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Original Research Article

Effect of Foliar Application of Zinc and Boron on the Physical Parameters of Pineapple cv. Mauritius

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Keywords

Pineapple, Boron, Zinc and Physical parameters

A B S T R A C T

The present experiment was carried out at Horticultural farm, Department of Horticulture & Post- Harvest Technology, Palli Siksha Bhavana, Sriniketan, West Bengal. 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 physical characters and fruit quality characters as well. Treatment combination of zinc sulphate @ 0.5% and borax @ 0.5% resulted maximum fruit length (16.81cm), fruit weight (664.36g), fruit volume (631.03ml).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 yield and quality of pineapple. More precisely application of zinc sulphate @ 0.5% and borax @ 0.5% is best with respect to improving the yield and quality of pineapple cv. Mauritius.

Introduction

Pineapple (*Ananas comosus* (L.) Merr) belongs to the family Bromeliaceae is one of the choicest fruit all over the world because of its pleasant taste and flavour. Pineapple composes of nutrients which are good for human health. It mainly contains water, carbohydrate, sugars, and vitamins A, C, Potassium and Magnesium. It is also a source of bromelin, a digestive enzyme. Micronutrients are key elements in plant growth, development and quality of fruits. According to Su (1975), the micronutrients that are most important for pineapples in many parts of the world, are iron (Fe), zinc (Zn), copper (Cu) and Boron (B). The Zn and B are essentially required and play very important role in assimilate production, various enzymatic activities and synthesis. These micronutrients also help in the uptake of major nutrients and play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzyme activity, hormone synthesis, nitrogen fixation and reduction (Das 2003).

Materials and Methods

The present investigation on "Effect of Foliar application of Zinc and Boron on physical parameters of Pineapple (*Ananas 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.

Results and Discussion

Application of $ZnSO_4$ at 0.5 % + Borax at 0.5 % has registered significantly higher fruit length (26.77cm) and it was followed by $ZnSO_4$ 1.0 % + Borax 1.0 % (24.94 cm), $ZnSO_4$ 0.5% (24.83 cm), $ZnSO_4$ 1.0% + Borax 0.5%(22.73 cm), $ZnSO_4$ 0.5% + Borax 1.0% (22.50 cm) and $ZnSO_4$ 1.0% (22.41 cm) respectively. The fruit length recorded was significantly shorter (20.53cm) in plants from treatment control. In this treatment zinc applied during fruit growth stage which perhaps enhanced growth promoter production responsible for cell division and further growth of fruit. In the later stage greater translocation of assimilates triggard by application of boron also helped to increase cellular weight and volume. Ultimately both the zinc and boron played role in increasing fruit length.

The data pertaining to the fruit length without crown was influenced by various treatments on pineapple cv. 'Mauritius' are presented in Table 1 shows that there was significant dissimilarity in fruit length during present investigation. Higher value of fruit length (16.81cm) was noted with treatment of $ZnSO_4$ 0.5 % + Borax 0.5 %. Which was followed by T_8 ($ZnSO_4$ 1.0% + Borax 1.0%) and T_1 ($ZnSO_4$ 0.5%) 15.83cm and 15.67cm respectively. However, significantly minimum length was recorded in control. Similar result was discovered by Yong- hong lin in pineapple, Saleh and Monem (2003), Bhowmick *et al.,* (2012) in mango, Khayyat *et al.,* (2007) in date palm, Kumar *et al.,* (2009) in litchi, Yadav *et al.,* (2013) in peach, Venu *et al.,* (2014) in acid lime, which are in accordance with the results of the present experiment. Application of boron and zinc during fruit growth stage helped to increase fruit size by increasing the rate of cell division, cell enlargement, tissue differentiation and successive storage of assimilates within the fruit tissue.

Crown length (Table 1) under different levels of zinc and boron ranged from 7.35cm to 9.28cm. It was not significant. However, the maximum crown length was recorded with the application of $ZnSO_4$ at 0.5% + Borax at 0.5% (9.28cm) while minimum crown length was noticed with Borax at 1.0 % (7.35cm).

It was seen from the Table 2 that the different levels of boron and zinc has no significant effect in lengthwise no. of eyes in pineapple. However, maximum no. of eyes in length was reported with $ZnSO_4$ 1.0% + Borax 1.0% (6.27) while minimum was noticed in control (5.40).

As the no. of eyes is mostly the varietal character thus significant changes in their no. may not be possible by any external means so application of micronutrients could not be able to change no. of eyes in length.

