International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(5): 435-439
www.biochemjournal.com
Received: 15-02-2025
Accepted: 26-03-2025

Anil Chouhan
Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Brijpal Bisen
Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Latesh Kumar
Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

S Reddy Veera Nagaveni
Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Brijpal Bisen
Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Effect of potassium nitrate (KNO_3) and gibberellic acid (GA_3) on quality attributes of mango (*Mangifera indica* L.) cv. Amrapali

Anil Chouhan, Brijpal Bisen, Latesh Kumar and S Reddy Veera Nagaveni

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i5f.4368

Abstract
An investigation was carried out at new nursery, Adhartal, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur to evaluate the positive effect of foliar sprays of Potassium Nitrate (KNO_3) and Gibberellic Acid (GA_3) on quality attributes of mango cv. Amrapali" conducted in 2023. The experimental material for the present investigation was comprised of 9 treatments with KNO_3 @ 1.0%, 2.0% and GA_3 @ 25 ppm, 50 ppm along with their combinations and water spray as control. The impact of various treatments on different quality attributes viz., TSS (^{0}Brix), ascorbic acid (mg/100 g), acidity (%), total sugar (%), reducing sugar and non-reducing sugar was recorded. The data revealed a significant influence, with the maximum TSS (21.81 ^{0}Brix), ascorbic acid (52.50 mg/100 g), total sugars (18.63%), reducing sugars (6.99%), non-reducing sugars (10.29%) and the minimum acidity (0.15%) was recorded in treatment T_8 (foliar spray of KNO_3 @ 2% + GA_3 @ 50 ppm) which is at par with T_7 (KNO_3 @ 1% + GA_3 @ 50 ppm). However, the treatment T_9 (control) recorded less performance for the similar characteristics except for acidity content.

Keywords: Mango, *Mangifera,* potassium nitrate, gibberellic acid, quality attributes

Introduction
Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae, is one of the most important fruit crops in India and is referred to as the "king of fruits" because of its delicious taste, excellent flavour, and attractive fragrance. The inflorescence of mango is panicles that are grown terminally. Mango is andro-monoecious, i.e., each inflorescence bears both hermaphrodite and staminate flowers (Coetzer *et al*., 1955) [3]. In India, mango is cultivated on an area of 2.3 million hectares, with a production of 20.5 million tonnes and a productivity of 15.3 MT/ha. (Anonymous, NHB-2021) [1]. Mango fruits are a rich source of vitamin A and a fairly good source of vitamin C. Many products can be prepared from immature green and ripened fruits. Ripe fruits are used in preparing squash, nectar, jam, jelly, custard powder, baby food, toffee, etc. among the mango cultivars Amrapali has already occupied a major area in a newly planted mango orchard in high-density planting, replacing the traditional cultivars by its dwarf stature and regular bearing in nature.

The plant growth regulators positively affected yield and quality attributing properties like fruit size and fruit weight, TSS, ascorbic acid and total sugars of mango. Foliar application of plant growth regulators is based on the principle that the nutrients are quickly absorbed by natural opening of the leaves and transported to different parts of the plant to fulfil the functional requirement of nutrition (Maurya *et al*., 2020) [9]. It was reported that in mango, the application of KNO_3 is effective twice at 1st flower bud differentiation, followed by another spray during the full bloom stage with a concentration of 1% for flowering, fruiting, yield, and quality characteristics (Dadhaniya *et al*., 2018) [4].

Many investigations used GA_3 to increase fruit set percentage, induce higher fruit retention, improve yield, enhance the number of fruits per tree, exert an effect on fruit quality, and enhance fruit chemical properties (Maurya and Singh, 1981) [8]. Gibberellins as a pre-harvest spray was reported as an efficient growth regulator in enhancing fruit storability and marketability through its action on cell juvenility and retardation of senescence, fruit coloration and softness (Taduri *et al*., 2017) [14].

GA_3 enhances sugar mobilization and transport by increasing phloem loading, which boosts the accumulation of sugars in fruits and it delays senescence, allowing more time for sugar accumulation by delaying ripening and softening. GA_3-treated mangoes often show improved postharvest shelf life, uniform colour development and maturity. Potassium boosts sugar transport and accumulation, directly affecting sweetness. It also helps to activate enzymes involved in sugar synthesis (e.g., sucrose synthase), improves stress tolerance, which can reduce degradation of ascorbic acid during maturation. Potassium nitrate concentrations especially in combination with urea gave better results for most of the flowering and yield parameters of 'Tommy Atkins' mango in Ethiopia (Yeshitela *et al*., 2005) [18].

