RESEARCH FACTS

UNIVERSITY OF SASKATCHEWAN
Livestock and Forage Centre of Excellence
LFCE.USASK.CA

IN PROGRESS

Precision management of cattle manure

PROJECT TITLE

Precision cattle manure management for agronomic and environmental benefit at the Livestock and Forage Centre of Excellence (Clavet)

In progress:

Results expected in March 2023

RESEARCHERS

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Background:

The means to achieve maximum benefits from feedlot cattle manure applied to cropland as a source of plant nutrients and organic matter while minimizing impacts on water and air is addressed through precision manure management research conducted on Section 21 at the Livestock and Forage Centre of Excellence (Clavet), University of Saskatchewan.

Objective:

To evaluate the agronomic and environmental performance of cattle manure applications made at constant and variable rates across watersheds.

What They Will Do:

The research began in 2018 to establish background soil and water nutrient levels, to conduct site preparation and to install monitoring devices on Section 21 near the new Beef Cattle Research and Teaching Unit. The field research with manure is being conducted in the field from 2019 to 2022, using three watersheds in each of three management zones. The silage barley crop grown in all three zones is being managed using agronomic practices typical of the area and normally employed by the

university's Department of Animal and Poultry Science on the land it owns and operates.

The treatments in the three management zones are:

1. Constant rate (traditional) land application of manure at the rate of 60 tonne per hectare every second year across the entire watershed area.

2. Precision (variable) rate of application of manure across the watershed area. Variable rate application will be made using capabilities provided by a GPS-linked manure spreader with variable rate application capability and the prescription developed based on detailed soil and landscape assessment and available remote sensing data. The variable rate application will be made according to management zones within the watershed identified primarily by soil measurements (properties, nutrient amounts and supply rates), by landscape (elevation, surface curvature maps), and by remote sensing tools where available (aerial imagery, reflectance, yield maps), as well as by distance from water body. Variable rate application will vary 50 per cent below and 50 per cent above the constant rate application. Approximately the same total amount of manure is applied to the landscape as the constant rate treatment.

3. No manure application and crop grown with commercial fertilizers under normal practice as required and recommended.

Variable and constant rate manure application treatments at the rate of ~60 tonnes per hactare (wet basis) is being applied every second year, as this rate was shown in a study in east-central Saskatchewan to maximize yield in a similar rotation (Landry et al. 2011). It is being applied as broadcast followed by incorporation.

Implications:

Preliminary findings as of spring 2020

Fresh cattle manure applied provides sufficient phosphorus (P) but not enough available nitrogen (N) in the year of application for silage barley due to high carbon to nitrogen (C:N) ratio of manure. Manured fields can benefit from addition of supplemental fertilizer N in first couple of years but do not require fertilizer P in order to provide a yield similar to commercial fertilizer only fields.

Over timeas available N levels increase from mineralization of manure organic N, supplemental fertilizer N may be reduced or eliminated. Reducing or eliminating cattle manure application in the identified high productivity, fertility lower slope regions of the landscape and in the catchment basin centers was found to increase overall efficiency of nutrient use, reducing nutrient accumulation in regions of the landscape where it is susceptible to loss.

Precision manure application with variable rate according to long-term productivity and soil assessments (reduce rate on high productivity, maintain or increase rate on low productivity and do not apply in basin centers or sloughs) appears to have agronomic and environmental benefits. Precision manure application appears to be an effective approach to reducing greenhouse gas emissions in the landscape and nutrient concentrations in run-off water. No hormones that were tested for so far that could originate from the feedlot could be identified in the manure from the feedlot or in soils receiving the feedlot manure.

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