E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; 7(2): 509-511
Received: 23-12-2023
Accepted: 27-01-2024

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Effect of zinc scheduling on yield and yield attributes of wheat crop (*Triticum aestivum* L.): A case study in Uttarakhand region

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i2g.360

Abstract
This research was performed at the region of Uttrakhand College of Agriculture of HNBGU University. In order to investigate the "Effect of Zinc scheduling on yield and yield attributes of Wheat crop (*Triticum aestivum* L.) *Var.* – PBW-292, field experiment was carried out during *rabi* season (2021-2022). The layout of experimental field was laid randomized block design (RBD) with 6 treatments and 3 replications. Consisting of T_1 (Control), T_2 RDF 100% + 2 Kg /ha zinc (monohydrate), T_3 RDF 100% + 2.5 Kg /ha zinc (monohydrate), T_4 RDF 100% + 3 Kg /ha zinc (monohydrate), T_5 RDF 100% + 3.5 Kg /ha zinc (monohydrate), T_6 RDF 100% + 4 Kg /ha zinc (monohydrate). All treatments were applied at the time of sowing and half nitrogen applied as top dressing later. The results indicated that among all the treatments, T_4 (RDF 100% + 3 kg/ha Zinc monohydrate), overall was found best for farmer point of view with respect to Number of grain spike^{-1} (31), Spike length (12.8 cm) test weight (44.23 gm), Biological yield (99.3 q ha^{-1}), Grain yield (42.8 q ha^{-1}), Straw yield (56.2 q ha^{-1}). The aforementioned study suggests that applying zinc in addition to the recommended NPK can boost crop output. Applications of zinc and NPK at the same time will increase the yield even more. The quality of the crop will also improve because the nitrogen and zinc levels of the edible components were raised by these additions.

Keywords: Effect of zinc, zinc availability, zinc, grain yield, wheat

Introduction
Wheat is primarily grown in temperate regions and also at higher altitude under tropical climatic areas in winter season. It is the single, most important cereal crop that has been considered as integral component of the food security system of the several nations. It is a Rabi season crop so it is less in under attack of pest and diseases. In modern agriculture, the application of fertilizer is very important. It acts as important agent to increase efficiency of soil in crop production (In financial year 2021, the estimated yield of wheat in the south Asian country of India was approximately 3.5 thousand kilograms per hectare).
According to a recent assessment by the state's agriculture department, 359 lakh metric tons (LMT) of wheat will be produced in UP overall in 2022, which is 16 LMT fewer than the amount produced in 2021. Zinc is one of the most important micronutrients for human health, being involved in many physiological and biochemical processes. It is well documented that Zn deficiency impairs the immune system and increases the incidence of infectious diseases such as diarrhea and pneumonia, especially in the developing world (Walker and Black, 2007) [2]. Zn supply for people in the developing world comes mainly from cereal crops. Wheat is a highly consumed cereal crop (McKevith, 2004; Kumar *et al.* 2022) [5, 4]. The Zn and Nitrogen availability also affect the yield and growth of late sown Wheat. So, the nitrogen scheduling is most common practice for better production of Wheat crop. Zinc element plays a vital role in the yield improvement of wheat. In India, most of the land patches available for wheat growth does not match the amount required for optimal yield affecting both quality and quantity. They are needed in trace amount but their availability in adequate manner improves the cell physiology that is reflected in yield. Zinc is very helpful in numerous plant processes - (a) uptake of nitrogen, (b) synthesis of chlorophyll, (c) in carbon anhydrase activity.

Deficiency of zinc [optimum 5.8%], reduce the functioning rate of protein synthesis and the protein content also decreased drastically. Zinc is very important element for cell membrane integrity and phytochrome activities. The grain yield and protein percentage in seed is increased by foliar application of zinc. Also, many agronomic traits are caused by foliar application of zinc. Irrigation with foliar application of zinc influences the growth and yield contributing characters of wheat. Zinc increases the amount of chlorophyll content and also the concentration of abscisic acid and due to this the components of wheat are increased. Over a fifth of India's land area (21.06) is arid and causes serious abiotic stress.

Improving the zinc content of the grains that a big portion of the population consumes for their calories is required given the developing zinc shortage in Indian soil and the widespread public health issue of zinc deficiency. Wheat crop has very definable stages and it requires irrigation at all stages. Low moisture content in soil can affect the physiological appearance of the crop and the deficiency can appear as variations. Ensuring proper irrigation and disease control is very important at CRI (crown root initiation) stage which appears after 21 days of sowing for successful cultivation of wheat.

