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Effects of biochar and polyacrylamide on decomposition of soil organic matter and ^{14}C-labeled alfalfa residues

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Abstract

© 2016, Springer-Verlag Berlin Heidelberg.Purpose: Various soil conditioners, such as biochar (BC) and anionic polyacrylamide (PAM), improve soil fertility and susceptibility to erosion, and may alter microbial accessibility and decomposition of soil organic matter (SOM) and plant residues. To date, no attempts have been made to study the effects of BC in combination with PAM on the decomposition of soil SOM and plant residues. The objective of this study was to evaluate the effects of BC, PAM, and their combination on the decomposition of SOM and alfalfa residues. Materials and methods: An 80-day incubation experiment was carried out to investigate the effects of oak wood biochar (BC; 10 Mg ha−1), PAM (80 kg ha−1), and their combination (BC + PAM) on decomposition of SOM and 14C-labeled alfalfa (Medicago sativa L.) residues by measuring CO2 efflux, microbial biomass, and specific respiration activity. Results and discussion: No conditioner exerted a significant effect on SOM decomposition over the 80 days of incubation. PAM increased cumulative CO2 efflux at 55–80 days of incubation on average of 6.7 % compared to the soil with plant residue. This was confirmed by the increased MBN and MB14C at 80 days of incubation in PAM-treated soil with plant residue compared to the control. In contrast, BC and BC + PAM decreased plant residue decomposition compared to that in PAM-treated soil and the respective control soil during the 80 days. BC and BC + PAM decreased MBC in soil at 2 days of incubation indicated that BC suppressed soil microorganisms and, therefore, decreased the decomposition of plant residue. Conclusions: The addition of oak wood BC alone or in combination with PAM to soil decreased the decomposition of plant residue.

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Keywords

14 C-alfalfa residue decomposition, Biochar, Microbial biomass, Polyacrylamide, Soil organic matter

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