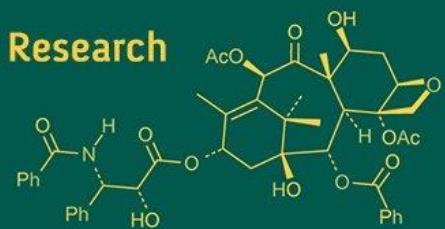
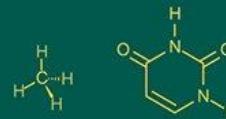
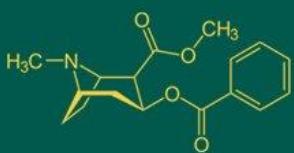


# International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693  
 ISSN Online: 2617-4707  
 NAAS Rating (2025): 5.29  
 IJABR 2025; SP-9(12): 1515-1518  
[www.biochemjournal.com](http://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<sup>-1</sup> 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<sup>-1</sup> NPK through fertigation closely followed by 171-102-205 kg ha<sup>-1</sup> 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<sup>th</sup> 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) <sup>[1]</sup>. 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) <sup>[7]</sup>. 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<sup>-1</sup> NPK (T<sub>1</sub>), 171-93-93 kg ha<sup>-1</sup> NPK (T<sub>2</sub>), 197-107-107 kg ha<sup>-1</sup> NPK (T<sub>3</sub>), 222-122-122 kg ha<sup>-1</sup> NPK (T<sub>4</sub>), 145-79-79 kg ha<sup>-1</sup> NPK (T<sub>5</sub>), 120-66-66 kg ha<sup>-1</sup> NPK (T<sub>6</sub>), 171-102-205 kg ha<sup>-1</sup> NPK (T<sub>7</sub>), 197-117-236 kg ha<sup>-1</sup> NPK (T<sub>8</sub>), 222-133-267 kg ha<sup>-1</sup> NPK (T<sub>9</sub>), 145-87-174 kg ha<sup>-1</sup> NPK (T<sub>10</sub>) and 120-72-143 kg ha<sup>-1</sup> NPK (T<sub>11</sub>) 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<sub>8</sub> (197-117-236 NPK kg ha<sup>-1</sup> as fertigation) which was at par with treatment T<sub>7</sub>, (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) T<sub>9</sub> (222-133-267 kg ha<sup>-1</sup> NPK through fertigation and T<sub>4</sub> (222-122-122 NPK kg ha<sup>-1</sup> 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<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> NPK through soil application). However, for pooled mean data, significantly maximum average fruit volume (194.74 cc) was recorded in treatment T<sub>8</sub> (197-117-236 NPK kg ha<sup>-1</sup> as fertigation) which was at par with treatment T<sub>7</sub> and T<sub>9</sub>, respectively. While, the minimum average fruit volume (122.89 cc) was recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup>

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<sub>8</sub> (197-117-236 NPK kg ha<sup>-1</sup> as fertigation) which was at par with treatment T<sub>7</sub> respectively. While, the lowest average pulp weight (106.71 g) and pulp: seed ratio (16.57) was recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> 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 gibberellin 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)<sup>[12]</sup> enlargement of fruit cells, and the accumulation of assimilates in intercellular spaces (Bolland, 1970)<sup>[2]</sup> along with enhanced current photosynthesis that supports better fruit development (Thakur & Singh, 2004)<sup>[17]</sup>. The improvement in fruit diameter, pulp weight, and pulp-seed ratio under the treatment T<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation) and treatment T<sub>7</sub> (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) might be due to primarily attributed to enhanced vegetative growth.

Similar findings were reported by Boora *et al.* (2002)<sup>[3]</sup> in sapota, and a comparable trend was observed by Firake and Kumbhar (2002)<sup>[4]</sup> in pomegranate, as well as by Ramniwas *et al.* (2012a)<sup>[12]</sup>, Kumawat *et al.* (2017)<sup>[9]</sup>, and Rao *et al.* (2017)<sup>[13]</sup> in guava under high-density planting systems. Singh *et al.* (2006)<sup>[16]</sup> 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)<sup>[6]</sup> 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 <sub>1</sub>	178.64	5.34	122.89	106.71	16.57
T <sub>2</sub>	187.53	5.84	139.02	119.80	19.19
T <sub>3</sub>	194.80	6.70	183.84	123.91	19.67
T <sub>4</sub>	215.54	7.34	185.86	133.73	21.17
T <sub>5</sub>	185.50	5.72	133.75	113.00	18.07
T <sub>6</sub>	184.33	5.40	130.67	110.83	17.72
T <sub>7</sub>	221.18	7.35	191.27	155.13	24.32
T <sub>8</sub>	231.05	7.51	194.74	161.89	25.28
T <sub>9</sub>	217.19	7.31	186.71	143.90	22.66
T <sub>10</sub>	197.07	6.66	146.98	124.82	19.80
T <sub>11</sub>	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<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation) followed by treatment T<sub>7</sub> (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) recorded (4.194%). However, the minimum reducing sugars (3.118%) was recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> NPK through soil application). Significantly maximum non reducing sugars (4.164%) was recorded in treatment T<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation) followed by treatment T<sub>7</sub> (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) recorded (3.993%). While, the minimum non reducing sugars (2.862%) was recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> NPK through soil application). However, significantly maximum total sugars (8.381%) were recorded in treatment T<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation) followed by treatment T<sub>7</sub> (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) recorded (8.187%). While, the minimum total sugars (5.980%) were recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> NPK through soil application). For pooled mean, significantly highest Total Soluble Solid (12.77 °Brix) under treatment T<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation) which was at par with treatment T<sub>7</sub> (12.27 °Brix) and T<sub>9</sub> (11.64 °Brix) respectively. However, the lowest Total Soluble Solid (10.25 °Brix) was recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> NPK through soil application). Whereas, for pooled mean data, significantly the minimum acidity (0.320%) was recorded in the treatment T<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation) which was at par with treatment T<sub>7</sub> (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) recorded (0.340%). While, the maximum acidity (0.486%) was recorded in treatment T<sub>1</sub> (171-93-93 kg ha<sup>-1</sup> 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<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> 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<sub>8</sub> (197-117-236 kg ha<sup>-1</sup> NPK through fertigation), T<sub>7</sub> (171-102-205 kg ha<sup>-1</sup> NPK through fertigation) and T<sub>9</sub> (222-133-267 kg ha<sup>-1</sup> 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<sup>-1</sup> year<sup>-1</sup>) 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 <sub>1</sub>	3.118	2.862	5.980	10.25	0.486
T <sub>2</sub>	3.194	2.946	6.140	10.50	0.387
T <sub>3</sub>	3.245	2.994	6.238	11.25	0.344
T <sub>4</sub>	3.385	3.476	6.861	11.42	0.341
T <sub>5</sub>	3.231	3.313	6.544	10.60	0.442
T <sub>6</sub>	3.215	3.116	6.331	10.48	0.445
T <sub>7</sub>	4.194	3.993	8.187	12.28	0.340
T <sub>8</sub>	4.218	4.164	8.381	12.77	0.320
T <sub>9</sub>	4.174	3.764	7.937	11.64	0.343
T <sub>10</sub>	3.275	3.542	6.817	11.24	0.419
T <sub>11</sub>	3.255	3.444	6.700	10.60	0.425
F test	Sig	Sig	Sig	Sig	Sig
SE(m)±	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<sup>-1</sup> 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.

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