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Co-denitrification an important process in urine amended grassland soil

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Grazed grassland livestock systems are often associated with considerable losses of reactive forms of nitrogen (N) to the environment such as nitrate leaching, ammonia and nitrous oxide (N2O) emissions. Previous research has focused on losses to air and water due to the health, economic and environmental impacts of reactive N. Di-nitrogen (N2) emissions from soils are still poorly characterized, both in terms of the processes involved and their magnitude, due to methodological constraints. There have been relatively few studies on N2 losses in vivo and even fewer have examined the relative contribution of the different N2 emission pathways. Cow urine was amended with 98 atom% 15N-labelled urea resulting in a urine N concentration of 10 g N L-1 and a 15N enrichment of 45 atom% excess. Two litres of urine was applied to replicated monolith lysimeters at a rate of 100 g N m-2 and N2 and N2O emissions were measured over 123 days using the static chamber technique. Headspace N2 and N2O samples were analyzed for 15N by isotope ratio mass spectrometry in the UC Davis Stable Isotope Facility. Contributions of true denitrification and co-denitrification to N2 emissions were calculated using the 15N flux method. The study found that N2 emissions accounted for 95% of gaseous N loss, with 55.8 g N m-2 emitted as N2 by the process of co-denitrification, compared to only 1.1 g N m-2 from conventional denitrification. This study highlights the large N2 fluxes and the importance of co-denitrification in contributing to N dynamics in urine amended grassland soil.

Reference
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