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Single application of Sewage Sludge to an Alluvial Agricultural Soil - impacts on Soil Quality

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Limited information exists on the effects of sewage sludge on soil quality with regard to their ability to maintain soil functions. We studied effects of sewage sludge amendment on soil chemical properties, microbial community structure and microbial degradation of the herbicide glyphosate. Three months soil column leaching experiment has been conducted using alluvial soils (Eutric Fluvisol) with no prior history of sludge application. The soil was loamy with pH 7,4 and organic matter content of 3,5%. Soil material in the upper 2 cm of columns was mixed with dehydrated sewage sludge which was applied in amounts corresponding to the standards governing the use of sewage sludge for agricultural land. Sludge did increase some nutrients (total N, NH4+, available P and K, organic carbon) and some heavy metals contents (Zn, Cu, Pb) in soil. However, upper limits for heavy metals in agricultural soils were not exceeded. Results of heavy metal availability in soil determined by sequential extraction will be also presented. Restriction fragment length polymorphism (RFLP) analyses of 16s/18s rDNA, using universal fungal and bacterial primers, revealed clear shifts in bacterial and fungal community structure in the upper 2 cm of soils after amendment. Fungal fingerprints showed greater short term effects of sewage sludge, whereas sewage sludge seems to have prolonged effects on soil bacteria. Furthermore, sewage sludge amendment significantly increased glyphosate degradation from 21.6$\pm$1% to 33.6$\pm$1% over a 2 months period. The most probable reasons for shifts in microbial community structure and increased degradation of glyphosate are beneficial alterations to the physical-chemical characteristics of the soil. Negative effects of potentially toxic substances present in the sewage sludge on soil microbial community functioning were not observed with the methods used in our study.