



Nutrient Management on Tile Drained Land

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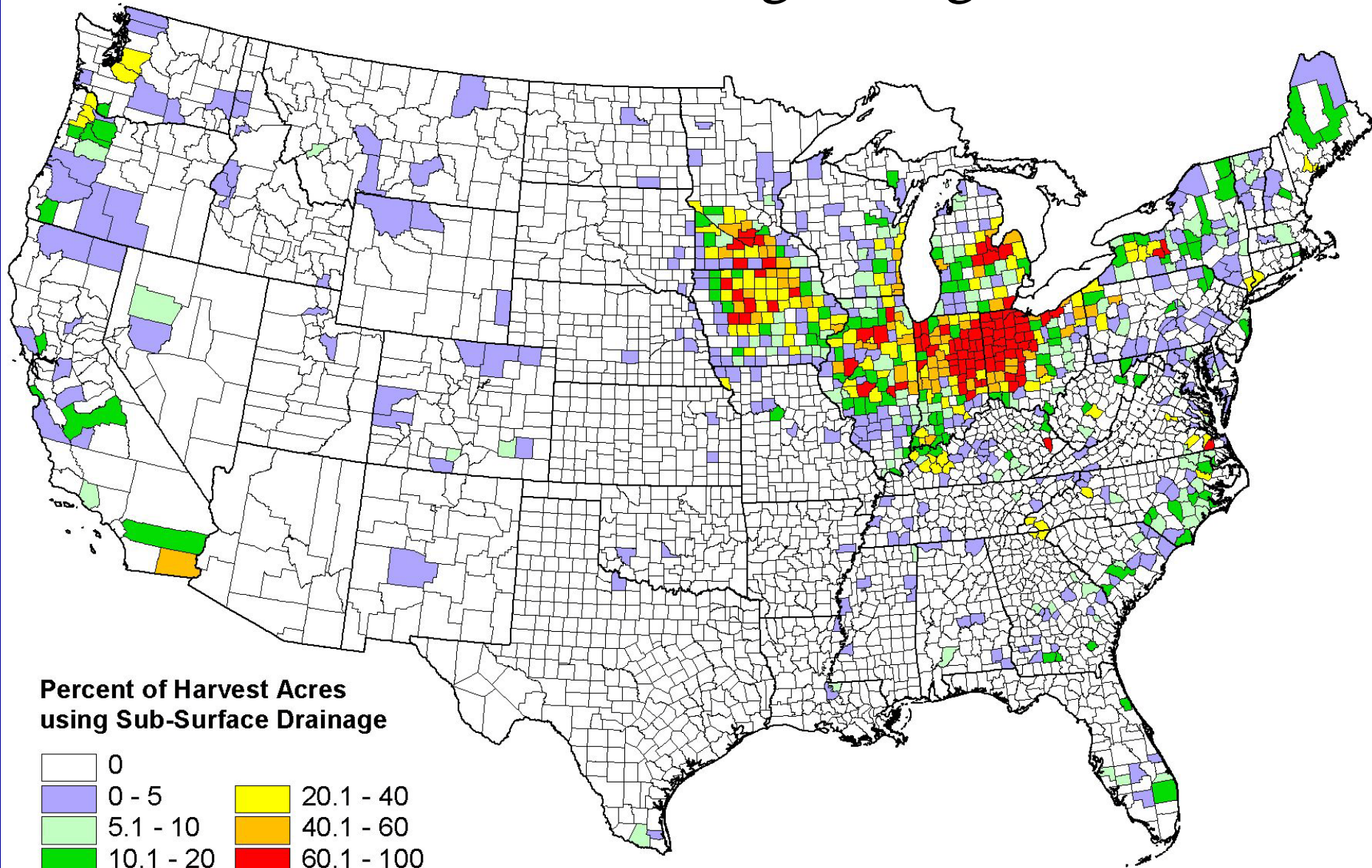
2008 Soil, Water, and Nutrient
Management Meetings



