Original Research Article

Effect of Zinc and Foliar Application of Silicon on growth and yield of maize (*Zea mays.* L)

Abstract

The field experiment was conducted during *Zaid* season of 2022 at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). The soil of the experiment plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.82%), available N (291.24 kg/ha), available P (32.85 kg/ha) and available K (264.78 kg/ha). The treatments consisted of two sources (Zinc), (Silicon) levels and one control plot, respectively. The experiment was laid out in randomized block design with ten treatments and were replicated thrice. Result defined that maximum plant height (187.78cm), No. of leaves per plant (12.0) dry weight (181.62 g/plant), crop growth rate (39.08 g/m2/day), No. of cobs/plant (1.63/plant), Length of the cob/plant (15.43 cm), No. of rows/cob(14.82), No. of grains/cob (317.54), seed yield (7.92 t/ha) and Stover yield(11.34 t/ha), test weight (241.96 g), were obtained in the treatment combination of Zn3(15kg/ha) + Si3(500ppm).

Keywords: *Zinc & Silicon , growth and yield* .

Introduction

Maize (*Zea mays* L.) is the third most important cereal crop in India after wheat and rice. It is grown all over the world under a wide range of climate. Currently it is cultivated in an area of 9.2 m ha with a production of 27.8 m t and productivity of 2965 kg/ha in India (IIMR 2022). Maize (*Zea mays L.*) is the third most important cereal crop in the agricultural economy after wheat and rice, in the world as well as in India. It is popularly known as "miracle crop" and "Queen of Cereals". Maize is recognized as the "golden food" because of its higher potentiality of grain yield and higher nutritional value. It plays very important role in the daily calorie intake of humans (WHO). Several million people, particularly in developing countries, derive their protein and calorie requirements from maize (Prasad, *et al.* 2005).

Maize is a high yielding crop, easy to process, readily digestible and cheaper than

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Comment [D2]: Did u measure these soil parameters? If yes, how did you measure them?

Comment [D3]: The control was glaringly absent from your methodology, why?

Comment [D4]: Your data is supposed to be subjected to a suitable statistical tool to help bring out the significant of non-significant outcome. If you did. Then state the package you used and how it was used. It should reflect in your abstract.

Comment [D5]: 1.The abstract is too shallow
2.The results were merely enumerated without indicating their significance to the study
3.The abstract in inconclusive because of the following:
4.No indication of contribution to scientific knowledge
5.No suggestions and or recommendation to the farmers as regards the applicability of the above method for a better crop yield.
6.The abstract is supposed to be an overview of the entire research, but reverse is the case
7.The abstract needs to be completely recast to capture the above suggestions.

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other cereals. It has got much industrial importance and used as basic raw material for the of starch, oil, protein, alcoholic beverages and food sweeteners. More recently maize is known for its bio-fuel value too. It is a versatile and miracle crop thus termed as "Queen of cereals". Monocropping and monoculture of maize, its exhaustive nature, less awareness about micronutrients application and indiscriminate use of major nutrients led to the imbalance in soil nutrient states and as a result micronutrients deficiency is noticed in many parts in general and zinc in particular.

Zinc is the important micronutrient for cereals particularly maize, as it plays a major role in synthesis of tryptophan, which is a precursor of indole acetic acid (Tsui, 1998). Zinc deficiency causes loss in yield up to 50% in maize. Nearly half of the world's cereal-growing area is affected by soil Zn deficiency. Zinc deficit is a chief worldwide problem damaging cultivation of plant, and this difficulty is due to exacerbated in alkaline soils, these soil types are mostly found in semi-arid and arid parts of the world, Cakmak, (2000). Zinc deficiency is rated as the widest spread micronutrient problem in Indian soils as it is deficient in 50 per cent soils of 14 Indian states and among cereals maize has been found to respond to zinc application.

Silicon enhances disease resistance in plants, imparts turgidity to the cell walls and has a purative role in mitigating the metal toxicities. Transpiration from leaves of some plants is considerably reduced by the application of Si (Agarie *et al.*, 1998). Several studies revealed that Si application significantly increased the water-use efficiency (WUE) of maize (*Zea mays* L.) plants. However, information on types of silicate fertilizer, extent and time of their usage, their effect on growth and yield of maize is very limited. Members of the grass family accumulate large amounts of Si in the form of silica that is localized in specific cell types. It is also suggested that Si plays a crucial role in preventing or minimizing the lodging in crop, a matter of great importance in term of agriculture productivity.

MATERIALSANDMETHODS

This experiment was carried out investigation entitled, "Effect of Zinc and foliar application of silicon on growth and yield of maize *(Zea mays L.)*", was laid out during Zaid season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25.570 N latitude, 87.190 E longitude and at an altitude of 98 m above mean sea level. The

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experiment was laid out in randomized block design comprised of levels of Zinc and silicon with ten treatments and each were replicated thrice viz. Treatment 1 (Zn(5kg/ha) + Si(200ppm), Treatment 2 (Zn(5kg/ha) + Si(350ppm)), Treatment 3 (Zn(5kg/ha) + Si(500ppm)), Treatment 4 (Zn(10kg/ha) + Si(200ppm)), Treatment 5 (Zn(10kg/ha) + Si(350ppm)), Treatment 6 (Zn(10kg/ha) + Si(500ppm)), Treatment 7 (Zn(15kg/ha) + Si(200ppm)), Treatment 8 (Zn(15kg/ha) + Si(350ppm)), Treatment 9 (Zn3(15kg/ha) + Si3(500ppm)), Treatment 10 (Control (120:60:40 NPK kg/ha)).

