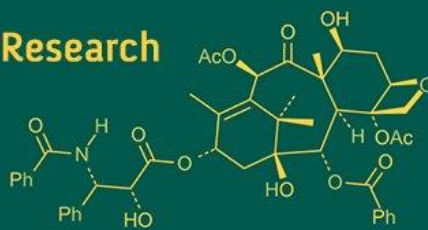


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(6): 1692-1695
www.biochemjournal.com
Received: 16-03-2026
Accepted: 18-04-2026

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Influence of nano urea and micronutrients on fruit quality of guava cv. Allahabad safeda

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i6St.8907>

Abstract

The current study entitled “Influence of nano urea and micronutrients on fruit quality of guava cv. Allahabad Safeda” was carried out during 2024-25 at the Research and Instructional Farm, Bharrergaon, Pt. KLS College of Horticulture and Research Station, Rajnandgaon (C.G.). The experiment was laid out in a Randomized Block Design (RBD) with Nine treatments and three replications. Among the treatments, T8 (Nano urea 2.0% + ZnSO₄ 0.4% + Boron 0.4%) recorded significantly higher TSS (13.18 °Brix), ascorbic acid (232.48 mg 100 g⁻¹ pulp), total sugars (10.15%), reducing sugars (5.53%) and non-reducing sugars (4.68%), while minimum acidity (0.32%) was observed under the same treatment. The results indicate that foliar application of nano urea combined with zinc and boron significantly improves fruit quality in guava.

Keywords: Guava, Boron, Foliar Spray, Nano urea, Zinc sulphate.

Introduction

Guava (*Psidium guajava* L.), popularly known as the “Apple of the Tropics,” belongs to the family Myrtaceae and is one of the most important fruit crops grown in tropical and subtropical regions of the world. The genus *Psidium* comprises more than 150 species, including *P. cattleianum* (strawberry guava), *P. guineense* (Brazilian or Guinea guava), *P. friedrichsthalianum*, *P. pomiferum*, and *P. pyriferum*; however, *P. guajava* is the most widely cultivated species due to its superior fruit quality and adaptability (Mitra and Bose, 1999) [11]. In India, guava is extensively cultivated and bears fruits during three distinct seasons: rainy, winter, and summer. Owing to its high nutritional value, excellent processing potential, affordability, and wide availability, it is often referred to as the “Poor Man’s Apple” (Agrawal *et al.*, 2002) [1]. As a climacteric fruit, guava exhibits increased respiration and ethylene production during ripening (Jain *et al.*, 2003) [9]. Guava ranks fourth among fruit crops in India after mango, banana, and citrus, occupying approximately 3.63 lakh hectares with an annual production of 54.46 lakh metric tonnes (Anon., 2025). Major guava-producing states include Uttar Pradesh, Madhya Pradesh, Bihar, Maharashtra, West Bengal, Andhra Pradesh, and Karnataka. Uttar Pradesh is particularly renowned for the high-quality Allahabad guava (Anon., 2023). In Chhattisgarh, guava is an emerging and economically important fruit crop, cultivated over 19.88 thousand hectares with an annual production of nearly 1.96 lakh metric tonnes. Major guava-growing districts include Durg, Rajnandgaon, Raipur, Kabirdham, and Bilaspur (Anon., 2025).

Foliar application of nutrients has gained considerable importance in modern fruit production systems. Compared with soil application, foliar feeding improves nutrient-use efficiency by minimizing nutrient losses through leaching, fixation, and other soil-related constraints. The application of micronutrients through foliar sprays has been reported to enhance fruit weight, fruit number, yield, and overall fruit quality, while being more economical than soil application (Yadav *et al.*, 2014) [15].

Urea is the most widely used nitrogen source for foliar fertilization because of its high solubility, rapid absorption through leaves, low phytotoxicity, and efficient utilization by plants (Fernández *et al.*, 2013) [6]. Although foliar fertilization is not intended to completely replace soil fertilization, several studies have demonstrated that foliar application of urea can significantly improve fruit yield and quality, often producing results comparable to or better

than conventional soil fertilization (Blasberg, 1953; Fisher and Cook, 1950; Hasani *et al.*, 2016) [4, 7, 8].

Material and method

Application of treatments

The required quantities of zinc sulphate and boric acid were weighed and dissolved in a small amount of water separately. These solutions were then added to the main spray tank containing the required volume of water. Nano urea was added last, just before spraying. A non-ionic sticker was added to the spray solution at a concentration of 0.1% to ensure better adhesion and absorption of nutrients on the leaf surface. The treatments were applied as foliar sprays using a high-volume knapsack sprayer, ensuring thorough coverage of the entire tree canopy until the point of drip-off. The sprays were scheduled at two critical stages: the first spray at the pre-flowering stage and the second spray 21 days after the first spray the control trees were sprayed with water containing the sticker.

Aftercare

Fertilizer application

A uniform basal dose of fertilizers, as per the recommended package of practices for the region, was applied to all the experimental trees. The entire dose of phosphorus and potassium, along with half the dose of nitrogen (for the control treatment), was applied to the tree basins during the month of June. The remaining half of the nitrogen for the control trees was applied in September. For the foliar spray treatments (T₁ to T₈), no soil application of nitrogen was done.

