Original research article

Response of Phosphorus and Zinc on Yield and Economics of Wheat (*Triticum aestivum)*

ABSTRACT

The field experiment titled "Responseof Phosphorus and Zinc on Yield and Economics of Wheat (*Triticum aestivum*)"was conducted during *Rabi* season, 2022 at Crop Research Farm in the Department of agronomy, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh.The treatment consisted of three level of Phosphorus (60, 75 and 90 kg/ha),Zinc (15, 25 and 35 kg/ha) and control. The experiment was layout in Randomized Block Design (RBD) with 10 treatments and replicated thrice. The soil in the experimental area was sandy loam with pH (8.0), EC (0.56 dS/m), Organic Carbon (0.62%), Available N (225 kg/ha), Available P (38.2 kg/ha), and Available K (240.7 kg/ha). Application of Phosphorus 90 kg/ha and Zn 35 kg/ha produces higher Grain yield (4.90 t/ha), Straw yield (8.38 t/ha), Gross return (154405 INR/ha), Net return (103109.85 INR/ha) and B:C (2.01).

Keywords: *Wheat, Phosphorus, Zinc, Economics and Yield*

INTRODUCTION

Wheat (*Triticum aestivum* L) ranks Ist in the world among cereals in both area and production. wheat is called the 'king of cereals' and belongs to the family *Poaceae*. Wheat is a grass that is commonly grown for its seed, a cereal grain that is a staple food all over the world. Wheat is cultivated in most of parts of the world. It is staple diet for majority of the population in both developed and developing countries. Wheat compares well with other important cereals in the nutritive value. It contains more protein than other cereals. The nutritive values of wheat are starch (60-68%), protein (8-15%), fat, sugar, cellulose, minerals, vitamins, etc. (**Singh S.S. 2015)**.

The sharp rise in minimum support price and government's procurement are the two important drivers which led to significant increase in the area under wheat cultivation. The national productivity trend for wheat showed a marginal improvement, which has increased from 3009 kg/ha to 3100 kg/ha from 2012-2013 to 2017-2018. The rise in productivity is due to adoption of high-yielding varieties coupled with other inputs **(Singh *et al.* 2019)**.

Phosphorus is also an important, rather second most essential nutrient which encourages root development and also provides energy by forming (ATP) Adenosine tri-Phosphate **(Shaheen *et al.* 2007**). It is an essential plant nutrient which place major role for achieving the maximum agricultural production. Phosphorus observed the second most extensively occurring nutrient deficiency, after nitrogen stress, in serial chain across the world. Crops phosphorus use efficiency ranged from the 37%. Significantly maximum yield of grain in wheat has been obtained by many researchers with optimum use of P fertilizer. Organic and inorganic source of P are applied to a soil in the form of both fertilizer when available P is less than crops requirement.

Zinc has diverse physiological functions in biological systems. It interacts with a large number of enzymes and other proteins in the body and performs critical structural, functional and regulatory roles. Zn and other micronutrient deficiencies are also said to have a significant negative impact on the gross national product in underdeveloped nations by lowering productivity and raising healthcare expenses. **(Cakmak and Kutman *et al.* 2018).** It is essential for normal plant growth and development as carbohydrates, protein metabolism and sexual fertilization depend on zinc. One of the essential heavy metals that plants need as a micronutrient for numerous metabolic activities is zinc.

Comment [a1]: Explain in a new paragraph the objectives to be achieved from this study

MATERIALS AND METHODS

This experiment was laid out during the *Rabi* season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25^0 39” 42” N latitude, 81^0 67” 56” E longitude and at an altitude of 98 m above mean sea level. The experiment was laid out in Randomized Block Design Which consisting of ten treatments with T_1 – Phosphorus 60 kg/ha + Zinc 15 kg/ha, T_2 –Phosphorus 75 kg/ha + Zinc 25 kg/ha, T_3 – Phosphorus 90 kg/ha + Zinc 35 kg/ha, T_4 - Phosphorus 60 kg/ha + Zinc 15 kg/ha, T_5 - Phosphorus 75 kg/ha + Zinc 25 kg/ha, T_6 - Phosphorus 90 kg/ha + Zinc 35 kg/ha, T_7 - Phosphorus 60 kg/ha + Zinc 15 kg/ha, T_8 - Phosphorus 75 kg/ha + Zinc 25 kg/ha, T_9 - Phosphorus 90 kg/ha + Zinc 35 kg/ha, T_{10} - Control (150-60-40 NPK kg/ha). Seeds are sown at a spacing of 22.5 × 10 cm to a seed rate of 100 kg/ha. The recommended dose of Nitrogen

(150 kg/ha), Phosphorus (60 kg/ha) and Potassium (40 kg/ha) and Phosphorus and Zinc were applied as per the treatments. Nitrogen, Phosphorus and Potash was applied as basal at the time of sowing. One hand weeding was done manually with *Khurpi* at 25 DAS followed by second manual weeding was done at 45 DAS. This was done to control grass as well as broad leaf weeds.Data recorded on different aspects of crop, *viz.*, growth, yield attributes were subjected to statistically analysis by analysis of variance method. (**Gomez and Gomez, 1976)** and economic data analysis mathematical method.