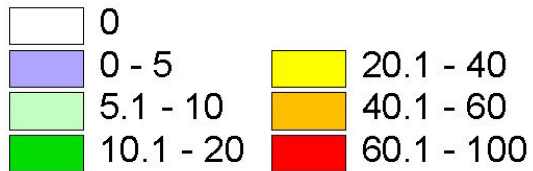
Outline

- Advantages and disadvantages to tile drainage
- Case studies and field studies – when and how much N are we losing?
- Management considerations and new technologies to minimize N losses

Sub-surface drainage of Agricultural land



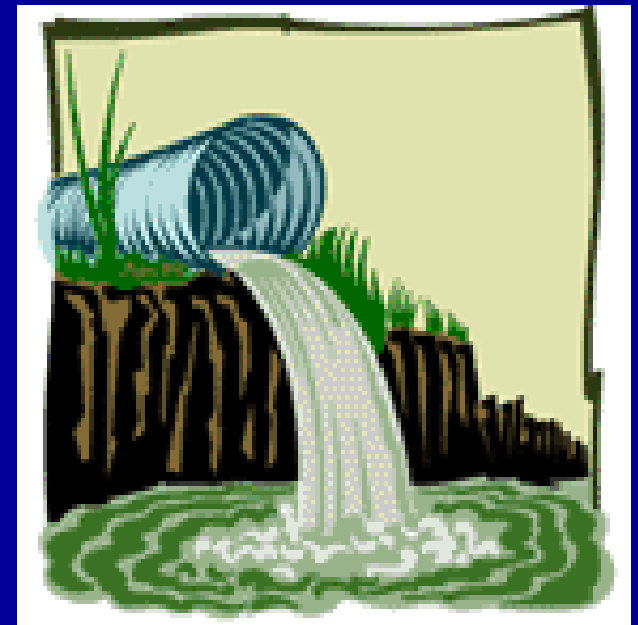
**Percent of Harvest Acres
using Sub-Surface Drainage**



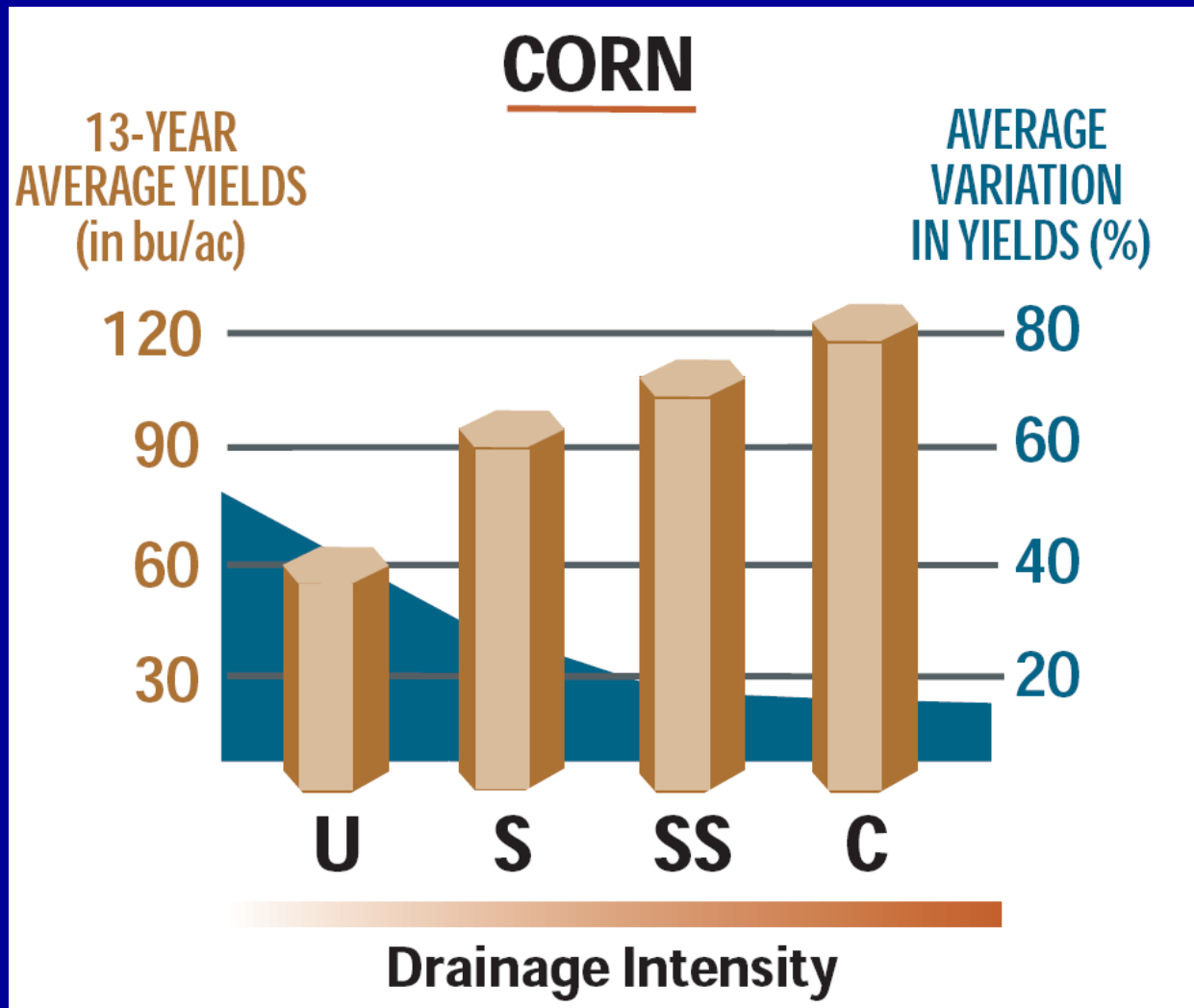
Source: 1992 NRI; 1992 Census of Agriculture

