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SHORT COMMUNCATION

EFFECT OF VARIOUS SOURCES OF ZINC ON WHEAT STRAW YIELD AND NUTRIENT UPTAKE

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SUMMARY

To study the effect of different sources of zinc on yield, nutrient content and its uptake by wheat crop, a field experiment was conducted at Research Farm of Department of Soil Science, CCS HAU, Hisar. The experiment site was neutral in reaction, non-saline, low in organic carbon content and texturally sandy loam. The grain and straw yield of wheat increased significantly in all the treatments over control. The highest grain and straw (58.87 q/ha and 74.0 q/ha) yield were recorded with the application of RDF+ 5kg Zn/ha. The maximum concentration (39.70 and 24.0 mg/kg) of Zn and its uptake (233.70 and 178.0 g/ha) by grain and straw was also recorded maximum in treatment receiving RDF+ 5kg Zn/ha.

Key words : Wheat, straw, grain, nutrient uptake and zinc

Wheat is one of the most important cereal crops. The wide spread cultivation of the crop all along the globe is largely due to high versatility of evolution, which enable its adaptation to different agro climatic conditions (Kant *et al*., 2014). India is a thickly populated country of world; therefore, to satisfy their appetite, farming of food and fodder crops is must. But livestock population, in our country is also very large and we are unable to produce sufficient fodder for them, due to lack of resources. Therefore, it is an instant need to cultivate for grain as well as straw production (Preeti *et al*., 2016). Deficiency in feed and fodder has been identified as one of the major components in achieving the desired level of livestock production (Kumar *et al*., 2013).

Generally, deficiency of Zn in human beings is very common in the regions with severe zinc-deficient soils. Because the cereal crops produced from Zn deficient soil may have its low concentrations in cereal that can cause Zn-deficiency related health problems. Therefore, there is a great need to improve the zinc status of the soil and nutritive value of cereal crops. Zinc is an essential element for higher plants, and its importance in agriculture is increasingly being recognized (Genc *et al*., 2006). Its deficiency is a common micronutrient disorder in cereal crops, reduces yields and nutritional quality of crops. The quantity of nutrient depends on different factors such as ability of soil to supply nutrients, rate of absorption of nutrients to functional sites and nutrients mobility within the plants. Mobility and availability of micronutrients to plants in soil depends on the chemical form of metal, soil pH, organic matter and type of clay and its content, redox conditions and root exudates chelators produced in rhizosphere which facilitate uptake of immobile or relatively less mobile metals. About 50% of cereal crops are cultivated on soils with low Zn availability worldwide (Alloway, 2009). Zinc is important in photosynthesis and respiration, and its deficiency decreases the photosynthetic rate, chlorophyll content, activity of carbonic anhydrase, and protein biosynthesis (Fu *et al*., 2016). Therefore, application of Zn fertilizer may be an important measure for improving the yield and quality of crop. Also, suitable and proper application methods of Zn fertilizers are still unclear. It has been reported that basal application of Zn fertilizer may have a strong residual effect (Liu *et al*., 2004), but in some soils, Zn can be fixed and is therefore not utilized by the crop (Rengel, 2015). Therefore, present study was planned to study the effect of various sources of Zn application on yield and Zn uptake by wheat.

The presented study was conducted at Research Farm area of Department of Soil Science, CCS HAU, Hisar. The experimental filed was neutral, non-saline, low in organic carbon, nil in $CaCO_3$ and sandy loam texture. The initial physico-chemical properties of the soil of experimental field are: pH

7.70, EC 0.15dS/m, OC 0.37%, $CaCO_3$ (%)Nil, Texture Sandy loam with available Zn (2.42mg/kg) The experiments were performed in 117 m^2 plots with three replications of each treatment. The following treatments were applied: T_1- Absolute control; T_2- Recommended dose of N, P and K fertilizer (RDF); T_3- RDF+ Zn-EDTA 2.5 kg/ha; T_4- RDF + 1.5 kg/ha Nano Zn fertilizer; T_5- RDF + 5 kg/ha $ZnSO_4.7H_2O$). Wheat (WH 1105) crop was used as test crop and was allowed to grow up to maturity. At harvest, yield was recorded and grain & straw samples of the crop were collected. The samples were processed, digested in diacid mixture (4:1 Nitric acid and perchloric acid) and analyzed for Zn using Atomic Absorption Spectrophotometer.

