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Soil GHG emissions in a Miscanthus plantation as affected by increasing rates of biochar application.

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Biochar is defined as charcoal produced by pyrolysis with the aim to apply it to the soil in order to improve its fertility and carbon (C) storage capacity. Biochar physical and chemical properties can vary depending on the original biomass feedstock and pyrolysis conditions. The potential agricultural benefits and CO_2 carbon sequestration from the application of biochar to soil, were assessed in field trials with well characterised biochar. In May 2010 we applied biochar from *Miscanthus* biomass produced at 450 ºC at 3 different application rates: 10, 25 and 50 tons ha^{-1} to a 6 year old *Miscanthus x giganteus* plantation in Brattleby (Lincoln, UK) . Each treated 25 m^2 plot had 4 replicates according to a randomised block experimental design. Biochar was incorporated to a depth of 10 cm in the soil between plant rhizomes after the harvest, through shallow tilling. CO_2 emissions from biochar amended soil were monitored every two weeks by a portable infrared gas analyser (IRGA) with a closed dynamic chamber system, and continuously through 8 automated chambers (both systems from Li-COR, Lincoln, Nebraska). N_2O fluxes were monitored using a closed static chamber technique with manual gas sampling and subsequent gas chromatography. Cation/anion exchange resin lysimeters were buried 20 cm deep in order to capture the leached nitrogen. Higher biochar applications led to a reduction of CO_2 effluxes in the first 10 weeks of the experiment, after which no treatment effect was observed. The emission of N_2O was significantly reduced in the 25 and 50 tons ha^{-1} application rates. Addition of biochar had no significant affect on the surface soil temperature, however the temperature sensitivity of soil respiration in the biochar treated plots decreased with increasing application rates