



## Improving nitrous oxide emission estimates from cattle excreta

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Nitrous oxide emission factors from grazing cattle excreta were, on average, lower than the IPCC default. Magnitude of emissions were strongly affected by environmental and soil conditions, but not by manipulation of urine composition. Cattle excreta deposited at pasture are a large source of a potent greenhouse gas, nitrous oxide (N<sub>2</sub>O). Currently, Ireland uses the IPCC default emission factor (EF) of 2% to estimate excreta-derived N<sub>2</sub>O however there is a large uncertainty around this figure. The aims of this study were to (1) quantify N<sub>2</sub>O emissions and EFs from excreta deposited to pasture by grazing animals, (2) assess impact of environmental drivers on emissions and potential of using soil-specific manipulation of grazing timing as a N<sub>2</sub>O mitigation tool and (3) assess potential mitigation of N<sub>2</sub>O emissions from urine patches by manipulating urine composition.

Two experiments were conducted. In the first experiment which was a randomised split-plot design with five replicates real ruminant urine and dung were applied to three pasture soils in spring, summer and autumn. Nitrous oxide was measured with a manual static chamber method for 365 days following treatment application. In the second experiment which was a randomised block design with six replicates urine with incremental additions of minor constituents hippuric acid (HA) and/or benzoic acid (BA) was applied to pasture and N<sub>2</sub>O measured using the same method for 66 days.

The average N<sub>2</sub>O emission factor was 0.31% and 1.18% for cattle dung and urine, respectively. N<sub>2</sub>O loss was driven by rainfall, temperature and soil moisture, with highest N<sub>2</sub>O EFs during late grazing and from the imperfectly-drained soil. However, manipulation of ruminant urine by adding HA and/or BA was found to have no effect on N<sub>2</sub>O.

The N<sub>2</sub>O EFs found in this study were lower than the current default values used in Ireland. Adopting these new, country-specific EFs will lead to reduction in N<sub>2</sub>O inventory. Manipulation of minor constituents in urine composition had no effect on N<sub>2</sub>O however other urine manipulations might prove successful.