Effect of Foliar Application of Zinc, Boron and Magnesium on Growth, Yield and Quality of Guava (*Psidium guajava L.*) Narmadapuram

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Abstract- Foliar application of Zn, B, and Mg on fruit growth, quality, and yield of guava (*Psidium guajava* L.), an experiment was carried out in Narmadapuram. Applying foliar treatment of Zn, B, and Mg focused guava's development and production. The solutions of Zn as $ZnSO_4$, B as Boric acid, and Mg as $MgSO_4$ were prepared in different concentrations and apply on plant. The experiment consisted of 9 combinations of treatments 2 micronutrients and 1 macronutrient with control, which were applied thrice except a spray of plain tap water as control. From various combinations of Zn + B + Mg maximum number of leaves increased per shoot (11.12), maximum leaf area (113.43cm^2), shoot length (10.65cm), Shoot diameter (2.86cm), fruit diameter (6.78cm), fruit volume (212.37cm^3), Seed % (8.76%), pulp % (91.24%), Pulp: Seed (10.41:1), TSS (7.65^{0}Brix), acidity% (0.26%), Ascorbic acid content (194.65 mg/100gm pulp), maximum number of fruits (305), average fruit weight (204.74gm), and yield/ tree (64.77 kg) were recorded with combined application of 0.4% of $ZnSO_4$, 0.6% of $MgSO_4$, and 0.2% of H_3BO_3. The study indicated that the combined application of micronutrients and macro-nutrient enhanced fruit quality as well as overall production.

Keywords: Boric acid, Boron, Foliar application, Magnesium, Psidium guajava, Zn

INTRODUCTION

The term "guava" refers to the fruit of the Psidium guajava tree, a member of the Myrtaceae family, which is the fruit of the guava tree. Numerous other tropical and subtropical areas of the world also cultivate it. The complex nutritional profile of guava, which includes high levels of vitamin C, dietary fibre, antioxidants, and other vital elements, makes it significant. It is frequently consumed raw, juiced, or in a variety of culinary preparations, including drinks, sweets, jams, and jellies. In addition, because of their possible therapeutic benefits, guava leaves and extracts are employed in conventional and herbal medical systems. Fruit ripens to its greatest eating quality during arid seasons, such as India's winter. (Rathore, 1976). However, long-term use of fertilizers and pesticides has left the soil deficient in nutrients, and as plants cannot grow or produce as much when they have inadequate nutrients, it is well known that plant growth is decreased. In other words, both macro- and micronutrients are necessary for development and growth. In addition to being essential for advancement and improvement, zinc also plays a role in controlling the metabolism of proteins and carbohydrates (Yadav *et al*. 2011). The transport of sugar, plant reproduction, and pollen grain germination all require boron. According to Meena et al. (2008), boron has a significant impact on root growth, cell elongation, and the construction of cell walls. In the absence of enough magnesium, plants start to break down the chlorophyll in their leaves, causing the margins to turn reddish-purple and lowering the activity of photosynthesis. An additional method of giving fruit plants in these types of environments nourishment is through foliar treatments. Furthermore, because plants only need small amounts of micronutrients, it is safer and easier to apply them through foliar application, which allows for quick absorption and directs the specific nutrients to a specific portion of the tree's foliage and fruits at a time when a rapid response is desired. (Stiles, 1982). Foliar application therefore has a good impact on plant growth, development, and production.

