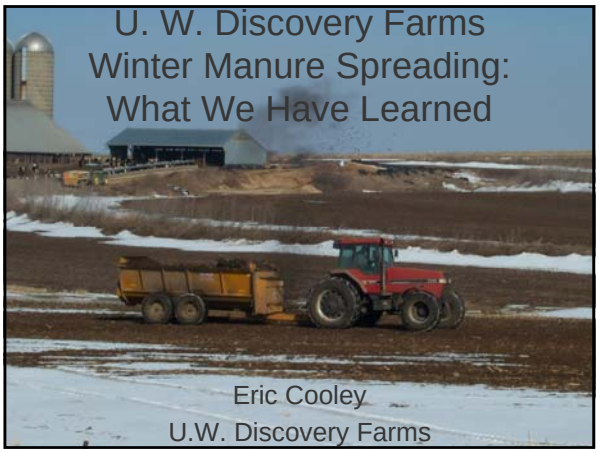
U. W. Discovery Farms Winter Manure Spreading: What We Have Learned



Eric Cooley
U.W. Discovery Farms

What Are Discovery Farms?

Discovery farms are real-life Wisconsin farms in different geographic areas facing different environmental challenges.

Our goal is to identify and reduce the sources of phosphorus, nitrogen, and other constituents that may impair surface and groundwater.

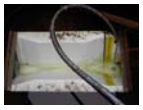
5 to 7 year total program length.

Farmer Led Program!

The Discovery Farms Program is farmer led in all aspects of the program:

- Determine research needs and priority
- Integral part of research design and implementation
- Collaborative analysis of research results, management effects and possible remedial practices to reduce losses
- Essential part of outreach efforts

What Do We Measure?



The quantity and quality of water leaving the agricultural watersheds

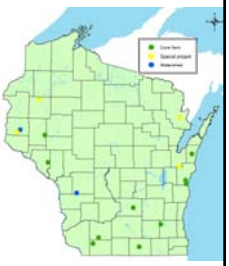
- Streams
- Edge-of-field
- Subsurface tiles

Monitoring Runoff in the Winter

- Relatively few research studies
- Potentially long duration runoff events (both rain and snowmelt events)
- Runoff during the day and freezing at night
- Multiple site visits per day

Discovery Farms Data

- 175 site years
  - 68 edge-of-field
  - 26 tile
  - 24 in-stream
  - 57 watershed (stream/EOF)
- Several “special projects”
  (Feed Storage Leachate Study, Vertical Tillage, Headland Poultry Stacking, Endocrine Disrupters)



Frozen Ground Period

- Frozen continuously at any depth in the soil: (1, 2, 8, 8, 16, or 32 inches)

	Freeze	Thaw
Average	12/6	3/29
Earliest	11/18	3/17
Latest	1/9	4/15

Timing – Critical Runoff Periods

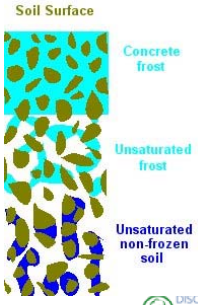
	Mean-Monthly Runoff (inches)	Mean-Monthly Runoff as a Percentage of Annual Runoff		Runoff Frequency	Total Precipitation (inches)	Mean-Monthly Runoff as a Percentage of Total Precipitation
October	0.04	2%		16%	2.40	2%
November	0.02	<1%		13%	1.72	1%
December	0.03	1%		23%	1.81	2%
January	0.09	4%	58%	43%	1.32	6%
February	0.44	18%		66%	1.40	31%
March	0.85	35%		97%	2.25	38%
April	0.25	10%		51%	3.64	7%
May	0.18	7%	30%	37%	3.34	5%
June	0.32	13%		49%	4.04	8%
July	0.12	5%		52%	4.16	3%
August	0.09	4%		28%	3.53	2%
September	0.01	<1%		16%	2.61	0%

