Acta Scientific AGRICULTURE (ISSN: 2581-365X)

Volume 10 Issue 8 October 2026

Research Article

Influence of Foliar Application of Bio-Stimulants on Fruit Quality, Biochemical and Physicochemical Composition of Guava var. Japanese Red Diamond

Nihali HN*, Chaitanya HS, Sridhar R, Kantharaj Y and Nagaraja MS

PG Scholar, Department of Fruit Science, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, India

***Corresponding Author:** Nihali HN, PG Scholar, Department of Fruit Science, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, India.

DOI: 10.31080/ASAG.2026.10.1579

Received: October 14, 2026

Published: November 03, 2026

© All rights are reserved by **Nihali HN., *et al.***

Abstract

A field experiment was conducted during 2025–2026 at a farmer's field in Harige village, Shivamogga taluk, Karnataka, India, to evaluate the influence of foliar application of bio-stimulants on fruit quality and postharvest behaviour of guava var. Japanese Red Diamond. The experiment comprised seven treatments in a randomized block design with three replications: control (T_1), seaweed extract at 1000 and 2000 ppm (T_2 and T_3), amino acid at 1000 and 2000 ppm (T_4 and T_5), and salicylic acid at 100 and 200 ppm (T_6 and T_7). Foliar applications were made at flowering, 30 days after fruit set and 60 days after fruit set. Fruit physical, physico-chemical, biochemical, sensory and storage attributes were evaluated at harvest. Seaweed extract at 1000 ppm (T_2) recorded the highest fruit weight (164.00 g), fruit volume (189.33 cm^3), fruit length (6.43 cm), fruit breadth and diameter (8.34 cm). Salicylic acid at 100 ppm (T6) produced the highest fruit firmness (6.89 kg cm^{-2}), shelf life (7.60 days), TSS (12.69 °Brix), TSS:acid ratio (40.93), reducing sugar (4.66%), non-reducing sugar (3.56%), total sugars (8.22%), lycopene (6.42 mg 100 g^{-1}) and vitamin C (238.74 mg 100 g^{-1}), together with the lowest titratable acidity (0.31%) Moisture content was not significantly affected. The results indicate that seaweed extract at 1000 ppm was particularly effective for improving fruit size, whereas salicylic acid at 100 ppm was superior for biochemical quality and postharvest performance of guava var. Japanese Red Diamond.

Keywords: Guava; Seaweed Extract; Amino Acid; Salicylic Acid; Fruit Quality; Biochemical Attributes and Physicochemical Attributes

Introduction

Guava (*Psidium guajava* L.) is an important tropical fruit crop valued for its edible fruit, nutritional attributes and wide adaptability. Fruit quality is determined not only by external characteristics such as size, weight and firmness, but also by internal attributes including soluble solids, sugars, acidity, ascorbic acid and antioxidant pigments. Consequently, production practices that simultaneously improve fruit development and biochemical quality are important for obtaining produce with greater market and consumer value. Plant bio-stimulants have received increasing attention as complementary inputs capable of improving plant processes and crop performance without functioning simply as conventional fertilizers. Their effects may involve changes in nutrient-use efficiency, photosynthetic activity, carbon metabolism, stress

responses and fruit development [1-3]. Seaweed extracts contain a range of biologically active constituents and have been associated with improved growth, yield and fruit quality in horticultural crops [4]. Protein hydrolysates and amino-acid-based products can also influence metabolic activity and plant performance [5]. Salicylic acid acts as an important signaling molecule and has been associated with regulation of physiological and defense processes and with delayed ripening and improved postharvest quality in fruit crops. Evidence from guava supports the potential of these inputs. Mosa., *et al*. [6] reported improvements in vegetative growth, yield and fruit quality of guava var. Maamoura with biostimulant treatments. Saishree., *et al.* [7] observed improved phenology and yield characteristics of guava var. Arka Kiran following seaweed extract and humic acid application. More recent work has also indicated positive responses of fruit crops to seaweed-based bio-stimulants, although the magnitude and direction of response depend on crop, cultivar, formulation, concentration and application strategy. Despite these findings, information is limited on the comparative response of guava var. Japanese Red Diamond to seaweed extract, amino acid and salicylic acid applied at different concentrations under field conditions in the Shivamogga region. Moreover, treatment effects on fruit size, biochemical composition and storage behavior may differ among bio-stimulant classes. Therefore, the present study was undertaken to evaluate the influence of selected foliar bio-stimulants on physical, physico-chemical and biochemical attributes of guava var. Japanese Red Diamond.

