Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 1166-1168
Received: 16-09-2018
Accepted: 18-10-2018

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Effect of foliar application of zinc and boron on quality of pineapple cv. Mauritius

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Abstract
The present investigation was undertaken to study the effect of different levels of boron and zinc on quality attributes of pineapple cv. Mauritius at Horticultural farm, Department of Horticulture and Post-Harvest Technology, Palli Siksha Bhavana, Visva-Bharati, west Bengal during 2015 to 2016. The experiment was laid out in Randomized block design with nine treatments and replicated in three times, considering ten plants as a unit. The treatments comprising two levels of each zinc sulphate hepta hydrate (viz. @ 0.5% and @ 1.0 %), borax (viz. @ 0.5% and @ 1.0 % as source of boron). Two sprays were done at the flowering stage and at one month later of first spray. The results revealed that the effect of zinc and boron were found significant on fruit quality characters. Treatment combination of zinc sulphate @ 0.5% and borax @ 0.5% resulted maximum TSS Acid ratio (21.46), total sugar (8.66%) and reducing sugars (1.72%), lowest acidity (0.67%) along with higher TSS (14.36ºBrix). From the result of the present experiment it can be concluded that post flowering sprays of zinc and boron has significant role to improve the quality of pineapple.

Keywords: Zinc, boron, pineapple cv. Mauritius

Introduction
Pineapple is a tropical fruit which grows in countries which are situated in the tropical and subtropical regions. In India, the total pineapple production is estimated to be around 1.7 million tonnes (FAO, 2014) while the total pineapple production worldwide is 25.43 million tonnes (FAO, 2014). There are several countries such as Thailand, Brazil, India, Philippines and China which contribute significantly to the total production. Tropical soils are naturally poor in organic matter, what normally results in a micronutrient deficiency that can be efficiently corrected by leaf spraying, while the nutrient application to the soil does not always provide satisfactory results, due to the slight limit between deficiency and toxicity. Among micronutrients, boron and zinc deserve special attention, because their deficiencies are more frequent in crops. Their presence is also fundamentally important, because they are directly related to fruit formation and quality (Malavolta *et al.*, 1997) [2]. Santos *et al*. (2007) reported that ornamental pineapple plants cultivated without micronutrients did not flower naturally, but responded well to induction with ethephon. Usha & Singh (2002) [11] observed increases in grapevine fruits yield and quality, with B and K via foliar application, and Stover *et al*. (1999) in apple yield, with foliar application of B and Zn as solubor and Zn as zinc chelate. For Kavati (1992), micronutrient supply via foliar spraying, for the atemoya (*A. cherimoya* Mill. x *A. squamosa* L.) crop, especially of Zn and B, resulted in visual responses in the plant development.

Materials and Methods
The present investigation on "Effect of foliar application of zinc and boron on chemical parameters of pineapple (A*nanas comosus*) cv. Mauritius" was conducted during 2015-2016 at Horticultural farm, Department of Horticulture & Post-Harvest Technology, Palli Siksha Bhavana, Visva-Bharati, West Bengal. The experiment was laid out in Randomized Block Design with three replications with ten plants in each replication of a treatment.

Symbol	Details of the treatment
T_1	Zinc sulphate 0.5 %
T_2	Zinc sulphate 1.0 %
T_3	Borax 0.5 %
T_4	Borax 1.0 %
T_5	Zinc sulphate 0.5% + Borax 0.5%
T_6	Zinc sulphate 0.5% + Borax 1.0%
T_7	Zinc sulphate 1.0 % + Borax 0.5%
T_8	Zinc sulphate 1.0 % + Borax 1.0%
T_9	Control

Results and Discussion

TSS was significantly influenced by different treatments (Table 1). Significantly the maximum TSS was recorded with the application of $ZnSO_4$ at 1.0 % + Borax at 1.0% (15.07^0 Brix) which was at par with the application of $ZnSO_4$ at 1.0 % + Borax 0.5 % (14.59), $ZnSO_4$ at 0.5 % + Borax at 0.5% (14.36^0 Brix), $ZnSO_4$ at 0.5% (14.23^0 Brix). Significantly minimum TSS was noticed from control (12.03^0 Brix). Increase in TSS during ripening is a result of the transformation of complex sugar into simpler form under the action of the phosphorylase enzyme (Nakasone and Paull, 1998) and their combined synergetic effect particularly at higher concentrations. The increase in TSS by boron might be due to more rapid translocation of sugars from leaves to developing fruits. The total soluble solids content is used as an indication of fruit maturity and quality, and for pineapples, they range between 10.8- 17.5% with very little variation between varieties (Dull, 1971). The results from the study gave total soluble solids ranged 12.03-15.07. The favourable effects of boron and zinc sprays in increasing the TSS content have also been reported by Shrivastava *et al*. (2015) and Amorim *et al*. (2013) [1] in pineapple, Kavitha *et al.* (2000) [16] and Singh *et al.* (2010) in papaya and Rawat *et al.* (2010) and Chaitayna *et al.* (1997) [2] in guava, Prabu and Singaram (2001) [1] in grapes.

