EFFECTS OF LEAD AND PLANT GROWTH ON SOIL MICROBIAL COMMUNITY STRUCTURE

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Abstract: Lead (Pb) is a common inorganic toxicant at contaminated sites. Unlike other metals, Pb has no biological role (non essential) and is potentially toxic to microorganisms. Effects of plant growth and chelating agents upon microbial community structure were tested in an artificial soil mix, contaminated with various levels of lead (Pb). Across 3 Pb treatments, bacterial populations were lower at both 1,000 and 2,000 compared to those found at 500 mg Pb/kg dry soil. In the presence of EDTA, bacterial populations were higher at 1,000 and 2,000 mg Pb/kg dry soil indicating the alleviation of the toxic effect of Pb. Fungal populations were higher at 500 and 2,000 than at 1,000 mg Pb/kg dry soil where growth was inhibited. Generally, EDTA decreased the fungal populations at all Pb levels and also in the absence of Pb. The growth of soil bacteria and fungi to soil-applied Pb indicates that these microorganisms may have resistance mechanisms to deal with metal toxicity. 16S rRNA gene based analysis of microbial community diversity in metal-contaminated soils indicated that the presence of plants generally enhances microbial diversity, presumably through stimulation of microbial activities by root exudates or via creation of various physical niches. Such an enhancement was less pronounced in the presence of higher levels (1000 ppm) of Pb. At 2000 ppm of Pb this relationship was inverted, with plant presence depressing the diversity, a phenomenon we have no explanation for. A subgroup of bacteria, presumably high-GC gram-positives have disappeared from low-metal samples in the presence of plants, an interesting phenomenon deserving further study.

Keywords: Lead, community structure, chelates, soil microbial population, EDTA

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