

Effects of Different Soil Treatments on the Availability of Toxic Elements, Germanium and Rare Earth Elements

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Effects of six different soil treatments (Lime + Inorganic Fertilizer, Inorganic Fertilizer, Cow dung + Lime, Cow dung, Horse dung + Lime, Horse dung) on the availability of toxic elements (Pb, Cr, As and Cd), Germanium (Ge) and Rare Earth Elements (REE) (La, Ce, Nd, Gd, Er) to *Zea mays* (Maize), *Phalaris arundinaceae* (Reed canary grass), *Brassica napus* (Rapeseed), and *Lupinus albus* (White lupin) was investigated. Six sets of twenty small pots of soil of about 2kg each were prepared and amended using the different soil treatments respectively. Soils in each set of twenty pots were assigned for amendment by each of soil treatment plan while twenty pots of unamended soils were set aside as control. Each of the four different plants used for the investigation were cultivated in 5 replicates for each soil treatment plan and control. The application of manure/fertilizer (Cow dung, Horse dung or Inorganic fertilizer) as amendment to soils increased the availability of Rare Earth Elements, Germanium and Toxic Contaminants compared to the application of a combination of manure and lime (Cow dung + Lime, Horse dung + Lime or Inorganic fertilizer + Lime) respectively. However, this was not always the case as there were some instances where results from experiments showed that application of a combination of manure and lime resulted increased availability of Ge, REE and toxic elements compared to application of manure/fertilizer only. Compared to the control, there are indications that suggest that the quantity of manure applied to soil as amendment may not have increased the bioavailability of all elements considered in the experiments. Also, compared to the control, liming has an inhibitory effect on the availability of both toxic elements, Ge and REE elements in soil. Of the four plants used in the investigation ,white lupin and rapeseed showed higher potentials for use in phytomining of REE while for toxic elements in soil, white lupin and reed canary grass showed higher potentials for use in phytoremediation.