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EFFECT OF FOLIAR FEEDING OF MICRONUTRIENTS ON PHYSICAL PARAMETERS OF WINTER SEASON GUAVA (*PSIDIUM GUAJAVA* L.) CV. SHWETA

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ABSTRACT

To study the Effect of foliar feeding of micronutrients on physical parameters of winter season guava (*Psidium guajava* L.) cv. Shweta were sprayed twice with the micronutrients *viz.,* $CaCl_2$ (0.02%), Borax (0.04%) and $ZnSO_4$ (0.05%), the first spraying was done in 2nd week of September (just before flowering) and second spraying was done after fruit setting in 1st week of October. The treatments comprise T_1 (control), T_2 ($CaCl_2$ 0.2%), T_3 (Borax 0.4%), T_4 ($ZnSO_4$ 0.5%), T_5 ($CaCl_2$ 0.2% + Borax 0.4%), T_6 ($CaCl_2$ 0.2% + $ZnSO_4$ 0.5%) and T_7 (Borax 0.4% + $ZnSO_4$ 0.5%). It was observed that maximum fruit length (9.43 cm), diameter (8.25 cm), weight (218.77 g), fruit volume (195.39 cm^3), specific gravity (1.12), pulp weight (216.04 g), pulp: seed ratio (79.14) and yield per plant (45 kg) was in winter guava cv. Shweta with foliar feeding of Borax 0.4% + $ZnSO_4$ 0.5% (T_7). Overall, the foliar feeding of Borax 0.4% + $ZnSO_4$ 0.5% (T_7) resulted in improved physical attributes of Shweta cultivar of guava.

***Keyword*:** Foliar Feeding, $CaCl_2$, Borax, $ZnSO_4$, Guava and Physical Parameters.

Introduction

Guava (*Psidium guajava* L.), which is also known as the apple of tropics or the poor man's fruit, and belongs to Myrtaceae family, comprising about 150 species. The ordinary guava is a diploid (2n = 22) however, aneuploids, triploids and synthetic triploids (2n = 33) are also possible. (Jaiswal and Amin, 1992). Guava is native to tropical America, ranging from Mexico to Peru (Agnihotri *et al*., 2013).

Heavy clay to extremely light sandy soil with a pH between 4.5 and 8.2 are suitable for guava cultivation. In India, guava has been cultivated since the early 17th century and was domesticated more than 2000 years ago. It is grown in both tropical and subtropical regions up to 1,500 meters above sea level. It requires a mean annual temperature between 23°C to 28°C but is quite adaptable and can tolerate temperatures as low as 15°C and as high as 45°C for short periods and thriving even in the drought conditions prevalent in North India during the summers. An annual rainfall of about 100 cm is sufficient during the rainy season (July-September). However, rainfall during the harvesting period can deteriorate the quality of the fruits. Additionally, the crop is sensitive to water-logging (NHB, 2023).

Guava is the fifth widely grown fruit crop in India, following mango, banana, citrus, and papaya. In fiscal year 2023, volume of guava produced in India is estimated to have amounted to 5.59 million metric tons. The cultivation area of guava was about 359 thousand hectares in the country in 2023 (Statista, 2024).

In recent years, foliar feeding of fruit trees has become increasingly important. According to the foliar application principle, nutrients are rapidly absorbed by leaves and transported to different parts of the plant to meet nutritional requirements efficiently. The present investigation is, therefore, taken to study the effect of

foliar feeding on physical parameters of guava that influences the marketability of the fruits.

Material and Methods

The present investigation was carried out at Main Experimental Station of Horticulture, Acharya Narendra Deva University of Agriculture and Technology, Ayodhya (U.P.) during the year 2023-24. The experiment was conducted in RBD with three replications. The 15 years old uniform vigorous guava cv. Shweta were sprayed twice with the micronutrients *viz.,* $CaCl_2$ (0.02%), Borax (0.04%) and $ZnSO_4$ (0.05%), the first spraying was done in 2nd week of September (just before flowering) and second spraying was done after fruit setting in 1st week of October. The treatments comprise T_1 (control), T_2 ($CaCl_2$ 0.2%), T_3 (Borax 0.4%), T_4 ($ZnSO_4$ 0.5%), T_5 ($CaCl_2$ 0.2% + Borax 0.4%), T_6 ($CaCl_2$ 0.2% + $ZnSO_4$ 0.5%) and T_7 (Borax 0.4% + $ZnSO_4$ 0.5%).

