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Effect of nitrogen and zinc on growth and yield of sweet corn

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Abstract
The field experiment which was conducted during the kharif season of 2023 at Crop Research farm, Department of Agronomy. In which the treatments consisted of 3 levels of nitrogen (100 kg/ha, 125 kg/ha, and 150kg/ha) and zinc (0.2, 0.3 and 0.5%) with recommended doses of phosphorus and potash and a control (120-60-40 kg N-P-K/ha). The experiment which was laid out in a Randomized Block Design with 10 treatments and replicated thrice. The application of 150 kg/ha nitrogen along with foliar spray zinc 0.5% (Treatment 9) recorded highest dry weight (124.41 g), cobs per plant (2.90), rows per cob (20.50), grains per row (34.33), cob yield (6.53 t/ha) and green fodder yield (15.30t/ha).

Keywords: Economic, nitrogen, sweet corn, yield and zinc

Introduction
Sweet corn (*Zea mays saccharata* L.) has an important position among the various types of corn, especially due to large number of people to consume it. Due to its high sugar content sweet corn has become very popular in the cities and villages of our country (Game *et al*., 2017) [4] Sweet corn is a heavy crop that requires sufficient nitrogen, phosphorus and potassium for growth and development (Ortas and Sari, 2003) [8]. according to (Sheng *et al.* 2018) [11], regular eating of sweet corn can lessen the severity of chronic diseases such heart disease, eye disease, obesity, diabetes, and digestive disorders. Since gluten is typically supplied in the form of corn flour, sweet corn kernels play a significant role in helping celiac disease patients satisfy their nutritional demands.

Nitrogen is essential for the production of chlorophyll and various amino acids. Corn is a significant user of plant nutrients. (Bar-Yosef *et al.* 1989) [2]. The nutrient-rich embryo found in maize kernels is usually removed in the dry milling process, while the entire kernel of sweetcorn is consumed. However, sweetcorn's potential dietary advantage is diminished because the zinc in the embryo is mainly Zn phytate, which humans cannot absorb. A number of sweet corn varieties and hybrids have been developed so far by incorporating these recessive mutations. The sweet corn industry is growing due to higher demand within the country, increased exports, and the need to replace imports. This crop is appealing to farmers because it grows quickly and can be easily mechanized. The majority of sweet corn is grown for processing and sold in supermarkets as canned kernels, frozen cobs, and frozen kernels (Najeeb *et al.* 2011) [7]. Over time, various sweet corn varieties and hybrids have been created by incorporating these recessive mutations.

Materials and Methods
A field trial was conducted during kharif season of 2023 in sandy soil at the Crop Research Farm of the Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh. There were 10 treatment combinations comprising of three doses of nitrogen (100, 125 and 150 kg/ha) and foliar spray of 3 levels of zinc (0.2, 0.3 and 0.5% Zn and tested in randomized block design with factorial concept and replicated thrice. The soil of experimental field was loamy sand in texture, slightly alkaline in reaction (pH 7.20), electrical conductivity 0.59dS/m, medium in available nitrogen (22 kg/ha) and potassium (227.8 kg/ha), and low in available phosphorous (24.9 kg/ha).

The nutrient sources were single super phosphate (SSP) and murate of potash (MOP), applied as per the recommended dose of phosphorus 60 kg/ha and potassium 40 kg/ha Nitrogen in form of Urea and foliar spray of Zinc was done as per the treatments. Throughout the experiment, a variety of crop growth and yield-related characteristics were measured and examined.

Results and Discussion

Plant dry Weight

At 80 DAS, significant and higher plant dry weight (124.41 g) was observed in the treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. However, treatment 6 [Nitrogen 125 kg/ha + 0.5% Zinc] was found to be statistically at par with treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. The reason for this could be the ongoing presence of zinc in the soil and plants, as well as the important role zinc plays in nitrogen metabolism. As a result, there is an increase in the production of amino acids, leading to enhanced growth and development.

The increased accumulation of dry matter and the average rate of crop growth with the application of zinc to the soil and leaves can be attributed to the higher plant height and leaf area index resulting from this treatment. Zinc content in plants is known to play a role in metabolic activity, the regulation of auxin levels, and the production of nucleic acids, all of which contribute to the growth and development of plants. The importance of applying zinc through foliar spray in addition to soil application has also been shown by (Debnath *et al.* 2014) [3].

