



# Manure N Availability as a Function of Application Timing, Nitrification Inhibitor, and Cover Crop

Advanced Nutrient Management Technology & Application Field Day

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## N content of dairy manure

Dairy Manure	Total N	NH <sub>4</sub> /Total N
	lb/1000 gal or lb/T	%
Liquid, <4.0% DM	14.5 (1.9 – 25.0)	58 (35 – 84)
Slurry, 4.1 to 11.0% DM	23.1 (13.6 – 36.0)	47 (32 – 70)
Semi-solid, 11.1 to 20.0%DM	8.3 (4.3 – 13.1)	39 (2.8 – 70)
Solid, >20.0% DM	9.2 (1.4 – 29.6)	23 (1.1 – 50)

Mean followed by 2.5 to 97.5 % range. Analyzed at UW-Soil & Forage Analysis Lab, 2002-2013.

$$\text{Manure total N} = \text{NH}_4\text{-N} + \text{organic N}$$

Just like fertilizer; can volatilize      Slowly available

Estimated N availability – 1<sup>st</sup> year

- Liquids – 50% of total N if injected or incorp. in 1 hr; 30% if incorp. >72 hr
- Solids – 35% of total N if incorp. in 1 hr; 25% if incorp. >72 hr

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Manure N availability as influenced by timing of application and use of Instinct on well drained silt loam soils as measured with corn grain yield

Year	Timing	Arlington		Sun Prairie		Waterloo	
		- Instinct	+ Instinct	- Instinct	+ Instinct	- Instinct	+ Instinct
----- % of total N available -----							
2013	Early Fall	39	20	*	*	23	78 ↑
	Late Fall	45	55 ↑	*	*	40	55 ↑
	Spring	70	63	*	*	*	61
2014	Early Fall	-	-	*	*	-	-
	Late Fall	44	63 ↑	*	*	-	-
	Spring	*	*	*	*	-	-

\* Availability could not be calculated with method used. - Indicates treatment did not exist.

When N avail. was > 10% different, Instinct increased manure N availability 80% of the time.

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Manure N availability as influenced by time of application, Instinct, and cover crop as measured with corn grain yield

	Arlington well drained			Marshfield somewhat poorly drained		
	2016	2017	2018	2016	2017	2018
----- % of total N available -----						
Fall	.	0	38	54	15	38
Fall + I	.	12 ↑	42	38 ↓	14	42
Fall + CC	.	0	0	0	12	42
Fall + I + CC	.	0	3	5	6	28
Spring	.	52	55	14	15	43
Spring + I	.	52	72 ↑	6	17	23 ↓

- Spring manure applications had greater N availability and NUE than fall on well drained soil.
- When N avail. was > 10% different, Instinct increased N availability at Arlington and decreased N availability at Marshfield.
- When there is good cover crop growth in the fall, use of cover crops decreases availability of manure N for the following corn crop. (preliminary data analysis)

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## Using manure as an in-season source of N

- Preplant fertilizer N rates
- Preplant manure
  - Surface application disk incorporation
    - Immediate (1 hr)
    - 1 day
    - 3 day (surface)
  - Injection
    - S-time (Kongsgilde Vibro-flex) with shields
    - 4-6 inches deep
    - 15-inch spacing
- Sidedress manure at V5-V6
  - Injection – same equip as preplant
    - 30-inch spacing
  - Surface



6,500 gal/a (target rate)  
Solids content: 14% average  
Sand bedding  
N application rate average  
• 146 lb/a total N  
• ~40% of total N as  $\text{NH}_4\text{-N}$

## Effect of spring application method and timing on **corn grain yield** on a somewhat poorly drained soil at Marshfield

Timing	Method & days to incorp.	Grain yield			
		2009	2010	2011	2012
		----- bu/a -----			
Preplant	Injected	144 ab	123 a	107	179 a
	Surface broadcast (< 1 hour)	134 bc	124 a	110	158 bc
	Surface broadcast (1 day)	133 c	122 a	112	159 bc
	Surface broadcast (3 days)	137 bc	105 ab	103	166 ab
Sidedress	Injected	147 a	98 b	114	175 a
	Surface band (no incorporation)	-	89 b	108	150 c

## Effect of spring application method and timing on **manure N availability** on a somewhat poorly drained soil at Marshfield

Timing	Method & days to incorp.	Manure N Availability †				Mean
		2009	2010	2011	2012	
		% of total N available				
Preplant	Injected	48	53	38	63	51
	Surface broadcast (< 1 hour)	22	50	42	31	36
	Surface broadcast (1 day)	19	51	46	32	37
	Surface broadcast (3 days)	30	33	31	43	34
Sidedress	Injected	39	42	60	72	53
	Surface band (no incorporation)	-	26	48	23	32

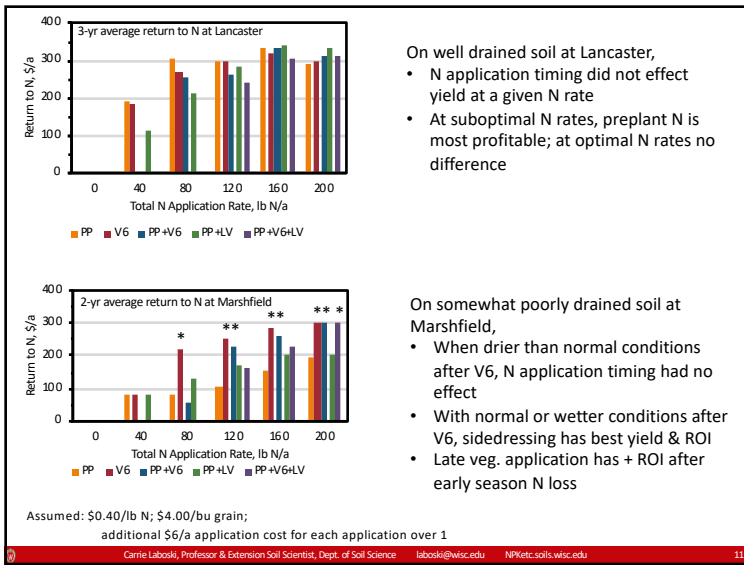
## Key Points

- Manure sampling & testing is as important as knowing the rate that was applied
- Weather and soil drainage have large impacts on N availability
  - Spring application may be better than fall on well drained soils
  - Pre-sidedress nitrate soil sampling can help evaluate manure N availability
- Nitrification inhibitors (eg. Instinct) are insurance against N loss, not yield enhancers
  - Greater benefit for manures with higher % of total N as  $\text{NH}_4\text{-N}$  (>65%)
- Grass cover crop may take up fall manure N, but may not release it in time for corn
- Sidedress application of manure is a viable N source for corn
  - Another manure application window
  - May be lower N loss
- Timing of fertilizer N application
  - In season N applications improve yield & ROI, and reduce N loss on somewhat poorly drained and wetter soils and on sandy soils
  - On well drained soils, spring preplant vs. split vs. sidedress did not influence yield
  - Pre-tassel applications can be useful for rescue; but not as part of a planned application

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## Fall vs. spring manure, nitrification inhibitor, & cover crop

## Timing of fertilizer N



- On well drained soil at Lancaster,
- N application timing did not effect yield at a given N rate
  - At suboptimal N rates, preplant N is most profitable; at optimal N rates no difference

- On somewhat poorly drained soil at Marshfield,
- When drier than normal conditions after V6, N application timing had no effect
  - With normal or wetter conditions after V6, sidedressing has best yield & ROI
  - Late veg. application has + ROI after early season N loss