

Applying Manure---The Right Rate at the Right Time

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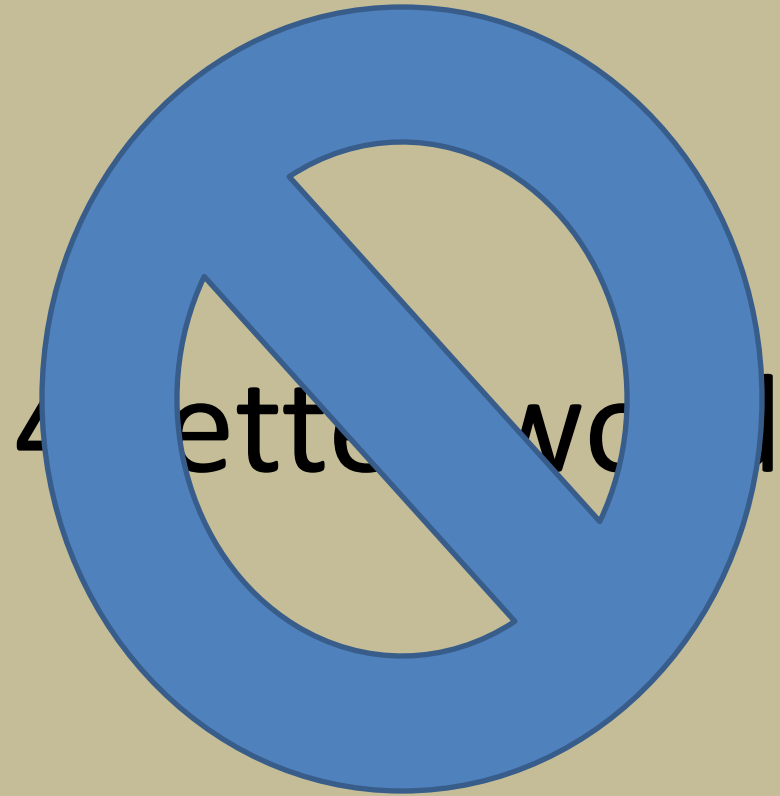
Minnesota Nutrient Efficiency & Management

February 15, 2011

Outline – So I don't get lost either!

- Values and costs of manure and manure application
- Does today's decision matter?
 - Contributions from a single storm
- Considerations for application
 - Manure and tile drainage: too wet, too dry or both?
 - No till and P stratification

Important manure facts





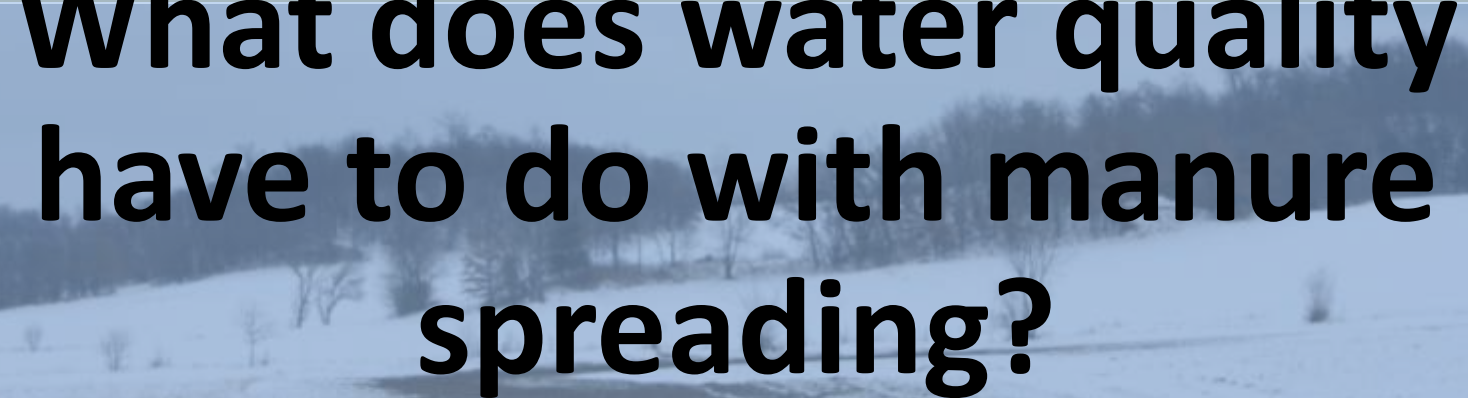




A blue Husky manure spreader truck is shown in a green field. The truck has "Husky" written on its side in yellow. The background is a lush green field.

Why do we spread manure?

What's in it?

A snowy field with a dark path or road winding through it. The background shows a line of trees under a blue sky.

**What does water quality
have to do with manure
spreading?**

Important manure facts

- Manure is a great source of nutrients
- All manure is not created equal
- Nutrients are not all available
 - **Total nutrient content = inorganic + organic**



What's manure worth?

- Based on nutrient content
 - Book values
 - Manure testing history
- Based on purchased fertilizer cost
 - Usually based on N, P, K
- Based on handling and transportation cost
- Soil amendments?
 - Organic matter, infiltration, structure

What did I forget?

- Cost to mix, load and haul manure to field
- Cost to apply manure (compared to fertilizer)
- Cost to incorporate (minus value of tillage)
- Compaction potential
- Public relation issues – odor, traffic, etc.
 - **Regulations**



