Original Research Article

EffectofNitrogenandZincongrowthandyieldofMaize (*Zea mays* L.)

ABSTRACT

A field experiment was conducted during *Kharif* (rainy) season of 2023 at Crop Research Farm Department of Agronomy. The treatments consisted of 3 Nitrogen (100, 120 and 140) and Zinc Sulphate ($ZnSO_4$) (15, 20 and 25kg/ha) along with recommended doses of Nitrogen, phosphorus and potash and a control (120-60-40 kg N-P-K/ha). The experiment was laid out in a Randomized Block Design with 10 treatments and replication thrice. Application of a Nitrogen and zinc sulphate in treatment 9 (Nitrogen 140 kg/ha + $ZnSO_4$ 25 kg/ha)recorded highest plant height (182.4 cm), maximum plant dry weight (98.81 gm), Number of cobs per plant (3.3), Number of seed per cob (466.45), Seed index (27.20), seed yield (5.05), stover yield (23.2).

Keywords: *Nitrogen, Zinc, Growth, Yield, Maize.*

INTRODUCTION

Maize is the world's most widely cultivated food crop providing ample food calories and protein for more than one thousand million human beings in the world. Maize is known as "Queen of cereals" because it has the highest genetic yield potential among the cereals. It ranks 3rd among the cereals in India after wheat and rice. The term corn refers as "to sustain life" that provides nutrients for human and animals worldwide. It is cultivated throughout the year in all the seasons and grown around the globe. The nutritional value of maize is high as it contains 72% starch, 10% protein, 8.5% fiber, 4.8% oil, 3.0% sugar and 1.7% ash. Comparatively maize gives more yield than the other cereals such as rice, wheat etc. It is an important staple food and also used as a fodder crop in India. Starch, cooking oil and gluten are also extracted from maize. The starch in maize can be hydrolysed and enzymatically treated to produce syrups, particularly high fructose corn syrup, a sweetener and also as fermented and distilled to produce grain alcohol **(Rathore *et al*. 2022).**

Globally, total area of maize amounts to 197 million hectares and production of 1210 million thousand tonnes in 2021. In India, maize is the third most important food crops after rice and wheat. According to advance estimate it is cultivated in an area of about 9.86 million hectares with production of 31.51 million tones and an average productivity of 3195 kg/ha which is the fifth largest producer in the world contributing three percent of the total global production. Uttar Pradesh contributes an area of about 0.77 million hectares with 7.98% to all over India and production 1.80 million tones(**GOI, 2021)**.

Nitrogen is vital for crops because it is a major constituent of chlorophyll, the compound by which plants use sunlight energy to produce sugars from water and carbon dioxide that is photosynthesis. It is correspondingly a major factor of amino acids, the building blocks of proteins. Lacking proteins, plants wither and die. The main nutrients are required for plant growth are nitrogen (N), phosphorus (P), and potassium (K) and the use of nitrogen fertilizer outcomes in improved crop production costs and atmospheric pollution. Numerous plant particles such as amino acids, chlorophyll, nucleic acids, ATP and phytohormones, that contains nitrogen as a basic part, are required to complete the biological processes, involving carbon and nitrogen metabolisms, photosynthesis and protein production. Nitrogen application is more important than the other major important fertilizers/nutrients for successful crop production **(Singh and Meena 2004).**

Maize is nitro positive and needs ample quantity of nitrogen for its better production. It is, therefore, imperative to use an optimum amount of N through a suitable and efficient source. Nitrogen plays a very significant role in crop development because it is not only an integral part of structural and functional proteins, chlorophyll and nucleic acids (RNA and DNA) but also it is very essential for the proper utilization of carbohydrates. Nitrogenous fertilizer is the major source of nitrogen supply the crop. The beneficial effects of nitrogen on crop production are well documented however, nitrogen mining by crops for optimum productivity widely vary on account of different agro-climates, soils, cultivars, management practices and other factors **(Meena *et al.*, 2013).** The response of nitrogen application depends on moisture supply and the quantity of the nitrogen applied in the soil. Maize has maximum nitrogen use efficiency of about 50 per cent, but under poor management, its efficiency varies between30 to 40 per cent.

In the plant system, zinc is important for several enzymatic and physiological processes. Additionally, many enzymatic reactions are activated by zinc, which is a key nutrient in the construction of several enzymes like alcohol dehydrogenase, carbonic anhydrase, and superoxide dismutase. Zinc is also necessary for the synthesis of enzymes in plants. Plants enzymes activated by Zn are involved in carbohydrate metabolism, and regulation of auxin synthesis and pollen formation. Zn seems to affect the capacity for water uptake and transport in plants and also reduce the adverse effects of short periods of heat and salt stress. As Zn is required for the synthesis of tryptophan which is a precursor of IAA, it also has an active role in the production of an essential growth hormone auxin (**Alloway,2008**).

