
In-Crop Application of Liquid Hog Manure for Irrigated Potatoes

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Introduction

There is an interest in the use of liquid swine manure as a supplement to commercial fertilizer in irrigated potato production. Application of swine manure to a potato crop affords distinct advantages to both the hog and potato producer. Potato, unlike small grain crops, is a high value crop that has a high nutrient requirement to ensure maximum production.

In-crop manure injection

In-crop injection of swine manure prior to crop canopy closure offers a new opportunity for efficient manure disposal. Synchronization of manure application at a stage of crop development when fertilizer requirements are nearing their maximum would improve fertilizer use efficiency, and have the greatest yield benefit. By eliminating the time-delay between application and crop use, losses of nitrate-N through surface run-off, leaching or gaseous losses are minimized, reducing the threat of surface and ground water contamination. In addition, application near complete canopy closure should confine a greater proportion of the odour to within the canopy. Fall manure application raises serious concerns about odour production, and volatile and leaching losses of N. Nitrate leaching could be particularly serious on the light-textured soils that are ideal for potato production. There are, as yet, no adequately explored alternatives to fall swine manure application on potato soils.

Objective

The objective of this investigation was to determine the effect of in-crop injection of liquid swine manure on potato yield and quality.

Materials And Methods

Field studies were conducted at two locations in western Manitoba, on a fine sandy loam and a clay loam soil. Liquid hog manure was applied to Shepody potatoes at three rates, using a custom

liquid manure injector with a 260 mm wide sweep. Plot size was 3.3 m X 10 m. Plots were sown using a six-row commercial potato planter with a between-row spacing of 0.95 m and an in-row spacing of 0.38 m.

Important dates:

Planting: June 2

Hilling dates: July 7
July 19

Manure application : July 12

Harvest: September 22

Treatments: A combination of liquid swine manure and commercial fertilizer was applied to achieve a final N-rate of 200 kg ha⁻¹ by canopy closure (Table 1).

Table 1. Nitrogen Contributions from Fertilizer and Manure to Achieve Required N Rates.

Treatment No.	At planting	In-crop		Total N applied (kg ha ⁻¹)
	Fertilizer	Fertilizer	Manure	
1.	200	0	0	200
2.	150	0	50	200
3.	100	0	100	200
4.	50	0	150	200
5.	0	0	200	200
6.	0	200	0	200
7.	100	100	0	200

Results

Total yield

Manure injection had a negligible effect on total tuber yield on both clay-loam and sandy soils (Figure 1).

Tuber Yield by Size Class

Treatment effects on tuber mass tended to mirror effects on tuber number in the < 2-inch (smalls) and 10 oz - 2-inch (main) size classes (Figures 2 - 5). This suggests that treatment effects were mainly due to effects on tuber number.

Yields of tubers in the small (< 2 inch) and main (10 oz., 2 inch) size classes responded similarly to manure and fertilizer treatments (Figures 2 - 5). Lowest yields were observed on either side of the 100 - 150 kg ha⁻¹ in-crop manure or fertilizer treatments. This was probably not strictly related

to a specific manure effect because the pattern of yield response was similar for both manure and fertilizer treatments.

For bonus tubers (> 2 inch), tuber number followed a pattern similar to that of the smaller size classes, but tuber mass was not affected by treatment. This would suggest tuber bulking compensated for fewer tubers in this size class.

The pattern of treatment response was similar on both clay-loam and sandy soils, but was more pronounced on the clay-loam (Figures 4 & 5).

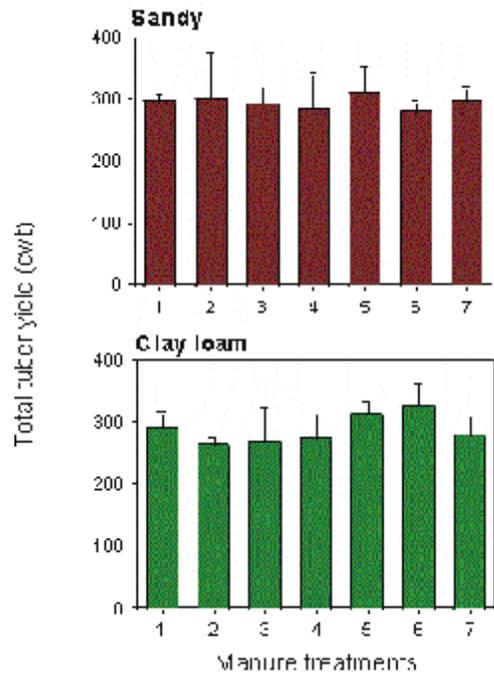


Figure 1. Effect of in-crop manure injection on total potato yield on a clay loam and a sandy soil.