Winter 2004

- Mid-Feb runoff
- 5" snow, 1" water equivalent
- Rain on snow

Fall applications

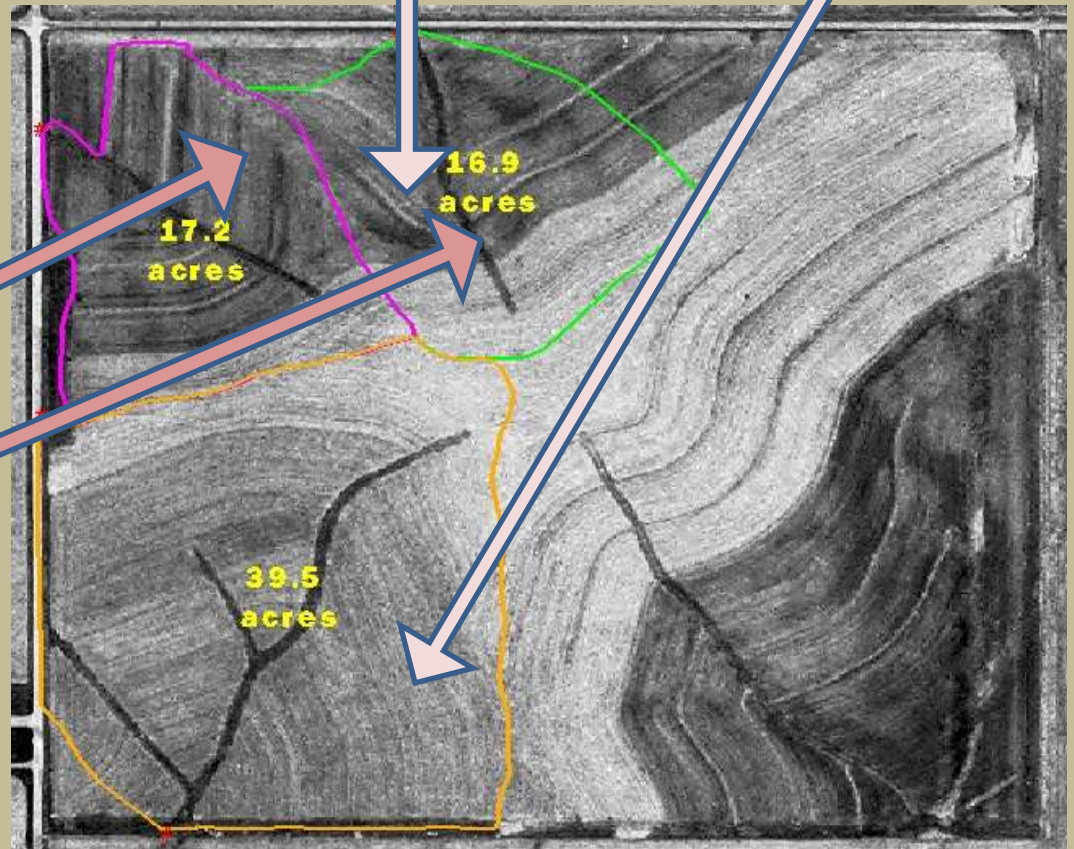
Sep: 6,000 gal/acre

Nov: 7,000 gal/acre

Winter applications

Feb. 14: 4,300 gal/acre

Feb. 13: 7,000 gal/acre



The Outcome

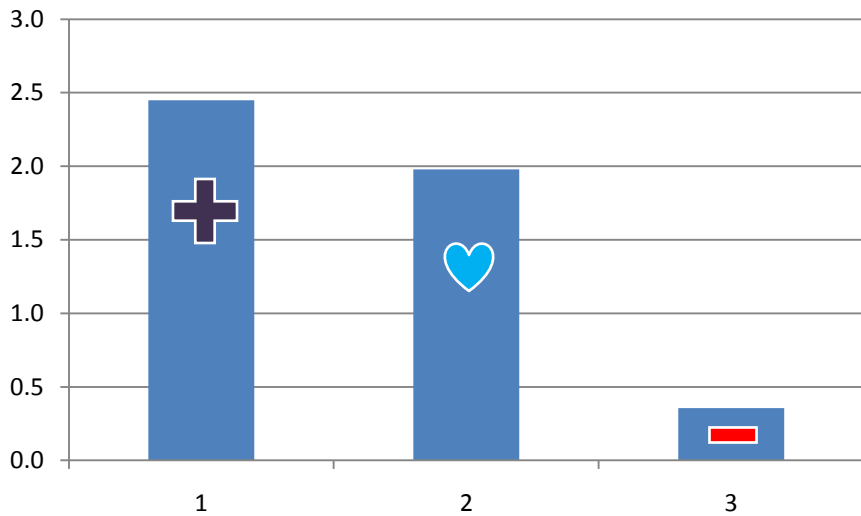


- Samples represent approximately the first two days of snowmelt in 2004

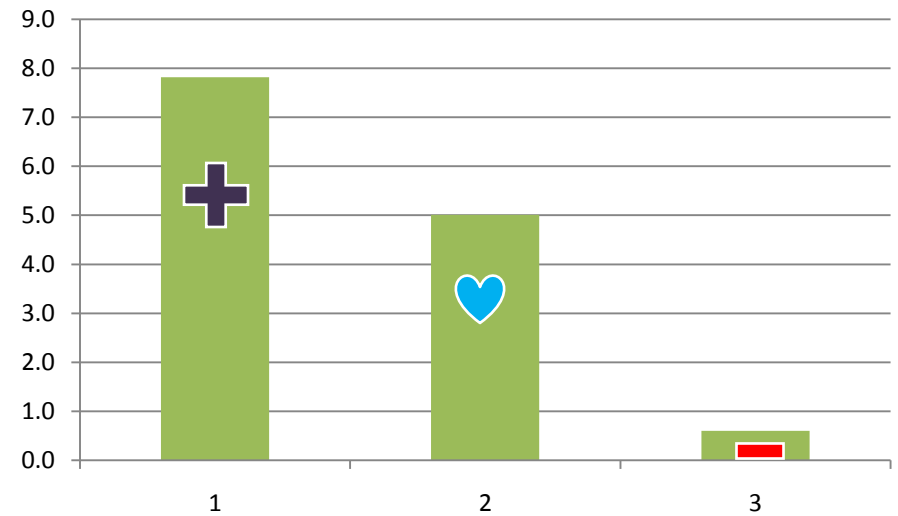


