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# Soil and fertilizer type effects on short-term N2 and N2O emissions: Results of a helium-oxygen incubation study

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Emitted N gas species from agricultural fields are highly relevant in terms of environmental and climate protection and mainly result from numerous simultaneously occurring production and consumption processes, which are influenced by a range of proximal (e.g. nutrient and oxygen availability) and distal factors (e.g. soil conditions, climate and management). Fertilization generally influences the rate of denitrification through increased C and N availability in the soil. But, compared to unfermented organic fertilizers, this effect is more pronounced for fermented residues (FR) due to higher concentrations of NH4+, Nt and labile organic C. Thus, FR likely serve as an additional energy source for denitrifying bacteria, potentially resulting in temporally increased denitrification rates. However, field studies of simultaneous N2 and N2O emissions following fertilization with FR are still lacking, but are required to improve our understanding of the combined effects of relevant factors on the resulting N2 : N2O ratios.

We will present results of an incubation experiment conducted to quantify the effects of i) 2 N fertilizer types (fermentation residue, FR and granular calcium ammonium nitrate, CAN) and ii) 5 soil types (ranging from slightly loamy sand to very clayey silt) on short-term emissions of N2 and N2O as well as N2 : N2O ratios. Immediately after fertilizer application and incorporation in spring 2012, five intact soil cores per treatment were randomly taken from each of 5 study sites in Germany. Simultaneous measurements of N2O and N2 fluxes were conducted in special gas-tight incubation vessels inside a climate box at 10°C using the helium–oxygen incubation method of Butterbach-Bahl et al. (2002), classified as a flow-through steady-state system according to Livingston and Hutchinson (1995).

Across all sites, FR samples showed both significantly higher absolute and relative (to fertilizer N input) N2O efflux and significantly higher average absolute and relative N2 efflux, than CAN samples. Despite its limited scope, this study thus provides valuable insights into short-term N2 and N2O emissions after FR and CAN fertilization for a range of 5 study sites representing the full range of precipitation-frost classes in Germany (Jungkunst et al. 2006).