MATERIAL AND METHODS

five-year-old plants were chosen for treatments in an experiment carried out in the Narmadapuram regional area, and the treatments were repeated three times a season. Soil and plant samples were obtained prior to foliar spraying, and these samples underwent the following tests. Azomethine H reagent was used to test for boron in the soil sample (Jackson, 1958). The plant samples were also analysed for magnesium (Mehlich, 1953) and zinc (Lindsay and Norwell, 1978), with Zn being calculated using AAS, and Mg titration technique was used. Treatment combinations for the plants were created in light of these tests. The treatment included T_0 as a control. The control treatments were also the primary treatments, T_1 as Zn_1 B_1 Mg_1 (0.2%, 0.1%, 0.4%), T_2 as Zn_1 B_1 Mg_2 (0.2%, 0.1%, 0.4%), T_3 as Zn_1 B_2 Mg_1 (0.2%, 0.2%, 0.4%), T_4 as Zn_2 B_1 Mg_1 (0.4%, 0.1%, 0.4%), T_5 as Zn_2 B_2 Mg_1 (0.4%, 0.2%, 0.4%), T_6 as Zn_2 B_1 Mg_2 (0.4%, 0.1%, 0.6%), T_7 as Zn_1 B_2 Mg_2 (0.2%, 0.2%, 0.6%), and T_8 as Zn_2 B_2 Mg_2 (0.4%, 0.2%, 0.6%) are all combinations of Zn, B and Mg. Prepare a solution of $ZnSO_4$ + $MgSO_4$+ H_3BO_3 and add 0.1% Sandovit solution, spray the both the top and bottom of the plant with a solution. Three distinct times were chosen to apply treatments: prior to flowering, prior to full bloom, and prior to the start of fruit set. Tables 1 and 2 listed a number of parameters, including the number of leaves per branch, leaf area, shoot length, shoot diameter, average fruit weight, volume, seed %, and pulp percentage. Various fruit metrics were used to determine the quality of the fruits. Initially, a refractometer was used to measure the fruit's TSS (Kusumiyati, 2020). The sugar content was calculated by titrating Fehling solutions A and B, and the acidity percentage was calculated using the acid-base titration method (Nielsen, 2014). The DCPIP method (Sadasivam and Subramanian, 1987) was used to determine the ascorbic acid content.

OBSERVATION

Table 1: Foliar application of Zinc, Boron, and Magnesium on Physical parameters of guava plant and fruit

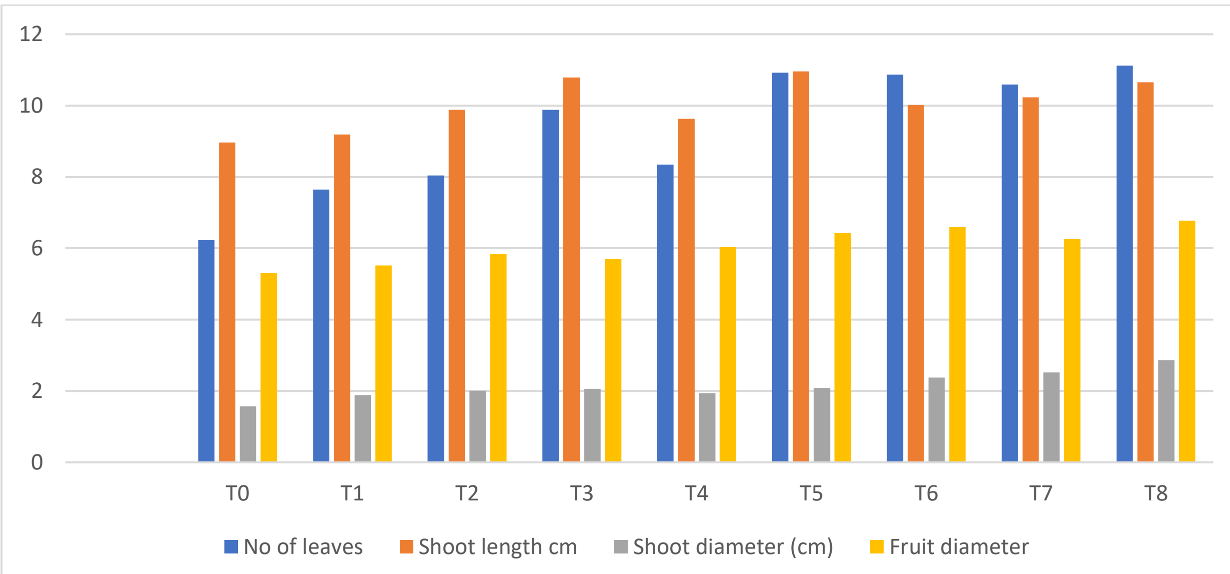
Treatment	No of leaves	Leaf area Cm^2	Shoot length cm	Shoot diameter (cm)	Fruit volume	Fruit diameter
T_0	6.23	107.9	8.97	1.57	132.34	5.30
T_1	7.65	108.3	9.19	1.88	137.22	5.52
T_2	8.04	109.2	9.88	2.01	168.31	5.84
T_3	9.88	112.2	10.79	2.06	146.76	5.70
T_4	8.35	109.9	9.63	1.94	156.49	6.04
T_5	10.92	112.4	10.96	2.09	191.32	6.43
T_6	10.87	111.9	10.02	2.38	200.12	6.60
T_7	10.59	111.7	10.23	2.52	183.44	6.26
T_8	11.12	113.4	10.65	2.86	212.37	6.78