Irrigation

The experimental trees were irrigated at regular intervals using a drip irrigation system, depending on the soil moisture status, and prevailing weather conditions, to avoid any moisture stress, particularly during the critical stages of flowering and fruit development.

Weeding and Interculture operations

The tree basins were kept clean and free from weeds throughout the experimental period by regular manual weeding and light hoeing. This was done to minimize crop-weed competition for water and nutrients.

Plant protection

Need-based prophylactic plant protection measures were adopted uniformly for all the experimental trees to protect them from the incidence of major pests and diseases.

Result and Discussion

TSS (°Brix)

The statistical analysis revealed that the highest total soluble solids (TSS) content was recorded in treatment T₈ (Nano urea 2.0% + ZnSO₄ 0.4% + Boron 0.4%), with a mean value of 13.18 °Brix, which was significantly superior to most other treatments. In contrast, the lowest TSS value (10.38 °Brix) was observed in the control treatment, T₀ (RDF). The increase in TSS may be attributed to the physiological role of boron in carbohydrate metabolism and sugar translocation. Boron facilitates the formation of borate-sugar complexes, which enhance the transport of sugars, mainly sucrose, through the phloem from source leaves to developing fruits, resulting in greater sugar accumulation

and improved fruit quality. These findings are in agreement with those reported by Reddy and Patel (2022) [12] in guava.

Titrateable Acidity (%)

The minimum titrateable acidity (TA), indicating superior fruit quality and better consumer acceptability, was recorded in treatment T₈ (Nano urea 2.0% + ZnSO₄ 0.4% + Boron 0.4%) with a value of 0.32%. This treatment was statistically at par with T₇ (0.33 %) and T₆ (0.35 %). In contrast, the highest acidity (0.46%) was observed in the control treatment T₀ (RDF), which was statistically comparable to T₁ (0.45 %). The reduction in fruit acidity may be attributed to the biochemical changes associated with fruit ripening. During maturation, organic acids accumulated in the fruit are progressively utilized as respiratory substrates in the Krebs (citric acid) cycle to meet the energy demands of ripening. Furthermore, a portion of these acids may be converted into sugars, contributing to improved sweetness and overall fruit quality. The lower acidity observed under nutrient treatments, particularly the combined application of nano urea, zinc, and boron, suggests enhanced metabolic activity and accelerated ripening processes. These results are in close agreement with the findings of Singh and Singh (2018) [14] in guava

Ascorbic Acid (mg/100 g of pulp)

The highest ascorbic acid content was recorded in treatment T₈ (Nano urea 2.0 % + ZnSO₄ 0.4 % + Boron 0.4 %), with a mean value of 232.48 mg/100 g, while the lowest value (189.29 mg/100 g) was observed in the control treatment T₀ (RDF). The increase in ascorbic acid content may be attributed to the beneficial effects of zinc on plant metabolism and antioxidant activity, which enhance the biosynthesis of vitamin C from carbohydrate precursors. These results agree with the findings of Zagade *et al.* (2017) [17]

Total Sugars (%)

The highest percentage of total sugars was recorded in treatment T₈ (Nano urea 2.0 % + ZnSO₄ 0.4 % + Boron 0.4 %), with a mean value of 10.15%. The accumulation of sugars in the fruit is a direct and logical outcome of two key physiological processes: the rate of photosynthesis in the leaves and the efficiency of sugar transport to the fruit. The nano urea component of the foliar sprays, by providing a readily available and efficiently absorbed source of nitrogen, is critical for maintaining high chlorophyll content and robust photosynthetic activity. Nitrogen is a core structural component of the RuBisCO enzyme, the primary enzyme responsible for carbon fixation during the Calvin cycle. The results align perfectly with the findings of Singh and Singh (2018) [14] in guava

Reducing Sugars (%)

The highest concentration of reducing sugars was recorded in treatment T₈ (Nano urea 2.0% + ZnSO₄ 0.4% + Boron 0.4%), with a mean value of 5.53%. The lowest concentration of reducing sugars was found in the control treatment T₀ (RDF) recorded a value of 4.35%. Reducing sugars are the direct products of photosynthesis (glucose) and are also formed by the enzymatic hydrolysis of more complex carbohydrates, primarily sucrose, during the ripening process. The key enzyme responsible for this conversion within the fruit is invertase, which breaks down

one molecule of the disaccharide sucrose into one molecule of glucose and one molecule of fructose as discussed by Reddy and Patel (2022) ^[12].

Non-reducing Sugars (%)

The statistical analysis showed that the highest concentration of non-reducing sugars was recorded in treatment T₈ (Nano urea 2.0 % + ZnSO₄ 0.4 % + Boron 0.4%), with a mean value of 4.68%. The lowest concentration of non-reducing sugars was found in the control treatment T₀ (RDF) produced a value of 3.80%. Sucrose is the primary form in which sugar is synthesized and transported from the photosynthetically active leaves (the source) to the sink tissues of the fruit through the phloem vascular system.