Methos used to record physical attributes of fruits:

Fruit weight: The weight was recorded on the physical balance and average weight per fruit was calculated using following formula:

$$\text{Fruit weight (g)} = \frac{\text{Total weight of fruits (g)}}{\text{Total number of fruits}}$$

Fruit length: The fruit length was measured using vernier calliper and average length of fruit was calculated using following formula:

$$\text{Fruit length (cm)} = \frac{\text{Total length of fruits (cm)}}{\text{Total number of fruits}}$$

Fruit diameter: The diameter of the fruit, used for estimation of fruit length, was measured with the help of vernier calliper and mean value was calculated and expressed in centimetre (cm).

$$\text{Fruit diameter} = \frac{\text{Total diameter of fruits (cm)}}{\text{Total number of fruits}}$$

Fruit volume: The volume was recorded using water displacement method. The fruit volume was calculated as under:

$$V = b\text{-}a$$

Where, V = Volume of fruit (cm^3), b = Final volume of water (ml), a = Initial volume of water (ml)

Pulp weight: The pulp weight is determined by subtracting the seed weight from the total weight of fruit. Pulp weight calculated by following formulae:

Pulp wt. = total weight of fruit – seed weight

Pulp: Seed ratio: The Pulp: Seed ratio was determined by dividing pulp weight by seed weight using following formulae:

$$\text{Pulp : Seed ratio} = \frac{\text{Weight of pulp}}{\text{Weight of seed}}$$

Specific gravity: The formula of specific gravity is given below:

$$\text{Specific gravity} = \frac{[\text{weight of fruit (g)}]}{[\text{volume of fruit } (ml^3)\ 1g\ ml^{-3}\ (\text{water})]}$$

Fruit yield:

The fruits were harvested at full maturity stage from each treatment and weighing them of each picking with the help of electronic balance. It was recorded in expressed in kg per tree.

The data was statistically analysed in MS Excel and OPSTAT software by using analysis of variance (ANOVA) for Randomized Block Design. The analysis of variance of the data was carried out using the techniques as described by Panse and Sukhatme, 1985. The critical difference (CD) was calculated for the effects exhibited significance at 5 per cent level of probability.

Results and Discussion

The experiment was aimed to investigate the effect of micronutrients on the physical characteristics and yield of guava. The results of this experiment are outlined below:

Weight of fruit:

The data regarding fruit weight presented in table 1 and Fig. 1, reveals that the foliar spraying of micronutrients in all treatments significantly increased fruit weight compared to the control. The highest (218.77 g) fruit weight was observed with the foliar feeding of Borax 0.4% + $ZnSO_4$ 0.5% (T_7), followed by (200.11 g) with the foliar feeding of $CaCl_2$ 0.2% + Borax 0.4% (T_5) and 181.00 g with $CaCl_2$ 0.2% + $ZnSO_4$ 0.5% (T_6). Conversely, the lowest (141.00 g) fruit weight was recorded under the control (T_1).

This increase in guava fruit weight could be attributed to the fact that mineral nutrients (Boron) appeared to play an indirect role in hastening the process of cell division and cell elongation, resulting in increased fruit size, weight, and volume, as well as a direct role to improve the translocation of food and minerals from other parts of the plant towards the developing fruits, which are an extremely active metabolic sink. Boron has been observed to have a positive association with the initial phases of fruit development (Heinicke, 1942). Similar, results were

reported by Meena *et al. (*2023) and Kumar *et al.* (2015) in guava. Comparable finding was also reported by Bhowmick and Banik (2011) in mango cv. Himsagar and Rajput *et al.* (1976) in mango.

Length of fruits

The data concerning fruit length presented in table 1 and Fig. 2, indicates that the length of fruits across various treatments was significantly influenced by foliar sprays of $CaCl_2$, Borax and $ZnSO_4$. The maximum (9.43 cm) fruit length was achieved with the foliar spray of Borax 0.4% + $ZnSO_4$ 0.5% (T_7), followed by 8.73 cm with the foliar feeding of $CaCl_2$ 0.2% + Borax 0.4% (T_5) and 7.62 cm with $CaCl_2$ 0.2% + $ZnSO_4$ 0.5% (T_6). Conversely, the minimum fruit length (6.01 cm) was recorded under the control (T_1).

Comparable finding was reported by Suman *et al.* (2021) in guava and Bhowmick and Banik (2011) in mango cv. Himsagar. Earlier, Rath *et al.* (1980) reported that spraying of zinc sulphate increased fruit weight in mango by increasing fruit length and diameter.

Fruit diameter

The results on fruit diameter for the various treatments presented in table 1 and fig 3, reveal that the foliar spray of $CaCl_2$, Borax, and $ZnSO_4$ has a considerable impact on fruit length. The highest (8.25 cm) fruit diameter was achieved with a foliar spray of Borax 0.4% + $ZnSO_4$ 0.5% (T_7), followed by a foliar spray of $CaCl_2$ 0.2% + Borax 0.4% (T_5) and $CaCl_2$ 0.2% + $ZnSO_4$ 0.5% (T_6). The lowest (5.12cm) fruit diameter was recorded with the control (T_1).

Among all the nutrient treatments, the increment of both morphological as well as yield attributing characteristics may be linked to the role of boron and in the present study helped to optimizing the plant growth attributes by expediting the transportation of photosynthates from leaves to maturing fruits. The swift expansion in the fruit size (polar and equatorial diameter) was observed with the application of boron could be attributed to factors such as increased cell division, cell elongation and elevated fruit moisture content (Rajput and Chand, 1976). The increase in fruit size (length and diameter) caused by borax treatment might be related to its role in cell division, cell elongation, and moisture content of the fruits. Comparable finding were reported by Suman *et al.* (2021), Lenka *et al.* 2019 in guava and Bhowmick and Banik (2011) in mango cv. Himsagar.

