Effect of boron on growth and yield of sweet corn (*Zeamays*L. Saccharata) varieties

ABSTRACT: A field experiment was conducted during *zaid*2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out on Randomized Block Design with Ten treatments each replicated thrice on the basis of one year experimentation. The treatments which are T1: Sugar-75 + 0.1 % boron foliar application, T2: Sugar-75 + 0.2 % boron foliar application, T3: Sugar-75 + 0.3 % boron foliar application, T4: Madhuri + 0.1 % boron foliar application, T5: Madhuri + 0.2 % boron foliar application, T6: Madhuri + 0.3 % boron foliar application, T7: Misthi + 0.1 % boron foliar application, T8: Misthi + 0.2 % boron foliar application, T9: Misthi + 0.3 % boron foliar application, T10: Control - N:P: K-120: 60:40(kg/ha) are used. The results showed that treatment T9-Misthi +0.3% boron foliar application was recorded significantly higher growth parameters like Plant height (175.5 cm), Plant dry weight (141.6 g/plant) and highest Crop growth rate (22.1 g/m^2/day). However, yield attributes and yield parameters like No. of Cobs/plant (1.81), No. of Grains/Cob (617.7), No. of Rows/cob (14.37), Seed index (68.4 g), cob length (18.5 cm), Grain yield (9.5 t/ha), Stover yield (15.4 t/ha) were recorded with the treatment T9-Misthi+ 0.3 % boron foliar application.

Comment [IA1]: The abstract is too detailed with methods and some results. No introduction, no interpretation of the results (discussion) and no conclusion.

A good abstracts must have a short introduction, methods, results obtained, the implication of the results (discussion) and then a conclusion. Try and restructure the abstract in this form

Keywords:*Boron, Madhuri, Misthi, Sugar-75, Growth, varieties, yield.*

Comment [IA2]: Try not to used words in tittle as key words

INTRODUCTION

Maize (*Zea mays* L) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as "queen of cereals" because it has the highest genetic yield potential among the cereals. Maize is one of the important cereal crops next to wheat and rice in the world. The productivity of maize mainly depends on its nutrient management **(Kumar *et al.*, 2019).** Being a C4 plant, maize is capable of utilizing solar radiation more efficiently compared to other cereals. Maize is grown throughout the year in all states of the country for various purposes including fodder for animals, food grain, sweet corn, baby corn, green cobs and popcorn, corn flour is consumed widely in Indian cooking. Among the cereals in India, maize occupies the third most important food crops after rice and wheat. In order to obtain more agricultural production, either more lands should be cultivated, which is not applicable in most cases, or higher yield must be produced in the currently cultivated lands.

Comment [IA3]: Reference?

In India, corn is being cultivated in an area of about 9.18 million hectares with a production of 27.23 million tonnes and an average productivity of 2965 kg/ha which is fifth largest producer in the world contributing three per cent of the global production. Madhya Pradesh tops the list with the contribution of 14.87 per cent (1.37 million tonnes) to the total Indian maize grown area. In India, Karnataka produces corn of about 3.73 million tonnes with a per cent of 13.69 among the states and highest productivity was noticed in Tamil Nadu of about 6551kg/ha.While,UttarPradeshcontributesanareaofabout0.73millionhectareswitha7.98per centtoalloverIndiawhichhastheproductionofabout1.53milliontonnes(5.63percenttoall India)

Comment [IA4]: Reference?

and productivity is 2090 kg/ha, respectively **(Agricultural Statistics at a Glance, 2019)**. Sweet corn is highly exhaustive crop, because of its high nutrient demand **(Krishnaveni and Ramaswamy, 1985)**. 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 largequantities.

Boron application improves growth, and enhances stress tolerance in plants and improves grain production. World-wide Boron deficiency is more extensive then the any other plant micro nutrient deficiency boron deficiency caused sterility in maize, in sufficient levels of available boron soil reduce crop yield, impair grain quality, and increase the susceptibility of crops to diseases. Boron is considered as an essential element for plant growth and development, sexual reproduction in plant is more sensitive to B deficiency, then vegetative growth **(Goldbach*et al.*, 2007).** The main function of Boron relates to cell wall strength and development, cell division, fruit and seed development sugar transport and hormone development. Boron deficiency depresses commercial corn yield primarily through grain set failure. Boron deficiencies are usually apparent on the new leaves of maize since it is during the development of new tissue that nutrients are most required **(Ahmed *et al.*, 2009).**

Varieties play an important role in gaining better and higher yield. Depending upon the variety, we can obtain disease-free, pest-free, hybrid etc. crops. Varieties are one of the very important parameters in crop production. Most of the agronomic requirements of baby corn are similar to grain maize; however, for successful production of baby corn, selection of suitable varieties need to be studied under local agro-climatic conditions. Varieties also play a significant role in obtaining higher growth, yield contributes and yields viz., plant dry weight, crop growth rate, days to tasseling, days to silking number of cobs/plants, weight of corn with husk, weight of corn without husk, corn yield and fodder yield etc.**(Sharma *et al.*, 2014).**

