Liquid Swine Manure Application Timing and Instinct™ on Net Soil N Mineralization and Corn Yield in Indiana

Min Xu*, Brad C. Joern, James J. Camberato

Department of Agronomy, Purdue University, West Lafayette, IN, 47907

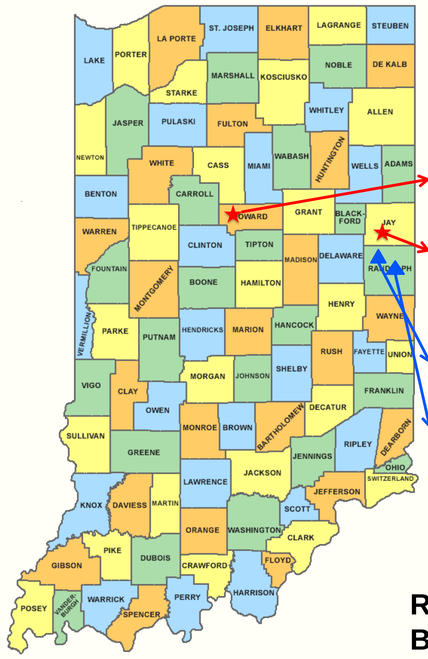
Introduction

In the Midwest USA, farmers tend to apply manure to cropland in the fall due to storage limitations and favorable soil conditions. Greater N losses are associated with fall-applied manure compared to spring-applied manure due to the long time between manure application and corn N demand. Delaying manure application until soils are cool (< 4˚C) and using of nitrification inhibitors like Instinct™, may reduce N losses from liquid swine manure and increase manure N availability to corn.

Objectives

To evaluate the effects of swine manure application timing and Instinct™ on manure N availability and corn grain yield.

Materials and Methods



Manure N rates:
(Total N, Potentially Available N)

2011-2012 locations:

Location 1:
420 kg N/ha, 340 kg N/ha

Location 2:
240 kg N/ha, 200 kg N/ha

2012-2013 locations:

Location 3:
165 kg N/ha, 130 kg N/ha

Location 4:
165 kg N/ha, 130 kg N/ha
(Additional 67 kg N/ha sidedressed UAN applied on manure-treated soils)

Randomized Complete Block Design

Treatments:

Manure Applications Timing Treatments:
Early fall (Aug./Sept.), late fall (Oct./Nov.) and spring (Mar., Apr./May)

Manure plus Instinct™ (2.6 L/ha) Treatments:
Late fall (Oct./Nov.), and spring (Mar., Apr.)

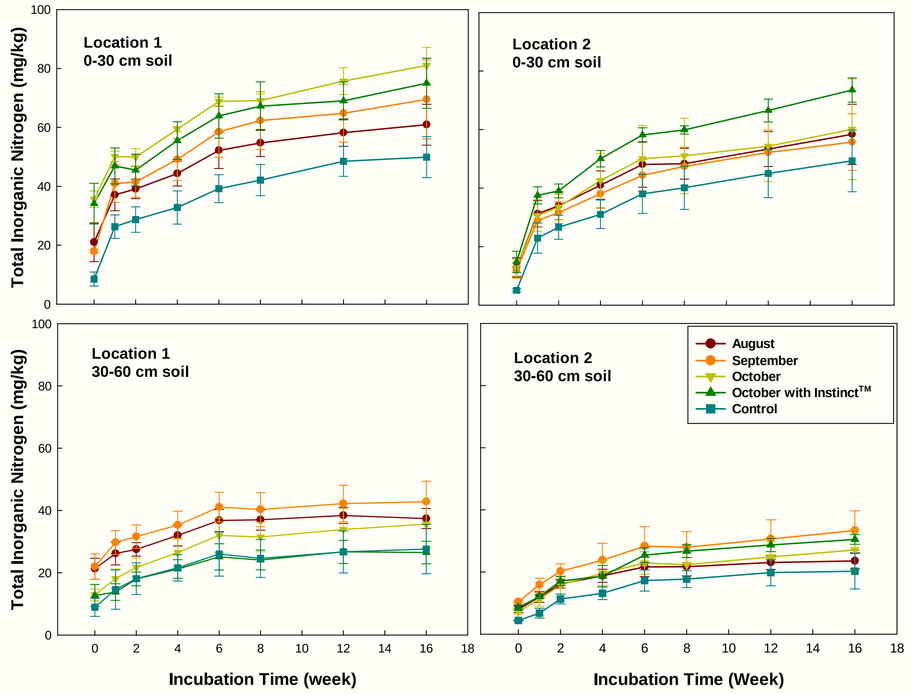
Commercial Fertilizer Treatments:
134 kg N/ha, 179 kg N/ha, 224 kg N/ha.
(Pre-plant anhydrous ammonia 82-0-0 at Location 1 and sidedress UAN 28-0-0 at Location 2, 3 and 4.)

