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STUDIES ON FOLIAR FEEDING EFFECT OF NUTRIENTS ON QUALITY AND YIELD OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. SHWETA

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ABSTRACT

The present investigation entitled "Studies on Foliar Feeding Effect of Nutrients on Quality and Yield of Guava (*Psidium guajava* L.) cv. Shweta" was carried out during the year 2024-2025 at Main Experiment Station, Department of Fruit Science, College of Horticulture and Forestry, ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India. The treatments comprised of the spraying of different chemicals to study the physico-chemical attributes of guava fruits cultivar Shweta. The experiment was conducted in randomized block design (RBD) with eight treatments and three replications. The experiment consisted of eight treatments including T_1 (Control), T_2 (ZnSO4 @ 0.5%), T_3 (CaCl2 @ 0.5%), T_4 (Borax @ 0.5%), T_5 (ZnSO4 @ 0.5 % + CaCl2 @ 0.5 %), T_6 (ZnSO4 @ 0.5 % + Borax @ 0.5%), T_7 (CaCl2 @ 0.5 % + Borax @ 0.5 %) T_8 (ZnSO4 @ 0.5 %+ CaCl2 @ 0.5 % + Borax @ 0.5 %) were used for this study. The highest fruit length (8.17cm), width (8.70cm), weight (233.67g), volume (211.67cc), specific gravity (1.10), pulp weight (211.05g), fruit set (76.92%), yield (39.29kg/plant) ,TSS (11.5%), ascorbic acid (283.2mg/100g), reducing sugars (5.30%), non- reducing sugar (3.90%), total sugars (9.20%), organoleptic score (8.70) whereas lower acidity (0.31%) were observed with the foliar application of ZnSO4 @ 0.5% +CaCl2 @ 0.5% +Borax @ 0.5% under the agroclimatic condition of Eastern Uttar Pradesh of India.

INTRODUCTION

Guava (*Psidium guajava* L.) ranks as the fourth-largest fruit crop in India and is popular among both the rich and poor in tropical and subtropical regions. It belongs to the Myrtaceae family and is native to Tropical America. Guava is highly esteemed for its resilience, adaptability, high yield and is valued for providing significant returns with minimum care or investment. Guava is a highly valued fruit is often referred as "apple of the tropics". Additionally, guava contains a variety of bioactive compounds with nutritional and medicinal value, contributing to its status as a nutritionally important and economically significant fruit crop. Guava is the fifth widely produced fruit crop in India, following mango, banana, citrus and papaya. Guava occupies about 361,000 hectares in India with a yearly output reaching 5.368 million metric tons (MoA & FW, 2023-24). Allahabad has the distinct reputation for growing the best guava in the country as well as in the world. Micronutrients are essential for proper plant growth and development as they play key roles in numerous enzymatic activities and synthesis processes. Severe deficiencies in these elements can sometimes result in irreversible damage to plants (Kumar, 2002). Deficiency of both macro- and micronutrients can cause visible symptoms like stunted growth, lower yields, dieback and plant death. Foliar application of nutrients and growth regulators plays a vital role in improving plant quality and considered more effective for the rapid recovery of plants. In fruit tree cultivation, foliar feeding has gained considerable attention because soil-applied nutrients often need to be used in larger amounts, largely due to losses from leaching and limited plant availability resulting from complex soil interactions. In fact delivering nutrients through foliar application can be 10 to 20 times more efficient than traditional soil application methods (Zaman and Schumann, 2006). In this experiment objectives are to determine the foliar feeding effect of nutrients on physical attributes and chemical attributes of guava fruits.

