Feeding Strategies for the Mitigation of Soil Nitrous Oxide Emissions Using Alfalfa Under Grazing & Feedlot Production Systems

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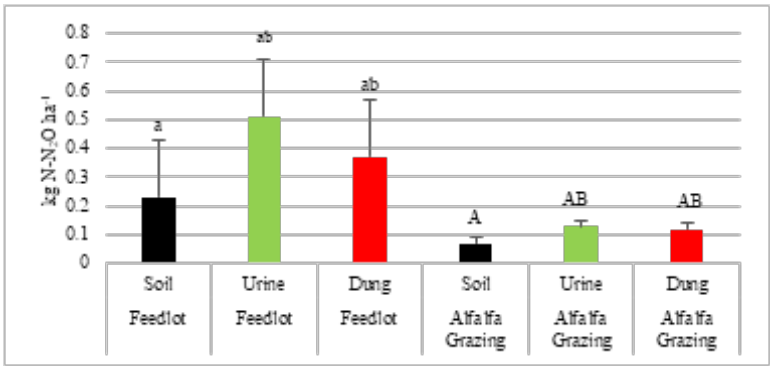
Introduction: In the last years, the agriculturization process occurred in the Argentinian Pampas Region has generated deep changes in livestock production in terms of intensification from grazing to feedlots, with the modification of animal diets. As a consequence, greenhouse gas emissions from animal excretions might have changed. There is a few local information in reference to factors that contribute to soil N_2O emissions. The goal of this work was to study how dietary changes in two contrasting livestock production systems schemes (alfalfa grazing and feedlot) affect soil N_2O emissions – due to urine and dung depositions – and to understand the edaphic and biological factors determinants of these emissions during the spring season.

Method and Materials: throughout the spring season of 2020, emissions were monitored daily with static chambers deployed on fresh urine and dung patches during the first week after deposition; sampling frequency was gradually reduced until the end of the experiment (46 days after applications). The evaluations were made in two different cattle management systems on an Entic Haplustoll: a) grazing pure alfalfa pasture and b) feedlot (corn silage). Water-filled soil pore space (WFPS) was monitored during the gas sampling period.

Results: Low rainfall during the measured period leads to soil moisture levels under 60% WFPS. In consequence, low N_2O emissions were observed and could be attributed to nitrification rather than denitrification given the more aerobic condition in the soil. A few peaks of N_2O that were observed seemed to be related to previous precipitation events or the existing moisture of fresh excreta. There was a trend in N_2O emissions due to the type of production system, being higher in excreta from cattle in feedlot than in alfalfa pasture. The total N_2O emissions did not differ between urine and dung, but those from the areas with excreta were higher than the soil area without excreta (control treatment). The cumulative N_2O emissions from excreta of cattle in alfalfa pasture were lower than those in feedlot.

Conclusions: Livestock intensification using feedlot can bring about negative environmental effects due to higher N_2O emissions compared to grazing pastures.

Figure 1. Cumulate N_2O emissions from urine or dung patches from cattle grazing alfalfa pasture or in feedlot production systems.



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