

INFLUENCE OF ZINC AND BORON ON GROWTH AND YIELD OF SUNFLOWER

ABSTRACT

The experiment was conducted at crop research farm in Department of Agronomy during Rabi, 2022 on sunflower crop. The treatment consisted of 3 levels of foliar application of zinc (10 kg/ha, 0.5%, 10 kg/ha + 0.25%) and foliar application of boron (3 kg/ha, 0.3%, 3 kg/ha + 0.15%) and control (80,40,40 kg/ha). The experiment was laid out in Randomized Block Design with 10 treatments and replicated thrice. Foliar application of Zinc at 10 kg/ha + 0.25% with foliar application of Boron at 3 kg/ha + 0.15% recorded maximum plant height (122.58 cm), Plant dry weight (46.82 g/plant), head diameter (19.20), Seeds/capitulum (311.59), Test weight (53.92 g), Seed yield (1.79 t/ha), stalk yield (4.31 t/ha), Harvest index (29.35 %), gross returns (Rs.1,07,472.00/ha) and net return (Rs.74,608.00/ha). Maximum Benefit Cost Ratio (2.27) was also recorded in the same treatment no. 9 in sunflower crop.

Keywords: Foliar application, boron, zinc, sunflower.

1. Introduction:

Sunflower is an important oilseed crop growing in temperate regions. It is the world's largest producer of vegetable oil. It has gained popularity in India as a result of the national emphasis of vegetable oil production. India is one of the world's largest producers of oilseed crops. Oilseeds play a significant role in the Indian agricultural economy. Oilseeds have grown in popularity as demand for healthy vegetable oils, biofuels and other industrial applications has increased. Furthermore, the meal fractions, which are the components of the seed that remain after the oil have been extracted, are an important source of high protein animal feed. Growing interest has resulted in 82% increase in oilseed crop cultivation areas and a 240% increase in total world production over the preceding three decades(1). It is the world's third most significant oilseed crop, trailing only soyabean, rapeseed, and mustard. Farmers consider sunflower to be a highly profitable crop, particularly in the Southern peninsula, which includes Northern Karnataka, Marathwada, and Rayalaseema, where the crop is mostly grown under rainfed circumstances during the late kharif/rabi season. Karnataka accounts for about half of the country's sunflower area and ranks one in terms of area and output, followed by Andhra Pradesh. Uttar Pradesh has the highest productivity, followed by Tamil Nadu. Sunflower oil is regarded as superior to other vegetable oils. When compared to other crops of equal maturity, sunflower produces a substantially more profitable oil seed crop. If irrigation facilities are available, sunflower is typically grown as a Kharif or rice fallow crop in coastal Tamil Nadu. With the potential introduction and expansion of sunflower/ gingelly/ greengram-rice-sunflower/ blackgram/ maize/ cotton cropping systems in Tamil Nadu's coastal districts, oil seed output increased(2), (3) However, due to the degraded nature of coastal soils, its production potential is very low, and cultivation is most likely on soils where salinity problems already exist or may develop as a result of the use of saline irrigation water during the critical crop growing period(4), (5).

To overcome the Zn deficit, Zn can be used in conjunction with other fertilisers. Zn promotes sunflower development, plant height, leaves, and dry matter production. Such improvements in crop characteristics can be related to this micronutrient's increased metabolic role. Foliar fertilisation is becoming more common, particularly in the cultivation of high-value crops such as sunflower (6). Foliar application of several Zn compounds has been shown to improve seed output and seed quality in sunflower (7). Foliar Zn administration is also recommended to mitigate the negative impacts of water stress on plant photosynthesis and photosynthesis-related features, as well as yield contributing qualities.

Boron (B) is one of the key nutrients required for crop growth, development, yield, and quality. It has numerous critical activities in plants, the most prominent of which are cell wall production and structural integration. Inhibits root elongation, resulting in the death of sesame root tips.

2. Material and methods:

The experiment was conducted to know the Influence of zinc and boron on growth and yield of sunflower (*Helianthus annuus* L.) was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh during 2022. The experiment was laid out in a Randomised block design consisting of ten treatments including control with 3 replications, with the treatment combinations (T₁) Zinc 10 kg/ha + Boron 3 kg/ha, (T₂) Zinc 10 kg/ha + Boron 0.3% foliar application, (T₃) Zinc 10 kg/ha + Boron 3 kg/ha+0.15% foliar application, (T₄) Zinc 0.5% foliar application + Boron 3 kg/ha, (T₅) Zinc 0.5% foliar application + Boron 0.3% foliar application, (T₆) Zinc 0.5% foliar application + Boron 3 kg/ha + 0.15% foliar application, (T₇) Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha, (T₈) Zinc 10 kg/ha + 0.25% foliar application + Boron 0.3% foliar application, (T₉) Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application, (T₁₀) Control.

