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Effect of different levels of micronutrients on growth and flowering attributes of guava (*Psidium Guajava* L.) fruit in meadow orchard

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Abstract
Guava (*Psidium guajava* L.) being most important cultivated species of Myrtaceae family. It ranks third in vitamin C content (260 mg/100 g) after Barbedose cherry (1500 mg/100 g) and Anola (700 mg/100 g). Guava is one of the most popular fruit of India. It is the fourth most important crop by area and production after mango, bananas and citrus. So, to find out Effect of different levels of Micronutrients on growth & flowering attributes of guava (*Psidium guajava* L.) fruit in meadow orchard; a field experiment was conducted at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.) during the year 2021. The experiment comprised of 11 treatments of different levels of zinc & boron replicated thrice in a Randomized Block Design. The main objective of the experiment was to evaluate the influence of zinc and boron on growth & flowering attributes of guava. The levels of zinc & boron include 0.2%, 0.4%, 0.6%, 0.8%, 1% respectively. From the present investigation 1% boron was found best with, 5.80m Plant height, 6.38 primary branches per plant, 31.85 days required for flowering, 31.33 days required from flowering to fruit set, 126.52 days required from fruit set to maturity & 178.58 flowers per plant. These practices may be passed on to the farmers for obtaining higher returns in this agro-climatic zone.

Keywords: Micronutrients, attributes, meadow, guava, *Psidium guajava* L.

Introduction

Guava (*Psidium guajava* L.) is a widely grown fruit crop in subtropical and tropical areas around the world. Guava belongs to the Myrtaceae family, which has 140 genera and 3000 species worldwide. Guava, sometimes known as the "tropical apple," is one of India's most popular fruits, behind mango, banana, and citrus. Guava is grown in more than 60 countries, with a global yield of over 40 million tonnes (Irshad *et al.*, 2020) [7]. India is the largest guava grower in the world, followed by China and Kenya, with Brazil and Venezuela also making an impression (Gill, 2016; Angulo). It is grown in the states of Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal, Punjab, Assam, Orissa, Gujarat, Karnataka, and Kerala. In India, guava's total area, output, and productivity are approximately 255000 hectares, 4048000 MT, and 15.87 MT/hectare, respectively (NHB, 2015-16) [9].

The guava has three distinct flowering and fruiting seasons. The three distinct flowering seasons are Ambe bahar (February-March), Mrig bahar (June-July), and Hastabahar (October-November), with fruiting periods of July-August, October-December, and February-April, respectively (Shukla *et al.*, 2009) [12].

The traditional way of farming has had problems generating sufficient levels of productivity due to the large tree canopy architecture of guava. As a result, the guava sector has also been transformed by this planting technology, which has enhanced productivity while cutting production costs (Ashwini *et al.*, 2022) [3]. Guava trees are planted at a 2.0m×1.0m spacing, yielding a plant population of 5000 plants per hectare. Because the guava tree takes a lot of nutrients from the soil, fertiliser appears to have a significant impact on guava tree yield. As a result, we need to improve the guava yield potential in this meadow orcharding system. This can be accomplished by increasing guava flowering and fruiting by delivering an optimal dose of nutrients. It has recently been shown that making micronutrients available for plant intake can improve flowering and fruiting. As a result, foliar micronutrient administration to guava crops in a meadow orchard system is projected to improve yield responsiveness.

With this regard Hada *et al.*, (2014) [6] conducted a study to see how varying doses of boron and zinc affected flowering, fruiting, and growth parameters in winter season guava (*Psidium guajava* L.) cv. Sardar. In $ZnSO_4$ (0.8%) + borax (0.4%), the greatest shoot length (38.12 cm), number of leaves (26.23), and leaf area (62.82 cm2) were discovered.
Kumar *et al.*, (2015) [8] also conducted an experiment on guava plants that included foliar sprays of boron, zinc, calcium, and potassium at two stages, namely at fruit set and two weeks after fruit set, and found that foliar spray on 'Pant Prabhat' guava plants showed an increasing trend towards plant height (12.17%) with 0.03% zinc two weeks after fruit set.
Foliar nutrition and growth regulator administration is crucial for improving plant quality and, in comparison, is more effective for speedy plant recovery. Micronutrient spraying improves yield parameters like average fruit weight, number of fruits per tree, and yield per tree. Zinc is an essential component of several enzyme systems in plants that control a wide range of metabolic activities requiring water. Zinc is required for auxin and protein synthesis, seed development, and optimum maturity (Toor *et al.*, 2020) [14]. On the other hand, Pollen viability and fruit set are aided by Boron (Chatzissavvidis, and Antonopoulou, 2020) [4].
In light of the foregoing, the current study, named "Effect of different levels of Micronutrients on growth & flowering attributes of guava (*Psidium guajava* L.) Fruit in meadow orchard" was carried out at SHUATS, Prayagraj, Uttar Pradesh.

