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Effect of Nitrogen and Zinc on yield of wheat (*Triticum aestivum* L.)

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Abstract
A field experiment was conducted during *Rabi* season 2015-16 to study the Effect of Nitrogen and Zinc on Yield of Wheat *(Triticum aestivitm* L.) at the research farm of department of Soil Science. Laid out in factorial with 3x3 randomized block design with three levels of Nitrogen [0, 60 and 120] kg ha^{-1}, three levels of Zinc [0, 15 and 30 kg ha^{-1}}, respectively. The treatments combinations were replicated three times and were allocated at random in each replication. The treatment combination T_8 - [@ 120 kg Nitrogen ha^{-1} +@ 30 kg Zinc ha^{-1}] gave the best results with respect to plant height 101.2 cm, it gave highest yield 5.600 t ha^{-1}, straw yield 7.570 t ha^{-1} and test weight 44 g 1000 seed g^{-1} the economical point of view, the same treatment combination (T_8 - @ 120 kg Nitrogen ha^{-1} +@ 30 kg Zinc ha^{-1}) gave the maximum profit of Rs = 63395 ha^{-1} with C:B ratio of 1:2.77.

Keywords: Nutrients, economics, grain yield, C: BR leveling, Weeding and wheat.

Introduction
Wheat (*Triticum aestivum* L.*)* is the major staple crop around the world. Wheat productivity components are affected by physical, chemical and biological soil properties and climatic conditions Galantine *et al.* (2000). Crop rotation is one of the major cultural practices in farming systems. A well planned rotation reduces disease, pests and weeds. In addition, it provides advantages such as increasing deep soil fertility, utilizing various layers of the soil to the same extent and preventing erosion. Nitrogen is fertilizer technology that facilitating an apt combination for enhancing wheat yield, the combined use of N fertilizers plays an important role in wheat production Thus; it improves the physical and chemical structure of soil and increases its productivity Dogan *et al*. (2007) and Seibutis *et al***.** **(**2009) In India, Wheat is the second most important food crop after rice with a total production of 93.90 million tonnes which is 12% of the world food production from 29.90 million hectares of land (Anonymous 2009) [2]. The wheat straw can be used as animal fodder; the management of rice straw is more problematic. The time between harvesting of rice and sowing of wheat crop is limited and allowing time for the rice residue to breakdown delays the sowing of wheat beyond the optimum sowing date (15-20 November). This delay results in yield losses of 1% per day delay in sowing. To avoid sowing delays and blockage of cultivation implements by rice residue, farmer's burn rice straw in the field. However, this results in nutrient loss and decreases in soil microbial populations. Burning also produces harmful greenhouse gases and particulate emissions, associated with human health problems. To eradicate the problems of burning residues and late sowing of wheat, a machine called the 'Happy Seeder' has been developed which simultaneously cuts and spreads rice straw on the soil surface (as mulch) while sowing wheat with zero or strip tillage Sidhu *et al*. (2007). The application of N increased the Zn concentration in wheat tops and roots in unlimed soil, and decreased it limed soils. However, becouse of an increase in wheat yield, the uptake of zinc by wheat tops and roots also increased whit N application both in limed and unlimed soils. The audition of Zn 10 mg per kg, increased the N concentration in the absence of N, but in the presence of N, the addition of Zn to 20 mg per kg decrease the N concentration in wheat tops and roots. The applied of Zn tom 10 mg per kg in unlimed soil and to 20 mg per kg in limed soil increased the N uptake by wheat tops and roots, respectively. The Zn concentration was higher in absence of limed than in its presence while a reverse trend was true for N concentration Verma T. S. and Sharad N (2001) [11]. Zinc (Zn) deficiency is one of the most wide spread limiting factor to crop production. Zn is an element required by virtually all plants as it is a critical component of many enzymes and proteins Sharma (2006). Zinc play an important role in completion the life cycle of plants and also a key role in nitrogen metabolism, photosynthesis and toxin synthesis Vaillant *et al.* (2005) and involved in diverse metabolic activities, influences the activity of hydrogenise and carbohydrates, synthesis of cytocrome and the stabilization of ribosomal function Tisdale *et al*. (1984). The integrity of cellular membranes also requires Zn to preserve the structural orientation of macromolecules and keep ion transport system Chauhan *et al*. (2014).

