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# Studies on effect of Biofertilizers and Biostimulant on Post Harvest Quality Parameters and Shelf Life of Guava (*Psidium guajava* L.) cv. Allahabad Safeda under Meadow Planting System

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**ABSTRACT: The experiment was conducted at the Fruit research station, Sangareddy, Sri Konda Laxman Telangana State Horticultural University, Hyderabad during the period of June, 2019 to January, 2020 (Mrig bahar crop). Extensive application of inorganic chemical fertilizers produce huge quantity of chemical residues in field as well as in the crop produce. The organic manures can provide as substitute to mineral fertilizers for improving soil structure and microbial biomass. In view of the above facts, the present investigation was planned to ascertain the effect of biofertilizers and biostimulant on post-harvest quality parameters and shelf life of guava (*Psidium guajava* L.) cv. Allahabad Safeda under meadow planting system. The study revealed that maximum total soluble solids (12.26°Brix), reducing sugars (4.58%), Non reducing sugars (3.54%), total sugars (8.12%), ascorbic acid (226.15 mg/100 g) and shelf life (7.64 days) with minimum acidity (0.36%)are shown by the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB @ 50 g tree$^{-1}$ + Seaweed extract @ 75 g tree$^{-1}$.**

**Keywords:** Guava, *Azotobacter*, PSB, seaweed extract, quality parameters, shelf life.

## INTRODUCTION

Guava (*Psidium guajava* L.) isgrown in tropical and subtropical regions of India, originated in Tropical America and belongs to the family Myrtaceae. In India, guava is cultivated in 2,64,000 hectares of area with 40.53 lakh tonnes of production and 15.3 MT ha$^{-1}$ of productivity. Uttar Pradesh has highest area and production Andhra Pradesh leads in productivity (Anonymous, 2017-18). Telangana has 2,560 ha area in guava with production of 38,740 MT (Anonymous, 2017-18). Winter guava is mostly preferred in the state which gives flowering in June-July and comes to harvest during Nov. - Dec.

Presently, meadow planting system of guava is getting popularity. Fruit plant withdraw huge quantity of vital nutrient reserves in the soil. Extensive application of inorganic chemical fertilizers produce huge quantity of chemical residues in field as well as in the crop produce, generate numerous environmental and health hazards in addition to socio-economic problems. Thus, organic manures can provide as substitute to mineral fertilizers for improving soil structure and microbial biomass. For sustaining highest productivity of the land and building up of soil fertility, the use of vermicompost, biofertilizers and biostimulant to crops has been suggested. Lodaya and Masu (2019) studied the effect of bio-fertilizer, manures and chemical fertilizers on fruit quality and shelf life of guava (*Psidium guajava* L.) cv. Allahabad Safeda. They reported that soil application of 30% RDF through chemical fertilizers + 30% RDN through Poultry manure + 20 ml Bio NPK Consortium has been recorded maximum T.S.S. (11.93 °Brix), reducing sugars (6.35%), non-reducing sugars (1.72%), total sugars (8.07%) and ascorbic acid (177.67 mg 100g$^{-1}$ of pulp). Sayan Sau *et al*. (2016) conducted research on influential role of biozyme on yield and quality of guava cv. Allahabad Safeda. The study revealed that application of 250:375:250 g N, $P_2O_5$ and $K_2O$ per plant + Biozyme @ 10 ppm recorded maximum T.S.S. (11.26 °Brix), total sugars (9.31%) and vitamin C content (195.75 mg 100g$^{-1}$). Thus, considering the potentialities of biofertilizers and biostimulant, the present study was conducted to study the response of guava with biofertilizers and biostimulant.

