Nitrogen Credits from Manure and SOM and Effects of Swine Manure Application Timing and Instinct™ on Corn Yield

Jeff Vetsch

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Southern Research and Outreach Center

Sixth Annual Minnesota Crop Nutrient Management Conference, Feb. 9, 2015, Mankato.

Outline

- Nitrogen (N) availability of manure.
- N credits as affected by manure source, application method and incorporation timing.
- Liquid swine manure (LSM) application timing and Instinct™.
  - Slides not included in this posting please contact author directly.
- N mineralization from soil organic matter (SOM).

Manure Management and Air Quality

Our Manure and Air Quality research, and outreach programs focus on developing and executing innovative, practical, economically feasible, and environmentally-sound manure

Manure Management Basics

Watch narrated video presentations to learn the basics of manure handling systems, crop benefits and beef, dairy, poultry, swine manure.

Feedlots and Manure Storage

Learn about open lot runoff and manure pit storage.

Manure Pathogens

Milk House Wastewater

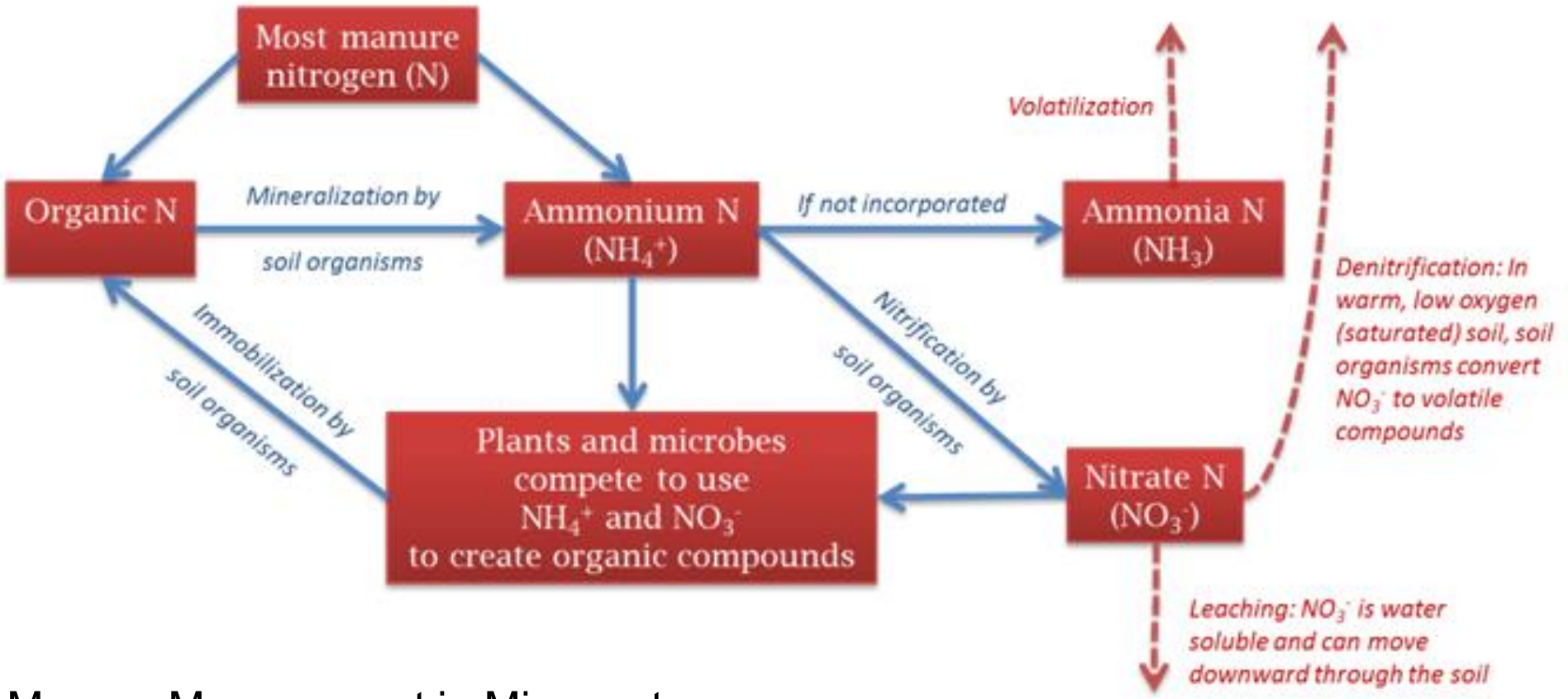
Research, treatment and system designs to manage milk house waste.

Air Quality

Create an odor management plan, identify high odor sources and control technologies.

