

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
 ISSN Online: 2617-4707
 NAAS Rating (2026): 5.29
 Indexing: Embase
 IJABR 2026; SP-10(10): 539-543
www.biochemjournal.com
 Received: 31-07-2026
 Accepted: 23-09-2026
 Published: 07-10-2026

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Effect of integrated nutrient management on growth, yield parameters and economics of guava (*Psidium guajava* L.) cv. G-27

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i10Sg.10338>

ABSTRACT

The experiment was conducted at the Vikrant Agriculture Research and Development Centre, Sakatpura, Vikrant University, Gwalior (Madhya Pradesh) during the study period 2025-26. Aimed to assess the effect of integrated nutrient management on growth, yield and economics of guava. The treatment comprising eight treatments in randomized block design with three replications. Viz., T_1 - 100% RDF (Control), T_2 - 75% RDF + Vermicompost, T_3 - 75% RDF + Azotobacter, T_4 - 75% RDF + Vermicompost + Azotobacter, T_5 - 75% RDF + Vermicompost + PSB, T_6 - 75% RDF + Vermicompost + KSB, T_7 - 75% RDF + Azotobacter + PSB + KSB and T_8 - 75% RDF + Vermicompost + Azotobacter + PSB + KSB. The result revealed that growth parameters viz., plant height (2.79 m), stem girth (20.90 cm), canopy spread (2.83 m), number of shoot (31.33), shoot diameter (5.73 mm), number of leaves shoot⁻¹ (28.67 leaves shoot⁻¹) and leaf area (0.63 m²) were significantly higher under T_8 (75% RDF + Vermicompost + Azotobacter + PSB + KSB), yield parameters viz., number of fruits per plant (184.67 fruits/plant), (193.75 g) Fruit weight (g), (40.27 kg/plant) fruit yield per plant and (76.07 q/ha) fruit yield were also in similar trend which was statistically at par, with T_7 (75% RDF + Azotobacter + PSB + KSB) and economics viz., cost of cultivation was maximum (₹70134 ha⁻¹), gross returns (₹159747 ha⁻¹), net returns (₹ 85500 ha⁻¹) and (2.15) b:c ratio under the treatment T_8 (75% RDF + Vermicompost + Azotobacter + PSB + KSB) followed by T_7 (75% RDF + Azotobacter + PSB + KSB).

Keywords: Azotobacter, Economics, Growth, Integrated nutrient management, Yield

Introduction

Guava (*Psidium guajava* L.), a member of the family Myrtaceae, is a prominent fruit crop of tropical and subtropical regions, valued for its remarkable nutritional composition, wide adaptability and substantial economic importance. Popularly referred to as the "apple of the tropics," guava is an excellent source of vitamin C, antioxidants and dietary fibre, which enhances its significance for both fresh consumption and processing industries. Owing to its hardy nature and capacity to perform well under diverse Agro-climatic conditions-including a wide soil pH range (4.5-8.2), drought and moderate salinity-guava is cultivated extensively across many countries. In India, it is regarded as one of the major fruit crops due to its adaptability and commercial potential (Bhamini *et al.*, 2022) [1].

The increasing demand for nutrients under intensive farming has led to the development of the new idea of integrated nutrient delivery, which combines organic, inorganic and biofertilizers. The fundamental objective of an integrated plant nutrition supply system is to optimize the benefits from all potential plant nutrient sources in an integrated manner in order to maintain or potentially increase soil fertility and plant nutrient supply to an optimal level for sustaining the desired crop productivity. Guavas respond well to manuring in terms of boosting fruit yield and quality and they are quite resilient to soil and agroclimatic conditions. Guava has responded well to the balanced use of inorganic fertilizers and organic manures, according to fertilizer trials carried out in India.

Integrated Nutrient Management (INM) is an efficient and sustainable approach that integrates chemical fertilizers, organic manures and biofertilizers to maintain soil fertility and enhance crop productivity. In perennial fruit crops like guava, balanced and continuous nutrient supply is essential for optimum vegetative growth, flowering, fruit set and quality development. Excessive reliance on chemical fertilizers may deteriorate soil health over time, whereas integrated use of organic and biological inputs improves nutrient use efficiency, enhances soil microbial activity and sustains long-term productivity Adak *et al.*, (2014) [2]. Therefore, adoption of INM practices in different level 75% and 100% RDF in guava cultivation is considered vital for achieving higher yield, improved fruit quality and economic sustainability (Dwivedi *et al.*, 2010) [3]. Biofertilizers such as Azotobacter, Phosphate Solubilizing Bacteria (PSB) and Potash Solubilizing