## MATERIALS AND METHOD

The study was conducted at Fruit Research Station (FRS), Sangareddy, SKLTSHU, Telangana during the period of June, 2019 to January, 2020 (Mrig bahar crop). The soil type was sandy clay loam having pH 8.26, EC 0.20 dSm$^{-1}$, low in available N (120.61 kg ha$^{-1}$), low in available P (20.14 kg ha$^{-1}$) and medium in available potash (162.56 kg ha$^{-1}$). The experiment was laid out in Factorial Randomized Block Design (FRBD) in three replications with 12 treatment combinations comprised of three levels of biofertilizers *viz*., $B_1$- *Azotobacter* @ 50 gtree$^{-1}$, $B_2$- PSB@ 50 gtree$^{-1}$, $B_3$- *Azotobacter* @ 50 gtree$^{-1}$ + PSB@ 50 gtree$^{-1}$ and four levels of biostimulant *viz*., $S_1$- Seaweed extract @ 25 gtree$^{-1}$, $S_2$- Seaweed extract @ 50 gtree$^{-1}$, $S_3$- Seaweed extract @ 75 gtree$^{-1}$ and $S_0$- Control (without seaweed extract). The treatment combinations include $B_1S_1$: *Azotobacter* @ 50 gtree$^{-1}$ + Seaweed extract @ 25 gtree$^{-1}$, $B_1S_2$: *Azotobacter*@ 50 gtree$^{-1}$ + Seaweed extract @ 50 gtree$^{-1}$, $B_1S_3$: *Azotobacter* @ 50 gtree$^{-1}$ + Seaweed extract @ 75 gtree$^{-1}$, $B_1S_0$: *Azotobacter*@ 50 gtree$^{-1}$ + Control (without seaweed extract),$B_2S_1$:PSB@ 50 gtree$^{-1}$ + Seaweed extract@ 25gtree$^{-1}$, $B_2S_2$: PSB @ 50 gtree$^{-1}$ + Seaweed extract@ 50gtree$^{-1}$, $B_2S_3$: PSB@ 50 gtree$^{-1}$ + Seaweed extract@ 75gtree$^{-1}$, $B_2S_0$: PSB@ 50 gtree$^{-1}$ + Control (without seaweed extract), $B_3S_1$: *Azotobacter* @ 50 gtree$^{-1}$ + PSB@50 gtree$^{-1}$ + Seaweed extract @ 25 gtree$^{-1}$, $B_3S_2$: *Azotobacter* @ 50 gtree$^{-1}$ + PSB@50 g tree$^{-1}$ + Sea weed extract @ 50 gtree$^{-1}$, $B_3S_3$: *Azotobacter* @ 50 gtree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 gtree$^{-1}$, $B_3S_0$: *Azotobacter* @ 50 gtree$^{-1}$ + PSB@ 50 g tree$^{-1}$+ Control (without seaweed extract)

***Note**: Vermicompost @ 5 kg tree$^{-1}$ is common to all the treatments

PSB: Phosphate solubilizing bacteria

## RESULTS AND DISCUSSION

**Total Soluble Solids (°Brix).** Interaction between biofertilizers and biostimulant had significant effect on total soluble solids (°brix). Among all the interactions maximum total soluble solids (12.26°brix) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, which is on par with the application of $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (12.19°brix). The minimum total soluble solids (9.17°brix) was recorded with the application of $B_1S_0$-*Azotobacter* @ 50 g tree$^{-1}$ and without seaweed extract.

The total soluble solids in guava fruits were increased towards the ripening due to hydrolysis of insoluble starch into soluble sugars. Increase in the TSS of fruits because application of these biofertilizers and seaweed extract enhanced the physiology of leaves, thereby causing better translocation of the important components in fruits and assimilation of photosynthates by developing fruit (Naik and Babu, 2007). The results are in conformity with those reported by Baksh *et al*. (2008) in guava, Rathi and Bist (2004) in pear, Attia *et al*. (2009) in banana.

**Titrable acidity (%).** Interaction between biofertilizers and biostimulant had significant effect on titrable acidity (%). Among all the interactions minimum acidity (0.36 %) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, followed by $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (0.38 %). The maximum acidity (0.52 %) was recorded with the application of $B_3S_0$-*Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ and without seaweed extract.

The use of biofertilizers and seaweed extract decreased the acidity content of fruits it may be due to conversion of organic acids into sugars, better translocation and maximum accumulation of sugars into fruit tissues. The results are in conformity with those reported by Singh and Singh (2009) in ber, Baksh *et al*. (2008) in guava, Rathi and Bist (2004) in pear.

**Reducing Sugars (%).** Interaction between biofertilizers and biostimulant had significant effect on reducing sugars (%). Among all the interactions maximum reducing sugars (4.58 %) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, followed by $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (4.52 %). The minimum reducing sugars (3.48 %) was recorded with the application of $B_1S_0$-*Azotobacter* @ 50 g tree$^{-1}$ and without seaweed extract.

