Efficiency of Seed Treatment for Ameliorating Zinc Deficiency in Crops

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INTRODUCTION

Micronutrients deficiencies and their impacts on crop yields are widely reported in various parts of the world. As much as 48% of soils in India are Zn deficient whereas crops showed significant responses to Zn fertilization in nearly 72% field experiments due to widespread hidden hunger. Correction of micronutrient deficiency requires the application of high doses of fertilizer to soils because of low nutrient-use efficiency. Foliar sprays have limitations because they ameliorate deficiencies in crops only at a later growth stage when crops have sufficient foliage to receive the spray. Band placements have similar limitations to soil applications of critical micronutrients at early stages of seedling development. However, seed treatment is found to be a better option as it requires micronutrient fertilizer in lesser quantities, it is easy to operate and it provides micronutrients around the vicinity of newly emerging seedlings which support the emergence of a vigorous seedling and better establishment and growth. Therefore, studies were carried out to evaluate the comparative effects of Zn seed-treatments and soil applications of Zn on germination, yield and the fertilizer-use efficiency in various crops.

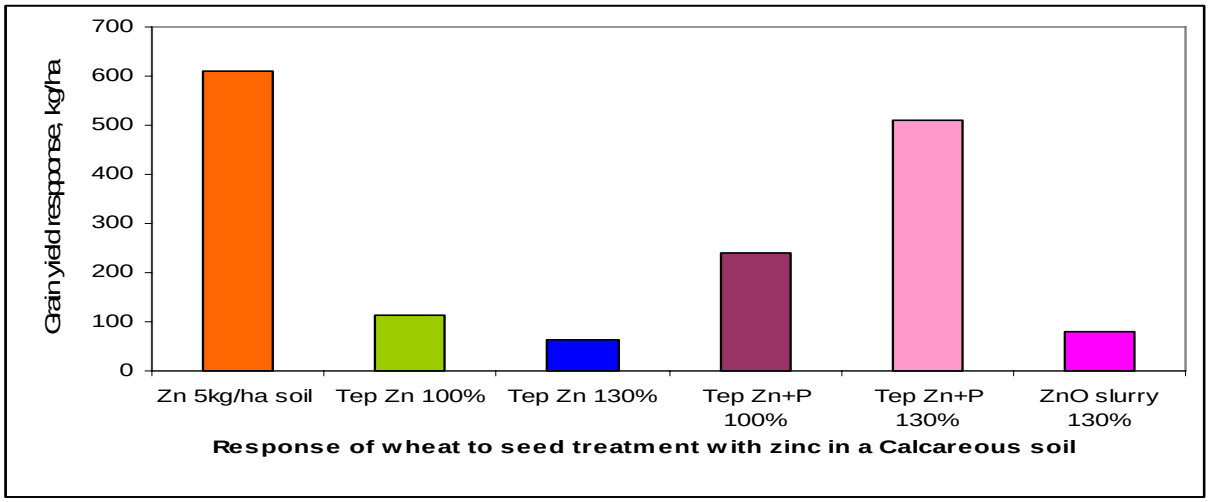
METHODS

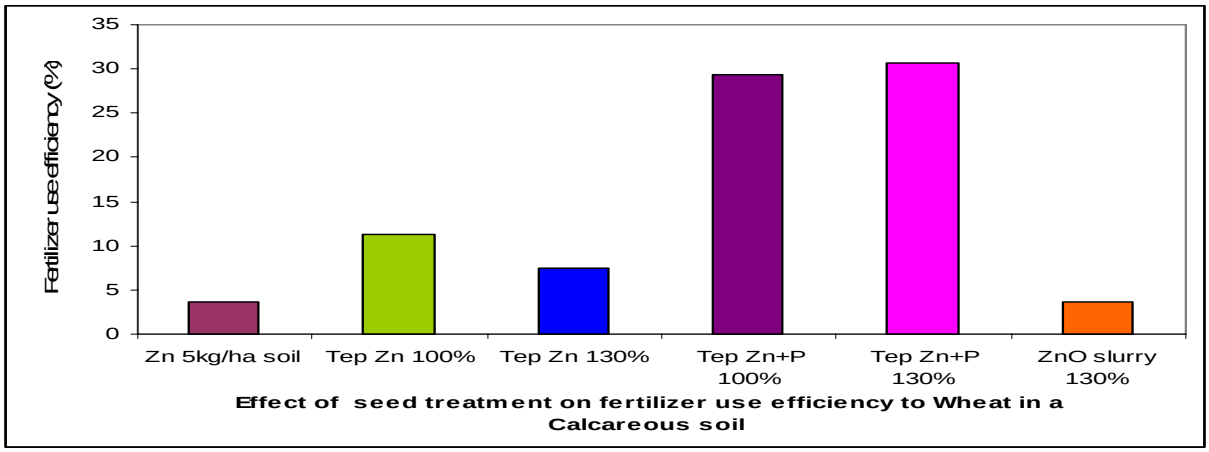
Field studies were carried out to evaluate the efficiency of seed-coating treatments with Zn formulations (Teprosyn) for correcting Zn deficiencies in important crops. The treatments consisted of seed coating with Teprosyn-Zn (55% Zn), Teprosyn-ZnP_2O_5 (30% Zn and 20% P_2O_5), ZnO (80% Zn) in comparison to basal soil applications of 5 kg Zn ha^{-1} with $ZnSO_4$ (21% Zn) as control. Seed coating were performed at 100% and 130% of the recommended rate (6-10 ml slurry kg^{-1} of seed) for maize (*Zea mays* L.), wheat (*Triticum aestivum*), soybean (*Glycine max*. Merr.), sunflower (*Helianthus annus* L.), groundnut (*Arachis hypogaea* L.) and mustard (*Brassica juncea* Coss). The suspension was applied at the rate of 6-10 ml kg^{-1} of seed depending on the crop and rate of application. Considering a normal seed rate of 20 to 100 kg ha^{-1} for a range of crops, the quantity of suspension required would vary between 120 to 1000 ml ha^{-1}. The seeds were coated uniformly in a container by diluting 4 parts of the required quantity of concentrated micronutrient formulation with 1 part of water and dried seed in the shade before sowing. The crops were raised by adopting all standard agronomic practices.