3. Results and Discussion:

3.1 Growth parameters

3.1.1 Plant height (cm)

At 80 DAS, there was significant difference among the treatments. However, highest plant height (122.58 cm) was recorded with the application of Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application, whereas treatment Zinc 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application (120.97 cm) was found to be statistically at par with T₉. According to (8), the favourable effect of zinc on plant height may be owing to its importance in the production of proteins and auxins in plants, as well as the activation of various enzymes such as proteinases and peptidases.

3.1.2 Dry weight (g)

At 80 DAS highest plant dry weight (46.82 g) was recorded with treatment Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application, whereas treatment Zinc 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application (46.80 g) was statistically at par with T₉.

Micronutrients such as zinc and boron are involved in nitrogen fixation and translocation into parts, which could explain why dry matter production was higher. (9) Dry matter generation is

determined by leaf area and activity. According to (10), increased leaf area per plant would contribute to enhanced dry matter production and seed yield.

3.2 Yield Parameters

3.2.1 Head Diameter (cm)

Significantly Maximum Head Diameter (19.20 cm) was recorded with the treatment of application of Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application over all the treatments, minimum was recorded in Control (16.30 cm). However, the treatments Zinc 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application (19.00 cm) and Zinc 10 kg/ha + 0.25% foliar application + Boron 0.3% foliar application (19.00 cm) which was found to be statistically at par with T9. We can infer that the efficient amount of boron given aids in the progression of the plant's biological features and produce. (8) found that consuming FeSO₄, ZnSO₄, and boron separately or in combination had a positive effect on plant height and head diameter. (11) discovered similar results.

3.2.2 Seeds per capitulum

Significantly Maximum seeds/capitulum (355.59) was recorded with the treatment of application of Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application over all the treatments, minimum was recorded in Control (333.69). However, the treatments Zinc 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application (353.82) and Zinc 10 kg/ha + 0.25% foliar application + Boron 0.3% foliar application (353.86) which was found to be statistically at par with T9. Zinc and boron perform critical roles in the quantitative and qualitative development of plants, resulting in larger seed weight. According to (12), zinc treatment improves seed reproduction and development. (13)

3.2.3 Test weight (g)

Significantly Maximum test weight (g) (53.92 g) was recorded with the treatment of application of Zinc 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application over all the treatments, minimum was recorded in Control (41.25 g). However, the treatments Zinc 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application (53.08 g) and Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application (52.46 g) was found to be statistically at par with T9.

3.2.4 Seed yield (t/ha)

Significantly Maximum seed yield (1.54 t/ha) was recorded with the treatment of application of Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application over all the treatments, minimum was recorded in Control (0.96 t/ha). However, the treatments Zinc 0.25%

foliar application + Boron 3 kg/ha + 0.15% foliar application (1.50 t/ha) was found to be statistically at par with T9. Because it maintains a favourable equilibrium between photosynthesis and respiration, the treatment increased seed yield. The element's principal role in plants is to provide structural integrity to the cell wall. Borax is a component of cell membranes and is required for cell division. The use of both Zn and B boosted yield when compared to the control (14).

4. Conclusion

It is concluded that Foliar Application of Zinc 10 kg/ha + 0.25% in combination with Foliar application of Boron 3 kg/ha + 0.15% was found to be best for obtaining maximum grain yield. It also fetched the maximum gross return, net return and B:C ratio.

5. Acknowledgement

The authors are thankful to Department of Agronomy, Naini Agricultural Institute, Prayagraj, Sam Higginbottom University of Agriculture Technology and Sciences, (U.P) India for providing necessary facilities to undertaken the studies.

