International Journal of Advanced Biochemistry Research 2025; SP-9(12): 1515-1518

International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(12): 1515-1518
www.biochemjournal.com
Received: 25-09-2025
Accepted: 29-10-2025

SN Kolekar
Ph.D. Scholar, Department of Fruit Science, Post Graduate Institute, Dr. P. D. K. V., Akola, Maharashtra, India

Dr. SG Bharad
Professor and Head Department of Fruit Science, Faculty of Horticulture, Dr. PDKV, Akola, Maharashtra, India

Dr. RN Deshmukh
Ph.D. Scholar, Department of Fruit Science, Post Graduate Institute, Dr. P. D. K. V., Akola, Maharashtra, India

Dr. PK Nagre
Associate Dean, College of Agriculture, Akola, Dr. PDKV, Akola, Maharashtra, India

Dr. UA Raut
Professor, Department of Fruit Science, Dr. PDKV, Akola, Maharashtra, India

Dr. MM Deshmukh
Professor and Head, College of Agricultural Engineering and Technology Akola, Dr. PDKV, Akola, Maharashtra, India

Dr. SD Jadhao
Professor and Head Soil Science, Dr. PDKV, Akola, Maharashtra, India

Corresponding Author:
SN Kolekar
Ph.D. Scholar, Department of Fruit Science, Post Graduate Institute, Dr. P. D. K. V., Akola, Maharashtra, India

Effect of fertigation scheduling on physical and chemical attributes of guava under high density planting system

SN Kolekar, SG Bharad, RN Deshmukh, PK Nagre, UA Raut, MM Deshmukh and SD Jadhao

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i12Sr.6736

Abstract
The present investigation entitled "Fertigation studies in high density planting guava" was conducted during two consecutive years 2022-23 and 2023-24 at Farmers Field, Yeota, Tal and Dist. Akola, Maharashtra on four-year-old guava plants of cv. Sardar planted at a spacing of 4 m × 3 m. The experiment was conducted to evaluate the effect of different fertigation levels on growth and yield parameters, and to find out the optimum fertigation level for high-density guava planting. The experiment was laid out in Randomized Block Design. The results indicated that, growth was significantly influenced by different fertigation levels. The maximum physical quality parameters *viz.*, average fruit weight (231.05 g), fruit diameter (7.51 cm), average fruit volume (194.74 cc), average pulp weight (161.89 g) and pulp: seed ratio (25.28) was observed with the application of 197-117-236 kg ha^{-1} NPK through fertigation. Similarly, reducing sugars (4.218%), non reducing sugars (4.164%) and total sugars (8.381%) was found with the application of 197-117-236 kg ha^{-1} NPK through fertigation closely followed by 171-102-205 kg ha^{-1} NPK through fertigation.

Keywords: Guava, high density planting, fertigation levels, physical parameters, chemical parameters

Introduction

Guava (*Psidium guajava* L.) is a very popular fruit in India and has been under cultivation in India since early 17^{th} century. It belongs to family "Myrtaceae" and an important commercial fruit crop of tropical and sub-tropical region of India. It is known as "Apple of tropics" and rich in vitamin "C" and pectin content besides being a good source of other vitamins and minerals. Fruits are fair source of vitamin A (about 250 mg/100 g) and contain appreciable quantities of thiamine, niacin and riboflavin. The ascorbic acid content ranges from 75-260 mg/100 g, which varies with cultivar, season, location and stage of maturity. The fruit also contains considerable amount of calcium, phosphorus and iron. However, 80% of iron remain in the seed and is not utilizable. Moreover, guava fruits are rich source of pectin which ranges between 0.5 and 1.8% (Adsule and Kadam, 1995) [1]. Maharashtra is one of the leading producers of guava in the country. Owing to its high nutritive value, adoptability this crop has great scope in the fruit culture of Vidarbha region which is primarily known for citrus cultivation. There is substantial increase in production area under guava in Vidarbha region. Major guava producing districts in Maharashtra are Pune, Jalgaon, Aurangabad, Satara, Ahmednagar, Nasik, Beed, Jalna, Amaravati, Buldana and Wardha. Fruit production is undergoing a change where emphasis is being given to higher production per unit area. High density planting or meadow orchard system is the fastest way of reducing the gestation period and simultaneously increasing productivity of the orchards. Fertigation enables adequate supplies of water and nutrients with precise timing and uniform distribution to meet the crop nutrient demand. Further, fertigation ensures substantial saving in fertilizer usage and reduces leaching losses (Kumar *et al.*, 2007) [7]. Similar to frequent application of water, optimum split applications of fertilizer improve quality and quantity of crop yield than the conventional practice. Under such conditions, location specific research for providing the information on proper nutrition through fertigation could be helpful for the growers.