Materials and Methods

The experiment was conducted during 2025–2026 at a farmer's field in Harige village, Shivamogga taluk, Shivamogga district, Karnataka, India. The experimental region falls in the Southern Transitional Zone (Zone 7) of Karnataka. The experiment was conducted on guava (*Psidium guajava* L.) var. Japanese Red Diamond trees planted at 8 ft × 6 ft (2.44 m × 1.83 m) spacing. Seven treatments were evaluated in a randomized block design with three replications, with four trees maintained for each treatment in each replication, resulting in a total of 84 experimental trees. The treatments comprised T_1: control, T_2: seaweed extract @ 1000 ppm, T_3: seaweed extract @ 2000 ppm, T_4: amino acid @ 1000 ppm, T_5: amino acid @ 2000 ppm, T_6: salicylic acid @ 100 ppm and T_7: salicylic acid @ 200 ppm. The first spray was applied at flowering, the second spray 30 days after fruit set and the third spray 60 days after fruit set. Nitrogen, phosphorus and potassium were supplied through soil application at 100:40:40 g plant^{-1}; urea was applied in split doses, while phosphorus and potassium were applied as basal doses. Orchard sanitation and other routine cultural operations were maintained uniformly for all the treatments throughout the experimental period to minimize variation arising from management practices. The data were subjected to analysis of variance (ANOVA) for a randomized complete block design (RCBD) following Fisher and Yates (1963). When the F-test was significant, the critical difference (CD) at the 5% probability level was used for comparing treatment means. OPSTAT statistical software was used to assign letter groupings to the treatment means in DMRT format for presentation in the tables.



Figure 1: Different stage of spraying (A.) 1st spray at the time of flowering (B.) 2nd spray 30 days after fruit set (C.) 3rd spray 60 days after fruit set.

Result, Discussion and Conclusion

The results presented in Table 1 revealed that foliar application of bio-stimulants significantly influenced fruit weight and fruit volume of guava cv. Japanese Red Diamond. Seaweed extract @ 1000 ppm (T_2) recorded the highest fruit weight (164.00 g), which was statistically on par with T_3 (160.33 g) and T_6 (151.66 g), while the control (T_1) recorded the lowest fruit weight (126.31 g). A similar trend was observed for fruit volume, with T_2 recording the maximum value (189.33 cm^3), followed by T_3 (182.93 cm^3), whereas the minimum fruit volume was recorded in T_1 (148.66 cm^3). The increase in fruit weight and volume under seaweed extract may be attributed to the presence of biologically active compounds and growth-promoting substances in seaweed extracts, which can influence cell division, cell expansion and photosynthetic activity. Enhanced photosynthate production and its translocation towards developing fruits could have contributed to improved fruit growth. Similar improvement in fruit weight of guava following

seaweed extract application was reported by Saishree., *et al.* [7]. Mosa., *et al.* [6] also reported improved fruit quality in guava with bio-stimulant application.

Treatment	Fruit weight (g)	Fruit volume (cm^3)	Fruit length (cm)	Fruit breadth (cm)
T_1: Control	126.31^{d}	148.66^{d}	5.00^{d}	6.61^{e}
T_2: Seaweed extract @ 1000ppm	164.00^{a}	189.33^{a}	6.43^{a}	8.34^{a}
T_3: Seaweed extract @ 2000ppm	160.33^{a}	182.93^{b}	6.24^{b}	8.05^{b}
T_4: Amino acid @ 1000 ppm	135.00^{bcd}	160.00^{cd}	5.60^{c}	6.87^{e}
T_5: Amino acid @ 2000 ppm	130.30^{cd}	155.30^{d}	5.25^{d}	6.65^{e}
T_6: Salicylic acid @ 100 ppm	151.66^{ab}	175.33^{abc}	6.08^{b}	7.62^{c}
T_7: Salicylic acid @ 200 ppm	145.00^{abc}	167.66^{bcd}	5.78^{c}	7.22^{d}
S.Em. ±	3.58	3.01	0.04	0.05
CD @ 5%	11.05	9.28	0.14	0.16

Table 1: Effect of foliar bio-stimulants on fruit weight, fruit volume, fruit length and fruit breadth of guava var. Japanese Red Diamond.

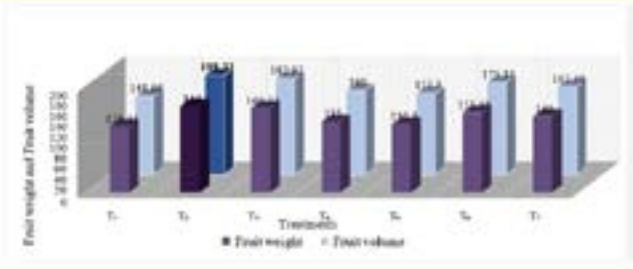


Figure 2: Graphical representation of fruit weight and fruit volume.