Materials and Methods
The present study entitled Effect of Nitrogen and Zinc on Yield of Wheat (*Triticum aestivum* L.). Comprise of a field experiment which was laid out at crop research farm of Department of soil sciences, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad-211007 (U.P.) India during the winter season (2015-16). The materials is going to be used and methods adopted in the present investigation with a brief discussion of site of the experiment, soil properties and climatic conditions prevalent in the locality are presented
T_0-N_0 Z_0 (control), T_1-N_0 Z_1, T_2- N_0 Z_2, T_3- N_1 Z_0, T_4- N_1 Z_1, T_5- N_1 Z_2, T_6- N_2 Z_0, T_7- N_2 Z_1, T_8- N_2 Z_2.

2.3 Experimental detail

Crop	**: Wheat**	Size of bund	: 0.3cm
Variety	: PBW-343	Length of the field	: 17.5m
Design of experiment	: RBD 3 x 3 factorial	Width of the field	: 8.8m
Number of treatments	: 9	Net cultivated area	: 81 m^2
Number of replications	: 3	Gross experimental area	: 8.8 m 17.5=154 m^2
Total number of plot	: 27	Seed rate	: 100 kg ha^{-1}
Plot size	: 2 m x 1.5 m=3m^2	Spacing	: RxR (20cm) PxP(5cm)

Table 2: Source and amount of fertilizer applied

Treatment	Dose (kg ha^{-1})	Source	Quantity (kg ha^{-1})	Quantity(g $plot^{-1}$)
Nitrogen	120 kg N ha^{-1} 60 Kg N ha^{-1}	Urea(46 % N) Urea(46 % N)	260.87 kg ha^{-1} 130.445 kg ha^{-1}	78 g $plot^{-1}$ 39 g $plot^{-1}$
Zinc	30 Kg Zn **ha^{-1}** 15 kg Zn **ha^{-1}**	$ZnSo_4$(33 % Zn) $ZnSo_4$(33 % Zn)	90.90 kg **ha^{-1}** 45.45 kg **ha^{-1}**	27.27 g **$plot^{-1}$** **13.36** $plot^{-1}$

Table 3: calendar of field operation for experiment

Operation	Date	Remarks
ploughing	24.10.2015	Ploughing was done to bring soil to fine tilth.
Layout	25.10.2015	Manual labour was cmployed
Making of bonds and leveling of plots	30.10.2015	Bunds and leveling of plots were done manually.
Fertilizer appliction	16.11.2015	Application of Neem cake before sowing were done.
Sowing of Wheat	17.11.2015	Wheat PBW 343 seed was sown on 5 cm plant to Plant and 20 cm row to row.
First Irrigation	27.11.2015	Light irrigation was given within 10days of sowing.
Seccond Irrigation	12.12.2015	Light irrigation was given within 25days of sowing.
1 st Weeding	22.12.2015	The first manual with the help of khurpi
Third Irrigation	2.1.2016	Light irrigation was given within 45days of sowing.
Seccond Weeding	22.1.2016	The 2nd manual with the help of khurpi
Fourth Irrigation	22.1.2016	Light irrigation was given within 65days of sowing.
Fifth Irrigation	12.2.2016	Light irrigation was given within 85days of sowing.
End Irrigation	02.3.2016	Light irrigation was given within 105days of sowing
Harvesting	22.03.2016	The harvesting 1m^2 was done plot wise.

Top dressing

Application of remaining 25% dose of Urea was applied after 45 days and 25% after 85 days as top dressing according to treatment combination.