Manure Application

Nitrogen Availability from Manure



Manure Management in Minnesota
Jose Hernandez and Michael Schmitt
Revised 2012

Sample Name: Lewers 11/3/11

Material: Swine-finish (indoor pit)

Treatment: None

Storage System: Liquid

Type of Storage: concrete pit

Type of Bedding: none

Laboratory Analysis

Moisture: 93.90%

Dry Matter: 6.10%

	Total Nutrients lbs/1000 gal	Estimated Available Nutrient Credits for Manure: In 1st Year of Application lbs/1000 gal	If Applied 2 Consecutive Yrs lbs/1000 gal	If Applied 3 Consecutive Yrs lbs/1000 gal
Total Nitrogen (Injected)	60.25	39.16	45.19	48.20
Total Nitrogen (Surface Applied)	60.25	30.13	36.15	39.16
Total Phosphorus as P_2O_5	14.84	8.90	10.39	11.13
Total Potassium as K_2O	32.26	25.81	29.03	30.65
Sulfur	3.19	1.91	2.23	2.39
Estimated Value of Available Nutrients in Surface Applied Manure[1]		$33.96	$39.64	$42.48

Additional Tests

NH_4-N: 45.06 lbs/1000 gal

Additional Information

1 Value based on commercial fertilizer costs as of 3/1/2011:

N (urea) $0.52/lb
P_2O_5 (DAP) $0.56/lb
K_2O (Potash) $0.47/lb
S (Elemental Sulfur) $0.62/lb

NH_4-N / Total N = 45.1/60.2=0.75 = 75%

Table 2: Manure nitrogen availability and loss as affected by method of application and animal species.

Animal Species and Year of Application [2]	Surface broadcast and Incorporation Timing [1]			Injection	
	None	< 4 days	< 12 hours	Sweep	Knife
	% Total N				
Swine					
Year 1	35	55	75	80	70
Year 2	15	15	15	15	15
Lost [3]	50	30	10	5	15
Poultry					
Year 1	45	55	70	NA	NA
Year 2	25	25	25	NA	NA
Lost [3]	30	20	5	NA	NA

[1] *The categories refer to the length of time between manure application and incorporation.*

[2] *Third-year available N is not listed but can be computed by adding Year 1 and Year 2 and lost percentages and subtracting this sum from 100.*

[3] *Lost refers to estimated volatilization and denitrification processes.*

Manure Management in Minnesota, Jose Hernandez and Michael Schmitt. 2012

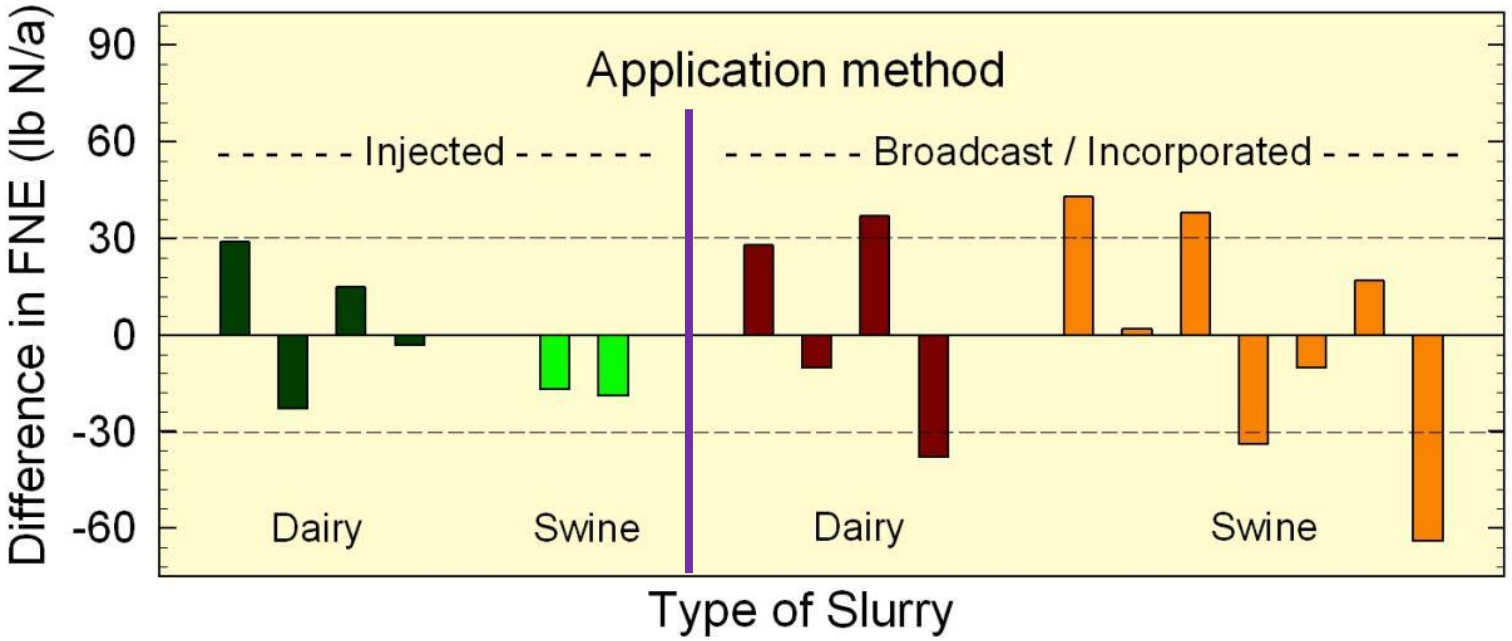
Table 2: Manure nitrogen availability and loss as affected by method of application and animal species.

