ZINC ROLE IN Bt. COTTON QUALITY AND YIELD IMPROVEMENT IN DERA GHAZI KHAN DIVISION

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Abstract

In Kharif 2022 and Kharif 2023, a research was conducted in the fields of farmers in Dera Ghazi Khan to assess the impact of different zinc levels on the quantity and quality of cotton produced. Three replications of the experiment were carried out using a Randomised Complete Block Design. There were five different zinc application levels: 0, 5, 10, 15, and 20 kg ha^{-1}. The lowest average seed cotton yield was seen in the control group in 2022 and 2023, at 2462 kg/ha and 2371 kg/ha, respectively. However, in 2022 and 2023, the 20 kg ha^{-1} zinc treatment showed the greatest yield of 2683 kg/ha and 2511 kg/ha, respectively, indicating an increase in yield of 5.90 % and 8.98 % over the control. T_5 (20 kg ha^{-1}) showed the highest number of productive bolls per plant, whereas T_1 (control) showed the lowest number. In contrast, the control group showed the highest plant height when compared to the other treatments. T_5 (20 kg ha^{-1}) had the largest number of sympodial branches per plant and the lowest number of monopodial branches per plant compared to the control. The data clearly shows that the administration of various zinc dosages had a substantial impact on the number of bolls per plant, plant height, number of sympodial branches per plant, number of monopodial branches per plant, and seed cotton production. Zinc must thus be applied to cotton in order to improve its production and quality.

Key words: Productivity, quality, Bt. cotton, Zinc, improvement

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Introduction

In the world's most developed nations, the utilisation of micronutrients in the soil is regarded as the cornerstone of agriculture. One of the most important factors for improving the quality and quantity of any crop is appropriate plant nutrition. Although zinc is not required in large quantities for many crops, it is essential for the proper operation of several physiological processes (Mousavi et al., 2011; Yosefi et al., 2011). Zinc is an essential component of many proteins and enzymes. It is important for several functions, including the synthesis of different growth hormones, internode elongation, and numerous metabolic processes. Zinc is required for around 10% of the proteins in the human body (Abdou et al., 2011). Because zinc is so important for growth and development, almost one-third of the world's population lacks it, especially children under the age of five (Akay et al., 2011). Additionally, it strengthens the immunological system of the human body (Peck AW, McDonald 2010). According to Tisdale et al. (1984), zinc affects the activity of the hydrogenase enzyme, which is essential for plant metabolism. According to Chang et al. (2007), deficiencies in zinc are extremely widespread in humans, animals, and plants. Over 30% of people worldwide suffer from a severe zinc shortage (Sangh, 2012).

Materials and Methods

A field experiment was carried out in the Dera Ghazi Khan farmer's fields in 2022 and 2023. Three replications and a randomised complete block design were used to set up the experiment. There were five different zinc treatments applied: 0, 5, 10, 15, and 20 kg ha^{-1}. The identical dosages of N-P-K i.e 250, 125, and 100 kg ha^{-1} were administered to each treatment. To evaluate the effect of zinc on cotton output and quality, data spanning two years was combined. The soil under investigation has the following characteristics: pH of 8.3, electrical conductivity of 1.13 dSm^{-1}, organic matter of 0.86%, P_2O_5 was 7.7ppm and K_2O was 119 ppm and zincwas 0.58 ppm.

Results and Discussion

Table 1 lists the physical and chemical characteristics of the experimental site. The soil had the following parameters: pH 8.3, electrical conductivity of 1.13 dSm^{-1}, organic matter of 0.86%, accessible P and K of 7.7 and 119 ppm, and zinc was 0.58 ppm.

Table 1. Pre-sowing data of study site

pH	EC (dSm^{-1})	Organic matter (%)	Available P (ppm)	Available K (ppm)	Zn (ppm)	Soil texture		
						Sand	silt	clay
8.3	1.13	0.86	7.7	119	0.58	30	44	26

Plant Height

Figure 2 displays the results pertaining to cotton performance with respect to plant height. The findings showed that plant height varied. The plants in treatment 5 had the lowest plant height (118 cm), whereas the plants in control had the highest plant height (137 cm).

