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Assessment of Growth Variation and Phytoextraction Potential of Four Salix Varieties Grown in Zn Contaminated Soil Amended with Lime and Wood Ash

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Abstract : Soils contaminated with metals, e.g., copper (Cu), zinc (Zn) and nickel (Ni) are one of the main global environmental problems. Zn is an important element for plant growth, but excess levels may become a threat to plant survival. Soils polluted with metals may also pose risks and hazards to human health. Afforestation based on short rotation Salix crops may be a good solution for the reduction of metals toxicity levels in the soil and in ecosystem restoration of severely polluted sites. In a greenhouse experiment, plant growth and zinc (Zn) uptake by four Salix cultivars grown in Zn contaminated soils collected from a mining area in Finland were tested to assess their suitability for phytoextraction. The sequential extraction technique and inductively coupled plasma–mass spectrometry (ICP–MS) were used to determine the extractable metals and evaluate the fraction of metals in the soil that could be potentially available for plant uptake. The cultivars displayed resistance to heavily polluted soils throughout the whole experiment. After uptake, the total mean Zn concentrations ranged from 776 to 1823 mg kg^{-1}. The average uptake percentage of Zn across all cultivars and treatments ranged from 97 to 223%. Lime and wood ash addition showed a significant effect on plant dry biomass growth and metal uptake percentage of Zn in most of the cultivars. The results revealed that Salix cultivars have the potential to accumulate and take up significant amounts of Zn. Ecological restoration of polluted soils could be environmentally favorable in conjunction with economically profitable practices, such as forestry and bioenergy production. As such, the utilization of Salix for phytoextraction and bioenergy purposes is of considerable interest.

Keywords : lime, phytoextraction, Salix, wood ash, zinc
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