In light of the views mentioned above, the present experiment was carried out to know the effect of Potassium Nitrate (KNO_3) and Gibberellic Acid (GA_3) on quality attributes of mango (*Mangifera indica* L.) cv. Amrapali.

Materials and Methods

The investigation was conducted to ascertain the effect of Potassium Nitrate (KNO_3) and Gibberellic Acid (GA_3) on fruit retention and yield of mango (*Mangifera indica* L.) cv. Amrapali at new nursery, Adhartal, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. The experiment was laid out in Randomized Block design in nine treatments with three replications with the foliar sprays of KNO_3 at two different concentrations i.e., 1%, 2% and GA_3 at two different concentrations i.e., 25 ppm and 50 ppm and their combinations along with spray of water as a control. solutions were prepared in water after dissolving them in the required amount of alcohol. The experiment treatment details were as follows:-T_1: 2 Sprays of KNO_3 of 1.0%, T_2: 2 Sprays of KNO_3 of 2.0%, T_3: 2 Sprays of GA_3 @ 25 ppm, T_4: 2 Sprays of GA_3 @ 50 ppm, T_5: 2 Sprays of 1.0% KNO_3 + GA_3 @ 25 ppm, T_6: 2 Sprays of 1.0% KNO_3 + GA_3 @ 50 ppm, T_7: 2 Sprays of 2.0% KNO_3 + GA_3 @ 25 ppm, T_8: 2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm and T_9: Control (Spray of water)

Spraying of chemicals & growth regulators was done with a power sprayer on 18-year-old mango plants which are at 5m X 5m spacing. The treatments were given as pre-harvest sprays on fruits two times. First spray at the pea stage was done on march 15th 2023 and second spray at the marble stage was done on April 10th 2023. The fruit sampling for different parameters in randomly selected plants at each treatment was done on 28th may 2023. A sample of 5 ripe fruits of each tree was taken at the harvest time to be used for determining the physical and chemical properties. The total soluble solids percentage (TSS%) was determined by using a hand refractometer and the acidity% as citric acid content using fresh juice with titration against 0.1NaOH (Ranganna, 1986) [11]. The total sugars%, reducing sugars%, non-reducing sugars% and ascorbic acid were determined according to A.O.A.C (2005) [2]. The observations were recorded from 5 randomly selected plants in each treatment and analyzed using the OPSTAT statistical package.

Results and Discussion

The effect of GA_3 and KNO_3 on mango was studied with respect to quality parameters like TSS (^{0}Brix), ascorbic acid (mg/100 g), and acidity (%), total sugar (%), reducing sugar and non-reducing sugar. The results of these attributes are discussed below:

TSS (^{0}Brix)

According to the observation in Table 1, the total soluble solids content of mango fruit was significantly influenced by GA_3 and KNO_3. The data revealed a significant influence, with the maximum fruit pulp TSS (21.81 ^{0}Brix) recorded in treatment T_8 (2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm), which is on par with treatment T_7 (21.25^{0}Brix), and the lowest TSS (19.51^{0}Brix) recorded in treatment T_9. Our results imply that auxin promotes fruit growth by mobilizing carbohydrates, potentially under the effect of GA_3. This could entail dissolving the components of the cell wall for simpler transportation as well as turning starches and organic acids into sugars that can be used. Drawing from Gupta and Brahmachari (2004) [6] in mango.

Ascorbic acid (mg/100 g)

According to the observation in Table 1, the ascorbic acid content of Mango fruit was significantly influenced by foliar application GA_3 and KNO_3. The maximum (52.50 mg/100 g) ascorbic acid (mg/100 g) was recorded in treatment T_8 (2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm), at par with T_7 (50.93 mg/100 g), while the minimum (45.36 mg/100 g) ascorbic acid was recorded in the fruits of treatment T_9. The study suggests that steady synthesis of glucose-6-phosphate, a precursor to vitamin C, throughout fruit development is the potential reason for the observed increase in ascorbic acid content. This finding supports similar observations in strawberry cv. Chandler by Dubey *et al*. (2017) [5] and mango cv. Amrapali by Kumar *et al*. (2018) [7].

Acidity (%)

According to the observation in Table 1, the acidity (%) content of Mango fruit was significantly influenced by foliar application GA_3 and KNO_3. The minimum acidity (0.15%) was recorded in treatment T_8 (2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm), at par with T_7 (0.16%), while the maximum (0.21%) ascorbic acid was recorded in the fruits of treatment T_9. The treatment of KNO_3 result in a decrease in fruit acidity. The observed reduction in organic acids is possibly due to their rapid transformation into sugars and their derivatives, suggesting an increased metabolic activity for fruit development. These results were supported by Gupta and Brahmachari (2004) [6] and Parahua and Pandey (2019) [10].

