Effect of Zinc and Boron on Growth, Yield and Quality of Guava (*Psidium guajava* L.) cv. L-49.

Abstract

A field experiment was conducted during 2020-2021 at Horticulture Research Farm-1, BBAU, Lucknow on 15- year- old guava plants, Studies on the Effect of Zinc and Boron on Growth, Yield and Quality of Guava (*Psidium guajava* L.) cv. L-49", revealed Number of fruits per tree, Yield per tree (kg), Total chlorophyll content (mg/g), Average weight of fruit (g), Volume of fruit (cc), TSS (^{0}Brix), Acidity (%), Ascorbic acid content in pulp (mg/100g), Non reducing sugar (%), Reducing sugar (%), Total sugar (%), were significantly affected by foliar application of Zinc sulphate and boron. All parameters best performed under the Treatment nine (T_9) where the dose of Zinc and Boron (Borax 0.2%+ Zinc Sulphate 0.2%) applied as foliar spray.

Key word: Zink, Boron, Guava, foliar spray

Introduction

Guava (*Psidium guajava* L.) is one of the most popular fruits grown in tropical, subtropical and some parts of arid region of India. Guava is an evergreen, shallow-rooted shrubs or small tree with spreading branches. Guava is most important cultivated species of Myrtaceous family, it is considered to be the apple of tropics because of its desert and culinary use. Guava is one of the most popular fruits grown in tropical, sub-tropical and some parts of arid region of India. It is the sixth most important fruit in production after banana mango, citrus, papaya and pineapple. This fruit originated in Tropical America and seems to have been growing from Mexico to Peru. The trees were domesticated more than 2000 years ago. It was speeded rapidly through the world`s tropics by Spanish and Portuguese soon after the discovery of the new world. The thin skin varies in colour from pale green to light-yellow, blushed with pink for certain cultivars. Underneath the skin is a layer of flavourful sweet and tangy flesh with colour varying from white, yellowish, light pink, dark pink, or red. When immature, the fruit is green, hard, and very astringent. When ripe, some varieties have a custard-like consistency while others are crispy like an apple. The central pulp can be of the same colour or darker than the surrounding flesh, is juicy and normally filled with very hard, yellowish seeds and Characteristics of L-49 (Lucknow-49) variety It is prolific bearer, greenish yellow with milky white sweet pulp and rough surface. Shell is fairly thick, contains fairly soft few seeds in inner portion of pulp. Since the number of seeds is less, keeping quality is medium it is very popular in Maharashtra and Andhra Pradesh. It is suitable for table purpose and yields about 25t/ha. The major guava producing state of India are Uttar Pradesh, Maharashtra, Madhya Pradesh, Bihar, West Bengal, Punjab, Gujarat, Andhra Pradesh, Telangana and Karnataka. Presently the area under guava is 276 thousand ha. The total production of guava is 42.36 matric tones. Maharashtra ranks first in the production of guava with production of 311 thousand metric tonnes. The average productivity of guava is 12 MT/ha but the productivity is highest in M.P 29.0 MT/ha (NHB, 2018-19). The fruit type is berry and it is an excellent source of vitamin C (210-305 mg/100g) and pectin (0.5-1.8%) but has low energy (66 Cal/100g). The ripe fruits contain 12.3-26.3% dry matter, 77.9-86.9% moisture, 0.51-1.02% ash, 0.10-0.70% crude fat, 0.82-1.45% crude protein and 2.0-7.2% crude fibre. The fruit is also rich in minerals like phosphorus (22.5-40.0 mg/100g), Calcium (10.0-30.0 mg/100g) and Iron (0.60-1.39 mg/100g) as well as vitamins like Niacin (0.20-2.32 mg/100g), Thiamine (0.03-0.07mg/100g), Riboflavin (0.02-0.04mg/100g) and vitamin-A (Mitra and Bose,2001). Guava leaf is rich in tannins (9-12%), the leaves also contain 0.3% essential oil (with eugenol) and triterpenoids which may contribute the overall medicinal activity (Chapman, 1964). Micronutrients are those trace elements which are essential for the normal healthy growth and reproduction of plants. For a trace element to be essential for either plant (i.e., a micronutrient), it needs to satisfy three criteria: (1) the organism cannot grow and reproduce normally without the element, (2) its action must be specific and unable to be replaced by any other element and (3) its action must be direct. However, advocated that an element can also be regarded as essential if it is a component of a molecule known to be an essential metabolite, even if it cannot be demonstrated that it fulfils all of the criteria. It is very important that the micronutrient element requirements of crops are met as well as their macronutrient needs if they are to yield satisfactorily and bear products (e.g., grains and fruits) of acceptable quality. The dose response curves for all micronutrients show that, just as yields can be affected by deficiencies, they can also be reduced by toxicity due to excessive concentrations of the same elements. It is therefore important that soils and/or crops are monitored to ensure that the available micronutrient concentrations in soils are in the optimum range, being neither too low, nor too high. Typical dose–response graphs for micronutrients and non-essential elements (Arnon and Stout, 1939). The foliar application of micro-nutrients plays a vital role in improving the quality and comparatively more effective for rapid recovery of plants. The yield parameter like average fruit weight, number of fruits/tree and yield/tree are increased by the spray of micro-nutrients. Zinc is important constitute of several enzyme systems which regulate various metabolic reaction associated with water relation in the plant. Zinc is essential for auxin and protein synthesis, seed production and proper maturity. it is also increase fruit size as well as yield. Zinc is essential for improving the vegetative growth of guava trees in terms of terminal shoots, shoot diameter and number of leaves per shoot. Boron is a constituent of cell membrane and essential for cell division. It is role as a regulator of potassium/calcium ratio in plant and help in nitrogen adsorption and translocation of sugar in plant. Boron increase nitrogen availability to plant. It is involved in the synthesis of cell wall components. It has a role in pollen viability and good fruit set. It increases the growth of primary and lateral roots Awasthi et al., (2009).

