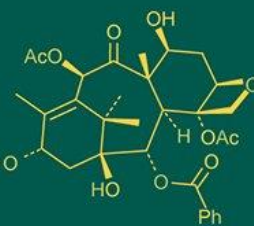
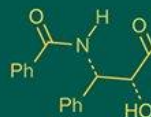


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Effect of natural biostimulants on quality parameters of guava cv. Allahabad Safeda

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Abstract

A field experiment was conducted during May to December 2025 at the Horticultural Research Farm, College of Horticulture, Anand Agricultural University, Anand, Gujarat, to evaluate the effect of natural biostimulants on quality of guava cv. Allahabad Safeda. The experiment was laid out in a Completely Randomized Design (CRD) with ten treatments and three repetitions. Foliar application of vermiwash, moringa leaf extract and cow urine at different concentrations was evaluated. Among the treatments, vermiwash at 100 mL/L (T₅) significantly improved quality parameters such as TSS (13.34 °Brix), ascorbic acid (177.59 mg/100 g), fruit firmness (4.74 kg/cm²), reducing sugar (7.00%), non-reducing sugar (4.00%) and total sugar (11.00%), while decreasing acidity (0.77%). The results indicated that foliar application of vermiwash at 100 mL/L is an effective and eco-friendly practice for improving quality of guava cv. Allahabad Safeda.

Keywords: Guava, natural biostimulants, vermiwash, moringa leaf extract, cow urine, fruit quality

Introduction

Guava (*Psidium guajava* L.) is one of the most important fruit crops of tropical and subtropical regions and belongs to the family Myrtaceae (2n = 22). It is believed to have originated in Tropical America and is now cultivated in more than 60 countries because of its wide adaptability, regular bearing habit and high economic value (Mitra and Bose, 2001) ^[10]. In India, guava ranks fourth after mango, banana and citrus in terms of area and production and is popularly known as the "Apple of the Tropics" owing to its exceptional nutritional value, affordability and adaptability to diverse agro climatic conditions. The cultivar Allahabad Safeda is one of the most commercially important variety because of its high yield potential, attractive fruits, excellent flavour and suitability for both fresh consumption and processing.

In recent years, sustainable fruit production has become an important priority because excessive use of synthetic fertilizers and agrochemicals has resulted in soil degradation, environmental pollution, decline in beneficial microorganisms and accumulation of chemical residues in fruits (Aktar *et al.*, 2009) ^[1]. Since guava fruits are mostly consumed fresh, minimizing chemical residues while maintaining high productivity and fruit quality has become a major concern. Consequently, ecofriendly production technologies are gaining increasing attention in horticultural research.

Natural biostimulants have emerged as sustainable alternatives capable of enhancing plant growth, productivity and fruit quality by stimulating physiological and biochemical processes. These substances improve nutrient uptake, photosynthetic efficiency, enzyme activity and stress tolerance through naturally occurring bioactive compounds, plant growth regulators and beneficial microorganisms. Among various natural biostimulants, moringa leaf extract, vermiwash and cow urine have shown considerable potential in improving crop performance under sustainable production systems.

Moringa leaf extract is a rich source of natural cytokinins (zeatin), amino acids, vitamins, antioxidants, minerals and phenolic compounds, which promote cell division, chlorophyll synthesis and photosynthetic activity, ultimately improving growth and yield (Anjorine *et al.*, 2001) ^[2]. Similarly, vermiwash is a biologically active liquid containing macro and micronutrients, enzymes, vitamins, beneficial microorganisms and plant growth promoting

Substances that enhance nutrient availability, root activity and crop productivity (Zambare *et al.*, 2008) [17]. Cow urine also contains appreciable quantities of nitrogen, phosphorus, potassium, micronutrients and growth promoting substances and has been reported to improve plant growth while exhibiting pesticidal properties under natural farming systems (Astiari *et al.*, 2023) [3].

Materials and Methods

The present investigation was conducted during May to December 2025 at the Horticultural Research Farm, College of Horticulture, Anand Agricultural University, Anand, Gujarat, India. The experimental orchard consisted of 18 year old guava trees planted at a spacing of 6 × 6 m.

The experiment was laid out in a Completely Randomized Design (CRD) with 10 treatments and three repetitions, comprising two plants per treatment in each repetitions. The treatments consisted of foliar application of different concentrations of moringa leaf extract (MLE), vermiwash and cow urine as follows: T₁: 20 mL/L Moringa leaf extract, T₂: 40 mL/L Moringa leaf extract, T₃: 60 mL/L Moringa leaf extract, T₄: 50 mL/L Vermiwash, T₅: 100 mL/L Vermiwash, T₆: 150 mL/L Vermiwash, T₇: 50 mL/L Cow urine, T₈: 100 mL/L Cow urine,

T₉: 150 mL/L Cow urine and T₁₀: Control.