Fruit volume

The data recorded on fruit volume presented in table 1 and fig 4, indicates that the foliar feeding of various treatments significantly influenced the fruit volume. The highest fruit volume was 195.39 cm^3 with foliar treatment of Borax 0.4% + $ZnSO_4$ 0.5% (T_7), followed by 180.27 cm^3 with foliar feeding of $CaCl_2$ 0.2% + Borax 0.4% (T_5) and 166.05 cm^3 with $CaCl_2$ 0.2% + $ZnSO_4$ 0.5% (T_6). A minimum fruit volume of 141.02 cm^3 was observed in the control (T_1).

Zinc is known to be crucial for the biosynthesis of auxin (IAA) because it activates the enzyme tryptophane synthetase (Brahmachari and Kumar, 1997). The amount of zinc enhanced the auxin content while also acting as a catalyst in the oxidation process. The beneficial effect of zinc sulphate may be due to the fact that it accelerates the activity of indole acetic acids and that of other growth stimulating compounds thereby increases the availability of photosynthates. Zinc treatment would increase the weight and volume of fruits due to faster sugar cell proliferation and increased pulp content. Comparable finding was also reported by Meena *et al.* (2023) and Kumar *et al.* (2015) in guava.

Specific gravity of fruits

Data regarding the specific gravity of fruits under different treatments are shown in table 2 and fig 5. The highest (1.12) specific gravity of fruits was observed with the foliar feeding of Borax 0.4% + $ZnSO_4$ 0.5% (T_7) followed by guava fruits with a specific gravity of 1.11 recorded with the foliar spray of $CaCl_2$ 0.2% + Borax 0.4% (T_5). Conversely, the lowest (1.00) fruit specific gravity was noted under the control condition (T_1). The accumulation of more total solids into treated fruits in comparison to control might be the reason of increased specific gravity. Comparable finding was also reported by Samant *et al.* (2008) in ber cv. Umran and suman *et al.* (2021) in mango.

Pulp weight

The data concerning the pulp weight of fruits under various treatments are detailed in table 2 and fig.6. The highest (216.04 g) pulp weight of fruits was observed with the foliar spray of Borax 0.4% + $ZnSO_4$ 0.5% (T_7), followed by guava fruits with a pulp weight of 196.68 g recorded under the foliar spray of $CaCl_2$ 0.2% + Borax 0.4% (T_5). Conversely, the lowest (137.29 g) pulp weight was noted in the control (T_1). Comparable finding also reported by Ram *et al.* (2000) in mandarin and Ram *et al.* (2005) in ber. Also reported by Bhowmick and Banik (2011) on mango cv. Himsagar.

Pulp: Seed ratio

The data concerning the Pulp: Seed ratio of fruits under various treatments, which significantly

influenced them, are presented in table 2 and fig. 7. The maximum (79.14) Pulp: Seed ratio of fruits was recorded with the foliar spray of Borax 0.4% + $ZnSO_4$ 0.5% (T_7) followed by guava fruits with a Pulp: Seed ratio of 57.35 recorded under the foliar spray of Borax 0.4% (T_5). Conversely, the lowest (37.01) Pulp: Seed ratio was recorded in the control (T_1). Similar result reported by Kumar *et al.* (2015) in guava.

Yield/plant

The data concerning plant yield, presented in table 2 and fig.8, indicate that the foliar feeding of various treatments significantly influenced the plant yield. The maximum plant yield (45.00 Kg/plant) was observed with the foliar feeding of Borax 0.4% + $ZnSO_4$ 0.5% (T_7), followed by guava plant yield (32.33 Kg/plant) recorded under the foliar spray of $CaCl_2$ 0.2% + Borax 0.4% (T_5). Conversely, the minimum (24.00 Kg/plant) plant yield was noted in the control (T_1). Similar results reported by Adak *et al.* (2020) in guava cv. Shweta. Also reported by Meena *et al.* (2023) and Suman *et al.* (2021) in guava.

Conclusion

The study shows that two foliar feedings of Borax 0.4% + $ZnSO_4$ 0.5% (T_7) during the winter season on guava cv. Shweta leads to significant enhancements in the physical attributes of the fruits. This treatment results in highest fruit length (9.43 cm), diameter (8.25 cm), weight (218.77 g), volume (195.39 cm^3), specific gravity (1.12), pulp weight (216.04 g), pulp-to-seed ratio (79.14), and yield per plant (45 kg).

Table 1 : Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on physical attributes of winter season guava cv. Shweta.

