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Effect of foliar application of zinc and boron on growth and yield of sweet corn (*Zea mays* L. *Saccharata*)

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Abstract
A field experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) during *Kharif*, 2023. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), organic carbon (0.75%), available N (269.96 kg/ha), available P (33.10 kg/ha), and available K (336 kg/ha). The experiment was laid out in Randomized Block Design with 10 hybrids each replicated thrice. Based on the objectives taken significantly higher plant height (121.44 cm), cob length (23.28 cm), number of rows/cob (18.69) and Harvest Index (40.41%) were recorded in 0.3% zinc + boron 0.3%. Minimum days to tasseling and silking were observed in 0.2% zinc + boron 0.3% recording 62.33 and 70.33 DAS.

Keywords: Sweet corn, Growth, yield, boron, zinc, foliar, kharif

Introduction
Maize (*Zea mays*) is a C4 plant and has high yielding potential. Besides human food and animal feed, this crop has its significance as a source of large number of industrial products like starch and oil. It is a widely grown cereal and is categorized as primary staple food in many developing countries. India contributes merely about 2.5 percent in world maize production. It is third most important cereal crop after rice and wheat and is being grown throughout the year but mainly as *kharif* crop. At present maize is being grown in most of the states of the country with annual grain production of 24.53 million tonnes and productivity 2583 kg ha^{-1}. Sweet corn is highly exhaustive crop, because of its high nutrient demand. Nitrogen being an important component of leaves in the form of chlorophyll and proteins, it plays a significant role in growth and development of corn plants and hence it required in large quantities. It can be a profitable crop for the farmers and seed industry, particularly for those residing in peri-urban areas. Nutritional value per 100 g of sweet corn (seeds) is carbohydrates (19 g), Sugars (3.2 g), dietary fiber (2.7 g), fat (1.2 g), protein (3.2 g), Vitamin A (10 µg), Vitamin B9 (46 µg), vitamin C (7 mg), iron (0.5 mg), magnesium (37 mg) and potassium (270 mg). As regards to health benefits, cooked sweet corn has significant antioxidant activity, which can substantially reduce the chance of heart disease and cancer (USDA nutrient database).
Among nutrient elements, Zinc and Boron plays a vital role besides nitrogen in plant nutrient that influences vigour of plant, root growth and improves the quality of crop yield. Boron is an essential factor for cell division because it is a constituent element of nucleoproteins which are involved in the cell reproduction processes. It is also a component of a chemical essential to the reactions of carbohydrate synthesis and degradation. It is important for seed and fruit formation and crop maturation. Zinc and Boron hastens the ripening of fruits thus counteracting the effect of excess nitrogen application to the soil. It helps to strengthen the skeletal structure of the plant thereby preventing lodging.

Materials and Methods
A field experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) during *Kharif*, 2022. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), organic carbon (0.75%), available N (269.96

kg/ha), available P (33.10 kg/ha), and available K (336 kg/ha). The experiment was laid out in Randomized Block Design with 10 Treatments each replicated thrice with three levels of foliar application of Zinc and Boron. The treatments studied were T1 - 0.1% zinc + boron 0.1%, T2 - 0.1% zinc + boron 0.2%, T3 - 0.1% zinc + boron 0.3%, T4 - 0.2% zinc + boron 0.1%, T5 - 0.2% zinc + boron 0.2%, T6 - 0.2% zinc + boron 0.3%, T7 - 0.3% zinc + boron 0.1%, T8 - 0.3% zinc + boron 0.2%, T9 - 0.3% zinc + boron 0.3% and T10 – Control. The observations were recorded on different growth parameters at harvest *viz*. plant height (cm), plant dry weight, test weight, seed yield, stover yield and harvest index. were analyzed statistically to test their significance and the experiment findings have been summarized in the light of scientific reasoning and have been discussed below under the following heading: -

Results and Discussion

A. Growth Attributes

At 100 DAS, significantly higher plant height (168.40 cm) was recorded with application of 0.3% zinc + boron 0.3%. However, 0.3% zinc + boron 0.2% (167.00 cm) and 0.2% zinc + boron 0.3% (165.20 cm) were statistically at par with 0.3% zinc + boron 0.3%. The nutrients when applied as foliar spray could have created stimuli in the plant system and increased the production of growth regulators in cell system and the action of growth regulators in plant system ultimately stimulated the necessary growth and development. Similar findings were also reported by Patel (2012) [8]. Minimum days to tasseling were observed in 0.2% zinc + boron 0.3% recording 62.33 DAS. Maximum days to tasseling were recorded in control (68.33 DAS). Minimum days to silking were observed in 0.2% zinc + boron 0.3% and 0.1% zinc + boron 0.1% recording 70.33 DAS. Maximum days to tasseling were recorded in control (75.33 DAS). Boron plays a key role in flowering, pollen development, pollination, and reproductive growth in tassels and ears (Kumar *et al.*, 2023) [2].