Material and Methods

It is 3088 square kilometres in size and is situated in Uttarakhand's northwest at an altitude of 450 metres above mean sea level (MSL). Geographically, Dehradun is situated between $77^0$34'45" and $78^0$18'30" east longitude and $29^0$58' and $31^0$2'30" north latitude. Dehradun experiences a humid subtropical climate. For a few days in the summer, temperatures can rise as high as 44 °C, and a scorching wind known as Loo blows through North India. In the plains, wintertime temperatures are often between 1 and 20 °C, and fog is extremely prevalent. Although Dehradun can experience below-freezing temperatures during severe cold spells, this is not typical. There are frequently long stretches of intense rainfall throughout the monsoon season. The soil at the test site is referred to as "sandy loam," and it has the qualities of a deep, well-drained, coarse loamy cover over fragmented soils and medium fertility. Five different locations throughout the field were used to collect a total of five soil samples from the top (0–15 cm) layer of the soil. A representative sample of the soil was taken for its physiochemical process after the soil had been properly mixed. The analysis revealed that the soil of the experimental site was Sandy loam in texture, good in organic matter, low in available nitrogen, medium in available phosphorus and Potassium contents with neutral in reaction and normal in electrical conductivity (0.23 dsm^{-1}). The experimental site having slightly alkaline pH and experiment was laid out in completely Randomized block design (RBD). T_1 (Control), T_2 RDF 100% + 2 Kg /ha zinc (monohydrate), T_3 RDF 100% + 2.5 Kg /ha zinc (monohydrate), T_4 RDF 100% + 3 Kg /ha zinc (monohydrate), T_5 RDF 100% + 3.5 Kg /ha zinc (monohydrate), T_6 RDF 100% + 4 Kg /ha zinc (monohydrate). All the treatments were applied at the time of sowing except nitrogen which is later applied as top dressing in the crop period. The spacing of wheat crop was 20 x 23 cm. Gross plot size was $2m^2$ (2 m x 1m) and net plot size was $12m^2$ (6 x2 m^2). Total numbers of plots were 18.

Results and Discussion

Crop productivity depends on the amount of micro- nutrient is given to the crop. By giving proper cultural practices and adequate quantity of fertilizers results in good yield. The amount of zinc can affect the growth of crop as high amount decreases the yield parameters (i.e., grain yield, biological yield, straw yield). As more zinc create the unavailability of other nutrients like phosphorus in the soil. The optimum supply of essential plant nutrient from soil as well as fertilizer is mandatory for higher productivity. Maximum grains $spike^{-1}$, spike length, test weight grain yield, biological yield, straw yield was significantly affected by different treatments. The maximum grain yield was found at T_4 (42.8 q ha^{-1}) and at par with T_5, T_3, T_2, T_6 and the T_1 (control). In all treatments, zinc applied at the time of sowing but in different amount in different treated plots. The straw yield was found maximum in T_4 (56.2 q ha^{-1}) and at par T_5, T_6, T_3, T_2 and T_1. Likewise, the biological yield was found best in T_4 (99.3 q ha^{-1}) and at par with T_5, T_3, T_6, T_2 and T_1. The highest test weight 44.23 gm is which is found in T_4.

Genc *et al*. (2008) [6] examined that Zn has vast functions in plant metabolic activities and consequently the deficiency of zinc has a multitude of effects on plant growth. Zinc sulphate specifically increases grain content, test weight, grain yield, straw yield, biological yield and decreases the harvest index. By applying Zinc Sulphate, the margins over costs increased but the highest marginal return occur through 5kg ha^{-1} application. It is well known that zinc has adequate effect on stronger emergence, faster stand establishment, healthier root growth, greater potential vigor and increased yield potential.

Data regarding the effect of zinc on the yield attributes of late sown wheat is given in Table 1 and other growth attributes presented in Table 2.

Sardana *et al.* (2014) [8] studied the effect of N (120-150 kg /ha); P (60 kg P_2O_5/ha); K_2O (30 and 60 kg/ha): $ZnSO_4$ (25 and 50kg/ha) on durum wheat cultivars PBW 233. Fertilizer application significantly increased the grain yield. The treatment 150:60:60:25 (N: P: K: Zn) produced the highest grain yield (37.4 q/ha), which was at par with the grain yield obtained (35.4 q/ha) at the rate of 150: 60: 30: 25 N: P: K: Zn, respectively. Parihar *et al*. (2005) [9] reported that application of Zn up to 10 kg ha^{-1} increased the grain yield by 7.2% over control. Chowdhury *et al.* (2008) [10] revealed that application of micronutrients (soil + foliar) was the best method to increase grain yield of wheat. Wroble (2009) [11] stated that both soil and foliar application of micronutrients were positively correlated with wheat grain yield.