Table 1: Presents the performance of different treatment combinations on various parameters related to maize growth and yield

S. No.	Treatment combinations	Dry weight (g)	Cobs/ plant	Rows/Cob	Grains/Row	Cob yield (t/ha)	Green fodder yield (t/ha)
1.	Nitrogen 100 kg/ha + 0.2% Zinc	114.94	2.12	17.93	28.22	5.19	11.78
2.	Nitrogen 100 kg/ha + 0.3% Zinc	114.11	2.26	17.17	28.91	4.97	12.99
3.	Nitrogen 100 kg/ha + 0.5% Zinc	115.23	1.70	18.22	28.21	5.12	12.08
4.	Nitrogen 125 kg/ha + 0.2% Zinc	114.61	2.17	17.68	27.55	5.25	14.16
5.	Nitrogen 125 kg/ha + 0.3% Zinc	116.69	2.22	17.53	28.11	5.24	12.01
6.	Nitrogen 125 kg/ha + 0.5% Zinc	119.06	2.43	20.09	31.19	6.39	13.44
7.	Nitrogen 150 kg/ha + 0.2% Zinc	115.29	2.14	18.88	29.59	5.06	11.04
8.	Nitrogen 150 kg/ha + 0.3% Zinc	116.70	2.12	17.98	28.81	5.18	13.39
9.	Nitrogen 150 kg/ha + 0.5% Zinc	124.41	2.90	20.50	34.33	6.53	15.30
10.	Control (120:60:40 NPK kg/ha)	110.54	1.50	16.95	25.42	4.16	11.98
	S Em (±)	1.75	0.18	0.36	1.09	0.20	0.77
	CD (p=0.05)	5.21	0.53	1.06	3.23	0.59	2.27

Cobs per plant

Significant and higher number of cobs/plant (2.90) was observed in the treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. However, treatment 6 [Nitrogen 125 kg/ha + 0.5% Zinc] was found to be statistically at par with treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc].

So here the maximum cobs per the pant was due to the application of the nitrogen which is due to the starch in the plant and translocation of the sugars leads to the increase in the growth and cobs per plant. Similar result was reported by (Rahman *et al.* 2016) [9]. The increase in the application of the nitrogen fertilizer which improves the various yield of sweet corn such as cobs per plant, kernel weight and the kernel per cob due to the physiological activities (Sahoo and Mohanty, 2020) [10].

Rows per cob

Significant and higher number of grains/row (34.33) was observed in the treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. However, treatment 6 [Nitrogen 125 kg/ha + 0.5% Zinc] was found to be statistically at par with treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc].

In which the availability of nitrogen may increase the cell number and cell size which is leading to the better growth of rows per cob. Here the similar result was reported by the (Dankhra *et al.* 2019) [5].

Grains per row

Significant and higher number of grains/row (34.33) was observed in the treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. However, treatment 6 [Nitrogen 125 kg/ha + 0.5% Zinc] was found to be statistically at par with treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. (Anderson *et al.* 1985) similarly found that nitrogen consumption led to an increase in the number of grain rows, grain number in the ear, 1000-grain weight, ear weight, grain yield, and harvest index.

Cob yield

Significant and higher cob yield (6.53 t/ha) was observed in the treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. However, treatment 6 [Nitrogen 125 kg/ha + 0.5% Zinc] was found to be statistically at par with treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc].

The application of the zinc to the sweet corn crop which basically improve the fruit growth by tryptophan and auxin. The enhancement effect in the cobs per plant and their weight and length supported to the favorable effect of the zinc application to the crops on the nutrient, growth parameters and biological activity. The applied zinc resulted in higher cob yield. Similar results were reported by (Nail C *et al*. 2020) [6].

Green fodder yield

Significant and higher green fodder yield (15.30 t/ha) was observed in the treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc]. However, treatment 6 [Nitrogen 125 kg/ha+ 0.5% Zinc] was found to be statistically at par with treatment 9 [Nitrogen 150 kg/ha + 0.5% Zinc].

The zinc plays an important role in increasing the green fodder yield considering that the zinc occurs many physiological process in the plant something like chlorophyll formation, biomass accumulation and stomatal regulation which increase the green fodder yield. The zinc also help in converting the ammonia to nitrate in the crops. Similar results were reported by (Tamil Amutham *et al*. 2018) [12].

Conclusion

From this research, it is concluded that application of Nitrogen 150 kg/ha along with zinc 0.5% (Treatment 9) recorded highest yield and benefit cost ratio.

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