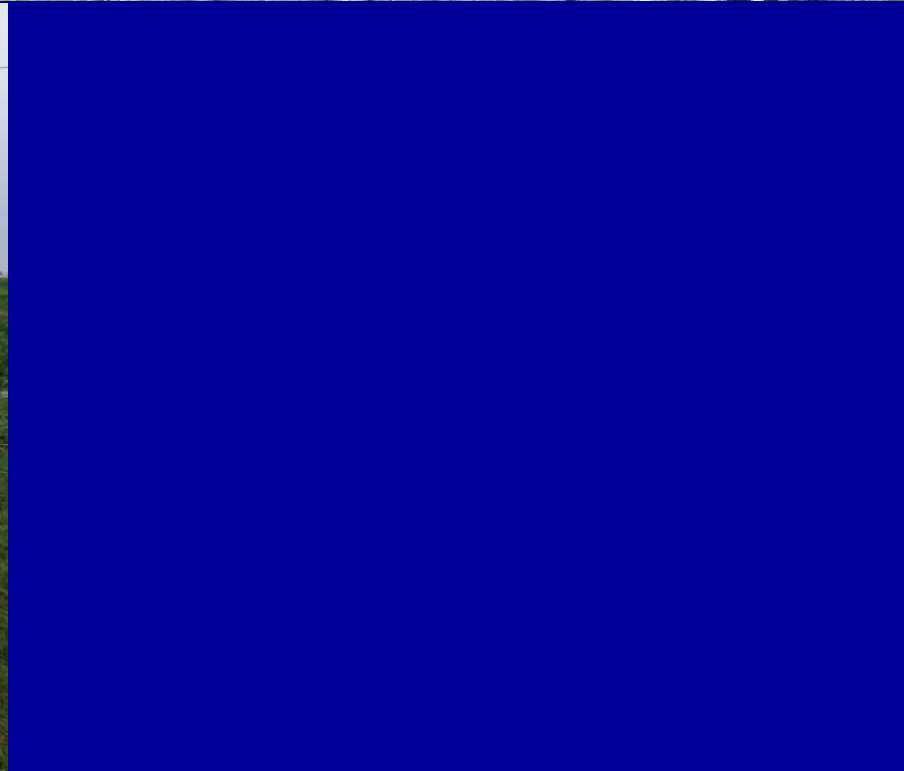
Benefits

- Increased timeliness of field operations
- Decrease in soil loss and nutrient runoff losses
- Increased yields



