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

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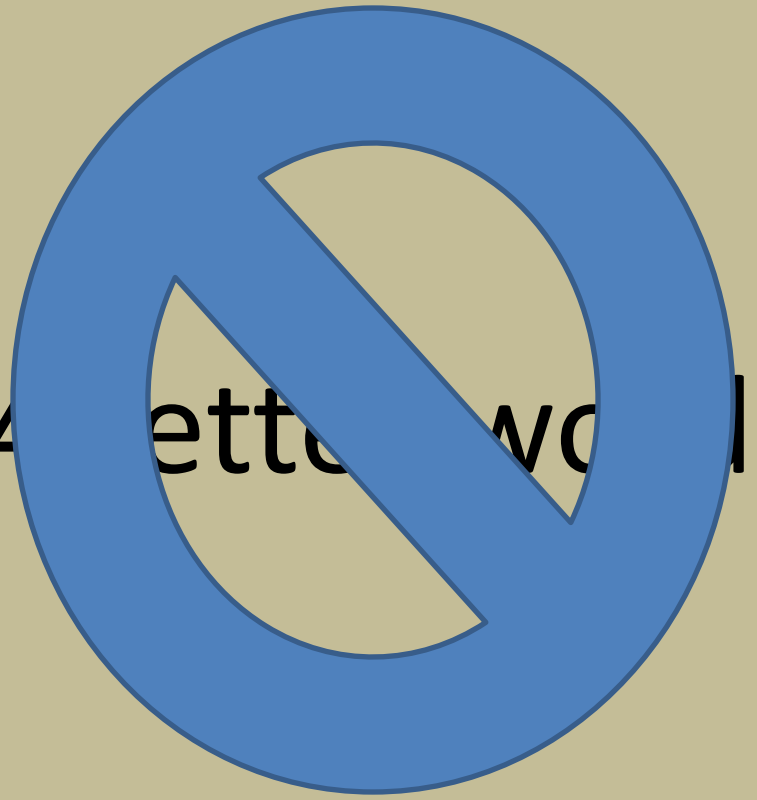
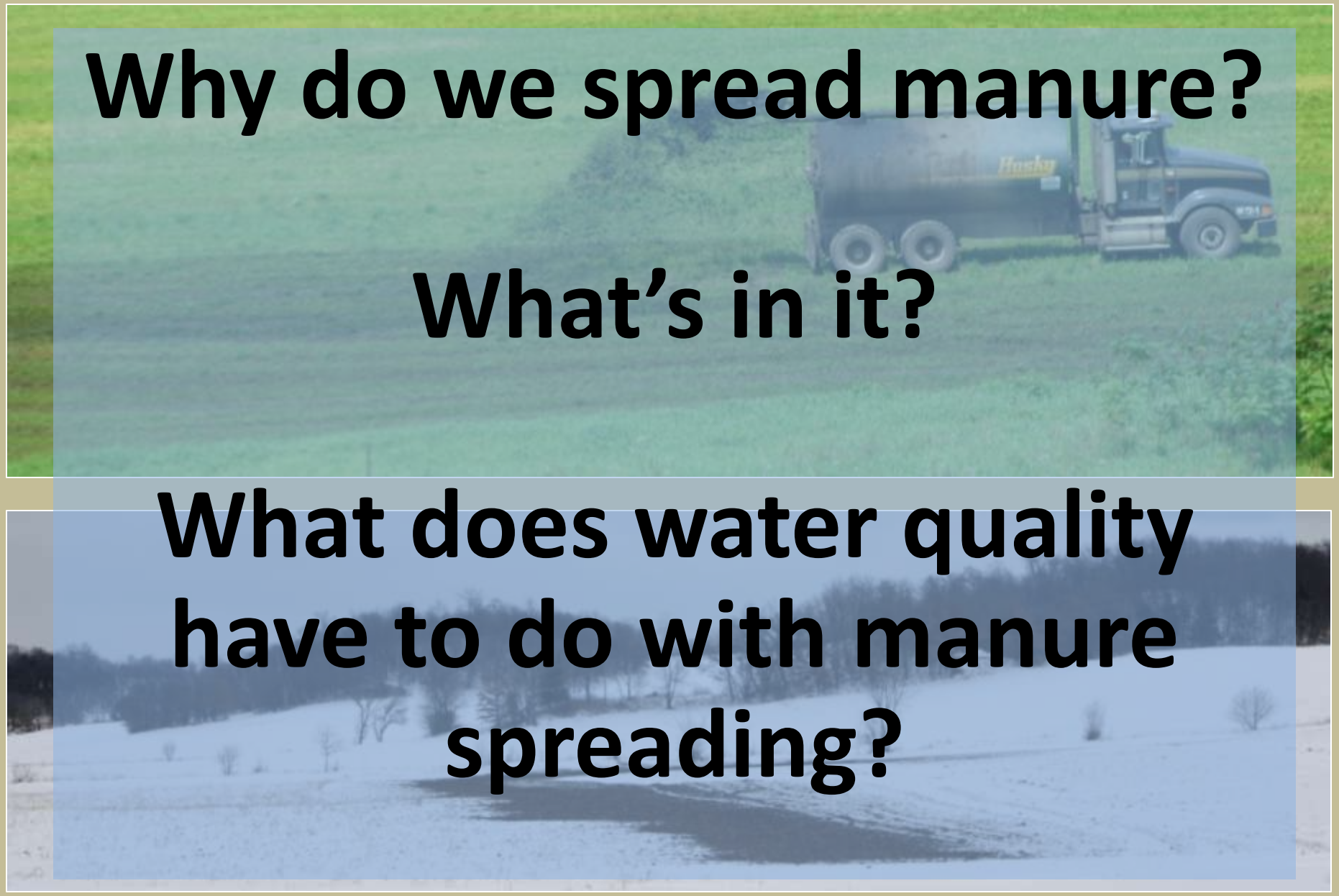
Outline – So I don't get lost either!