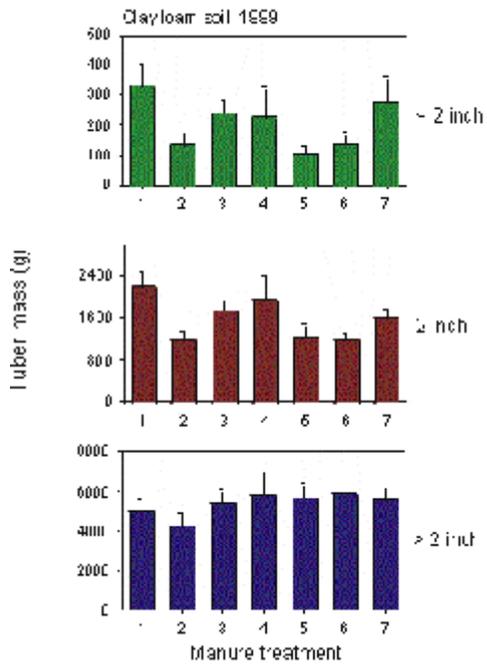


Figure 2. Tuber mass on a clay loam soil.

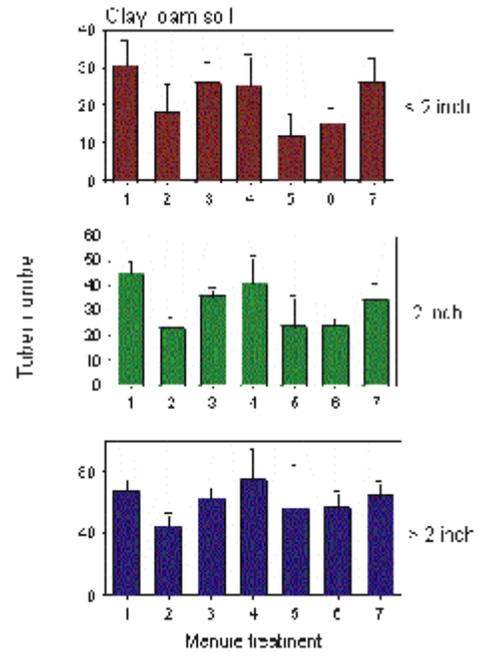


Figure 3. Tuber number on a clay loam soil.

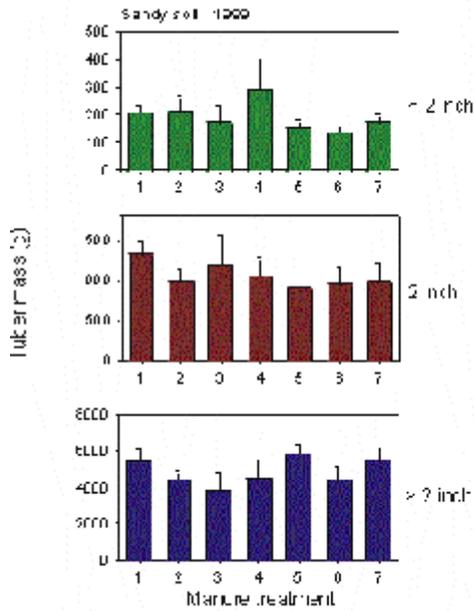


Figure 4. Tuber mass on a sandy soil.

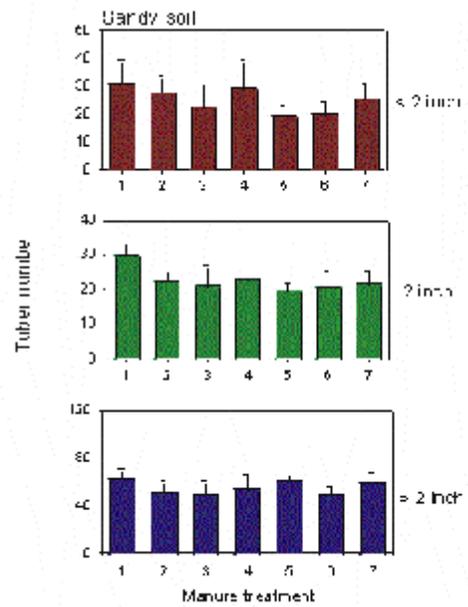


Figure 5. Tuber number on a sandy soil.

Leaf petiole N

Leaf petiole N levels on clay loam soils were not affected by manure application method (data not presented). On sandy soil, in-crop manure application reduced petiole N compared to controls (Figure 6). Tuber yield response to manure treatments was probably not related to crop N deficiency.

