



Benefits and limitations of pig slurry to reclaim bare mine soils under Mediterranean semiarid conditions

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In this study, the effects of pig slurry application on reclamation of mine soils from Cartagena-La Unión Mining District (SE Spain) were investigated in a field experiment. Exchangeable metals (Cd, Cu, Pb and Zn), total organic carbon, total nitrogen, soluble carbon, microbial biomass and three enzyme activities were periodically monitored during 67 days. In addition, one year after the application of the pig slurry, soil and developed vegetation was sampled. Results showed that only exchangeable Cd and Zn significantly decreased in the amended plots, mainly for Cd, with decreases of 98%. The rest of metals and chemical properties did not change with time after application of amendments, showing values not significantly different than those present before pig slurry application. Soluble carbon, microbial biomass carbon and the enzyme activities increased after the application of pig slurry. However, after various days these parameters started a decreasing trend until reaching values similar to the control from approximately day 25. Thus, mainly precipitation as phosphate from the waste was very effective for Cd immobilization. No increments were observed in soil organic carbon because the organic carbon applied with the slurry was too low to be significantly detected. Nonetheless, pig slurry is a good fertilizer owing to the high quantity of nutrients provided, needed to promote the development of vegetation. One year after application, a native vegetation cover (25–30%) was reached by spontaneous colonization. Triggered plant growth by the effect of amendment improved soil conditions, particularly by the help of the medium created by their rhizosphere systems. Increments in soil organic carbon and total nitrogen, and decreases in the exchangeable metals fraction concentration were observed in rhizospheric soils when compared to the bare soils. This improvement in soil quality mediated by vegetation was more efficient than the direct effect of the amendment. In conclusion, the use of pig slurry to reclaim bare contaminated soils by heavy metals brings indirect positive effects by triggering a vegetation cover which can stabilize metals and increase soil quality (phytostabilization).

Keywords: heavy metals, microbial biomass, enzyme activities, phytoremediation.