

Post-emergent Swine Manure Injection on Cereal Crops: Agronomic and Economic Results

With increased hog production in Western Canada, manure is becoming a valuable fertilizer source to farms that are near hog operations. Research has indicated that swine manure is an excellent source of nutrients including nitrogen (N), phosphorus (P) and a number of other nutrients. Most swine manure is applied to annual cropland in the fall or spring of each year. However, there may be a benefit to both the hog producer and grain farmer to extend the application season to include low-disturbance manure injection at the post-emergent crop stage.



Test site 1, August 2000, first year of testing.

Post-emergent swine manure injection has the potential to increase grain protein by providing supplemental N to the crop prior to and during seed formation. If grain protein can be increased without crop damage there is potential to increase economic returns to the grain producer.

The objective of the project was to determine the protein, yield, and economic effects of low-disturbance, post-emergent swine manure injection of wheat.

At a Glance

- Post-emergent, low-disturbance injection of swine manure on wheat was an effective and economic means of boosting grain protein.
- Grain yield increased in 2 of 4 years due to manure injection but there was no yield response in the other two drier years.
- Late manure application, after the wheat was past the 3-leaf stage, resulted in potential yield loss due to coulters injection and wheel track damage.



Harvesting at one of the post-emergent injection test sites.

The Project

The project was done in the black soil zone, at two sites in 2000, 2001, and 2002 and at one site in 2003. Plots were selected on land without a recent history of manure application. Except for one site (on fallow), all manure treatments were applied to stubble wheat crops that had received the farmer's normal fertilizer application. New sites were selected each year as the manure application was intended to affect the crop only in the year of application.

The PAMI manure truck equipped with Bourgault low-disturbance manure injection coulters at 12-inch (30 cm) row space was used to apply the manure (Figure 1).



Figure 1. PAMI manure truck with coulters injectors.

Coulter injection depths were set as shallow as possible to minimize crop damage while preventing manure pooling on the soil surface (Figure 2).



Figure 2. Soil disturbance from coulters.

Manure treatments were injected at 1000, 2000 and 3000 Imperial gallons/acre (gpa) (11 233, 22 647, and 33 700 l/ha) at target application dates of June 1 (early), June 15 (mid), and June 30 (late). A check with no disturbance and disturbed (coulters in the soil with no manure applied) were used to compare the manure treatments. The three application rates provided approximately 23, 45, and 68 lb/ac (26, 50, and 76 kg/ha) available N (for explanation of available N, see "Swine Manure Facts" on page 3) to the growing crop.

Plots were harvested with a small plot combine to determine grain yield. Grain samples from each plot were analyzed for protein content.

The Results

Wheat plots that received swine manure as a post-emergent injection produced significantly higher protein compared to the undisturbed check (Figure 3).

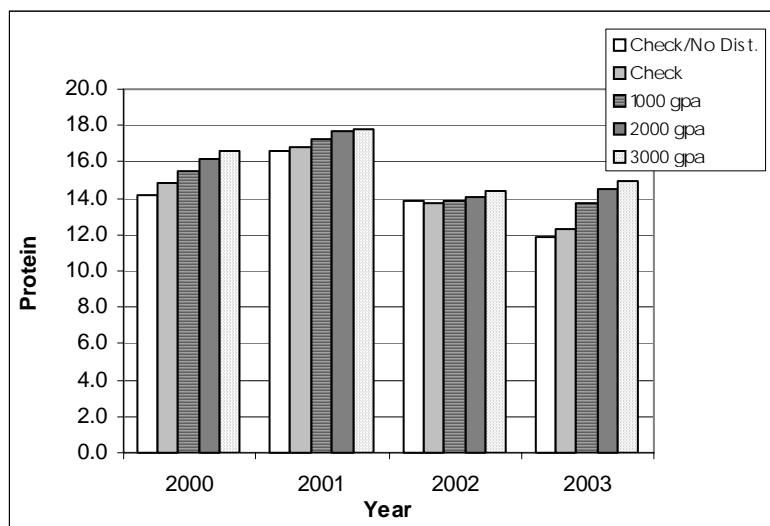


Figure 3. Effect of post-emergent manure injection on wheat protein.

Protein levels generally increased linearly with the rate of manure application averaging increases of about 0.8, 1.2, and 1.5 percentage points higher than the undisturbed check at manure application rates of 1000, 2000, and 3000 gpa (11 233, 22 674, and 33 700 l/ha). Timing of application (early, mid, or late) had little effect on wheat protein content.

Grain Yield

Yields varied greatly over the 4 years of testing, due mainly to differences in spring soil water and growing season rainfall (**Figure 4**).

