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Accumulation of arsenic by various grass species growing in strongly contaminated sites affected by historical As mining and processing

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Historical ore mining and processing has considerably affected soil properties, causing the changes in local landscapes and soil enrichment in potentially toxic elements. Złoty Stok (formerly: Reichenstein), in SW Poland, was over many decades the largest European centre of arsenic mining and processing. Numerous mine and processing dumps have remained in that area. Waste material was in several sites intentionally spread on the land surface. Moreover, large floodplain areas were flooded by tailings released from disposal impoundments during stormy rains. The soils in all those sites contain high concentrations of arsenic, in extreme cases over 1%, while the permissible soil concentrations, considered environmentally safe, remain in the range 10-100 mg/kg, depending on land usage and soil properties. Remediation should be undertaken in all the sites with higher As concentrations, in order to reduce potential environmental risk and prevent As from entering the food chain. Because of relatively low As solubility and bioavailability, phytostabilization seems to be the best option of remediation. Grasses are particularly suitable for this purpose because of their quick growth, relatively large biomass, efficient coverage of the surface, and thick root systems. Major grass species are known as eliminators of heavy metals, highly resistant to their high concentrations. We examined the suitability of three grass species: *Festuca rubra, Agrostis capillaris* and *Holcus lanatus* for phytostabilization of As rich soils. As concentrations in their shoots were examined in the field and in a pot experiment. The latter was performed in order to examine the effects of various soil treatment, including fertilization, on plant growth and As uptake by plants. Soil treatment with manure increased strongly As extractability in soils but did not increase As uptake by grasses. The concentrations of As in plant shoots were in the pot experiment by manifold higher than those in the field. The maximum concentrations of As reported from the field for *F. rubra, A. capillaris* and *H. lanatus* were: 51, 9.3 and 62 mg/kg, while the corresponding maximum As concentrations from the pot experiments were: 390, 1020 and 570 mg/kg, respectively. Large differences between the field and pot data indicate that the populations growing in highly contaminated sites have probably developed a specific tolerance to soil As. Its possible mechanisms are discussed. One of the conclusions is that further pot experiments should be carried out with the seed material collected from enriched sites rather than with commercial cultivars. The data from the field indicate that all the three species of

grass examined in this study are As excluders and relatively good candidates for phytostabilization of As-rich soils. However, the concentrations of As in the shoots of grasses growing in the most strongly enriched sites exceeded 4 mg/kg, the value set as a safe As content in fodder, posing therefore a risk to potential animal consumers.