Physical Attributes / Treatments	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cm^3)
T_1 - Control	141.00	6.01	5.12	141.02
T_2 - $CaCl_2$ 0.2%	152.00	6.42	5.57	146.15
T_3 - Borax 0.4%	171.00	7.03	5.95	158.34
T_4 - $ZnSO_4$ 0.5%	161.00	6.81	5.78	151.94
T_5 - $CaCl_2$ 0.2% + Borax 0.4%	200.11	8.73	8.04	180.27
T_6 - $CaCl_2$ 0.2% + $ZnSO_4$ 0.5	181.00	7.62	6.47	166.05
T_7 - Borax 0.4% + $ZnSO_4$ 0.5%	218.77	9.43	8.25	195.39
SEm±	2.30	0.10	0.17	2.51
CD at 5%	7.09	0.30	0.52	7.74

Table 2: Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on physical attributes of winter season guava cv. Shweta.

Physical Attributes / Treatments	Specific gravity	Pulp weight (g)	Pulp: Seed ratio	Yield/plant (Kg)
T_1 - Control	1.00	137.29	37.01	24.00
T_2 - $CaCl_2$ 0.2%	1.04	148.38	40.99	26.00
T_3 - Borax 0.4%	1.08	167.75	51.62	33.00
T_4 - $ZnSO_4$ 0.5%	1.06	157.66	47.20	30.00
T_5 - $CaCl_2$ 0.2% + Borax 0.4%	1.11	196.68	57.35	40.00
T_6 - $CaCl_2$ 0.2% + $ZnSO_4$ 0.5	1.09	177.48	50.42	37.00
T_7 - Borax 0.4% + $ZnSO_4$ 0.5%	1.12	216.04	79.14	45.00
SEm±	0.01	2.30	0.74	1.07
CD at 5%	0.03	7.09	2.28	3.29

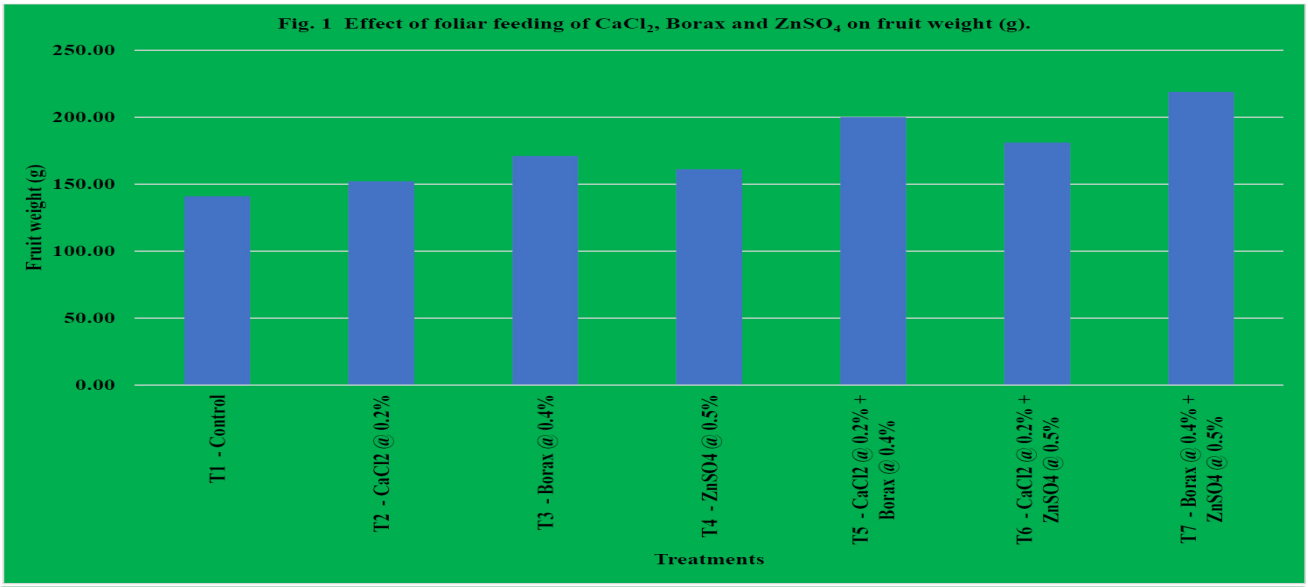


Fig. 1 Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on fruit weight (g).
250.00
200.00
150.00
100.00
50.00
0.00
Fruit weight (g)
T1 - Control
T2 - CaCl2 @ 0.2%
T3 - Borax @ 0.4%
T4 - ZnSO4 @ 0.5%
T5 - CaCl2 @ 0.2% + Borax @ 0.4%
T6 - CaCl2 @ 0.2% + ZnSO4 @ 0.5%
T7 - Borax @ 0.4% + ZnSO4 @ 0.5%
Treatments