Total sugar (%)

The observation in Table 2 showed that foliar application GA_3 and KNO_3 significantly impacted the total sugar (%) content of Mango fruit. The data showed the significant influence, and the maximum total sugars (18.63%) were recorded in treatment T_8 (2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm), which is on par with T_2 (18.12%). While the minimum total sugar (17.48%) was recorded in the fruits of treatment T_9. This enhancement could be attributed to the combined effects of potassium nitrate and the growth regulator because GA_3 and KNO_3 affect physiological processes, their administration results in an increase in the overall sugar content of fruits. Growth regulator GA_3 may affect how carbohydrates are metabolized, encouraging the synthesis of sugars. As a supply of potassium and nitrogen, which are vital elements for plant growth, KNO_3 may promote improved photosynthesis and fruit sugar accumulation. This is in agreement with Vijayalakshmi and

Srinivasan (2000) [17], Stino *et al*. (2011) [13] in mango.

Reducing sugar (%)

The observation in Table 2 showed that foliar application GA_3 and KNO_3 significantly impacted the total sugar (%) content of Mango fruit. The maximum reducing sugars (6.99%) were recorded in treatment T_8 (2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm), which is on par with T_7 (6.89%) and T_2 (6.78%). While the minimum reducing sugar, (5.49%) was recorded in the fruits of treatment T_9. This may be because of contribution of potassium nitrate along with growth regulator GA_3. These results were accompanied with the studies of Gupta and Brahmachari (2004) [6].

Non-reducing sugar (%)

The observation in Table 2 showed that foliar application GA_3 and KNO_3 significantly impacted the total sugar (%) content of Mango fruit. The minimum non-reducing sugars (10.29%) were recorded in treatment T_8 (2 Sprays of 2.0% KNO_3 + GA_3 @ 50 ppm), which is on par with T_7 (10.41%), T_6 (10.48%), and T_5 (10.65%). While the maximum non-reducing sugars (11.98%) was recorded in the fruits of treatment T_9. This shows the significant effect of application of GA_3 and KNO_3 on fruit trees. Similar findings obtained by Tsomu and Patel (2019) [16] in Mango cv. Mallika, Tripathi *et al*. (2018) [7], Shukla *et al*. (2011) [12] in Aonla.

Table 1: Effect of Potassium Nitrate (KNO_3) and Gibberellic Acid (GA_3) on TSS (^{O}Brix), Acidity (%) and Ascorbic acid (mg/100 g) of mango cv. Amrapali

Notation	Treatment	TSS (^{o} Brix)	Acidity (%)	Ascorbic acid (mg/100 g)
T_1	KNO_3 @ 1%	19.81	0.20	47.67
T_2	KNO_3 @ 2%	19.90	0.19	47.86
T_3	GA_3 @ 25 ppm	19.95	0.18	48.26
T_4	GA_3 @ 50 ppm	20.52	0.17	48.73
T_5	KNO_3 @ 1% + GA_3 @ 25 ppm	20.85	0.17	48.94
T_6	KNO_3 @ 2% + GA_3 @ 25 ppm	20.97	0.16	50.08
T_7	KNO_3 @ 1% + GA_3 @ 50 ppm	21.25	0.16	50.93
T_8	KNO_3 @ 2% + GA_3 @ 50 ppm	21.81	0.15	52.50
T_9	Control (Water Spray)	19.51	0.20	45.36
	SEm±	0.84	0.004	1.52
	C.D. at 5%	2.53	0.01	4.56

Table 2: Effect of Potassium Nitrate (KNO_3) and Gibberellic Acid (GA_3) on reducing sugar (%), non-reducing sugar (%) and total sugar (%) of mango cv. Amrapali

Notation	Treatment	Reducing Sugar (%)	Non-reducing Sugar (%)	Total Sugar (%)
T_1	KNO_3 @ 1%	5.69	11.58	17.62
T_2	KNO_3 @ 2%	6.78	11.32	18.11
T_3	GA_3 @ 25 ppm	6.10	11.22	17.33
T_4	GA_3 @ 50 ppm	6.19	10.90	17.10
T_5	KNO_3 @ 1% + GA_3 @ 25 ppm	6.33	10.64	16.98
T_6	KNO_3 @ 2% + GA_3 @ 25 ppm	6.48	10.48	16.97
T_7	KNO_3 @ 1% + GA_3 @ 50 ppm	6.89	10.41	17.35
T_8	KNO_3 @ 2% + GA_3 @ 50 ppm	6.99	10.29	18.63
T_9	Control (Water Spray)	5.49	11.98	17.48
	SEm±	0.38	0.54	0.56
	C.D. at 5%	1.15	1.64	1.68

