

Determination of Efficiency of Mycorrhiza and Azotobacter in Uptake of Microelements, Zn, Cu and Fe under Different Levels of Phosphorus in Corn Hybrid of KSC 704

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INTRODUCTION

Wong et al. (1990) studied the effects of P and Zn on corn growth in calcareous soil, and they concluded that there was an antagonistic effect when P and Zn were not balanced. Other studies show that an application of 50 mg l⁻¹ Zn with Azotobacter and Azosperillium can increase N, Mg, Mn, carbohydrate and protein concentrations in above-ground plant tissues. Furthermore, the same amount of Zn with Mycorrhiza (inoculated and not inoculated) did not have an effect in sorghum (Bagoyako et al. 2000).

METHODS

This study was conducted as a factorial experiment using a completely randomized block design (CRBD) with three replicates in 2004. Results of the soil analysis are in Table 1. The effects of three factors Azotobacter (inoculated and not inoculated), Mycorrhiza (inoculated and not inoculated) and P (0, 50, 100, 200 Kg ha⁻¹) were evaluated. Plants were sampled in the milky stage. Mineral concentrations of above-ground tissues were determined by Atomic Absorption Spectrophotometry (AAS). Data were analyzed with SAS software using a GLM.

Table 1. Physical and chemical soil characteristics.

Soil texture	Sand	Loam	Clay	Organic carbon	Total N	Absorbable K	Absorbable P	pH	EC	Depth	Test no.
	%	%	%	%	%	ppm	ppm			cm	
Sandy-clay-loam	50	20	30	0.35	0.30	245	8.8	8.2	0.9	0.30	1

RESULTS AND DISCUSSION

The application of Mycorrhiza decreased Cu concentrations significantly (14.9%). The treatment with Azotobacter decreased Fe concentrations (6.7%). Different P levels decreased Fe (21.4%) and Zn (15.8%) concentrations in above ground plant tissues. The interaction between Mycorrhiza and Azotobacter decreased Cu concentrations (15.6%) significantly ($p < 0.05\%$), but had no effect on Zn concentration. The interaction of Mycorrhiza and different P levels decreased Zn concentrations significantly (22.23%). The combined treatment with Mycorrhiza, Azotobacter and P had no effect on the concentrations of analyzed minerals.

Mycorrhiza may improve the absorption of N and microelements in two ways: i) fungi hyphes may promote the development of roots and increase the uptake of microelements, ii) a suitable symbiosis between Mycorrhiza and plant roots may increase the absorption and transition of nutrients from the soil to the roots and improve plant growth (Turk et al. 2006). Bagoyako et al. (2000) concluded that higher P application rates increased P and decreased Ca, Mg, and Zn concentrations in the plant tissue, and our results are consistent with this.

Caarletti (2002) discussed that Azotobacter can increase plant growth and biomass via production of plant growth promoting rhizobacteria (PGPR) and decrease the concentration of micronutrients in plants.

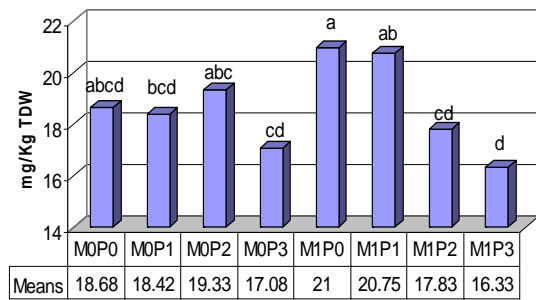


Fig. 1. Effect of Mycorrhiza (inoculated / not inoculated) and P on Zn concentrations of above-ground plant tissues.

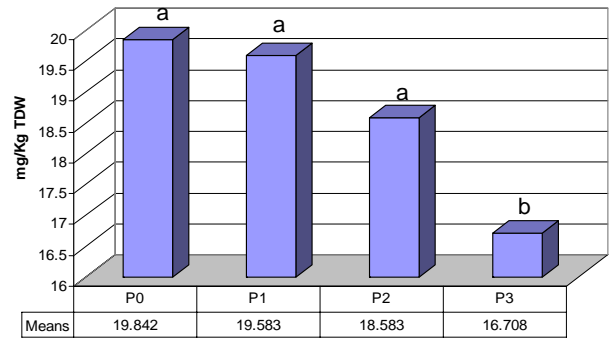


Fig. 2. Effect of P on Zn concentrations of above-ground plant tissues.

