Original Research Article

INFLUENCE OF ZINC AND BORON ON GROWTH AND YIELD OF SUNFLOWER

ABSTRACT

Background: The experiment was conducted in CRF in Department of Agronomy during Rabi season of 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% in combination 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), and higher yield attributes namely 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), 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 has been extracted, are an important source of high protein animal feed. Growing interest has resulted in an 82% increase in oilseed crop cultivation areas and a 240% increase in total world production over the preceding three decades **(Rahman and Monika, 2016)**. 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 #1 in terms of area and output, followed by AP. UP has the highest productivity, followed by Tamil Nadu. Sunflower oil is regarded as superior to other vegetable oilsWhen 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 **(Rex Immanuel, 2019; Rex Immanuel et al., 2019a)**. 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 **(Rex Immanuel et al., 2018; Rex Immanuel and Ganapathy, 2019)**.

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 **(Fernández and Brown, 2013)**. Foliar application of several Zn compounds has been shown to improve seed output and seed quality in sunflower **(Tahir et al. 2014)**. 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 RBD consisting of Ten treatments including Control with 3 replications, with the treatment combinations (T_1) Zinc 10 kg/ha + Boron 3 kg/ha, (T_2) Zinc 10 kg/ha + Boron 0.3% foliar application, (T_3) Zinc 10 kg/ha + Boron 3 kg/ha+0.15% foliar application, (T_4) Zinc 0.5% foliar application + Boron 3 kg/ha, (T_5) Zinc 0.5% foliar application + Boron 0.3% foliar application, (T_6) Zinc 0.5% foliar application + Boron 3 kg/ha + 0.15% foliar application, (T_7) Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha, (T_8) Zinc 10 kg/ha + 0.25% foliar application + Boron 0.3% foliar application, (T_9) Zinc 10 kg/ha + 0.25% foliar application + Boron 3 kg/ha + 0.15% foliar application, (T_{10}) 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 T_9. According to **Farokhi et al. (2014)**, 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 proteinase 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 T_9.

Micronutrients such as zinc and boron are involved in nitrogen fixation and translocation into parts, which could explain why dry matter production was higher. **Elayaraja and colleagues (2014)**. Dry matter generation is determined by leaf area and activity. According to **Sarmah et**

al. (1992), 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. **Farokhi et al. (2014)** found that consuming FeSO4, ZnSO4, and boron separately or in combination had a positive effect on plant height and head diameter. **Chowdhary et al. (2010)** 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 **Baloch et al. (2015)**, zinc treatment improves seed reproduction and development. **Sepehr and colleagues, 2002**.

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) which 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) which was found to be statistically at par with T9. Because it maintains a favourable equilibrium between photosynthesis and respiration, the B 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 **(Gitte et al. 2005)**.

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.

6. References

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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