Materials and Methods

The present investigation entitled "Fertigation studies in high density planting guava was conducted during two consecutive years 2022-2023 and 2023-2024 at Farmers Field, Yeota Tal and Dist: Akola Maharashtra on four-year-old guava cv. Sardar spaced at 4 m x 3 m. The experiment was conducted to assess the impact of different levels of fertigation on the growth, yield, fruit quality of guava and to find out the optimum economic levels of fertigation for guava trees in high density planting. The experiment was laid out in Randomized Block Design with three replications. The experiment comprised different levels of fertigation *viz*., RDF through soil application as 171-93-93 kg ha^{-1} NPK (T_1), 171-93-93 kg ha^{-1} NPK (T_2), 197-107-107 kg ha^{-1} NPK (T_3), 222-122-122 kg ha^{-1} NPK (T_4), 145-79-79 kg ha^{-1} NPK (T_5), 120-66-66 kg ha^{-1} NPK(T_6), 171-102-205 kg ha^{-1} NPK (T_7), 197-117-236 kg ha^{-1} NPK (T_8), 222-133-267 kg ha^{-1} NPK (T_9), 145-87-174 kg ha^{-1} NPK (T_{10}) and 120-72-143 kg ha^{-1} NPK (T_{11}) were used in the present study.

Results and Discussion

Fruit physical quality parameters

The results pertaining to the effect of different levels of fertigation on fruit physical quality parameters viz., average fruit weight (g), average fruit diameter (cm), average fruit volume (cc), average pulp weight (g) and pulp: seed ratio was significantly increased with different fertigation levels (Table 1). The results indicated that the pooled mean of two-year data, the maximum average fruit weight (231.05 g) the maximum average fruit diameter (7.51 cm) was recorded in treatment T_8 (197-117-236 NPK kg ha^{-1} as fertigation) which was at par with treatment T_7, (171-102-205 kg ha^{-1} NPK through fertigation) T_9 (222-133-267 kg ha^{-1} NPK through fertigation and T_4 (222-122-122 NPK kg ha^{-1} as fertigation) respectively. However, the minimum average fruit weight (178.64 g), the minimum average fruit diameter (5.34 cm) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application). However, for pooled mean data, significantly maximum average fruit volume (194.74 cc) was recorded in treatment T_8 (197-117-236 NPK kg ha^{-1} as fertigation) which was at par with treatment T_7 and T_9 respectively. While, the minimum average fruit volume (122.89 cc) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application). Whereas, for pooled mean data, the significantly highest average pulp weight (161.89 g) and pulp: seed ratio (25.28) was recorded in treatment T_8 (197-117-236 NPK kg ha^{-1} as fertigation) which was at par with treatment T_7 respectively. While, the lowest average pulp weight (106.71 g) and pulp: seed ratio (16.57) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application).