RESULTS AND DISCUSSION

Growth attributes

Effect of Zinc and Foliar Application of Silicon on growth and yield of maize *(Zea mays* L.*)* presented in below Table 1.

Plant height

Plant height increased significantly due to the application of silicon and zinc. Among these applications Zn(15kg/ha) + Si(500ppm) gives highest plant height (187.78 cm). Soil application of zinc in the form of $ZnSO_4$ results in enhanced plant growth and increased rate of photosynthesis and other metabolic activities and increases plant height (Aktas 2006).

Number of leaves per plant

Among the treatments, the maximum number of leaves (12.0) was observed in treatment 9 Zn(15kg/ha) + Si(500ppm) which was followed by treatment 6 Zn(10kg/ha) + Si(500ppm) and treatment 8 Zn(15kg/ha) + Si(350ppm). silicon (500 ppm) has enhanced plant height, number of leaves, yield and some biochemical constituents in maize (Boarse *et al.* 2018).

Plant dry weight

The maximum plant dry weight (181.62g/plant) was recorded in treatment with Zn(15kg/ha) + Si(500ppm). Phyto hormones which stimulate the formation of lateral roots and absorbent root hairs, which eventually helped in uptake of higher nutrients and minerals by plants and leads to increase in higher biomass accumulation and higher plant dry weight. The results were found to be in resonance with Zhou *et al* (2014).

Yield attributes and Yield

Maximum Number of cobs/plant (1.63/plant), Length of the cob/plant (15.43 cm), Number of rows/cob (14.82), Number of grains/cob (317.54), seed yield (7.92 t/ha) and Stover yield (11.34 t/ha) was observed in Zn(15kg/ha) + Si(500ppm) (Table 2). This might be due to the effect of silicon during seedling growth, silicon mediated the photosynthetic rate, root activities and nitrate reductase activity. improvement in maize yield may be due to increasing in length of cobs and the weight of 1000 seed weight. Shahab *et al* (2016) found similar effect in grain yield.

CONCLUSION

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1.Plant height
2.Length of cob
3.Test weight
4.Seed yied
5.Stover yield
6.And the harvest index.
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8.How many plants per replicate were measured
They should all be clearly stated for reference's sake

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From the above experiment it is concluded that the application of Zn (15 kg/ha) along with Si (500 ppm) in maize crop gave positive result as a highest plant height, no.of leaves per plant, plant dry weight, highest seed yield (7.92 t/ha) compared to others. Thus, application of Zn (15 kg/ha) and Si (500 ppm) is one of the possible ways to enhance growth and seed yield of Maize.

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Table 1. Effect of Zinc and foliar application of Silicon levels on plant growth attributes on Maize.

S.NO.	Treatments	Plant height (Cm)	No. of leaves per plant	Plant Dry weight (g)
1.	Zn(5kg/ha) + Si(200ppm)	167.38	10.3	137.00
2.	Zn(5kg/ha) + Si(350ppm)	171.38	11.2	142.17
3.	Zn(5kg/ha) + Si(500ppm)	172.80	11.5	147.16
4.	Zn(10kg/ha) + Si(200ppm)	176.26	11.1	140.32
5.	Zn(10kg/ha) + Si(350ppm)	181.72	11.2	156.04
6.	Zn(10kg/ha) + Si(500ppm)	185.56	11.8	175.31
7.	Zn(15kg/ha) + Si(200ppm)	178.38	11.5	151.30
8.	Zn(15kg/ha) + Si(350ppm)	184.56	11.6	166.77
9.	Zn(15kg/ha) + Si(500ppm)	187.78	12.0	181.62
10.	Control (120:60:40 NPK kg/ha)	166.21	9.5	131.71
	SEm(±)	1.47	0.37	2.13
	CD (p=0.05)	4.37	1.1	6.33

Table 2. Effect of Zinc and foliar application of Silicon levels on yield attributes on Maize.

S.No.	Treatments	No. of cobs per plant	Length of the cob (cm)	No. of rows per cob	No. of grains per cob	Test weight(g)	seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	Zn(5kg/ha) + Si(200ppm)	1.13	12.37	10.61	216.33	213.83	6.14	9.21	39.32
2.	Zn(5kg/ha) + Si(350ppm)	1.10	12.87	12.08	223.97	216.33	6.46	9.46	39.60
3.	Zn(5kg/ha) + Si(500ppm)	1.10	13.30	12.72	241.03	216.77	6.54	9.60	39.91
4.	Zn(10kg/ha) + Si(200ppm)	1.10	12.53	14.01	217.10	210.57	6.35	9.48	39.40
5.	Zn(10kg/ha) + Si(350ppm)	1.30	14.33	14.07	271.43	223.33	6.62	10.64	40.02
6.	Zn(10kg/ha) + Si(500ppm)	1.50	15.30	14.43	311.86	237.30	7.55	11.26	39.77
7.	Zn(15kg/ha) + Si(200ppm)	1.27	13.70	14.50	259.68	220.50	6.84	10.09	40.48
8.	Zn(15kg/ha) + Si(350ppm)	1.30	14.57	14.76	288.79	230.17	7.33	10.90	39.82
9.	Zn(15kg/ha) + Si(500ppm)	1.63	15.43	14.82	317.54	241.96	7.92	11.34	40.92
10.	Control (120:60:40 NPK kg/ha)	1.03	11.70	10.44	203.34	207.57	5.56	8.82	38.71
	SEm±	0.12	0.28	0.47	3.46	1.97	0.13	0.03	0.40
	CD (5%)	0.35	0.84	1.41	10.27	5.87	0.39	0.12	NS