T_1: KNO_3 @ 1% T_2: KNO_3 @ 2% T_3: GA_3 @ 25 ppm

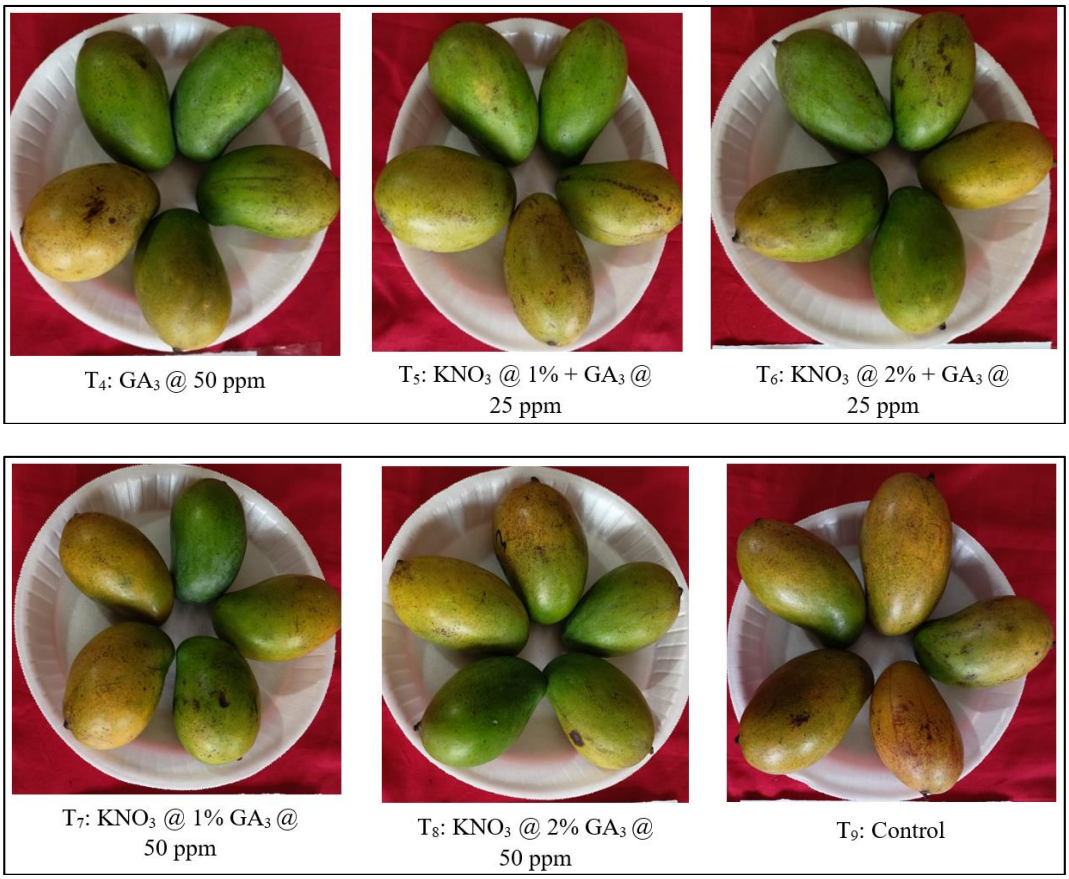

Fig 1: Visual Characterization of Quality Attributes in Mango (*Mangifera indica* L.) cv. Amrapali as Affected by KNO_3 and GA_3 Spray

Conclusion

In conclusion, the results of the present investigation showed that the foliar sprays of Potassium Nitrate (KNO_3) and Gibberellic Acid (GA_3) had a significant impact on different quality attributes of mango cv. Amrapali. Among the treatments studied, the maximum TSS (21.81 ^{0}Brix), ascorbic acid (52.50 mg/100 g), total sugar (18.63%), reducing sugar (6.99%) was observed in trees that are foliar sprayed with KNO3 @ 2% + GA3 @ 50 ppm. Whereas the maximum acidity (0.20%) was observed in treatment control. While the lowest TSS (19.51 ^{0}Brix), ascorbic acid (45.36 mg/100 g), total sugar (17.48%), reducing sugar (5.49%) was recorded with control.