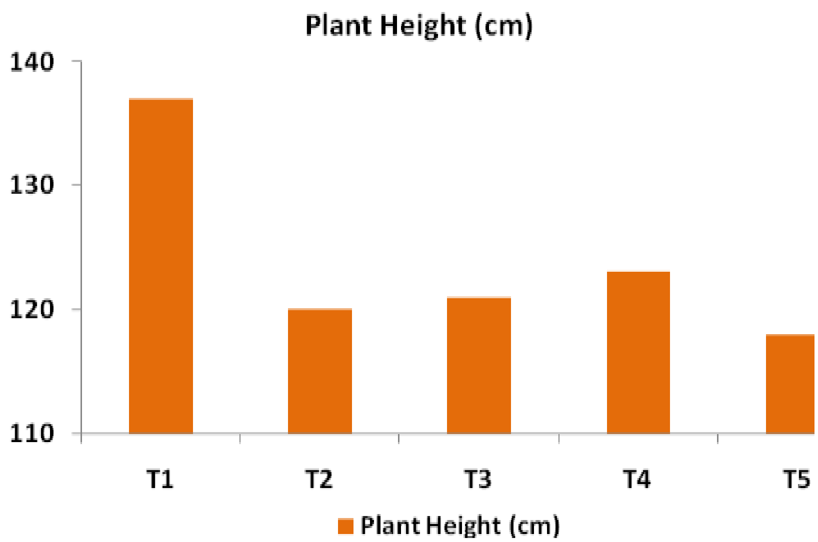


Figure 2. Effect of different doses of Zn on plant height of cotton

Number of Monopodial branches/plant

Vegetative branches known as monopodial branches develop when the terminal buds develop into a leader shoot and the lateral branches take on a secondary role. The data makes it evident that there was no statistically significant difference in the formation of vegetative branches between the different zinc doses used. However, each plant had 1.75–1.95 monopodial branches. The data clearly indicate that the establishment of monopodial branches was not affected by different zinc application doses. (Figure 3). The results makes it clear that there was no statistically significant effect of varied zinc doses on the growth of monopodial branches. However, there were between 1.75 and 1.95 plants with monopodial branches. The use of zinc did not significantly alter the monopodial growth, according to the results.

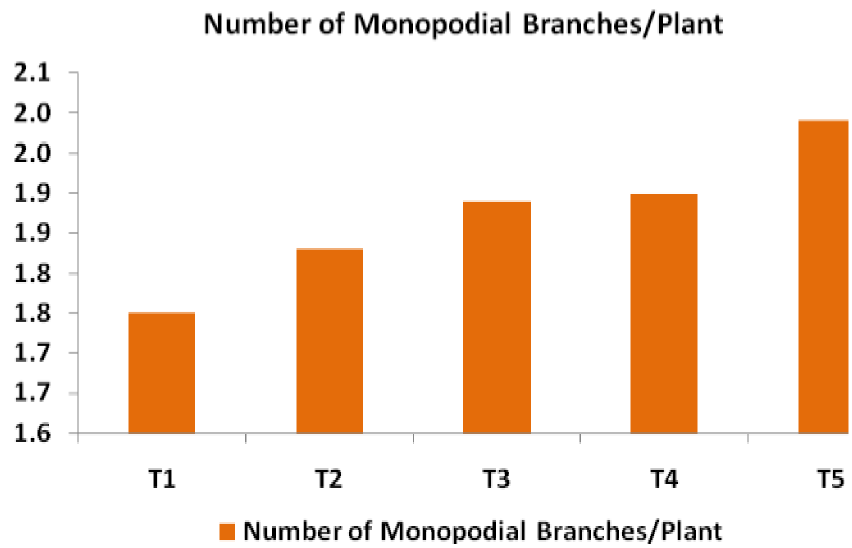


Figure 3. Effect of different doses of Zn on Number of MonopodialBranches/Plant

Number of Sympodial Branches/Plant

Fruiting branches that emerge from auxiliary buds are commonly referred to as sympadial branches. The information displayed in Figure 4 demonstrated a notable variance in sympodial branches as a result of different zinc application doses. The control group recorded the lowest sympodial branches (10.18 $plant^{-1}$) while the 20 kg ha^{-1} zinc treatment showed the largest sympodial branches (16.82 $plant^{-1}$), indicating a 65.23% increase over the control group. It is clear that a higher zinc dosage led to more branches on each plant. These outcomes are consistent with earlier research by (Xi-Wen et al., 2011).

