Phytromediation of contaminated soils with some heavy metals

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The objectives of the current investigation were to: 1-Assess the ability of sunflower, sorghum and elephant grass plants to accumulate some heavy metals, i.e., chromium, cobalt, nickel and arsenic in their tissues,2- Determine to which extent these plants can extract these heavy metals from contaminated soils and 3- compare the efficiency of phyto and chemical remediation to extract heavy metals from contaminated soils.To achieve the above mentioned objectives, the following experiments were conducted :5-1 : Nutriculture experiment :It was carried out to fulfill the first purpOse and both of sunflower and sorghum plants werAsed. floagland solution as modified by Johnson et al. (1957) was used in this experiment. The rates of 0, 1 and 2 mg/I., for the tested elements were applied.The results obtained could be summarized as follows :1- Dry matter yield of sunflower was not significantly affected by increasing rates of chromium and cobalt. While, increasing nickel rate to 2 mg Ni/L was associated with a decrease in dry matter yield.In case of sorghum plant there was a significant decrease in their biomass with increasing the rate of chromium and arsenic and with the third level of cobalt while, sorghum dry matter yield was not significantly affected by increasing nickel rate.2- Chromium, cobalt, nickel and arsenic concentrations and uptake were increased in sunflower plants with increasing chromium, cobalt, nickel and arsenic. Similar results were obtained with sorghum plants.5-2 : Soil experiment :Pot experiment was conducted to achieve the second ..objective. Three surface soil samples (0-30 cm) were collected to represent the Nile alluvial clay, sandy clay loam (calcareous) and sandy soils. The treatments were 0,, 30 and 60 mg Cr/kg soil as Cr2(SO4)3, 0, 400 and 800 mg Co /kg soil as CoSO4, 0, 40 and 80 mg Ni/kg soil as NiSO4 and 0, 10 and 20 mg As/kg soil as As203 added to (sunflower, sorghum and elephant grass). After 45 days from the treatments, plants were harvested and divided into two parts (shoots and roots). The obtained results could be summarized as follows:1 Dry matter yield of sunflower (shoots) of plants grown on clay and sandy clay loam soils was significantly increased with using the second rate of chromium. However, it was decreased for both soils with the third rate and the same trend was obtained with roots of sunflower and shoots of sorghum. In case of sandy soil, no significant effect was associated with increasing chromium rate up to 30 mg Cr/kg soil but for roots there was a significant decrease in their yield with increasing chromium rate. This trend was obtained with dry matter yield of sorghum roots in case of sandy and sandy clay loam soil, but there is an increase in sorghum roots with the second and third rates of chromium with the clay soil. For elephant grass plants dry matter yield of shoots was decreased withincreasing chromium rate and the same trend was obtained with roots in sandy clay loam soil. In sandy and clay soil, however, dry weight of roots was increased with increasing chromium levels.2-Dry matter yield of sunflower shoots was negatively affected by cobalt rate and decreased with decreasing clay fraction in soil. A similar trend to that obtained with chromium was noticed for dry weight of sunflower roots. For sorghum dry weight, there was a decrease with increasing Co rate. An increase with the second rate was noticed in case of clay soil and the same trend was obtained for roots with the three tested soils. For elephant grass plants dry weight of shoots decreased with increasing cobalt rate except in sandy soil where an increase was noticed with using second rate of cobalt. For roots, dry weight was increased with the second rate and decreased with the third one.3-Dry weight of plants grown on the tested soils increased with the second rate of nickel (40 mg/kg), while, higher rate of nickel (80 mg/kg soil) resulted in a significant reduction in the dry weight.4-In sunflower plants using the second and third levels of arsenic enhanced dry weight of shoots of plants grown on soils except sandy soil there was a sharp decrease in shoots dry weight. In case of sorghum, dry matter yield of shoots and roots was decreased with increasing arsenic rate from 0.0 to 20 mg As/kg soil. For elephant grass applying arsenic at the third rate to the tested soils caused a decrease in shoot dry weight, while, using the second level enhanced dry weight of both shoots and roots.5-Plants grown on all tested soils with no application of chromium did not contain a detectable concentration of chromium. However, using the second and third rates of chromium resulted in increasing chromium concentration in shoots and roots sharply and the highest values were noticed with the third rate when added to sandy soil followed by sandy clay loam one, and clay soil was the lowest one.6-A trend similar that obtained with chromium was achieved with cobalt. Worthy to note that, cobalt concentration in sunflower and elephant grass shoots and roots was increased to be 5656, 13289 and 1572, 3365 Rig plant for the former and latter when grown on sandy, soil. This means that these plants can considered as hyperaccumulator plants for cobalt.-7-concentration of nickel in shoots and roots of plants grown on the studied soils was increased with increasing nickel rate from 0.0 up to 80 mg Ni/kg and the highest concentration was noticed in plants grown on sandy soils.8-Arsenic concentrations in plant shoots were not detected in check treatment which did not receive arsenic. However, its concentration was slightly increased with applying 10 and 20 mg arsenic to clay and sandy clay loam soil. Sharp increases in arsenic concentration were noticed with sandy soil.9-The current study revealed that chromium uptake by shoots and roots was gradually increased with increasing chromium rate. Plants grown on sandy soil absorbed more chromium as compared with the other two soils except in case of sunflower shoots as well as shoots and roots of elephant grass.