Table 2: Foliar application of Zinc, Boron, and Magnesium on Physical parameters of guava and yield

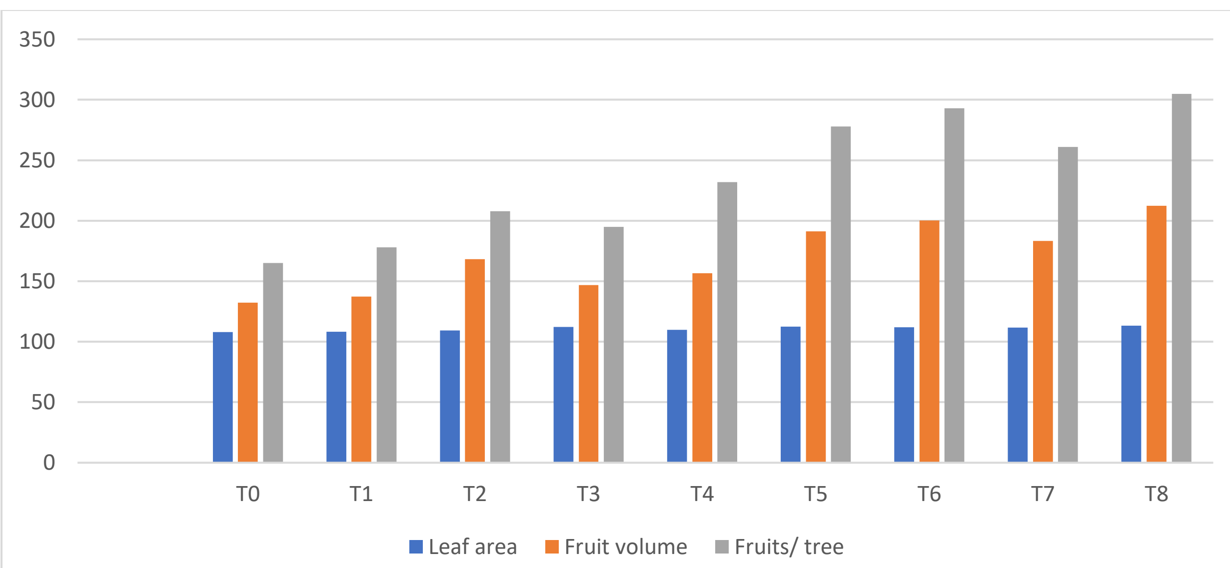
Treatment	Seed %	Pulp %	Pulp: Seed	Fruits/ tree	Yield/tree kg
T_0	11.32	88.68	7.83:1	165	21.83
T_1	11.00	89.00	8.09:1	178	24.42
T_2	10.89	89.11	8.18:1	208	35.00
T_3	10.76	89.24	8.29:1	195	28.61
T_4	9.98	90.02	9.02:1	232	36.30
T_5	9.69	90.31	9.31:1	278	53.18
T_6	9.12	90.88	9.96:1	293	58.63
T_7	9.22	90.78	9.84:1	261	47.87
T_8	8.76	91.24	10.41:1	305	64.77

Table 3: Foliar application of Zinc, Boron, and Magnesium on Chemical parameters of guava

