Aged biochar affects gross nitrogen mineralisation and nitrogen recovery: a 15N study in two soils

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Biochar is pyrolysed biomass, and when applied to soils, it could increase agricultural productivity through increased nutrient retention. The biochar-mediated nutrient retention capacity depends on the biochar properties, which change with time. Here, we examined the effects of a field aged biochar (21 months), applied at 20 t ha-1 in two soil types, on gross nitrogen (N) mineralisation (GNM) and 15N recovery in a grassland field experiment using a 15N tracer. The experiment also included a phosphorus (P) addition treatment (1 kg ha-1). We only found a significant increase GNM in the sandy Tenosol, when it received both biochar and P. Biochar and P addition possibly enhanced microbial activity resulting in an increased GNM in the nutrient limited Tenosol. Biochar addition negated GNM in the clayey Dermosol possibly due to stabilization of soil organic matter (SOM). Biochar significantly increased total 15N recovery in the Tenosol (on average by 12%) and reduced leaching to sub-surface soil layers (on average by 52%). Overall 15N recovery was greater in the Dermosol, but was not affected by biochar or P treatment. The increased N retention with biochar addition in the sandy Tenosol may be due to NH4+-N retention at exchange sites on aged biochar in the soil. Our results suggest that aged biochar may increase N use efficiency through reduced leaching or gaseous losses in sandy soils.