- 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





Why do we spread manure?

What's in it?

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

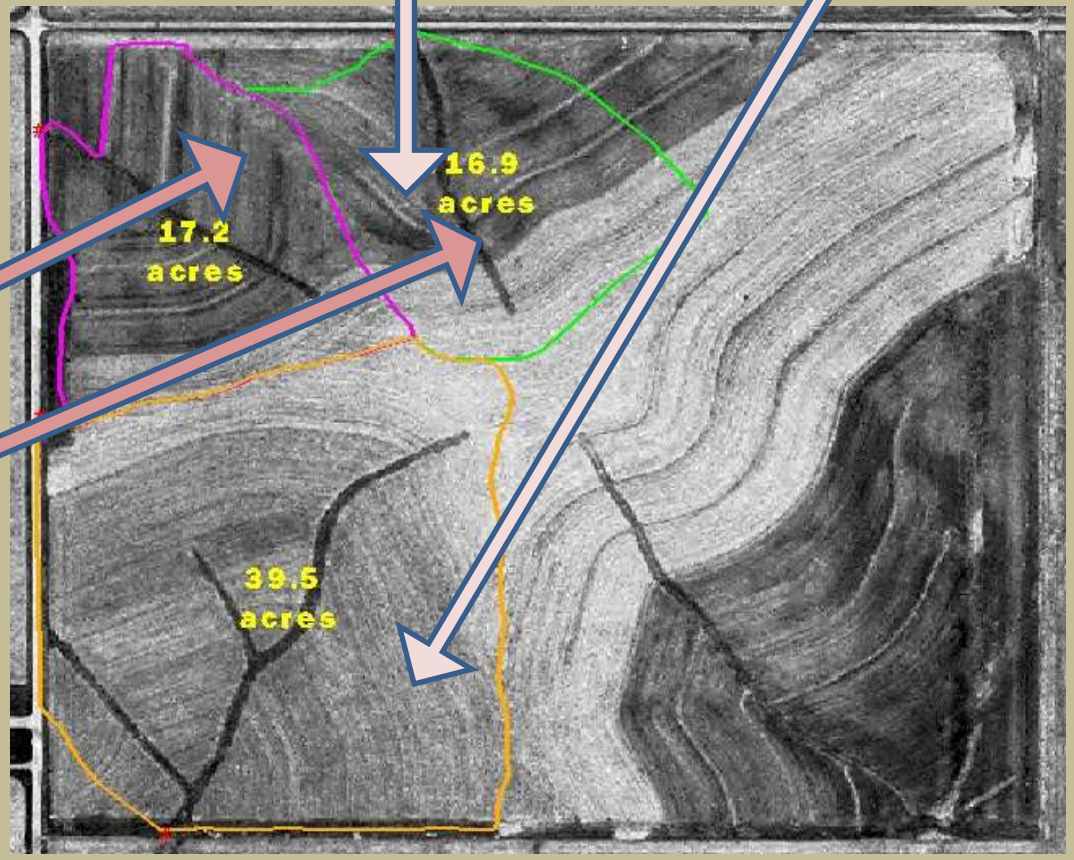
Sep: 6,000 gal/acre

Nov: 7,000 gal/acre

Winter applications

Feb. 14: 4,300 gal/acre

