Gen8-2011 - Is Manure Enough?

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Is Manure Enough?

Oxford Soil & Crop Partner Project

Purpose:

Best Management Practice (BMP) recommendations for livestock farms have suggested that a maximum of two-thirds to three-quarters of the nitrogen needs for corn should come from manure, with the remainder would be supplied from commercial nitrogen sources. In the past few years, several situations where predicted nitrogen from manure didn't seem to result in expected yields have made livestock producers re-evaluate manure nitrogen.

- Are higher yields – 200 bu/ac or more – resulting in manure not releasing enough available N?
- Is manure being rotated to more fields, where residual nitrogen from previous applications is no longer part of the nitrogen inventory?
- Are cool spring and summer conditions delaying the nitrification and mineralization processes in manure to release N in time to meet corn N requirements?
- Are wet conditions resulting in losses through denitrification (or leaching) limiting the nitrogen available for corn crops?

This project was set up to determine if manure nitrogen will provide the same yield potential as commercial nitrogen.

Methods:

Treatments were set up to compare full manure, full commercial nitrogen and a combination of manure and nitrogen. Treatments were replicated once. At one location, the project was carried out in both 2010 and 2011 in different fields on the same farm. Manure was spring applied and 30 lbs of commercial N was applied as starter. The remaining commercial nitrogen was side-dressed at 50 or 150 lbs/ac in mid June. Side dress nitrogen samples were taken to give an indication of soil nitrogen available in mid June. Field were harvested, and results are shown below

Results:

2010 and 2011 growing seasons provided opposing weather conditions for trying to predict nitrogen availability for a corn crop. 2010 early warmth and adequate moisture resulted in excellent growing conditions for Ontario corn crops. Yields were higher than average and many livestock producers considered that the manure applied to provide corn nitrogen may not have been enough to maximize yields.

2011 was a later growing season with more than average rainfall, resulting in frequent periods of saturated soils. Again there was a fear that manure and commercial nitrogen would not be available for corn crops due to denitrification (or leaching in lighter soils).

The results from this project show that corn yields can be just as high when manure is the sole source of nitrogen. The manure nitrogen did not "fall short" due to higher than average yields. Is this because of the organic matter levels in the project fields were high enough to mineralize additional nitrogen? It would appear from the individual plot data that a combination of manure and commercial fertilizer is the best economic

approach for livestock farms or for corn producers that have access to manure or other organic materials. Results also suggest that a high rate of manure may provide too much nitrogen that could have a negative affect on yield. In those situations the manure would have been more economical to apply at a different location.

Yield Summary	2010 JK	2011 JK	2011 BA	2011 BDH
	Curries	Curries	Oxford Centre	Embro
	bushels/acre			
Check	148	156	105	---
Full Fertilizer	**210**	201	153	176
2/3 manure 1/3 fertilzier	204	---	138	**193**
Normal Rate Manure	196	**206**	**160**	176
High Rate Manure	204	203	161	---

Photo on left shows Currie's site at side-dress. Plot ends at centre of field (arrow). Side toward the grain bins has full manure while corn in bottom portion of photo has only starter N applied.

Photo on right shows same field in mid August. Where the difference is obvious is the section of the field with only commercial nitrogen applied

Summary:

The results indicate that there is more to learn about the impact that spring weather has on predicting available nitrogen. Current BMP recommendations, suggesting that a portion of the nitrogen for a corn crop come from commercial sources appears sound and the best economical use of manure; both from nitrogen availability for the corn, but also from keeping phosphorus and potassium levels in the soil balanced, especially where manure is frequently applied to the same field. The results also suggest that when there is a very high amount of nitrogen in the soil in early to mid June, there may be a negative yield response. Side-dress nitrogen test combined with check yields suggest that the residual nitrogen (organic nitrogen) from previous manure applications can be significant, and although N from previous applications are often not considered in the "nitrogen inventory" that portion can be significant.

Individual site results:

2010 – Curries					
Treatment – North of barn	**Moisture %**	**test weight kg/hL**	**Side-dress N - test lbs/ac (2 ft depth)**	**N Rec. lbs/ac**	**Yield bu/ac**
non limiting N	20.4	71.9	146	6	209.5
no N	21.2	70.8	121	44	148.2
5000 gal	20.0	71.9	292	0	203.9
2500gal	19.9	72.2	187	0	185.2
3500gal	20.0	72.0	237	0	200.3
3500gal	19.9	72.5	145	8	201.4
3500 gal + 55lb N SD	20.4	71.5			203.3
3500gal	20.6	70.9			187.2
3500 gal + 55lb N SD	20.5	71.5			204.8
2011 – Curries					
Treatment – South of barn	**moisture %**	**test weight kg/hL**	**Side-dress N - test lbs/ac (2 ft depth)**	**N Rec. lbs/ac**	**Yield bu/ac**
Non limiting N 5500 gal/ac (209 lbs N)	20.7	52.6	480	0	195.1
3,800 gal/ac (145 lbs N)	19.7	54.5	289	0	205.6
Side-dress N 150 lbs/ac	20.4	52.8	128	30	192.7
Starter N only	21.3	50.3	83	87	152.4
Starter N only	20.7	51.1			159.3
Side-dress N 150 lbs/ac	20.6	53.8	109	53	209.1
3,800 gal/ac manure	20.0	52.9	198	0	206.6
5,500 gal/ac manure	20.1	51.8	358	0	210.0
Liquid hog manure/ 1000 gallons: 4.8% DM with 63lbs total N; 46 lbs of total is NH4-N; 22 lbs P205 and 38lbs K20 Soil test results (range over treatments): pH 6.9 – 7.5; %OM 4.7 – 5.5; %P 21-32 ppm; %K 91-117 ppm; %Mg 269 -299 ppm					

Next Steps:

A variation of this project should be repeated over a variety of soils (including heavy clay) and high vs low organic matter fields. This project should also be repeated in fields where manure has not been previously applied and in fields where manure is applied occasionally or once in the rotation..

2011 Oxford Centre Treatments	Test Weight lb/bu	Moisture %	Yield bu/ac
2/3 Liquid hog Manure + 1/3 Fert	53.9	20.5	141.8
Full Fert	55.0	21.6	158.4
Full Manure (liquid hog)	54.0	20.8	160.0
2x rate - liquid hog manure	54.6	20.5	159.8
Check (No N)	54.7	20.3	132.8
Full Fert	53.8	20.9	147.1
Check (No N)	54.6	20.5	77.8
2/3 Manure + 1/3 Fert	54.3	20.0	123.0
2x Manure	53.9	21.2	161.8
2/3 Manure + 1/3 Fert	53.6	21.2	149.9
Liquid hog manure/ 1000 gallons: 10% DM with 100lbs total N; 68 lbs of total N is NH4-N; 35 lbs P205 and 50 lbs K20			

2011 Embro	Test Weight lbs/bu	Moisture %	Yield bu/ac
60 gal 28% (215 lb N)	56	24.5	180.5
	57	24.0	170.6
10000 gal liquid dairy manure (~180 lbs N)	57	23.5	174.7
	56	23.5	176.4
5000 gal manure +25gal28% (~ 90 lbs from each source)	56	24.0	194.6
	57	24.5	190.7

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Project Contacts:

Cathy Dibble, Oxford SCIA, cdibble@odyssey.on.ca

Christine Brown, OMAFRA, christine.brown1@ontario.ca