Timing – Critical Runoff Periods Frozen ground

	Mean-Monthly Runoff (inches)	Mean-Monthly Runoff as a Percentage of Annual Runoff		Runoff Frequency	Total Precipitation (inches)	Mean-Monthly Runoff as a Percentage of Total Precipitation
December	0.03	1%		23%	1.81	2%
January	0.09	4%		43%	1.32	6%
February	0.44	18%	53%	66%	1.40	31%
March	0.85	35%		97%	2.25	38%

Critical Runoff Conditions: Frozen Ground

- Concrete frost
- Ice crusting of soil
- Deep or dense snowpack

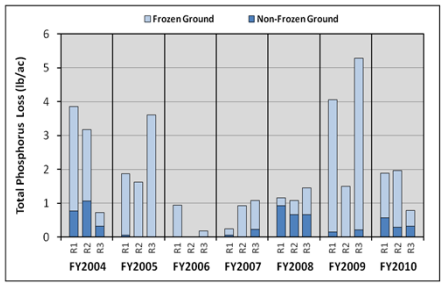


Late Winter Applications

FY2004
R1: Sept, Feb – Liquid
R2: Sept, Feb – Liquid
R3: Nov – Liquid

FY2005
R1: Sept, Oct – Solid
R2: Sept, Oct – Solid
R3: Sept, Oct, Jan, Feb – Solid, Oct - liquid

FY2009
R1: Oct, Feb, March – Solid
R2: Oct, March – Solid
R3: Jan, Feb – Solid



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FY2005
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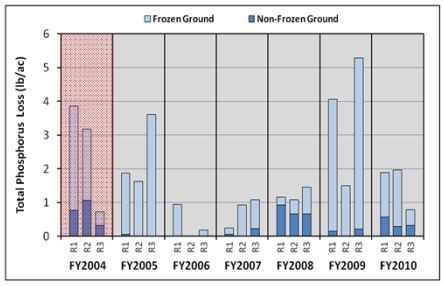
R3: Sept, Oct, Jan, Feb – Solid, Oct - liquid

FY2009
R1: Oct, Feb, March – Solid
R2: Oct, March – Solid
R3: Jan, Feb – Solid



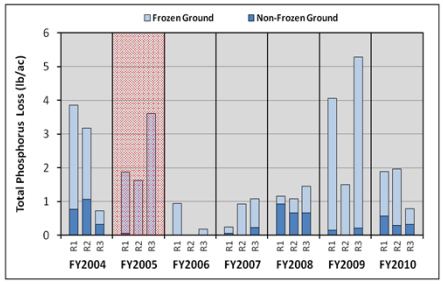
Field Year 2004 is a twelve month period extending from October 1, 2003 to September 30, 2004

Late Winter Applications

FY2004
R1: Sept, Feb – Liquid
R2: Sept, Feb – Liquid
R3: Nov – Liquid

FY2005
R1: Sept, Oct – Solid
R2: Sept, Oct – Solid
R3: Sept, Oct, Jan, Feb – Solid, Oct - liquid

FY2009
R1: Oct, Feb, March – Solid
R2: Oct, March – Solid
R3: Jan, Feb – Solid



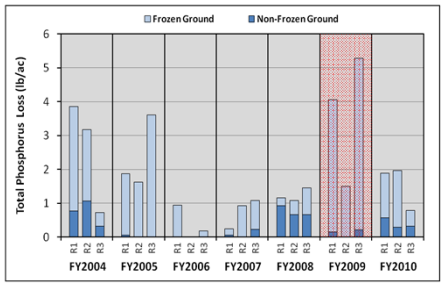
Field Year 2005 is a twelve month period extending from October 1, 2004 to September 30, 2005

Late Winter Applications

FY2004
R1: Sept, Feb – Liquid
R2: Sept, Feb – Liquid
R3: Nov – Liquid

FY2005
R1: Sept, Oct – Solid
R2: Sept, Oct – Solid
R3: Sept, Oct, Jan, Feb – Solid, Oct - liquid