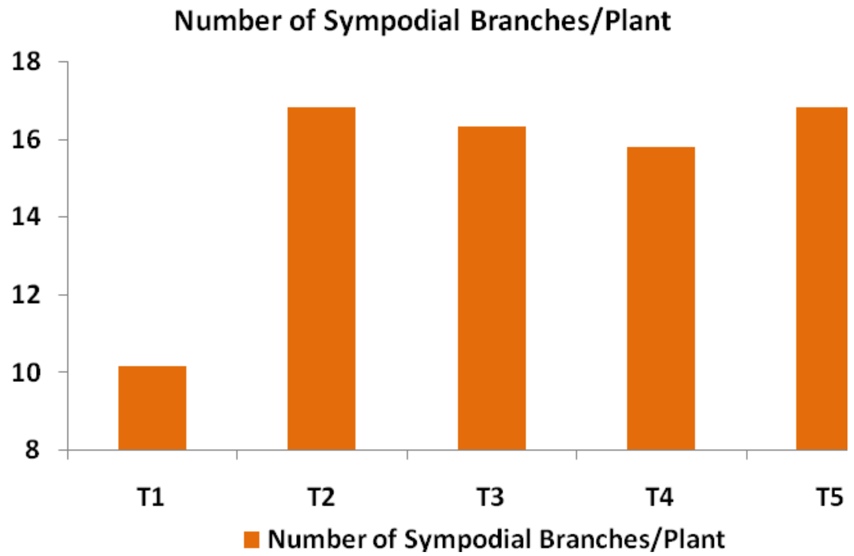


Figure 4. Effect of different doses of Zn on Number of SympodialBranches/Plant

Number of Productive bolls Plant^{-1}

Zinc application greatly increased the quantity of bolls Plant-1; they are regarded as the productive bolls, which open uniformly (Figure 5). The 20 kg ha-1 Zinc had the largest number of bolls plant-1 (48.1), followed by 47.5 in 15 kg ha^{-1} Zinc and 45.3 in 10 kg ha^{-1} Zinc, indicating increases of 31.06 %, 29.43 %, and 23.42%, respectively, compared to the control. Researchers have noted a comparable upward tendency in the number of bolls plant^{-1} as a result of applying micronutrients to cotton crops (Chirstos Dordas 2006; Saravanan M. 2009). The use of zinc to cotton produced similar outcomes, as reported by Makhdomm et al. (2010).

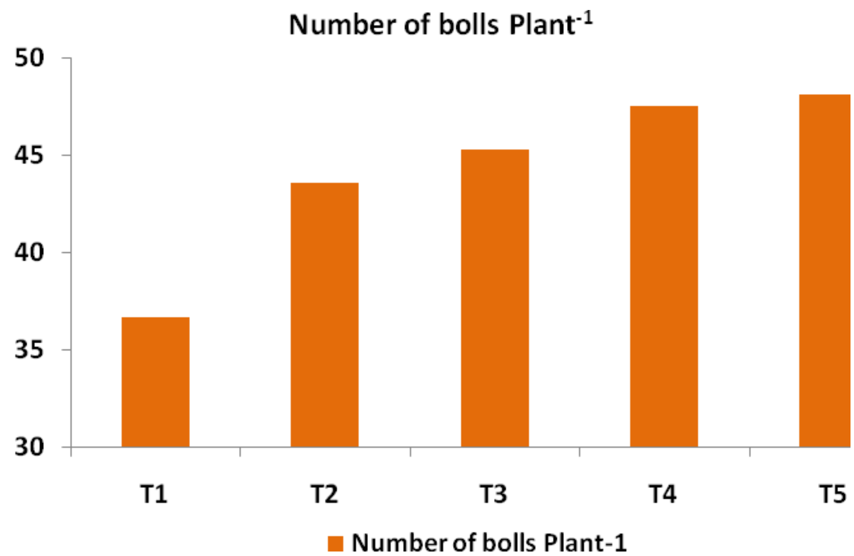


Figure 5. Effect of different doses of Zn on Number of bolls Plant^{-1}

Ten Boll weight

This study demonstrated a statistically significant effect of zinc treatment on boll weight. Figure 6 displays a 24.05% increase in 10 boll weight. The maximum weight of 52.1 g was reported in T_5, and the lowest weight of 42.0 g was obtained in the control group. It's possible that the cotton crop's enhanced availability of zinc is the cause of this boll weight rise. These results align with those of Khuran et al. (1996), who also observed a rise in boll weight following zinc application. This results from an increase in the activity of enzymes that are actively involved in the metabolism of carbohydrates and an increase in the weight of the boll (Taheri et al., 2011).

