Response of Phosphorus and Zinc on Yield and Economics of Wheat

(*Triticum aestivum)*

ABSTRACT

The field experiment titled "Response of 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

In terms of area and production, wheat (Triticum aestivum L) comes in first place among cereals worldwide. The Poaceae family includes wheat, which is known as the "king of cereals." The cereal grain known as wheat is a grass that is frequently farmed for its seed and is a staple diet all across the world. The majority of the world's land is used for growing wheat. For the vast majority of people in both industrialised and developing nations, it is a staple diet. The nutritional content of wheat is comparable to that of other significant cereals. Compared to other cereals, it has greater protein. According to **Singh S.S. (2015)**, wheat has nutritional values such as starch (60–68%), protein (8–15%), fat, sugar, cellulose, minerals, and vitamins.

“The step increase in the minimum support price and government procurement are the two major forces that have resulted in a significant expansion in wheat cultivation area. The national wheat productivity trend improved little, rising from 3009 kg/ha to 3100 kg/ha between 2012-2013 and 2017-2018. Productivity has increased due to the use of high-yielding varieties in conjunction with other inputs” **(Singh et al. 2019)**.

Phosphorus is a vital, if not the most important, nutrient that promotes root development and provides energy by generating (ATP) Adenosine tri-Phosphate **(Shaheen et al. 2007)**. It is an important plant nutrient that plays a significant role in achieving maximum agricultural productivity. After nitrogen stress, phosphorus was shown to be the second most commonly occurring nutritional deficit in serial chains around the world. Crop phosphorus utilisation efficiency ranged from 37% to 47%. Many researchers have achieved significantly higher grain yields in wheat by making optimal use of P fertiliser. When available P is less than the crop's requirement, both organic and inorganic sources of P are supplied to the soil in the form of fertiliser.

Zinc performs a variety of physiological activities in biological systems. It interacts with many enzymes and other proteins in the body and plays important structural, functional, and regulatory roles. Zn and other micronutrient deficiencies are also claimed to have a substantial negative impact on GDP in developing countries by lowering productivity and increasing healthcare costs. **Cakmak and Kutman et al. (2018)**. Zinc is required for regular plant growth and development since carbohydrates, protein metabolism, and sexual fertilisation are all dependent on it. Zinc is an essential heavy metal that plants require as a micronutrient for a variety of metabolic functions.

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”. [11] (**Gomez and Gomez, 1976)** and economic data analysis mathematical method.

RESULT AND DISCUSSION

Grain yield (t/ ha)

Treatment 9 [Phosphorus 90 kg/ha + Zinc 35 kg/ha] recorded highest grain yield (4.90 t/ha). The increased grain production could be attributed to increased dry matter buildup in grain and the number of grains/spikes as a result of the usage of a plant growth regulator. **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)**. **Sharma *et al.* (2020)** consisted of phosphorus levels (0, 40, 80, and 120 kg ha-1) and zinc levels (0, 15, and 30 kg ha-1). The results showed that application of phosphorus and zinc fertilizer significantly increased the plant height, number of tillers, grain yield, straw yield, and net return. The benefit-cost ratio was maximum (2.72) for the treatment of 120 kg ha-1 phosphorus and 30 kg ha-1 zinc.

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.

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Table 1. Effect of Phosphorus and Zinc on Yield attributes of Wheat.

S.No.	Treatment Combinations	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
1.	Phosphorus 60 kg/ha +Zinc 15 kg/ha	3.68	5.19	40.95
2.	Phosphorus 75 kg/ha + Zinc 25 kg/ha	3.75	5.45	40.42
3.	Phosphorus 90 kg/ha +Zinc 35 kg/ha	3.95	5.93	39.58
4.	Phosphorus 60 kg/ha +Zinc 15 kg/ha	4.02	6.24	38.78
5.	Phosphorus 75 kg/ha + Zinc 25 kg/ha	4.09	6.52	38.32
6.	Phosphorus 90 kg/ha+ Zinc 35 kg/ha	4.16	6.96	37.58
7.	Phosphorus 60 kg/ha +Zinc 15 kg/ha	4.28	7.16	37.20
8.	Phosphorus 75 kg/ha + Zinc 25 kg/ha	4.46	7.45	37.36
9.	Phosphorus 90 kg/ha+ Zinc 35 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. Effect of Phosphorus and Zinc on Economics of Wheat.

S.No.	Treatment Combinations	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	Phosphorus 60 kg/ha +Zinc15 kg/ha	46083.79	109340.00	63256.21	1.37
2.	Phosphorus 75 kg/ha + Zinc25 kg/ha	47901.97	113577.15	65675.18	1.38
3.	Phosphorus 90 kg/ha +Zinc 35 kg/ha	49720.15	119517.5	69797.35	1.40
4.	Phosphorus 60 kg/ha +Zinc 15 kg/ha	46871.29	122883.00	76011.71	1.62
5.	Phosphorus 75 kg/ha + Zinc 25 kg/ha	48689.47	126032.50	77343.03	1.58
6.	Phosphorus 90 kg/ha+ Zinc 35 kg/ha	50507.65	130241.75	79734.10	1.58
7.	Phosphorus 60 kg/ha +Zinc 15 kg/ha	47658.79	133910.00	86251.21	1.80
8.	Phosphorus 75 kg/ha + Zinc 25 kg/ha	49476.97	139620.50	89843.53	1.81
9.	Phosphorus 90 kg/ha+ Zinc 35 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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