Winter 2004 Nutrient Loss

P loss Winter 2004



N Loss Winter 2004



“Effective” Wintertime
Application Rates



Feb. 14: 5,200 gal/acre

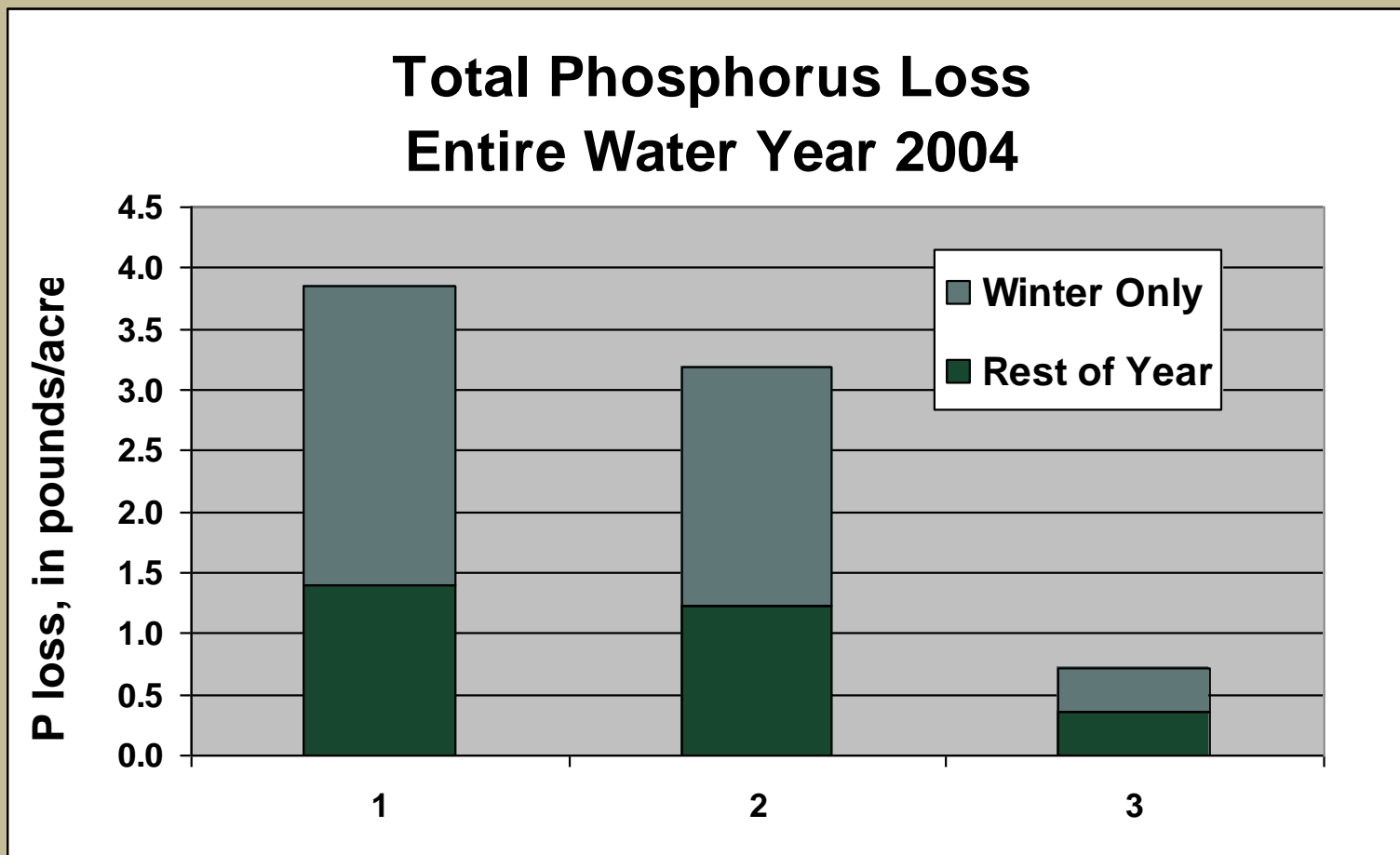


Feb. 14: 4,800 gal/acre

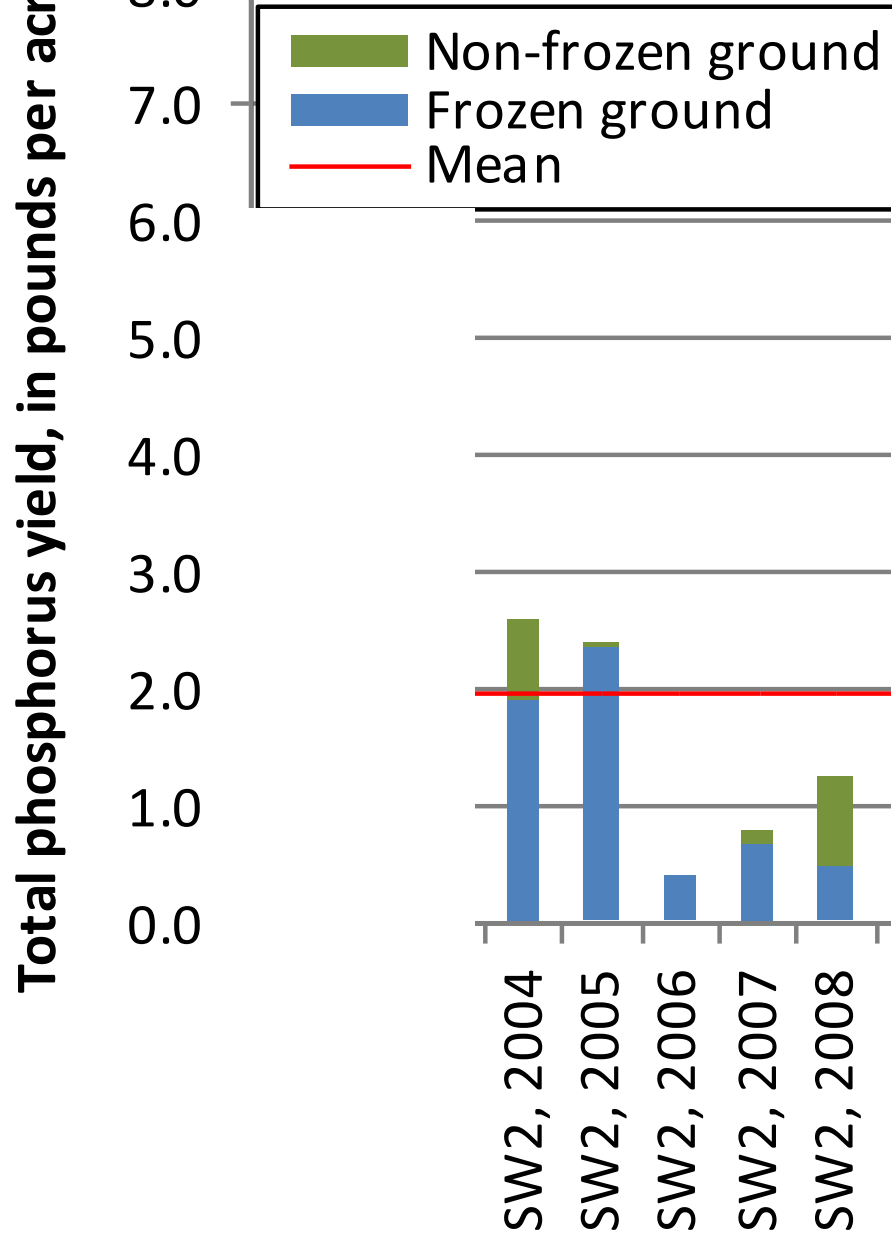


Feb. 14: 1,550 gal/acre

P Losses for Entire 2004

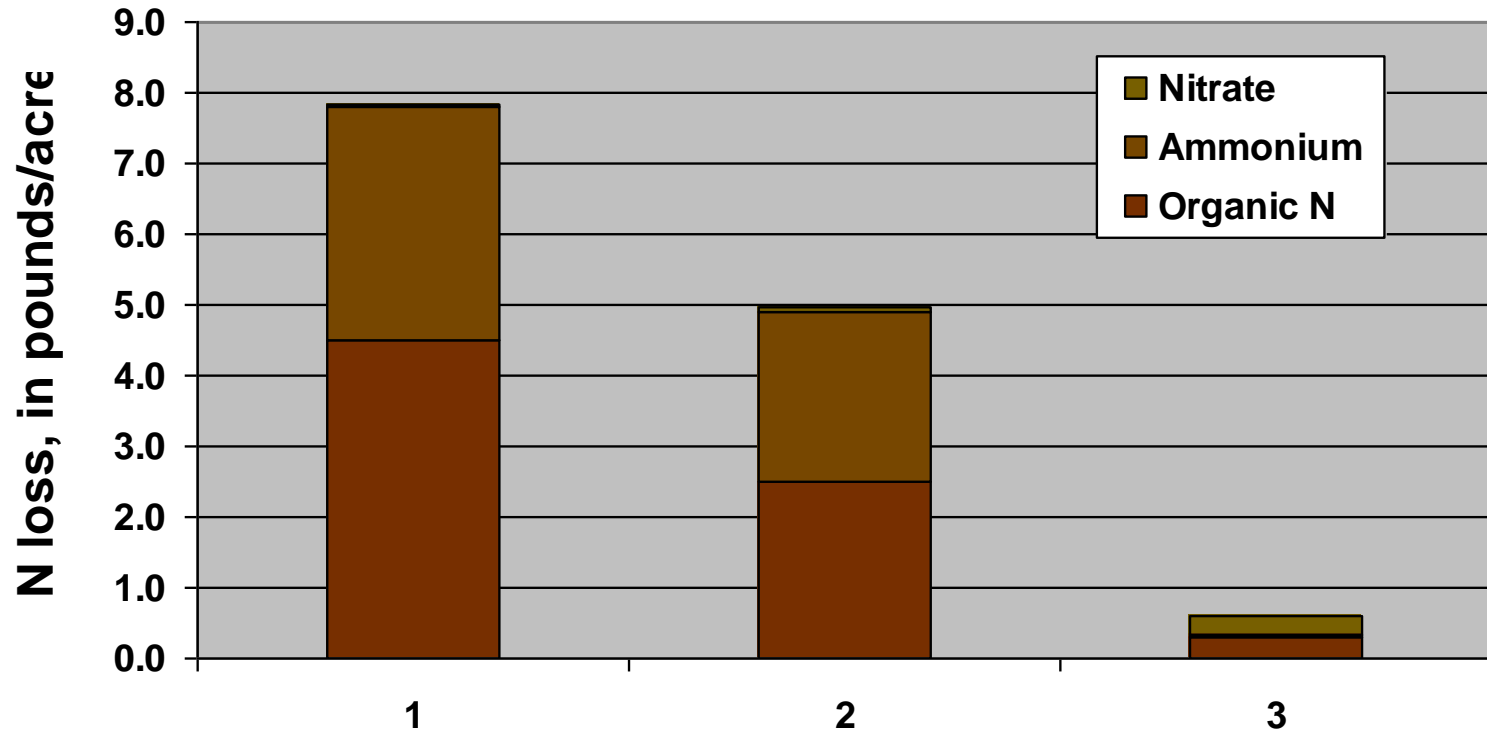


A manure management decision can have a big impact to annual nutrient losses.