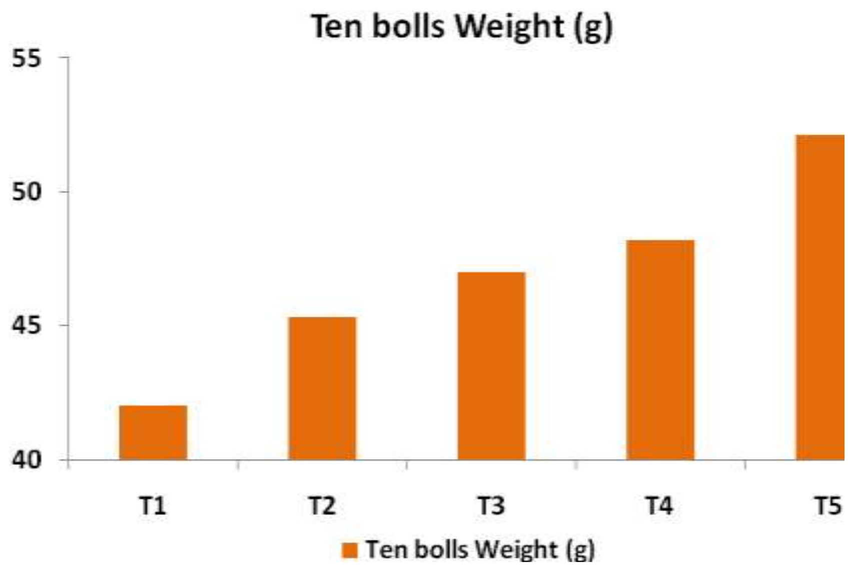


Figure 6. Effect of different doses of Zn on Ten bolls weight

Staple length

Figure 7 displays the research findings for the staple length. The findings make it clear that applying zinc has a statistically significant impact on staple length. T5 had the longest staple length (27.1 mm), while T_1 had the shortest (22.93 mm), with an increase in staple length of 18% over control and T5's 27.1 mm showing an increase of 18.19 % above control. The crop grew faster with the large dose of zinc, and the length of the staple increased as well. These outcomes concur with the findings published by Galavi et al. (2010).

