



Fast effects of biochar amendment on soil C and N dynamics, nutrient availability and fertility under controlled conditions

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The shift towards a biobased economy will probably trigger the application of bioenergy by-products and charred residues to the soil as either amendments or fertilizers. However, limited research has been done to determine how this will influence C and N dynamics and soil functioning. The aim of this work was to investigate the effects of ¹⁵N enriched pyrogenic organic matter (¹⁵N-PyOM) on C and N mineralisation, nutrient availability and fertility of amended soil. A typical Andalusian agricultural soil (calcareous Rhodoxeralf) was amended (0.1% w/w) with ¹⁵N enriched-biochar produced from *Lolium perenne*. The bioavailability and partitioning of the ¹⁵N from the biochars was tested by determining its content in the soil and the ray grass grown on this soil under controlled conditions for 72 days. After 30, 60 and 72 days of incubation, soil samples were analyzed for C, N, ¹⁵N, microbial biomass C. In addition, the chemical alteration of the ¹⁵N-containing organic structures during mobilization/immobilization was followed by solid-state ¹⁵N NMR spectroscopy.

Soil amendment led to a general increase in the biomass production and N retention. After 72 days of incubation, 10 % of the ¹⁵N added in the soil with the PyOM had been degraded and available for grass growth. ¹⁵N and ¹³C NMR spectra confirmed that part of the pyrogenic heterocyclic N has been transformed into amide N, possibly by the use of microbiologically mobilized ¹⁵N from the char.

Newer results indicate that PyOM can be microbially degraded, the efficiency of which depends on its chemical composition and properties. The chemical properties of the used material as well as the optimal conditions for microbial decay during the laboratory incubation experiments are likely to have augmented PyOM decomposition. In summary, our results indicate that:

- i) a re-evaluation of the potential of pyrogenic material as a sink of C and N is needed.
- ii) the characterization of the chemical composition of char material is strictly required in order to enable such evaluation.
- iii) the application of ¹⁵N-enriched PyOM is a promising approach to study the degradation of pyrogenic material and the changes in the N budget.

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