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Hog Manure as a Fertilizer in the Gray Soil Zone

Background

Research in the Brown, Dark Brown, and Black soil zones of Saskatchewan has shown that swine manure is an excellent, sustainable source of fertilizing annual crops. However, no research has been conducted in the low organic matter Gray soil zone to determine the effectiveness of swine manure as a fertilizer under those soil conditions.

PAMI Manure Injection Truck at work.

The Project

PAMI, the Department of Soil Science at the University of Saskatchewan, and Agriculture and Agri-Food Canada jointly conducted the project on annual cropland on Gray soils at Loon Lake and Melfort, Saskatchewan.

Liquid swine manure was applied to the sites in fall 1999, 2000 and 2001 using the PAMI manure injection truck. The truck tool bar was equipped with modified Bourgault low disturbance disc coulters (Figure 1) at a row space of 12 inches (30 cm). Target coulter depth was 4.5 inches (11.3 cm). Application rates were 3,000, 6,000 and 9,000 gpa (33,900, 67,800, 101,700 L/ha) to provide approximately 75, 135 and 200 lb/ac (84, 151, and 224 kg/ha) of *available nitrogen (N)**.

The 3,000 gpa (33,900 L/ha) treatment was applied annually; 6,000 gpa (67,800 L/ha) applied every second year; and 9,000 gpa (101,700 L/ha) applied in the first year only (Table 1). The intent of the 6,000 gpa (67,800 L/ha) rate was to supply crop nutrients for 2 years and the 9,000 gpa (101,700 L/ha) rate was to supply nutrients for 3 years. Commercial nitrogen fertilizer was used to compare crop performance with swine manure.

At a Glance

Annual applications of liquid swine manure rates of about 3,000 Imperial gallons/acre (gpa) (33,900 L/ha) or about 90 lb/ac (100 kg/ha) *total N** produced good annual crop yields with no evidence of soil nutrient buildup or leaching.

Larger single applications intended to last two or three years were not effective in producing crop responses beyond the first year. Extra sulfur fertilizer may be needed in Gray soils as swine manure contains very little sulfur.

**Note: In liquid swine manure, recent research has found that approximately 75% of the "total N" is available in year 1 and the balance will be slow released over time. Therefore, the term "available N" refers to the N used in year 1.*

Figure 1. Bourgault Low-disturbance Disc Coulter.

Table 1. Application Schedule.

	Year 1 (2000)	Year 2 (2001)	Year 3 (2002)
Urea	x	x	x
Swine Manure			
3,000 gpa	x	x	x
6,000 gpa	x	--	x
9,000 gpa	x	--	--

Results

In 2000 at Melfort, the addition of swine manure increased wheat yield from 16.3 bu/ac (1,095 kg/ha) in the check to 28.9 bu/ac (1,944 kg/ha) at 3,000 gpa (33,900 L/ha), 35.7 bu/ac at 6,000 gpa (67,800 L/ha) to 39.7 bu/ac (2,670 kg/ha) at 9,000 gpa (101,700 L/ha). Urea produced similar yield response to swine manure at equivalent rates.

At Loon Lake in 2000, the addition of swine manure more than doubled canola yield and more than quadrupled barley yields compared to the check. Pea yield was not affected by the addition of swine manure due to the pea's ability to fix nitrogen.

In Spring 2001, the Melfort site was seeded to canola. The year 2 application of 3,000 gpa (33,900 L/ha) produced the highest yield (36 bu/ac) compared to 21 bu/ac (2,106 kg/ha) for the check. Canola yields from the plots with 6,000 and 9,000 gpa (67,800 and 101,700 L/ha) injection rates in year one were similar to the check, so there was no evidence of nitrogen carryover affecting yield. Severe symptoms of sulfur deficiency affected yields in the 6,000 and 9,000 gpa (67,800 and 101,700 L/ha) single application plots.

At the Loon Lake site, in 2001 yields were low due to drought. Similar to the previous year, peas showed little yield response to manure. Barley responded to the addition of the year 2, 3,000 gpa (33,900 L/ha) swine manure with a yield increase of 20.5 bu/ac (1,100 kg/ha) over the check. There was no residual effect on barley and flax crop yields in 2001 due to swine manure applications of 6,000 and 9,000 gpa (67,800 and 101,700 L/ha) in the previous year.

Oat yield at Melfort in 2002 was increased by both swine manure and urea. However, higher manure application rates did not increase yields above the 3,000 gpa (33,900 L/ha) application rate likely due to drought stress at that site.

Severe drought at Loon Lake resulted in complete crop failure in 2002.

Conclusions

Annual application of swine manure at rates of 3,000 gpa (33,900 L/ha) produced good yield responses on gray soils at Melfort and Loon Lake with no evidence of nutrient buildup or leaching. Single large applications intended to last two or three years did not increase yield in the second or third year following application. Additional sulfur fertilizer may be required to supplement the low levels of sulfur found in swine manure.

A detailed PAMI technical report (5099G) on this topic is available. A shipping and handling charge will apply.

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