RESPONSE OF ATTA HABIB WHEAT VARIETY TO DIFFERENT ZINC APPLICATIONS

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Abstract

A study was performed at the Agriculture Research Institute, Tarnab, Peshawar, during 2022. The experiment comprised with following treatments; T1=untreated, T2=1% foliar with $ZnSO_4$, T3=1% priming with $ZnSO_4$, T4=15 kg ha^{-1} Zn soil application, T5=1% foliar with $ZnSO_4$+1% priming with $ZnSO_4$+15 kg ha^{-1} Zn soil application. Using a randomized complete block design with three replications. Results revealed that maximum plant height (97.00 cm) productive tillers m^{-2} (366.33), spikes m^{-2} (356.00), grain $spike^{-1}$ (58.00), thousand seed weight (52.00 g), biological yield (10097 kg ha^{-1}) and grain yield (4357.0 kg ha^{-1}) were recorded in plot treated with 1% foliar with $ZnSO_4$+1% priming with $ZnSO_4$+15 kg ha^{-1} while minimum plant height (83.33 cm) productive tillers m^{-2} (279.67), spikes m^{-2} (260.00), grain $spike^{-1}$ (47.00), thousand seed weight (43.00 g), biological yield (7751 kg ha^{-1}) and grain yield (3817.3 kg ha^{-1}) were recorded in control plot. Conclusion of this study is application of 1% foliar with $ZnSO_4$+1% priming with $ZnSO_4$+15 kg ha^{-1} in soil performed better in yield so it is recommended for general cultivation.

Keywords: Atta Habib, Foliar, Priming, Application of Zinc

Introduction

The world's most significant crop for grains is wheat. Pakistan ranks 8th among nations that produce wheat, contributing over 3.17% of global wheat production. In Pakistan, wheat is a major food crop and plays a key role in the economy. In Pakistan, 8.66 million hectares of wheat were planted in 2015–16, yielding a total of 23.517 million tons (MNFSR, 2016). While it was grown on 0.758 million hectares in Khyber Pakhtunkhwa, producing an average of 1607.5 kg per ha. Most people utilize wheat as a food crop because of its deliciousness and value as a source of calories, proteins, and vitamins. Livestock are fed on low-quality wheat and by-products of the flour milling process. Micronutrients are necessary for plant growth and the control of its essential physiological functions. Like macronutrients, they are equally essential in little doses (Bharti et al., 2013). Micronutrient deficiency in Pakistan is brought on by calcareous soils, high pH, poor organic matter, salt stress, and uneven NPK fertilizer application (Hafeez et al., 2013). The world is paying more attention to zinc, one of the most significant micronutrients in biological zones (Cakmak, 2008; Kabata and Pendias, 2011). Deficiency of Zn affects about 1/3 of the total world's populations (Habib, 2009; Muyhaura et al., 2010). One of the symptoms of a Zn deficit in soils is a reduction in plant cell growth and development (Gomez et al., 2010). Zn insufficiency in people is quite prevalent, particularly in nations with heavy cereal-based food consumption. The need to develop cereal crops with enough Zn nutrition is therefore great. Production of wheat is likewise severely hampered by a Zn deficiency. It is generally acknowledged that the most prevalent micronutrient shortfall in soils used to cultivate cereals worldwide is a zinc deficiency. The lack of soil Zn causes serious economic losses as well as reduced plant growth and crop production. When nutrient deficiencies cannot be adequately addressed by applications of nutrients to the soil, foliar application of various nutrients to plants is another option (Cakmak, 2008). When the roots cannot provide the required nutrients to plant, in such circumstances foliar spraying of microelements is very helpful (Kinaci and Gulmezoglu, 2007; Babaeian et al., 2011). Later applications of zinc fertilizer to crops result in increased Zn deposition, notably in cereals. Previous Zn research showed that the largest Zn accumulation occurs during the grain development stage, with the concentration of Zn in wheat grains increasing during the milky stage of grain development. When compared to applying Zn at early growth stages, it has been found that applying Zn at late growth stages, such as the milk and dough stages, resulted in a substantially greater enhancement in grain Zn concentration (Cakmak, 2012). A potential problem is that increasing in Zn concentration in flour may affect negatively its processing traits (Kinaci and Gulmezoglu, 2007). Zn is more efficient at increasing Zn concentration in seeds when applied topically at all stages of seed development. The maximum Zn content in seeds can be attained when applied during the early phases of seed development (Levent et al., 2006). The biggest global concern right now is raising the Zn content of grains in order to reduce health issues caused by Zn insufficiency. Wheat crops contain extremely little zinc in their grains, therefore cultivating wheat on soils poor in zinc lowers the zinc content. Hence, adding Zn to wheat by foliar treatment is crucial for both increased crop output and improved human health. Keeping in view the significance of Zn, this experiment was performed to study the effectiveness of different Zinc application methods towards wheat variety (Atta Habib).