Materials and Methods

A field experiment was conducted during *Kharif-2023* at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The treatments consisting of three levels ofNitrogen*viz.* 100,120,140 kg/ha and zinc*viz.* 15,20,25 kg/ha. The experiment was laid out in Randomized Block Design with ten treatments each replicated thrice. The treatment combinations treatment 1 - Nitrogen 100 kg/ha + Zinc 15 kg/ha2 Nitrogen 100 kg/ha + Zinc 20 kg/ha , treatment3-Nitrogen 100 kg/ha + Zinc 25 kg/ha, treatment4 -Nitrogen 120 kg/ha + Zinc 15 kg/ha, treatment5 - Nitrogen 120 kg/ha + Zinc 20 kg/ha, treatment6 - Nitrogen 120 kg/ha + Zinc 25 kg/ha, treatment7 - Nitrogen 140 kg/ha + Zinc 15 kg/ha, treatment8 - Nitrogen 140 kg/ha + Zinc 20 kg/ha, treatment9 - Nitrogen 140 kg/ha + Zinc 25 kg/ha, treatment10 - Control (RDF-120,60,40 kg/ha). The growth parameters and yield, production was recorded at harvest from randomly selected plants in each plot. The data was computed and analysed by following statistical method of **Gomez and Gomez (1984)**

RESULT AND DISSCUSSION

Growth parameters:

Plant height (cm):

The data revealed that, significantly higher plant height (182 cm) was recorded with the application of 140 kg/ha Nitrogen + 25 kg/ha Zinc,Significant and higher plant Further, significantly higher plant height was observed with application of Zinc (30kg/ha) it may be due to zinc is an activator of plant nutrients and plays an important role in growth and metabolism of microorganisms, where Zinc element is present in the enzyme system as co-factor and mental activator of many enzymes, and this improvement in plant height. Similar findings was also reported by **Vankatakrishnan*et al.* (2003).**

Plant dry weight (g):

the data observed that, significantly themaximumdrymatteraccumulation(98.81 g) was recorded with treatment 140 kg/ha Nitrogen + 25 kg/ha zinc,Significant and higher plant dry weight was observed with application of Zinc (25 kg/ha) may be due to micronutrient helps to activate the synthesis of tryptophan and precursor of IAA which is responsible to stimulation of plant growth and accumulation of biomass and micronutrient being a component of ferrodoxin and electron transport are also associated with chloroplast which acceleration in photosynthesis is evident for the better vegetative growth, resulted in higher plant dry weight. Similarly, findings were also reported by **Singh *et al.*(2017).**

Yield and Yield attributes

The data revealed that, maximum head diameter (3.3)wasrecordedwiththetreatmentofapplicationofNitrogen 140 kg/ha + ZnSO4 25 kg/ha) Thoughtherewassignificantdifference among thetreatments.The data revealed that, Significantly Maximum no. of grain/cob (29.60) was recorded with the treatment ofapplication of 140 kg/ha Nitrogen + 25 kg/ha zinc. Significant and higher number of grains/cob was obtained with the application of zinc (30kg/ha) might be due to the increased fertilizers application could be attributed to the increased physiological processes in crop plant leading to higher growth and increased photosynthates to silk. The similar findings were reported by **Kumar *et al.* (2007).** Significant and higher length of cob was observed with the application of Zinc(30kg/ha) might be due to higher chlorophyll contents and photosynthetic activity, synthesis of metabolites and

regulate growth substancesoxidation and metabolic activities. These similar findings were reported **by Meena et al**. **(2013).** At harvest, highest seed index (27.20) was observed in treatment140 kg/haNitrogen + 25 kg/ha Zinc though there was no significant difference among the treatments.

Significant and higher grain yield was obtained with application of Zinc (30kg/ha) may be due to Zn consequently improved physiology of plant and correcting the efficiency of different enzymes, chlorophyll content, IAA hormone and might have improved in nitrate conversion to ammonia in plant leading to higher yield.The similar findings were reported by **Firdous *et al*. (2018).**

Table 1. Effect of different levels of nitrogen and zinc on yield attributes of maize.

S.No.	Treatment combination	Plant Height(cm)	Plant Dry Weight(g)	No. of Cob/Plant	No. of grain /cob	Seed Index (g)	Grain Yield (t/ha)
1.	Nitrogen 100 kg/ha + ZnSO415 kg/ha	168.3	87.55	2.2	20.93	23.72	3.70
2.	Nitrogen 100 kg/ha + ZnSO420 kg/ha	164.8	87.48	2.2	22.00	22.87	3.37
3.	Nitrogen 100 kg/ha + ZnSO425 kg/ha	165.3	90.47	2.3	22.43	22.00	3.40
4.	Nitrogen 120 kg/ha + ZnSO4 15 kg/ha	171.7	91.46	2.5	23.40	23.76	3.70
5.	Nitrogen 120 kg/ha + ZnSO4 20 kg/ha	177.7	94.80	3.0	24.20	24.78	4.53
6.	Nitrogen 120 kg/ha + ZnSO4 25 kg/ha	178.0	96.45	3.1	26.20	26.70	4.78
7.	Nitrogen 140 kg/ha + ZnSO415 kg/ha	175.4	93.94	2.7	27.60	24.40	4.37
8.	Nitrogen 140 kg/ha + ZnSO4 20 kg/ha	173.7	91.79	2.7	29.00	24.32	4.13
9.	Nitrogen 140 kg/ha + ZnSO4 25 kg/ha	182.4	98.81	3.3	29.60	27.20	5.05
10.	CONTROL NPK, 120:60:40 kg/ha	153.1	78.92	2.1	23.00	20.79	3.16
	F test	S	S	S	S	NS	S
	SEm (±)	1.17	3.77	0.23	1.02	1.81	0.29
	CD (p=0.05)	15.05	7.93	0.28	2.14	-	0.62

CONCLUSION

It can be concluded that in Maize with the application of Nitrogen 140 kg/ha along with theapplicationof Zinc 25 kg/ha hadobservedhighestgrowthand yield of maize.

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