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Foliar Feeding of Different Levels of Boron and Zinc on Physico-Chemical Characters and Economics of Winter Season Guava (*Psidium guajava* L.) Cultivar L-49

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ABSTRACT

The present investigation was carried out at Fruit Research Farm, Horticulture Unit, B.H.U., Varanasi (U.P.) during the year 2012-2013. The experiment was conducted with foliar feeding of different levels of Zinc and Boron and their combinations on guava cultivar L-49. The main objective of the research was to study the effect of boron and zinc on the quality of guava fruits and to work out the economics of different treatments. The average fruit weight (239.18 g), fruit volume (230.77 ml), specific gravity (1.03), polar diameter (7.30 cm), radial diameter (7.12 cm) of fruit at harvest were recorded maximum with foliar spray of Borax 0.4% + Zinc Sulphate 0.8%. Minimum acidity (0.20 %) was recorded in treatment T_8 (Borax 0.4% + Zinc Sulphate 0.8%). The quality parameters like total TSS (12.65 °Brix), TSS/acid ratio (63.25), ascorbic acid content (210.86 mg/ 100 g pulp) was maximum with foliar spray of Borax 0.4% + Zinc Sulphate 0.8%. The cost benefit ratio was found maximum (1:8.43) in T_8 (Borax 0.4% + Zinc Sulphate 0.8%). From the study it can be concluded that various quality parameters were improved with the foliar application of Borax 0.4% + $ZnSO_4$ 0.8% and it was economically viable treatment.

Key words: *Psidium guajava, Zinc, Boron, Economics, Quality*

INTRODUCTION

Guava (*Psidium guajava* L.) is an important fruit crop belonging to family Myrtaceae. The foliar feeding of fruit trees has gained much importance in recent years, as nutrients applied through soil are needed in higher quantity because some amount leaches down and some become unavailable to the plant due to complex soil reactions. Zinc increases fruit size as well as yield. The application of boron on the guava plant enhances the yield and quality of fruits. The main aim of the experiment was to study the effect of boron and zinc on the quality of guava fruits and to work out the economics of different treatments.

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Shukla[7] concluded that the maximum vitamin C (626.49 mg/100 g) was recorded with calcium carbonate+borax 0.4%. Similarly, it was also observed that such fruit (sprayed with Ca+B 0.4%) had slightly higher TSS (16.5%) at harvest than those in control (15.1%). Yadav[10] investigated the effect of foliar application of micronutrients and GA_3 on physicochemical characters of guava fruit cv. L-49.The maximum total soluble solids (11.70 ^{0}Brix), ascorbic acid (172.00 mg/100 g), acidity (0.30%) were recorded with foliar application of Borax-04 per cent followed by zinc sulphate 0.8%. Trivedi *et al.*[9] reported that the combined foliar application of zinc sulfate (0.6%) and boric acid (0.5%) before and after fruit set resulted in higher TSS, acidity, ascorbic acid, and sugar-acid ratio. Dutta and Banik[2] reported the highest cost:benefit ratio of 1:34.92 with the spraying of urea + K_2SO_4 + Zn + NAA followed by 1:34.06 with urea application alone.

MATERIAL AND METHODS

Experimental Details

The experiment was laid out in Randomized Block Design with three replications with a unit of one plant in each replication of a treatment.

Treatments	Details of the treatment
T_0	(Control)
T_1	(Zinc Sulphate 0.4%)
T_2	(Zinc Sulphate 0.8%)
T_3	(Borax 0.2%)
T_4	(Borax0.4%)
T_5	(Borax 0.2%+Zinc Sulphate 0.4%)
T_6	(Borax 0.2%+Zinc Sulphate 0.8%)
T_7	(Borax 0.4%+Zinc Sulphate 0.4%)
T_8	(Borax 0.4%+Zinc Sulphate 0.8%)

The observations were recorded on physico-chemical composition of fruits such as, average fruit weight (g)**,** fruit volume (ml)**,** specific gravity (w/v), polar diameter of fruit at harvest (cm), radial diameter of fruit at harvest (cm). The quality parameters were assessed on total soluble solids (^{0}Brix)**,** acidity (%), TSS: acid ratio, ascorbic acid content (mg/100g pulp) and economic parameters were also calculated.

