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INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT AND FOLIAR APPLICATION OF NANO UREA ON GROWTH, FLOWERING AND YIELD OF GUAVA VAR. ALLAHABAD SAFEDA

R. Celestial*¹, K. Venkata Subbaiah¹, M. Siva Prasad¹ and T. Thulasi Rami Reddy²

¹Department of Fruit Science, College of Horticulture, Dr. Y.S.R Horticultural University, Anantharajupeta - 516 105, A.P., India.

²Department of Soil Science, Dr. YSR Horticultural University, College of Horticulture, Anantharajupeta - 516 105, A.P., India.

*Corresponding author E-mail : celestialmanuel07@gmail.com

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ABSTRACT

The experiment entitled “Influence of integrated nutrient management and foliar application of nano urea on growth, physiology, flowering and yield of guava var. Allahabad Safeda” was carried out at College of Horticulture, Anantharajupeta, Dr. Y.S.R.H.U during the year 2024–2025. The experiment was laid out in a randomized complete block design with three replications comprising of nine treatments. The treatment combination of T₄ (75% RDF + 5 kg vermicompost enriched with 100 g Azospirillum + 100 g VAM + 100 g KSB + 0.2% nano urea) significantly enhanced plant height (2.89 m), canopy spread, E-W (3.78m), N-S (2.68m), rate of transpiration (4.00 $\mu\text{mol m}^{-2} \text{s}^{-1}$), photosynthetic rate (14.63 $\mu\text{mol CO}_2 \text{m}^{-2} \text{s}^{-1}$), leaf intercellular CO₂ (291.33 $\mu\text{mol CO}_2 \text{m}^{-2} \text{s}^{-1}$), stomatal conductance (0.37 $\text{mmol m}^{-2} \text{s}^{-1}$) and chlorophyll content (42.82 SPAD). Reproductive performance also improved, with early flowering (9.50 days), 50% flowering (14.33 days), maximum flowers per shoot (153.17), fruit number (99.02) and fruit yield (95.63 kg/tree) compared to other treatment combinations.

Key words : Guava, Allahabad safeda, INM, Biofertilizers, Nano urea.

Introduction

Guava (*Psidium guajava* L.), popularly known as the “poor man’s apple” and the “apple of the tropics,” is valued for its pleasant taste, affordability and exceptional nutritional composition. It is a rich source of vitamin C (150-200 mg/100 g) and provides essential Bcomplex vitamins, including thiamine (0.03-0.07 mg/100 g) and riboflavin (0.02-0.04 mg/100 g). The fruit also supplies appreciable amounts of minerals such as phosphorus (22.5-40.0 mg/100 g), calcium (10.0-30.0 mg/100 g) and iron (0.60-1.39 mg/100 g), along with a considerable pectin content (0.5-1.8%) (Singh *et al.*, 2008; Adsule and Kadam, 1995).

Despite its nutritional and commercial importance, guava production is constrained by issues such as market glut and the indiscriminate use of inorganic fertilizers. Continuous reliance on chemical inputs leads to nutrient

imbalances, reduced soil fertility, environmental degradation and ultimately a decline in yield and fruit quality. To overcome these challenges, sustainable approaches like organic manures, biofertilizers and nano-fertilizers are gaining attention in recent days. Vermicompost is rich in micro and macro nutrients, humic substances and natural phytohormones (Borang *et al.*, 2016), thereby enhancing root growth, nutrient uptake and fruiting performance in the crop. Similarly, biofertilizers improves soil biological activity, enhance nutrient availability and promote eco-friendly crop production. The application biofertilizers and organic manures has been shown to boost vegetative growth, yield and fruit quality in several crops (Abraham *et al.*, 2015). In recent years, nano-fertilizers, often described as “smart fertilizers,” have emerged as a promising innovation to increase nutrient use efficiency, reduce losses and minimize environmental pollution through

controlled and targeted nutrient delivery (Manjunatha *et al.*, 2016). Keeping in this view, the present investigation was carried out to study the influence of integrated nutrient management on growth and yield of guava var. Allahabad Safeda.

Materials and Methods

The present experiment was conducted in the guava var. Allahabad Safeda at Fruit Science block in College of Horticulture, Anantharajupeta, with a spacing of 3×3 meters. The experiment was carried out during 2024-2025 in Randomized Block Design (RBD) comprising of 9 treatments, replicated thrice with two plants per replication. The treatment details are given below.