The higher leaf area, providing a larger photosynthetic surface, coupled with increased uptake of water and nutrients from a conducive soil environment, likely enhanced the production of photosynthates in leaves and their translocation to developing fruits. This facilitated better fruit filling, thereby increasing fruit length, volume, and weight. Variations in fruit weight, length, and diameter might be attributed to key physiological processes such as photosynthetic efficiency, the rate of photosynthate translocation from source to sink, and photorespiration. Under optimal nutrient conditions, the synthesis of growth-promoting hormones such as cytokinin's and gibberellic acid is enhanced, further contributing to increased fruit size and volume. The observed increase in fruit weight and pulp weight might be due to improved vegetative growth (Ramniwas *et al.*, 2012b) [12] enlargement of fruit cells, and the accumulation of assimilates in intercellular spaces (Bollard, 1970) [2] along with enhanced current photosynthesis that supports better fruit development (Thakur & Singh, 2004) [17]. The improvement in fruit diameter, pulp weight, and pulp-seed ratio under the treatment T_8 (197-117-236 kg ha-1 NPK through fertigation) and treatment T_7 (171-102-205 kg ha^{-1} NPK through fertigation) might be due to primarily attributed to enhanced vegetative growth.

Similar findings were reported by Boora *et al.* (2002) [3] in sapota, and a comparable trend was observed by Firake and Kumbhar (2002) [4] in pomegranate, as well as by Ramniwas *et al.* (2012a) [12], Kumawat *et al.* (2017) [9], and Rao *et al.* (2017) [13] in guava under high-density planting systems. Singh *et al.* (2006) [16] noted that 75% of the recommended dose of NPK through fertigation resulted in the highest fruit weight and volume in pomegranate, which was at par with 125% RD through fertigation. Similarly, Ingle *et al.* (2006) [6] reported maximum fruit weight in acid lime with the application of 75% RDF through drip irrigation.

Table 1: Effect of different fertigation levels on physical quality parameters of guava (pooled mean).

Treatments	Average fruit weight (g)	Average fruit diameter (cm)	Average fruit volume (cc)	Average pulp weight (g)	Pulp: seed ratio
T_1	178.64	5.34	122.89	106.71	16.57
T_2	187.53	5.84	139.02	119.80	19.19
T_3	194.80	6.70	183.84	123.91	19.67
T_4	215.54	7.34	185.86	133.73	21.17
T_5	185.50	5.72	133.75	113.00	18.07
T_6	184.33	5.40	130.67	110.83	17.72
T_7	221.18	7.35	191.27	155.13	24.32
T_8	231.05	7.51	194.74	161.89	25.28
T_9	217.19	7.31	186.71	143.90	22.66
T_{10}	197.07	6.66	146.98	124.82	19.80
T_{11}	188.45	6.56	133.35	118.76	18.91
F test	Sig	Sig	Sig	Sig	Sig
SE(m)±	5.90	0.08	2.98	3.94	0.35
CD 5%	17.40	0.24	8.78	11.64	1.03

The data regarding the effect of fertigation on the reducing sugars content of the fruits revealed that different levels of fertigation resulted in significantly higher sugars content compared to soil application of fertilizers is presented in Table 2.

For pooled mean data, significantly maximum reducing sugars (4.218%) was recorded treatment T_8 (197-117-236 kg ha^{-1} NPK through fertigation) followed by treatment T_7 (171-102-205 kg ha^{-1} NPK through fertigation) recorded (4.194%). However, the minimum reducing sugars (3.118%) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application). Significantly maximum non reducing sugars (4.164%) was recorded in treatment T_8 (197-117-236 kg ha^{-1} NPK through fertigation) followed by treatment T_7 (171-102-205 kg ha^{-1} NPK through fertigation) recorded (3.993%). While, the minimum non reducing sugars (2.862%) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application). However, significantly maximum total sugars (8.381%) were recorded in treatment T_8 (197-117-236 kg ha^{-1} NPK through fertigation) followed by treatment T_7 (171-102-205 kg ha^{-1} NPK through fertigation) recorded (8.187%). While, the minimum total sugars (5.980%) were recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application). For pooled mean, significantly highest Total Soluble Solid (12.77 ˚Brix) under treatment T_8 (197-117-236 kg ha^{-1} NPK through fertigation) which was at par with treatment T_7 (12.27 ˚Brix) and T_9 (11.64 ˚Brix) respectively. However, the lowest Total Soluble Solid (10.25 ˚Brix) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application). Whereas, for pooled mean data, significantly the minimum acidity (0.320%) was recorded in the treatment T_8 (197-117-236 kg ha^{-1} NPK through fertigation) which was at par with treatment T_7 (171-102-205 kg ha^{-1} NPK through fertigation) recorded (0.340%). While, the maximum acidity (0.486%) was recorded in treatment T_1 (171-93-93 kg ha^{-1} NPK through soil application).