Statistical analysis

The statistical analysis of the data obtained in the different set of experiment was calculated as suggested by Panse and Sukhatme[5].

RESULTS AND DISCUSSION

Physical Parameters of Fruit

The results obtained in present investigation revealed from Table 1 that the maximum fruit weight (239.18 g) was obtained with foliar spray of Borax 0.4% + $ZnSO_4$ 0.8% followed by T_7 (Borax 0.4% + $ZnSO_4$ 0.4%). These findings are in conformity with the results reported by Khan *et al.*[3] and Trivedi *et al*[9]. The results further revealed that the combination of boron and zinc produced an additive effect on the fruit weight. The higher fruit weight due to combined application of higher concentrations of zinc and boron may be attributed to their stimulatory effect on plant metabolism.

Maximum fruit volume (230.77 ml) was recorded with foliar spray of Borax 0.4% + $ZnSO_4$ 0.8% followed by Borax 0.4% + $ZnSO_4$ 0.4% and Borax 0.2% + $ZnSO_4$ 0.8%. The results corroborate the findings of Pal *et al*[4]. The increase in fruit size due to the increase in volume of guava fruit may be explained due to fact that higher concentration of mineral nutrients (boron and zinc) appears to have indirect role in hastening the process of cell division and cell elongation due to which volume of fruits might have improved. The maximum

polar diameter (7.30 cm) and radial diameter (7.12 cm) were recorded with Borax 0.4% + Zinc sulphate 0.8%. The minimum polar diameter and radial diameter were recorded under control. These results are in conformity with those reported by Singh *et al*.[8], Bisen *et al.*[1] and Trivedi *et al*[9]. This increase in polar diameter and radial diameter of guava fruit may be explained due to fact that mineral nutrients (boron and zinc) appear to have direct role in hastening the process of cell division and cell elongation due to which size might have improved.

Table 1: Foliar feeding of different levels of boron and zinc on physico-chemical characters of winter season guava cv. L- 49

Treatments	Average fruit weight (g)	Volume of fruit (ml)	Specific gravity (w/v)	Polar diameter (cm)	Radial diameter (cm)	TSS (^{0}Brix)	Acidity (%)	TSS/acid ratio	Ascorbic acid content
T_0	154.46	159.02	0.97	5.80	5.68	9.50	0.37	25.67	142.26
T_1	162.67	163.02	0.99	5.93	5.80	10.25	0.31	33.06	152.42
T_2	173.33	173.31	1.00	6.30	6.12	11.95	0.26	45.96	161.21
T_3	185.33	187.05	0.99	6.38	6.21	11.61	0.29	40.03	167.34
T_4	206.30	202.90	1.01	6.72	6.51	12.17	0.23	52.91	174.76
T_5	192.17	191.05	1.00	6.84	6.69	11.95	0.28	42.67	180.58
T_6	214.47	210.77	1.01	7.04	6.83	12.05	0.25	48.20	185.31
T_7	229.33	224.55	1.02	6.50	6.27	12.38	0.22	56.27	192.17
T_8	239.18	230.77	1.03	7.30	7.12	12.65	0.20	63.25	210.86
S Em ±	3.58	3.70	0.005	0.13	0.19	0.29	0.005	2.74	3.04
C.D. at 5%	10.76	11.09	0.017	0.40	0.58	0.89	0.017	8.21	9.13