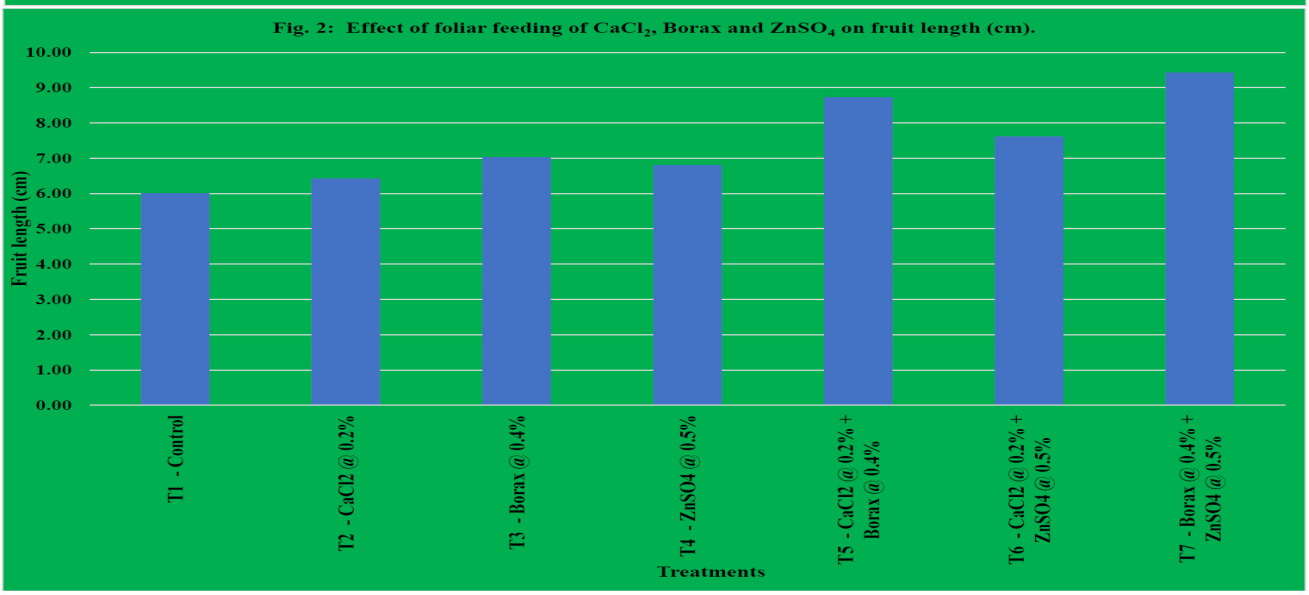


Fig. 2: Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on fruit length (cm).
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Fruit length (cm)
T1 - Control
T2 - CaCl2 @ 0.2%
T3 - Borax @ 0.4%
T4 - ZnSO4 @ 0.5%
T5 - CaCl2 @ 0.2% + Borax @ 0.4%
T6 - CaCl2 @ 0.2% + ZnSO4 @ 0.5%
T7 - Borax @ 0.4% + ZnSO4 @ 0.5%
Treatments

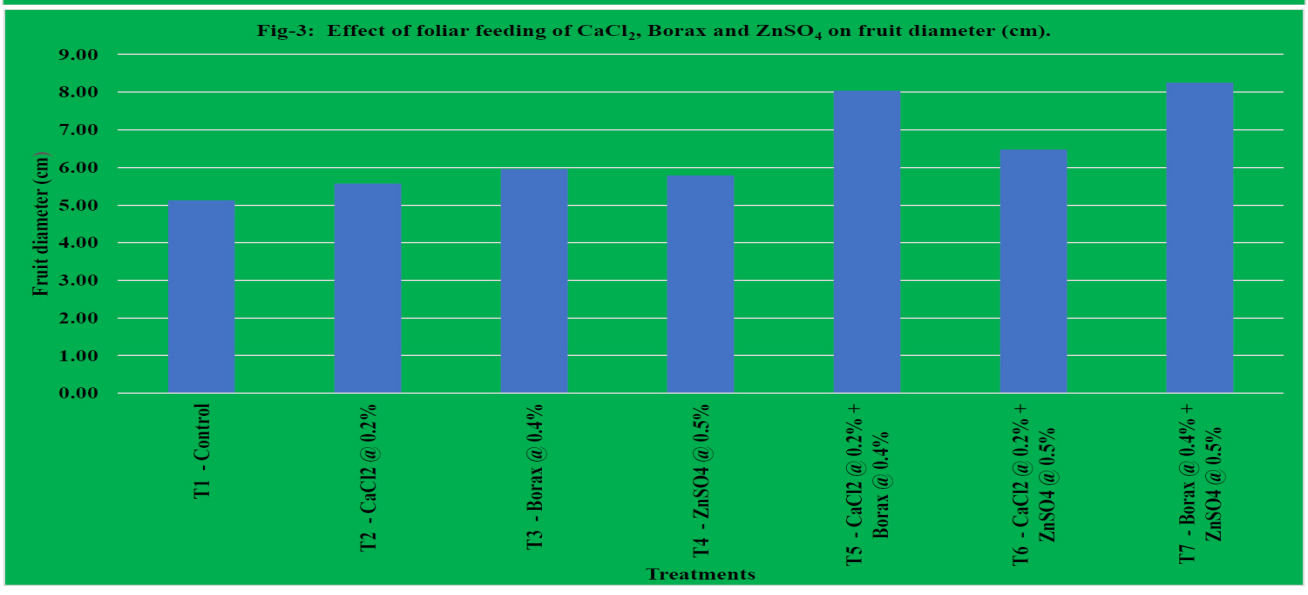


Fig-3: Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on fruit diameter (cm).
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Fruit diameter (cm)
T1 - Control
T2 - CaCl2 @ 0.2%
T3 - Borax @ 0.4%
T4 - ZnSO4 @ 0.5%
T5 - CaCl2 @ 0.2% + Borax @ 0.4%
T6 - CaCl2 @ 0.2% + ZnSO4 @ 0.5%
T7 - Borax @ 0.4% + ZnSO4 @ 0.5%
Treatments