Materials and methods

A study was performed in order to checked response of wheat variety Atta Habib to different zinc application methods at the Agriculture Research Institute, Tarnab, Peshawar, during 2022. The experiment comprised with following treatments; T1=Control, T2=1% foliar with $ZnSO_4$, T3=1% priming with $ZnSO_4$, T4=15 kg ha^{-1} Zn soil application, T5=1% foliar with $ZnSO_4$+1% priming with $ZnSO_4$+15 kg ha^{-1} Zn soil application. Using a randomized complete block design with three replications, all treatment combinations were distributed randomly to the experimental units. The plot size was kept at 3 m by 3 m. $ZnSO_4.7H_2O$ source was used to prepare a 1% solution for foliar application and Zn priming. In order to completely moisten the plot area, the solution was diluted with water while keeping in mind the treatments and volume. Within various growth stages, the foliar Zn treatment was sprayed in the late afternoon. Atta Habib wheat type was sown at a rate of 120 kg per hectare with a 30 cm R-R gap. Application rates for nitrogen and phosphorus were 120 kg per ha and 90 kg per ha, respectively. As a supply of nitrogen and phosphorus, urea and DAP were employed. The entire phosphorous dose and half of the nitrogen dose were applied at the time of sowing, and the remaining dose was added later during the second irrigation. For all of the treatments, all other agronomic procedures remained standard and consistent.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) using Statistix 8.1 software and means were separated using LSD test at a 5% level of significance.

Results and Discussions

The data shows in the Table 1 that different Zinc application methods significantly affected the plant height, productive tillers, spikes and grains spikes of Atta Habib. Maximum height of plant was recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (97.50 cm) as followed by 1% priming with $ZnSO_4$ (91.66 cm), 15 kg ha^{-1} soil application (89.66 cm) and 1% foliar with $ZnSO_4$ (87.73 cm) over the check plot (83.33 cm). Similarly, the highest productive tillers were recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (366.33 m^{-2}) followed by 1% priming with $ZnSO_4$ (295.83 m^{-2}), 1% foliar with $ZnSO_4$ (288 m^{-2}) and 15 kg ha^{-1} soil application (281.00 m^{-2}) over the control plot (279.67 m^{-2}). In case of spikes, maximum score was recorded when applied 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (356.00 m^{-2}) as followed by 1% foliar with $ZnSO_4$ (276.00 m^{-2}), 1% priming with $ZnSO_4$ (273 m^{-2}) and 15 kg ha^{-1} soil application (261.10 m^{-2}) as compared with control (260.00 m^{-2}). Maximum grains spikes were recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (58.00 $spikes^{-1}$) followed by 1% priming with $ZnSO_4$ (55.00 $spikes^{-1}$), 1% foliar with $ZnSO_4$ (49.00 $spikes^{-1}$) and 15 kg ha^{-1} soil application (47.06 $spikes^{-1}$) over control plot (47.00 $spikes^{-1}$). Similar findings were reported by Massoud et al. (2005) that zinc spraying boosted wheat plant height. Our findings concur with those of Jhonson and Susan (2011), who found that zinc administration increased maximum plant height in a variety of cultivars. Wheat productive tillers per m^{-2} were dramatically increased as a result of various zinc application techniques. The influence of productive tillers per m^2 was also found to be considerable in the case of varieties. In plots treated with 1% foliar + 1% priming + 15 kg ha^{-1} soil application, there were more productive tillers recorded per square meter than there were in plots treated with no zinc application. According to Nadim et al. (2013), zinc applied foliar enhanced the number of tillers m^{-2}. The varying genetic make-up of the cultivars may be the cause of the variation in productive tillers m^{-2}. Our findings, however, conflict with those of Huidarian et al. (2011), who noted that increased tiller m^2 was noted in various types with zinc application. According to Mann et al. (2004), the application of zinc resulted in a good rise in the number of spike m^2 of various types. According to Bakht et al. (2010), applying various zinc application techniques increases the number of grains $spike^{-1}$. They also discovered that applying various zinc application techniques to various types increases the number of grains $spike^{-1}$.