Materials Methods: The present inspection entitled “Effect of Zinc and Boron on Growth, Yield and Quality of Guava (*Psidium guajava* L.) cv. L - 49” was carried out at Horticulture Research Farm-I, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow 226 025 (U.P.) during the winter season of 2020-21. The information of methodology adopted in this experiment has been presented below: 3.1 Climatic conditions: Geographically, Babasaheb Bhimrao Ambedkar University, (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow (U.P.), India situated at 80055' East longitude and 26046' North latitude and 123 meter above MSL (mean sea Level). The climate of Lucknow is characterized by sub-tropical with hot, dry summer and cool winters. This region received an average annual rainfall of 650-750 mm, which is distributed over a period of more than 100 days with peak period during January-June. It also received scattered showers during summer months. In general, the temperature ranges from 5.50 to 250. The average relative humidity is 60% in different seasons of the year. The soil of the experimental field was medium black with good drainage and uniform texture with medium NPK status. Total soluble solids (TSS) were determined using hand held refractometer at room temperature. The readings were corrected at 20°C and expressed as percentage soluble solids. Organoleptic evaluation of the fruits was done by panel of 10 judges on the basis of Hedonic scale (1 to 9 points) as described by Amerine *et al*. (1965). The titratable acidity in juice was determined by titrating a known volume of juice with 0.1 N NaOH using phenolphthalein as an indicator.

Result and Discussion:

The data revealed that the maximum Number of fruits per tree 242.69 T_8 under the application of (Borax 0.2%+ Zinc Sulphate 0.2%) followed by 234.20T_7 under the treatment of (Borax 0.2%+ Zinc Sulphate 0.1%) However, the minimum number of fruit per tree 170.45 was recorded in control. Maximum Yield per tree (kg) 57.04 T_8 (Borax 0.2%+ Zinc Sulphate 0.2%) and followed by 52.2T_7 (Borax 0.2%+ Zinc Sulphate 0.1%) in comparison 25.85 T_0 (Control). These results are in conformity with the findings of **Brahmachari and Kumar (1997)** in guava, Singh *et al.* (1993) in guava cv. L-49, Kundu and Mitra (1999); EI-Sherif *et al*. (2000) and Singh *et al*. (2004); Kumar *et al.* (2010); Khan *et al*. (2012) and Trivedi *et al*. (2012).