The results of the present investigation clearly indicated that, different fertigation levels exerted a significant influence on the quality attributes of guava fruits, particularly in terms of reducing sugars and non-reducing sugars. Higher fertigation levels, especially those approaching the upper range of the recommended NPK levels, tended to enhance the accumulation of both reducing and non-reducing sugars. This improvement might be attributed to the adequate and timely supply of nutrients through fertigation, which ensures optimum photosynthetic activity, efficient translocation of assimilates, and enhanced enzymatic conversion of carbohydrates during fruit development. The increased availability of potassium, in particular, is known to promote sugar synthesis and accumulation, thereby improving the sweetness and overall palatability of the fruit (Yadav *et al.*, 2011) [19]. Similar positive effects of balanced fertigation on sugar content in guava have been reported by earlier researchers (Sharma *et al.*, 2018; Singh *et al.*, 2020) [14, 15], indicating that nutrient-rich fertigation regimes can play a decisive role in achieving superior fruit quality under high-density planting systems.

Among the different fertigation levels, treatment T_8 (197-117-236 kg ha^{-1} NPK through fertigation) recorded the highest Total Soluble Solids (TSS) in guava fruits. Among different fertigation levels, higher doses produced better quality fruits. It might be due to fertigation of higher levels of fertilizers *i.e.*, treatments T_8 (197-117-236 kg ha^{-1} NPK through fertigation), T_7 (171-102-205 kg ha^{-1} NPK through fertigation) and T_9 (222-133-267 kg ha^{-1} NPK through fertigation) enhanced plant growth and facilitated greater carbohydrate accumulation in fruits. During subsequent fruit development, stored starch was hydrolyzed into sugars, resulting in increased TSS and reduced acidity. The decline in titratable acidity with increasing fertigation levels can be attributed to the conversion of organic acids into sugars and their utilization for respiration during ripening (Gupta & Bramachari, 2004) [5]. Fertigation also ensures a consistent moisture and nutrient regime in the rhizosphere, thereby improving nutrient availability. Similar results were reported by Kumawat (2013) [8], who observed higher TSS and lower acidity in guava with increased nutrient application through fertigation. Conversely, soil application of fertilizers showed higher acidity, possibly due to slower starch-to-sugar conversion. Rai *et al.* (2002) [11] reported that N and P application (220 g tree^{-1} year^{-1}) significantly influenced TSS, while phosphorus specifically affected acidity in litchi. These findings align with earlier observations in banana by Nateshbeena *et al.* (1993) [10] and Tirkey *et al.* (2003) [18].

Table 2: Effect of fertigation levels on chemical quality parameters of guava (pooled mean).

Treatments	Reducing sugars (%)	Non reducing sugars (%)	Total sugars (%)	TSS (˚Brix)	Titratable acidity (%)
T_1	3.118	2.862	5.980	10.25	0.486
T_2	3.194	2.946	6.140	10.50	0.387
T_3	3.245	2.994	6.238	11.25	0.344
T_4	3.385	3.476	6.861	11.42	0.341
T_5	3.231	3.313	6.544	10.60	0.442
T_6	3.215	3.116	6.331	10.48	0.445
T_7	4.194	3.993	8.187	12.28	0.340
T_8	4.218	4.164	8.381	12.77	0.320
T_9	4.174	3.764	7.937	11.64	0.343
T_{10}	3.275	3.542	6.817	11.24	0.419
T_{11}	3.255	3.444	6.700	10.60	0.425
F test	Sig	Sig	Sig	Sig	Sig
SE(m)$\pm$	0.007	0.038	0.036	0.39	0.007
CD 5%	0.021	0.112	0.106	1.15	0.021

Conclusion

Based on the findings, it can be concluded that the fertigation level of 197-117-236 kg ha^{-1} NPK significantly improved the physical quality and chemical quality parameters of guava under high-density planting. This treatment enhanced key physical and chemical quality parameters, including average fruit weight (g), average fruit diameter (cm), average fruit volume (cc), average pulp weight (g) and pulp: seed ratio and reducing sugars (%), non-reducing sugars (%), total sugars (%), Total Soluble Solids (˚B), and titratable acidity (%) respectively.

