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Impact of Nitrogen and Zinc on Nutrient Uptake by Wheat and Soil Nutrient Status under Alluvial Soil

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Abstract

The field experiment was conducted on alluvial soil to study the impact of nitrogen and zinc on nutrient uptake by wheat and soil status under alluvial soil. The study involved nine treatments and three levels of nitrogen and zinc as urea and zinc sulfate and was carried out during 06—07 on wheat (HD-2285). Maximum nitrogen and zinc contents in grain and straw were recorded to be 33.04,13.45 mg/kg and 3.45,1.45 mg/kg respectively, under combination of N_2Zn_2 where 140 kg of nitrogen and 30 kg of zinc per hectare were supplied to the plot. Other parameters also showed significant role by application of different combinations of nitrogen and zinc except control. The data on yield of grain, straw and test weight also revealed that there were significant differences between various treatment combinations, showing maximum grain yield (54.45q/ha), straw yield (76.00 q/ha) and test weight (40.50 g) . Similar trend was found with soil nutrient status which showed significant difference in all treatment combinations.
Key words : Nitrogen, Zinc. Grain, Straw, Nutrient content.

The advent of the green revolution and rise in food grain production coincided with productivity growth of a magnitude of 2—3% at national level; saving crores of rupees to Indian treasury from importing wheat from other countries, also saving plenty of area under conventional varieties for additional food grain production in the country. Wheat forms the most cultivated field crop, constitutes highest consumed staple food of world population 62—65% (1). In terms of production, wheat (*Triticum* spp.) occupies the prime position among the food crops in the world. In India, it is the second most important food crop being next to rice and contributes to the total food grain production of the country to the extent of about 32% (2).Nitrogen is a primary nutrient in large proportions at 80—120 kg/ha absorbed by wheat crop from soil and it is the most limiting factor affecting crop production. However, low nitrogen content of Indian soils further accelerates the problem delaying crop establishment. Hence, there is a need for judicious application of nitrogenous fertilizers for replenishing the crop requirement. Among essential nutrients, zinc deficiency is another limiting factor that also affects the productivity levels of wheat. Because, it is an essential component required in the biosynthesis of plant hormone such as, iodole acetic acid (IAA) is a component of a variety of enzymes i.e., carbonic anhydrases, alcohol dehydrogenase. In the necrotic areas intensity resulting in the collapse of the affected leaves near the middle earing and maturity is delayed (3). The zinc defficiency in wheat can be corrected by adding zinc sulfate (23–35%).

Methods

The experiment was undertaken during 06—07 during the *rabi* season at Allahabad Agricultural Institute—Deemed University, Soil Science Research farm. The soil of the experimental plot was sandy loam,

Table 1. Initial properties of soil.

Soil particulars	Analyzed value	Method followed
Soil pH	7.5	Digital pH meter
EC (dS/m)	0.85	Electrical conductivity meter
Organic carbon (%)	0.45	Walkley and Black (4)
Available N kg/ha	270.09	Kjeldhal method
Available P_2O_5 kg/ha	24.02	Olsen et al. (5)
Available K_2O kg/ha	170.06	Toth and Prince (6)
Available Zn (kg/ha)	0.50	Shaw and Dean method (7)

Table 2. Effect of different levels of nitrogen and zinc on nitrogen and zinc content in grain and straw.

Treatments	N content (mg/kg)		Zn content (mg/kg)	
	Grain	Straw	Grain	Straw
N_0Zn_0 (T_0)	28.52	9.50	2.80	1.10
N_0Zn_1 (T_1)	29.99	10.90	2.91	1.19
N_0Zn_2 (T_2)	30.25	10.57	2.96	1.21
N_1Zn_0 (T_3)	30.54	11.05	3.08	1.26
N_1Zn_1 (T_4)	32.56	11.97	3.29	1.35
N_1Zn_2 (T_5)	32.05	12.48	3.33	1.35
N_2Zn_0 (T_6)	30.85	11.56	3.16	1.30
N_2Zn_1 (T_7)	33.25	12.95	3.43	1.39
N_2Zn_2 (T_8)	33.04	13.45	3.45	1.45
Mean	31.23	11.60	3.16	1.29

Table 2. Continued.

	Grain (N)			Straw (Zn)			Grain (Zn)			Straw (N)		
	F-test	SE	CD	*F*-test	SE	CD	*F*-test	SE	CD	*F*-test	SE	CD
Nitrogen	S	0.12	0.25	S	0.06	0.14	S	0.01	0.02	S	0.01	0.01
Zinc	S	0.12	0.25	S	0.06	0.14	S	0.01	0.02	S	0.01	0.01
Interaction	S	0.21	0.44	S	0.11	0.24	S	0.02	0.04	S	0.01	0.02

alluvial in nature (pH 7.5), low in available N and medium in P and K. The experiment consisted of nine treatments with three levels each of nitrogen and zinc asurea(N_0 = 0 kg N/ha, N_1 = 120 N kg/ha, N_2 = 140 kg/ha) and zinc sulfate (Z_0 = 0 kg Zn/ha, Z_1 = 15 kg Zn/ha, Z_2 = 15 kg Zn/ha) in three replications. Important soil characters of experimental field are presented (Table 1).

