

Beneficial effects of phytomanagement options on soil structural and functional microbial biodiversity

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Abstract:

Through the proper phytomanagement of contaminated sites, soil structural and functional microbial biodiversity can be restored, thereby enhancing soil functionality and the provision of vital ecosystem services. Here, a network of sites (located in Spain, France and Portugal) contaminated by metal(loid)s and organic compounds were subjected to a variety of phytomanagement options. Short- and long-term effects on soil microbial communities, as biological indicators of soil quality, were determined for assessing the beneficial effects of applied phytomanagement options on soil functionality and, concomitantly, soil ecosystem services. In particular, a variety of microbial parameters that provide information on the biomass (total bacteria and fungi by qPCR), activity (enzyme activities) and diversity (community-level physiological profiles with Biolog Ecoplates™, 16S rRNA amplicon sequencing, HT-qPCR of functional genes) were determined in soil samples. In general, phytomanagement treatments led to an improvement in soil functionality. The application of organic amendments resulted in a significant increase in soil microbial biomass, activity and diversity. A PCA analysis carried out with all the microbial parameters studied here differentiated the sites and phytomanagement treatments. Similarly, the composition of OTU obtained from next generation sequencing data (16S rRNA) varied significantly among the different sites and treatments. The data presented here provide insights into the structural and functional diversity of soil microbial communities subjected to phytomanagement. It was concluded that, during phytomanagement, a proper selection of the organic amendments and plants species is essential for the intended reduction in the adverse effects caused by contaminants on soil microbial diversity.

Key words: metabarcoding, microbial diversity, phytoremediation, soil contamination