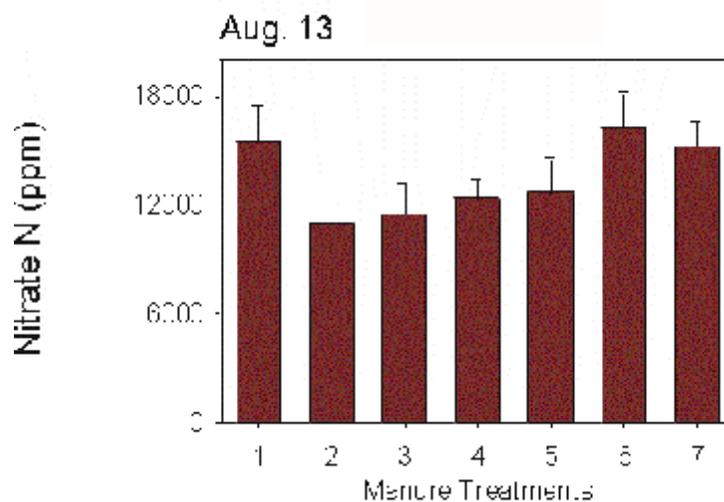


Figure 6. Effects of in-crop application of swine manure on petiole nitrogen 74 days after planting in potato crops grown on a sandy soil.

Discussion

The results suggest a possible toxicity effect of the manure and fertilizer when applied at the time of two-thirds row closure.

A possible explanation for the observed yield suppression at the highest in-crop manure or fertilizer application rate is that N concentrations in excess of 150 kg ha^{-1} inhibit initiation of tubers, or impair further development of already-formed tuber initials (hooks) (Figure 7). This would result in fewer tubers in the small and main tuber classes, and increased bonus tubers at the highest N application rates.

Application of swine manure later in the season (after tuber initiation) may be one way to overcome the putative toxicity problem.

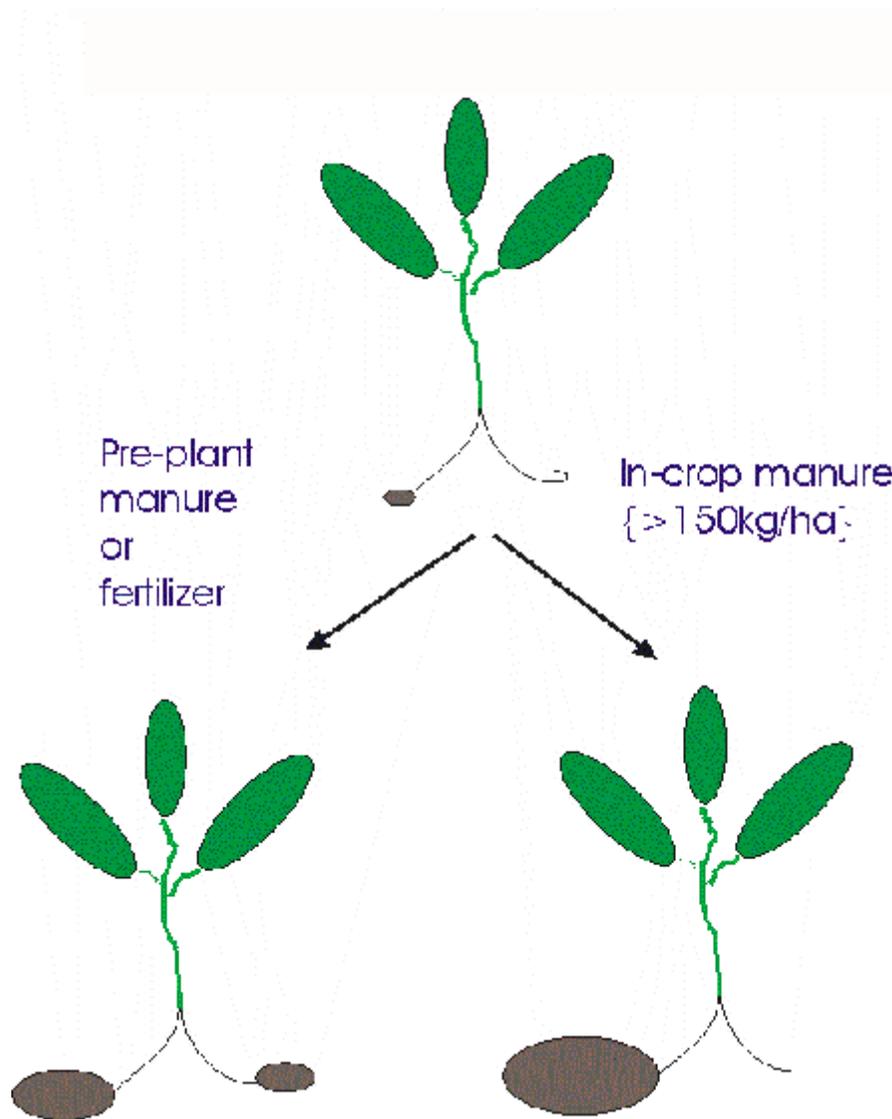


Figure 7. Effect of timing of in-crop manure application on tuber initiation and subsequent growth.

Conclusions

Swine manure can be applied at rates up to 150 kg ha⁻¹ on irrigated potatoes around hilling time without a penalty to marketable yield.

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