As presented in Table 2, fruit dimensions were significantly affected by foliar bio-stimulant application. Seaweed extract @ 1000 ppm (T_2) recorded the maximum fruit length (6.43 cm), breadth (8.34 cm), followed by T_3, which recorded 6.24 cm fruit length and 8.05 cm breadth. The minimum fruit length (5.00 cm) and breadth (6.61 cm) were recorded in the control. The greater fruit dimensions under T_2 may be associated with enhanced vegetative activity and assimilate availability resulting from seaweed-derived bioactive compounds. Increased photosynthetic activity and movement of assimilates towards developing fruits could have favored cell enlargement and fruit expansion. The present findings are in accordance with the beneficial effect of seaweed-based bio-stimulants on fruit growth reported in guava by Saishree., *et al.* [7].

The results presented in Table 2, showed that fruit firmness and shelf life were significantly influenced by the foliar treatments, whereas moisture content was not significantly affected. Salicylic acid @ 100 ppm (T_6) recorded the highest fruit firmness (6.89 kg cm^{-2}) and longest shelf life (7.60 days), followed by T_7 with 6.61 kg cm^{-2} firmness and 7.20 days shelf life. The control recorded the lowest firmness (5.32 kg cm^{-2}) and shortest shelf life (4.66 days). The improved firmness and extended shelf life under salicylic acid may be associated with its role as a signaling molecule in regulating ripening-related processes and antioxidant defense. Maintenance of greater tissue firmness may delay softening and deterioration during storage. Similar beneficial effects of salicylic acid in delaying ripening and improving postharvest behavior have been reported in mango and banana by Reddy and Sharma (2016), Shivendra and Singh (2015) and Srivastava and Dwivedi (2000). The non-significant variation in moisture content indicates that the treatments did not produce a statistically detectable effect on this attribute under the present conditions.

As presented in Table 3, foliar application of bio-stimulants significantly influenced TSS, titratable acidity and TSS:acid ratio. Salicylic acid @ 100 ppm (T_6) recorded the highest TSS (12.69 °Brix) and TSS: acid ratio (40.93), which were statistically comparable with T_7 (12.58 °Brix and 38.12, respectively). T_6 also recorded the

Treatment	Firmness (kg cm^{-2})	Moisture (%)	Shelf life (days)
T_1: Control	5.32^{g}	80.82	4.66^{f}
T_2: Seaweed extract @ 1000ppm	6.37^{c}	83.24	6.80^{c}
T_3: Seaweed extract @ 2000ppm	6.08^{d}	82.74	6.30^{d}
T_4: Amino acid @ 1000 ppm	5.84^{e}	81.70	5.60^{e}
T_5: Amino acid @ 2000 ppm	5.54^{f}	81.28	5.33^{e}
T_6: Salicylic acid @ 100 ppm	6.89^{a}	84.52	7.60^{a}
T_7: Salicylic acid @ 200 ppm	6.61^{b}	84.06	7.20^{b}
S.Em. ±	0.04	0	0.12
CD @ 5%	0.13	NS	0.38

Table 2: Effect of foliar application of bio-stimulants on fruit firmness, moisture content and shelf life of guava var. Japanese Red diamond.

lowest titratable acidity (0.31%), followed by T_7 (0.33%), whereas the control recorded the lowest TSS (11.51 °Brix), lowest TSS:acid ratio (27.40) and highest acidity (0.42%). The increase in TSS and reduction in acidity under salicylic acid may indicate enhanced conversion and accumulation of soluble metabolites during fruit development and ripening. A higher TSS combined with lower acidity generally contributes to improved sweetness and flavor balance. Similar improvement in fruit quality attributes under bio-stimulant treatments has been reported in guava by Mosa., *et al.* [6]. Sandhyarani., *et al.* [8] also reported increased TSS and related quality attributes under a treatment involving Azotobacter, PSB and seaweed extract.

The result presented in the Table 4, revealed that salicylic acid @ 100 ppm (T_6) recorded the highest reducing sugar (4.66%), non-reducing sugar (3.56%) and total sugar (8.22%), followed by T_7 with 4.44, 3.45 and 7.89%, respectively. The control recorded the lowest reducing sugar (3.40%), non-reducing sugar (3.15%) and total sugar (6.55%). The increased sugar concentration under T_6 may be associated with enhanced photosynthetic carbon assimilation, carbohydrate translocation and conversion of stored carbohydrates into soluble sugars during fruit development and ripening.

