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Influence of Plant Functional Groups on Microbial Residue Accumulation Process in two Different Soil Types

Rajasekaran Murugan[1], Sanjay Kumar[2]

[1] *University of Kassel, Dept of Soil Biology and Plant Nutrition, Germany*
[2] *University of Agricultural Sciences, Regional Rice Research Station, India*

Abstract

In this study, influence of plant functional groups on specific contribution of microbial residues to soil organic C (SOC) was evaluated in a tropical Eucalyptus forest ecosystem with different plantation age and soil types. The treatments were stem girdling (SG), understory removal (UR) and control (CO). The amino sugars glucosamine and muramic acid were used as biomarkers for fungal and bacterial residues, respectively. Removal of plant functional groups significantly decreased the total amino sugar concentrations, especially in the SG treatment, followed by the UR. This suggests a negative effect of SG and UR on the accumulation of microbial residues in soil. The highest bacterial residues were observed in the SG treatment, which could be attributed to reduction in belowground carbon input and increased N availability. The SG and UR treatment recorded significantly lower concentrations of fungal residues, fungal C/bacterial C ratio and microbial residue C/soil organic C compared to the control. Accumulation of fungal residues as indicated by the fungal C/bacterial C ratio was in sandy loam soils with a high C/N ration and low pH. In contrast, the microbial residue C/soil organic C ratio was higher in clay loam soil. The fungal C/bacterial C ratio was higher in 5-year-old than in 15-year-old plantation. Our results highlight the ecological importance of plant functional groups and their effects on microbial residue build-up in different soil type. The use of the two ratios (fungal C/bacterial C and microbial residue C/soil organic C) reflects different dynamics of fungal and bacterial contribution to soil organic C sequestration. The different patterns of individual amino sugars suggest a change in the quality of microbial-derived soil organic matter.

Keywords: Amino sugars, bacteria, Eucalyptus, fungi, microbial community structure, soil organic matter

Contact Address: Rajasekaran Murugan, University of Kassel, Dept of Soil Biology and Plant Nutrition, Nordbahnhof Straße 1a, 37213 Witzenhausen, Germany, e-mail: raja.murugan15@gmail.com