MATERIALS AND METHODS

A field trial was conducted during *zaid* of 2022 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (U.P.), India which is located at 25.40˚ N latitude, 81.85 ˚ E longitude, and 98 m altitude above the mean sea level (MSL). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out on Randomized Block Design with ten treatments each replicated thrice on the basis of one year experimentation.Nutrient sources were Urea, Single Super Phosphate and Murate of Potashto fulfill the requirement of Nitrogen, Phosphorus and Potassium respectively. RDF of 120:60:40 NPK kg/ha was used in all treatments as basal dose, also the foliar application of the nutrientBoron was done according to the treatments.Seeds were dibbled manually at a depth of 3-4 cm. The growth parameters of the plants were recorded at frequent intervals from germination up until harvest and finally, the yield parameters were recorded after harvest.These parameters were statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design.

Comment [IA5]: What statistical tool did you used?

RESULTS AND DISCUSSION

Plant height (cm)

The significantly taller plant height (68.20 cm) at 40 DASwas recoded in treatment 9 with variety Misthi + 0.3 % boron foliar application. However, treatment 8 with Misthi + 0.2

% boron foliar application (67.6 cm) was found to be statistically at par with treatment 9 Misthi + 0.3 % boron foliar application as compared to other treatments.

The probable reason for the influence in plant height might be due to Misthi variety proved superior over other varieties and the application of Boron might be the involvement of in different physiological processes like enzyme activation, electron transport, chlorophyll formation, stomatal regulation, etc. With the increase in levels of boron the plant height gradually increased, which might be attributable to greater photosynthetic activity and chlorophyll synthesis due to boron fertilization resulting into better vegetative growth. Similar results were reported by **Adhikary*et al*. (2018) and Alom*et al*. (2010).**

Plant dry weight (g)

The significantly maximum plant dry weight (24.7 g) was recorded with treatment 9intreatment 9 with Misthi + 0.3 % boron foliar over the other treatments. However, treatment 2 Sugar-75 + 0.2 % boron foliar application (24.0 g/plant), treatment 3 Sugar-75 + 0.3 % boron foliar application (24.2 g/plant), treatment 6Madhuri + 0.3 % boron foliar application (23.8 g/plant) and treatment 8Misthi + 0.2 % boron foliar application (24.5 g/plant) were found to be statistically at par with treatment 9 Misthi + 0.3 % boron foliar as compared to other treatments.

Misthi variety showed highest dry weight due to the higher growth and biomass accumulation when compared to other varieties. Similar trends were observed by **Singh *et al*. (2015).**Dry weight was increased significantly with increasing levels of Boron. As boron generally influences cell division and nitrogen absorption from the soil might enhance plant growth which reflects in terms of plant dry weight. These findings are in harmony with those obtained by **Kumar *et al.* (2019).**

Crop growth rate (g/m^2/day) and Relative growth rate (g/g/day)

During 40-60 DAS, there was significant difference among the treatments. However, highest Crop growth rate (15.7 g/m^2/day) was recorded with the treatment 8 Misthi + 0.2 % boron foliar, whereas the minimum Crop growth rate (15.1 g/m^2/day) was recorded with the treatment 10 Control (N:P: K-120: 60:40 kg/ha). Highest Relative growth rate (0.056g/g/day) was recorded with the treatment 6Madhuri + 0.3 % boron foliar application whereas, minimum Relative growth rate (0.053g/g/day) was recorded with treatment 10 Control (N:P: K-120: 60: 40kg/ha).

Yield attributes

The significantly higher number of cobs/plant (1.81), number of grains per cob (617.7), number of rows per cob (14.37)seed index (68.4 g) and cob length (18.5 cm) were found with treatment 9(Misthi + 0.3 % boron foliar application). However, the treatment8Misthi + 0.2 % boron foliar application (18.3 cm) was found to be statistically at par with treatment 9Misthi + 0.3 % boron foliarapplication.

Increase in this attribute by foliar spray might be due to the involvement of the boron in enzyme activation, membrane integrity, chlorophyll formation, stomatal balance and starch utilization at early stages which enhanced accumulation of assimilate in the grains resulting in heavier grains. These results are in agreement with the findings of **Khan *et al.*(2019).**The performance of Misthi variety as regard of yield attributes was found to be superior. The probable reason for this may be the genetic make-up of the variety that has helped in improving the photosynthetic activity due to increased source capacity and efficient translocation of photosynthesis to the sink. The results were in accordance **Mashood*et al*. (2018).**

Yield

Significantly higher grain yield (9.5 t/ha) andstover yield (15.40 t/ha) were found in treatment 9Misthi+ 0.3% boron foliar application.However, the treatment 8 Misthi + 0.2 % boron foliar application (9.4 t/ha) which was found to be statistically at par with treatment 9Misthi + 0.3 % boron foliar application. Highest Harvest Index (38.23 %) was recorded with the treatment1 Sugar-75 + 0.1 % boron foliar application whereas, minimum Harvest Index (37.95 %) was recorded with treatment 5 Madhuri + 0.2 % boron foliar application.