Titratable acidity in the fruits was significantly affected by different treatments (Table 1). The data revealed that acid content in fruits reduced under the effect of all treatments in comparison to control. Among the treatments significantly minimum acidity per cent (0.67%) was recorded by the application of Borax at 0.5 % + $ZnSO_4$ at 1.0 % followed by $ZnSO_4$ at 1.0 % + Borax at 1.0 %. while it was highest (0.86%) in control. The two major organic acids in pineapple are citric and malic acids (Saradhuldhat & Paull, 2007). The reduction of titrable acidity of pineapple fruits due to application of different levels of boron, zinc and their different combinations might be due to positive influence of boron and zinc in rapid conversion of acids into sugars and their derivatives by the reaction involving the reversal of glycolic pathway or might have been used as substrate in the respiration or both (Pandey *et al*. 2008). The results were in close conformity with the findings of Shrivastava (1970) in pineapple, also reported reduction of acidity in fruits with foliar application of micronutrients (zinc and boron) alone or in combination with other nutrients.

Table 1: Effect of foliar application of zinc and boron on TSS, acidity and TSS acid ratio of pineapple cv. Mauritius

Treatments		TSS (^{0}Brix)	Acidity (%)	TSS Acid ratio
Notations	Detail			
T_1	$ZnSO_4$ 0.5%	14.23	0.80	17.76
T_2	$ZnSO_4$ 1.0%	13.80	0.84	16.32
T_3	Borax 0.5%	13.05	0.82	15.90
T_4	Borax 1.0%	13.71	0.78	17.53
T_5	$ZnSO_4$0.5% + Borax 0.5%	14.36	0.67	21.46
T_6	$ZnSO_4$0.5% + Borax 1.0%	13.13	0.78	16.80
T_7	$ZnSO_4$ 1.0% + Borax 0.5%	14.59	0.83	17.49
T_8	$ZnSO_4$ 1.0% + Borax 1.0%	15.07	0.72	20.93
T_9	Control	12.03	0.86	13.98
CD (P=0.05)		0.84	0.06	0.91
S.Em(±)		0.43	0.03	0.37
CV (%)		5.45	12.23	15.04

Significant differences were reported with regards to TSS Acid ratio among different treatments (Table 1). Application of ZnSO4 at 0.5 % + Borax at 0.5 % has registered significantly maximum TSS (21.46) and it was on par with ZnSO4 1.0 % + Borax at 1.0 % + (20.93). The minimum TSS was (13.98) observed in the treatment control. A consistent decrease in acid content and increase in TSS resulted into an increase in TSS/acid ratio. 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 fruit.

Table 2: Effect of foliar application of zinc and boron on total sugar, reducing sugar and non-reducing sugar of pineapple cv. Mauritius

Treatments		Total sugar (%)	Reducing sugar (%)	Non reducing sugar (%)
Notations	Detail			
T_1	$ZnSO_4$ 0.5%	8.14	1.55	6.56
T_2	$ZnSO_4$ 1.0%	7.82	1.40	6.40
T_3	Borax 0.5%	6.81	1.43	5.36
T_4	Borax 1.0%	7.03	1.43	5.71
T_5	$ZnSO_4$0.5% + Borax 0.5%	8.66	1.72	6.83
T_6	$ZnSO_4$0.5% + Borax 1.0%	7.43	1.45	5.96
T_7	$ZnSO_4$ 1.0% + Borax 0.5%	8.26	1.55	6.72
T_8	$ZnSO_4$ 1.0% + Borax 1.0%	8.11	1.58	6.50
T_9	Control	6.33	1.31	5.04
CD (P=0.05)		0.50	0.11	NS
S.Em(±)		0.18	0.04	0.65
CV (%)		15.63	8.22	18.19

The data presented in Table 2 showed that foliar application of zinc and boron had significant effect on total sugars for different treatments. The data indicate the maximum total sugars in treatment with $ZnSO_4$ at 0.5 % + Borax at 0.5 % (8. 66 %) which was observed statistically at par with $ZnSO_4$ at 1.0 %+ Borax at 0.5 % (8.26 %).

Increased concentrations of boron and zinc alone or in combination showed a positive effect in increasing the total

sugars percentage in pineapple fruits might be due to breakdown of complex polymers into simple substances by hydrolytic enzymes. However, zinc acts as a catalyst in the oxidation and reduction processes and it has great importance in the sugar metabolism (Rath *et al.*, 1980). These findings were in accordance with the results of Shrivastava *et al.* (2015), Kavitha *et al.* (2000) [16] and Singh *et al.* (2010) in papaya, Trivedi *et al.* (2012) [11], Singh and Brahmachari (1999) and Kumawat *et al.* (2012) [10] in guava, Ghosh (2009) [5] in litchi, Ghanta and Dwivedi (1993) [3] in banana also observed higher total sugars with the foliar application of zinc and boron.