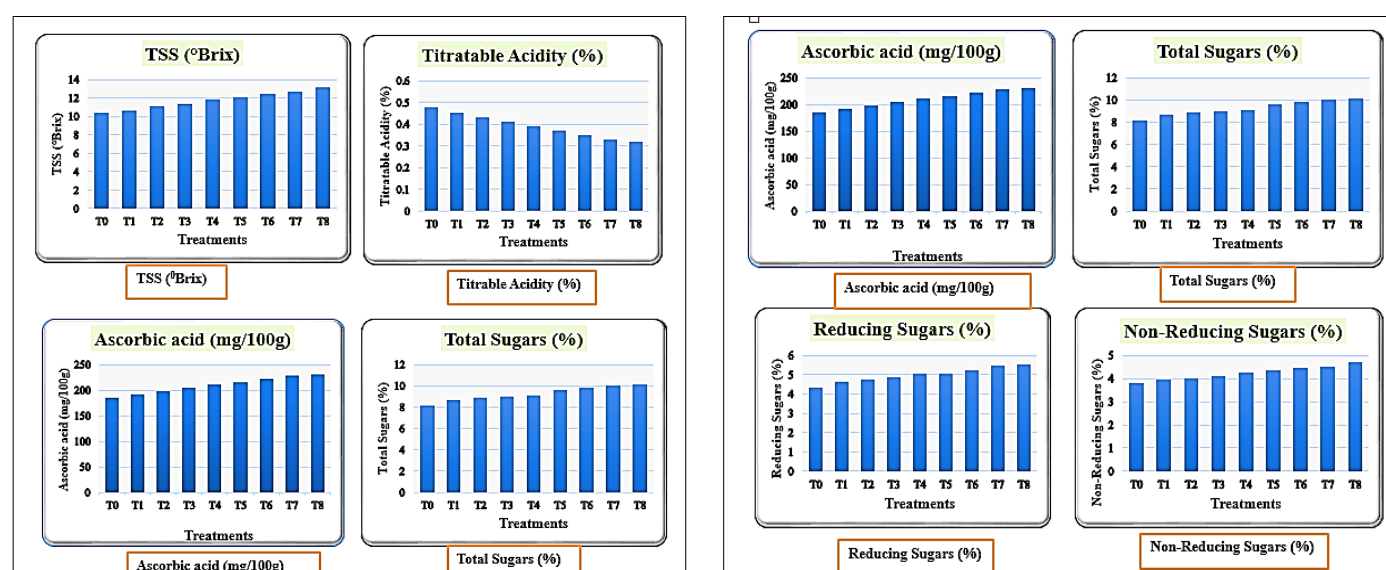
Therefore, a high concentration of sucrose measured in the fruit is a direct indicator of an efficient and active sugar translocation system. As previously discussed in the context of TSS and total sugars, the micronutrient boron plays an indispensable and well-documented role in this transport process.

Conclusion:

In conclusion, Foliar application of Nano urea 2.0 % + ZnSO₄ 0.4 % + Boron 0.4% (T₈) significantly improved TSS, ascorbic acid, total sugars, reducing sugars and non-reducing sugars while reducing fruit acidity in guava cv. Allahabad Safeda. Therefore, this treatment may be recommended for improving fruit quality under Chhattisgarh conditions.

Table 1: Effect of foliar application of nano urea and micronutrients on fruit quality parameters of guava cv. Allahabad Safeda

Notation	Treatments	TSS (°B)	Titrate acidity (%)	Ascorbic acid (mg/100 g)	Total Sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
T ₀	Control (N:P: K 0.8%: 0.2%: 0.2%) RDF	10.38	0.46	189.29	8.12	4.35	3.80
T ₁	Nano urea 0.5% + Zinc sulphate 0.2% + Boron 0.2%	10.59	0.45	192.43	8.67	4.60	3.95
T ₂	Nano urea 0.5% + Zinc sulphate 0.4% + Boron 0.4%	11.12	0.43	198.78	8.86	4.75	4.02
T ₃	Nano urea 1.0% + Zinc sulphate 0.2% + Boron 0.2%	11.33	0.41	204.31	8.95	4.85	4.10
T ₄	Nano urea 1.0% + Zinc sulphate 0.4% + Boron 0.4%	11.80	0.39	210.45	9.06	5.02	4.25
T ₅	Nano urea 1.5% + Zinc sulphate 0.2% + Boron 0.2%	12.10	0.37	216.33	9.65	5.04	4.34
T ₆	Nano urea 1.5% + Zinc sulphate 0.4% + Boron 0.2%	12.40	0.35	222.45	9.85	5.23	4.45
T ₇	Nano urea 2.0% + Zinc sulphate 0.2% + Boron 0.2%	12.65	0.33	227.70	10.07	5.49	4.51
T ₈	Nano urea 2.0% + Zinc sulphate 0.4% + Boron 0.4%	13.18	0.32	232.48	10.15	5.53	4.68
	SE(m)±	0.49	0.01	6.37	0.34	0.15	0.12
	C. D. at 5 %	1.46	0.04	19.09	1.02	0.46	0.37
	C.V.%	7.21	5.32	5.26	6.31	5.36	4.92



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