



How does pyrogenic organic matter affect the N dynamic in agricultural soils? An incubation study

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Besides other environmental factors, N availability drives the carbon (C) and nitrogen (N) cycles in grasslands. Since grass-dominated ecosystems cover approximately 40% of the terrestrial surface and store more than 30% of global soil organic carbon (SOC), alterations to those ecosystems could have significant consequences and potential implications for global C and N cycles and climate (Schlesinger et al., 1990). Understanding the processes that govern the efficient cycling of nutrients through soil/plant systems remains an important topic to underpin the choice of strategies aimed at ensuring the long-term sustainability of ecosystems.

In Mediterranean ecosystems, wild-fires occur frequently. Whereas factors such as water shortage or erosion contribute to reduced N-availability by lowering the litter input, burning additionally increase the refractory N and C-pools by charring litter and humic material (charred pyrogenic organic matter-PyOM) (Gonzalez-Pérez, 2004). In general, the addition of organic matter either as plant residues or farmyard manure has been shown to significantly increase biological activity, microbial biomass and enzyme activity in soil (Dick, 1992). Even in situations where microbial biomass appears to be unaffected, the activity of specific processes (e.g. N mineralization) can be significantly influenced by the addition of organic residues). However, little is known about the changes of the N cycle caused by the addition of PyOM.

Therefore, the interest of our research was to study the impact of ^{15}N enriched-biochars either alone or in conjunction with a ^{15}N enriched fertilizer (K^{15}NO_3) on aggregate stability and organic carbon (C) and nitrogen (N) distribution among the different soil fractions. The latter may help to elucidate both, the quality of the stored organic matter and if the accumulation is related to interaction with the mineral matter.

Therefore, biochar derived from grass material grown on ^{15}N -enriched fertilizer was added to a typical Andalusian agricultural soil (*calcareous Rhodoxeralf*, FAO-UNESCO classification). The bioavailability of the ^{15}N from the biochars was tested by determining its content in grass (*lolium perenne*) grown on this soil under defined conditions. Following the ^{15}N within the soil fractions gave further information about some mechanisms involved in N-partitioning and stabilization. Chemical alteration of the ^{15}N -containing organic structures during mobilization/immobilization were followed by solid-state NMR spectroscopy in order to obtain some more insights into the processes involved in the C and N-sequestration.

References:

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