The data presented in Table 2 reveals that no. of eyes in circumference of pineapple fruit was significant. Maximum no. of eyes in circumference of pineapple fruit (26.93) was recorded under T_8 ($ZnSO_4$ 1.0 + Borax 1.0 %) which was statistically at par with T_5 ($ZnSO_4$ 0.5 % + Borax 0.5 %), T_1 ($ZnSO_4$ 0.5 %), T_7 ($ZnSO_4$ 1.0% + Borax 0.5 %), T_9 ($ZnSO_4$ 0% + Borax 0%), T_4 (Borax 1.0 %) and T_6 ($ZnSO_4$ 0.5 % + Borax 1.0%) 26.53, 26.60, 26.07, 25.00 and 24.73 respectively.

Table.1 Effect of foliar application of Zinc and Boron on Fruit length with crown, Fruit length without crown and crown length of pineapple cv. Mauritius

Treatments		Fruit Length With Crown (cm)	Fruit Length Without Crown (cm)	Crown Length (cm)
Notation	Details			
T_1	$ZnSO_4$ 0.5%	24.83	15.67	8.87
T_2	$ZnSO_4$ 1.0%	22.41	13.70	8.31
T_3	Borax 0.5%	22.23	13.35	8.67
T_4	Borax 1.0%	20.99	13.67	7.35
T_5	$ZnSO_4$0.5% + Borax 0.5%	26.77	16.81	9.28
T_6	$ZnSO_4$0.5% + Borax 1.0%	22.50	14.55	7.66
T_7	$ZnSO_4$ 1.0% + Borax 0.5%	22.73	14.87	8.03
T_8	$ZnSO_4$ 1.0% + Borax 1.0%	24.94	15.83	8.34
T_9	Control	20.53	12.73	8.01
	CD (P=0.05)	0.72	0.78	NS
	S.Em(±)	0.33	0.30	0.59
	CV (%)	4.79	3.71	12.79

Table.2 Effect of foliar application of Zinc and Boron on No. of Eyes in length, No. of Eyes in circumference and No. of Eyes in 25cm^2 of pineapple cv. Mauritius

Treatments		No. of eyes in length	No. of eyes in circumference	No. of eyes in 25 cm^2	Eye Index
Notation	Details				
T_1	$ZnSO_4$ 0.5%	5.87	26.53	8.20	3.88
T_2	$ZnSO_4$ 1.0%	5.53	24.13	8.67	3.80
T_3	Borax 0.5%	5.60	22.93	8.47	3.76
T_4	Borax 1.0%	5.73	25.00	8.47	3.66
T_5	$ZnSO_4$0.5% + Borax 0.5%	6.07	26.53	8.33	4.17
T_6	$ZnSO_4$0.5% + Borax 1.0%	5.80	24.73	8.93	3.80
T_7	$ZnSO_4$ 1.0% + Borax 0.5%	5.47	26.60	7.73	3.90
T_8	$ZnSO_4$ 1.0% + Borax 1.0%	6.27	26.93	8.87	3.74
T_9	Control	5.40	26.07	8.53	3.60
	CD (P=0.05)	NS	2.25	NS	0.20
	S.Em (±)	0.19	0.77	0.31	0.08
	CV (%)	5.63	5.26	6.28	14.23

Table.3 Effect of foliar application of Zinc and Boron on Fruit weight with Crown, Fruit weight without crown, crown weight, Fruit circumference and fruit volume of pineapple cv. Mauritius

Treatments		Fruit Weight With Crown (g)	Fruit Weight Without Crown (g)	Crown Weight (g)	Fruit Circumference (cm)	Fruit Volume (ml)
Notation	**Details**					
T_1	$ZnSO_4$ 0.5%	691.64	639.67	50.93	32.57	617.51
T_2	$ZnSO_4$ 1.0%	614.63	571.73	42.89	32.13	482.33
T_3	Borax 0.5%	667.03	620.03	45.39	31.83	601.83
T_4	Borax 1.0%	597.59	559.00	38.60	32.07	421.27
T_5	$ZnSO_4$0.5% + Borax 0.5%	715.15	664.36	50.79	33.09	631.03
T_6	$ZnSO_4$0.5% + Borax 1.0%	620.27	578.87	45.53	32.27	468.95
T_7	$ZnSO_4$ 1.0% + Borax 0.5%	623.57	581.71	41.86	32.73	508.63
T_8	$ZnSO_4$ 1.0% + Borax 1.0%	692.71	643.03	49.68	32.90	620.06
T_9	Control	539.79	482.07	56.99	31.67	405.00
	CD (P=0.05)	23.12	24.55	5.60	NS	6.14
	S.Em(±)	10.58	13.22	2.35	0.52	2.11
	CV (%)	7.72	7.39	18.80	12.78	0.75

Treatments

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

As presented in Table 2.it reveals that there is no significant difference in different levels of zinc and boron on No. of eyes in 25 cm^2 of pineapple fruit.