References

1. Rahman, M. and Monika, M.J. (2016). Designer Oil Crops. Breeding Oilseed Crops for Sustainable Production Opportunities and Constraints. *Academic Press*, 361-376.
2. Rex Immanuel, R. (2019). Nutrient uptake and nutrient use efficiency of sunflower in response to Zn and B micronutrient fertilization. *Plant Archives*, **19** (Sup 2): 543- 547
3. Rex Immanuel, R.; Saravanan, D.; Sudhagar Rao, G.B.; Thirupathi, M. and Saravanaperumal, M. (2019a). Zinc and boron micronutrient fertilization on the growth and physiological attributes of sunflower in rice-sunflower cropping sequence. *Plant Archives* 19(2): 3015-3020.
4. Rex Immanuel, R.; Ganapathy, M. and Thirupathi, M. (2018). Perception analysis of coastal agroecosystem degradation, its effect on agricultural production and the performance of multipurpose tree species. *The Research Journal of Social Sciences*, **9**(12): 122-135.
5. Rex Immanuel, R. and Ganapathy, M. (2019). Characterization of degraded lands in coastal agro ecosystem of northern Tamilnadu, India. *Journal of Emerging Technologies and Innovative Research*, **6**(2): 200-216.
6. Fernández, V. and P.H. Brown. 2013. From plant surface to plant metabolism: the uncertain fate of foliar-applied nutrients. *Frontiers Plant Science*, **4**: 289.
7. Tahir, M., S.A. Shah, M. Ayub, A. Tanveer and U.R. Haseeb. 2014. Growth and yield

- response of sunflower (*Helianthus annuus* L.) to sulphur and boron application. *Pakistan Journal of Scientific and Industrial Research Series B: Biological Sciences.*, 57(2): 5-10.
8. Farokhi H, Shirzadi MH, Gholamreza Afsharmanesh Mostafa Ahmadizadeh. Effect of different micronutrients on growth parameters and oil percent of Azargol sunflower cultivar in Jiroft region. *Bulletin of Environment, Pharmacology and Life Sciences Bulletin of Environment Pharmacology and Life Sciences.* 2014;3(7):97-101.
 9. Elayaraja D, Singharwel R. Zinc and boron application on groundnut yield and nutrient uptake in coastal sandy soils. *An Asian Journal of Soil Science* 2014;7:50-53.
 10. Sarmah PC, Katyal SK, Verma OPS. Growth and yield of sunflower (*Helianthus annuus* L.) varieties in relation to fertility levels and plant population. *Indian Journal of Agronomy.*, 1992;37(2):285-289.
 11. Chowdhary AR, Prabhakara Setty, Nagarathna TK. Growth and yield of sunflower as influenced by micronutrients application in alfisols. *Karnataka Journal of Agricultural Science* 2010;23(3):495-496.
 12. Baloch RA, Baloch SU, Baloch SK, Baloch AB, Bashir W, Kashan SD et al. Effect of Zinc and Boron in combination with NPK on Sunflower (*Helianthus annuus* L.) growth and yield. *Journal of Biological Agriculture and Health* 2015;5(19):101-107
 13. Sepehr E, Malakouti MJ, Rasouli MH. The effect of K, Mg, S, and micronutrients on the yield and quality of sunflower in Iran. 17th The World Congress of Soil Science (WCSS), Thailand 2002.
 14. Gitte, A. N., Patil, S. R. and Tike, M. A. 2005. Influence of zinc and boron on biochemical and yield characteristics of sunflower. *Indian Journal of Plant Physiology.*, 10: 400-403.

Table 1: Effect of zinc and boron on growth and yield parameters of Sunflower.

Treatments	Plant Height (cm)	Dry weight (g)	Head diameter (cm)	Seeds/capitulum	Test weight (g)	Seed Yield (t/ha)
T1	117.00	43.09	16.90	336.84	42.00	1.01
T2	118.03	44.00	17.10	339.82	45.20	1.08
T3	118.50	45.00	17.50	344.79	46.11	1.15
T4	118.70	45.12	17.90	344.80	48.47	1.40
T5	119.00	46.18	18.10	346.79	50.21	1.42
T6	120.97	46.80	19.00	353.82	53.08	1.50
T7	119.47	46.00	18.70	350.80	51.07	1.43
T8	120.19	46.61	19.00	353.86	52.46	1.44
T9	122.58	46.82	19.20	355.59	53.92	1.54
T10	115.17	42.00	16.30	333.69	41.25	0.96
Sem(±)	1.10	0.49	0.22	4.32	0.68	0.02
CD(p=0.05)	3.28	1.47	0.66	12.84	2.03	0.07

UNDER PEER REVIEW