Treatment	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)	Lycopene (mg 100 g^{-1})	Vitamin C (mg 100 g^{-1})
T_1: Control	3.40^{d}	3.15^{e}	6.55^{f}	5.09^{e}	188.76^{f}
T_2: Seaweed extract @ 1000ppm	4.35^{ab}	3.38^{b}	7.73^{b}	5.92^{b}	216.36^{c}
T_3: Seaweed extract @ 2000ppm	4.18^{b}	3.29^{bc}	7.47^{c}	5.67^{bc}	206.32^{d}
T_4: Amino acid @ 1000 ppm	3.81^{c}	3.38^{cd}	7.19^{d}	5.49^{cd}	202.58^{de}
T_5: Amino acid @ 2000 ppm	3.66^{cd}	3.21^{de}	6.87^{e}	5.24^{de}	198.53^{e}
T_6: Salicylic acid @ 100 ppm	4.66^{a}	3.56^{a}	8.22^{a}	6.42^{a}	238.74^{a}
T_7: Salicylic acid @ 200 ppm	4.44^{ab}	3.45^{b}	7.89^{b}	6.28^{a}	230.86^{b}
S.Em. ±	0.06	0.05	0.04	0.04	1.36
CD @ 5%	0.21	0.18	0.13	0.12	4.20

Table 4: Effect of foliar application of bio-stimulants on reducing, non-reducing and total sugars of guava var. Japanese Red Diamond.

The higher sugar concentration also corresponds with the higher TSS and TSS:acid ratio observed under the same treatment. Mosa., *et al.* [6] reported improvement in fruit quality of guava following bio-stimulant application, supporting the present findings. Similar increases in TSS and sugars following bio-stimulant application have also been reported by Sandhyarani., *et al.* [8].

The results presented in Table 4, revealed that foliar application of bio-stimulants significantly influenced lycopene and vitamin C contents of guava fruits. Salicylic acid @ 100 ppm (T_6) recorded the highest lycopene content (6.42 mg 100 g^{-1}) and vitamin C content (238.74 mg 100 g^{-1}), followed by T_7 with 6.28 and 230.86 mg 100 g^{-1}, respectively. The control recorded the lowest lycopene (5.09 mg 100 g^{-1}) and vitamin C (188.76 mg 100 g^{-1}). The enhancement of these nutritionally important compounds under salicylic acid may be associated with stimulation of antioxidant metabolism and improved maintenance of antioxidant constituents during fruit development and ripening. Salicylic acid is known to participate in physiological and defense-related processes and has been associated with improved antioxidant retention and postharvest quality in fruit crops. The present findings therefore indicate that T_6 improved not only physical and sensory quality but also nutritionally important biochemical constituents [9].

Bibliography

1. Calvo P., *et al*. "Agricultural uses of plant biostimulants". *Plant and Soil* 383 (2014): 3-41.

2. Du Jardin P. "Plant biostimulants: Definition, concept, main categories and regulation". *Scientia Horticulturae* 196 (2015): 3-14.

3. Bulgari R., *et al*. "Biostimulants application in horticultural crops under abiotic stress conditions". *Agronomy* 9.6 (2019): 306.

4. Bhattacharyya D., *et al*. "Seaweed extracts as biostimulants in horticulture". *Scientia Horticulturae* 196 (2015): 39-48.

5. Boselli M., *et al*. "Protein hydrolysates effects on grapevine (Vitis vinifera L., cv. Corvina) performance and water stress tolerance". *Scientia Horticulturae* 258 (2019): 108784.

6. Mosa WFA., *et al*. "Vegetative growth, yield, and fruit quality of guava (Psidium guajava L.) cv. Maamoura as affected by some biostimulants". *Bio Resources* 16.4 (2021): 7379-7399.

7. Saishree RS., *et al*. "Effect of seaweed extract and humic acid treatment on the phenological and yield characteristics of guava (Psidium guajava L.)". *Journal of Experimental Agriculture International* 46.11 (2024): 353-361.

8. Sandhyarani M., *et al*. "Studies on effect of biofertilizers and bio-stimulant on yield parameters of guava (Psidium guajava L.) var. Allahabad Safeda under meadow planting system". *International Journal of Environment and Climate Change* 12.11 (2022): 2116-2120.

9. Valizadehkaji B and Mohammaei M. "Foliar application of biostimulants and potassium silicate enhances yield and fruit quality of mandarin cv. 'Page'". *Applied Fruit Science* 67.8 (2025).