Materials and Methods

During the Mrig bahar of 2021, the current research was conducted on 5-year-old Guava plant at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.). The experimental field lies about 8 kilometers from Allahabad city, on the left side of the Allahabad-Rewa Road, near the Yamuna River.
The trial was set up in a randomised block design, with three replications for each of the eleven treatment combinations. Table 1 shows the treatment details and treatment combinations. The present study used 5-year-old uniform healthy bearing Guava trees of the variety Allahabad Safeda grown under similar cultural techniques. Three micronutrient sprays were carried out in three stages during a 30-day period. The first spray was applied prior to flowering, the second during the fruiting period, and the third during the fruit set stage. Plant height (m), number of primary branches per plant, plant spread (E-W & N-S), days required for flowering, days required from flowering to fruit set, days required from fruit set to maturity & number of flowers per plant were all successfully measured to determine the best treatment combination for guava cultivation.

Table 1: Treatment Details & Treatment combinations

S. No	Treatment	Treatment combinations (%)
1	T_0	[Control, Water Spraying]
2	T_1	[0.2% Zinc]
3	T_2	[0.4% Zinc].
4	T_3	[0.6% Zinc]
5	T_4	[0.8% Zinc]
6	T_5	[1.0% Zinc]
7	T_6	[0.2% Boron]
8	T_7	[0.4% Boron]
9	T_8	[0.6% Boron]
10	T_9	[0.8% Boron]
11	T_{10}	[1.0% Boron]

Results and Discussion

Growth attributes

Effect of varying levels of micronutrients on plant height (m), Number of primary branches pe plant & Plant spread (m) (E-W & N-S) of guava is shown in Table 2 and Fig 1. The changes in growth parameters were considerable, since the F Cal value was greater than the F Tab value, according to the data. Treatment T_{10} was shown to be the best, with the maximum plant height of 5.8 m, number of primary branches per plant of Guava i.e.,6.38 & Plant spread (m) (E-W) and (N-S) of Guava i.e., 6 m and 5.9 m respectively. but treatment T_0 Control had the lowest plant height of 3.43 m, number of primary branches per plant of Guava i.e.,4.21 & Plant spread (m) (E-W) and (N-S) of Guava i.e., 4.03 m and 3 m respectively. The above result might be due to B foliar sprays which may have promoted chlorophyll synthesis, resulting in an increase in chlorophyll content and, as a result, higher vegetative growth (Sharma and Bhattacharya, 1994). Also, boron is an essential component of enzymes involved in nitrogen and carbohydrate metabolism, leading in an increase in nitrogen intake by the plant, resulting in increased vegetative growth and hence the number of primary branches per plant and Plant Spread (Alloway, 2008) [2].