Animal Species and Year of Application [2]	Surface broadcast and Incorporation Timing [1]			Injection	
	None	< 4 days	< 12 hours	Sweep	Knife
	% Total N				
Beef					
Year 1	25	45	60	60	50
Year 2	25	25	25	25	25
Lost [3]	40	20	5	5	10
Dairy					
Year 1	20	40	55	55	50
Year 2	25	25	25	25	25
Lost [3]	40	20	10	5	10

Manure Management in Minnesota
Jose Hernandez and Michael Schmitt
Revised 2012

Manure N availability

Hanson, Randall, Everett, Blanchet



Known known:

Direct injection, full cover, using knives or sweeps reduces risk of loss; N credits are reliable

Known unknown:

N availability with broadcast slurry

Russelle et al., 2008. U MN Ext. Bull. 08583

← UW-Extension/Madison Plant Disease Diagnostic Clinic (PDDC) Update 12/27/14-12/31/14

Agronomic Management and Fungicide Effects on Oat Yield and Quality in Wisconsin →

New Manure and Legume Credits app for iPhone

Posted on January 13, 2015 by rwschmidt

Farmers can save money and protect the environment by taking credit for the fertilizer value of manure and legume crops. The value of these credits are subtracted from the base (unadjusted) fertilizer recommendations for a field. This reduces the money spent on purchased fertilizer applications and helps prevent over application.

There are formulas and math involved in determining the credit values. This app includes three calculators that have these formulas built in and do all the math for you.

The new NPK Credits app is free and available now for iPhone and iPad. This app was developed by the University of Wisconsin Nutrient and Pest Management Program and uses research from University Extension specialists. For more information and for screen shots, visit the app page on our site.

Check this app out at the Apple App Store. It's free! Android version coming soon.

https://itunes.apple.com/us/app/npk-credits-manure-legume/id954888966?mt=8

WCM newsletter current issue

- WCM 32, December 11, 2014 (387)

Author search

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Site search

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Search

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The effects of swine manure application timing and Instinct™ on corn yield and N availability.

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Revised Feb, 2015

Nitrogen Mineralization from Soil Organic Matter Has it Changed in the Last 40 Years?

Gyles Randall[1] and Jeff Vetsch

Univ. of Minnesota, [1]Retired

and [2]Southern ROC

Purpose

To present a historical timeline of nitrate-N concentrations in tile drainage water from “0-lb N/A” control plots from 1973-2013.

Lamberton 1973-1985

- Site history
  - no N or manure for previous 10 yrs
  - corn, soybean, small grain rotation
- Soil: Normania cl, mod. well drained
- Crop: Continuous corn
- Fertilizer N Rates (Spring), 1973-79
  18 (as starter), 100, 200 & 400 lb N/A
- 12 - 45'x50' separated drainage plots (3 reps)

1973-75 Nitrate-N Concentration

Annual N rate	Year 1973	1974	1975
lb N/A	- - - - - - - mg/L - - - - - -		
18	13	19	19
100	15	25	23
200	13	37	43
400	12	65	81
Annual flow (inches)	1.46	3.58	5.04

1976-79 Nitrate-N Concentration

Annual N rate	Year 1976	1977	1978	1979
lb N/A	- - - - - - - - mg/L - - - - - - - -			
18	*	28	21	16
100	*	48	53	47
200	*	73	119	106
400	*	150	191	172
Annual flow (Inches):		0.56	1.99	8.21

* = Drought, no tile flow

1980-85 (RESIDUAL Phase) Nitrate-N Conc.

1973-79	Year					
N rate	1980	1981	1982	1983	1984[1/]	1985
lb N/A	- - - - - - - - - mg/L - - - - - - - - -					
18	--	--	9	6	12	12
100	--	--	23	11	15	14
200	--	--	56	26	18	16
400	--	--	115	65	33	25
Ann. Flow (In):	0	<1	5.4	15.2	18.3	15.3

[1/] 40 lb N/A was spring-applied to all plots.

Cont. Corn Yields – Control Trt.

