

APPLICATION OF MANURE AND COMPOST TO CONTAMINATED SOILS AND ITS EFFECT ON ZINC ACCUMULATION BY *SOLANUM NIGRUM* INOCULATED WITH ARBUSCULAR MYCORRHIZAL FUNGI

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Phytoremediation can be defined as the combined use of plants, soil amendments and agronomic practices to remove pollutants from the environment or to decrease their toxicity. Addition of organic matter (OM) amendments, such as compost or manure, is an inexpensive practice to facilitate re-vegetation of contaminated soils. Organic amendments can decrease heavy metal bioavailability. Some microorganisms, such as arbuscular mycorrhizal fungi (AMF) can also facilitate the re-vegetation of polluted soils by enhancing plant growth and improving plant reproduction. A greenhouse experiment was carried out to assess the influence of the addition of OM amendments on the growth and metal accumulation by *Solanum nigrum* in Zn contaminated soils, and to evaluate the effect of the application of different AMF on the bioavailability of Zn. The production of percolates and the corresponding Zn contents was also considered. The experiment was a factorial design with two matrix Zn levels (soil collected from a metal contaminated site with 433 mg Zn kg⁻¹, and the same soil spiked with 500 mg Zn more per kg of dry soil), three amendment treatments (no amendment, 10% compost and 5% manure) and three AMF treatments (no AMF, *Glomus claroideum* and *Glomus intraradices*).

The application of the amendments, especially manure induced a significant decrease on the percentage of root colonisation of both AMF. Addition of manure to the growing matrix always resulted in a significant increase of the biomass of all plant parts when comparing with the control, while the application of compost only resulted in a significant higher leaf biomass of plants growing on both contaminated soils - AMF inoculation generally did not significantly affect the biomass of *S. nigrum*.

Zinc accumulations of up to 7465 mg kg⁻¹ in the roots, 5446 mg kg⁻¹ in the stems and 2082 mg kg⁻¹ in the leaves were registered for plants grown in the non-amended soils. After the addition of manure and compost to the soil, reductions of respectively 80% and 48% in the levels of metal accumulated in the plant tissues were obtained. The establishment of *S. nigrum* in combination with the application of these amendments also provided a reduction in the quantity of Zn leached through the soil in the order of ca. 70 to 80%. AMF generally did not seem to have any effect on this accumulation in amended soils.

The capacity of *S. nigrum* to thrive in soils presenting Zn levels considered as phytotoxic is a valuable characteristic for its application in re-vegetating and stabilising Zn polluted soils. The addition of manure to the soil increased the ability of the plant to decrease the percolation of Zn from the contaminated matrix. The use of *S. nigrum* in the stabilisation of Zn contaminated soil amended with manure can thus be seen as a feasible short-term phytostabilisation practice, as this association has the potential to inhibit further contamination of the food chain through herbivores and dissemination of the contamination throughout the soil and to other environmental compartments via leaching.

Keywords: arbuscular mycorrhizal fungi, organic matter amendments, phytostabilisation, *Solanum nigrum*, Zn