Nitrogen Speciation

Nitrogen Loss Speciation Winter 2004

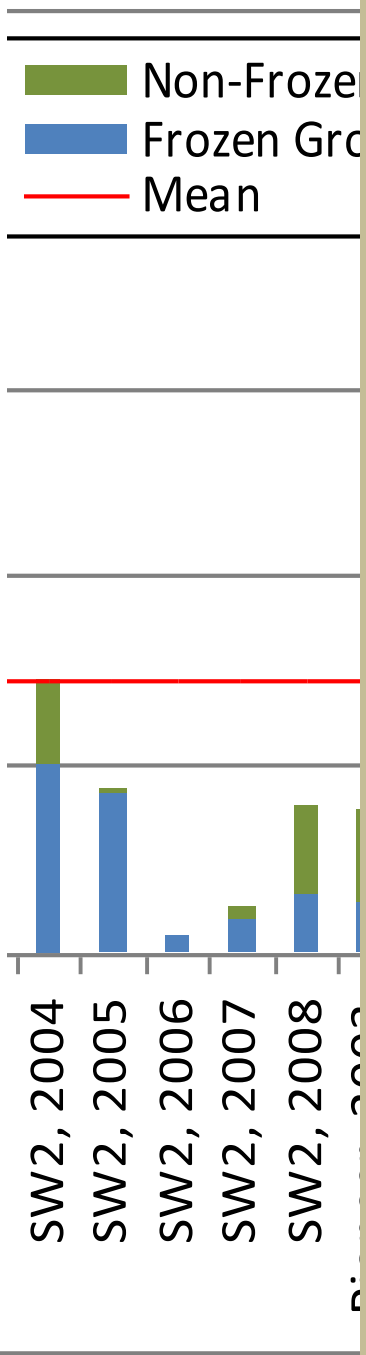


Total nitrogen yield, in pounds per acre

25.00
20.00
15.00
10.00
5.00
0.00

Non-Frozen
Frozen Gro
Mean

SW2, 2004
SW2, 2005
SW2, 2006
SW2, 2007
SW2, 2008



Winter 2005

- Several rain events
- Ice layer
- Warm temps

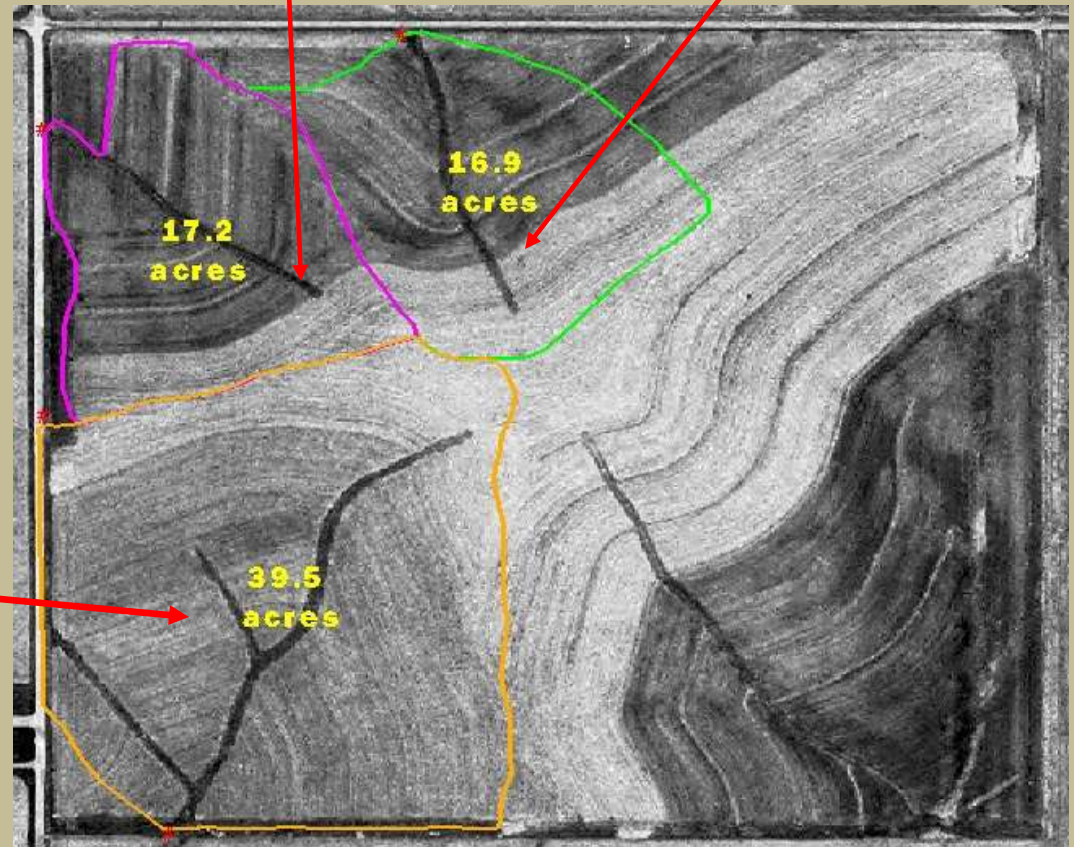
Fall applications

Oct:

4,100 gal/acre and 13 T/acre
(partial field only)

Sep:

