Scholarly Research Journal for Interdisciplinary Studies,
Online ISSN 2278-8808, SJIF 2016 = 6.177, www.srjis.com
UGC Approved Sr. No.49366, NOV-DEC 2017, VOL- 4/37

IMPACT OF ZINC IN ALLUVIAL SOIL FOR RABI CROP

Pratiksha Raghuvanshi, Ph. D.

Department of Botany, S V College Aligarh

Abstract

The stagnation in crop productivity has been found due to deficiency of some micro and secondary nutrients. Hence, micronutrients have assumed increasing importance in crop production under modern agriculture. Zinc is essential for promoting certain metabolic reactions. It is necessary for the production of chlorophyll and carbohydrates. Zinc is directly or indirectly required by several enzyme systems, auxin and protein synthesis, seed production and rate of maturity. Zinc is believed to promote RNA synthesis, which in turn is needed for protein production. Zinc is not translocated within the plant. So symptoms first appear on the younger leaves and other plant parts. Common symptoms of zinc deficiency, which generally occurs, are stunted growth poor tillering, development of light green yellowish bleached spots, chlorotic bands on either side of the midrib in the plants. The sustainable production needs balanced supply from soil along with suitable physical and biological properties to attain a better growth of roots and efficient utilization of nutrient from the rhizosphere. Application of Zn increased significantly the uptake of potassium by the crops in both crop seasons. Wheat straw utilized the greater amounts of K as compared to other crops. Zinc uptake was highest in wheat crop and minimum in berseem plants. The uptake of Zn by these crops increased significantly with its addition over control.

Keywords: *Deficiency, Yield, Rhizosphere, Crop Productivity.*

Experimental, Discussion and Results:

The deficiency of zinc under semi-arid climate has emerged as a serious limitation to crop production. The incessant efforts for enhancing food grain production from shrinking land resources will further magnify the depletion of limited micronutrient reserve and would cause the deficiency of other micronutrients besides accentuating the existing ones.

Plants absorb Zn as zinc ions (Zn++). Since it dose not have variable valences, it has no role in influencing redox processes directly. Zinc is a constituent of three enzymes namely carbonic anhydrase (CA), alcoholic dehydrogenase and superoxide dismutase (SOD). Zinc is involved in the synthesis of indole acetic acid, metabolism of gibberellic acid and synthesis of RNA. Because of its preferential binding to sulphydryl group, Zn plays an important role in the stabilization and structural orientation of the membrane proteins. Zinc influences translocation and transport of P in plants. Under Zn deficiency, excessive translocation of P occurs resulting in P toxicity.

Aims and Objectives:

1. To assess the zinc status of the soils of Aligarh district
2. To study the interactive effect Zn on wheat

The investigation Insisted:

(A) Survey of Aligarh district of western Uttar Pradesh with a view to assess the status of zinc in soils and delineate zinc deficient and sufficient areas. (B) The field experiment to evaluate the effect of doses of zinc on rabi crops.

In crop production, the importance of Zn was realized due to raising its deficiency from intensified agriculture, increasing prevalence of high yielding crop varieties, multiple cropping. These factors have combined to create large gaps between the soil Zn supply and crop requirements. The zinc deficiency in the soil adversely affects crop yield and nutritional quality. A review of pertinent research concerning status of zinc, factors affecting Zn availability to plants, response of crops to zinc are presented.

Singh and Singh (2006) reported 0.35 to 2.5 mg kg-1 available zinc in soils growing different crops in Agra district of Uttar Pradesh. Singh and Verma (2006) reported traces to 1.6 mg g-1 available Zn in cotton-wheat growing soils with a mean value of 0.5 mg kg-1. Seventy eight percent soils samples are deficient in zinc. Sen and Rajpoot O.P. (2007) reported that the available Zn content of Himanchal soils ranged from 0.22 to 1.5 mg kg-1. Singh Brij Raj (2008) reported 1.05 to 4.80 mg kg-1 DTPA-Zn in orchard soils. Prasad and Singh D.P. (2009) reported that DTPA-extractable Zn in vertisols ranged from 0.15 to 0.65 mg kg-1 soil.

Factors affecting the availability of zinc: The availability of the zinc is governed by the variation in soil temperature, moisture, pH, carbonate, organic matter, phosphate and heavy metals content etc. The literature on some factors in relation to pH, organic carbon and calcium carbonate has been reviewed in brief.

(1) Soil reaction: The zinc is most soluble and available under acid condition. As the pH is increased, the ionic forms of nutrient cations are changed to hydroxides or oxides, resulting in decrease of their solubility and availability to plants as all the hydroxides of trace element cations are in soluble, some more than others. The exact pH at which precipitation occurs varied from element to element and even between the oxidation states of a given element.

(2) Organic carbon: The ubiquitous presence of organic matter in soils profoundly influences the chemical equilibria of zinc by forming metal chelates of varying thermodynamics and biotic stability. The type of complex formed and their relative stability depend upon the chemical attributes. Of humic and fulvic polyelectrolytes and the nature of metal ions involved in such reactions.

(3) Calcium Carbonate: Zinc deficiency has largely been reported in crops cultivated on calcareous and alkali soils.

The area under investigation falls in the Indo-Gangetic plains. The soils in this tract owe their origin to the alluvium deposited by the two great rivers, the Ganga and the Yamuna, belonging to Pleistocene age. The alluviums can be divided into two sub-groups: (i) Old (Pleistocene) alluvium known as Bangar and (II) recent alluvium known as khaddar. The boundary between two alluviums is not sharp. The old alluviums usually occupy terrace like position and tend to be silty sands. The recent alluviums occupy the flood plains and lower lying terrains and vary from clay to coarse sand in texture. Lime nodules are commonly present in the old but not in the recent alluviums.