Quality parameters of fruits

Analysis of data clearly indicates in Table 1 that application of boron and zinc significantly improved the fruit quality of guava in terms of TSS, ascorbic acid, TSS/acid ratio and percent acidity. The highest increase in T.S.S. (12.65 ^{0}Brix) was noticed with foliar spray of Borax 0.4% + $ZnSO_4$ 0.8% followed by T_7 (Borax 0.4% + $ZnSO_4$ 0.4%). Similar results were also reported by Trivedi *et al.*[9] and Sharma *et al*[6]. The increase in TSS due to spray of boron might be due to fact that boron helps in sugar transport and there by triggering the accumulation of more sugars in fruits. Acidity of fruits was reduced by application of all the treatments. However, the minimum acidity (0.20 %) was noted with Borax 0.4% + $ZnSO_4$ 0.8% followed by T_7 (Borax 0.4% + $ZnSO_4$ 0.4%). These results are in close conformity with the findings of Singh *et al.*[8], Trivedi *et al*[9]. The reduction in content of acid in fruit with borax treatment might be due to hastening process of ripening during which degradation of acid might have occurred and helped in preventing excessive polymerization of sugar and accumulation of more sugar in the cells of plant. The highest TSS/ acid ratio (63.25) was also reported with foliar spray of Borax 0.4% + $ZnSO_4$ 0.8%. It may be due to increased sugar and reduced leaf starch content, as a result of transformation of starch into sugar and its translocation into the fruits. Foliar spray of Borax 0.4% + $ZnSO_4$ 0.8% also resulted in maximum ascorbic acid content (210.86 mg/100g pulp). 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.*[8], Khan *et al.*[3] in citrus and Trivedi *et al*[9].

Economics of cultivation

A critical examination of data presented in Table 2 reveals that boron and zinc increased the net returns and B: C ratio. The maximum B: C ratio (8.43:1) was also recorded with T_8 (Borax 0.4%+ Zinc Sulphate 0.8%).

Table 2: Effect of different levels of boron and zinc on economics of winter season guava cv. L-49

Treatment	Treatment Cost (Rs)	Total Expenditure (Rs)	Gross Income (Rs)	Net Income (Rs)	Cost: Benefit ratio
T_0 - Control	0.0	34500.0	162293.51	127793.51	1:3.70
T_1 - Zinc Sulphate @ 0.4%	2757.46	37257.46	182000.58	144743.12	1:3.88
T_2 - Zinc Sulphate @ 0.8%	2815.18	37315.18	207991.95	170676.77	1:4.57
T_3 - Borax @ 0.2%	2737.4	37237.4	216350.67	179113.27	1:4.81
T_4 - Borax @ 0.4%	2774.8	37274.8	257107.09	219832.29	1:5.89
T_5- Borax @ 0.2% + Zinc Sulphate @ 0.4%	2794.86	37294.86	251615.96	214321.1	1:5.74
T_6- Borax @ 0.2% + Zinc Sulphate @0.8%	2852.58	37352.58	290358.96	253006.38	1:6.77
T_7- Borax @ 0.4% + Zinc Sulphate @ 0.4%	2832.26	37332.26	321780.45	284448.19	1:7.61
T_8- Borax @ 0.4% + Zinc Sulphate @ 0.8%	2889.98	37389.98	352896.87	315506.89	1:8.43

On the basis of results obtained in the present investigation it is concluded that foliar spray of $ZnSO_4$ 0.8% + Borax 0.4% was found to be most beneficial treatment for average weight of fruit, volume of fruit, specific gravity, polar length and diameter of fruits. From this experiment it can be concluded that various quality parameters like TSS, TSS/acid ratio and ascorbic acid were improved and acidity were reduced with the foliar application of Borax 0.4% + $ZnSO_4$ 0.8%. On the basis of economic analysis, Borax 0.4% + zinc sulphate 0.8% was found to be economically viable treatment. Hence, it can be concluded that Borax 0.4% + $ZnSO_4$ 0.8% is the best treatment for quality improvement in guava.

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