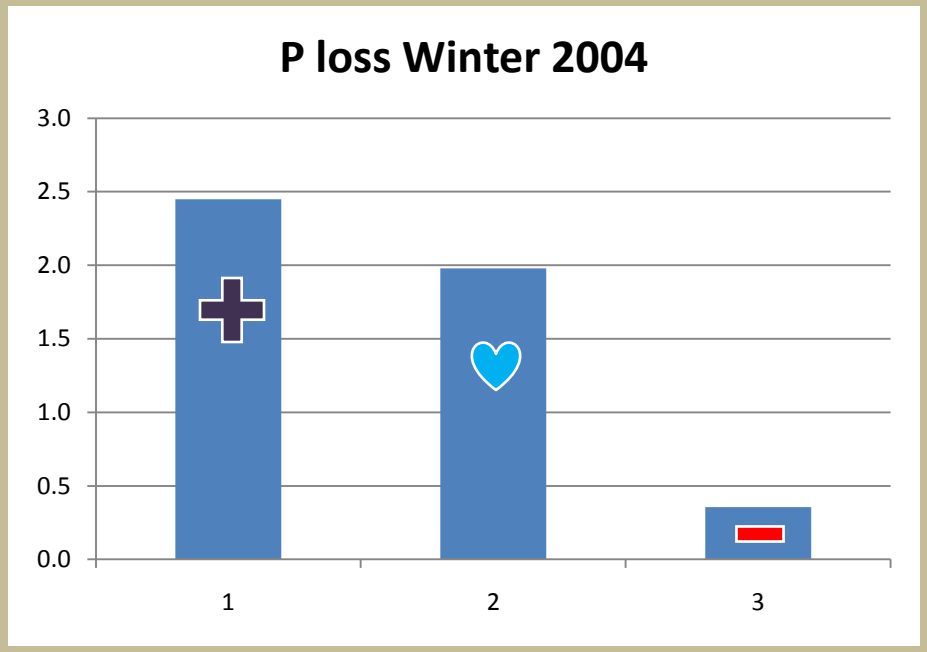
Feb. 13: 7,000 gal/acre

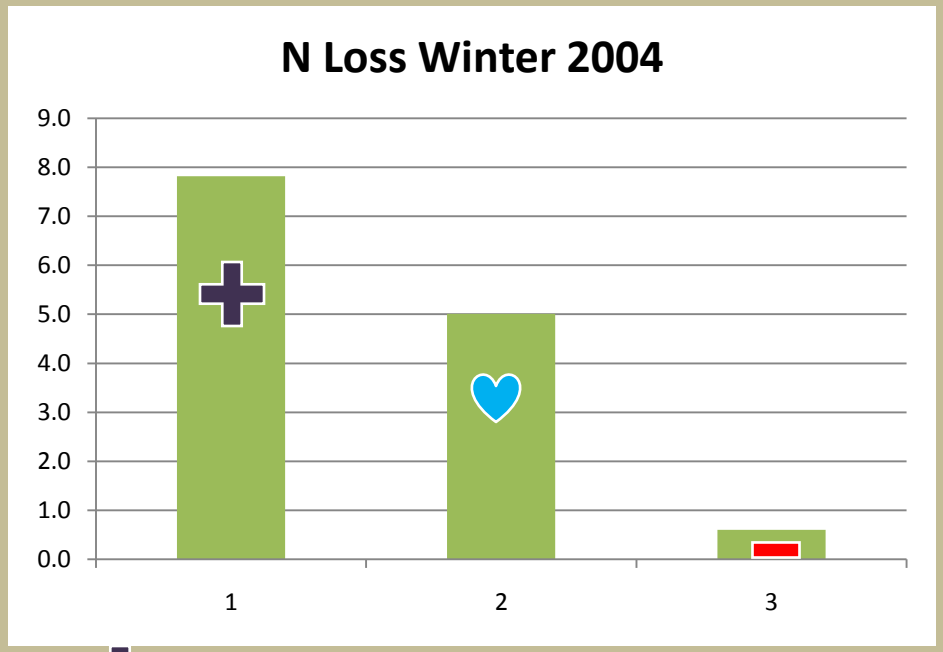


The Outcome

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

Winter 2004 Nutrient Loss





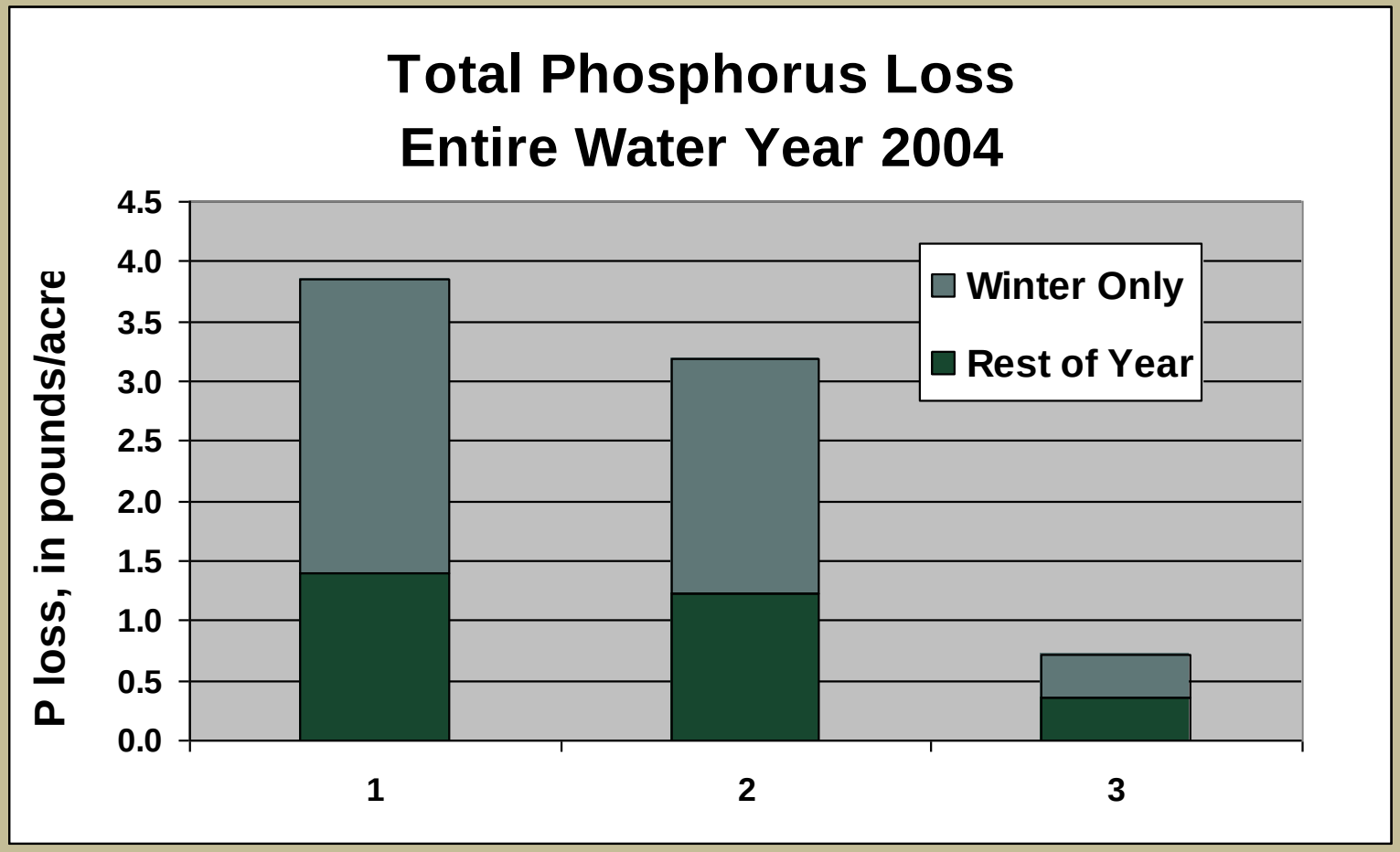
"Effective" Wintertime Application Rates