MATERIAL AND METHODS

The experiment titled Studies on Foliar Feeding Effect of Nutrients on Quality and Yield of Guava (*Psidium guajava* L.) cv. Shweta was carried out during 2024–25 at the Main Experiment Station of Horticulture, Acharya Narendra Deva University of Agriculture and Technology (ANDUAT), Kumarganj, Ayodhya. It involved ten year old Shweta guava plants planted at a spacing of 8 m × 8 m. A Randomized Block Design with eight treatments and three replications was involved, and nutrient sprays were applied twice once prior to flowering in August 2024 and once after fruit set in September 2024. The eight treatments details are Control (T1), $ZnSO_4$ @ 0.5% (T2), $CaCl_2$ @ 0.5 (T3), Borax @ 0.5% (T4), $ZnSO_4$ @ 0.5% + $CaCl_2$ @ 0.5% (T5), $ZnSO_4$ @ 0.5% + Borax @ 0.5%

(T6), $CaCl_2$ @0.5% + Borax @ 0.5 (T7), $ZnSO_4$ @ 0.5% + $CaCl_2$ @ 0.5% + Borax @ 0.5% (T8). The length and width of five sample fruits from each treatment were measured using a digital Vernier Calipers and recorded in cm. The weight of these sampled fruits was measured using electronic balance with the average weight expressed in grams per fruit. Fruit volume was determined using the water displacement method, as described by Gustafson (1926). The specific gravity of the fruits was calculated by dividing the weight of each fruit by its volume. The pulp weight of fruits from each treatment was recorded by extraction of seed and wash with tap water and weighing the seed weight with the help of balance. Fruit-set percentages for each treatment were recorded on four branches per experimental plant, one from each cardinal direction. During flowering, the number of flowers on these tagged branches was counted and after flowering the number of fruit set was recorded by visually assessing fertilized fruit identified by swollen ovaries and dry, fallen petals. The average fruit set percentage was then determined using the following formulae:

Treatments	Physical attributes and yield							
	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Fruit volume (cc)	Specific gravity	Pulp weight (g)	Fruit set (%)	Yield (kg/plant)
T1- Control	5.54	6.24	128.23	125.00	1.03	113.88	57.99	20.52
T2- ZnSO4 0.5%	6.47	7.12	162.90	152.50	1.07	143.32	65.03	27.95
T3- CaCl2 0.5%	5.83	6.41	143.27	136.67	1.05	122.57	68.28	31.65
T4- Borax 0.5%	6.84	7.21	172.80	160.00	1.08	153.13	62.38	25.81
T5- ZnS04 0.5 % + CaCl2 0.5%	7.14	7.46	182.43	167.53	1.09	161.10	69.19	32.21
T6- ZnSO4 0.5% + Borax 0.5%	7.60	8.05	226.37	206.67	1.10	204.17	72.90	36.33
T7- CaCl2 0.5% + Borax 0.5%	7.35	7.75	191.90	176.33	1.09	168.68	70.42	33.70
T8- ZnSO4 0.5% + CaCl2 0.5% + Borax 0.5%	8.17	8.70	233.67	211.67	1.10	211.05	76.92	39.92
S.Em±	0.13	0.15	2.22	3.59	0.01	2.13	1.51	2.44
CD at 5%	0.38	0.46	6.74	10.90	0.04	6.45	4.58	7.41

$$\text{Fruit set (\%)} = \frac{\text{Number of fruit set}}{\text{Number of flowers}} \times 100$$

The biochemical parameters, including total soluble solids, were measured at room temperature using a digital hand refractometer. Titratable acidity was determined by titrating the fruit pulp extract with 0.1N sodium hydroxide (NaOH) using phenolphthalein as the indicator (Ranganna, 2010). The Ascorbic acid content and sugars in the fruit samples was estimated following the method outlined by Ranganna (2010). For organoleptic quality firstly fruit samples were collected early in the morning and immediately taken to the laboratory, where a panel of twelve judges conducted an organoleptic test, scoring colour, flavour, and texture of the guava fruits using a 9-point Hedonic Rating Scale based on Amerine *et al.* 1965. Statistical analysis of the experimental data was performed based on the guidelines provided by Panse and Sukhatme.