The performance of sweet corn varieties in respect of grain yield was very encouraging and followed a similar trend that of yield attributes. The little millet variety Misthi recorded higher seed yield and straw yield over other varieties might be due to the higher production efficiency that has been reflected through improvement in different yield attributing characters. Similar findings were reported by **Scaria*et al*. (2016).**Boron plays a vital role in increasing seed yield because zinc and boron takes place in many physiological process of plant such as chlorophyll formation, stomatal regulation, starch utilization which enhance seed yield. Boron is a required for many physiological processes and plant growth, also adequate nutrition is a critical for increase yields and quality ofcrops.Theseresultsarein confirmatorywiththeworkof**Alimuddin*etal*.(2020).**

CONCLUSION

Based on my research ~~trail,~~trial the treatment combination of0.3% Boron foliar application with variety Misthiwas found to be more productive. Although the findings are based on one season further research is needed to confirm the findings and their recommendation.

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Table 1. Effect of Boronon growth and growth attributes of sweet corn varieties.

S. No.	Treatment Combinations	40 DAS		40 DAS- 60 DAS	
		Plant Height(cm)	Dry weight (g)	Crop Growth Rate (g/m^2/day)	Relative Growth Rate (g/g/day)
1.	Sugar-75 + 0.1 % boron foliar application	64.3	23.4	15.2	0.05
2.	Sugar-75 + 0.2 % boron foliar application	65.8	24.0	15.6	0.05
3.	Sugar-75 + 0.3 % boron foliar application	66.9	24.2	15.6	0.05
4.	Madhuri + 0.1 % boron foliar application	63.5	22.9	15.2	0.05
5.	Madhuri + 0.2 % boron foliar application	63.9	23.2	15.2	0.05
6.	Madhuri + 0.3 % boron foliar application	65.2	23.8	15.5	0.05
7.	Misthi + 0.1 % boron foliar application	64.5	23.6	15.4	0.05
8.	Misthi + 0.2 % boron foliar application	67.6	24.5	15.7	0.05
9.	Misthi + 0.3 % boron foliar application	68.2	24.7	15.6	0.05
10.	Control - N:P: K-120: 60:60(kg/ ha)	62.8	22.5	15.1	0.05
	F-test	S	S	NS	NS
	SEm (±)	0.23	0.27	0.16	0.00
	CD (p=0.05)	0.68	0.82	-	-

Table 2. Effect of Boronon yield and yield attributes of sweet corn varieties.

S. No.	Treatments	No. of cobs/plant	No. of grains/cob	No. of rows/cob	Seed Index(g)	Cob length (cm)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	Sugar-75 + 0.1 % boron foliar application	1.41	585.4	12.91	66.1	17.5	8.7	14.1	38.23
2.	Sugar-75 + 0.2 % boron foliar application	1.55	598.7	13.57	67.2	18.1	9.1	14.7	38.10
3.	Sugar-75 + 0.3 % boron foliar application	1.56	608.1	13.77	67.7	18.2	9.2	15.0	37.96
4.	Madhuri + 0.1 % boron foliar application	1.22	578.7	12.50	65.1	17.1	8.6	13.9	38.12
5.	Madhuri + 0.2 % boron foliar application	1.24	582.3	12.66	65.6	17.4	8.7	14.2	37.95
6.	Madhuri + 0.3 % boron foliar application	1.52	593.0	13.45	66.8	18.0	9.0	14.5	38.21
7.	Misthi + 0.1 % boron foliar application	1.45	589.4	13.28	66.4	17.7	8.9	14.4	38.03
8.	Misthi + 0.2 % boron foliar application	1.69	614.3	14.14	68.0	18.3	9.4	15.2	38.04
9.	Misthi + 0.3 % boron foliar application	1.81	617.7	14.37	68.4	18.5	9.5	15.4	38.10
10.	Control - N:P: K-120: 60:60(kg/ ha)	1.14	577.3	12.34	64.8	16.9	8.5	13.9	38.07
	F test	S	S	S	S	S	S	S	NS
	S. Em (±)	0.02	1.19	0.07	0.18	0.07	0.04	0.15	0.28
	CD (P = 0.05)	0.08	3.54	0.20	0.55	0.21	0.15	0.47	-