Increased yields





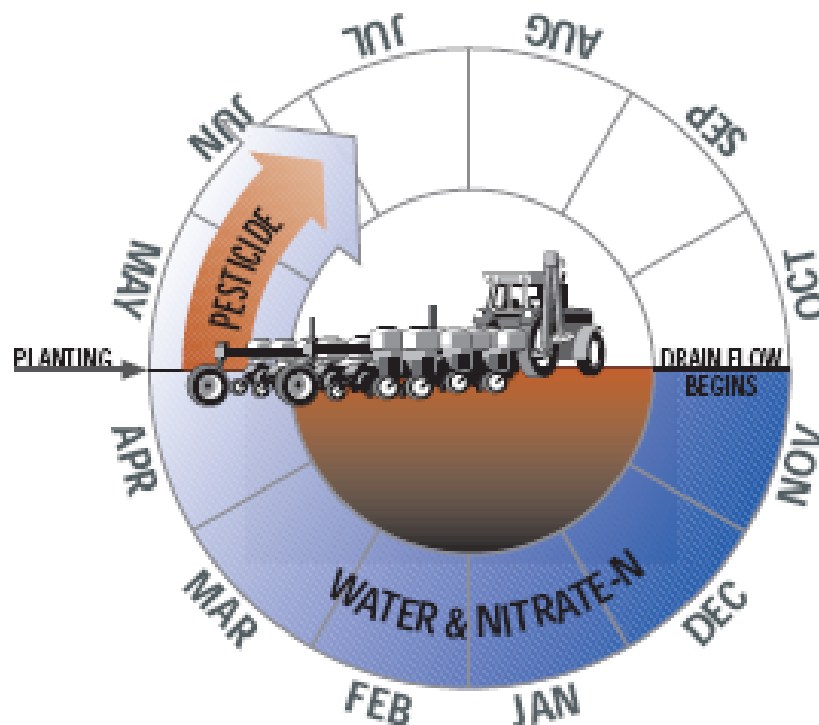
Disadvantages

- Nitrogen losses – economic loss
- Nitrate losses – environmental/health issue
- Manure losses