Feb. 14: 5,200 gal/acre

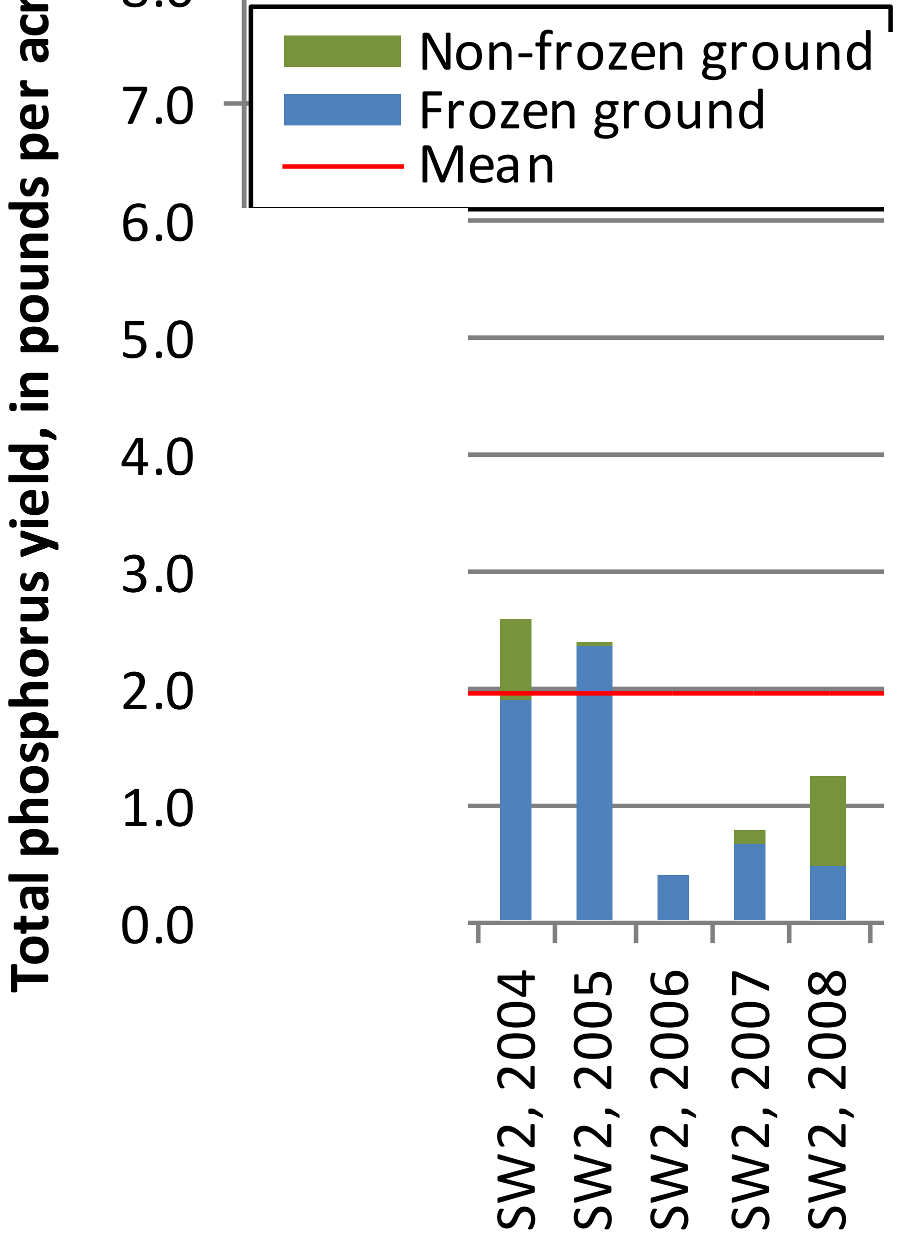
Feb. 14: 4,800 gal/acre

Feb. 14: 1,550 gal/acre

P Losses for Entire 2004