RESULTS AND DISCUSSIONS

Effect of nutrients on physical attributes

The data pertaining to the effect of foliar spray of Zinc sulphate, Calcium chloride and Borax on the physical attributes of guava cv. Shweta are presented in (Table 1). Foliar application of various treatments significantly enhanced the fruit's length, width, weight, and volume compared to the untreated control (Table 1). Treatment 8 ($ZnSO_4$ 0.5% + $CaCl_2$ 0.5% + Borax 0.5%) resulted in the largest fruit dimensions with a length of 8.17 cm, width of 8.70 cm, weight of 233.67 g, volume of 211.67 cc and pulp weight 211.05 closely followed by treatment T6 ($ZnSO_4$ 0.5% + Borax 0.5%). In contrast, the control plants produced fruits with the smallest measurements. The enlargement of guava fruits was attributed to a faster rate of cell division and cell expansion as well as increased intercellular spaces resulting from the introduction of higher concentrations of nutrients and growth regulators. Additionally, the boost in both length and width of the fruit may be linked to higher levels of essential minerals like boron and zinc, which seem to directly promote cell division and elongation, ultimately contributing to the overall improvement in fruit size and weight (Tirkey *et al.* 2018). Similar findings have been reported by Goswami *et al.* (2014) and Kumar *et al.* (2023).

Analysis of the data presented in table 1 showed that fruit set was significantly affected by the different treatments. Treatment 8 ($ZnSO_4$ 0.5% + $CaCl_2$ 0.5% + Borax 0.5%) was observed the highest fruit set at 76.92 % along with the highest fruit yield per plant (39.92 kg). In contrast, the lowest fruit set (43.77%) and fruit yield per plant (20.52 kg) were observed in the control treatment (T1). The observed increase in fruit set (%) following the application of calcium, boron and zinc is probably linked to enhanced absorption and utilization of metabolites. The role of borax, which is vital in the translocation of carbohydrates, formation of auxins towards sink organs, and enhancement of pollen viability and fertilization. Calcium chloride help in the synthesis of plant growth regulators and enzymes that drive essential metabolic processes. The control treatment recorded the minimum number of flowers, fruit set and fruit retention accompanied by the maximum percentage of fruit drop. These observations are in agreement with the findings of Awasthi and Lal (2009) in guava and Yadav *et al.* (2011) in ber. Increase in fruit yield (kg/tree) attribute to a combined effect of increased fruit number resulting from reduced fruit drop and enhanced fruit weight, brought about by the foliar application of calcium, boron, and zinc. This enhancement could also be linked to the stimulation of starch synthesis and the efficient translocation of carbohydrates in treated plants. These outcomes align with the observations of Singh and Maurya (2004) in mango fruits. Similarly finding were reported by Awasthi and Lal (2009) in guava.

Table.1Foliar feeding effect of nutrients on physical attributes and yield of Guava fruits

Effect of nutrients on chemical attributes

The highest total soluble solids (11.5%) were recorded in T8 (ZnSO4 0.5% + CaCl2 0.5% + Borax 0.5%) and lowest (8.6%) were recorded in Control (T1). During fruit ripening, the enhancement in Total Soluble Solids (TSS) is primarily linked to the breakdown of insoluble starch into soluble sugars and a reduction in moisture content, as noted by Koksal *et al.* (1994). Research by Peter *et al.* (1999) demonstrated that calcium chloride promotes quicker starch-to-sugar conversion compared to other calcium compounds. Support for the present observations is also provided by the work of Awasthi and Lal (2009) in guava fruits.