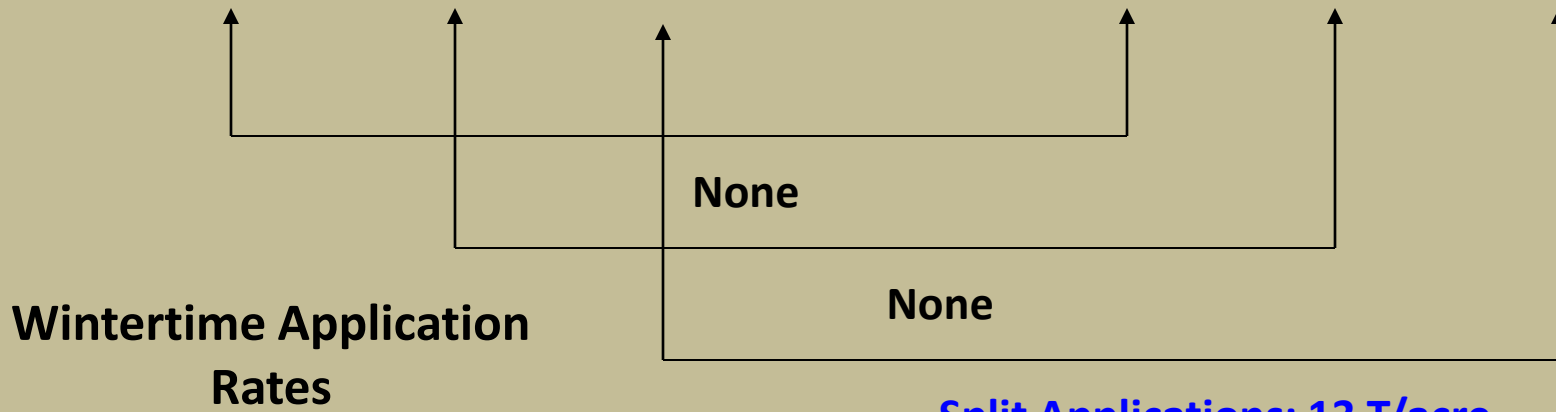
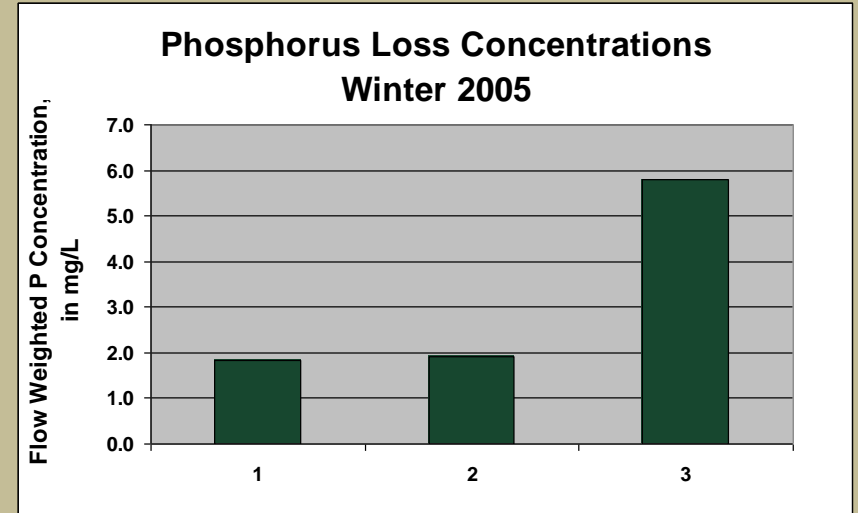
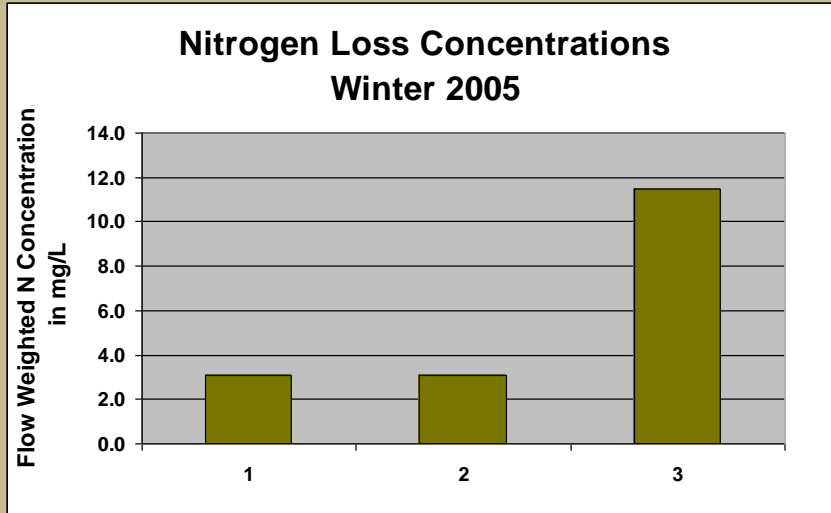
13 T/acre