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Bacteria (KSB) play a crucial role in improving nutrient availability and uptake. Azotobacter enhances nitrogen fixation, PSB increases phosphorus solubilization and KSB improves potassium availability in the rhizosphere. These beneficial microorganisms, which are live formulations, are applied to seeds, roots, or soil to increase the availability of nutrients, especially through their biological activity and assistance in replenishing the lost microflora, which improves the overall health of the soil (Hazarika and Ansari, 2008). Inorganic, organic and biofertilizers was using different amounts of for guava cultivation can definitely enhance the growth, quality, productivity and profitability of guava. It has been discovered that applying organic manure and biofertilizers in addition to inorganic fertilizers is a practical and economical way to improve the development, productivity, and quality of several fruit crops, including guava. However, research on their combined effect in guava plants remains limited. This study evaluates their impact on growth and yield performance, aiming to identify the best combinations for improved propagation, plant establishment and productivity.

Methods and material

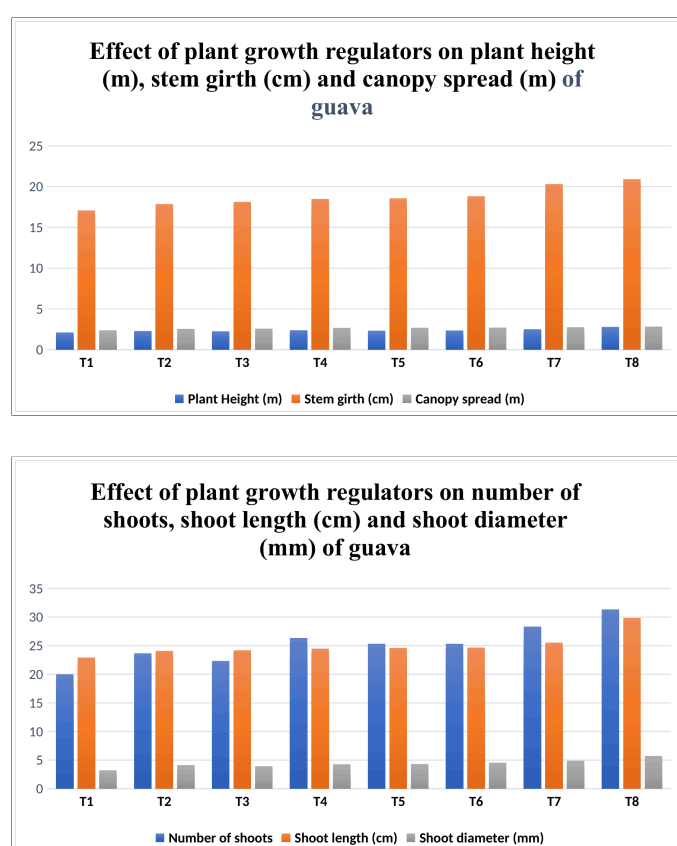
The experiment was conducted at the Vikrant Agriculture Research and Development Centre, Sakatpura, Vikrant University, Gwalior (Madhya Pradesh) during the study period 2025-26. The experimental site is located at 26°13' North latitude and 76°14' East longitude, at an altitude of 211.52 meters above mean sea level in the Gwalior district of the Gird region of northern Madhya Pradesh. The region falls under a semi-arid and sub-tropical climatic zone characterized by extreme weather conditions, including hot and dry summers and cold winters. The monsoon generally commences during the last week of June. The annual rainfall ranges between 700 and 800 mm, with the majority received from the last week of June to mid-September. Winter rainfall is occasional and uncertain. The maximum temperature during summer may rise up to 47 °C, while the minimum temperature during winter may fall to as low as 2.8 °C. Frost occurrence is common from the last week of December to the first week of February. The treatment comprising eight treatments with thrice replication. T₁ - 100% RDF (Control), T₂ - 75% RDF + Vermicompost, T₃ - 75% RDF + Azotobacter, T₄ - 75% RDF + Vermicompost + Azotobacter, T₅ - 75% RDF + Vermicompost + PSB, T₆ - 75% RDF + Vermicompost + KSB, T₇ - 75% RDF + Azotobacter + PSB + KSB and T₈ - 75% RDF + Vermicompost + Azotobacter + PSB + KSB. 100 % NPK (300:150:150 g/plant), 75 % NPK/ha (200:112.5:112.5 g/plant) Vermicompost = 10 kg/tree and Azotobacter + PSB + KSB 30 ml/tree. Observations on growth, yield parameters and economics of guava fruits under different treatments were recorded following standard procedures prescribed for each character.