RESULTS AND DISCUSSION

Results indicated that seed treatments with the recommended level of Teprosyn-Zn, Teprosyn-ZnP or ZnO did not adversely influence seed germination in crops that have big and bold sized seeds except of mustard due to a smaller seed size. Seed coating significantly increased the seed yield for maize, wheat, sunflower, soybean and groundnut crops in comparison to the Zn control, but it did not improve the mustard yields. Seed coating treatment with Teprosyn- ZnP_2O_5 of maize, wheat and sunflower gave better results in soils deficient in Zn and P compared to Teprosyn-Zn in Zn-deficient soil at different locations. Seed coating with ZnO resulted in lower yields than Teprosyn-Zn. The seed coating with Teprosyn-Zn gave a higher yield of soybean and wheat at the 130% level in vertisol, which was Zn-deficient when compared to the Zn-control treatment. Yields obtained with soil applications of 5 kg Zn ha^{-1} were similar to or better than all seed treatments irrespective of Zn formulation. Thus, seed treatments may be a better option for controlling hidden hunger and increasing agronomic- and nutrient use-efficiency than soil application.

Thus, the efficiency of seed coating treatments was found similar to or better than basal applications for most of the crops. Seed coating did not raise the status of available Zn in the soil. The application of 5 kg Zn ha^{-1} left residual effects to the following crops, but it was found costly. Seed coating treatments significantly increased the fertilizer-Zn use efficiency and its physiological efficiency compared to soil application. Seed coating improved the Zn content in seeds similar to that of soil application.





CONCLUSIONS

The seed coating with Teprosyn-ZnP or Teprosyn-Zn was found to be helpful in correcting Zn deficiencies in wheat, maize, sunflower, groundnut and soybean. Studies revealed that the Zn content in blood serums was low in families feeding from Zn-deficient soil than those consuming grains produced on soils adequate in Zn. These findings suggest that a seed-coating treatment with a concentrated micronutrient-formulation slurry at the individual-farmer or seed-corporation level would be very beneficial for correcting widespread Zn deficiencies in important crops and for ensuring a better Zn supply in the food chain at the national level besides improving the soil environment.

REFERENCES

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