Reducing sugar of the fruits was significantly influenced by different treatments. Fruits obtained with the foliar application of $ZnSO_4$ at 0.5 % + Borax at 0.5 % (1.72 %) have shown significantly higher. Which was followed by $ZnSO_4$ at 1.0 % + Borax at 1.0 % (1.58%) and $ZnSO_4$ at 1.0 % + Borax at 0.5 % (1.55%) treatment. minimum (1.31%) was noticed in control. (Table 2).The results are conformity with Ghanta and Dwivedi (1993) [3] in banana, Alila *et al.* (2005) in papaya, Ghosh (2009) [5] in litchi, Sankar *et al.* (2013) in mango cv. Alphonso.

As presented in Table 2. it reveals that there is no significant difference in different levels of zinc and boron on Non reducing sugar of pineapple fruit.

Table 3: Effect of foliar application of zinc and boron on days to harvest from flowering of pineapple cv. Mauritius

Treatments		Days to harvest
Notations	**Detail**	
T_1	$ZnSO_4$ 0.5%	81.33
T_2	$ZnSO_4$ 1.0%	89.66
T_3	Borax 0.5%	89.17
T_4	Borax 1.0%	90.51
T_5	$ZnSO_4$0.5% + Borax 0.5%	77.83
T_6	$ZnSO_4$0.5% + Borax 1.0%	92.33
T_7	$ZnSO_4$ 1.0% + Borax 0.5%	91.17
T_8	$ZnSO_4$ 1.0% + Borax 1.0%	86.51
T_9	Control	94.97
CD (P= 0.05)		1.48
S.E(m±)		0.51
CV (%)		9.01

Significant variation was observed among the treatments with respect to days to harvest from flowering (Table 3). Foliar application of $ZnSO_4$ at 0.5% + Borax at 0.5% has taken significantly less number of days to fruit harvest after spray (77.83 days) and it was followed by $ZnSO_4$ at 0.5 % (81.33 days) and $ZnSO_4$ at 1.0% + Borax at 1.0% (86.51 days) treatments. Maximum number of days to harvest from flowering (94.97 days) was recorded in control.

It is apparent from the results that less number of days to harvest after foliar application was taken by the plants received combination of low concentration of boron and low concentration of zinc as compared to untreated plants in control. This may be due to significant effect of boron and zinc in higher synthesis of metabolites. Boron plays vital role in early flower initiation. Furthermore, the supply of B needed for reproductive growth in many crops is more than that needed for vegetative growth (Mengel and Kirkby (1982), Marschner (1986); Hanson, (1991), and the same may be true in Pineapple.

References

1. Amorim AV, Garruti DS, Lacerda CF, Moura CFH, Filho EG. Postharvest and sensory quality of pineapples grown under micronutrients doses and two types of mulching. African Journal of Agricultural Research. 2013; 8(19):2240-2248.
2. Chaitanya CG, Kumar G, Raina BL, Muthoo AK. Effect of foliar application of zinc and boron on yield and quality of guava. Haryana J Hort. Sci. 1997; 261:78-80.
3. Ghanta PK, Dwivedi AK. Effect of some micronutrients on yield and quality of banana cv. Giant Governor. Environment and Ecology. 1993; 11(2):292-294.
4. Ghanta PK, Dhus RS, Mitra SK. Response of papaya to foliar spray of Boron, Manganese and Copper. Horticultural Journal. 1992; 5(1):43-48.
5. Ghosh AS. Effect of foliar application of micronutrients on retention, yield and quality of fruit in litchi cv. Bombai. Environment and Ecology. 2009; 27(1):89-91.
6. Kavitha M, Kumar N, Jeyakumar P. Role of Zinc and Boron on fruit yield and associated characters in papaya cv. Co5. South Indian Horticulture. 2000; 48(16):6-10.
7. Kumawat KL, Sarolia DK, Shukla AK. Growth, yield and quality of rejuvenated guava as influenced by thinning-bending and micronutrients. Indian Journal of Horticulture. 2012; 69(4):478-483.
8. Prabu PC, Singaram P. Effect of foliar and soil application of zinc and boron on yield and quality of grapes *cv.* Muscat. Madras Agril. J. 2001; 88(7):505-507.
9. Singh VG, Chatterjee C, Bhriguvanshi SR, Yadava LP. Effect of foliar application of Zn, B and Mn on fruit quality and yield of mango (*Mangifera indica* L.). Plan Archives. 2009; 9(1):73-77.
10. Trivedi N, Singh D, Vijay B, Prasad VM, Collis JP. Effect of foliar application of zinc and boron on yield and fruit quality of guava (*Psidium gujava* L.). Hort Flora Research Spectrum. 2012; 1(3):281-283.
11. Usha K, Singh B. Effect of macro and micro-nutrient spray on fruit yield and quality of grape *Vitis vinifera* L. cv. Perlette. Acta Horticulturae. 2002; 30:197-202.