Eye index was significantly influenced by different treatments (Table 2).Significantly the highest eye index was recorded with the application of $ZnSO_4$ at 0.5% + Borax at 0.5% (4.17) which was followed by $ZnSO_4$ at 1.0 % + Borax at 0.5%.Significantly minimum eye index was noticed from control (3.60). As in T_5 the fruit length and fruit circumference was maximum with respect to no. of eyes, eye index was highest while due to least fruit length and circumference. It was minimum under control.

Data concerning to fruit weight with crown have been presented in Table 3. It is evident from table that there was a spectacular increase in fruit weight with crown of pineapple fruit by application of different

treatments. The maximum (715.15 g) fruit weight was recorded with T_5 ($ZnSO_4$ 0.5% + Borax 0.5%), which was at par with T_8 ($ZnSO_4$ 1.0% + Borax 1.0%) while minimum (539.79 g) fruit weight was noted in control. The appreciable improvement in fruit weight by boron and zinc application has been also reported by Amorim *et al.,* (2010), Yong- hong lin and jen-hshuan chen (2011), Verma *et al.,* (2008) in Aonla, Baiea *et al.,* (2013) in mango, Pant and Lavania (2000), Ghanta (1992) and Singh *et al.,*(2010) in papaya. Thus the finding of the present experiment corroborates to the findings of above scientists.

Data concerning to fruit weight without crown are presented in Table 3. An examination of data clearly indicated that all the treatments significantly increased fruit weight as compared to control. The maximum (664.36g) fruit weight was recorded with T_5 ($ZnSO_4$ 0.5% + Borax 0.5%), which was followed by T_8 ($ZnSO_4$1.0% + Borax 1.0%) and T_1 ($ZnSO_4$ 0.5%) 643.03g and 639.67g respectively while minimum (482.07 g) fruit weight was noted in control. The increase in fruit weight with the sprays of Borax and $ZnSO_4$ might be due to the involvement of these chemicals in hormonal metabolism, increase in cell division and expansion of cell wall. Boron is also known to stimulate rapid mobilization of water and sugar in the fruit which intern increased in accumulation of dry matter within the fruit (Bhatt *et al.,* 2012). Application of zinc also improved the other physical characteristics of pineapple fruits. It was probably due to the effect of zinc in regulating the semi permeability of cell walls, thus mobilizing more water into fruits resulting increase in fruit weight (Singh *et al.,* 2010).

Different levels of zinc and boron caused spectacular effect on crown weight. The minimum (38.60g) was recorded with T_4 (Borax1.0 %), while maximum crown weight was noted in control.

It is evident from the result that the control plants exhibited maximum crown weight which may be due to lower translocation of assimilates towards the fruit tissue and higher in fruit crown. Such translocation helped higher growth of fruit crown under the control treatment. Whereas application of zinc also increased the crown growth but that was not significant.

Fruit circumference (Table 3) under different levels of zinc and boron ranged from 31.67cm to 33.09 cm. It was non-significant. However maximum fruit circumference was reported with $ZnSO_4$ 1.0% + Borax 1.0% (32.90cm) while minimum was noticed in control (31.67cm).

Data presented in Table 3 clearly indicate that all the treatment increased volume of fruit as compared to control. The maximum (631.03ml) volume of fruit was recorded with T_5 ($ZnSO_4$ 0.5% + Borax 0.5%), while minimum (405.00ml) fruit volume was noted in control. Improvement in fruit volume could be attributed to the beneficial effect of zinc and boron as its application was known to increase the fruit volume in guava (Rajkumar *et al.,* 2014), in mango (Sankar *et al.,* 2013), Bhowmick *et al.,* (2012), in acid lime (Venu *et al.,* 2014), in peach Yadav *et al.,* (2013).

In this treatment zinc applied during fruit growth stage which perhaps enhanced growth promoter production responsible for cell division and further growth of fruit. In the later stage greater translocation of assimilates triggard by application of boron also helped to increase cellular weight and volume. Ultimately both the zinc and boron played role in increasing fruit volume.

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