

## MASTER'S THESIS

# The role of mycorrhizae associated with vetiveria zizaniodes and cyperus polystachyos in the remediation of metal (lead and zinc) contaminated soils

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**The Role of Mycorrhizae Associated with  
*Vetiveria zizaniodes* and *Cyperus polystachyos* in the  
Remediation of Metal (Lead and Zinc) Contaminated Soils**

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## Abstract

Mycorrhizae are fungi known to associate with the rhizosphere of most vascular plants. The principle advantages of such association are enhanced water and mineral uptake for the infected plant, especially beneficial under the conditions of low moisture and nutrient contents. They are also believed to play important roles in phytoremediative processes. The present study aims to investigate the effects of mycorrhizae on the growth, nutrient as well as heavy uptake by infected host plant, and the role of mycorrhizae aids in phytoremediation.

The effects of mycorrhizae on growth, nutrient and metal uptake by host plants were investigated in a greenhouse trial using Vetiver grass (*Vetiveria zizanioides*) and Many-spike flatsedge (*Cyperus polystachyos*). Inoculation of mycorrhizae significantly increased the growth as well as nutrient uptake of both plant species. The colonization of mycorrhizae increased Pb and Zn uptake by plants under lower metal concentrations (at 0 and 10 mg/kg of Pb or Zn), while decreased Pb and Zn uptake under higher metal conditions (at 100 and 1000 mg/kg of Pb or Zn). When *G. mosseae* was inoculated with *C. polystachyos*, a high positive correlation was found between the mycorrhizal colonization with metal concentrations, Pb:  $r=0.9496$  and Zn:  $r=0.9901$ . Moreover, *C. polystachyos* had a dependency ( $p<0.05$ ) on mycorrhizae for growth than *V. zizanioides*. In addition, P concentration in soil was negatively correlated with mycorrhizal colonization as well as metal concentrations.

A field study in Pb/Zn mine tailings was conducted to investigate the influence of mycorrhizae on phytoremediation of Pb/Zn contaminated soils. The of increase in plant biomass, Pb and nutrient uptakes in shoot of mycorrhizal *V. zizanioides* is more pronounced with the aid of organic amendment than mycorrhizal plants growing on tailings alone. However, uptake of Zn and Cu by shoot depends more on organic amendment than mycorrhizal inoculation. These findings may provide a clue for phytoremediation of soils contaminated by high concentrations of heavy metals.

Plants are protected from the potential toxicity caused by Pb and Zn by inoculation with mycorrhizae, but the degree of protection varies according to the fungus and host plant combination. It seems clear that AM can play an essential role in the restoration of contaminated soils, by protecting the plants from high levels of heavy metals and that this effect can be partially due to improvement of the P status of the plant.

Reduction in metal uptake of plants associated with mycorrhizae may be undesirable in terms of phytoremediation of metal polluted soils. However, with the inoculation of mycorrhizae, the total metal uptake by the whole plant is increased due to the overall increase in biomass of host plants. It can be concluded that mycorrhizae might play an essential role in phytoremediation. The efficiency depends on suitable host plant-fungus combination as well as organic amendment.

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