RESULT AND DISCUSSION

Comment [a2]: The explanation of the research results must state the table number containing the data in the appendix

Grain yield (t/ ha)

Treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] recorded highest grain yield (4.90 t/ha). The higher grain yield could be due to more dry matter accumulation in grain and no of grains/spikes because of application of plant growth regulator. Such finding was also supported by the **Rahman *et al.* (2011). Bahrami *et al.* (2014)** also found that height reduction at tillering led to higher tiller survival and enhanced fertile tillers, which resulted in higher yield.

Straw yield (t/ ha)

Treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] recorded the higher stover yield (8.38 t/ha). Significant and, higher stover yield was obtained with the application of Zinc (35kg/ha) might be due to of its important role in biosynthesis of the IAA and initiation of primordial for reproductive parts resulted in providing favourable condition for metabolic reactions within the plants and stimulate the translocation of assimilates efficiently towards sinks which ultimately increases the stover yield. Similar result was reported by **Akhila *et al.* (2021).**

Harvest index (%)

Highest harvest index (46.73%) was recorded in treatment T9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] and though there was non-significant difference among other treatments.

Cost of Production (INR/ha)

Cost of production (51295.15 INR/ha) was found to be highest in treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] as compared to other treatment.

Gross return (INR/ha)

Gross return (154405 INR/ha) was found to be highest in treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] as compared to other treatment.

Net return (INR/ha)

Net return (103109.85 INR/ha) was found to be highest in treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] as compared to other treatment.

B: C Ratio

Benefit Cost Ratio (2.01) was found to be highest in treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] as compared to other treatment.

Higher gross return, Net return and Benefit cost ratio was recorded with application of Phosphorus (90 kg/ha) might be due to higher growth and yield attributes resulting in more grain and straw yield. similar result reported by **(Samimi and Thomas *et al.*, 2016).**

CONCLUSION:

It is concluded that in Wheat the application of Phosphorus 90 kg/ha along with the application of Zinc 35 kg/ha observed highest seed yield, straw yield, gross return, net return and benefit- cost ratio.

Comment [a3]: Conclusions do not represent results. Add contributions to these findings and suggestions for interested parties

Table 1. EffectofPhosphorus and ZinconYieldofWheat.

S.No.	Treatment Combinations	Grain yield (t/ha)	Strawyield(t/ha)	Harvestindex (%)
1.	Phosphorus 60 kg/ha+Zinc 15 kg/ha	3.68	5.19	40.95
2.	Phosphorus75 kg/ha +Zinc 25 kg/ha	3.75	5.45	40.42
3.	Phosphorus90kg/ha +Zinc35 kg/ha	3.95	5.93	39.58
4.	Phosphorus60kg/ha +Zinc15 kg/ha	4.02	6.24	38.78
5.	Phosphorus75 kg/ha +Zinc25 kg/ha	4.09	6.52	38.32
6.	Phosphorus90 kg/ha+Zinc35 kg/ha	4.16	6.96	37.58
7.	Phosphorus60kg/ha +Zinc15 kg/ha	4.28	7.16	37.20
8.	Phosphorus75 kg/ha +Zinc 25 kg/ha	4.46	7.45	37.36
9.	Phosphorus90 kg/ha+Zinc35 kg/ha	4.90	8.38	36.95
10	Control(150-60-40 NPK kg/ha)	3.63	4.13	46.73
	F-test	S	S	NS
	Sem (±)	0.16	0.23	1.08
	CD(p=0.05)	0.48	0.70	-

Table 2. EffectofPhosphorusandZinconEconomicsofWheat.

S.No.	Treatment Combinations	Cost ofcultivation (INR/ha)	Gross return (INR/ha)	Netreturn (INR/ha)	B:Cratio
1.	Phosphorus60 kg/ha+Zinc15 kg/ha	46083.79	109340.00	63256.21	1.37
2.	Phosphorus75 kg/ha +Zinc25 kg/ha	47901.97	113577.15	65675.18	1.38
3.	Phosphorus90kg/ha +Zinc35 kg/ha	49720.15	119517.5	69797.35	1.40
4.	Phosphorus60kg/ha +Zinc15 kg/ha	46871.29	122883.00	76011.71	1.62
5.	Phosphorus75 kg/ha +Zinc25 kg/ha	48689.47	126032.50	77343.03	1.58
6.	Phosphorus90 kg/ha+Zinc35 kg/ha	50507.65	130241.75	79734.10	1.58
7.	Phosphorus60kg/ha +Zinc15 kg/ha	47658.79	133910.00	86251.21	1.80
8.	Phosphorus75 kg/ha +Zinc 25 kg/ha	49476.97	139620.50	89843.53	1.81
9.	Phosphorus90 kg/ha+Zinc35 kg/ha	51295.15	154405.00	103109.85	2.01
10	Control(150-60-40 NPK kg/ha)	40206.52	101981.25	61775.25	1.51

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Comment [a4]: References are very minimal, add a minimum of 15 references from the latest journals, a maximum of the last 10 years