ABSTRACT

QUANTIFICATION OF N_2O FLUXES FROM IRISH GRASSLANDS

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Nitrous oxide (N_2O) emissions from grazed grasslands constitute approximately 28% of global anthropogenic N_2O emissions. Estimating the N_2O flux from soils is difficult because of the complex interplay of soils, vegetation, N fertilizer input regime and climate. The aim of this study was to investigate the influence of environmental and soil variables controlling the N_2O emissions from grassland. Nitrous oxide emissions were measured using static chambers from eight different grasslands in South-Western Ireland on a weekly basis from Sep 2007 – Aug 2009. The soil types ranged from free draining brown podzolic to impeded drainage gley soils. The climate was temperate with abundant rainfall throughout the year and an annual rain of 1200 to 1600 mm. The N_2O fluxes were found to be episodic in nature with pulses throughout the year and high pulses in summer. The instantaneous N_2O flux values ranged from -186 to 885.6 µg N_2O -N m^{-2} hr^{-1}; the daily values ranged from -3.56 to 11.11 mg N_2O -N m^{-2} d^{-1}; and the annual sum ranged from 2 – 12.40 kg N_2O -N ha^{-1} yr^{-1}. Pulses of N_2O fluxes were associated with fertilizer application times, grazing periods, and rainfall events. The sites with higher fluxes were associated with intensive management while the lower fluxes were associated with the extensively managed sites. An exponential relation was found between the annual N_2O flux and total N – input. Below an application N rate of 300 kg ha^{-1} yr^{-1}, the N_2O flux was constant (with a different constant on each site). Above 300 kg N ha^{-1} yr^{-1}, the N_2O flux increased exponentially. The soil temperature range of 6 ^oC – 15 ^oC influenced N_2O fluxes. The N_2O flux at 15 ^oC was five times higher than at 6 ^oC. Similarly, N_2O emissions increased with increasing water filled pore spaces (WFPS) with maximum N_2O emissions at 60 to 80 WFPS %.