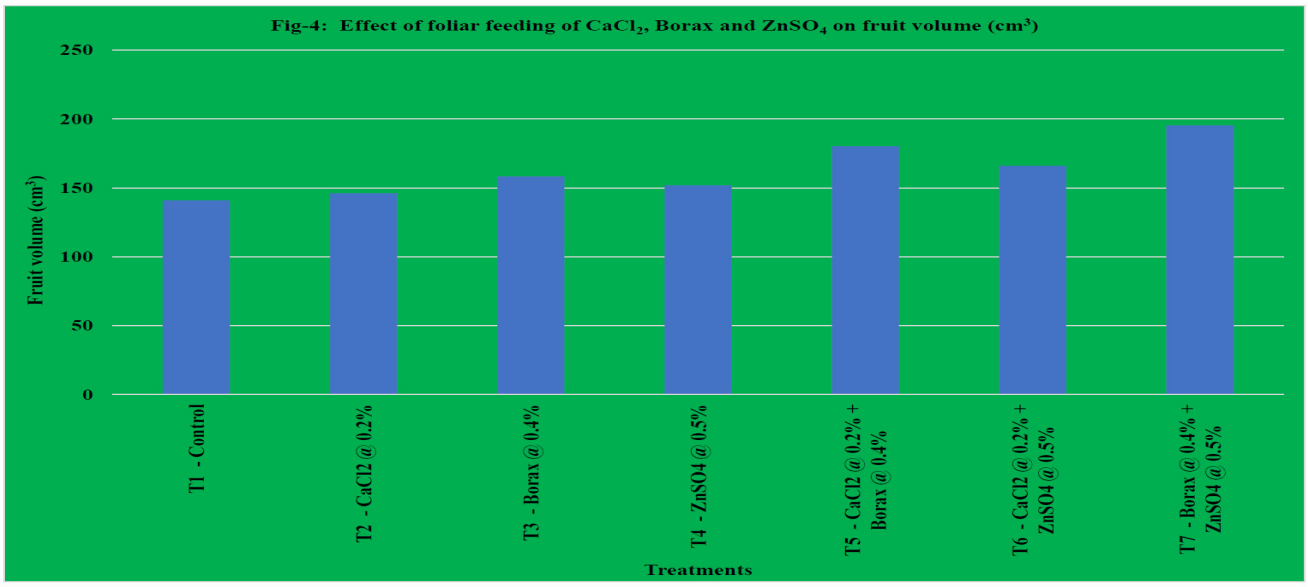


Fig-4: Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on fruit volume (cm^3)
Fruit volume (cm^3)
250
200
150
100
50
0
T1 - Control
T2 - CaCl2 @ 0.2%
T3 - Borax @ 0.4%
T4 - ZnSO4 @ 0.5%
T5 - CaCl2 @ 0.2% + Borax @ 0.4%
T6 - CaCl2 @ 0.2% + ZnSO4 @ 0.5%
T7 - Borax @ 0.4% + ZnSO4 @ 0.5%
Treatments

