Short communication
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EFFECT OF NICKEL AND ZINC ON YIELD AND THEIR UPTAKE IN WHEAT

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Wheat is the most important staple food grain in Indian diet and main source of protein and calories for large section of population. Stagnation in wheat production, low productivity and inferior quality of the produce is due to various constraints' including inadequate and imbalanced nutrient application Nickel and zinc play important role in the production technology of wheat. Nickel is the essential element for plants supplied with urea. Nickel may also be involved in plant disease resistance due to changes is N metabolism. Nickel has been demonstrated as essential to small grain crop. Zinc plays on important role as a metal component in various enzymes or as a functional structure or regulator cofactor of large number of enzymes. A suitable combination of Ni and Zn is the most important factor that affet the yield and quality of crop. Studies concerning the effect of Ni and Zn on wheat are very meagre. There force the prevent experiment was conducted to study the asset of nickel and Zinc on yield and their uptake by wheat.

Green house study was conducted in 2010-11 in pots containing 10kg dry soil with five plants per pot. The soil contained DTPA extractable Ni 0.11 mg kg^{-1}, Zn 0.52 mg kg^{-1} pH, 8.0, organic carbon 3.2 g kg^{-1} available N 90 mg kg^{-1}, P 4.5 mg kg^{-1}, and K 70 mg kg^{-1}.Treatments consisted of four levels of Ni (0, 2.5, 5.0 and 10 mg kg^{-1}) and Zn (0, 2.5, 5.0 and 10 mg kg^{-1}) were arranged in completely randomized design with three replications. All the pots received uniform application of N, P and K (75, 30, 30 mg kg^{-1}). Nickel and zinc were applied as nickel sulphate and zinc sulphate, respectively as per treatments. At appropriate moisture level wheat (PBW 343) was sown on November 15, 2010. The crop was raised with recommended agronomic practices. At harvest, the grain and straw yields were recorded. Grain and straw samples were digested in diacid mixture (HNO_3+$HClO_4$) and analyzed for Ni and Zn by atomic absorption spectrophotometer. The uptake of Ni and Zn was worked out by multiplying their content values with corresponded yield data.

Table 1: Effect of nickel and zinc on yield, content and uptake of Ni and Zn by wheat grain and straw

Treatment	Yield (g $plot^{-1}$)		Ni content (mg kg^{-1})		Zn content (mg kg^{-1})		N uptake (mg pot^{-1})		Zn uptake (mg pot^{-1})	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Nickel ($mgkg^{-1}$)										
0	7.75	10.69	6.2	5.0	25.2	19.0	0.05	0.05	0.20	0.21
2.5	8.01	11.15	15.6	7.3	23.6	18.2	0.12	0.08	0.19	0.21
5.0	8.30	11.50	19.6	12.2	22.1	16.6	0.16	0.14	0.18	0.19
10.0	4.31	6.03	28.8	17.2	20.3	15.1	0.12	0.10	0.09	0.09
SEm+-	0.25	0.59	0.79	0.72	0.68	0.83	0.002	0.001	0.006	0.005
CD(P=0.05)	0.74	1.74	2.30	2.11	1.98	2.41	0.006	0.003	0.017	0014
Zinc ($mgkg^{-1}$)										
0	5.89	8.15	18.7	11.7	17.6	13.2	0.10	0.09	0.10	0.11
2.5	6.82	9.45	18.4	11.2	21.6	16.1	0.12	0.10	0.15	0.15
5.0	8.05	11.19	17.1	10.1	24.8	19.0	0.13	0.10	0.20	0.21
10.0	7.61	10.57	16.0	8.8	27.2	20.6	0.11	0.08	0.21	0.22
SEm+-	0.25	0.59	0.79	0.72	0.68	0.83	0.002	0.001	0.006	0.005
CD(P=0.05)	0.74	1.74	2.30	2.11	1.98	2.41	0.006	0.003	0.017	0.014

Table1 showed that application of 2.5 mg Ni kg^{-1} did not cause any reduction in grain and straw yield of wheat.The grain and straw yield increased up to 5 mg Ni kg^{-1} soil but it was not statistically signitcant (Gupta *et al.*1996). Application of 10 mg Ni kg^{-1} deceased the grain yield by 44.4% over control indicating an adverse effect on grain and straw production. With successive increase in Zn

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levels, grain and straw yield of wheat increased significantly up to 5 mg Zn kg^{-1} and further increase in Zn level reduced the yield of wheat over 5 mg Zn kg^{-1} level . The increase in yield owing to application of Zn may be ascribed to improved growth and yield attributes and yield is directly related to these attributes. Kandali *et al.* (2014) and Singh *et al.* (2015) also reported such favorable effect of Zn on grain and straw yield.

Nickel content in grain and straw progressively increased with increasing level of Ni whereas a reverse trend was recorded with Zn application. The Ni content in grain and straw increased from 6.2 to 28.8 mg kg^{-1} and 5.0 to 17. 2 mg kg^{-1} with 10 mg Ni kg^{-1}(Kumar *et al.* 2013). Application of 10 mg Zn kg^{-1} tended to reduce the Ni content from 18.7 to 16.0 mg kg^{-1} in grain and from 11.7 to 8.8 mg kg^{-1} in straw. The depressing effect of Zn on Ni content may be attributed to dilution effect and the inhibitory effect of Zn on the translocation of Ni from straw to grain. These observations are in consonance with the results of Yadav *et al.* (2003) and Kumar *et al.* (2010). By and large,there is an indication that grain absorbed more Ni than straw. Uptake of Ni by grain and straw of wheat increased significantly up to 5 mg Ni kg^{-1}. Thereafter, a decrease was noted at 10 mg Ni kg^{-1} soil as compared to 5 mg Ni kg^{-1}, which is attributed to yield reduction of the crop. Similar results were reported by Gupta *et al.* (1996), Yadav *et al.* (2003) and Kumar *et al.* (2010) for lentil chickpea and mustard. Application of Zn increased the Ni uptake by wheat crop up to 5 mg kg^{-1} followed by a reduction at 10 mg Zn kg^{-1}. There was a gradual and significant decrease in Zn content with increased level of Ni and minimum values were recorded with 10 mg Ni kg^{-1}. The reduction in Zn content may be ascribed to antagonistic affect of Ni on Zn absorption by the plants. Similar results were reported by Gupta *et al.* (1996).

The Zn content in grain and straw of wheat increased significantly with its application over control Zinc content in grain and straw increased from 17.6 to 27.2 and from 13.2 to 20.6 mg kg with 10 mg Zn kg^{-1}, respectively. This increase may be attributed to increased availability of Zn as result of its addition (Tripathi *et al.* 2015). Zinc uptake by wheat crop decreased significantly with Ni addition up to 10 mg Ni kg^{-1} over control. This reduction may be ascribbed to low yield of the crop due to Ni application. Application of Zn increased its uptake by the crop significantly over control. The Zn uptake by grain and straw increased from 0.10 to 0.21 and from 0.11 to 0.22 mg pot^{-1}respectively with 10 mg Zn kg^{-1}.Since, the uptake of nutrients is a funaction of dry matter and nutrient content, this increased yield of wheat with higher Zn content resulted in greater uptake of this element. The results confirm the findings of Tripathi *et al.* (2015).

It may be concluded from the present study that application of Zn produced the higher yield of wheat. An antagonistic relationship betbeen Zn and Ni was recorded.

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