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Effect of Soil Drying Intensity on Nutrient Transformation and Microbial Community Composition

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ABSTRACT

Soil drying-rewetting events affect nutrient transformation and microbial community composition; however, little is known about the influence of drying intensity. Therefore, we analyzed the nutrient composition and microbial communities of soils exposed to various drying intensities. We also used a sterilization experiment to examine the contribution of soil microbes to nutrient pulses. Soil drying-rewetting decreased C mineralization by 9–27%. Both monosaccharide and mineral N contents increased at higher drying intensities (≤10% gravimetric water content) and increased by 204% and 110% in the soils dried to 2% gravimetric water content, respectively, whereas labile P only increased (by 105%) when the soil was dried to 2% gravimetric water content. Moreover, levels of microbial biomass C and N and dissolved organic N decreased with increasing drying intensity and were correlated with increases in dissolved organic C and mineral N, respectively, whereas the increases in labile P were not consistent with reductions in microbial biomass P. The sterilization experiment results indicated that microbes were primarily responsible for the C and N pulses, whereas non-microbial factors were the main contributors of the labile P pulses. Phospholipid fatty acid analysis indicated that soil microbes are highly resistant to drying-rewetting events and that drought-resistant groups were likely responsible for the nutrient transformation. Therefore, the present study demonstrates that moderate soil drying could improve the mineralization of N but not P and that different mechanisms are responsible for the C, N, and P pulses observed during drying-rewetting events.

Key Words: drying–rewetting, microbial biomass, microbial community composition, nutrient pulses, soil respiration