References

1. Adsule RN, Kadam SS. Guava. In: Kadam SS, Salunkhe GS, editors. Handbook of fruit science and technology: Production, composition, storage, and processing. CRC Press; 1995. p. 419-433.
2. Bollard EG. The physiology and nutrition of developing fruits. In: Hulme AC, editor. The biochemistry of fruits and their products. International Academic Press, London; 1970. p. 387-425.
3. Boora RS, Singh D, Siddiqui S, Verma SL. Response of sapota to NPK fertilization. Haryana J Hort Sci. 2002;31:15-17.
4. Firake NN, Kumbhar DB. Effect of different levels of N, P and K fertigation on yield and quality of pomegranate. J Maharashtra Agric Univ. 2002;27(2):146-148.
5. Gupta RK, Brahmachari VS. Effect of foliar application of urea, potassium nitrate and NAA on fruit retention, yield and quality of mango cv. Bombai. Orissa J Hort. 2004;32(2):7-9.
6. Ingle HV, Ingle SH, Ghive D. Fertigation studies in acid lime. Ann Plant Physiol. 2006;20:277-278.
7. Kumar R, Singh K, Sharma RR. Effect of fertigation on productivity and quality of horticultural crops. J Hortic Sci. 2007;2(2):87-99.
8. Kumawat KL. Assessment of spacing and fertigation schedule of guava (*Psidium guajava* L.) under ultra high-density planting system. PhD Thesis. Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur (India); 2013.
9. Kumawat KL, Sarolia DK, Kaushik RA, Jodha AS. Effect of irrigation and fertigation scheduling on growth, flowering, yield and economics of guava cv. Lalit under ultra high-density planting system. Indian J Hortic. 2017;74(3):362-368.
10. Nateshbeena B, Jayachandran BK, Kumar N. Effect of fertigation on growth and yield of banana. South Indian Hortic. 1993;41(5):297-300.
11. Rai M, Dey P, Gangopadhyay KK, Das B, Nath V, Reddy NN, Singh HP. Influence of nitrogen, phosphorus and potassium on growth parameters, leaf nutrient composition and yield of litchi (*Litchi chinensis*). Indian J Agric Sci. 2002;72:267-270.
12. Ramniwas R, Meena RS, Singh JP. Response of guava to different levels of fertigation under drip irrigation system. Indian J Hortic. 2012;69(1):78-82.
13. Rao KVR, Gangwar S, Bajpai A, Chourasiya L, Soni K. Influence of growth, yield and quality of guava (*Psidium guajava* L.) by drip irrigation and fertigation. J Appl Nat Sci. 2017;9(1):642-645.
14. Sharma R, Awasthi RP, Kaushik RA. Fertigation for sustainable guava production: A review. J Pharmacogn Phytochem. 2018;7(6):1431-1436.
15. Singh G, Singh AK, Singh CP. Effect of fertigation on growth, yield and quality of guava (*Psidium guajava* L.) under high-density planting system. J Pharmacogn Phytochem. 2020;9(5):2326-2330.
16. Singh P, Singh AK, Sahu K. Irrigation and fertigation of pomegranate cv. Ganesh in Chhattisgarh. Indian J Hortic. 2006;63(2):148-151.
17. Thakur SK, Singh P. Studies on fertigation of mango cv. Amrapali. Ann Agric Res. 2004;25:415-417.
18. Tirkey AS, Singh JP, Sinha RK. Effect of different levels of fertigation on banana yield under drip irrigation. Indian J Hortic. 2003;60(2):159-162.
19. Yadav P, Lal RL, Pandey C. Effect of different levels of fertigation on yield, quality and leaf nutrient status of litchi (*Litchi chinensis* Sonn.) cv. Rose Scented. Prog Hortic. 2011;43(2):276-280.