In 2000 and 2003, injection of swine manure significantly increased wheat yields. In contrast, there was no increase in yield from manure application in 2001 and 2002. The unusually high yield from the check compared to the manure treatments in 2001 was likely due to crop damage from injection. Overall yield effects of post-emergent swine manure injecting are highly variable and depend on growing conditions at the time of and following injection.

Although not measured in this project, wheel track damage from late manure injection was observed (**Figure 5 and 6**).



Figure 5. Wheel track damage at time of post-emergent application.



Figure 6. Wheel track damage as crop starts to mature.

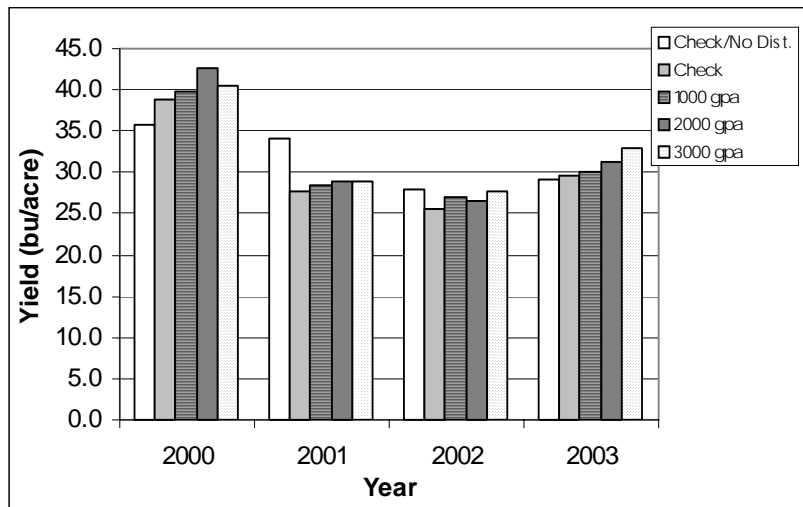


Figure 4. Wheat yield, 2000 - 2003.

Liquid Swine Manure

- is approximately 96% liquid and 4% solids.
- is a dilute source of crop nutrients that *typically* contains the following:
 - N = 30 lb/1,000 gallons*
 - P = 9 lb/1,000 gallons or 21 lb P₂O₅
 - K = 10 lb/1,000 gallons
 - S = 4 lb/1,000 gallons

**Note: In liquid swine manure, approximately 75% of the "total N" is plant available in year 1 and the balance will be slow released over time.*

Economics

Protein premiums for wheat were not paid above 15.5% in 2001, 2002, and 2003, and no premium paid for protein levels above 15% in 2000. As the protein levels from post-emergent swine manure application were often above these levels, the wheat would have to be blended with lower protein wheat for the producer to obtain maximum economic benefits. When the economic benefits from manure application were calculated, including the value of the protein premium from blending, most treatments had positive returns (**Figure 7**).

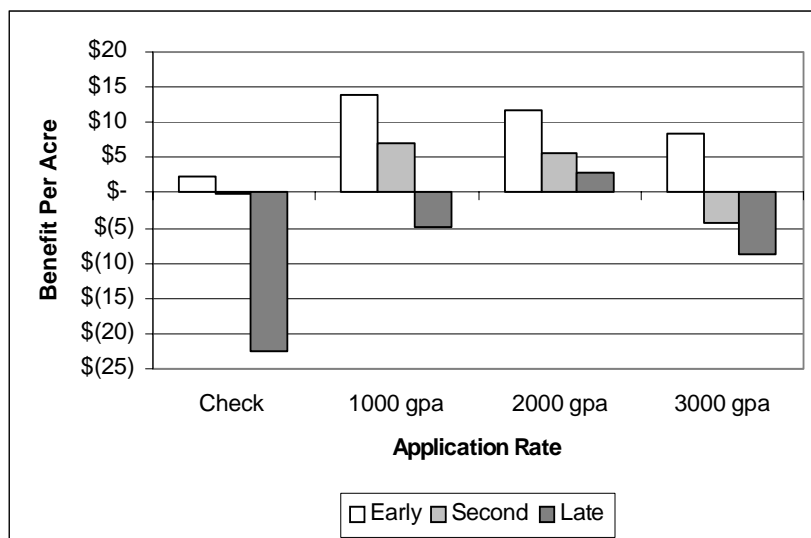


Figure 7. Economic benefits of post-emergent manure application including protein blending 2000 - 2003.

Conclusions

Post-emergent manure injection is an economically and agronomically effective means of boosting protein and will also increase grain yield in years of adequate rainfall and growing conditions. Late manure injection dates resulted in wheel track crop damage, which may offset the benefits of manure application. In dry years, post-emergent manure injection may cause crop damage resulting in yield and economic losses.

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