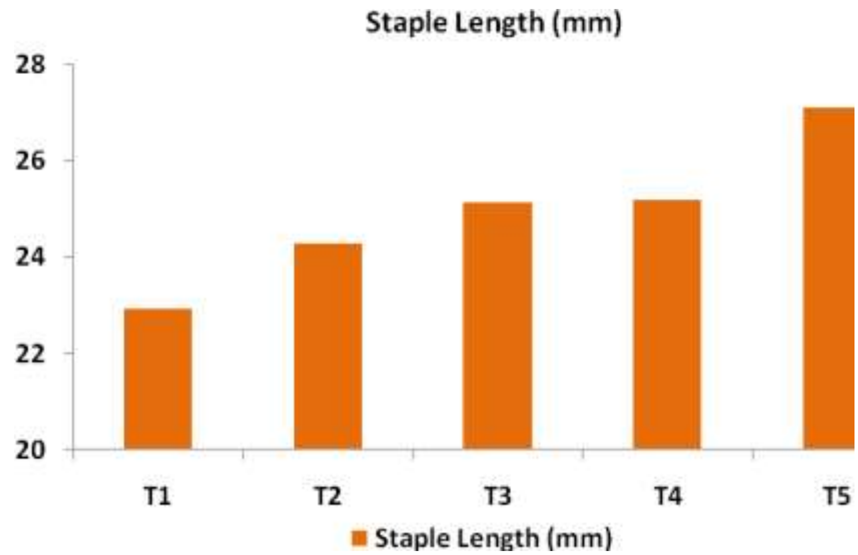


Figure 7. Effect of different doses of Zn on Staple Length

Effect of different doses of Zn on Seed cotton yield

Figure 8 presents the findings of the mean value of seed cotton production. The data clearly show that applying varying zinc dosages had a substantial impact on the production of seed cotton. In both years, the highest possible yield of seed cotton was achieved by applying Zn @ 20 kg ha^{-1}. The biggest yield was 2683 kg ha^{-1} in 2022 and 2448 kg ha^{-1} in 2023. Significant influence was also seen in the seed cotton yield in pooled. It demonstrates that zinc is a crucial factor in the production of higher-quality seed cotton. These results are consistent with those of Alam et al. (2010).

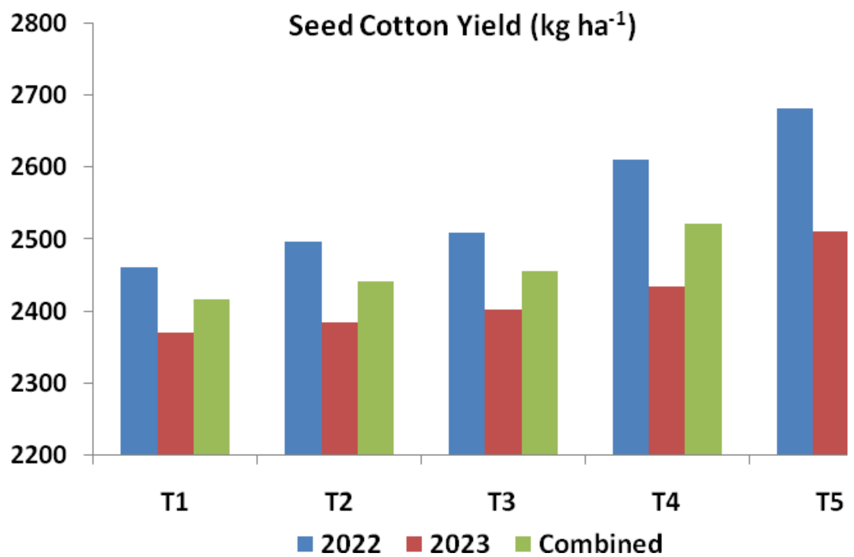
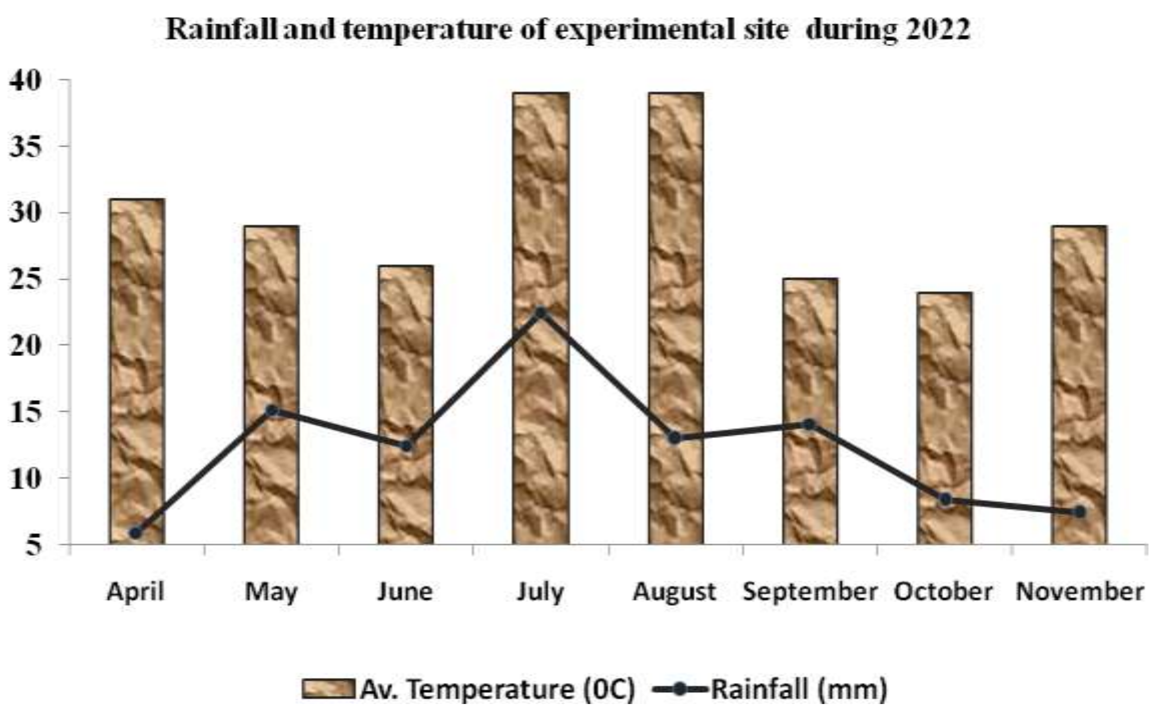
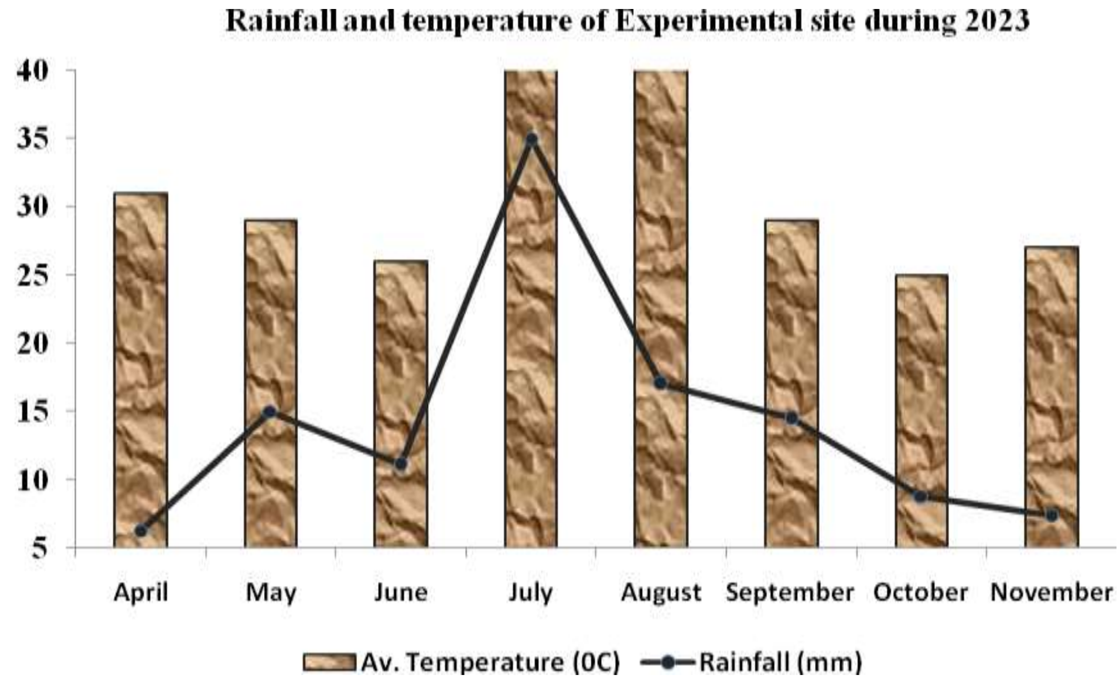


Figure 8 . Effect of different doses of Zn on Seed cotton yield





CONCLUSION

The results make it clear that the most beneficial zinc dosage was 20.0 kg ha-1. However, additional zinc dosages did not demonstrate any statistically significant effects. Where zinc was not administered, the plants reached their maximum height of 137 cm. The most sympodial branches (16.82 plant^{-1}), maximum ten boll weight (52.1 g), maximum staple length (27.1 mm), and highest seed cotton production (2683 kg ha^{-1} in 2022 and 2448 kg ha^{-1} in 2023) were also reported with zinc administration at a rate of 20 kg ha^{-1}. As a result, adding zinc to cotton combined with other NPK fertilisers significantly increased both the crop's production and quality. Therefore, in order to improve cotton output and quality, farmers are advised to use zinc at a rate of 20 kg ha^{-1}.

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