Manure Applications on Frozen and Snow Covered Soils

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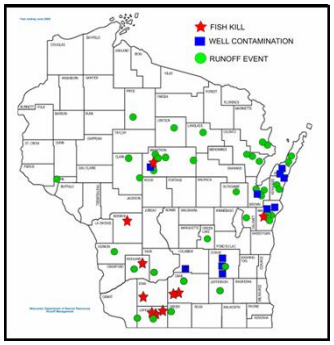
Negative Impacts of Improper Manure Applications and Runoff

- Environmental Impacts
  - Eutrophication
  - Hypoxia
  - Fish habitat & survival
- Human Health Concerns
  - Contaminated drinking water
  - Beach closures
- Ag's Public Relations!



Wisconsin DNR, winter 2005 / 2006

University of Wisconsin Discovery Farms Program

- On-farm research studying environmental implications of WI farming systems and practices (2000-2001)
- Privately owned farms
- Variety of management styles
- Multiple agricultural landscapes
- "Real-world" situations
- USGS Monitoring from 2003 – present

Edge-of-Field Surface Water Runoff Monitoring

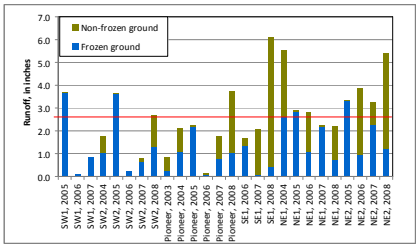
- Edge-of-field monitoring, often in lower end of waterway
- Runoff characteristics monitored
  - Runoff water volume
  - Sediment
  - Nutrients
- **98 "station-years**" of data on private Discovery Farms and the UW-Platteville Pioneer Farm

Use data to determine the "when?" and "why?" to help guide producers with their crop / field / manure management

UW-Discovery Farms Partners With U.S. Geological Survey

- USGS equipment and methods are nationally recognized and beyond reproach.

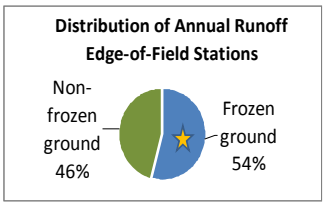
Precipitation and Runoff



- Runoff has averaged 2.5 inches per year
- About 8% of precipitation was measured as runoff
- 2.5" runoff / 31.25" precipitation. (harvesting water)
- Trend towards higher runoff on tighter clay soils in the northeast WI.

Source: Precipitation-Runoff Relations and Water-Quality Characteristics at Edge-of-Field Stations, Discovery Farms and Pioneer Farm, Wisconsin, 2003–8.

Distribution of Runoff



- Runoff volumes are nearly equally distributed between frozen and non-frozen periods.
- In any one year, frozen ground can contribute up to 100% of annual runoff.
- Because of this distribution, it is **important to focus on causes & timing of runoff** during both periods.

Source: Precipitation-Runoff Relations and Water-Quality Characteristics at Edge-of-Field Stations, Discovery Farms and Pioneer Farm, Wisconsin, 2003–8.

Edge-of-Field Winter Monitoring in WI

Experience shows this is an important and challenging time to capture water samples!

USGS has helped perfect WI winter monitoring method.

Maintenance – Remove snow & ice - when flow begins, it moves through the flume, gets measured / sampled & can flow away.

Critical Runoff Times

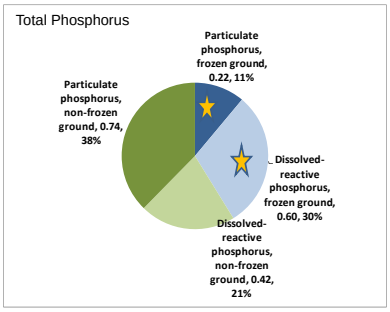
Runoff on frozen ground is occurring earlier than you might think.

		Mean-Monthly Runoff	Mean-Monthly Runoff as a Percentage of Annual Runoff	Runoff Frequency	Total Precip	Mean-Monthly Runoff as a Percentage of Total Precip
	October	0.07	3%	23%	2.32	3%
	November	0.02	<1%	15%	2.22	1%
55%	December	0.04	1%	35%	1.73	2%
	January	0.10	4%	50%	1.68	6%
	February	0.41	16%	58%	1.48	28%
	March	0.87	34%	100%	2.22	39%
35%	April	0.11	4%	54%	3.42	3%
	May	0.32	12%	38%	3.70	9%
	June	0.48	19%	42%	3.83	13%
	July	0.07	3%	42%	3.90	2%
	August	0.07	3%	19%	3.55	2%
	September	<0.01	<1%	19%	2.76	<1%

Source: Precipitation-Runoff Relations and Water-Quality Characteristics at Edge-of-Field Stations, Discovery Farms and Pioneer Farm, Wisconsin, 2003–8.