Flowering attributes

Days required for flowering

The effect of varying levels of micronutrients on Days required for flowering, Days required from flowering to fruit set, Days required from fruit set to maturity & Number of flowers per plant of guava is shown in Table 3 and Fig 2. Because the F Cal value was greater than the F Tab value, the influence of micronutrient on Flowering attributes of Guava was found to be significant. Treatment T_{10} was determined to be the best, with the lowest Days required for Guava flowering at 31.85 days, Days required from flowering to fruit set of Guava (31.33 days), Days required from fruit set to maturity of Guava i.e., 126.52 days & considerably higher number of flowers per plant of Guava (178.58) where-as control had the highest number of days for flowering, from flowering to fruiting and to maturity and also lowest number of flowers per plant. This result may be due to the foliar application of micronutrients boosts the photosynthetic chemicals inside the plant tissue, which reduces leaf loss and strengthens the plant's ability to persevere. The findings are consistent with Singh *et al.*, 2002, [13] who discovered that applying Zn and B as a foliar spray enhanced the number of leaves while also reducing leaf drop and hastening flowering. Furthermore, in many crops, the quantity of B required for reproductive growth is greater than that required for vegetative growth and this may be the case in guava. (Abd-Allah *et al.*, 2006. & Raj *et al.*, 2012) [1, 10].

Table 2: Effect of different levels of Micronutrients on growth attributes of guava (*Psidium guajava* L.) fruit in meadow orchard

Growth Attributes						
S. No.	**Treatment**	**Treatment combinations**	**Plant Height (m)**	**Number of primary branches per plant**	**Plant Spread (m) (E-W)**	**Plant Spread (m) (N-S)**
1	T_0	Water Spraying	3.43	4.21	4.03	3.00
2	T_1	0.2% Zinc	3.73	4.54	4.21	3.28
3	T_2	0.4% Zinc	4.25	4.98	4.66	3.92
4	T_3	0.6% Zinc	4.75	5.45	5.15	4.55
5	T_4	0.8% Zinc	5.25	5.86	5.60	5.17
6	T_5	1.0% Zinc	5.67	6.27	5.87	5.69
7	T_6	0.2% Boron	4.00	4.75	4.44	3.61
8	T_7	0.4% Boron	4.49	5.21	4.91	4.21
9	T_8	0.6% Boron	5.02	5.63	5.37	4.83
10	T_9	0.8% Boron	5.50	6.07	5.78	5.52
11	T_{10}	1.0% Boron	5.80	6.38	6.00	5.90
		F-Test	S	S	S	S
		S.EM=	0.18	0.15	0.14	0.23
		CD(5%)=	0.52	0.44	0.41	0.69

Table 2: Effect of different levels of Micronutrients on flowering attributes of guava (*Psidium guajava* L.) fruit in meadow orchard

Flowering Attributes						
S. No.	**Treatment**	**Treatment combinations**	**Days required for flowering**	**Days required from flowering to fruit set**	**Days required from fruit set to maturity**	**No of Flowers per plant**
1	T_0	Water Spraying	48.81	40.36	141.65	139.96
2	T_1	0.2% Zinc	46.95	39.39	140.08	144.33
3	T_2	0.4% Zinc	43.10	37.50	136.93	152.51
4	T_3	0.6% Zinc	39.48	35.50	133.83	160.68
5	T_4	0.8% Zinc	36.04	33.66	130.74	168.60
6	T_5	1.0% Zinc	33.25	32.05	127.43	176.06
7	T_6	0.2% Boron	44.99	38.48	138.46	148.36
8	T_7	0.4% Boron	41.32	36.45	135.36	156.41
9	T_8	0.6% Boron	37.74	34.55	132.30	164.64
10	T_9	0.8% Boron	34.36	32.71	128.50	175.73
11	T_{10}	1.0% Boron	31.85	31.33	126.52	178.58
		F-Test	S	S	S	S
		S.EM=	0.50	0.26	0.46	0.23
		CD(5%)=	1.49	0.78	1.37	0.69

