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Effect of silicon and boron on growth and yield of sweet corn

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Abstract
Field experiment titled "Effect of Silicon and boron on growth and yield of sweet corn" was conducted during kharif 2023 at Crop Research Farm. Department of Agronomy, Naini Agriculture Institute SHUATS, Prayagraj Uttar Pradesh. The chemical analysis of soil at pre experiment stage are nitrogen (188.3 kg/ha), Phosphorus (34.5 kg/ha), potassium (87 kg/ha), with pH (7.4). The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice. The treatments combination are T_1: Silicon 100 kg/ha + boron 0.50 kg/ha, T_2: Silicon 100 kg/ha + boron 1.0 kg/ha, T_3: Silicon 100 kg/ha + boron 1.50 kg/ha, T_4: Silicon 140 kg/ha + boron 0.50 kg/ha, T_5: Silicon 140 kg/ha + boron 1.0 kg/ha, T_6: Silicon 140 kg/ha + boron 1.50 kg/ha, T_7: Silicon 180 kg/ha + boron 0.50 kg/ha, T_8: Silicon 180 kg/ha + boron 1.0 kg/ha, T_9: Silicon 100 kg/ha + boron 1.50 kg/ha, T_{10}: Control – 120:60:60 (N:P:K) Kg/ha are used. Results obtained that combined the application of Silicon 100 kg/ha + boron 1.50 kg/ha was recorded significantly higher growth of crop which was recorded with the study of crop growth parameters such as plant height (158.2 cm), plant dry weight (62.12 g/plant) and yield attributes like effective cobs per plant (1.9), number of grains row per cob (16.5), number of grain per rows (24.7), number of grains per cob (374.5).

Keywords: Sweet corn, silicon, boron, growth parameters, yield attributes and economics

Introduction
Sweet corn (*Zea mays* L.) is one of the maximum flexible plants grown for the duration of the tropical in addition to temperate areas of the arena. A crop of Sweet corn is sown and harvested a few wherein withinside the global in each month of the year. There isn't anyt any cereal in the world which has so mammoth potentiality and this is why it's also called "QUEEN OF CEREALS". It is a maximum vital cereal crop which ranks 0.33 after wheat and rice withinside the global. Globally, India stands fifth rating acreage and eighth rank in manufacturing of Sweet corn. Currently, one hundred seventy international locations are worried in Sweet corn manufacturing that is together generating approximately 1147.7 million metric tonnes, of Sweet corn from a place of 193.7 million hectares with a median international productiveness of 5. Seventy five t/ha (FAOSTAT, 2020) [5].

India ranks 4th in vicinity and seventh in manufacturing a few of the Sweet corn-developing international locations, representing approximately 4% of the arena Sweet corn vicinity and 2% of overall international manufacturing. In India, after rice and wheat, Sweet corn is the 0.33 maximum vital meals crop, enticing at once extra than 12 million Sweet corn growers and contributing in keeping with cent to the overall price of output from all of the plants withinside the country. It contributes almost 9% of the countrywide meals basket (Anonymous 2012) [4] and occupies a place of 9.38 million ha with an annual manufacturing of 28.eight million tonnes and common productiveness of 3.07 tonnes/ha (Anonymous 2018) [5]. The corresponding figures for Himachal Pradesh are 294 thousand/ha, 784.29 thousand tonnes and 2.sixty eight tonnes/ha, respectively (Anonymous 2016) [5].

Sweet corn may be grown efficaciously in kind of soils starting from loamy sand to clay loam. However, soils with properly natural depend content material having excessive water maintaining capability with impartial pH are taken into consideration properly for better productivity. Being a touchy crop to moisture pressure specially extra soil moisture and salinity

stresses; it's far proper to keep away from low mendacity fields having negative drainage and additionally the sector having better salinity. Therefore, the fields having provision of right drainage have to be decided on for cultivation of Sweet corn. Vermicompost is a great alternative to business fertilizers and has greater N, P and K content material than the everyday heap manure. The utility of vermicompost facilitates to improves and conserves the fertility of soil. Vermicompost imparts a darkish color of the soil and thereby assist to keep the temperature of soil. Vermicompost is one of the manure utilized by the farmer in developing plants due to early availability and presence of just about all of the vitamins required via way of means of plants.