Treatments	Treatment details
T ₁	T ₁ (100% RDF at 500:200:500 g)
T ₂	75% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100g VAM + 0.2% nano urea
T ₃	75% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 0.4% nano urea
T ₄	75% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 100 g KSB + 0.2% nano urea
T ₅	75% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 100 g KSB + 0.4% nano urea
T ₆	50% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 0.2% nano urea
T ₇	50% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 0.4% nano urea
T ₈	50% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 100 g KSB + 0.2% nano urea
T ₉	50% RDF + 5 kg vermicompost enriched with 100 g <i>Azospirillum</i> + 100 g VAM + 100 g KSB + 0.4% nano urea

In this experiment, treatments were imposed with different levels of recommended dose of fertilizers viz., nitrogen in two equal splits whereas, phosphorus and potassium as single dose of application. Vermicompost was enriched with biofertilizers @ 100g each before 15 days of application. Nano urea was sprayed twice during flowering and fruit set stage. The growth parameters plant height and canopy spread in both directions E-W and N-S was measured using a measuring tape.

Leaf physiological parameters, including photosynthesis, transpiration, leaf intercellular CO₂ and stomatal conductance, were recorded using an IRGA (Infrared Gas Analyzer), chlorophyll content was recorded in the matured leaf by using chlorophyll meter SPAD. The flowering parameters like days to flowering were calculated from bud visibility to full sepal opening, while the number of flowers per shoot was counted from randomly selected shoots across treatments. The duration to 50% flowering was determined based on the time taken from spraying until half of the tagged shoots had flowered. The total number of fruits was obtained by counting fruits at each harvest, summing across all pickings and calculating the average, yield per tree (kg) was recorded by weighing the fully matured fruits from each harvest using a balance and the cumulative yield was expressed in kilograms per tree.

Results and Discussion

Growth parameters

The maximum plant height (2.89 m), canopy spread E-W (3.78 m) and N-S (2.68 m) was obtained in the treatment T₄ - 75% RDF + 5 kg vermicompost enriched with 100 g *Azospirillum* + 100 g VAM + 100 g KSB + 0.2% nano urea. This might be due to the synergistic effects of inorganic fertilizers, vermicompost, biofertilizers and nano urea, which together enhanced nutrient availability, root growth and photosynthetic activity, ultimately favouring shoot elongation by promoting the biosynthesis of growth regulators such as IAA and GA. Similar findings were reported by Shaban and Mohsen (2009), Athani *et al.* (2007) and Naik and Babu (2007).

Physiological parameters of leaf

The maximum rate of transpiration ($4.00 \mu\text{mol m}^{-2} \text{s}^{-1}$), rate of photosynthesis ($14.63 \mu\text{mol CO}_2 \text{m}^{-2} \text{s}^{-1}$), leaf intercellular CO₂ ($291.33 \mu\text{mol CO}_2 \text{m}^{-2} \text{s}^{-1}$), stomatal conductance ($0.37 \text{mmol m}^{-2} \text{s}^{-1}$) and chlorophyll content (42.82 SPAD) was recorded in the treatment T₄ - 75% RDF + 5 kg vermicompost enriched with 100 g *Azospirillum* + 100 g VAM + 100 g KSB + 0.2% nano urea. The improvement in transpiration rate, photosynthetic rate and total chlorophyll content may be ascribed to the balanced supply of N, P and K in conjunction with foliar application of nano urea, which collectively stimulate chlorophyll biosynthesis, activate photosynthetic enzymes and expand leaf area, thereby enhancing carbon assimilation (Tominaga *et al.*, 2018; Gupta *et al.*, 2021; Faralli *et al.*, 2023; Choudhary *et al.*, 2021). Furthermore, the increase in stomatal conductance and intercellular CO₂ concentration might be linked to nutrient-induced modulation of guard cell turgor and

Table 1 : Effect of integrated nutrient management and foliar application of nano urea on, plant height and canopy spread E-W and N-S (m).

Treatments	Plant height (m)		Canopy spread E-W (m)		Canopy spread N-S (m)	
	Initial	Initial	Initial	Final	Initial	Final
T ₁	2.11	2.25	1.94	2.21	1.89	2.05
T ₂	2.26	2.45	2.06	2.58	2.12	2.32
T ₃	2.22	2.39	2.01	2.55	2.16	2.36
T ₄	2.62	2.89	2.79	3.78	2.37	2.68
T ₅	2.42	2.68	2.17	2.84	2.01	2.29
T ₆	2.23	2.48	2.28	2.90	2.18	2.31
T ₇	2.42	2.73	2.74	3.58	2.26	2.55
T ₈	2.41	2.67	2.19	2.78	2.16	2.39
T ₉	2.21	2.48	2.24	2.87	2.15	2.39
Mean	2.32	2.53	2.26	2.89	2.14	2.37
SEm ±	0.09	0.15	0.18	0.26	0.12	0.11
CD @ 5%	0.26	0.44	0.55	0.78	0.36	0.32

Table 2 : Effect of integrated nutrient management and foliar application of nano urea on rate of transpiration, rate of photosynthesis, leaf intercellular CO₂, stomatal conductance and total chlorophyll.