Preparation and application of biostimulants

Fresh moringa leaves collected from the research farm were shade dried for one week, oven dried at 45°C for four hours and ground into fine powder. One hundred grams of powder was soaked in one litre of water for 24 h and filtered through a cotton cloth to obtain the stock extract. The required concentrations (20, 40, and 60 mL/L) were prepared by dilution with water.

Vermiwash was procured from a local vermicompost unit, while cow urine was obtained from the Livestock Research Station, Kamdhenu University, Anand. The desired concentrations were prepared by diluting the respective materials with water immediately before application.

All treatments were applied as foliar sprays using a foot sprayer. Two sprays were given: the first at the flowering stage in July and the second 30 days later in August. Uniform coverage of both upper and lower leaf surfaces was ensured during spraying.

The quality parameters evaluated included Total Soluble Solids (TSS), titratable acidity, reducing sugars, non-reducing sugars, total sugars, ascorbic acid content and fruit firmness. TSS was determined using a hand refractometer and expressed as °Brix. Titratable acidity was estimated by titration with 0.1 N NaOH using phenolphthalein as an indicator and expressed as percentage of citric acid. Reducing sugars and total sugars were estimated by the Lane and Eynon titrimetric method, while non-reducing sugars were calculated as the difference between total sugars and reducing sugars. Ascorbic acid content was determined

by titration with 2, 6-dichlorophenol indophenol dye and expressed as mg/100 g pulp. Fruit firmness was measured using a pocket penetrometer and expressed as kg/cm².

The experimental data were subjected to analysis of variance (ANOVA) for a Completely Randomized Design (CRD) and treatment means were compared using the Critical Difference (CD) test at the 5% level of significance as described by Panse and Sukhatme (1967) [11].

Results and discussion

Effect of natural biostimulants on TSS, acidity, ascorbic acid and fruit firmness

The significantly higher TSS value (13.34 °Brix) was recorded under treatment T₅ (100 mL/L Vermiwash), It was at par with T₈ (13.18 °Brix) and T₃ (12.96 °Brix), whereas the lower TSS (11.49 °Brix) was observed in the control treatment (T₁₀). The increase in TSS under treatment T₅ may be attributed to the growth promoting substances, micronutrients, vitamins, enzymes and improved nutrient uptake provided by vermiwash, which enhance photosynthesis, carbohydrate metabolism and sugar accumulation in fruits. Similar findings were reported by Rajkumar *et al.* (2019) [12] in grapes and Dadheech *et al.* (2021) [4] in aonla.

The variations were found to be statistically non-significant in acidity. Among the various treatments, the minimum acidity (0.77%) was recorded under treatment T₅ (100 mL/L Vermiwash), followed by T₈ (0.79%) and T₃ (0.81%).

The data showed that significantly maximum ascorbic acid content (177.59 mg/100 g) was recorded under treatment T₅ (100 mL/L Vermiwash), which was at par with T₈ (168.97 mg/100 g) and T₃ (168.42 mg/100 g). On the other hand, the lower ascorbic acid present in control treatment (T₁₀) recorded 150.63 mg/100 g. The increase in ascorbic acid content under treatment T₅ enhanced due to essential nutrients, enzymes and growth promoting substances present in vermiwash, which enhance photosynthesis, nutrient uptake and antioxidant metabolism, leading to greater accumulation of ascorbic acid in fruits. Similar findings were reported by Ghosh *et al.* (2009) [5] in aonla, Khachi *et al.* (2015) [7] in kiwifruit, Kumar *et al.* (2021) [8] in apple and Dadheech *et al.* (2021) [4].

The data revealed that significantly maximum fruit firmness (4.74 kg/cm²) was recorded under treatment T₅ (100 mL/L Vermiwash), It was found at par with T₈ (4.58 kg/cm²) and T₃ (4.51 kg/cm²). The minimum fruit firmness (3.81 kg/cm²) was observed in the control treatment (T₁₀). The increased fruit firmness under treatment T₅, the reason is that beneficial effects of vermiwash on cell wall strength and delayed fruit softening through the regulation of cell wall degrading enzymes. Similar findings were reported by Thanaa *et al.* (2017) [15] in plum, Mishra *et al.* (2022) [9] in apple, Singh *et al.* (2024) [14] in sapota and James *et al.* (2025) [6] in grapes.