Table 1: Effect of different treatments on grain, straw yield and biological yield of wheat

Treatments	Yield (q ha^{-1})		
	Grain	**Straw**	**Biological**
Control	23.8	32.1	55.9
RDF 100% + 2 Kg /ha zinc (monohydrate)	34.8	41.7	76.5
RDF 100% + 2.5 Kg /ha zinc (monohydrate)	39.2	51.0	90.2
RDF 100% + 3 Kg /ha zinc (monohydrate)	42.8	56.2	99.3
RDF 100% + 3.5 Kg /ha zinc (monohydrate)	40.9	53.7	94.6
RDF 100% + 4 Kg /ha zinc (monohydrate)	37.8	52.2	90
CD	1.610	0.642	1.667
SEm±	0.504	0.201	0.522

Table 2: Effect of Zinc on spike length, no. of grains spike^{-1} and test weight (1000 seeds)

Treatments	Length of spike (cm)	Number of grain spike^{-1}	Test weight (g)
Control	10.64	13	38.71
RDF 100% + 2 Kg /ha zinc (monohydrate)	10.88	28	38.10
RDF 100% + 2.5 Kg /ha zinc (monohydrate)	12.04	26	34.49
RDF 100% + 3 Kg /ha zinc (monohydrate)	12.28	31	44.23
RDF 100% + 3.5 Kg /ha zinc (monohydrate)	10.68	19	24.20
RDF 100% + 4 Kg /ha zinc (monohydrate)	10.64	20	26.43
CD	1.474	0.583	1.898
SEm±	0.462	0.183	0.595

Conclusion

According to the aforementioned study, adding zinc to the recommended NPK can boost wheat production. Applications of zinc and NPK at the same time will increase yield even more. The quality of the crop will also improve because the nitrogen and zinc levels of the edible components were raised by these additions.

References

1. Aggarwal P, Choudhary KK, Singh AK, Chakraborty D. Variation in soil strength and rooting characteristics of wheat in relation to soil management. Geoderma. 2006;136(1-2):353-363.
2. Belshe RB, Edwards KM, Vesikari T, Black SV, Walker RE, Hultquist M, *et al*. Live attenuated versus inactivated influenza vaccine in infants and young children. New Eng. J Med. 2007;356(7):685-696.
3. Vipin K, Dhyani BP, Akansha S, Kumar S, Shahi UP, Maurya PK, *et al*. Effect of Nitrogen management on yield attributes and nitrogen- use efficiency of late - sown wheat (Triticum aestivum) in western Uttar Pradesh -Indian Journal of Agronomy. 2021;66(2):229-233.
4. Kumar V, Dhyani BP, Shahi UP, Kumar S, Kumar A, Singh A. Effect of nitrogen schedule and management on yield of late-sown wheat (*Triticum aestivum*) in rice-wheat system. Indian Journal of Agronomy. 2022;67(2):144-147.
5. McKevith B. Nutritional aspects of cereals. Nutrition Bulletin. 2004;29(2):111-142.
6. McDonald GK, Genc Y, Graham RD. A simple method to evaluate genetic variation in grain zinc concentration by correcting for differences in grain yield. Plant and Soil. 2008;306(1):49-55.
7. Jinger PD, Dhar S, Dass A, Sharma VK, Paramesh V, Vijayakumar S. Co-fertilization of Silicon and Phosphorus Influences the Dry Matter Accumulation, Grain Yield, Nutrient Uptake, and Nutrient-Use Efficiencies of Aerobic Rice. Silicon. 2022;14(9):4683-4697.
8. Sardana K, Chugh S, Garg VK. The role of zinc in acne and prevention of resistance: have we missed the “base” effect. Int. J Dermatol. 2014;53(1):125-127.
9. Chakraborty M, Manjunath KR, Panigrahy S, Kundu N, Parihar JS. Rice crop parameter retrieval using multi-temporal, multi-incidence angle Radarsat SAR data. ISPRS Journal of Photogrammetry and Remote Sensing. 2005 Aug 1;59(5):310-322.
10. Chowdhury D, Lieberman J. Death by a thousand cuts: granzyme pathways of programmed cell death. Annu. Rev. Immunol.. 2008 Apr 23;26:389-420.
11. Kordi R, Maffulli N, Wroble RR, Wallace WA. editors. Combat sports medicine. Springer Science & Business Media; c2009.