Results and Discussion

Effect of Nitrogen and Zinc on Nitrogen and Zinc Content in Grain and Straw

The maximum nitrogen content in grain and straw was recorded from treatment T_8 (N_2Zn_2) gave 33.04 and 13.45 mg/kg followed by treatment T_7 (N_1Zn_2) given 33.25 and 12.95 mg/kg respectively, over control. The maximum zinc content in grain and straw was recorded from treatment T_8 (N_2Zn_2) gave 3.45 and 1.45 mg/kg followed by treatment T_7 (N_1Zn_2) given 3.4 and 1.39 mg/kg respectively, over control. The statistical analysis of the data on nitrogen and zinc content of wheat reveals that there were significant differences between all treatment combinations (Table 2). Similar fiunding also reported earlier for nitrogen (1) content and for zinc (8) contents in grain and straw.

Effect of Nitrogen and Zinc on Grain Straw Yield and Test Weight

The effect of different levels of nitrogen and zinc on grain, straw yield/ha and test weight showed significant difference between different treatment combinations. The maximum grain yield 54.45q/ha, straw yield 76.00 q/ha and test weight 40.50 g were recorded in T_8 treatment (N_2Zn_2) which was significantly supe-

Table 3. Effect of nitrogen and zinc on grain, straw yield and test weight of wheat crop.

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Test weight (g)
N_0Zn_0 (T_0)	33.05	49.32	30.06
N_0Zn_1 (T_1)	39.56	50.12	31.95
N_0Zn_2 (T_2)	39.35	52.15	32.05
N_1Zn_0 (T_3)	41.85	54.75	34.65
N_1Zn_1 (T_4)	46.25	58.26	37.45
N_1Zn_2 (T_5)	47.27	60.67	38.90
N_2Zn_0 (T_6)	50.56	57.43	36.05
N_2Zn_1 (T_7)	52.90	68.20	39.80
N_2Zn_2 (T_8)	54.45	76.00	40.50
Mean	45.03	58.54	35.71
F-test	S	S	S
SE ±	0.44	0.73	0.31
CD (*P* = 0.05)	0.93	1.55	0.66

Table 4. Soil nutrient status after post harvest.

Treatments	pH	OC (%)	EC (dS/m)	N (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)	Zn (kg/ha)
N_0Zn_0 (T_0)	6.8	0.42	0.31	254.95	24.50	138.35	0.48
N_0Zn_1 (T_1)	6.9	0.45	0.32	260.75	25.57	142.05	0.51
N_0Zn_2 (T_2)	7.0	0.50	0.33	259.60	28.05	152.52	0.56
N_1Zn_0 (T_3)	7.1	0.45	0.31	279.51	30.73	157.78	0.51
N_1Zn_1 (T_4)	7.2	0.48	0.33	268.50	31.05	162.98	0.52
N_1Zn_2 (T_5)	7.3	0.49	0.34	265.30	31.85	169.43	0.61
N_2Zn_0 (T_6)	7.2	0.45	0.32	272.57	31.90	170.09	0.50
N_2Zn_1 (T_7)	7.3	0.48	0.33	276.27	32.35	171.05	0.53
N_2Zn_2 (T_8)	7.4	0.51	0.35	280.90	33.96	175.36	0.75

rior than over control (Table 3). Similar findings have been also reported by some other authors (9) for grain, straw yield and test weight.

Effect on Soil Nutrient Status

The maximum available nitrogen and zinc was found under treatment T_8 (N_2Zn_2) (280.90 and 0.75 kg/ha) which was followed by treatment T_7 (N_1Zn_2) (276.27 and 0.53 kg/ha) respectively. Other combinations also showed significant differences over control. The maximum available phosphorus and potassium was obtained in treatment T_8 (N_2Zn_2) (33.96 kg P_2O_5, 175.36 kg K_2O/ha) respectively. The statistical analysis showed significant difference in all treatment combinations. The EC (dS/m) of soil ranged from 0.31 to 0.35 dS/m which indicates the soluble salt concentration in the soil was far below the toxic limits and also did not exhibit any specific trend in its distribution. Organic carbon (OC %) of the experimental soil varied from 0.42 to 0.51% the surface soil showed higher content of organic carbon and decreases uniformly with increasing soil depth. The pH of the soil ranged from 6.8 to 7.4, which reveals that the soil is neutral in reaction, so all the nutrients are readily available to plants.

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