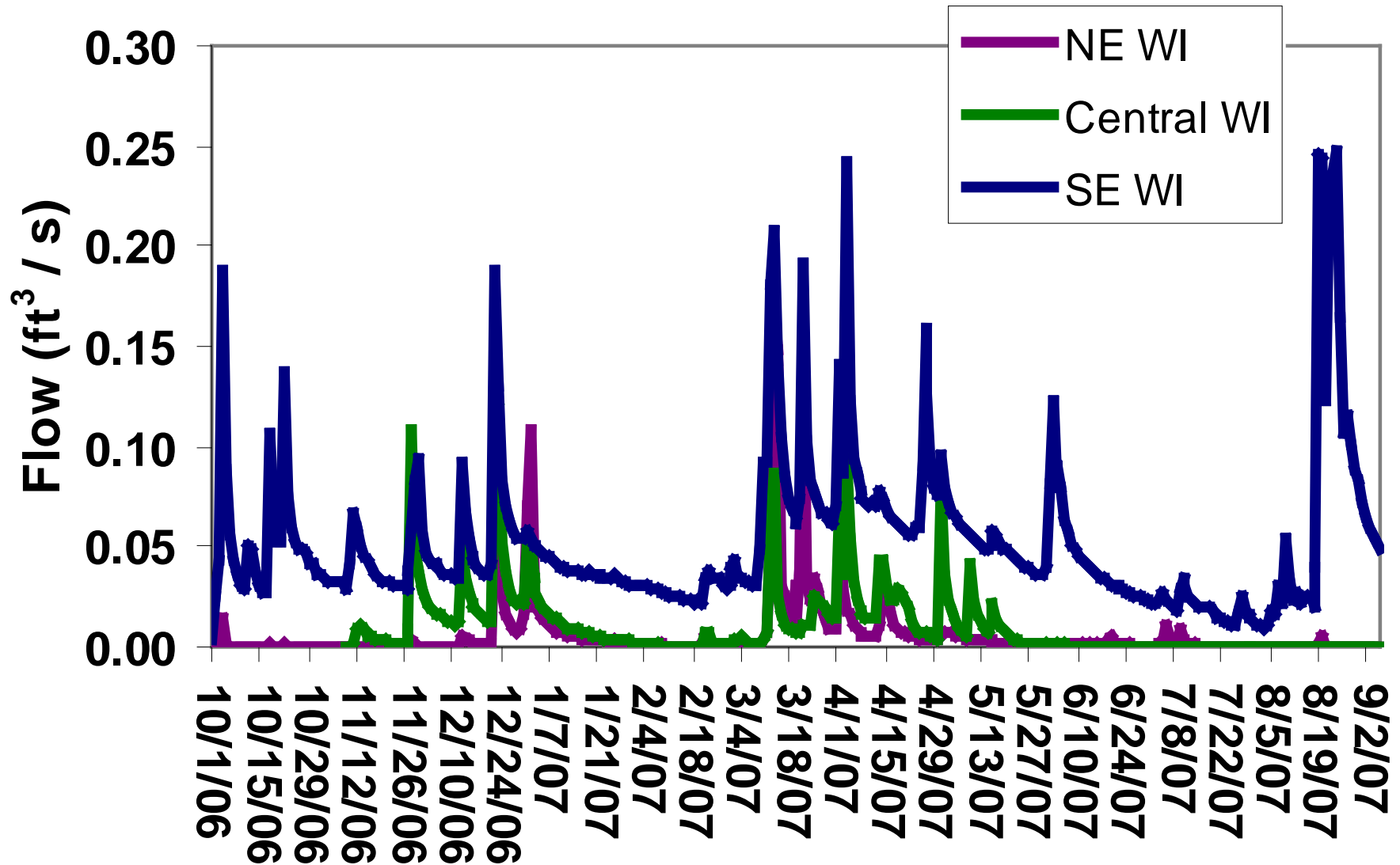
What do we know about management and losses?

- Unfortunately, little information about tile drainage and nutrient losses is available for Wisconsin.
- Discovery Farms has led to an increase in data, which is currently being evaluated.
- What have we learned so far:
 - When tile drains flow
 - Situations when N loss can be high



Nitrate-N is present in drainage water whenever there is subsurface drainage flow. Pesticides are present only during the first month or two after pesticide application (April or May).