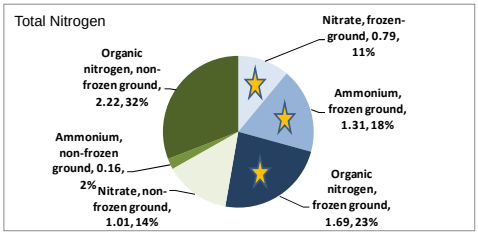
Phosphorus Losses

- **Most P lost during the non-frozen ground period (59%)**
- **Average loss was 2 lb per acre / year**
- **About ½ of P loss was dissolved**



Source: Precipitation-Runoff Relations and Water-Quality Characteristics at Edge-of-Field Stations, Discovery Farms and Pioneer Farm, Wisconsin, 2003–8, publication pending

Nitrogen Losses



- **Most N lost during the frozen-ground period**
- **Average loss was 7 lb per acre / year**
- **Most N losses were from Organic N**
- **Note ammonium losses from frozen ground**

Source: Precipitation-Runoff Relations and Water-Quality Characteristics at Edge-of-Field Stations, Discovery Farms and Pioneer Farm, Wisconsin, 2003–8, publication pending

Sometimes Winter Manure Spreading is Unavoidable

- Manure storage scenarios
  - Animals numbers increase, storage volume stays the same on individual farms.
  - Storage fills before spring and will overtop soon
- Daily & periodic haul scenarios
  - Many (historic) WI livestock facilities are built to require daily – weekly – periodic removal of manure.
  - Always have hauled through the winter - field stack during critical times.
  - Many of these farms have increased their animal numbers too.

Sometimes Winter Manure Spreading is Unavoidable

But know this;

Weather conditions …….
(especially as winter thaws and transitions to spring)

will create times when surface water runoff is very likely…..
and inevitable.

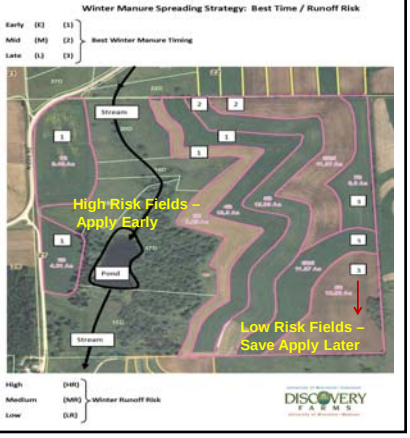
Winter Manure Management Strategies

- Where and when winter manure is applied has a large impact on risk to water quality.
- When manure applications are necessary:
  - develop a simple strategy defining spreadable cropland fields through winter time periods,
  - **Early Winter**: apply manure to higher risk fields (closer to water, steep slopes, etc) when risk for runoff is low; less snow, less frost, better chance for soil contact.
  - **Late Winter: Reserve fields with lower runoff risk (more distant from water, flatter slopes, etc), for manure applications late in the winter when there is a greater risk for runoff.**
- What does that look like?

Winter Spreadable Fields

Example:
Numbers, Letters, Colors

Doesn't matter, as long as it makes practical sense and can be followed by all involved, especially the person driving the tractor and spreading the manure.



Summary – Winter Manure Spreading

- Sometimes winter manure spreading is unavoidable
- Runoff on frozen ground is occurring earlier than you might think; February and March (WI).
- Weather conditions …….
  (especially as winter thaws and transitions to spring)
  will create times when surface water runoff is very likely…..
  and inevitable.
- Livestock farms should develop a winter manure spreading strategy to define where late winter manure could be spread with limited runoff risk.
  - Reserve fields with a lower runoff risk to spread late in the winter, as needed.
- On-line – Real time tool developed in Wisconsin; Multi-agency.
  Wisconsin Manure Management Advisory System;
  http://www.manureadvisorysystem.wi.gov/

Day-to-day Decisions Matter

2 Adjacent Fields
- Liquid dairy manure applied to 1 field (above)
- No manure applied to the other field (below)
- Then, snowmelt soon after = runoff event

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