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The effect of urea fertiliser formulations on gross nitrogen transformations in a permanent grassland soil.

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Introduction

By 2050, the current food production rate will need to increase by 70 % in order to meet the needs of the projected world population (FAO, 2014). Under the climate change response bill, Ireland has a target to reduce GHG emissions by 20% by 2020. Agriculture was responsible for almost one third of Ireland's overall Greenhouse Gas (GHG) emissions in 2012, with 39% of these emissions arising from chemical/organic fertilisers in the form of nitrous oxide (N_2O). N_2O losses represent environmental damage through ozone depletion and global warming as well as acidification, eutrophication, surface and groundwater contamination and it also represents financial loss to the farmer (Cameron 2013). The contradictory aims of increasing food production while reducing GHG emissions will require an adjustment to the current system of agricultural production. As part of a larger study evaluating the switching of nitrogen (N) fertiliser formulation to minimise N_2O emissions, (from calcium ammonium nitrate (CAN) to urea based formulations), this experiment examined the effect of urea based fertiliser formulations on gross N transformations in a permanent pasture soil at Hillsborough, Co. Down, Northern Ireland.

Study Design/Methodology

A laboratory incubation study was undertaken, to examine the effect of urea in various combinations with two types of inhibitors on soil N dynamics and N_2O and N_2 emissions. The inhibitors examined were the urease inhibitor N-(butyl) thiophosphoric triamide (nBTPT) and the nitrification inhibitor dicyandiamide (DCD). The fertiliser products were labelled with ^{15}N and the soil was incubated at 15 ˚C at a water filled pore space of 65%. Soil mineral N (urea, NH_4^+, NO_2^- and NO_3^-) concentrations, gaseous losses (N_2O and N_2) and the ^{15}N enrichments of NH_4^+, NO_2^-, NO_3^-, N_2O and N_2were analysed on 8 separate occasions over 25 days. An adapted numerical ^{15}N tracing model (Müller et al., 2007) was used to quantify the effect of the inhibitors on soil gross N transformation rates and N_2O and N_2 emissions and the findings will be presented.

Reference

C. Müller, T. Rütting, J. Kattage, R.J. Laughlin & R.J. Stevens (2007). Estimation of parameters in complex 15N tracing by Monte Carlo sampling. *Soil Biology and Biochemistry* **39**, 715-726.