Yield

The results presented in table 1, revealed that grain and straw yield of wheat increased significantly over control in all the treatments. The highest grain yield was recorded in T_5 (58.87 q/ha) treatment followed by T_4 (56.07 q/ha) and T_3 (55.87 q/ha). The grain yield of wheat significantly increased in treatment T_5 in which Zn was applied through $ZnSO_4.7H_2O$ over RDF+Zn-EDTA2.5 q/ha treatment (T_3), however it was statistically at par with treatment T_4 receiving RDF+1.5 q/ha nano Zn. In case of straw the highest yield was observed in treatment T_5 (74.0 q/ha) followed by T_3 (69.5 q/ha) and T_4 (68.4 q/ha).

Concentration of Zn in grain and straw

The results presented in table 2 revealed that zinc concentration in grain increased significantly over control in all the treatments. However, the highest zinc content in grain was recorded in T_5 (39.70 mg/kg) treatment followed by T_4 (37.27 mg/kg) and T_3 (36.03 mg/kg). The Zn content in grain was significantly increased in all Zn treated plots as compared to RDF treated plots. Application of zinc sulphate significantly increased grain zinc concentration over Zn-EDTA2.5 kg/ha but increase in zinc concentration was at par with treatment T_4 i.e. RDF+1.5 kg/ha Nano Zn. In case of straw the highest zinc concentration was observed in treatment T_5 (24.0 mg/kg) followed by T_4 (23.2 mg/kg) and T_3 (22.6 mg/kg). Zinc concentration in straw increased significantly in all treatments over control.

TABLE 1
Influence of various Zn sources on the wheat grain and straw yield (q/ha)

Treatment	Grain	Straw
T_1–Absolute control	42.23	52.8
T_2–RDF	49.40	61.4
T_3–RDF+Zn-EDTA 2.5 kg/ha	55.87	69.5
T_4–RDF+1.5 kg/ha Nano Zn	56.07	68.4
T_5–RDF+5 kg/ha $ZnSO_4.7H_2O$	58.87	74.0
C. D. (P=0.05)	2.8	3.6

Zinc uptake by grain and straw

The results presented in table 3 revealed that zinc uptake by wheat grain increased significantly over control in all the treatments. The highest zinc uptake in grain was recorded in T_5 (233.72 g/ha) treatment followed by T_4 (209. g/ha) and T_3 (201.18 g/ha). Zinc uptake by wheat grain also significantly increased in all zinc treatments over RDF (T_3) treatment. Application of zinc sulphate significantly increased zinc uptake over Zn-EDTA2.5 kg/ha but increase in zinc uptake was statistically at par with RDF+1.5 kg/ha nano Zn treatment. In case of straw the highest zinc uptake was observed in treatment T_5 (178.0 g/ha) followed by T_4 (158.9 g/ha) and T_3 (156.7 g/ha).

TABLE 2
Influence of various Zn sources on Zn concentration and Zn uptake in wheat grain and straw

Treatment	Zn concentration (mg/kg)		Zn uptake (g/ha)	
	Grain	Grain	Straw	Straw
T_1–Absolute control	26.70	112.74	78.4	14.8
T_2–RDF	31.43	154.98	126.1	20.7
T_3–RDF+Zn-EDTA 2.5 kg/ha	36.03	201.18	156.7	22.6
T_4–RDF+1.5 kg/ha Nano Zn	37.27	209.04	158.9	23.2
T_5–RDF+5 kg/ha $ZnSO_4.7H_2O$	39.70	233.72	178.0	24.0
C. D. (P=0.05)	3.1	13.8	22.1	3.7

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