RESEARCH FACTS

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Livestock and Forage Centre of Excellence
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IN PROGRESS

Quantifying greenhouse gas emissions from beef cattle urine and dung in grazed pasture sod-seeded with non-bloat legumes

PROJECT TITLE

Quantifying greenhouse gas emissions from beef cattle urine and dung in grazed pasture sod-seeded with non-bloat legumes

In progress:

*Results expected in June 2021**

RESEARCHERS

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*Given the restrictions surrounding the pandemic, the resesarchers expect to receive a nine- to 12-month extension.

Background:

Providing nutritionally balanced, highly digestible feed is essential to reducing methane (CH_4) production by ruminants. Alfalfa is a very nutritious legume, though it is of limited use in grazing pasture systems because of its propensity to cause bloat. Sod-seeding pastures with non-bloat legumes represents an innovative approach to improving cattle nutrition and pasture quality while reducing the overall carbon footprint of grazed pastures. However, one aspect of the grazing system that remains uncertain is the fate of nitrogen (N) from urine and dung in these pastures. Cattle excrement (urine and dung) contains N that acts as a substrate for nitrification and denitrification and, hence, as a source of nitrous oxide (N_2O) in grazed pastures. Current national inventory estimates of urine- and dung-derived emissions are based on a single, unpublished study. Aside from this, only one other study has measured N_2O emissions from urine and dung in western Canada (Thomas et al., 2017) and there have been no similar studies in Saskatchewan and certainly none that examined the impact of a change in plant composition and, hence, diet on N_2O emissions.

In general, the magnitude of N_2O emissions from urine and dung patches is related to the N concentration in the excreta, which in turn is related to the animals' diet. Thus, N_2O emissions from the urine and dung patches will likely be impacted by

the species composition of the pastures, especially the non-bloat legumes. In general, sampling schemes intended to capture the influence of multiple small urine/dung patches within a pasture involve intensively sampling a sub-set of the urine/dung patches (taking into account the inherent spatial variability of the soils) and mapping the distribution of these patches within the pasture. These two measurements are combined to obtain an integrated estimate of the "total" N_2O-N emissions. Studies with this level of detail are exceedingly rare—especially for Saskatchewan and the semi-arid prairies in general. Thus, by intensively measuring individual urine and feces patches and documenting the pasture landscape and the excretion patterns of cattle on this landscape, we will be able to provide estimates of the impact of the excreta on the overall GHG footprint of grazed pasture systems that incorporate different mixtures of non-bloat legumes.

Objectives:

- Obtain accurate estimates of N_2O-N losses from beef cattle urine and dung in grazed pastures
- Develop Saskatchewan-based emission factors for N_2O-N losses from grazed pastures

What They Will Do:

To capture the influence of multiple small urine/dung patches within a pasture, we are intensively sampling a sub-set of urine/dung patches (taking into account the inherent spatial variability of the soils) and mapping the distribution of these patches within the pasture. When we combine these two measurements, we will obtain an integrated estimate of the "total" N_2O-N emissions.

Implications:

In general, the magnitude of N_2O emissions from urine and dung patches is related to the N concentration in the excreta, which in turn is related to the animals' diet. Thus, N_2O emissions from the urine and dung patches will likely be impacted by the species composition of the pastures, especially the non-bloat legumes. By intensively measuring individual urine and feces patches and documenting the pasture landscape and the excretion patterns of cattle on this landscape, we will be able to provide estimates of the impact of the excreta on the overall GHG footprint of grazed pasture systems that incorporate different mixtures of non-bloat legumes. As such, this study addresses the gaps identified in the national greenhouse gas inventory (Environment and Climate Change Canada, 2017) and the need to develop a region-specific emission factor for grazed pasture systems in western Canada.

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