The maximum total chlorophyll content (1.81 mg/g) was accumulated under (Borax 0.2%+ Zinc Sulphate 0.2%) followed by (1.78 mg/ g) in (Borax 0.2%+ Zinc Sulphate 0.1%) whereas, minimum total chlorophyll content (1.28 mg/g) was recorded under T_0 (control). These findings are in line with earlier reports of **Lal and Sen (2000), El-Sissy and Waaz (2011) and Kumawat *et al.* (2012)**, who have shown that application of micronutrients alone or in combinations had significant effect on plant height, plant spread, shoot length, leaf area, and total chlorophyll content in guava plant.

The data presented in fourth row that the maximum average of fruit weight (g) 233.22 (Borax 0.2%+ Zinc Sulphate 0.2%) and followed by 220.28 (Borax 0.2%+ Zinc Sulphate 0.1%) in comparison to 161.80 (control). **Yadav *et al.* (2011)** studied the effect of foliar application of micronutrients and GA_3 on physicochemical characters of guava fruit cv. L-49.

Data presented in fifth row clearly indicate that all the treatment increased volume of fruit in cc as compared to control. The maximum volume of fruit 232.05 cc was recorded with (Borax 0.2%+ Zinc Sulphate 0.2%) followed by 219.90 cc (Borax 0.2%+ Zinc Sulphate

0.1%) while, minimum fruit volume 161.29 cc was observed in control. **Kumar *et al.* (2016)** study conducted of foliar sprays of boron, zinc, calcium and potassium at two stages, viz., at fruit set or two weeks after fruit set on guava plant. The foliar fertilization showed an increasing trend towards plant height (12.17% with 0.03% Zn two weeks after fruit set), fruit weight (150g with 0.03% B two weeks after fruit set), volume (147.67 with 0.03% B two weeks after fruit set) and yield (52.50 kg/tree with 0.01% Zn two weeks after fruit set) etc. It is clear from data that different levels of boron and zinc spectacularly increased TSS as compared to control.

The maximum TSS (12.55^{0}Brix) was recorded with (Borax 0.2%+ Zinc Sulphate 0.2%) followed by 12.49 (Borax 0.2%+ Zinc Sulphate 0.1%) while, the minimum TSS (9.91 ^{0}Brix) was noted in (control). It is evident from data that different levels of boron and zinc considerably acidity as compared to control. The lowest acidity 0.23 % was recorded with the application of (Borax 0.2%+ Zinc Sulphate 0.2%) followed by (Borax 0.2%+ Zinc Sulphate 0.1%) 0.24 % while, it was highest acidity 0.35 % was recorded in control. Acidity of fruits it was reduced by application of all the treatments. However, the maximum reduction was noted with ZnSO4 0.2% + Borax 0.2% followed by ($ZnSO_4$ 0.1% + Borax 0.2%). These results are in close conformity with the findings of Ingle et al. (1993) in guava; Singh and Brahmachari (1999); Singh et al. (2004), Trivedi et al. (2012).

The increased ascorbic acid of fruit significantly as compared to control. The highest ascorbic acid content (204.37 mg/100 g) was recorded with the treatment of Borax 0.2%+ Zinc Sulphate 0.2% followed by Borax 0.2%+ Zinc Sulphate 0.1% (196.72 mg/100 g) while, the lowest ascorbic acid (142.67 mg/100 g) in control. Foliar spray of ZnSO4 0.2% + Borax 0.2% also resulted in maximum ascorbic acid content (210.86 mg/100g pulp) as evident from table 4.2. The higher concentrations of boron and zinc increased the ascorbic acid content of fruit. These results are in conformity with the findings of **Singh et al. (2004), Khan et al. (2012) in citrus and Trivedi et al. (2012).**