Winter applications

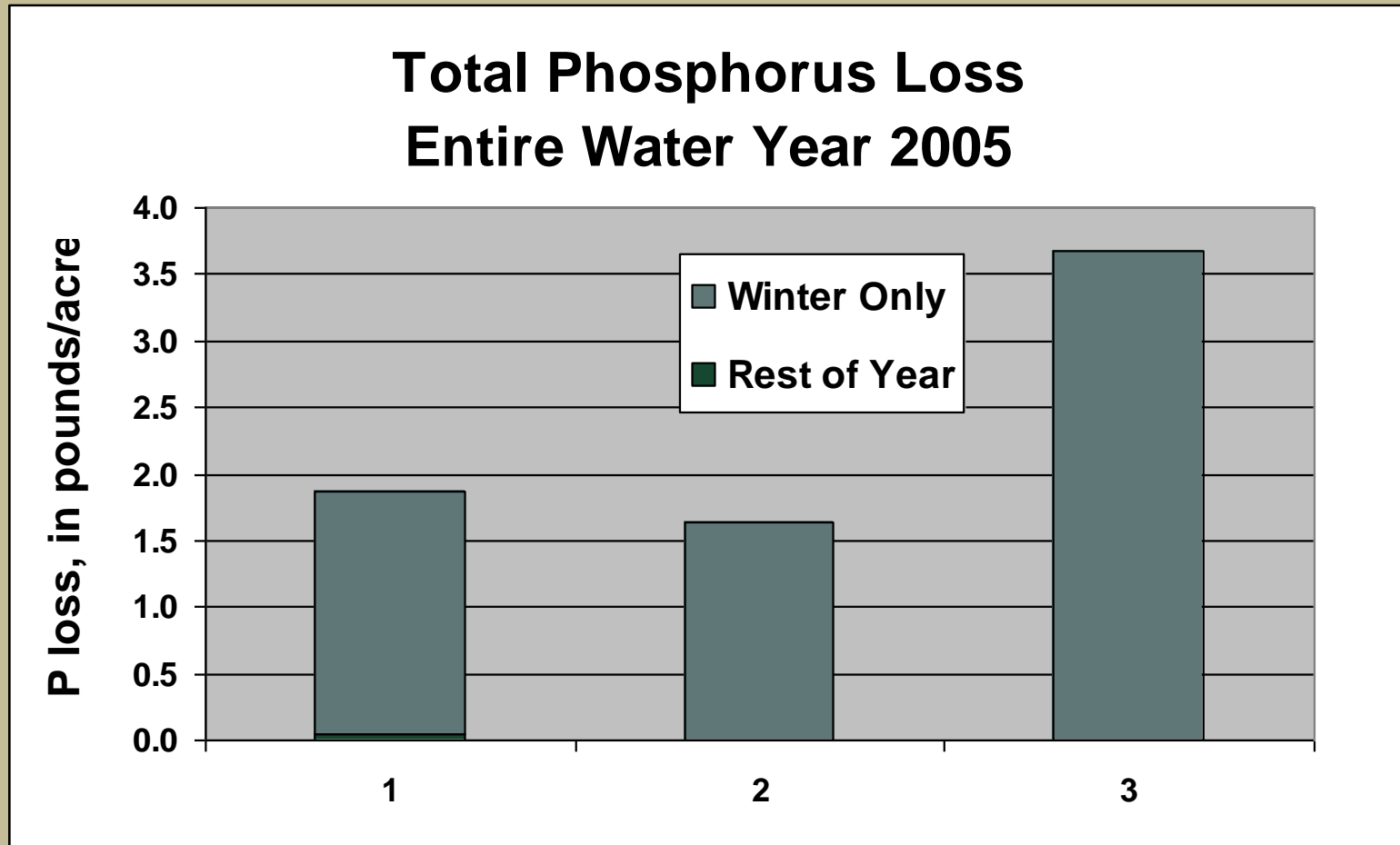
Jan 1, 28,
Feb 12, 19 at 13 T/acre

Winter 2005 Nutrient Concentrations

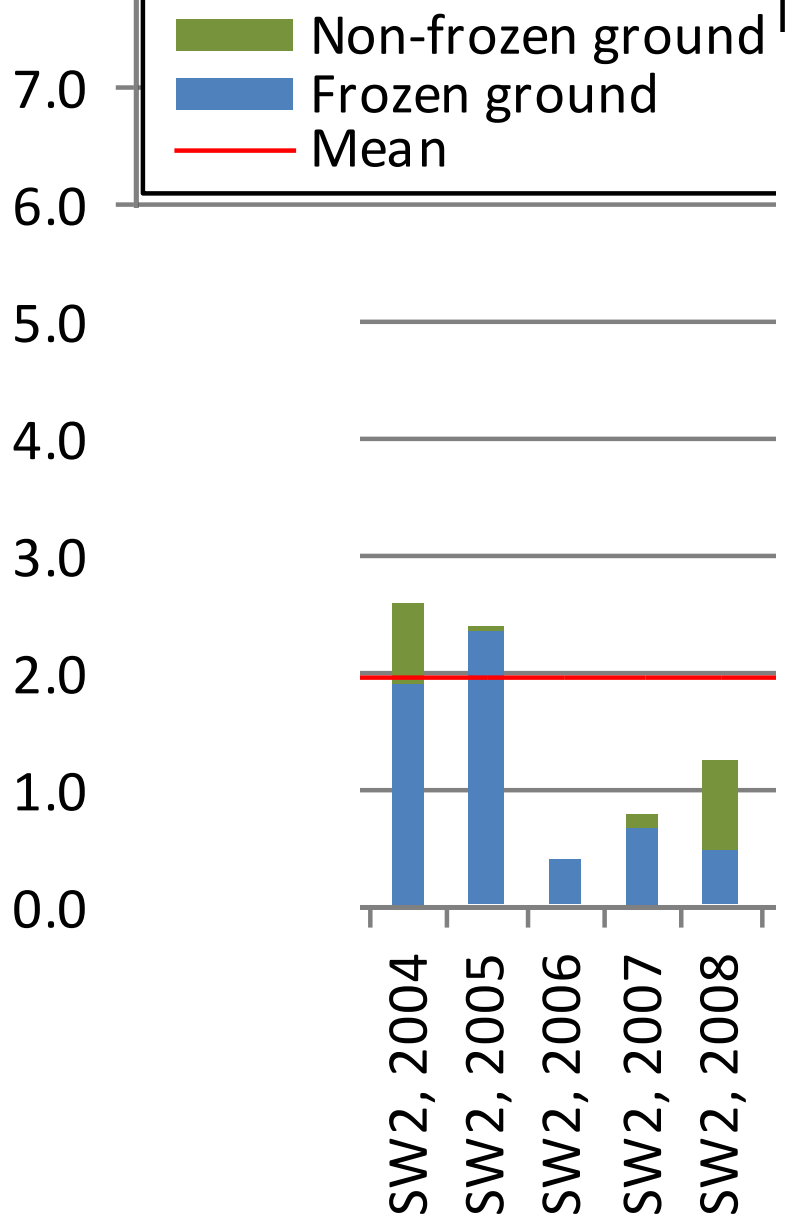


Split Applications: 13 T/acre

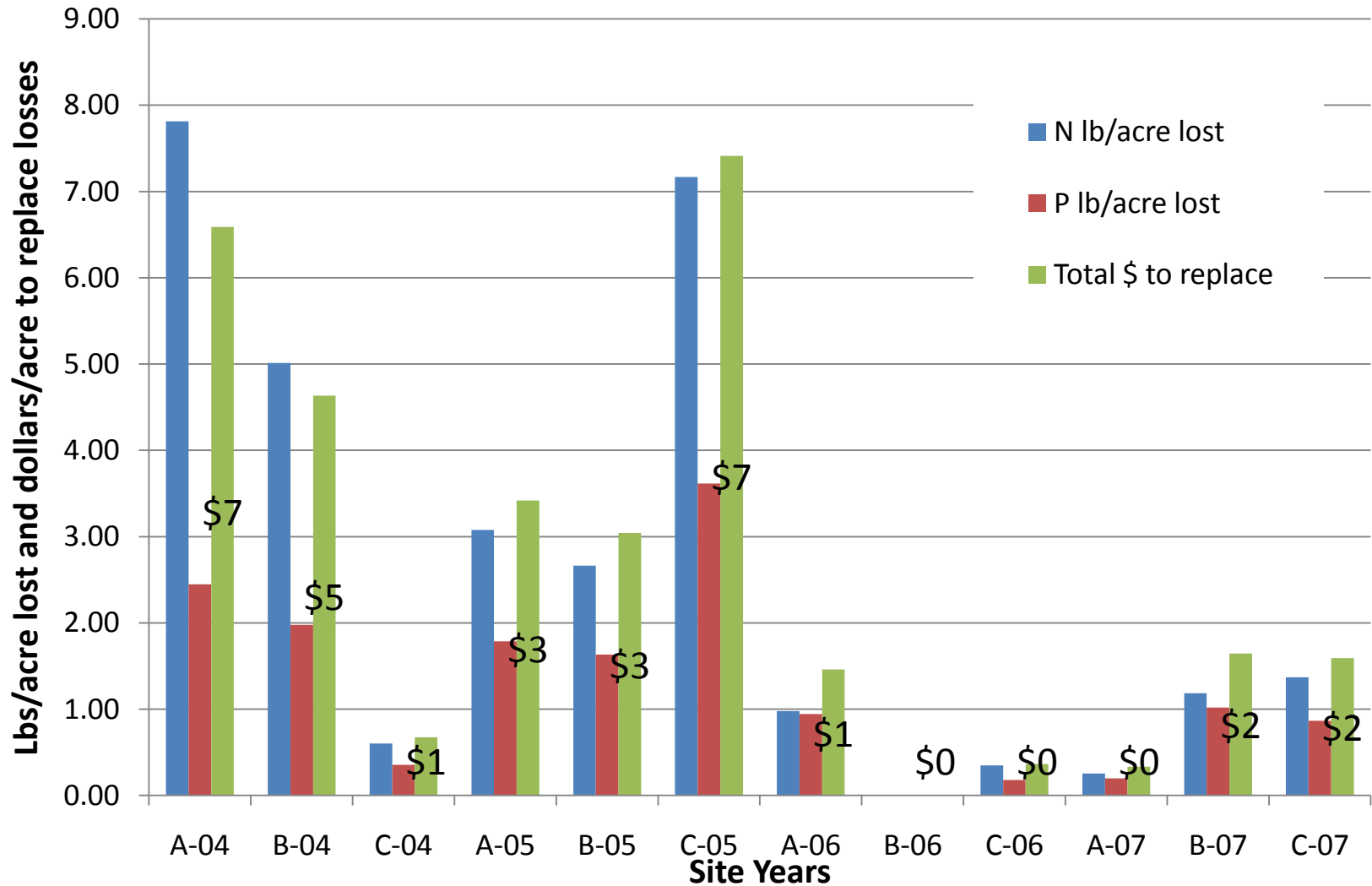
P Losses for Entire 2005



Total phosphorus yield, in pounds per acre



Economics of Losses



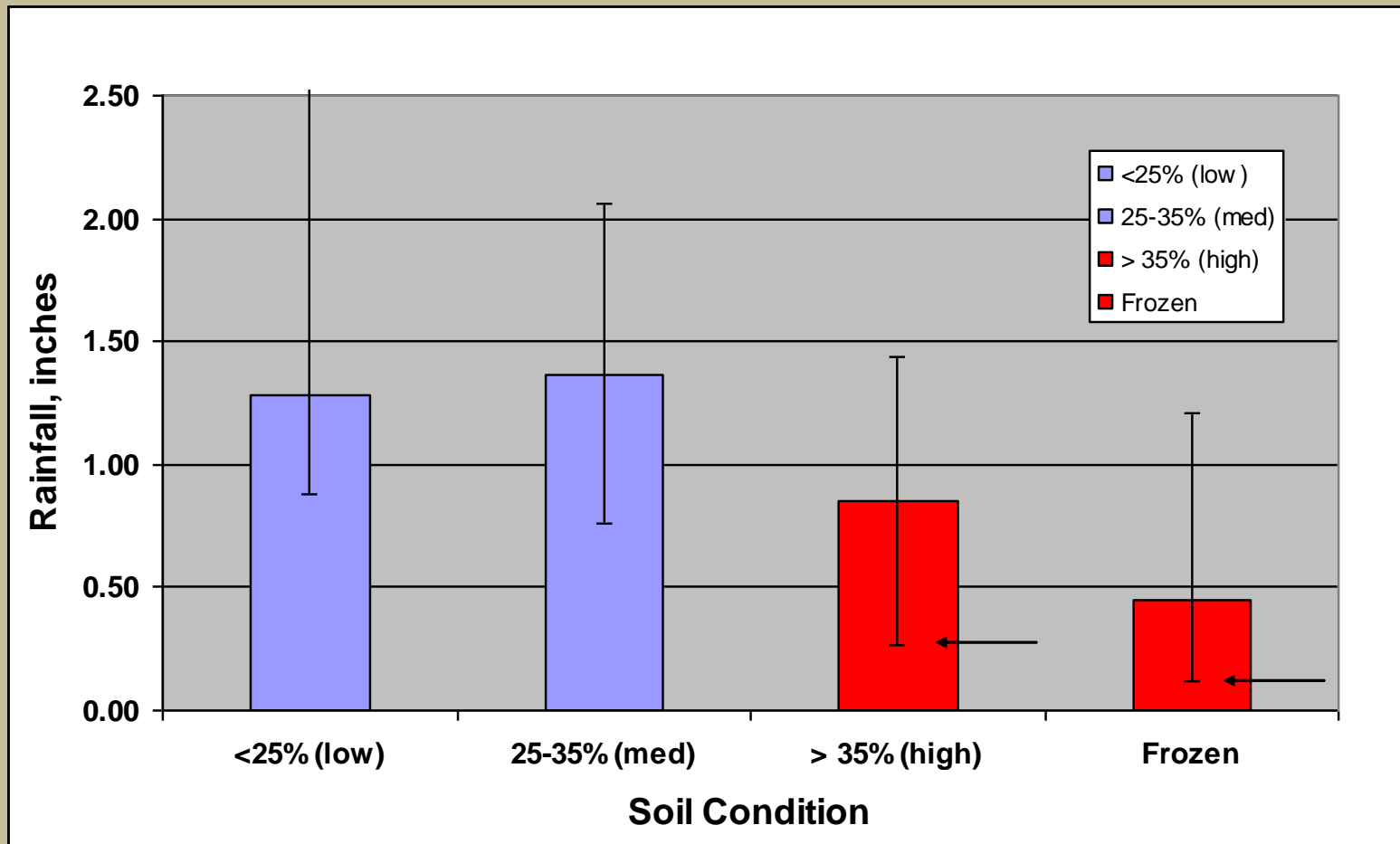
What is the distribution of runoff for various soil conditions?

Example: No-till farm in SW Wisconsin (2003-2008)

