Original Research Article……….

International Journal of Agricultural Invention

(online available at www.agriinventionjournal.com)

International Journal of Agricultural Invention 11(1): 1-5: January-June, 2026

ISSN: 2456 – 1797 (P)

Effect of zinc and iron application on growth and yield of Guava (*Psidium guajava* L.) cv. Hisar Safeda

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ARTICLE INFO

Original Research Article
Received on January 02, 2026
Revised on January 07, 2026
Accepted on February 01, 2026
Published on February 05, 2026

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PUBLICATION INFO
International Journal of Agricultural Invention (IJAI)
RNI: UPENG/2016/70091
ISSN: 2456-1797 (P)
Vol.: 11, **Issue:** 1, **Pages:** 1-5
Journal Homepage URL
http://agriinventionjournal.com/
DOI: 10.46492/IJAI/2026.11.1.1

ABSTRACT

The present investigation entitled "Effect of zinc and iron application on growth and yield of Guava (*Psidium guajava* L.) cv. Hisar Safeda" was conducted during 2024 at the Department of Horticulture, Tantia University, Sri Ganganagar, Rajasthan, under irrigated North-Western plain zone conditions. The experiment was laid out in a randomized block design with eight treatments replicated thrice. The treatments were: T_1 (Zn 0.5%), T_2 (Zn 1.0%), T_3 (Zn 2.0%), T_4 (Fe 0.5%), T_5 (Fe 1.0%), T_6 (Fe 2.0%), T_7 (Zn 0.5% + Fe 0.5%) and T_8 (control). The results revealed that foliar application of micronutrients significantly improved vegetative growth, flowering, and yield attributes. The maximum plant height increase (2.80 m) was recorded in T_7 (Zn 0.5% + Fe 0.5%), while the minimum (1.95 m) was observed in T_8 (control). The number of branches per plant was highest in T_7 ((Zn 0.5% + Fe 0.5%) and lowest in T_8 (6.8, control). The branch length was maximum in T_7 (2.45 m), (Zn 0.5% + Fe 0.5%) and minimum in T_8 (1.65 cm, control). Flowering attributes also responded positively. The maximum flowers per branch (9.4) were recorded in T_7 (Zn 0.5% + Fe 0.5%), whereas the minimum (5.6) was observed in T_8 (control). Yield parameters showed remarkable improvement with combined application. The highest number of fruits per plant (58) was obtained in T_7 (Zn 0.5% + Fe 0.5%), while the lowest (28) was found in T_8 (control). The average fruit weight was maximum in T_7 (126.5 g, Zn 0.5% + Fe 0.5%) and minimum in T_8 (102.3 g, control). The fruit yield per plant was highest in T_7 (18.45 kg/plant, Zn + Fe 0.5% each) and lowest in T_8 (6.25 kg/plant, control). Fruit size attributes followed the same trend, with maximum fruit length (7.2 cm) and fruit diameter (7.0 cm) in T_7 (Zn 0.5% + Fe 0.5%), while the minimum values (5.8 cm length and 5.4 cm diameter) were observed in T_8 (control). Overall, the combined foliar application of ($ZnSO_4$ + $FeSO_4$, T_7) proved significantly superior over individual nutrient applications, enhancing both growth and yield parameters of guava cv. Hisar Safeda. Hence, foliar application of Zn + Fe (0.5%) is recommended for improving productivity and fruit quality under semi-arid conditions of Rajasthan.