Result and discussion

Effect of integrated nutrient management on growth parameters of guava

A perusal of growth parameters data was presented in Table 1. Result found that the different integrated nutrient management growth parameters were significantly impacted by different treatments. Revealed that the maximum growth parameters Viz., plant height (2.79 m), stem girth (20.90 cm), canopy spread (2.83 m), number of shoot (31.33), shoot diameter (5.73 mm), number of leaves shoot⁻¹ (28.67 leaves shoot⁻¹) and leaf area (0.63 m²) were significantly influenced with the application of T₈ (75% RDF + Vermicompost + Azotobacter + PSB + KSB) which was statistically at par, with T₇ (75% RDF + Azotobacter + PSB + KSB) and followed by among the different treatments. It might due to the optimum dose of recommended dose of inorganic fertilizers and organic manure along with bio fertilizers enhanced the all traits responsible for increasing all growth parameters which the synergistic effects of inorganic fertilizers, organic manures and biofertilizers may have leading to T₈'s higher performance by increasing nutrient availability and improving soil health. Along with the presence of plant growth regulators like

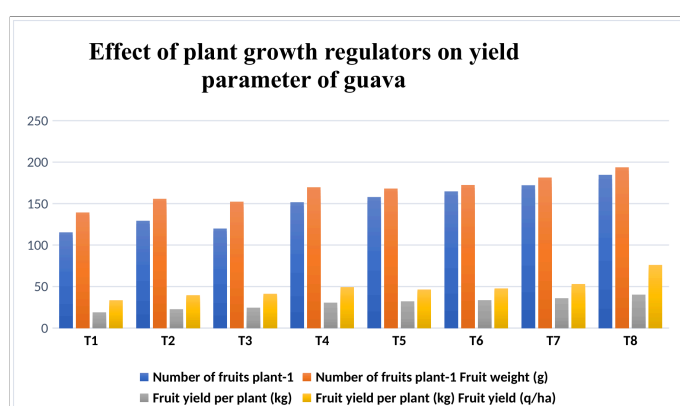
auxins and cytokinins, which encourage vegetative growth, vermicompost is known to improves soil physical characteristics, activity microbial and nutrient availability. Better root formation and greater nutrient uptake may be the cause of the improvements in plant height, stem girth and canopy spread seen in this study. Additionally, well documented is the function of biofertilizers such Azotobacter, PSB and KSB. These nutrients conveniently available to plants, Azotobacter improves nitrogen fixation, PSB solubilizes insoluble phosphorus and KSB mobilizes potassium. Increased shoot growth, leaf number and leaf area may have been the consequence of improved cell division and elongation brought on by this balanced nutrient supply. A greater photosynthetic surface is indicated by the increased leaf area under T₈, which eventually leads to improved vegetative growth and increased glucose synthesis. Increased metabolic activity and effective food use under integrated nutrient management are further suggested by the improvement in shoot diameter and number. These results closely align with previous research Ram *et al.* (2007) [4], Tyagi *et al.* (2021) [5], Chawla *et al.* (2022) [6], Chaurasia *et al.* (2022) [7], Aruna *et al.* (2023) [8], Jyoti *et al.* (2025) [9] and Kumar *et al.* (2025) [10].



Effect of integrated nutrient management on yield parameters of guava

A perusal indicates that effect of integrated nutrient management on guava was significantly influenced in various yield parameters viz., Number of fruits per plant, Fruit yield per plant (g) and Fruit yield (q/ha). Except Fruit length (cm) was non-significant. The data achieved that the number of fruits per plant (184.67 fruits/plant), (193.75 g) Fruit weight (g), (40.27 kg/plant) fruit yield per plant and (76.07 q/ha) fruit yield was recorded under the T₈ (75% RDF + Vermicompost + Azotobacter + PSB + KSB) which was statistically at par with T₇ (75% RDF + Azotobacter + PSB + KSB) and followed by among the different treatments. Yield parameters can be improvement under this treatment it may be due to a steady and optimum supply of nutrients from both inorganic sources and organic as well as biofertilizers that improved the effectiveness of nutrient uptake and use. In addition to supplying vital nutrients vermicompost enhances soil aeration, structures and activity of microbial, which