Acknowledgment

The authors express their gratitude to Department of Horticulture, College of Agriculture, Jabalpur for providing the necessary facilities.

References

1. Anonymous. Indian Horticulture Database, 2021-22 [Internet]. New Delhi: National Horticulture Board; 2021 [cited 2025 May 13]. Available from: http://nhb.gov.in
2. Association of Official Agricultural Chemists. *Official methods of analysis*. 18th ed. Washington D.C.: Association of Official Analytical Chemists; 2005.
3. Coetzer LA, Oosthuyse SA, Wishart DL, Robbertse PJ. Influence of pruning on flower sex ratio in some mango cultivars. South African Mango Grower Association. 1955;15:27-30.
4. Dadhaniya D, Roshni B, Kinjal H, Rutu S, Lakhee K, Adodariya BA, Prasana JS. Impact of KNO_3 on major fruit crops. Journal of Pharmacognosy and Phytochemistry. 2018;7(4):2699-2702.
5. Dubey V, Meena ML, Tripathi VK. Effect of plant bioregulators and micronutrient on vegetative growth, yield and quality of strawberry cv. Chandler. Progressive Research-An International Journal. 2017;12(3):330-332.
6. Gupta R, Brahmachari VS. Effect of foliar application of urea, potassium nitrate and NAA on fruit retention, yield and quality of mango cv. Bombai. The Orissa Journal of Horticulture. 2004;32(2):7-9.
7. Kumar R, Tripathi VK, Tomar S, Chaudhary M, Jeevan R. Effect of best plant bio-regulators and micronutrient for getting higher fruit setting in mango (*Mangifera indica* L.) cv. Amrapali. Journal of Plant Development Sciences. 2018;10(11):701-705.
8. Maurya AN, Singh JN. Effect of three growth regulators on fruit retention and quality of mango (*Mangifera indica* L.) cv. Langra. Journal of Agriculture India. 1981;16:53-56.
9. Maurya PK, Tripathi VK, Gupta S. Effect of pre-harvest application of GA_3, naphthalene acetic acid and borax on fruit drop, yield and quality of mango cv. Amrapali. Journal of Pharmacognosy and Phytochemistry. 2020;9(6):2123-2127.
10. Parahua S, Pandey SK. Influence of plant growth regulators and nutrients on fruit retention, yield and quality attributes of mango (*Mangifera indica* L.) cv. Amrapali. Journal of Pharmacognosy and Phytochemistry. 2019;8(2):550-555.
11. Ranganna S. *Manual of analysis of fruit and vegetable products*. New Delhi: Tata McGraw Hill Publishing Company Ltd.; 1986.

12. Shukla HS, Kumar V, Tripathi VK. Effect of gibberellic acid and boron on development and quality of aonla fruits 'Banarasi'. Acta Horticulturae. 2011;890:375-380.
13. Stino RG, Sahar M, Abd EW, Habashy SA, Kelani RA. Productivity and fruit quality of three mango cultivars in relation to foliar sprays of calcium, zinc, boron and potassium. Journal of Horticultural Science and Ornamental Plants. 2011;3(2):91-98.
14. Taduri M, Reddy NN, Lakshmi JN, Joshi V. Effect of pre-harvest treatments on shelf life and quality of mango cv. Amrapali. The Pharma Innovation Journal. 2017;6(7):54-59.
15. Tripathi VK, Pandey SS, Kumar A, Dubey V, Tiwari P. Influence of foliar application of gibberellic acid, calcium and boron on fruit drop, yield and quality attributes of aonla (*Emblica officinalis*) cv. NA-7. Indian Journal of Agricultural Sciences. 2018;88(11):1784-1788.
16. Tsomu T, Patel HC. Influence of plant growth regulators and micronutrients on yield and quality attributes of mango cv. Mallika. Journal of Pharmacognosy and Phytochemistry. 2019;8(4):1240-1247.
17. Vijayalakshmi D, Srinivasan PS. Improving the quality attributes of 'off' year Alphonso mango through chemicals and growth regulators. The Orissa Journal of Horticulture. 2000;28(1):31-33.
18. Yeshitela T, Robbertse PJ, Stassen PJC. Potassium nitrate and urea sprays affect flowering and yields of 'Tommy Atkins' (*Mangifera indica*) mango in Ethiopia. South African Journal of Plant and Soil. 2005;22(1):28-32.