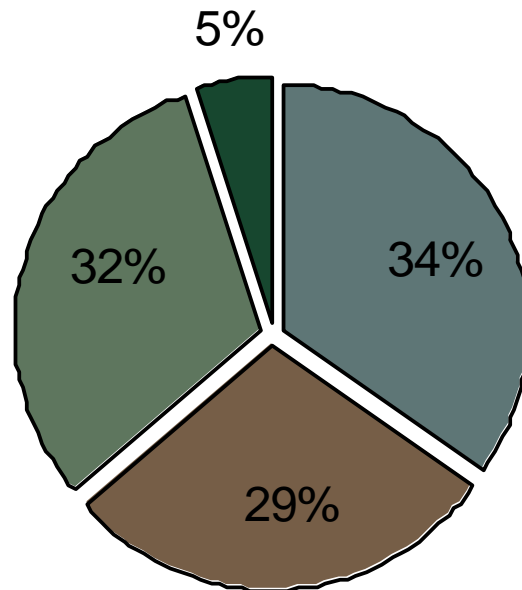
- Frozen ground: 80%, Non-Frozen Ground: ~ 20%
 - Of the frozen ground runoff, about $\frac{3}{4}$ has occurred in February and March
- Of the non-frozen ground runoff:
 - 83% occurred when soils were “Wet” (>35%)
 - 10% occurred when soils were “Medium” (25-35%)
 - 7% occurred when soils were “Dry” (<25%)

How much rain does it take to produce runoff for a given soil condition?

Example: No-till farm in SW Wisconsin (2003-2008)