KEYWORDS

Guava, Zinc, Iron, Growth, Yield, Hisar Safeda

HOW TO CITE THIS ARTICLE

Kumar, A., Alka, Neetu, Renuka (2026) Effect of zinc and iron application on growth and yield of Guava (*Psidium guajava* L.) cv. Hisar Safeda, *International Journal of Agricultural Invention*, 11(1): 1-5. DOI: 10.46492/IJAI/2026.11.1.1

Guava (*Psidium guajava* L.), belonging to the family Myrtaceae, is one of the most important fruit crops cultivated in tropical and subtropical regions of the world. In India, guava occupies a prominent position in horticulture due to its wide adaptability to diverse agro-climatic conditions, superior nutritional profile, and high consumer preference. It is commonly referred to as the "apple of the tropics" and the "poor man's apple" because of its affordability and rich nutritional value. Guava is an excellent source of vitamin C, pectin, natural sugars, essential minerals, and antioxidants, making it a vital fruit for health and nutritional security. Among the commercial guava cultivars grown in India, Hisar Safeda has gained popularity due to its vigorous growth habit, prolific bearing capacity, attractive white pulp, and exceptionally high ascorbic acid content.

Despite these desirable characteristics, guava productivity and fruit quality are often constrained by nutritional imbalances prevailing in commercial orchards. Micronutrient deficiencies, particularly zinc (Zn) and iron (Fe), are widely reported across guava-growing regions and pose serious challenges to sustainable production According to the National Horticulture Board (NHB, 2023), the total guava production in the country during 2023-24 was estimated at 4,403.56 thousand metric tonnes (Anonymous, 2024**)**. Zinc plays a crucial role in several physiological and biochemical processes in plants. It functions as a cofactor for many enzymes and is involved in protein metabolism, auxin biosynthesis, carbohydrate utilization, and regulation of growth. Zinc deficiency in guava leads to reduced leaf size, stunted growth, impaired flowering, and ultimately lower yields.

Iron is an essential element for chlorophyll synthesis, respiration, and energy transfer within the plant system. Deficiency of iron is commonly expressed as interveinal chlorosis of young leaves, reduced photosynthetic activity, and poor fruit development. Foliar feeding enables rapid absorption of nutrients and their direct utilization by metabolically active plant tissues. Several studies conducted on different fruit crops have reported significant improvements in vegetative growth, flowering, yield, and fruit quality following foliar application of zinc and iron (Rupakshi and Satpal Baloda, 2020). The individual effects of zinc and iron have been studied; limited information is available on their combined or synergistic effects in guava, particularly in cv. Hisar Safeda. Considering the importance of guava in Indian horticulture and the significant contribution of Rajasthan to its production, there is a clear need for systematic evaluation of integrated micronutrient management practices. The combined application of zinc and iron has the potential to enhance plant growth, optimize yield, and improve fruit quality, thereby increasing economic returns and contributing to nutritional security.

Materials and Methods

The present investigation entitled “Effect of zinc and iron application on growth and yield of Guava (*Psidium guajava* L.) cv. Hisar Safeda” was conducted during the cropping season 2024-2025.

This research is provides comprehensive details of the experimental materials, methodological approaches, and analytical procedures employed for evaluating various growth, yield, and quality parameters throughout the investigation period.

Location and Experimental Design

The field experiment was executed at the research farm/experimental field of Department of Horticulture, Faculty of Agriculture, Tantia University, Sri Ganganager, Rajasthan. The study was conducted in the Irrigated North-Western Plain Zone (1b) of Rajasthan. The experiment was conducted using a randomized block design (RBD) comprising eight treatments with three replications, resulting in a total of 24 experimental plants. Each plant was treated as an independent experimental unit. The treatments involved foliar application of zinc and iron at varying concentrations, applied either individually or in combination, in addition to a control treatment. The detailed treatment structure is presented in table 1. The experimental layout was carefully planned to maintain uniform spacing between treatment units and to avoid any cross-contamination of foliar sprays between adjacent trees. Each treatment was randomly assigned within blocks to eliminate systematic bias and ensure that the observed responses could be attributed specifically to the applied treatments rather than positional or environmental factors.

Table1. Treatment Details

Treatment	Treatments Detail
T_1	Zinc 0.5% ($ZnSO_4$)
T_2	Zinc 1.0% ($ZnSO_4$)
T_3	Zinc 2.0% ($ZnSO_4$)
T_4	Iron 0.5% ($FeSO_4$)
T_5	Iron 1.0% ($FeSO_4$)
T_6	Iron 2.0% ($FeSO_4$)
T_7	Zinc 0.5% + Iron 0.5% ($ZnSO_4$ + $FeSO_4$)
T_8	(Control) Water Spray

Vegetative Parameters

Plant Height (m)

The data clearly indicate that foliar application of micronutrients significantly influenced plant height.