Silicon (Si) is the main material in the soil in the atmospheric process, and the transformation of silicon into the mineral environment is the most important factor in the formation of soil. The amount of silicon in soil varies depending on soil type, weather conditions, the nature of the rocks and minerals from which the soil is composed, and more. Balanced situation. However, the amount of silicon in flowers varies from plant to plant, with silicon content ranging from 0.1% to 10% of dry weight. Silicon is not considered an essential nutrient, but it is an important nutrient for growing crops, especially grass. Silica strengthens plants, protects flowers from pests, increases yield and quality, increases vitamins and neutralizes heavy metal toxicity in acidic soil. Plants vary in their ability to absorb silicon. Depletion of soil silica due to lack of exposure to monoculture and/or deep cultivation of food crops such as rice may be the main reason for the decline in crop yield. Using silicates can make corn sweet by increasing the pH of the soil and increasing the available phosphorus, thus increasing the phosphorus and utilizing it. It can improve soil silica quality and control more crops. Potassium silicate and stabilized silicic acid are used as foliar sprays to promote plant growth and nutrients (Ahmad *et al*., 2011) [3]. The rise of many has a greater impact on the husk of sweet corn. Regarding the boron concentration in the leaf, the study showed that compared with the soil that does not provide boron, the soft stem with 1% leaf boron increased the scab rate by 8.22% and 8.02% in 2021 and 2022, respectively. Among other increases, the percentage of shells from tassel level boron soft stems compared to untreated plans was increased to 4.53% and 5.10% in 2021and 2022, respectively. Ali *et al*. With particular increase, the highest aggregation index of the degree of foliar boron ejection was up to 5.60% and 6.49% compared to the treatment manipulation. The physical activity of the flower in transferring additional nutrients from the material to the recipient is measured by the harvest. Jalal Bayar *et al*. (2024) [17] concluded that some specific boron levels, 1% foliar application of soft boron, increased the yield of sweet corn and added crops. Foliar spraying of boron can increase yield and additional yield as well as the tasseling level of sweet corn. The general performance of sweet corn grown in soils with foliar boron application at Tassling (VT) grade was better than in plots with foliar boron application at four leaves (V4) and eight leaves (V8). In order to maximize sweet corn yield and increase productivity in agroecological fields, it is recommended to use 1% leaf boron fertilizer at the tasseling stage.

Materials and Methods

Experiments at the Effect of Silicon and boron on growth and yield of sweet corn (*Zea mays* L) had been carried out at kharif season of 2023-2024 at crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj that's positioned at 250 24 forty two N latitude, 810 50 fifty six E longitude and ninety eight m altitude above the imply sea level.

This place is positioned about five kilometers from Prayagraj town at the proper financial institution of the Yamuna River beside Prayagraj Rewa Road. A composite soil sample was taken between 0 and 30 cm down. It was crushed, let to air dry, and its chemical and physical qualities examined. The soil reaction of the sandy clay loam was 7.6, the organic matter content was 0.69 (0.72%), the available nitrogen was 152.7 kg/ha, the phosphorus was 10.4 kg/ha, the potassium was 174.0 kg/ha, the sulfur content was 7.2 mg/kg, the zinc was 0.72 mg/kg, and the available B was 0.56 mg/kg. Sweet corn variety (Sweet Heart) was selected for sowing. Seeds were sown in line manually on 2023. Seeds were covered with the soil immediately after sowing. The spacing adopted was plant to plant 30 cm and row to row 60 cm according to the treatment details and the seeds were drilled at 3-4 cm depth. All the treatments were applied by balancing to the initial soil test values and crop requirements to justify the crop response to the supplied nutrients in both years.

Results and Discussion

Plant height

At 80 DAS the significantly higher plant height (162.1 cm) was recorded in the Silicon 100 kg/ha + boron 1.50 kg/ha. However in Silicon 100 kg/ha + boron 1.0 kg/ha (160.0 cm) and Silicon 100 kg/ha + boron 1.0 kg/ha (158.2 cm) were found statistically at par and minimum was recorded in control (149.0 cm).

Plant dry weight

At 80 DAS higher plant dry weight (64.32 g) was recorded in the Silicon 100 kg/ha + boron 1.50 kg/ha. However, in treatment Silicon 100 kg/ha + boron 1.50 kg/ha (62.46 g) were found statistically at par and minimum was recorded in (56.47 g).

Ahmed *et al*., (2011) [3] additionally said that dry count number yield multiplied drastically with B as much as 2.zero kg/ha. Exogenous utility of B reportedly spoke back in growing plant dry count number. Increased biomass manufacturing with the aid of using the utility of boron is concept because of position of boron in mobileular elongation, photosynthesis and transpiration.

Number of cobs per plant

Silicon 100 kg/ha + boron 1.50 kg/ha (2.10) was recorded higher significant value of number of cobs per plant. However, Silicon 100 kg/ha + boron 1.50 kg/ha (2.00) was found statistically at par with the Silicon 100 kg/ha + boron 1.50 kg/ha, and minimum was recorded in control (RDF: N:P:K: 120:60:60 kg/ha) (1.5). The application of zinc activates several enzymes that are involved in carbohydrate metabolism, protein synthesis and pollen formation.