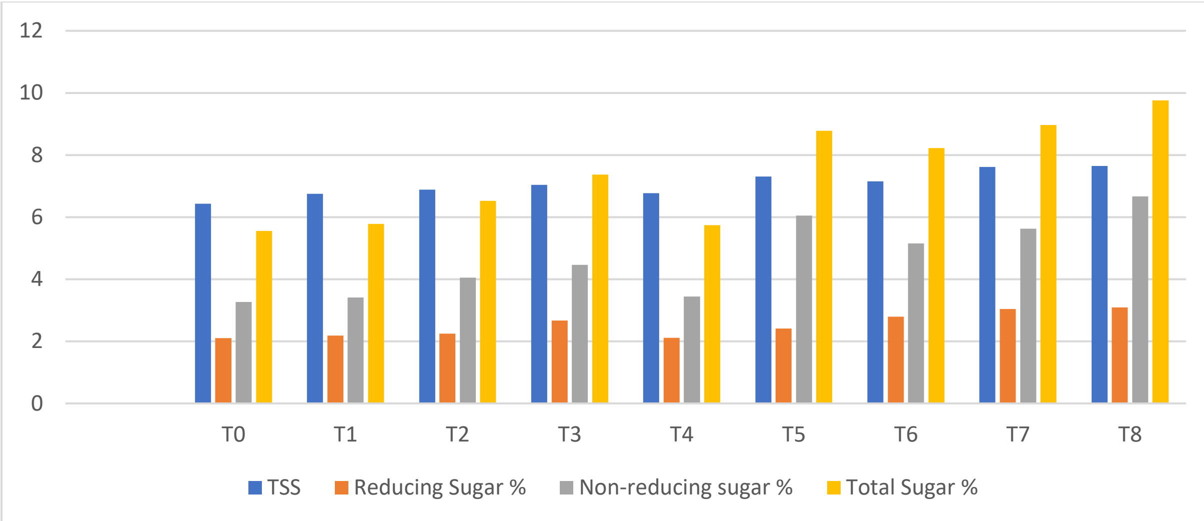
Treatment	TSS ^{0}Brix	Acidity%	Ascorbic Acid content (mg/gm)	Reducing Sugar %	Non-reducing sugar %	Total Sugar %
T_0	6.43	0.65	167.11	2.10	3.27	5.56
T_1	6.75	0.62	169.45	2.19	3.41	5.78
T_2	6.88	0.52	176.22	2.25	4.05	6.52
T_3	7.04	0.50	177.86	2.67	4.46	7.37
T_4	6.77	0.56	172.01	2.11	3.44	5.74
T_5	7.31	0.38	186.21	2.41	6.05	8.78
T_6	7.15	0.43	182.82	2.79	5.15	8.22
T_7	7.62	0.34	195.37	3.04	5.63	8.97
T_8	7.65	0.26	194.65	3.09	6.67	9.76



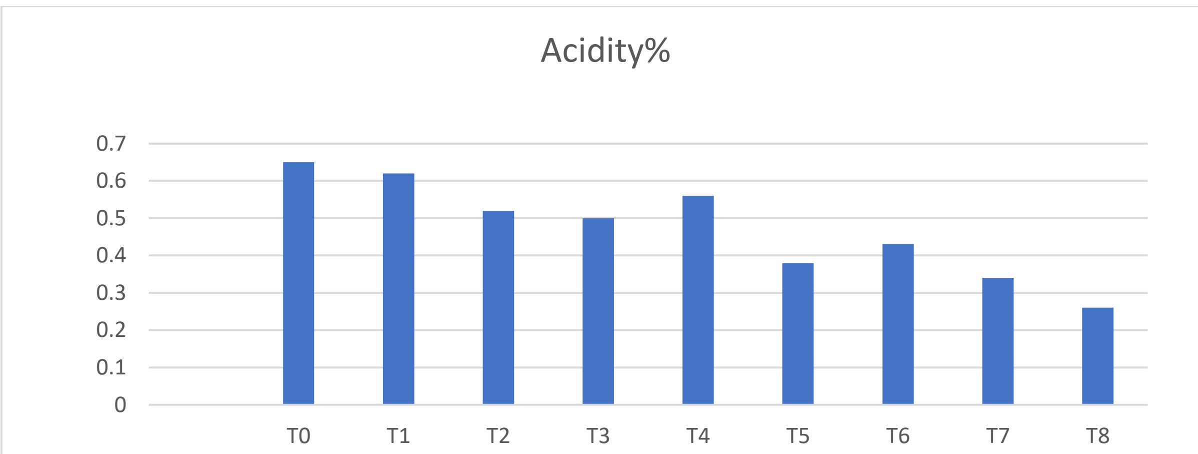
Graph 1: Physical Parameters of Plant leaf no, shoot length & diameter and Fruit diameter