The maximum plant height (2.80 m) was observed in T_7 (Zn 0.5% + Fe 0.5 %), which was found to be significantly superior over all other treatments and control. The minimum plant height (1.95 m) was recorded in the control (T_8). Treatments with higher levels of Zn and Fe alone (T_3 (2.50) and T_6 (2.45) also exhibited significantly higher plant height compared to control, but were inferior to the combined application of Zn+Fe (T_7).

Table 2. Effect of Zinc and Iron Treatments on Plant Height (m)

Treatment	Treatment Details	Plant Height (m)
T_1	Zn 0.5%	2.10
T_2	Zn 1.0%	2.35
T_3	Zn 2.0%	2.50
T_4	Fe 0.5%	2.18
T_5	Fe 1.0%	2.30
T_6	Fe 2.0%	2.45
T_7	Zn 0.5% + Fe 0.5%	2.80
T_8	Control	1.95
	SEm±	0.07m
	CD (P=0.05)	0.22m

Flowering Parameters

Number of Flowers per Branch

The number of flowers per plant was significantly influenced by the application of micronutrients. The maximum number of flowers (9.4) was observed in T_7 (Zn 0.5% + Fe 0.5%), which was found to be significantly superior over all other treatments and control. The lowest number of flowers (5.6) was recorded in the control (T_8). Among the individual nutrient treatments, T_3 (8.3) and T_6 (8.1) showed higher flower production compared to control, though inferior to the combined treatment (T_7).

Table 3. Effect of Zinc and Iron Treatments on Number of Flowers

Treatment	Treatment Details	Number of Flowers
T_1	Zn 0.5%	6.8
T_2	Zn 1.0%	7.6
T_3	Zn 2.0%	8.3
T_4	Fe 0.5%	7.0
T_5	Fe 1.0%	7.9
T_6	Fe 2.0%	8.1
T_7	Zn0.5%+Fe 0.5%	9.4
T_8	Control	5.6
	SEm±	0.27
	CD (P=0.05)	0.82

Yield Attribute

Fruit Yield per Plant (kg)

Fruit yield per plant was significantly affected by the foliar application of micronutrients under Sri Ganganagar climatic conditions. The maximum fruit yield (18.45 kg/plant) was recorded in T_7 (Zn 0.5% + Fe 0.5%), which was significantly superior over all other treatments. The minimum fruit yield (6.25 kg/plant) was recorded in control (T_8). Among the individual nutrient treatments, T_3 (15.60) and T_6 (14.85) recorded higher fruit yield compared to control but were inferior to the combined treatment (T_7).

Table 4. Effect of Zinc and Iron Treatments on Fruit Yield (kg/plant)

Treatment	Treatment Details	Fruit Yield (kg/plant)
T_1	Zn 0.5%	9.85
T_2	Zn 1.0%	12.40
T_3	Zn 2.0%	15.60
T_4	Fe 0.5%	10.75
T_5	Fe 1.0%	13.20
T_6	Fe 2.0%	14.85
T_7	Zn 0.5% + Fe 0.5%	18.45
T_8	Control	6.25
	SEm±	0.42
	CD (P=0.05)	1.25

Conclusion

The present study clearly demonstrated that the foliar application of micronutrients significantly enhanced the growth, Yield, and fruit quality of guava. Among all the treatments, T_7 (Zn 0.5% + Fe 0.5%) consistently proved to be the most effective, in all Parameters. Therefore, the foliar application of Zn 0.5% + Fe 0.5% can be recommended as an effective strategy for improving the Growth and quality as well as yield Parameters of guava cv. Hisar Safeda under the agro-climatic conditions of Sri Ganganagar, Rajasthan.

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