Increase in reducing sugars could be due to the reason that the application of biofertilizers and seaweed extract increased fixation and uptake of nitrogen, thereby triggering the catalytic activity of enzymes in the physiological process and increasing production of amino acids and sugars in the developing fruits that ultimately increased the sugar content of the fruits (Dutta and Kundu, 2012). The results are in conformity with those reported by Singh and Singh (2009) in ber, Baksh *et al*. (2008), Kaushik Das *et al*. (2017) in guava.

**Nonreducing Sugars (%).** Interaction between biofertilizers and biostimulant had significant effect on non reducing sugars (%). Among all the interactions maximum non-reducing sugars (3.54%) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, followed by $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (3.50 %). The minimum non-reducing sugars (2.74 %) was recorded with application of $B_1S_0$-*Azotobacter* @ 50 g tree$^{-1}$ and without seaweed extract.

Non-reducing sugar content of fruits increased by the application of biofertilizers and seaweed extract may be because of increase in uptake of nutrients which lead to increased catalytic activities by which starch is degraded into simple sugars and thereby the quality of the fruit is improved. The results are in conformity with those reported by Singh and Singh (2009) in ber, Baksh *et al*. (2008), Kaushik Das *et al*. (2017) in guava.

**Total sugars (%).** Interaction between biofertilizers and biostimulant had significant effect on total sugars (%). Among all the interactions maximum total sugars (8.12 %) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, followed by $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (8.02 %). The minimum total sugars (6.22%) was recorded with the application of $B_1S_0$-*Azotobacter* @ 50 g tree$^{-1}$ and without seaweed extract.

The total sugars in guava fruits were increased towards the ripening due to hydrolysis of insoluble starch into soluble sugars. Increase in the total sugars of fruits because application of these biofertilizers and seaweed extract enhanced the physiology of leaves, thereby causing better translocation of the important components in fruits and assimilation of photosynthates by developing fruit (Naik and Babu, 2007). The results are in conformity with those reported by Baksh *et al*. (2008) in guava, Rathi and Bist (2004) in pear, Attia *et al*. (2009) in banana.

**Ascorbic acid (mg/100 g).** Interaction between biofertilizers and biostimulant had significant effect on ascorbic acid (mg/100 g) in the fruits of guava. Among all the interactions maximum ascorbic acid (226.15 mg/100 g) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB @ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, followed by $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (222.89 mg/100 g). The minimum ascorbic acid (142.28 mg/100 g) was recorded with the application of $B_1S_0$-*Azotobacter* @ 50 g tree$^{-1}$ and without seaweed extract.

Ascorbic acid content of fruit increased with the application of biofertilizers and seaweed extract because they enhanced microbial inoculants efficiency to fix atmospheric nitrogen, increase in phosphorous availability and production of growth promoting substances which speed-up the physiological process like synthesis of carbohydrates, translocation and accumulation of quality constituents like sugars, total soluble solids and ascorbic acid (Tiwari *et al*., 2015). These results are in conformity with those reported by Yadav *et al*. (2012) in guava, Singh *et al*. (2000) in sweet orange, Singh *et al*. (2009) in ber, Tripathi *et al*. (2010) in strawberry.

**Table 1: Effect of biofertilizers and biostimulant on post harvest quality parameters and shelf life of guava cv. Allahabad Safeda under meadow planting system**.

| Treatments | TSS (ºBrix) | Acidity (%) | Reducing sugars (%) | Non reducing sugars (%) | Total sugars (%) | Ascorbic acid (mg/100 g) | Shelf life (days) |
|---|---|---|---|---|---|---|---|
| $T_1$ - ($B_1S_1$) | 10.31 | 0.49 | 4.06 | 3.18 | 7.24 | 166.13 | 6.46 |
| $T_2$ - ($B_1S_2$) | 11.17 | 0.47 | 4.22 | 3.24 | 7.46 | 178.43 | 6.68 |
| $T_3$- ($B_1S_3$) | 11.38 | 0.45 | 4.30 | 3.32 | 7.62 | 182.76 | 6.85 |
| $T_4$ - $B_1S_0$) | 9.17 | 0.50 | 3.48 | 2.74 | 6.22 | 142.28 | 5.53 |
| $T_5$ - ($B_2S_1$) | 10.56 | 0.48 | 4.12 | 3.26 | 7.38 | 173.28 | 6.54 |
| $T_6$ - ($B_2S_2$) | 11.26 | 0.46 | 4.26 | 3.30 | 7.56 | 187.43 | 6.77 |
| $T_7$ - ($B_2S_3$) | 11.47 | 0.43 | 4.34 | 3.36 | 7.70 | 196.94 | 6.96 |
| $T_8$ - ($B_2S_0$) | 9.25 | 0.51 | 3.52 | 2.83 | 6.35 | 147.26 | 5.68 |
| $T_9$ - ($B_3S_1$) | 11.71 | 0.41 | 4.46 | 3.42 | 7.88 | 206.51 | 7.24 |
| $T_{10}$ - ($B_3S_2$) | 12.19 | 0.38 | 4.52 | 3.50 | 8.02 | 222.89 | 7.52 |
| $T_{11}$ - ($B_3S_3$) | 12.26 | 0.36 | 4.58 | 3.54 | 8.12 | 226.15 | 7.64 |
| $T_{12}$ - ($B_3S_0$) | 9.37 | 0.52 | 3.64 | 2.94 | 6.58 | 155.16 | 5.77 |
| SE (m) ± | 0.03 | 0.012 | 0.004 | 0.0014 | 0.004 | 1.06 | 0.014 |
| CD at 5% | 0.08 | 0.036 | 0.012 | 0.0042 | 0.012 | 3.11 | 0.04 |