Wisconsin

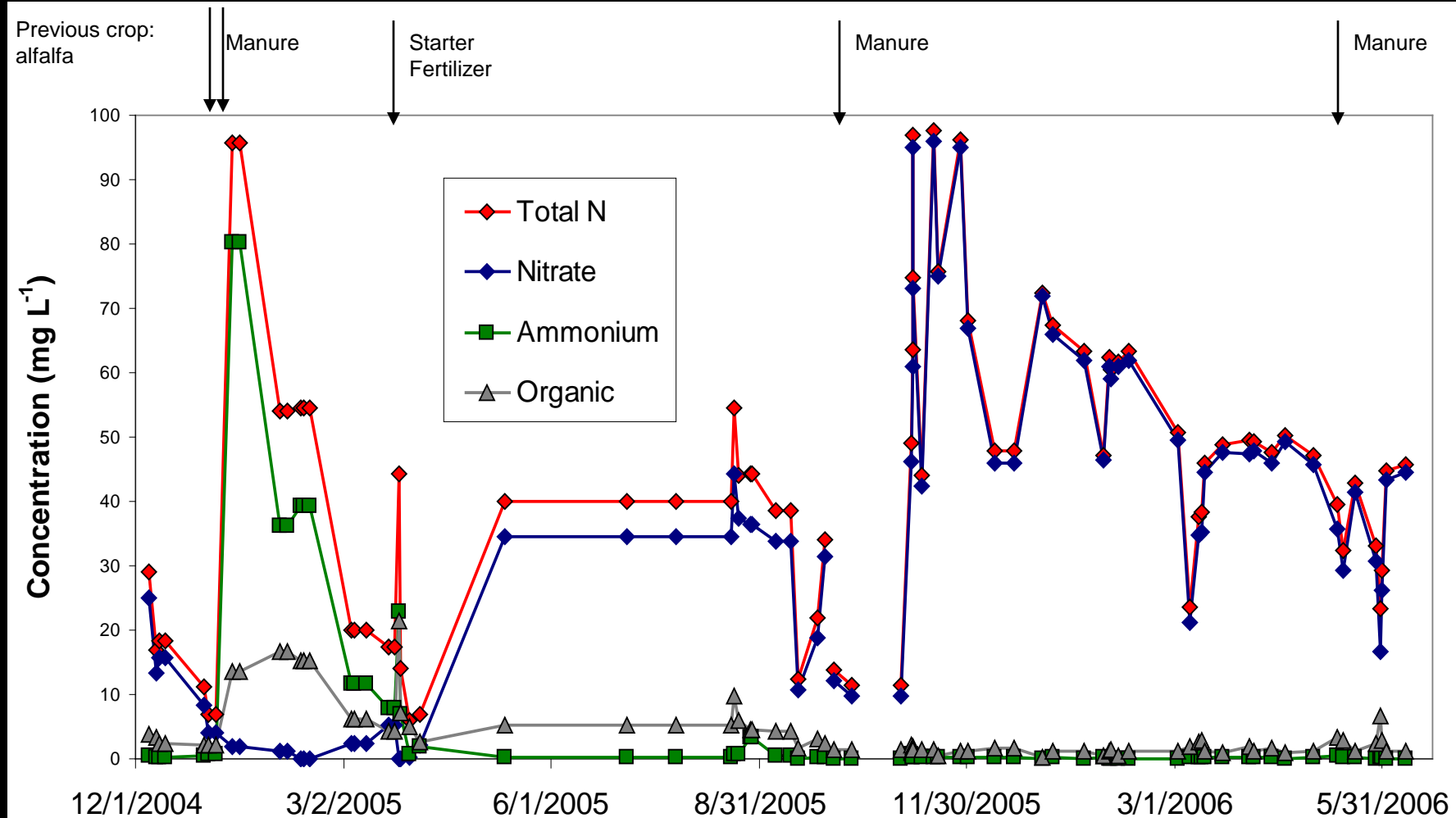


Management decisions to consider

Timing of application

- Late spring application resulted in a 25% decrease on N loss compared to preplant N (Bakhsh et al 2002 – Northeastern, IA)
- Fall manure increased N losses by 53% compared to spring applied UAN (NE IA)
- Fall applied manure resulted in greater N losses compared to spring applied manure (Ruark et al. 2008 – Northwestern IN)