Years	Yield (bu/A) Control	200 lb N/A	Moisture
1973-75	29-89	40-95	Dry
1977-79	85-123	129-141	Wet
1980-85 Residual	40-102	37-131	"

Waseca 1975-1980

- Site history
  - corn in 1974, 150 lb N/A
- Soil: Webster cl, poorly drained
- Crop: Continuous corn
- Fertilizer N rates (Spring), 1975-79
  0, 100, 200, & 300 lb N/A
- 12 – 45' x 50' separated drainage plots (3 reps)

1975-80 Nitrate-N Concentration

1975-79	Year[1/]			
N rate	1977	1978	1979	1980[2/]
lb N/A/yr	- - - - - - mg/L - - - - - -			
0	13	16	13	9
100	41	28	19	10
200	58	45	32	12
300	85	65	44	23
Ann. Tile Flow (In.)	4.8	5.6	17.1	2.9

[1/] No drainage occurred in 1975-1976 – Dry.

[2/] N was not applied in 1980.

1975-80 Corn Yields

1975-79	Year[1/]			
N rate	1977	1978	1979	1980[2/]
lb N/A/yr	- - - - - - bu/A - - - - - -			
0	94	81	78	56
100	146	144	160	65
200	146	150	173	91
300	144	156	175	136

1/ Yields ranged between 53 and 75 bu/A in 1975 and 30 to 64 bu/A in 1976.

2/ N was not applied in 1980

Waseca 2007-2010

- Cropping Systems
  - C-C-S, C-S-C, & S-C-C
- N rates
  - 0, full (PP), & 85% (SP)
- Application time
  - Spr. PP vs. 60 lb. PP & rest V3-V4

Funding provided by AFREC

4-Year Results

Crop Rotation	N Rate	NO_3-N Avg. Conc.	Avg. Yield	Yield Range
	lb N/A	mg/L	bu/A	bu/A
C-S-Corn	0	6.1	113	106-120
S-C-Corn	0	4.6	66	53-82
C-C-Soy	0	5.5	--	--

Funding provided by AFREC

2012 – 2013 Results

Funding provided by MN CR&PC and
Dow AgroSciences

Cont. Corn Yield and FW NO_3-N Conc.

N Treatment				
Source	Rate	Time	Yield	Nitrate-N Conc.
	lb/A		bu/A	mg/L
			2012 (4" flow, M-Jun)	
--	0	--	60	4.2
Urea	200	F	152	6.9
"	"	S	149	6.4
			2013 (14", A-July)	
--	0	--	68	3.6
Urea	200	F	160	29.
"	"	S	195	18.

Funding provided by MN CR&PC and Dow AgroSciences

Questions and Implications

- What happens to N applied as fertilizer or manure and not taken up by plant?
  - Denitrified, leached, left as RSN, (immobilized in labile N pools)
- Why were NO_3^- concentrations in zero- and suboptimal-N plots so much greater 30 or 40 years ago than they are today?
  - Weather: less drought, wetter today, freq. of >2+
  - Genetics: > yields, > NUE, better roots
  - Has mineralization of N from SOM declined?

Thanks

Questions

Jeff Vetsch

http://sroc.cfans.umn.edu

http://sroc.cfans.umn.edu/People/Staff/JeffreyVetsch/index.htm

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Education

MS, *University of Minnesota,* 2005. Soil Science
BS, *University of Minnesota,* 1990. Soil Science
Certified Professional Soil Scientist (License # 30653)

Research Interests and Activities

Coordinating the day-to-day activities of the soils research program at SROC are my primary responsibility. Secondary duties include: technology transfer or outreach of research information, via oral presentations, web based publications, extension bulletins, and journal publications. My primary research interest is nutrient management of corn and soybean. Current projects include: Enhancing Continuous Corn Production in High Residue Conditions with Nitrogen, Phosphorus and Sulfur Starter Fertilizers (.pdf) (funded by the Minnesota Agriculture Fertilizer Research and Education Council and the Fluid Fertilizer Foundation), Long-term Potassium Fertilization of Corn and Soybean (.pdf) (funded by the Minnesota Corn Research and Promotion Council Minnesota Corn Growers Association) The majority of our research is conducted in south-central and

Research Activities

Tillage Systems for Enhancing Profitability in a Corn-Corn-Soybean Rotation Phase 2 (2007 through 2011) (.pdf)

Curriculum Vitae (.pdf)

Completed Project Summaries

Annual Soils Research Results

Recent Presentations

Maximizing Yield While Minimizing Nitrate Loss (pdf)

Nutrient Management: Interactions with Climate Stressors (pdf)

Nutrient Management for Atypical Weather (.pdf)

Enhancing Continuous Corn Production in High Residue Conditions with Nitrogen, Phosphorus and Sulfur Starter Fertilizers (.pdf)