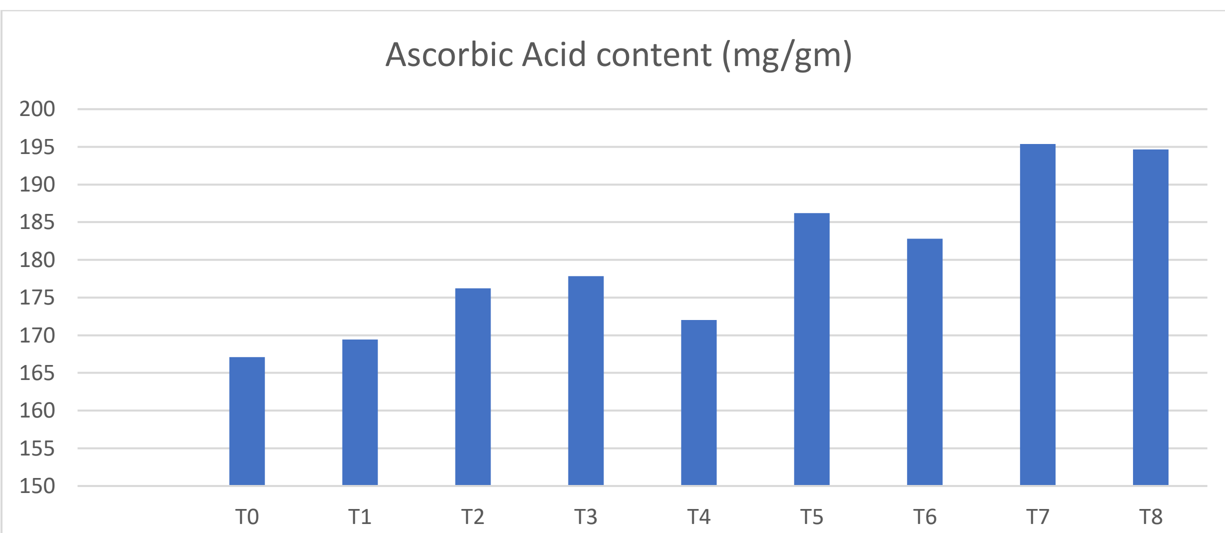
Graph 2: Physical Parameters of Plant leaf area, fruit volume and Fruit per tree



Graph 3: Chemical Parameters of Fruit, Sugar % and TSS (^{0}Brix)



Graph 4: Chemical Parameters of Guava Acidity %



Graph 4: Chemical Parameters of Ascorbic acid content (mg/100gm pulp)

RESULT AND DISCUSSION

Maximum growth in Narmadapuram was observed in T_8 with $Zn_2B_2Mg_2$ concentrations of 0.4%, 0.2%, and 0.6% respectively. The maximum number of leaves per shoot was recorded at 11.12. The maximum leaf area was recorded at 113.40 cm^2, The maximum shoot length was recorded at 10.65 cm, The maximum shoot diameter was recorded at 2.86 cm, the maximum fruit diameter in T_8 treated plants was recorded as 6.78 cm,, the maximum fruit volume in T_8 treated plants was recorded as 212.37 cm^3, the minimum seed percentage in T_8 treated plants was recorded as 8.76%, the maximum pulp percentage in T_8 treated plants was recorded as 91.24%, the maximum pulp: seed in T_8 treated plants was recorded as 10.41:1. Because of their size, weight, and volume, fruits with higher physical parameter values may include micronutrients that indirectly aid in the processing of cell division and elongation (Arora and Singh 1972). The T_8 treated plants exhibited a maximum TSS of 7.65^0Brix and a minimum acidity percentage of 0.26%. This decrease in acidity percentage is attributed to the presence of boron, which is consistent with the findings of Rajput and Chand (1976). The maximum reducing sugar percentage (3.19%), maximum total sugar percentage (9.76%), maximum non-reducing sugar percentage (6.67%), and maximum ascorbic content (mg/gm) of T_8-treated plants were all recorded. In Hoshangabad/Narmadapuram, the highest number of fruits harvested was 305, and the highest yield per tree was 64.77 kg. The various concentrations of Zn, Mg and B improved the no. of fruits per branch, accumulation of fruits per branch, and number of fruits/tree (Bagali et al. 1993).

CONCLUSION

For guava agriculture, the mixed application of 0.6% Mg + 0.2% B + 0.4% $ZnSO_4$ showed to be very helpful, leading to greater yield, better fruit quality, decreased acidity, and improved plant growth. These results highlight how crucial micronutrient control is to guava farming's optimisation of both fruit quality and agricultural productivity.

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