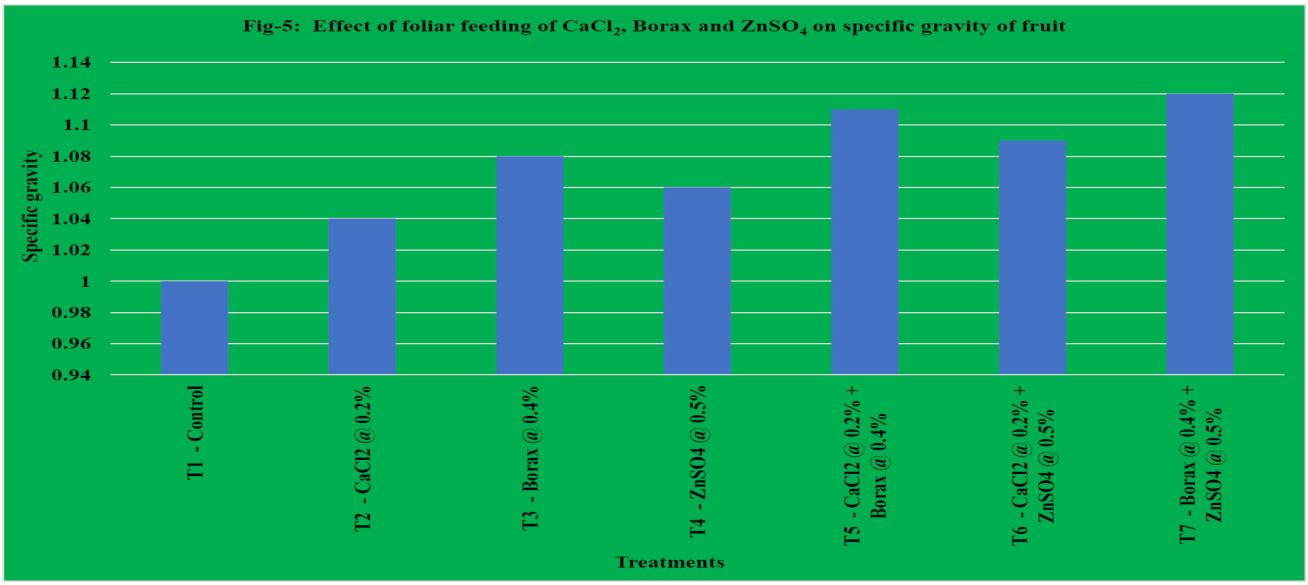


Fig-5: Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on specific gravity of fruit
Specific gravity
1.14
1.12
1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
T1 - Control
T2 - CaCl2 @ 0.2%
T3 - Borax @ 0.4%
T4 - ZnSO4 @ 0.5%
T5 - CaCl2 @ 0.2% + Borax @ 0.4%
T6 - CaCl2 @ 0.2% + ZnSO4 @ 0.5%
T7 - Borax @ 0.4% + ZnSO4 @ 0.5%
Treatments