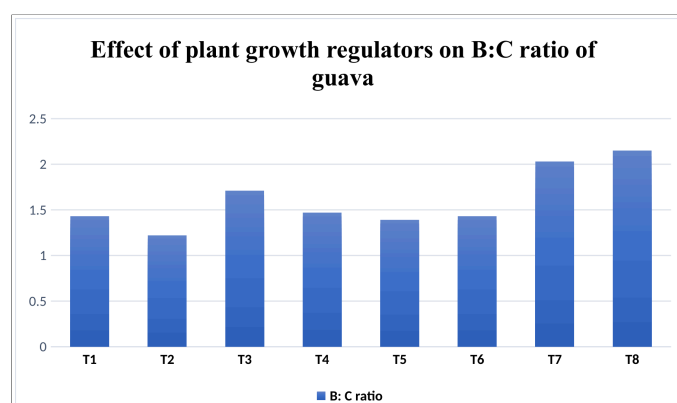
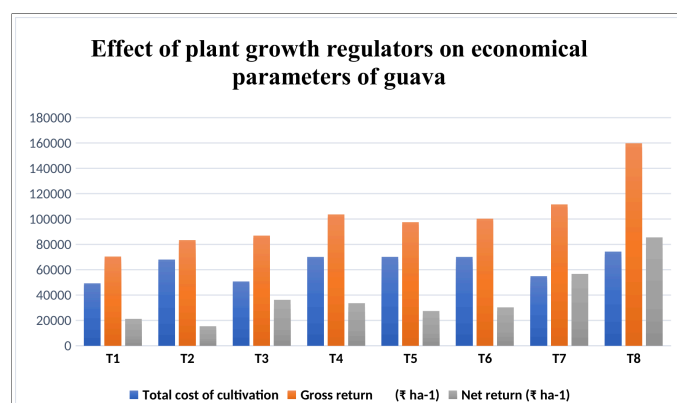
promotes improved root development and nutrient absorption. In order to improve nutrient availability biofertilizers like *Azotobacter*, PSB and KSB are essential. Better growth and fruit development are a finding of *Azotobacter* fixing atmospheric nitrogen, PSB increasing phosphorus solubilization and KSB improving potassium availability. When these inputs work together photosynthesis is improved carbohydrate synthesis is boosted and assimilates are efficiently translocated to developing fruits, which improves fruit size, weight and yield. Improved nutrient uptake and effective photosynthate translocation under integrated nutrient management techniques may potentially be responsible for the yield improvement (Bakshi *et al.*, 2017) [11]. Similar advancement in fruit quantity, weight and yield under nutrient management have also been documented in semi-arid environments, where the application of biofertilizers and vermicompost together greatly enhanced guava production parameters (Meena *et al.*, 2014) [12]. Recent studies also revealed that reduced levels of RDF supplemented with organic manures and biofertilizers significantly enhanced fruit yield and yield attributes in guava (Abhishek *et al.*, 2024) [13]. Similar experiment findings were also reported by Tyagi *et al.* (2021) [5], Chaurasia *et al.* (2022) [7], Rathore *et al.* (2025) [14] and Kumar *et al.* (2025) [10].



Effect of integrated nutrient management on economical parameter of guava

A perusal data presented in Tables 4.20 and Figures 4.20-4.23. The result revealed that the different parameters economics of guava cultivation under the affected of different integrated nutrient management treatments. Viz., cost of cultivation, gross returns, net monetary returns and Benefit: Cost ratio. The economics of different integrated nutrient management therapies utilized in the current study at different doses were computed. The implementation of different treatments was shown to be economically feasible. The cost of cultivation was maximum (₹70134 ha⁻¹), gross returns (₹159747 ha⁻¹), net returns (₹ 85500 ha⁻¹) and (2.15) b:c ratio under the treatment T₈ (75% RDF + Vermicompost + *Azotobacter* + PSB + KSB) followed by T₇ (75% RDF + *Azotobacter* + PSB + KSB). The highest cost of cultivation

under T₈ might be attributed to the additional cost incurred on RDF, vermicompost and biofertilizers which increases the initial investment compared to control or sole RDF treatments. However, this increased cost was effectively compensated by significantly higher yields and improved fruit quality resulting in enhanced gross and net returns. The higher gross returns under T₈ are attributed to increased yield and improved fruit quality under integrated nutrient management, which enhances nutrient availability, soil health and overall plant performance, resulting in greater marketable produce. The more net returns and B:C ratio indicate that integrated nutrient management is more profitable than conventional practices due to improved nutrient use efficiency reduced reliance on chemical fertilizers and higher yield performance. The similar results findings were also reported by Tiwari *et al.* (2018) [15], Tyagi *et al.* (2021) [5] and Gupta *et al.* (2021) [16].