Treatments	Transpiration rate (μmol m ⁻² s ⁻¹)	Photosynthesis rate (μmol CO ₂ m ⁻² s ⁻¹)	Leaf intercellular CO ₂ (μ mol CO ₂ m ⁻² s ⁻¹)	Stomatal conductance (mmol m ⁻² s ⁻¹)	Total chlorophyll
T ₁	2.60	8.80	231.33	0.20	33.73
T ₂	3.10	11.00	245.00	0.22	37.50
T ₃	3.33	11.93	259.00	0.29	36.65
T ₄	4.00	14.63	291.33	0.37	42.82
T ₅	3.47	13.40	245.00	0.28	37.49
T ₆	3.57	13.50	240.33	0.23	35.68
T ₇	3.90	13.83	279.00	0.36	40.65
T ₈	3.73	13.73	277.00	0.33	38.62
T ₉	3.10	12.10	234.33	0.25	36.85
Mean	3.41	12.54	250.81	0.28	37.72
SEm ±	0.14	0.33	4.81	0.02	1.34
CD @ 5%	0.42	0.96	13.90	0.07	4.23

photosynthetic demand, resulting in more efficient CO₂ uptake, transpiration, and nutrient transport. These findings are in line with Kullaj *et al.* (2020), Sun *et al.* (2023).

Flowering parameters

The early flowering at (9.50 days), the minimum number of days to 50% flowering at (14.33 days) and the highest number of flowers per shoot (153.17) was recorded in T₄ - 75% RDF + 5 kg vermicompost enriched with 100 g *Azospirillum* + 100 g VAM + 100 g KSB + 0.2% nano urea. It might be due to the improved nutrient availability that maintains a favourable C:N ratio, promotes hormonal balance (cytokinins, gibberellins and auxins) and enhances assimilate translocation. These

factors collectively accelerate floral bud differentiation and reproductive development, which is consistent with the findings of Kumar *et al.* (2009), Meena *et al.* (2014) and Choudhary *et al.* (2021).

Yield parameter

The maximum number of fruits per plant (99.02) and highest fruit yield (95.63 kg/tree) was recorded in the treatment T₄ - 75% RDF + 5 kg vermicompost enriched with 100 g *Azospirillum* + 100 g VAM + 100 g KSB + 0.2% nano urea. It may be due to enhanced nutrient mobilization, efficient photosynthate partitioning and stimulation of cell division and differentiation, which together improve overall productivity (Kumar *et al.*, 2009; Singh *et al.*, 2010; Sahu *et al.*, 2015). Improved nutrient

Table 3 : Effect of integrated nutrient management and foliar application of nano urea number of days to flowering, number of flowers per shoot, number of days for 50% flowering and yield.

Treatments	No. of days to flowering	No. of flowers/shoot	No. of days for 50% flowering	No. of fruit/plant	Yield (kg/ tree)
T ₁	14.83	105.17	18.00	77.50	69.76
T ₂	11.33	118.50	17.67	79.85	76.11
T ₃	13.33	112.17	15.33	84.83	80.59
T ₄	9.50	153.17	14.33	99.02	95.63
T ₅	10.67	113.50	16.30	82.23	80.49
T ₆	11.50	124.50	16.00	79.18	81.42
T ₇	10.17	144.50	15.00	96.17	87.95
T ₈	9.67	125.50	17.00	89.00	77.34
T ₉	9.83	137.83	16.00	89.12	85.23
Mean	10.37	130.75	16.15	86.32	81.61
SEm ±	0.29	8.56	0.70	3.99	4.27
CD @ 5%	0.88	25.89	2.14	8.54	13.62

availability also promotes fruit bud differentiation and photosynthesis, while interactions with arbuscular mycorrhizal fungi and vermicompost further support reproductive development, thereby increasing fruit set percentage, which results in a higher number of fruits and ultimately greater yield. The results are consonance with findings of Davarpanah *et al.* (2017), Tyagi *et al.* (2021), Balyan *et al.* (2024).

Conclusion

The present investigation on the influence of integrated nutrient management and foliar application of nano urea on growth, flowering and yield of guava var. Allahabad Safeda revealed that combination of T₄ - 75% RDF + 5 kg vermicompost enriched with 100 g *Azospirillum* + 100 g VAM + 100 g KSB + 0.2% nano urea recorded superior performance in terms of plant height, canopy spread, rate of transpiration, rate of photosynthesis, leaf intercellular CO₂ stomatal conductance, chlorophyll content, flowering and yield attributes indicating the effectiveness of this INM strategy in optimizing vegetative and reproductive development and nano urea for better nutrient use efficiency.

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