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Nitrogen fertiliser formulation: The impact on N2O emissions

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Agriculture was responsible for 31% of Ireland's Agricultural Greenhouse Gas (GHG) emissions in 2012, with 39% of these emissions arising from chemical/organic fertilizers in the form of nitrous oxide (N2O). Switching from calcium ammonium nitrate (CAN) to a urea based fertiliser limits the soil residence period of nitrate, the major substrate for denitrification loss in the N2O form. However, urea is susceptible to ammonia (NH3) volatilisation but this risk can be managed using urease inhibitors. The aim of this study was to evaluate the effect of switching from CAN to urea, urea with the urease inhibitor N- (n-butyl) thiophosphoric triamide (trade name Agrotain®) and/or the nitrification inhibitor dicyandiamide (DCD on direct and indirect N2O emissions.

The experiment is a two year study (commenced March 2013) at six permanent pasture sites located on the island of Ireland, at Johnstown Castle Co. Wexford, Moorepark Co. Cork and Hillsborough Co. Down, covering a range of soil textures and drainage characteristics. The experiment simulated a grazing environment; annual fertiliser N was applied at different rates (0, 100, 200, 300, 400 or 500 kg N ha-1) in five equal splits, with grass harvested prior to fertilizer application. Direct N2O emissions were quantified regularly using static chambers over 1 year and indirect N2O from ammonia volatilisation was measured using wind tunnels and annual emission factors calculated.

Switching from CAN to urea dramatically reduced direct N2O emissions, but had little effect on dry-matter yield. However, there was evidence of pollution swapping of direct for indirect N2O from NH3. In the first year, two urea based formulations successfully reduced both direct and indirect N2O emissions at all sites. Fertiliser formulation strategy has the potential to be a solution for reduction of direct and indirect N2O emissions.