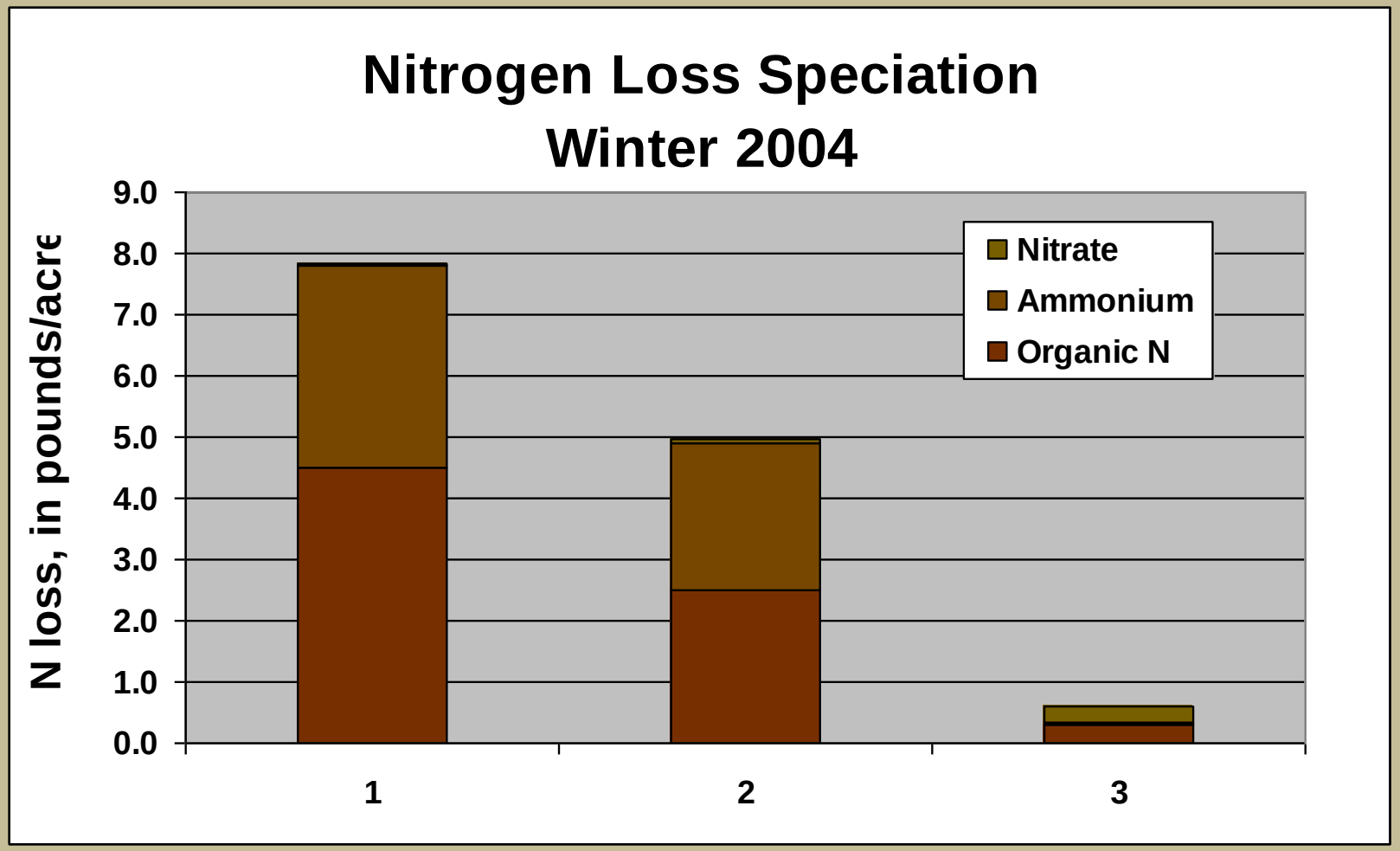


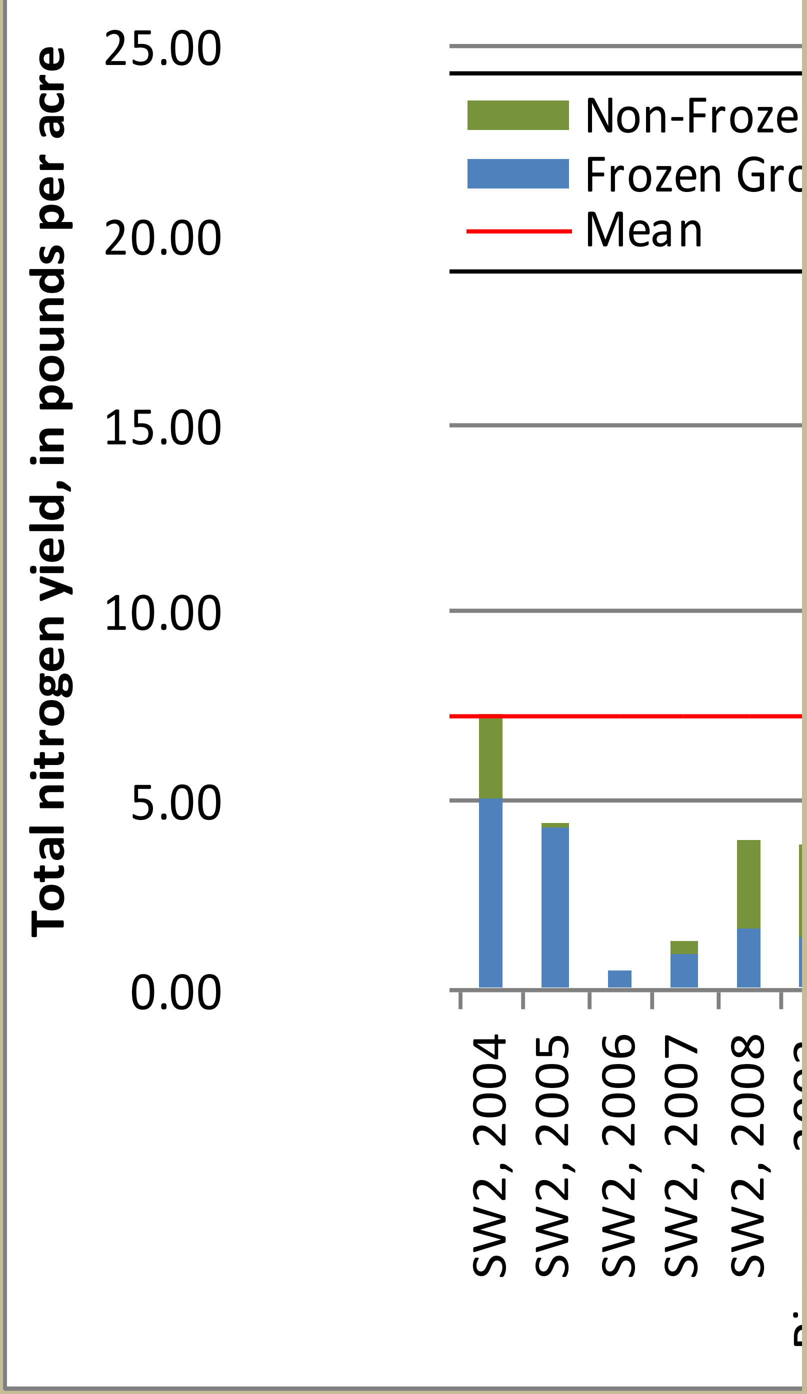
A manure management decision can have a big impact to annual nutrient losses.