Conclusion

Based on the experimental evidence, it can be concluded that the application of (75% RDF + Vermicompost + *Azotobacter* + PSB + KSB) was found the performing treatment for higher productivity, profitability and sustainability in this region.

Table 1. Effect of Integrated Nutrient Management on Growth parameters of Guava

Treatments	Plant Height (m)	Stem girth (cm)	Canopy spread (m)	Number of shoots	Shoot length (cm)	Shoot diameter (mm)	Leaf area m ²
T ₁ : 100% RDF (Control)	2.11	17.07	2.38	20.00	22.93	3.21	0.44
T ₂ : 75% RDF + Vermicompost	2.29	17.85	2.55	23.67	24.09	4.12	0.51
T ₃ : 75% RDF + <i>Azotobacter</i>	2.25	18.12	2.58	22.33	24.20	3.93	0.50
T ₄ : 75% RDF + Vermicompost + <i>Azotobacter</i>	2.39	18.48	2.68	26.33	24.48	4.27	0.56
T ₅ : 75% RDF + Vermicompost + PSB	2.33	18.55	2.69	25.33	24.60	4.31	0.55

(continued on next page)

Treatments	Plant Height (m)	Stem girth (cm)	Canopy spread (m)	Number of shoots	Shoot length (cm)	Shoot diameter (mm)	Leaf area m ²
T ₆ : 75% RDF + Vermicompost + KSB	2.36	18.81	2.71	25.33	24.67	4.55	0.56
T ₇ : 75% RDF + Azotobacter + PSB + KSB	2.51	20.30	2.76	28.33	25.54	4.90	0.59
T ₈ : 75% RDF + Vermicompost + Azotobacter + PSB + KSB	2.79	20.90	2.83	31.33	29.85	5.73	0.63
S.E(m)±	0.09	0.26	0.05	0.48	1.44	0.29	0.01
C.D. at 5%	0.28	0.78	0.16	1.45	NS	0.87	0.02

Table 2. Effect of Integrated Nutrient Management on Yield Parameter and Economics of Guava

Treatments	Number of fruits plant ⁻¹	Fruit weight (g)	Fruit yield per plant (kg)	Fruit yield (q/ha)	Total cost of cultivation	Gross return (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)	B: C ratio
T ₁ : 100% RDF (Control)	115.33	139.33	18.97	33.51	49210	70371	21161	1.43
T ₂ : 75% RDF + Vermicompost	129.33	155.74	22.67	39.67	67973	83307	15334	1.22
T ₃ : 75% RDF + Azotobacter	120.00	152.33	24.53	41.36	50661	86856	36195	1.71
T ₄ : 75% RDF + Vermicompost + Azotobacter	151.71	169.67	30.63	49.33	70051	103593	33542	1.47
T ₅ : 75% RDF + Vermicompost + PSB	157.88	168.06	32.27	46.43	70134	97503	27369	1.39
T ₆ : 75% RDF + Vermicompost + KSB	164.75	172.45	33.70	47.74	70009	100254	30245	1.43
T ₇ : 75% RDF + Azotobacter + PSB + KSB	172.08	181.37	36.02	53.10	54857	111510	56653	2.03
T ₈ : 75% RDF + Vermicompost + Azotobacter + PSB + KSB	184.67	193.75	40.27	76.07	74247	159747	85500	2.15
S.E(m)±	4.23	2.83	0.83	1.25	--	--	--	--
C.D. at 5%	12.84	8.58	2.53	3.79	--	--	--	--

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How to cite this article: Kaurav A, Kumar H, Thakur JP, Kumar S, Shrivastava M, Sahu A, et al. Effect of integrated nutrient management on growth, yield parameters and economics of guava (*Psidium guajava* L.) cv. G-27. *International Journal of Advanced Biochemistry Research*. 2026;SP-10(10):539-543. doi: <https://www.doi.org/10.33545/26174693.2026.v10.i10Sg.10338>

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