B. Yield Attributes

The observations on the cob length (cm) of sweet corn were statistically highest under 0.3% zinc + boron 0.3% (23.28 cm). However, 0.3% zinc + boron 0.2% (22.57 cm) and 0.2% zinc + boron 0.3% (22.91 cm) was statistically at par with 0.3% zinc + boron 0.3%. Zinc maintained and balanced source to sink ratio which might have resulted in increased yield attributes of maize. This report was substantiating with Srinivas Rao *et al*. (2010) [5]. There was significant effect of treatment combination on number of rows/cob. Significantly highest number of rows/cob was recorded in 0.3% zinc + boron 0.3% (18.69). 0.3% zinc + boron 0.2% (17.54 g), 0.3% zinc + boron 0.1% (17.78) and 0.2% zinc + boron 0.2% (17.56) were statistically at par with 0.3% zinc + boron 0.3%. More number of bigger size cobs might have accommodated number of grains providing sufficient space for development of individual grain, leading to higher test weight with boron and zinc application resulting in higher grain weight. Similar observations were made by Dibaba *et al*. (2013) [1] and Padma *et al*., (2018) [3]. The data showed there was no significant effect on seed index. Highest seed index was observed in 0.3% zinc + boron 0.3% recording 23.93g/hill. However, lowest was observed in 0.1% zinc + boron 0.1% (21.20 g). Significantly higher Harvest index was observed in the treatment combination of 0.3% zinc + boron 0.3% (40.41%). Treatment combination 0.3% zinc + boron 0.2% (40.24%) was statistically at par with 0.3% zinc + boron 0.3%.

Table 1: Effect of foliar application of Zinc and Boron on growth of Sweet Corn

	Plant height (cm)	Days taken to tasseling	Days taken to silking
1. 0.1% zinc + boron 0.1%	116.16	65.33	70.33
2. 0.1% zinc + boron 0.2%	106.55	65.33	71.33
3. 0.1% zinc + boron 0.3%	119.83	64.33	74.33
4. 0.2% zinc + boron 0.1%	105.39	65.33	72.33
5. 0.2% zinc + boron 0.2%	111.21	66.33	71.33
6. 0.2% zinc + boron 0.3%	114.65	62.33	70.33
7. 0.3% zinc + boron 0.1%	106.08	66.33	72.33
8. 0.3% zinc + boron 0.2%	103.49	64.33	74.33
9. 0.3% zinc + boron 0.3%	112.65	66.33	72.33
10. control	113.12	68.33	75.33
F-test	S	NS	NS
S.Em±	1.38	2.34	2.03
CD (P=0.05)	4.19	-	-

Table 2: Effect of foliar application of Zinc and Boron on yield parameters of Sweet Corn

Treatment combination	Cob length (cm)	Grains row/cob(No.)	Seed Index	Harvest index (%)
1. 0.1% zinc + boron 0.1%	19.22	15.89	65.62	30.00
2. 0.1% zinc + boron 0.2%	20.50	16.22	64.04	32.04
3. 0.1% zinc + boron 0.3%	20.50	15.33	64.23	28.09
4. 0.2% zinc + boron 0.1%	21.53	16.44	63.9	30.91
5. 0.2% zinc + boron 0.2%	21.35	17.56	65.43	28.77
6. 0.2% zinc + boron 0.3%	22.91	16.56	62.16	32.93
7. 0.3% zinc + boron 0.1%	22.12	17.78	65.63	38.33
8. 0.3% zinc + boron 0.2%	22.57	17.54	63.43	39.66
9. 0.3% zinc + boron 0.3%	23.28	18.69	64.62	38.80
10. control	20.92	16.78	64.04	25.97
F-test	S	S	NS	S
SEm±	0.39	0.51	2.56	0.89
CD (p=0.05)	1.16	1.54	-	2.54

Conclusion

The concluded experiment showed the treatment combination of foliar application of 0.3% Zinc with Boron at 0.5% recorded maximum Growth and higher yield attributes and was also economically profitable

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