Result and Discussion

Attributes

Effect of Nitrogen and Zinc on No. of grains spike^{-1} of Wheat

No. of grains spike^{-1} was influenced in various treatment combinations at 125 DAS when subjected to statistical analysis shows significant difference among the treatment. Data shows that the plot treated with the treatment combination T_8 ($N_{120}Z_{30}$) recorded maximum No. of grains spike^{-1} 56.00 in comparison to T_7 (N_{120} Z_{15}) No. of grains spike^{-1} that is 54.00 and minimum No. of grains spike^{-1} was observed in treatment combination T_0 (control) that is 40.

Effect of Nitrogen and Zinc on soil grain yield (t ha^{-1}) of Wheat

Grain yield was influenced in various treatment combinations at 125 DAS when subjected to statistical analysis shows significant difference among the treatment. Data shows that the plot treated with the treatment combination T_8 ($N_{120}Z_{30}$) recorded maximum grain yield that is 5.600 t ha^{-1} in comparison to T_7 (N_{120} Z_{15}) grain yield that is 5.00 t ha^{-1} and minimum grain yield was observed in treatment combination T_0 (control) that is 2.76 t ha^{-1}.

Effect of Nitrogen and Zinc fertilizer on straw yield (t ha^{-1}) of Wheat

Straw yield was influenced by various treatment combinations at 125 DAS when subjected to statistical analysis shows significant difference among the treatment. Data shows that the plot treated with the treatment combination T_8 (N_{120} Z_{30}) recorded maximum straw yield that is 7.58 t ha^{-1} in comparison to T_7 (N_{120} Z_{15}) straw yield that is 6.100 t ha^{-1} and straw yield was observed in treatment combination T_0 (control) that is 4.99 t ha^{-1}.

Effect of Nitrogen and Zinc on the test weight of grain (1000 grains/g)

Test weight of grains was influenced by various treatment combinations at 125 DAS when subjected to statistical analysis shows significant difference among the treatment. Data shows that the plot treated with the treatment combination T_8 (N_{120} Z_{30}) recorded maximum test weight of grain that is 44.00gm in comparison to T_7 (N_{120} Z_{15}) test weight of grain that is 43.20gm and minimum test weight of grain where observed in treatment combination T_0 (control) that is 37.00.

Economic

Table 4: Evaluation of Different Benefit cost Ratio(C: BR) of different treatment Combination with Wheat

Treatments	Grain Yield(t ha^{-1})	@ Rs /t. grain yield	Straw Yield (t ha^{-1})	@ Rs /t. of straw yield	Gross return (Rs ha^{-1})	Total cost of cultivation (Rs ha^{-1})	Net profit (Rs ha^{-1})	cost Benefit ratio (C:B R)
T_0	2.76	15000	4.97	2000	51340	29950	21390	1.71419032
T_1	3.2	15000	5.01	2000	58020	31543	26477	1.83939384
T_2	3.472	15000	5.31	2000	62700	33135	29565	1.89225894
T_3	3.97	15000	5.54	2000	70630	31255	39375	2.25979843
T_4	4.31	15000	5.8	2000	76250	32848	43402	2.3212981
T_5	4.6	15000	6.07	2000	81140	34440	46700	2.35598142
T_6	4.6	15000	5.7	2000	80400	32560	47840	2.46928747
T_7	5	15000	6.81	2000	88620	34153	54467	2.59479402
T_8	5.6	15000	7.57	2000	99140	35745	63395	1:2.77353476

Selling price of wheat grain = 15000.00 Rs t^{-1}and Straw 2000 Rs t^{-1}

As for the economy of different treatment is concerned, the treatment T8 (N_{120} Z_{30}) provides highest net profit of Rs. 63395.00 with benefit cost ratio is 1:2.773, however, the minimum net profit of Rs. 21390 was recorded in the treatment T_0 (N_0 Z_0) with benefit cost ratio 1:1.71 respectively.

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