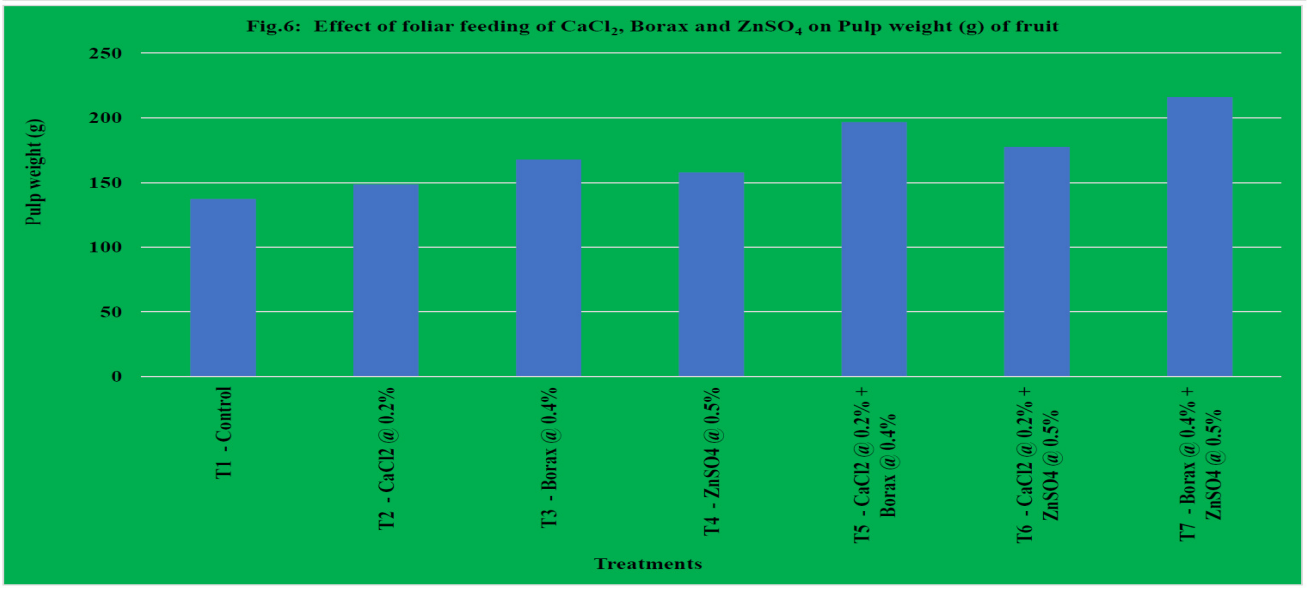
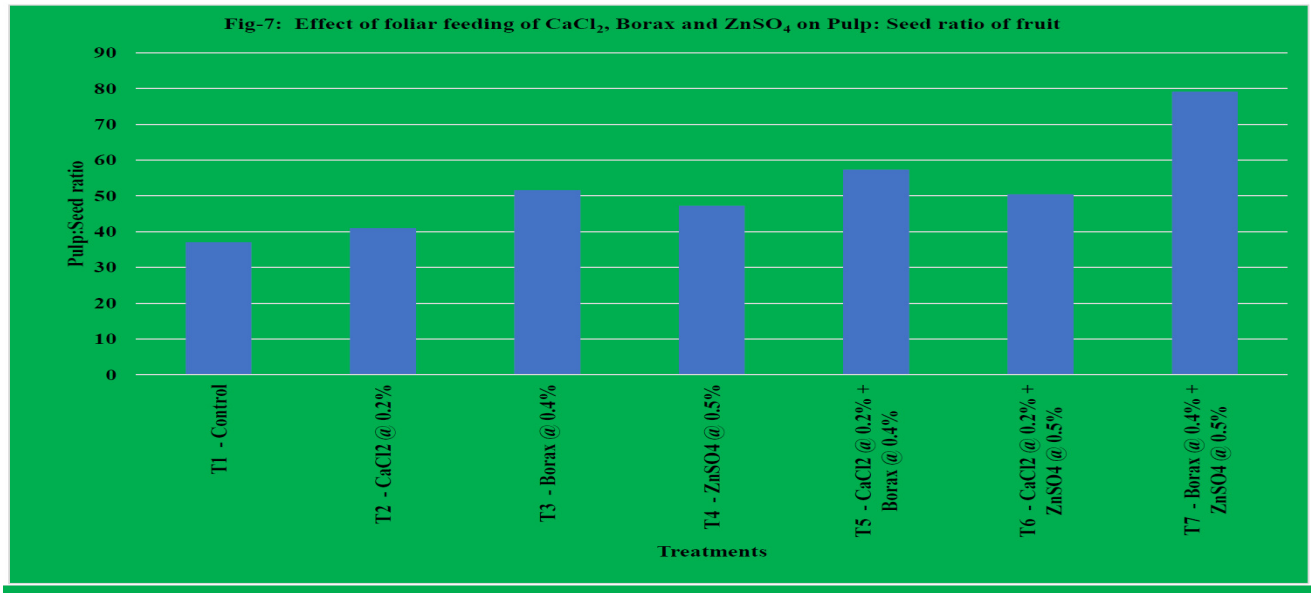
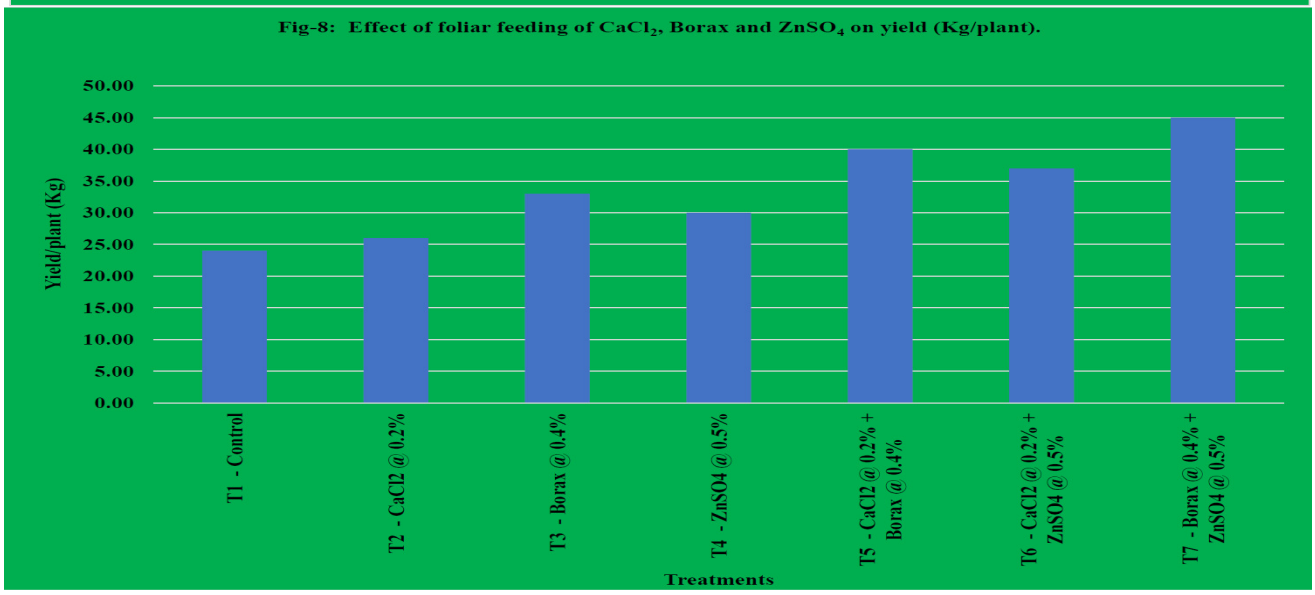


Fig.6: Effect of foliar feeding of $CaCl_2$, Borax and $ZnSO_4$ on Pulp weight (g) of fruit
Pulp weight (g)
250
200
150
100
50
0
T1 - Control
T2 - CaCl2 @ 0.2%
T3 - Borax @ 0.4%
T4 - ZnSO4 @ 0.5%
T5 - CaCl2 @ 0.2% + Borax @ 0.4%
T6 - CaCl2 @ 0.2% + ZnSO4 @ 0.5%
T7 - Borax @ 0.4% + ZnSO4 @ 0.5%
Treatments





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