

Relative Efficiency of Two Zinc Sources for Rice in a Calcareous Soil from an Arid Area of Iran

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INTRODUCTION

Zinc deficiency in agricultural crops is one of the most common micronutrient deficiencies (Lindsay 1972). Since Zn is essential in plant nutrition, it has to be supplied in some form to crops for optimum plant growth when Zn deficiency is expected in the soil. The use of various Zn fertilizers to correct Zn deficiency is widespread. In highly calcareous soils in Southern Iran, low level of available Zn may lead to a nutritional disorder. The relative effect of various Zn sources on plant growth under aerobic conditions has been reviewed by Maftoun and Karimian (1989), but limited information exists for anaerobic soil conditions. The present study was initiated to examine the effect of different levels of two Zn sources on growth and Zn utilization of rice in a calcareous soil.

METHODS

The soil used in this experiment was collected from an Ap horizon of an alluvial calcareous soil. Physical and chemical properties of the soil are: pH 7.5, 35% calcium carbonate equivalent (CCE), 22% clay, 42% silt, and 0.4 mg kg⁻¹ DTPA-extractable Zn. Plastic pots were filled with 5 kg soil, and Zn was added to the soil in powder form. Fifteen uniform rice (*Oryza sativa* L. cv Ghasroddashti) seeds were planted in each pot and thinned to 4 plants two weeks after emergence. Treatments consisted of two Zn sources (ZnSO₄ and ZnO), and three Zn rates (0, 5, 10 mg Zn kg⁻¹ soil). The statistical design was completely randomized with three replicates. The pots were daily irrigated with distilled water. The water level above the soil surface was 3.5 cm. Before harvest, tillers were determined by averaging the number of tillers from 4 plants in each pot. Shoots were harvested after the tillering stage, rinsed with distilled water, dried at 70°C for 48 h in an oven, weighed, and ground to pass a 40-mesh sieve. The ground plant samples were dry ashed at 500°C, dissolved in 2 N HCl and made to volume with hot distilled water. Zinc was measured by Atomic Absorption Spectrophotometry (AAS). Dry matter yield, number of tillers, Zn concentration and Zn uptake were subjected to analysis of variance using the MSTATC computer program.

RESULTS AND DISCUSSION

The soil application of Zn with both sources affected shoot dry weight and Zn uptake of rice significantly. Zinc addition up to 5 mg kg⁻¹ soil with both sources increased the top dry matter yield of rice significantly, which indicated an existing Zn deficiency in the soil (Fig.1). No increase in rice biomass was observed when 10 mg Zn kg⁻¹ soil were applied, which might have caused an over-fertilization.

Zinc uptake by shoots as affected by Zn levels and Zn sources is shown in (Fig.2). Zinc uptake increased with Zn application rates. The increase in Zn uptake by rice was more marked when Zn was supplied as ZnO compared to ZnSO₄. The increase of Zn uptake was due to increased dry matter yield and/or Zn concentration (Data not shown). The number of tillers was also significantly higher in Zn-treated plants than in Zn-untreated plants (Data not shown).

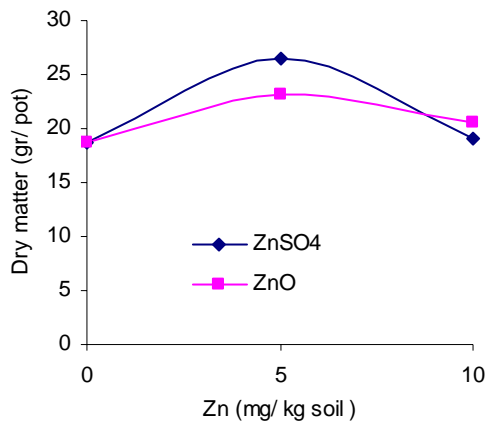


Fig.1. Effect of Zn levels and Zn sources on top dry matter of rice tillers.

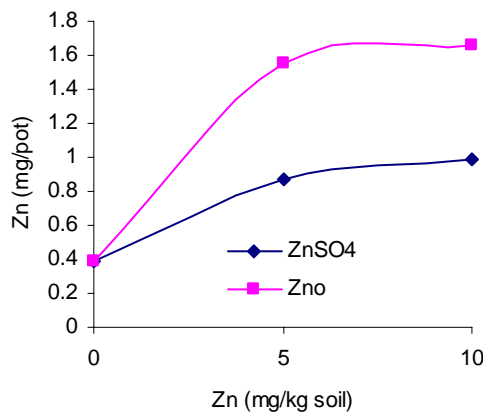


Fig.2. Effect of Zn levels and Zn sources on Zn uptake by rice.

CONCLUSIONS

It can be concluded that supplemented Zn is of potential practical importance to control Zn deficiency in calcareous soils of arid regions. There were significant differences between plant responses to Zn from ZnO and ZnSO₄, which might indicate the superiority of the former over the latter considering the lower cost of ZnO.

REFERENCES

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