BCRC
BEEF CATTLE RESEARCH COUNCIL
RESEARCH FACTS
RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY
Beef Science Cluster

Rate of Nitrogen and Phosphorous Release in Soil with Manure from Animals Fed Ethanol By-Products

Project Title:	Project Code:	FDE 04.09
Rate of N and P nutrients release in soil amended with DDGS manure and compost	Completed:	*2013*

Researchers:

Dr. Xiying Hao (AAFC, Lethbridge) xiying.hao@agr.gc.ca

Published:

- Nitrogen transformations and greenhouse gas emissions during composting of manure from cattle fed diets containing corn dried distillers grains with solubles and condensed tannins; Animal Feed Science and Technology 166-167

Background:

Beef cattle manure has long been applied to cropland to increase soil fertility and crop yields. Manure from conventionally-fed cattle provides a long-term source of nutrients and can influence soil properties such as increasing soil carbon (C) and nitrogen (N), change soil P, and soil available phosphorus (P) and potassium (K) concentrations.

Dried distillers' grains with soluables (DDGS) are being added more frequently to cattle diets. Manure from cattle fed DDGS is known to have higher nutrient content than cattle fed traditional diets, but it is not known how this plays a role in soil quality and plant nutrition.

Objectives:

To compare the effects of adding fresh and composted manure from cattle fed wheat-based DDGS and corn-based DDGS on biomass and nutrient uptake by canola and residual soil nutrients.

What they did:

The effect of four types of manure on canola biomass yield, canola N, P, K, and S concentration, soil available N, P, K, S, Cu, Zn, and the recovery of added manure N was determined. Manure came from cattle fed diets containing wheat DDGS or corn DDGS and was either fresh or composted. Four rates of manure (60, 120, 180, and 240 tonnes/hectare) were applied to two contrasting Saskatchewan soils (Brown and Black Chernozems) in controlled environment conditions, and canola was grown over a five-week period.

What they learned:

The wheat-based DDGS fresh manure produced the highest biomass yield and resulted in the highest N recovery compared to all other manures in this study.

Compared to fresh manure, the composted cattle manure contained higher concentrations of N and P. The increased concentration of salts in the wheat DDGS-fed composted manure was likely due to the fact that the longer the plant material was composted the less plant material was available therefore concentrating the nutrients in the manure. When the wheat DDGS-fed composted manure was applied, it resulted in a greater accumulation of nutrients in plant material and soil than the other sources. Researchers also saw toxicity to canola at higher application rates (90 and 120 t/ha). The toxic effects at high rates appeared to be more pronounced in the Black soil compared to the Brown soil. The N in wheat DDGS manures in general was recovered by canola to a greater extent compared to the corn DDGS manures.

Composted treatments resulted in higher soil residual P levels compared to the fresh manure treatments. The increased P in the composted manures has the potential for P loading in soil and would require reduced rates to avoid excessive build-up of PO_4-P in the soil.

The Black soil and Brown soil responded in a similar manner to the addition of the different manures under controlled environment conditions. Out of the four DDGS-fed manures studied, the wheat-based DDGS fresh manure at 180 t/ha on the Brown soil and the wheat-based DDGS fresh manure at 240 t/ha on the Black soil resulted in the highest biomass yield, favourable N recovery, and low toxic effects.

What it means:

Application of DDGS-fed cattle manure to two Saskatchewan soils resulted in significant increases in canola yield and N and P uptake. Composting, through its effect on reducing water content and concentrating the nutrients, resulted in greater canola growth enhancement than fresh manure at lower rates of manure application (e.g. 60 t/ha), but resulted in toxicity effects at the high rates (e.g. 240 t/ha).

The toxicity effect was especially evident for the composted DDGS wheat-fed manure treatments. The increased nutrients in the composted treatments will affect the optimum rates of manure application. To avoid toxicity and overloading of the soil with P, composted DDGS wheat-fed cattle manure should be applied at lower rates compared to the fresh manure. Phosphorus-based applications of manure would better match crop demand than N-based manure applications.

In each case it is recommended that the manure be sampled and analyzed to take into consideration the large variation in manure nutrient properties that can arise based on different feed and bedding sources.

Proudly Funded By:

Canadian Beef Cattle Check-off

BCRC Beef Cattle Research Council

Agriculture and Agri-Food Canada
Growing Forward | Cultivons l'avenir