The data shows in the Table 2 that different Zinc application methods significantly affected the thousand grains weight (g), biological yield (kg ha^{-1}), grain yield (kg ha^{-1}) and Harvest index (%) of Atta Habib. Maximum thousand grains weight (g) was recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (52.00 g) followed by 1% priming with $ZnSO_4$ (48.33 g), 1% foliar with $ZnSO_4$ (48.00 g) and 15 kg ha^{-1} soil application (45.00 g) over the control plot (43.00 g). Maximum biological yield (kg ha-1) was recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (10097) as followed by 1% priming with $ZnSO_4$ (8656), 1% foliar with $ZnSO_4$ (8208) and 15 kg ha^{-1} soil application (7864) over the control plot (7751). Similarly, maximum grain yield kg ha^{-1} was recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (4357) as followed by 1% priming with $ZnSO_4$ (3930), 1% foliar with $ZnSO_4$ (3890) and 15 kg ha^{-1} soil application (3876) over the control plot (3817). Maximum harvest index (%) was recorded with 1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application (49.00) as followed by 1% foliar with $ZnSO_4$ (51.66), 1% priming with $ZnSO_4$ (52.00) 15 kg ha^{-1} soil application and (55.00) over control (56.00). Ananda and Patil (2005) reported similar outcomes and discovered that applying zinc led to heavier grains. Zinc spraying considerably boosted the weight of wheat types per thousand grains, according to Mann et al. (2004). Our findings are consistent with those of Cakmak (2012), who claimed that the lack of zinc may contribute to a decrease in growth in terms of lower biomass production. According to Moghadam et al. (2012), zinc spraying techniques considerably boosted wheat's grain production. Also, our findings are consistent with those of Al-Abdulislam (1997), who showed a maximum harvest index for zinc doses above a certain level. While varieties had no discernible effect on the harvest index.

Table 1: Efficacy of different Zn methods against the wheat variety for Plant height (cm), Productive tillers m^{-2}, Spikes m^{-2} and Grains $spikes^{-1}$.

Treatments	Plant height (cm)	Productive tillers m^{-2}	Spikes m^{-2}	Grains $spikes^{-1}$
Control	83.33 d	279.67 d	260.00 d	47.00 d
1% foliar with $ZnSO_4$	87.73 c	288.00 c	276.00 b	49.00 c
1% priming with $ZnSO_4$	91.66 b	295.83 b	273.00 c	55.00 b
15 kg ha^{-1} soil application	89.66 bc	281.00 d	261.10 d	47.06 d
1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application	97.50 a	366.33 a	356.00 a	58.00 a
LSD $_{(0.05)}$	2.21	1.34	1.64	0.84

Mean in columns followed with the same letters are non-significant at p-value=5 %

Table 2: Efficacy of different Zinc methods against wheat variety for thousand grains weight(g), Biological yield (kg ha^{-1}), Grain yield (kg ha^{-1}) and Harvest index (%).

Treatments	Thousand grains weight (g)	Biological yield (kg ha^{-1})	Grain yield (kg ha^{-1})	Harvest index (%)
Control	43.00 d	7751 e	3817.3 e	56.00 a
1% foliar with $ZnSO_4$	48.00 b	8208 c	3891.0 c	51.66 b
1% priming with $ZnSO_4$	48.33 b	8656 b	3930.0 b	52.00 b
15 kg ha^{-1} soil application	45.00 c	7864 d	3876.0 d	55.00 a
1% foliar with $ZnSO_4$ + 1% priming with $ZnSO_4$ + 15 kg ha^{-1} soil application	52.00 a	10097 a	4357.0 a	49.00 b
LSD $_{(0.05)}$	0.48	0.48	9.97	2.40

Mean in columns followed with the same letters are non-significant at p-value=5 %

Conclusion

From the above research finding it is concluded that Zinc application method of 1 % foliar + 1 % priming + 15 kg ha^{-1} soil Zn application produced higher grain yield of wheat also produced more productive tiller m^{-2}, spike per m^2, and 1000 seed weight, grains $spike^{-1}$ and grain yield as compared with control. So this treatment is recommended for wheat growers in order to achieve maximum yield.

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