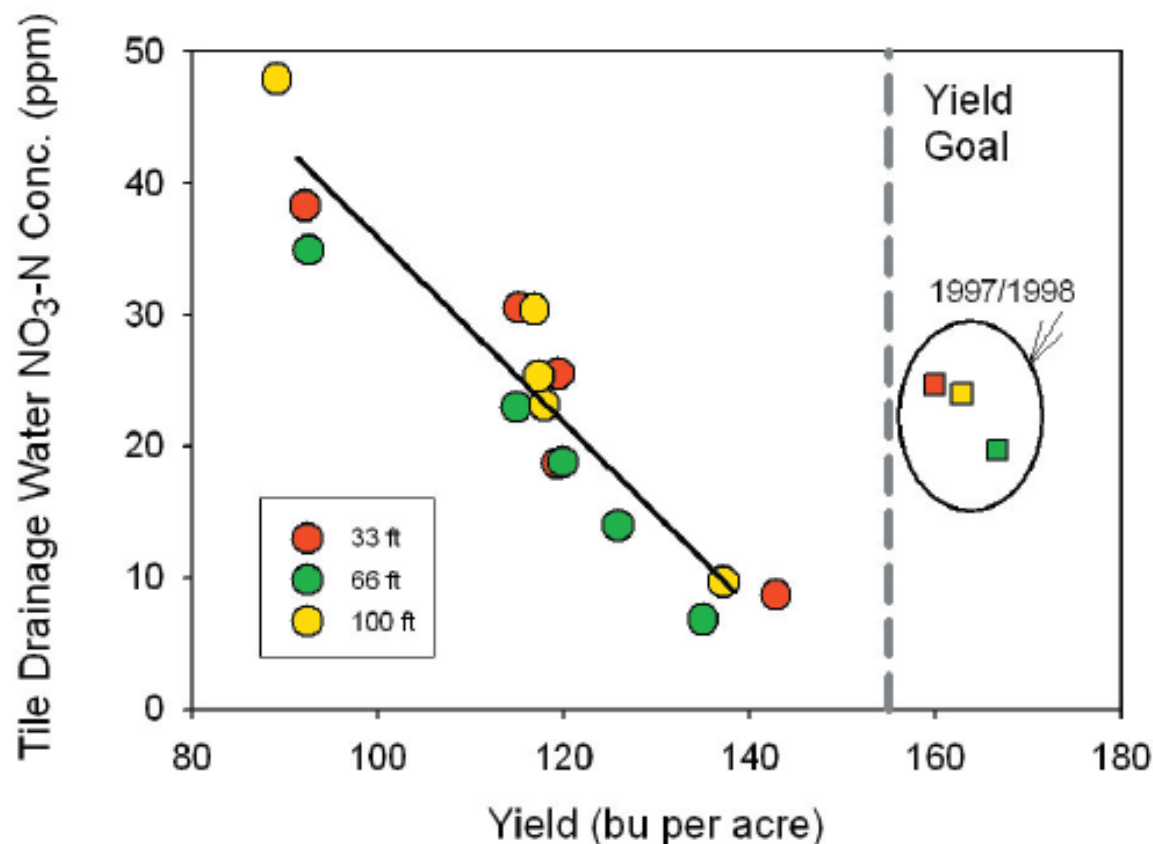
The "Perfect Storm" tile nitrogen losses



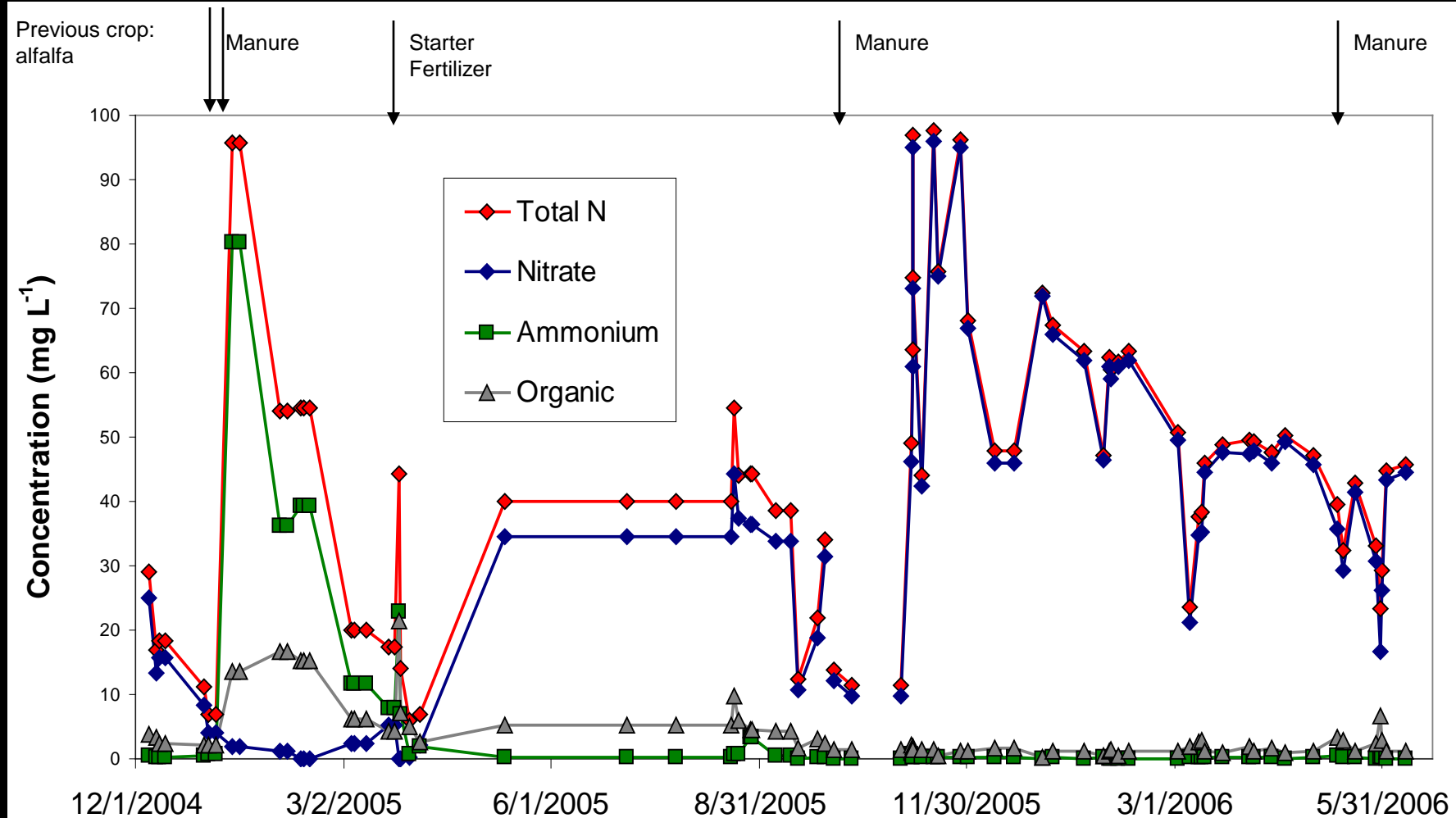
How much N do we lose?