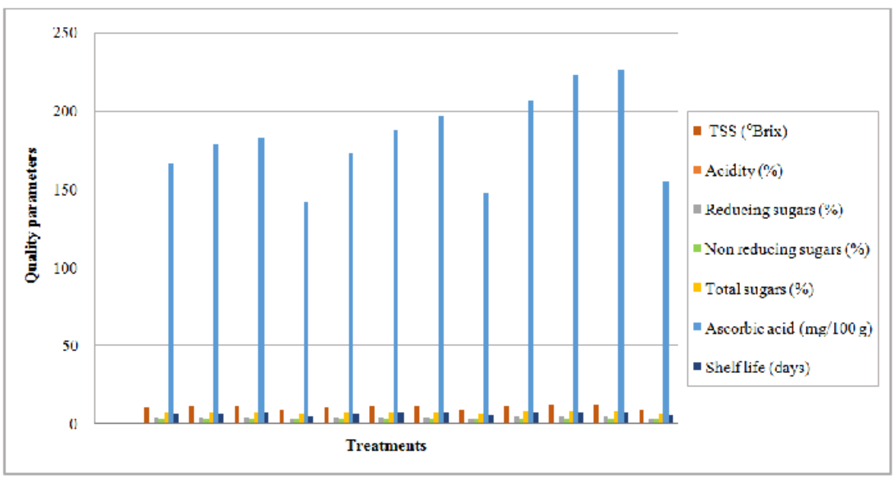


**Fig. 1.** Effect of biofertilizers and biostimulant on post harvest quality parameters and shelf of guava cv. Allahabad Safeda under meadow planting system.

**Shelf life (days).** Interaction between biofertilizers and biostimulant had significant effect on shelf life (days). Among all the interactions maximum shelf life (7.64 days) was recorded with the application of $B_3S_3$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$, followed $B_3S_2$- *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 50 g tree$^{-1}$ (7.52 days). The minimum shelf life (5.53 days) was recorded with the application of $B_1S_0$- *Azotobacter* @ 50 g tree$^{-1}$ and without seaweed extract.

The increase in shelf life with the application of biofertilizers and seaweed extract altered physiology and biochemistry of the fruit that reduced transpiration and respiration which in turn lowered the physiological loss in weight and increased shelf life in guava (Purnendra *et al*., 2017). The results are in conformity with those reported by Vanilarasu and Balakrishnamurthy (2014) in banana, Tandel *et al*. (2017) in papaya, Ravikiran *et al*. (2018) in mango.

## CONCLUSION

From this experiment, it can be concluded that $T_{11}(B_3S_{3})$ - *Azotobacter* @ 50 g tree$^{-1}$ + PSB@ 50 g tree$^{-1}$ + Sea weed extract @ 75 g tree$^{-1}$ per tree increased quality parameters like total soluble solids, reducing sugars, non reducing sugars, total sugars and ascorbic acid), reduced the acidity and increased shelf life under meadow planting system of guava Cv. Allahabad Safeda.

## FUTURE SCOPE

Effect of combination of biofertilizers and biostimulant quality of guava under high density planting system need to be studied. Similar studies have to be conducted in different varieties of guava. The experiment should be repeated in other locations and different soil types to confirm the findings of the present investigation.

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**Conflict of Interest.** None.

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