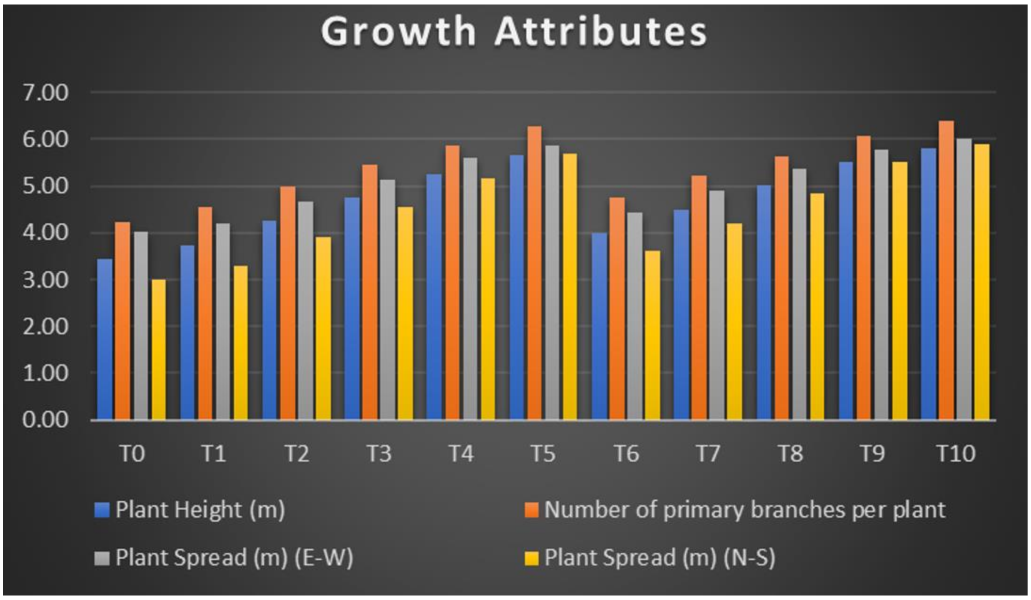

Fig 1: Effect of different levels of Micronutrients on growth attributes of guava (*Psidium guajava* L.) fruit in meadow orchard

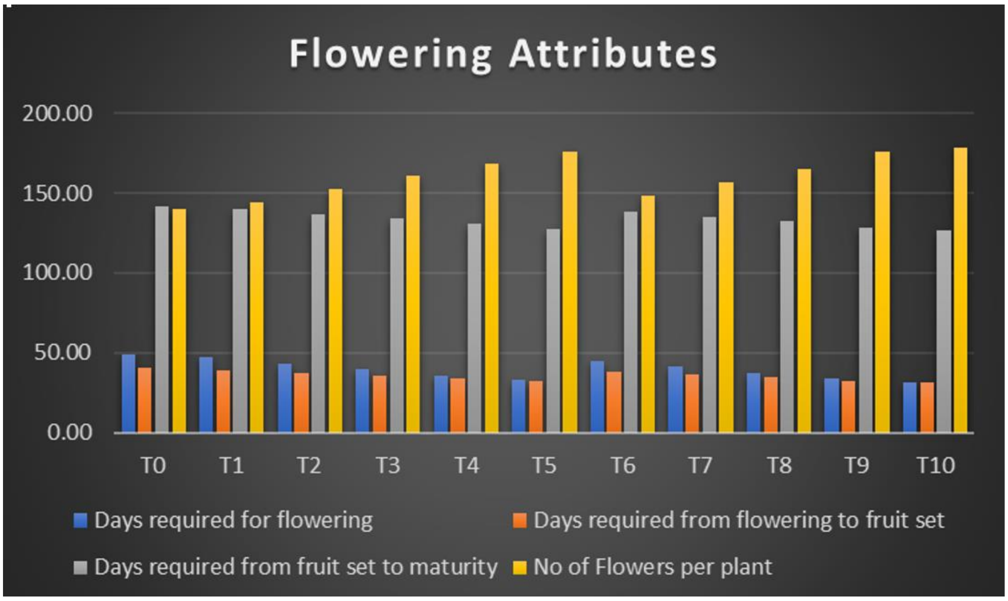

Fig 2: Effect of different levels of Micronutrients on flowering attributes of guava (*Psidium guajava* L.) fruit in meadow orchard

Conclusion

From the present investigation it may be concluded that effect of Treatment T_{10} i.e., 1% Boron was found to be best. The treatment T_{10} i.e., 1% Boron is best in terms of Plant height, number of primary branches per plant, plant spread (E-W & N-S), days required for flowering, days required from flowering to fruiting, days required from fruiting to fruit maturity & number of flowers per plant where-as Treatment T_6 was found at par with T_{11}. Except, for Specific gravity where the effect of micronutrients was found non-significant.

Since this is based on one season trail therefore, further evaluation trails are needed to substantiate the findings.

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