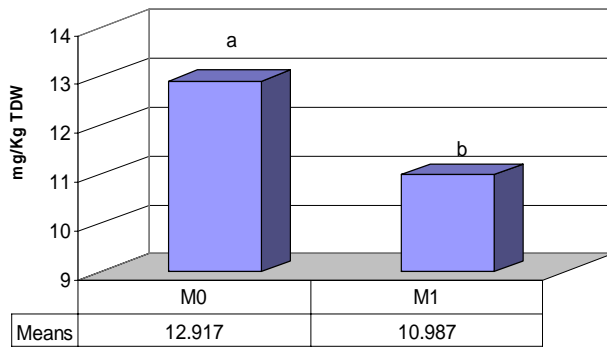


Fig. 3. Effect of Mycorrhiza (inoculated / not inoculated) on Cu concentrations of above-ground plant tissues.

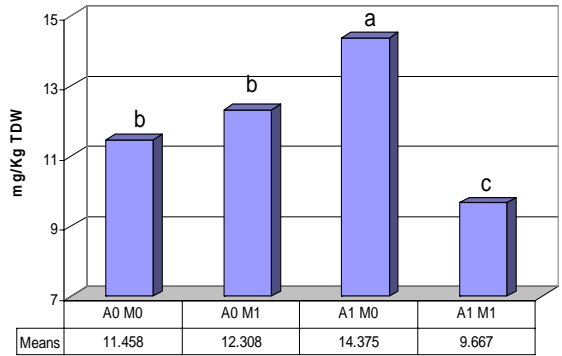


Fig. 4. Effect of Mycorrhiza (inoculated / not inoculated) and Azotobacter (inoculated / not inoculated) on Cu concentrations of above-ground plant tissues.

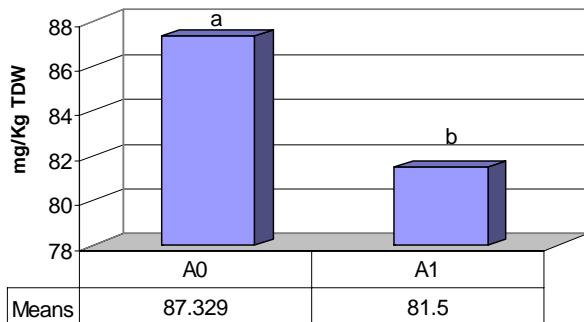


Fig. 5. Effect of Azotobacter (inoculated / not inoculated) on Fe concentrations of above-ground plant tissues.

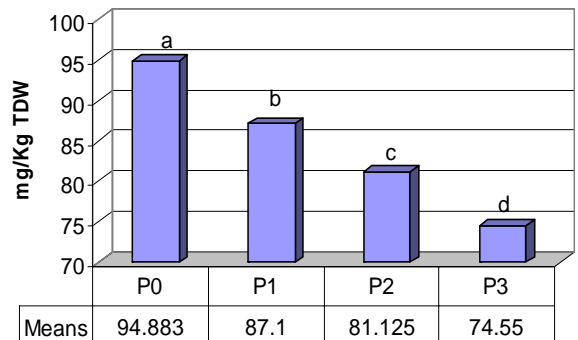


Fig. 6. Effect of P on Fe concentrations of above-ground plant tissues.

CONCLUSIONS

The application of Mycorrhiza and Azotobacter resulted in an increase of plant biomass and inhibited the decrease of Zn concentrations in plant tissue.

ACKNOWLEDGEMENTS

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REFERENCES

- Bagoyako, M., Georg, E., Romheld, V. and Buerkert, A. (2000) Effects of mycorrhiza and phosphorus on growth and nutrient uptake of millet, cow pea and sorghum. *A West African Soil-Journal of Agriculture Science, Cambridge*. 135:399 – 407.
- Carletti, S. (2002) Use of plant growth-promoting Rhizobacteria in plant micro propagation. Available on: www.ag.auburn.edu .
- Turk, M.A., Assaf, T.A., Hameed K.M., and Tawaha, A.M.AL. (2006) Significance of Mycorrhiza. *World Journal of Agriculture Science* 2:16-20.
- Wong, H, Zhang, T., Clen, Y. and Shaan, F. (1990) Study on interaction between P and Zn and their influences on the growth of maize seed lings in calcareous soil. *Acta-Pedologica-Sinica* 27: 241-249.