	2005	2006	2007
	lb / acre		
Total Nitrogen	14.6	99.0	35.0
Nitrate	3.2	95.1	34.0
Ammonium	7.1	0.4	<0.1
Organic Nitrogen	4.3	3.6	0.9
Total Phosphorus	1.1	1.3	0.3
Particulate P	0.5	0.6	0.1
Dissolved Reactive P	0.6	0.7	0.2

Figure 5. Relationship between yield and $\text{NO}_3\text{-N}$ concentrations in drainage water measured in the following spring at the WQFS. Data are for continuous corn fertilized with 180 lbs. N per acre grown on three different tile spacings (33, 66, and 100 feet).



The "Perfect Storm" tile nitrogen losses



How to evaluate your drain tiles for water quality

Interpreting Nitrate Concentration in Tile Drainage Water, Purdue University, Brouder et al., 2005

NO ₃ -N Concentration (ppm)	Interpretation
≤ 5	Native grassland, CRP land, alfalfa, managed pastures
5 – 10	Row crop production on a mineral soil without N fertilizer Row crop production with N applied at 45 lbs./acre below the economically optimum N rate† Row crop production with successful winter crop to “trap” N
10 - 20	Row crop production with N applied at optimum N rate Soybeans
≥ 20	Row crop production where: <ul style="list-style-type: none">• N applied exceeds crop need• N applied not synchronized with crop need• Environmental conditions limit crop production and N fertilizer use efficiency• Environmental conditions favor greater than normal mineralization of soil organic matter

Technologies

- Alternative N fertilizers
 - Slow release fertilizers or nitrification inhibitors that delay conversion of applied N to nitrate
- Alternative drainage systems
 - Controlled drainage systems – hold back the release of drainage water until agronomically necessary (currently being evaluated in Midwest)

Minimizing Nitrate Losses

(Randall and Mulla, 2001)

1. Don't tile drain
2. Wetland restoration areas to capture drain water
3. Fine-tune N application rates and timings
4. Use of soil N tests
5. Alternative cropping systems
6. Improvement in manure management

Review

- Consider tile drainage when developing your nutrient management strategy
- Take into consideration that fall application of N will lead to greater losses compared to spring application (especially true for manure)
- Take preplant / presidedress soil nitrate samples to evaluate N need following low-yielding year
- If you are concerned with leaching losses of N, consider the changes to your nutrient management plan and/or the application of new technologies