg per 100g pulp (Table 1) was recorded for *neemcake* @ 5 kg per plant treatment. Similar beneficial effect of organic manure on vitamin 'C' content of fruit was recorded by Pereira and Mitra (1999), who reported higher vitamin 'C' content (130.0mg/100g pulp) in fruits harvested from the plants receiving only FYM of 30 kg per plant. The present results were in accordance with the findings of Naik and Babu (2005), Athani et al. (2005) and Madhavi et al. (2005) in guava cv. 'Sardar'. The highest amount of ascorbic acid (2.61mg/100ml juice) was also recorded for vermicompost treated fruits in grape by Venkatesh et al. (1998).]

However, among the different treatments of inorganic fertilizer attempted in the present study, the application of higher dose of NPK (50% recommended dose of NPK) resulted higher ascorbic acid content (206.3mg/100g pulp) (Table 1) as compared to 25 per cent recommended dose of NPK treatment (196.9mg/100g pulp) (Table 1). Uma Shankar et al. (2002) was recorded higher ascorbic acid content of guava fruit with the application of NPK at 225g,150g and 150g and 225g, 150g and 225g per plant respectively. Similar results were recorded by Sen and Chauhan (1983) in guava. Similarly, the maximum ascorbic acid content of 204.5 mg per 100g pulp (Table 1) was recorded at with *PSB* treatment (20g/plant) as compared to minimum (198.8mg/100g pulp) at without *PSB* treatment in the present study (Table 1).

The sugar content (reducing, non- reducing and total sugar) of guava was significantly influenced with the use of different organic manure treatments. The maximum quantity of reducing sugar of 4.39 per cent (Table 2), non reducing sugar of 2.95 per cent (Table 2) and total sugar of 7.50 per cent (Table 2) were recorded at vermicompost @ 10 kg per plant treatment. Where as, the application of

**Table1**. Effect of inorganic fertilizers, organic manures and *PSB* on TSS, Acidity, TSS /acid ratio and Ascorbic acid content of guava fruits cv. "L-49".

| | Treatments | Total soluble solids (%) | Acidity (%) | TSS /acid ratio | Ascorbic acid (mg/100 g pulp) |
|---|---|---|---|---|---|
| (A) | Absolute control v/s treatment | | | | |
| | Absolute control | 11.27 | 0.664 | 17.01 | 166.0 |
| | Treatments | 14.30 | 0.455 | 32.35 | 200.2 |
| | F cal | Sig. | Sig. | Sig. | Sig. |
| (B) | Inorganic fertilizers v/s organic manures | | | | |
| | 100 % Recommended dose of NPK | 12.50 | 0.559 | 22.41 | 183.3 |
| | Organic manures (OM) | 14.45 | 0.446 | 33.18 | 201.6 |
| | F cal | Sig. | Sig. | Sig. | Sig. |
| (C) | Organic manures | | | | |
| | FYM @ 75 kg/plant | 14.40 | 0.457 | 32.39 | 200.8 |
| | *Neemcake* @ 5 kg/plant (NC) | 14.21 | 0.448 | 32.43 | 196.5 |
| | Vermicompost @ 10 kg/plant (VC) | 14.75 | 0.434 | 34.71 | 207.4 |
| | SEm ± | 0.11 | 0.004 | 0.39 | 1.9 |
| | CD at 5% | 0.30 | 0.011 | 1.09 | 5.4 |
| (D) | Inorganic fertilizers | | | | |
| | 50% Recommended dose of NPK | 15.11 | 0.396 | 38.38 | 206.3 |
| | 25% Recommended dose of NPK | 13.80 | 0.496 | 27.97 | 196.9 |
| | SEm ± | 0.09 | 0.003 | 0.32 | 1.6 |
| | CD at 5% | 0.24 | 0.009 | 0.89 | 4.4 |
| (E) | *PSB* | | | | |
| | Without *PSB* | 14.19 | 0.464 | 31.26 | 198.8 |
| | With *PSB* @ 20 g/plant | 14.72 | 0.429 | 35.10 | 204.5 |
| | SEm ± | 0.09 | 0.003 | 0.32 | 1.6 |
| | CD at 5% | 0.24 | 0.009 | 0.89 | 4.4 |

Sig. = Significant

*neemcake* resulted minimum sugar content of fruit. Venkatesh et al. (1983) also recorded the highest quantity of total sugar wit the application of vermicompost +25 per cent recommended fertilizer rates in grape. Similar beneficial effect on sugar content due to vermicompost was recorded by Rathore and Dhyani (2005) and Madhavi et al. (2005) in guava. Similarly, the application of different levels of recommended dose of fertilizer significantly influenced the sugar content of guava fruits. The application of 50 per cent recommended dose of NPK increased reducing sugar (4.41%) (Table 2), non-reducing sugar (3.01%) (Table 2) and total sugar (7.57 %) (Table 2) content as compared to 25 per cent recommended dose of NPK treatment. The present results are in accordance with the findings of Uma Shankar et al. (2002), Kumar et al. (2005) in guava. The data further reveal that the application of *PSB* had significantly affected on reducing, non-reducing and total sugar content of guava fruit. Where highest reducing sugar (4.39 %) (Table 2), non-reducing sugar (2.91 %) (Table 2) and total sugar content (7.45 %) (Table 2) was recorded at with *PSB* @ 20g per plant treatment as compared to lowest at without *PSB* treatment.

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**Table 2**. Effect of inorganic fertilizers, organic manures and *PSB* on reducing sugar content of guava fruits cv. "L-49".

| | Treatment | Reducing sugar (%) | Non-reducing sugar (%) | Total sugar (%) |
|---|---|---|---|---|
| (A) | Absolute control v/s treatment | | | |
| | Absolute control | 3.70 | 2.52 | 6.35 |
| | Treatments | 4.26 | 2.82 | 7.22 |
| | F cal | Sig. | Sig. | Sig. |
| (B) | Inorganic fertilizers v/s organic manures | | | |
| | 100 % Recommended dose of NPK | 3.99 | 2.65 | 6.79 |
| | Organic manures (OM) | 4.28 | 2.83 | 7.26 |
| | F cal | Sig. | Sig. | Sig. |
| (C) | Organic manures | | | |
| | FYM @ 75 kg/plant | 4.28 | 2.87 | 7.30 |
| | *Neemcake* @ 5 kg/plant (NC) | 4.17 | 2.68 | 6.99 |
| | Vermicompost @ 10 kg/plant (VC) | 4.39 | 2.95 | 7.50 |
| | SEm ± | 0.03 | 0.02 | 0.04 |
| | CD at 5% | 0.09 | 0.06 | 0.12 |
| (D) | Inorganic fertilizers | | | |
| | 50% Recommended dose of NPK | 4.41 | 3.01 | 7.57 |
| | 25% Recommended dose of NPK | 4.15 | 2.66 | 6.95 |
| | SEm ± | 0.03 | 0.02 | 0.03 |
| | CD at 5% | 0.07 | 0.05 | 0.09 |
| (E) | *PSB* | | | |
| | Without *PSB* | 4.17 | 2.76 | 7.07 |
| | With *PSB* @ 20 g/plant | 4.39 | 2.91 | 7.45 |
| | SEm ± | 0.03 | 0.02 | 0.03 |
| | CD at 5% | 0.07 | 0.05 | 0.09 |

Sig. = Significant

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