Number of grains per row

Higher number of grains per row was reported higher in Silicon 100 kg/ha + boron 1.50 kg/ha (23.7) was significant difference among the treatments. However, Silicon 100 kg/ha + boron 1.50 kg/ha (22.0) was found statistically at par with the Silicon 100 kg/ha + boron 1.50 kg/ha, and minimum was recorded in control (RDF: N:P:K: 120:60:60 kg/ha) (18.0)

Number of grains per Rows Cob

Higher number of grains per row cob was reported higher in Silicon 100 kg/ha + boron 1.50 kg/ha (16.5) was significant

difference among the treatments. However, Silicon 100 kg/ha + boron 1.50 kg/ha (16.1) was found statistically at par with the Silicon 100 kg/ha + boron 1.50 kg/ha, and minimum was recorded in control (RDF: N:P:K: 120:60:60 kg/ha) (10.3)

Number of grains per cob

Higher number of grains per cob was reported higher in Silicon 100 kg/ha + boron 1.50 kg/ha (374.5) was significant difference among the treatments. However, Silicon 100 kg/ha + boron 1.50 kg/ha (333.5) was found statistically at par with the Silicon 100 kg/ha + boron 1.50 kg/ha, and minimum was recorded in control (RDF: N:P:K: 120:60:60 kg/ha) (185.5).

Discussion

Jawahar and Vaiyapuri (2010) [6], Nagula *et al*., 2015 [11], Pati *et al*., 2016 [13], Patil *et al*., 2018a [14] also reported that silicon application level increased plant height. Silica application increases the height of the tree, possibly due to the release of silicon in the tissues, and ensures that the leaves remain in a straight position (Jawahar *et al*., 2019b) [7]. results. Tillers produce interesting material and this obviously depends on the nutrition of the main stem, as tillers take nutrients from the main stem in the early stages of growth, so silicon automatically increases the nutriti onal value of the main stem and produces main stem more tillers per tiller (Singh *et al*., 2006a) [15]. They reported that B affected tree height and the maximum tree height was 1.0 kg B/ha. Kaisher *et al*. The increase in plant height caused by PM is mainly due to PM providing more nutrients during the growing season. These results are consistent with Mitchell and Tu (2005) [10]. Application of silicon resulted in more yields, bunches per square metre, and grains per bunch. The benefits of rice using silicate residue have been found especially in soils where nitrogen is high and silica plant availability is low.

Table 1: Effect of Silicon and boron on growth and Yield of sweet corn

S No	Treatments	Plant height	Plant dry weight	Cobs/plant (No)	Number of grain per row	Number of grain rows per cob	Number of grains per cob
1.	Silicon 100 kg/ha + boron 0.50 kg/ha	158.2	57.16	1.9	22.0	14.5	319.3
2.	Silicon 100 kg/ha + boron 1.0 kg/ha	160.0	55.37	2.0	22.0	16.1	333.5
3.	Silicon 100 kg/ha + boron 1.50 kg/ha	162.1	60.11	2.1	24.7	16.5	374.5
4.	Silicon 140 kg/ha + boron 0.50 kg/ha	154.4	54.92	1.4	20.3	12.1	243.4
5.	Silicon 140 kg/ha + boron 1.50 kg/ha	155.5	55.27	1.4	20.0	12.3	246.3
6.	Silicon 140 kg/ha + boron 0.50 kg/ha	155.1	56.42	1.3	22.0	12.9	272.3
7.	Silicon 180 kg/ha + boron 0.50 kg/ha	152.1	53.11	1.2	20.0	12.1	226.1
8.	Silicon 180 kg/ha + boron 1.0 kg/ha	152.2	54.02	1.2	20.0	10.6	202.1
9.	Silicon 180 kg/ha + boron 1.50 kg/ha	153.5	54.09	1.2	20.0	10.9	212.1
10.	Control (RDF: 120:60:60 N:P:K kg/ha	149.0	50.66	1.5	18.0	10.3	185.5
	SE m (±)	2.50	0.80	0.07	0.35	0.50	9.58
	CD (p=0.05)	7.42	2.38	0.21	1.05	1.48	28.48

Conclusion

In conclusion, the application of Silicon 100 kg/ha combined with boron 1.50 kg/ha demonstrated significant enhancements in various growth parameters of the plants. At 80 days after sowing (DAS), this treatment exhibited superior plant height, plant dry weight, number of cobs per plant, number of grains per row, number of grains per row cob, and number of grains per cob compared to other treatments, indicating its effectiveness in promoting plant growth and productivity. These findings align with previous research emphasizing the positive impact of silicon application on plant height and yield. The observed improvements can be attributed to the role of silicon in cellular elongation, photosynthesis, and transpiration, as well as the activation of enzymes vital for carbohydrate metabolism, protein synthesis, and pollen formation. Overall, the results underscore the potential of Silicon 100 kg/ha combined with boron 1.50 kg/ha as a beneficial agricultural practice for enhancing crop growth and yield, particularly in soils with high nitrogen and low silica availability. Further studies can delve into optimizing these nutrient combinations for sustainable agricultural practices.

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