Field Conditions

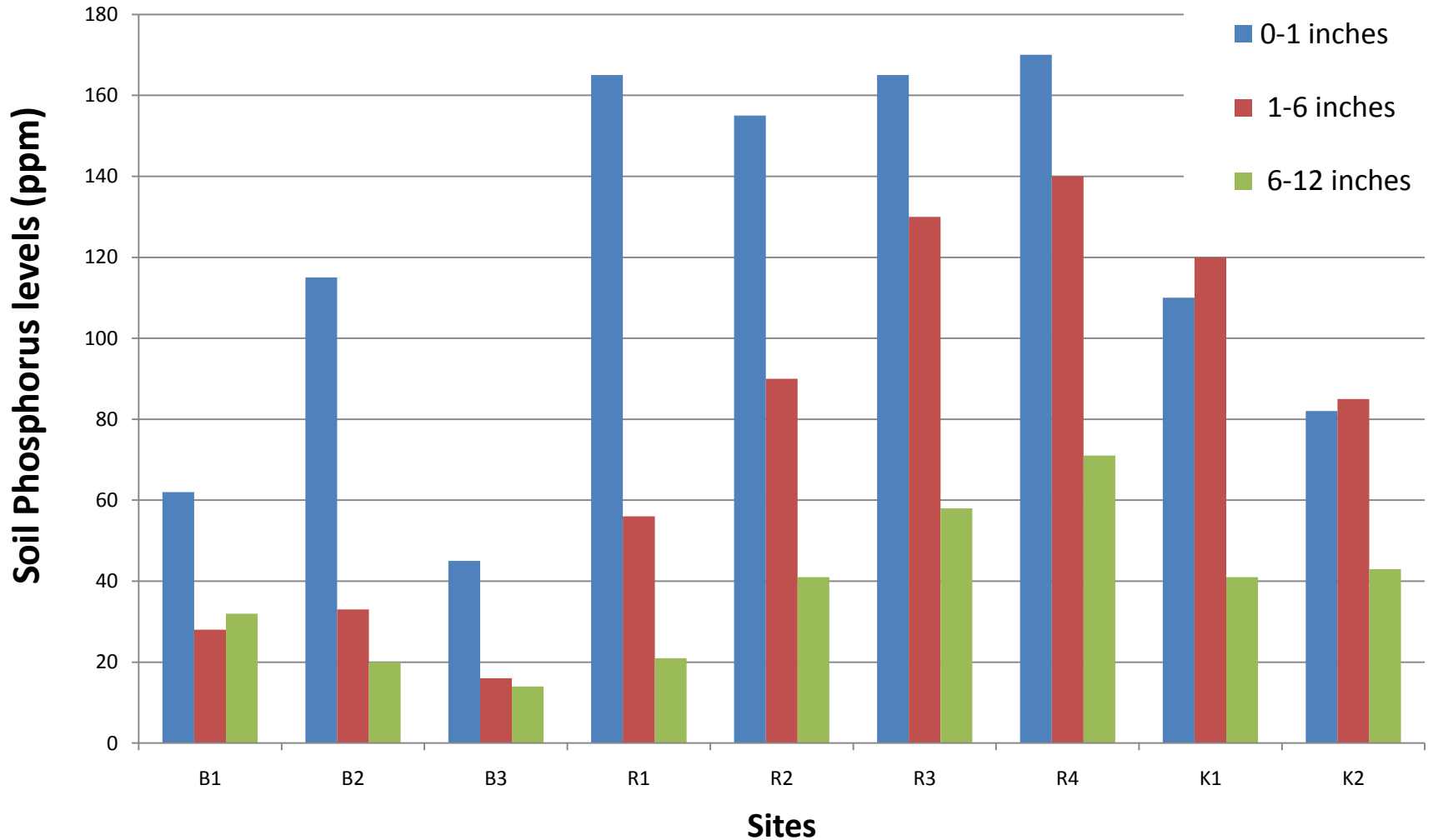


- Frozen Days
- "Low" Moisture Days
- "Medium" Moisture Days
- "High" Moisture Days

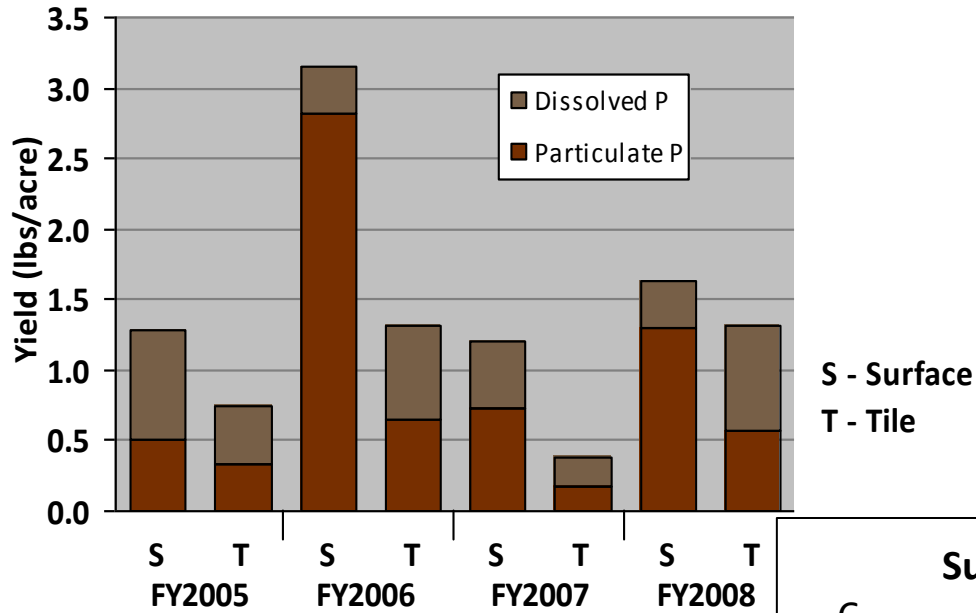
Manure and Tile Drainage



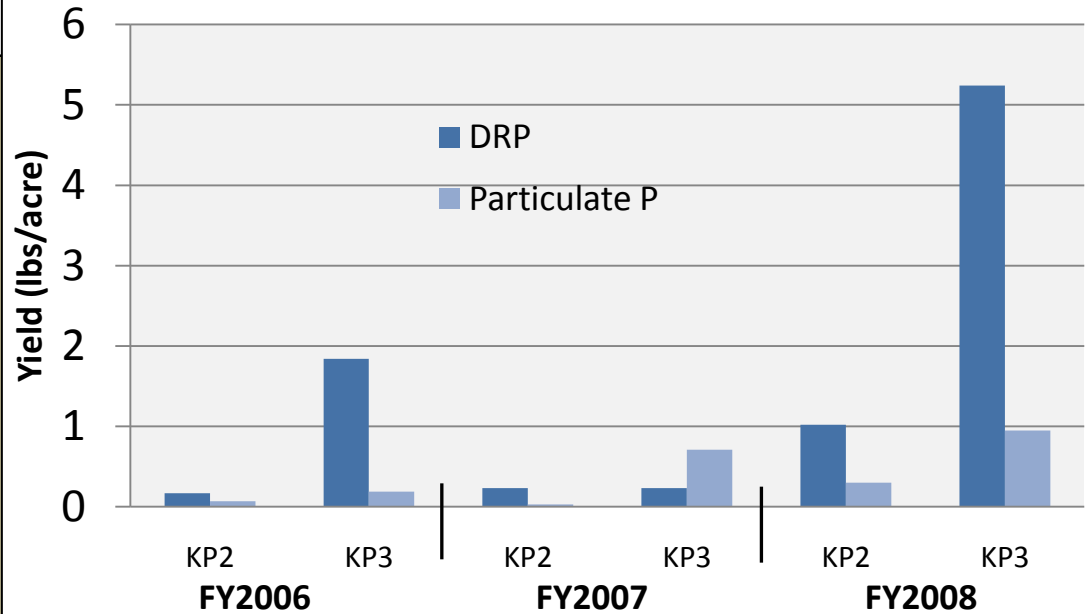
P Stratification in No Till



Basin Average Phosphorus Loss



Surface/Tile Basin Phosphorus Losses by Year



Manure Management through the Seasons

- Right rate
 - Reduced rates (?)
- Right time
 - Snowmelt
 - Soil at or near saturation
 - Soil dry and cracked (with tile or groundwater concerns)
 - Frozen/snow covered ground
- Right location
 - Away from surface water
 - Relatively flat

Manure applications on non-frozen ground: Conclusions

- Soil moisture and forecasted precipitation are important considerations
- When soil moisture content is medium to high category, consider:
 - Forecasted precipitation
 - Amount of water in manure

Conclusions

- Surface water runoff was not significantly affected by the surface application of manure, suspected that the low rates of the application may influence this
- Both LDM and SBM significantly increased the losses of TN and TP when applied within one week of runoff
- Nutrient losses were less when manures were applied in the fall or early winter

Why not ban winter spreading?

- Having all livestock farms apply manure in a narrow window greatly increases the risk
- Spreading entire field verses portions of a field can increase risk
- Storage does not reduce the risk of a runoff event
Management reduces risk
- **Work with producers to limit spreading in high risk periods, offer options to storage**
 - **Stacking; spreading fields with limited risk; etc**
- The shorter the time between a manure application and a runoff event, the greater potential for nutrient losses.

Needed research:

- Impacts of manure applications to frozen/snow-covered ground in early winter compared to late winter.
- Distance/rate/manure type impacts.
- Are “low” recommended rates really ok?
- Wintertime runoff “forecasting”
- Impact via subsurface Tiles

Questions?

Thank you!

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