Non-reducing sugar % of fruit significantly as compared to control. The highest non-reducing sugar content 3.48 % was recorded with (Borax 0.2%+ Zinc Sulphate 0.2%) followed by (Borax 0.2%+ Zinc Sulphate 0.1%) 3.20 % while, it was lowest 2.32 % in (control) non treated. It is evident from data presented in and exhibited in increased reducing sugar % of fruit, the maximum reducing sugar content 5.02% was recorded with (Borax 0.2%+ Zinc Sulphate 0.2%) followed by (Borax 0.2%+ Zinc Sulphate 0.1%) 4.85 % while, it was lowest 3.20 % in control. It is evident from data presented in and exhibited in increased total sugar % of fruit significantly as compared to control. The highest total sugar content 8.57 % was recorded with the application of (Borax 0.2%+ Zinc Sulphate 0.2%) followed by (Borax 0.2%+ Zinc Sulphate 0.1%) 8.15 % while it was lowest (5.56 %) in control. These results are in conformity with the finding of **Rajput and Chand (1970), Nitin et al. (2012) in guava fruit.**

Conclusion: On the basis of results obtained in the present investigation it is concluded that the foliar spray of Borax 0.2% + ZnSO4 0.2% was found to be most beneficial treatment for growth parameters, physical parameters of fruits, number of fruits per tree, yield per tree and chemical parameters i.e., total soluble solids, acidity, ascorbic acid, total sugar, reducing sugar and non-reducing sugar. Thus, the use of these micronutrients in balanced way may be suggested for growers to obtaining better yield and quality of guava. Can be recommended to guava growers for commercial cultivation of winter season guava (Psidium guajava L.), under Lucknow condition area in U.P.

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Table: Effect of Zinc and Boron on Growth, Yield and Quality of Guava (*Psidium guajava* L.) cv. L-49.

Treatments	**Number of fruits per tree**	**Yield per tree (kg)**	**Total chlorophyll content (mg/g)**	**Average weight of fruit (g)**	**Volume of fruit (cc)**	**TSS (^{0}Brix)**	**Acidity (%)**	**Ascorbic acid content in pulp (mg/100g)**	**Non reducing sugar(%)**	**Reducing sugar (%)**	**Total sugar (%)**
T_0 (Control)	170.45	25.85	1.28	161.80	161.29	9.91	0.35	142.67	2.32	3.20	5.56
T_1 (Zinc Sulphate 0.1%)	181.12	28.02	1.47	176.65	176.10	10.62	0.31	152.08	2.48	3.95	6.95
T_2 (Zinc Sulphate 0.2%)	190.24	32.60	1.49	184.70	184.08	10.74	0.28	162.28	2.54	4.21	7.27
T_3 (Borax 0.1%)	198.45	36.24	1.52	192.20	191.40	11.06	0.27	168.25	2.61	4.50	7.43
T_4 (Borax 0.2%)	208.13	42.10	1.56	201.18	200.12	11.28	0.26	176.70	2.68	4.66	7.69
T_5 (Borax 0.1%+ Zinc Sulphate 0.1%)	217.14	42.22	1.61	211.29	210.70	11.70	0.25	181.91	2.76	4.70	7.76
T_6 (Borax 0.1%+ Zinc Sulphate 0.2%)	230.14	48.40	1.69	218.90	270.80	12.13	0.24	185.82	2.88	4.78	7.88
T_7 (Borax 0.2%+ Zinc Sulphate 0.1%)	234.20	52.80	1.78	220.28	219.90	12.49	0.24	196.72	3.20	4.85	8.15
T_8 (Borax 0.2%+ Zinc Sulphate 0.2%)	242.69	57.04	1.81	233.22	232.05	12.55	0.23	204.37	3.48	5.02	8.57
SE(m)±	0.649	0.432	0.14	0.410	0.620	0.113	0.005	0.227	0.078	0.069	0.059
CD at 5%	0.918	1.306	0.38	4.12	4.37	1.19	0.016	2.38	0.28	0.26	028