Composition of soil- Sand 61% ; Silt 21% ; Clay 18%

Texture – Sandy loam pH - 8.2

Zn – 0.51mg/kg (Zinc: Zinc in the di acid (HNO_3 and $HClO_4$) extract of the plant material was determined on an atomic absorption spectrophotometer)

Percent apparent recovery (PAR)

Percent apparent recovery (PAR) of applied zinc was concluded from total zinc uptake by the crop using the following formula:

$$PAR = \frac{T-C}{F} \times 100$$

Where,

T= Total Zn uptake (g /ha) in treated plot C= Total Zn uptake (g/ ha) in control plot F= Amount of Zn added in treated plot (kg/ha)

Response of Wheat crops Yield to Zinc

(kg/ha)	WheatProduction After/ Before Zn	
Seed	**Grain Before/After**	**Straw**
0.0	29.0/27.5	22.0
2.5	33.2/31.25	28.7
5.0	36.4/32.50	30.5
7.5	38.5/35.50	32.7
10.0	40.8/36.20	34.5
15.0	44.7/38.20	38.6
Mean	37.1	31.1
SEm±	0.67	0.50
CD at 5%	1.44	1.07

The data on yields of various crops as affected by zinc levels in each season are summarized. A study reveals that the yields of linseed, wheat grain, berseem plants, lentil grain and cabbage head were significantly higher during both the years of study with the application of zinc over control. The highest yield of 13.37 q ha-1 of linseed seed, 14.25 q ha-1 of lentil grain and 37.56 t ha-1 of cabbage head 2008-09 were recorded with 7.5 kg Zn ha-1. The corresponding figures of these yields during 2009-10 were 13.45 q ha-1, 14.45 q ha-1 and 36.06 t ha-1. On the other hand, the highest yield of berseem (9.55 and 9.75 t ha-1) green foliage and grain yield of wheat (52.50 and 51.42 q ha-1) during first and second year were recorded at 5 and 10 kg Zn ha-1, respectively. The increases in linseed seed yield due to 2.5, 5.0, 7.5, 10.0 and 15.0 kg Zn ha-1 over control were 8.0 and 8.4, 36.0 and 26.7, 42.6 and 42.0, 38.7 and 36.7 and 4.6 and 4.3 per cent, respectively during 2008-09 and 2009-10. The corresponding increases in grain yield of wheat during first and second year were 3.7 and 4.4, 10.0 and 10.7, 16.0 and 16.3, 20.3 and 21.7 and 8.9 and 14.7 per cent. The green foliage yield of berseem increased by 6.9 and 8.2, 21.9 and 23.5, 17.1 and 18.8, 5.3 and 11.4 and 4.3 and 6.8 per cent with 2.5, 5.0, 7.5, 10.0 and 15.0 kg Zn ha-1, respectively during 2008-09 and 2009-10. The corresponding increases in seed yield of lentil were 12.6 and 12.3, 35.5 and 33.8, 39.7 and 38.9, 39.1 and 38.3 and 20.8 and 20.5 percent. The increases in head yield of cabbage due to 2.5, 5.0, 7.5, 10.0 and 15.0 kg Zn ha-1 over control during first and second year were 9.0 and 8.0, 25.2 and 23.8, 36.5 and 34.3, 35.1 and 32.2 and 22.7 and 19.0 percent, respectively. In general, there was a reduction in yields of various crops at 15 kg Zn ha-1 in both crop seasons. But all the levels of Zn tried in the present study were significantly superior in respect of yields of different crops over control during both the seasons. Under present investigation, the soil of experimental field possessed inadequate level of zinc to meet the requirement of these crops. As such the responses to zinc application observed in the present investigation are not unexpected. The increases in yield may be because of higher rate in protein synthesis and enhanced photosynthetic activity of the plants with increased chlorophyll synthesis due to fertilization with zinc. The content and yield of protein in the crops increased significantly with zinc application. Among these crops, the maximum and minimum values of protein content were recorded in lentil seeds and wheat straw, respectively. On the other hand a maximum value of protein yield was recorded in wheat followed by lentil grain in both crop seasons.

Application of Zn increased significantly the uptake of potassium by the crops in both crop seasons. Wheat straw utilized the greater amounts of K as compared to other crops. Zinc uptake was highest in wheat crop and minimum in berseem plants. The uptake of Zn by these crops increased significantly with its addition over control.

References

Rajpoot O.P. (2002). Soil Factors Associated with Zinc Deficiency in Crops and Humans, Environmental Geochemistry Health.

Singh D.P. (2003). Zinc in soils and crop nutrition International Zinc Association. Online: http://www. Zinc –crops.org/documents/Zn in soils and crop nutrition 2008. pdf

Sengar K.P.S. (2004). Zinc in soils and crop nutrition. IZA Publications. International Zinc Association.

Sudhakar M. (2008). Zinc in Soils and Crop Nutrition. 2nd ed, published by IZA and IFA Brussels, Belgium and Paris, France, pp. -13.

*Tomar D. K. (2009). Effect of zinc complexes on distribution of zinc in calcareous soil and zinc uptake by maize. J. Agric. Food. Chem.,**25**.*

Arshad, M., Murtaza, G., Ali, M. A., Shafi, M. and Dumat, C. (2011). Wheat growth and phytoavailability of copper and zinc as affected by soil texture in saline-sodic conditions.