Corn was planted in April 2012 at Locations 1 and 2 and May 2013 at Locations 3 and 4. Corn grain yields were taken from the center rows with a combine.

Soil samples were collected 12/14/2011 at Locations 1 and 2, and 11/20/2012 at Locations 3 and 4.

Results and Discussion

Soil N mineralization for samples collected in December from fall-applied manure treatments. (Soil incubated at 25 ˚C, 33 kPa moisture tension)



- During incubation study, negligible amounts of NH_4^+-N were recovered from 1M KCl soil extracts in all treatments.
- Topsoil and subsoil N levels were greater at Location 1 than Location 2, but the differences in soil N were small compared to the differences in the amount of manure N applied.
- Differences in total inorganic N after 16 weeks of incubation were mainly due to the differences in initial total inorganic N.
- Movement of manure N applied in Aug. and Sept. from 0-30 cm to 30-60 cm soil was evident at Location 1, likely due to nitrification of swine manure and subsequent nitrate leaching in the soil profile.

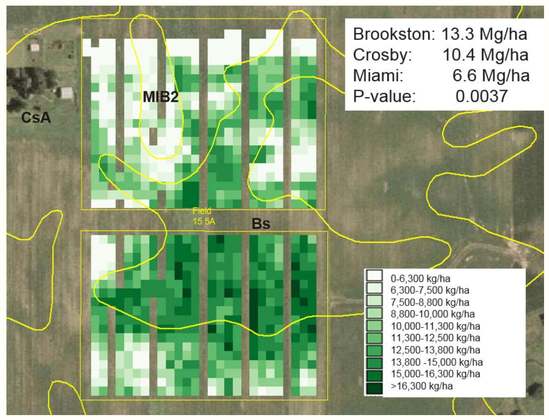
Corn yield response to swine manure application timing and Instinct™. Comparisons within location.

N source or statistic	2011-2012 N timing / rate	NI	Location 1	Location 2	2012-2013 N timing / rate	NI	Location 3	Location 4†
			----------Mg/ha----------				----------Mg/ha----------	
Manure	August (426, 243)‡	(-)	11.2	5.1	August	(-)	5.1 f	12.2
	September (417, 255)	(-)	12.2	4.8	October (138)§	(-)	5.6 ef	13.5
	October (418, 256)	(-)	12.1	4.8	October (138)	(+)	5.5 ef	12.1
	October (418, 256)	(+)	10.2	5.2	November (194)	(-)	6.1 de	12.0
	March (476, 231)	(-)	11.1	5.2	November (194)	(+)	6.3 cde	12.7
	March (476, 231)	(+)	10.6	5.0	May surface (165)	(-)	7.1 c	n/a
	April (379, 224)	(-)	11.5	5.2	May (165)	(-)	6.9 cd	n/a
	April (379, 224)	(+)	12.6	5.3				
Fertilizer¶	134 kg N/ha	(-)	11.6	5.7	134 kg N/ha	(-)	8.3 b	12.2
	179 kg N/ha	(-)	11.0	7.5	179 kg N/ha	(-)	9.5 a	13.5
	224 kg N/ha	(-)	11.9	6.0	224 kg N/ha	(-)	10.0 a	13.5
P>F			0.42	0.35			<0.0001	0.19

† Additional 67 kg N/ha as UAN (28-0-0) was sidedressed on all manure treatments.
‡ Numbers in parentheses: total manure N rates applied at Location 1 and 2, respectively.
§ Number in parentheses: total manure N rate at Location 3 and 4.
¶ Commercial fertilizer form: anhydrous ammonia (82-0-0) at Location 1, urea ammonium nitrate (UAN) (28-0-0) at Locations 2, 3, and 4.

- No significant effects on corn grain yield were observed from the use of Instinct™ with manure application.
- Grain yield was unaffected by manure application timing at Locations 1 and 2 due to limited rainfall during 2012 growing season.
- At Location 3, corn grain yield was significantly greater in spring-applied manure treatments compared to early fall manure treatments; and grain yield in manure-treated soils was significantly less than in fertilizer-treated soils.
- Additional 67 kg N/ha fertilizer N input together with 165 kg total manure N/ha supplied enough N for optimum grain yield at Location 4.

Corn yield response and soil type interaction at Location 1 during 2012 drought. (Brookston: SiCL; Crosby: SiL; Miami: SiL)



- Water holding capacity of different soil types significantly affected corn yield in a drier-than-normal growing season. (Brookston: 18.1 cm H_2O/100 cm soil; Crosby: 16.8 cm H_2O/100 cm soil)

Summary

- Swine manure application timing or the use of Instinct™ did not affect cumulative soil mineralized N.
- Swine manure N availability potential: Spring > Fall
- Weather variations have a great influence on swine manure N availability to corn;
- Little impact from Instinct™ on manure N availability was observed during the two study years.

Acknowledgement

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