FY2009
R1: Oct, Feb, March – Solid
R2: Oct, March – Solid
R3: Jan, Feb – Solid



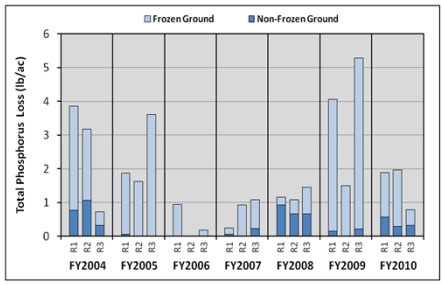
Field Year 2009 is a twelve month period extending from October 1, 2008 to September 30, 2009

Late Winter Applications

FY2004
R1: Sept, Feb – Liquid
R2: Sept, Feb – Liquid
R3: Nov – Liquid

FY2005
R1: Sept, Oct – Solid
R2: Sept, Oct – Solid
R3: Sept, Oct, Jan, Feb – Solid, Oct - liquid

FY2009
R1: Oct, Feb, March – Solid
R2: Oct, March – Solid
R3: Jan, Feb – Solid



Manure management decisions have an impact on losses

Late Winter Applications

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R1: Sept, Feb – Liquid
R2: Sept, Feb – Liquid
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FY2005
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R2: Sept, Oct – Solid
R3: Sept, Oct, Jan, Feb – Solid, Oct - liquid

FY2009
R1: Oct, Feb, March – Solid
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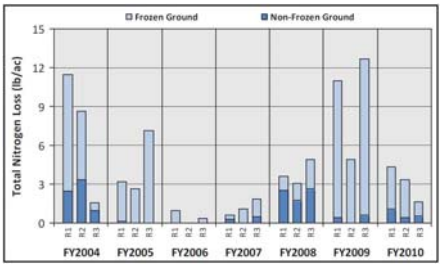
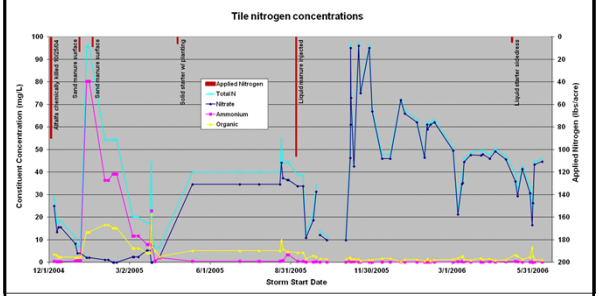
R3: Jan, Feb – Solid



Manure management decisions have an impact on losses

Nitrogen Loss Speciation



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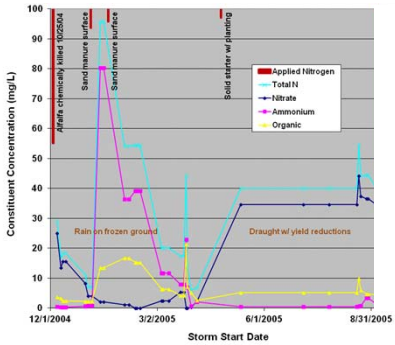
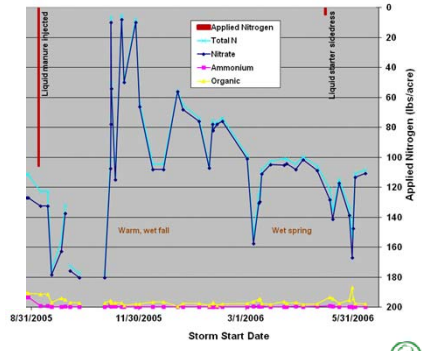


Nitrogen Loss Speciation



Frozen Ground Management

- Frozen ground can contribute the majority of the surface-water runoff losses as well as surface-water nutrient losses
- On-farm management of manure is critical to minimize the loss of nutrients during this period (for both solid and liquid manure)
- Observe frozen ground conditions for development of concrete frost, ice crusting and deep/dense snowpack
- Target low sloped land far from water bodies or karst features

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