Non-frozen ground
Frozen ground
Mean
Total phosphorus yield, in pounds per acr
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
SW2, 2004
SW2, 2005
SW2, 2006
SW2, 2007
SW2, 2008

Nitrogen Speciation





Total nitrogen yield, in pounds per acre
25.00
20.00
15.00
10.00
5.00
0.00
Non-Froze
Frozen Gro
Mean
SW2, 2004
SW2, 2005
SW2, 2006
SW2, 2007
SW2, 2008

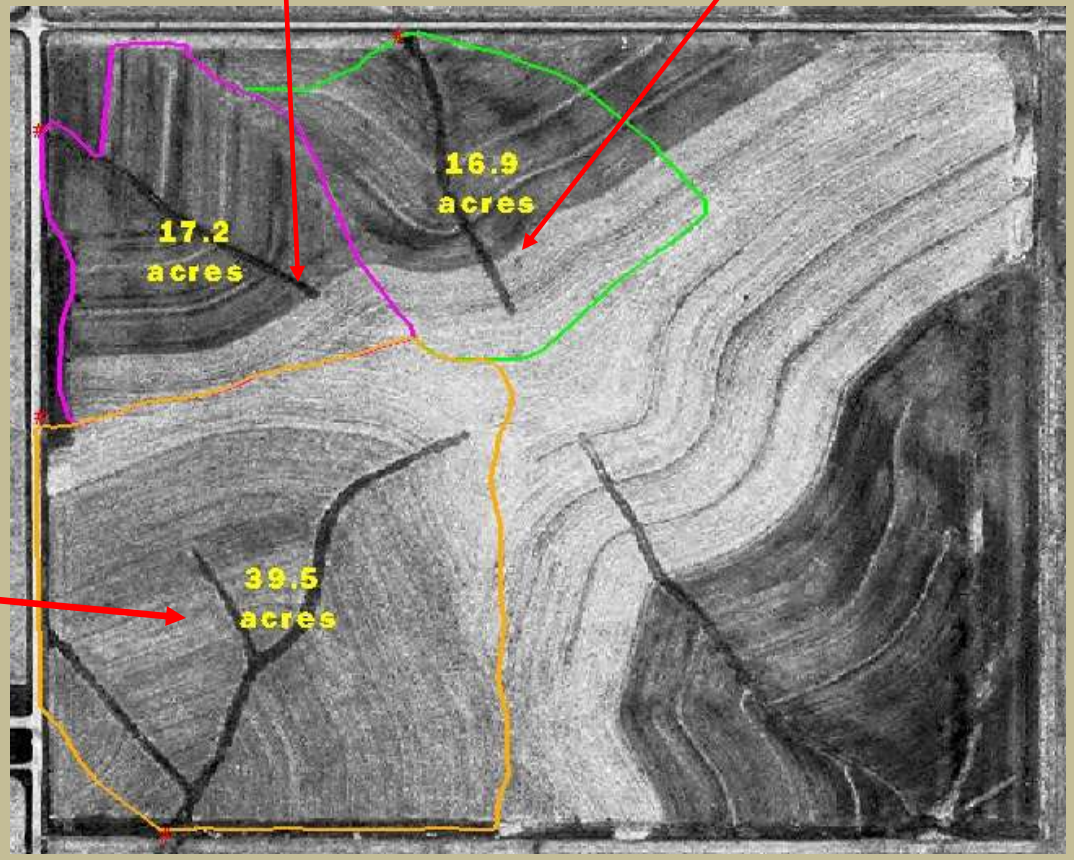
Winter 2005

- Several rain events
- Ice layer
- Warm temps

Fall applications

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

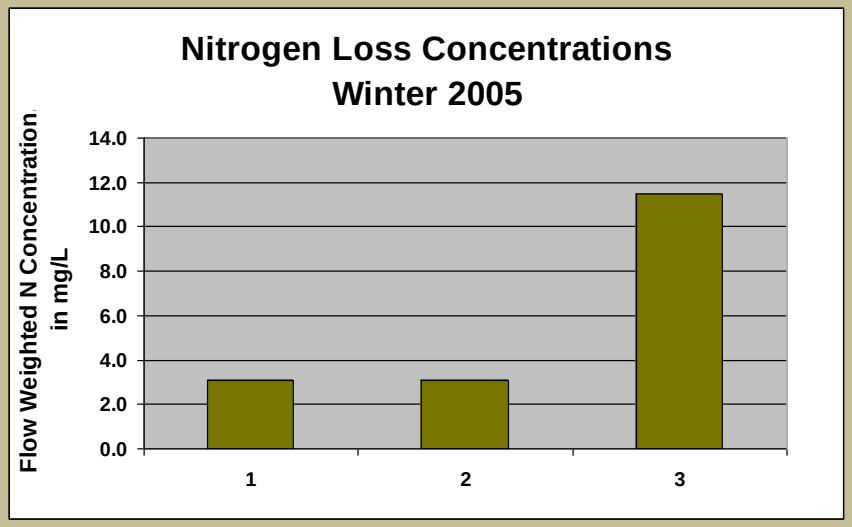
Sep:
13 T/acre

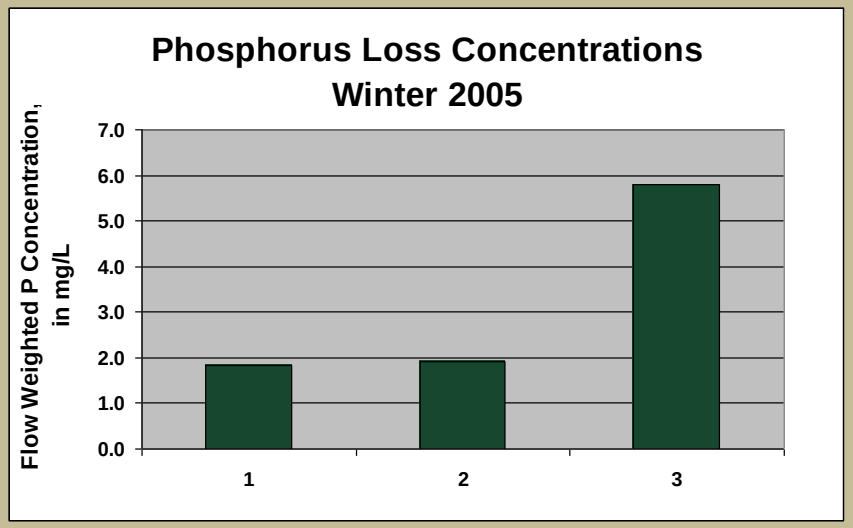


Winter applications

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

Winter 2005 Nutrient Concentrations