The highest Ascorbic acid (283.2 mg/100g) were recorded in T8 and lowest (217.8 mg/100g) were recorded T1. The foliar application of calcium chloride and borax significantly enhances the Ascorbic acid content in guava fruits. This improvement might be linked to Boron ability to stimulate ascorbic acid synthesis, as observed by Jain *et al.* (1985) and Similar result were reported by Bhatt *et al.* (2012) in mango and Yadav *et al.* (2015) in guava fruits. Acidity of guava fruit significantly decreased under different treatments (Table 2). Acidity was maximum in (0.97%) T1.

and lowest acidity were recorded in T8 whereas in treated plants it decreased which might be due to early ripening induced by treatments. Degradation of acid might have occurred during ripening Reduced acidity in fruits is often the result of increased sugar accumulation, improved sugar translocation to fruit tissues and the transformation of organic acids into sugars. Similar observations were made by Beniwal *et al.* (1992)

In addition, maximum reducing sugars (5.30%), non-reducing sugar (3.90%) and total sugars (9.20%) were recorded in T8 followed by T6, whereas minimum were recorded reducing sugars (4.50%), non-reducing sugar (3.77%) and total sugars (8.27%) were recorded in control (T1). Awasthi and Lal (2009) studied the effect of calcium, boron and zinc application as foliar spray on yield and quality of guava fruits and found improvement in yield and sugar content. The rise in non-reducing and total sugars following the application of zinc sulphate either alone or with other nutrients can be credited to improved photosynthetic efficiency and the enzymatic transformation of carbohydrates such as starch into sugars. This increase in sugar levels through foliar zinc application might be associated with zinc involvement in tryptophan synthesis, which is a precursor to the plant hormone auxin. Comparable observations have been documented in by Skoog (1940) and supported by Rawat *et al.* (2010).

The observation presented in table 2 reveals that every treatment resulted in an increased organoleptic score in comparison to the control. The most notable enhancement in sensory quality was recorded with T8 which recorded the highest score of 8.70 closely followed by T6 of 8.5 score. All the treatments, including the control received hedonic score of 7.5 or above, confirming that the all treatments fruits were edible because hedonic score less than 7.00 is considered that food product is not fit for consumption of human being. Thus the treatments had also improved the edible quality of fruits. The current results are additionally similar by Singh (1998) in guava.

Table.2 Foliar feeding effect of nutrients on chemical attributes and quality of Guava fruits

Treatments	Chemical attributes and quality						
	TSS (%)	Ascorbic Acid (mg/100g)	Acidity (%)	Reducing sugars (%)	Non-reducing sugar (%)	Total sugars (%)	Organoleptic (score)
T1- Control	8.6	217.8	0.97	4.50	3.77	8.27	7.5
T2- ZnSO4 0.5%	9.4	230.0	0.51	4.80	3.6	8.41	7.6
T3- CaCl2 0.5%	9.1	230.8	0.49	4.60	3.71	8.31	8.1
T4- Borax 0.5%	10.3	259.4	0.49	5.00	3.71	8.71	7.8
T5- ZnSO4 0.5 % +CaCl2 0.5%	9.6	252.1	0.57	4.80	3.61	8.41	8.1
T6- ZnSO4 0.5% + Borax 0.5%	10.7	279.2	0.40	5.16	3.84	9.00	8.5
T7- CaCl2 0.5% + Borax 0.5%	10.5	277.3	0.49	5.00	3.80	8.80	8.2
T8- ZnSO4 0.5% + CaCl2 0.5% + Borax 0.5%	11.5	283.2	0.31	5.30	3.90	9.20	8.7
S.Em±	0.19	1.63	0.11	0.08	0.13	0.15	0.14
CD at 5 %	0.58	4.94	0.32	0.25	0.41	0.45	0.42

CONCLUSION

The findings from the preliminary experiment evaluating the impact of different treatments on the physical and chemical attributes of guava fruit indicate that the highest values for fruit length, width, weight, volume, specific gravity, pulp weight, and yield per plant and chemical attributes TSS, ascorbic acid, acidity, reducing sugars, non- reducing sugar, total sugars and organoleptic quality whereas lower acidity can be recorded by foliar application of Zinc sulphate 0.5% + Calcium chloride 0.5% + Borax at 0.5% in guava fruits twice in the August and September under agroclimatic condition of the Eastern Uttar Pradesh.

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