



Hungarian University of Agriculture and Life Sciences

Szent István Campus

Abstract

Title of thesis: Investigation of Phytoremediation of Soil Contaminated with Toxic Elements Using Model Experiments

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Heavy metal contamination in soils is a serious environmental issue that reduces the productivity of agriculture, balance of ecosystems and human health because of the persistence and bioaccumulation of toxic elements. Phytoremediation is an environmental friendly and sustainable method of eliminating soil pollution through the use of plants that may absorb or stabilize the contaminants. The aim of the study was to examine the potential of *Brassica juncea* (Indian mustard) as a phytoremediator by using controlled model (potting) experiments. The main

objectives were to determine the impact of heavy metal contamination on germination, growth performance, and metal uptake and to evaluate the suitability of *B. juncea* as a bioindicator plant for soil toxicity assessment. Two polluted soils (Soil B and Soil D) were collected from a previous mining site in Mátraszentimre, Hungary, were used after dilution with clean sand or mould to reduce contamination levels. Seeds of two cultivars of *B. juncea* were planted under indoor conditions and watered daily, and monitored for germination rate, shoot and root length, and biomass production. Microwave-assisted H_2O_2/HNO_3 digestion was used to digest the harvested samples and the concentrations of cadmium (Cd), copper (Cu), lead (Pb) and zinc (Zn) were analyzed using the ICP-OES. The result indicated that *B. juncea* was able to germinate and proliferate in the contaminated soils, though the height and biomass of the plants was lower than controls. The shoots contained high levels of Pb and Zn, which means that they had a high phytoextraction potential.

Overall, the results confirm that *Brassica juncea* is a tolerant and effective species for phytoremediation and as a bioindicator to assess soil contamination by heavy metals. These results support the use of *B. juncea* in sustainable remediation strategies aimed at reducing the environmental risks associated with heavy metal pollution.