Table 1: Effect of natural biostimulants on TSS, acidity, ascorbic acid and fruit firmness of guava cv. Allahabad Safeda

Sr. No.	Treatment details	TSS (°Brix)	Acidity (%)	Ascorbic acid (mg/100 g)	Fruit firmness (kg/cm ²)
T ₁	20 mL/L Moringa leaf extract	11.79	0.87	154.55	3.90
T ₂	40 mL/L Moringa leaf extract	11.96	0.86	159.35	3.98
T ₃	60 mL/L Moringa leaf extract	12.96	0.81	168.42	4.51
T ₄	50 mL/L Vermiwash	12.64	0.84	163.07	4.18
T ₅	100 mL/L Vermiwash	13.34	0.77	177.59	4.74

T ₆	150 ml/L Vermiwash	12.74	0.81	164.40	4.26
T ₇	50 ml/L Cow urine	12.26	0.84	162.96	4.06
T ₈	100 ml/L Cow urine	13.18	0.79	168.97	4.58
T ₉	150 ml/L Cow urine	12.71	0.82	163.73	4.21
T ₁₀	Control	11.49	0.81	150.63	3.81
	S.Em ±	0.19	0.02	4.31	0.15
	CD at 5 %	0.57	NS	12.71	0.43
	CV%	2.68	4.56	4.57	5.98

Effect of natural biostimulants on reducing sugar, non-reducing sugar and total sugar

The observation recorded that significantly higher reducing sugar content (7.00%) was recorded under treatment T₅ (100 ml/L Vermiwash), which was statistically at par with T₈ (6.90%) and T₃ (6.80%). In contrast, the lower reducing sugar content (5.00%) was observed under control treatment (T₁₀). The increase in reducing sugar content under treatment T₅ may be attributed to the bioactive compounds and essential nutrients present in vermiwash, which enhance enzymatic activity and carbohydrate metabolism during fruit ripening. This promotes greater accumulation of reducing sugars in the fruits. Similar findings were reported by Rajkumar *et al.* (2019)^[12].

The significantly higher non-reducing sugar content (4.00%) was recorded under treatment T₅ (100 ml/L Vermiwash). The lower non-reducing sugar content (3.00%) was observed in the control treatment (T₁₀). The increase in non-

reducing sugar content under treatment T₅ may be attributed to enhanced photosynthesis, efficient synthesis and accumulation of sucrose promoted by the nutrients and bioactive compounds present in vermiwash. Improved carbohydrate metabolism and translocation of photosynthates to fruits resulted in higher non-reducing sugar content. Similar findings were reported in aonla and James *et al.* (2025)^[6] in grapes.

The statistically higher total sugar content (11.00%) was recorded under treatment T₅ (100 ml/L Vermiwash). It was remained at par with T₈ (10.60%) and T₃ (10.50%). In contrast, the lower total sugar content (8.00%) was observed in the control treatment (T₁₀). Improved metabolic activity and efficient conversion of carbohydrates into soluble sugars resulted in higher total sugar accumulation in the fruits. Similar findings were reported by Rajkumar *et al.* (2019)^[12] in grapes, Dadheech *et al.* (2021)^[4] in aonla and Rathod *et al.* (2021)^[13] in pomegranate.

Table 2: Effect of natural biostimulants on reducing sugar, non-reducing sugar and total sugar of guava cv. Allahabad Safeda

Sr. No.	Treatment details	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)
T ₁	20 ml/L Moringa leaf extract	5.40	3.50	8.90
T ₂	40 ml/L Moringa leaf extract	5.60	3.50	9.10
T ₃	60 ml/L Moringa leaf extract	6.80	3.70	10.50
T ₄	50 ml/L Vermiwash	6.00	3.60	9.60
T ₅	100 ml/L Vermiwash	7.00	4.00	11.00
T ₆	150 ml/L Vermiwash	6.30	3.70	10.00
T ₇	50 ml/L Cow urine	5.80	3.60	9.40
T ₈	100 ml/L Cow urine	6.90	3.70	10.60
T ₉	150 ml/L Cow urine	6.10	3.70	9.80
T ₁₀	Control	5.00	3.00	8.00
	S.Em ±	0.09	0.09	0.18
	CD at 5 %	0.26	0.27	0.52
	CV%	2.48	4.37	3.18

Conclusion

The present study revealed that foliar application of vermiwash at 100 ml/L applied twice during July and August significantly improved fruit quality in guava cv. Allahabad Safeda. The treatment enhanced Total Soluble Solids (TSS), ascorbic acid content, fruit firmness, reducing sugar, non-reducing sugar and total sugar, while reducing fruit acidity, resulting in superior fruit quality.

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