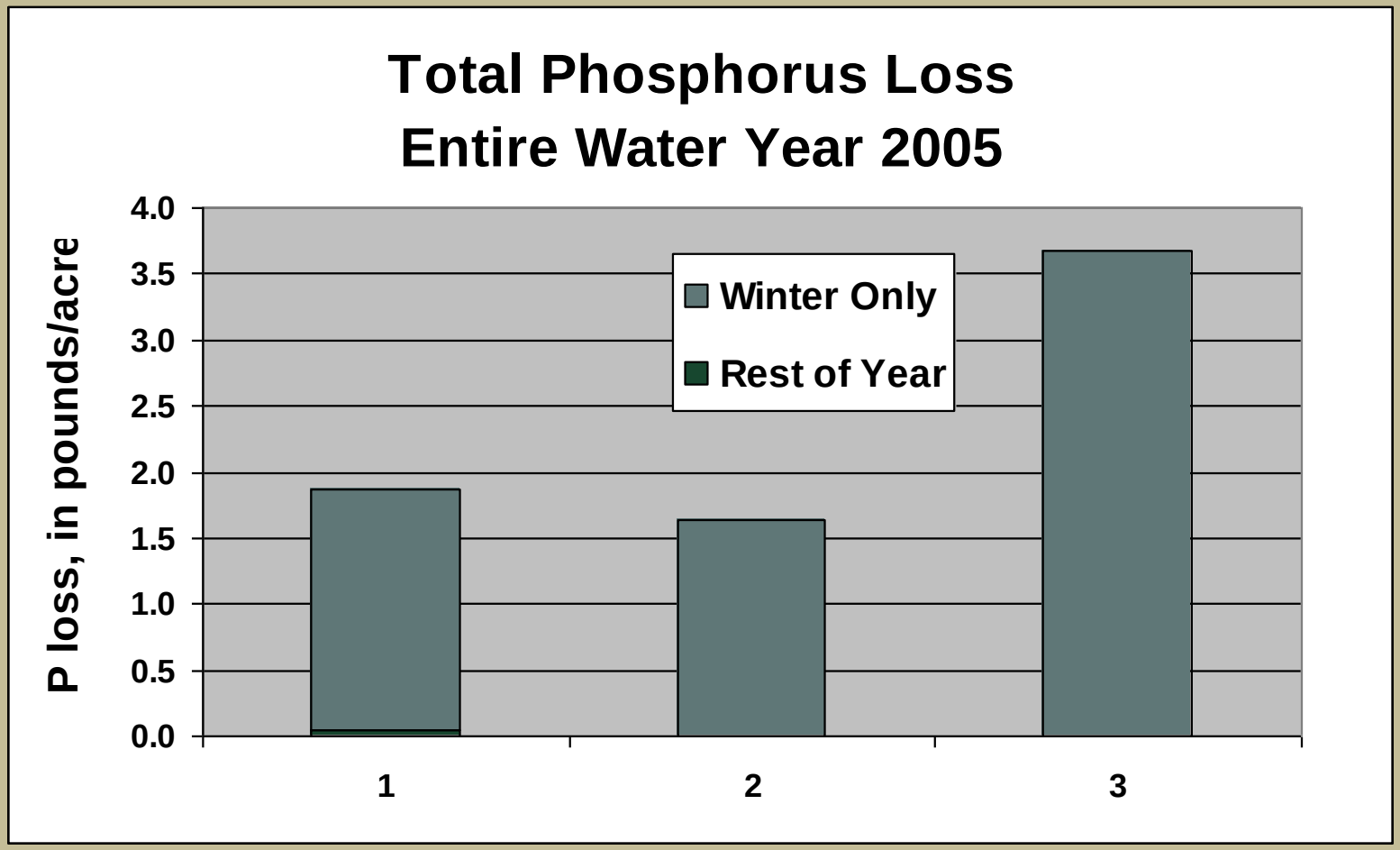
None

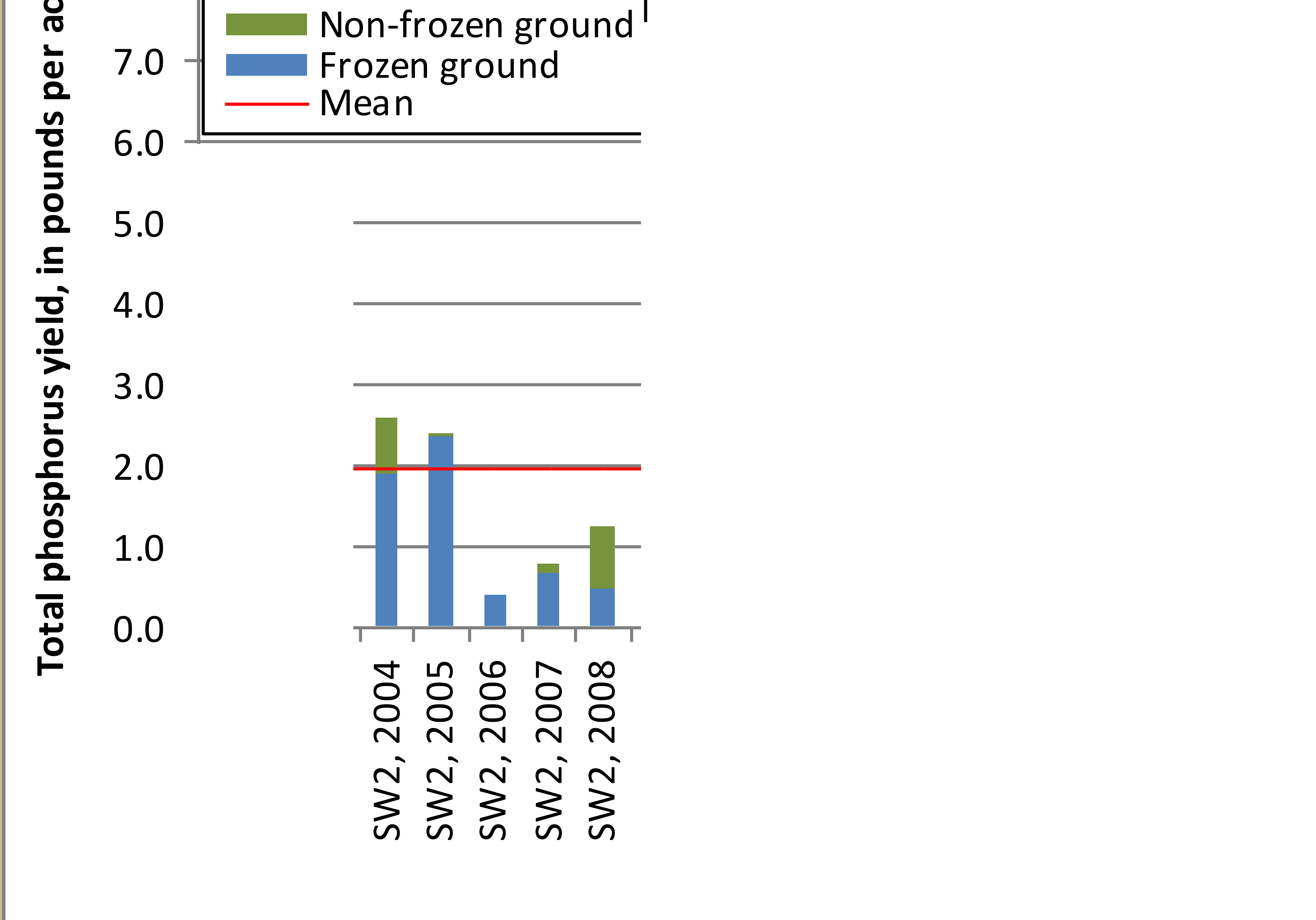
None

Wintertime Application Rates

Split Applications: 13 T/acre

P Losses for Entire 2005





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Frozen ground
Mean
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SW2, 2004
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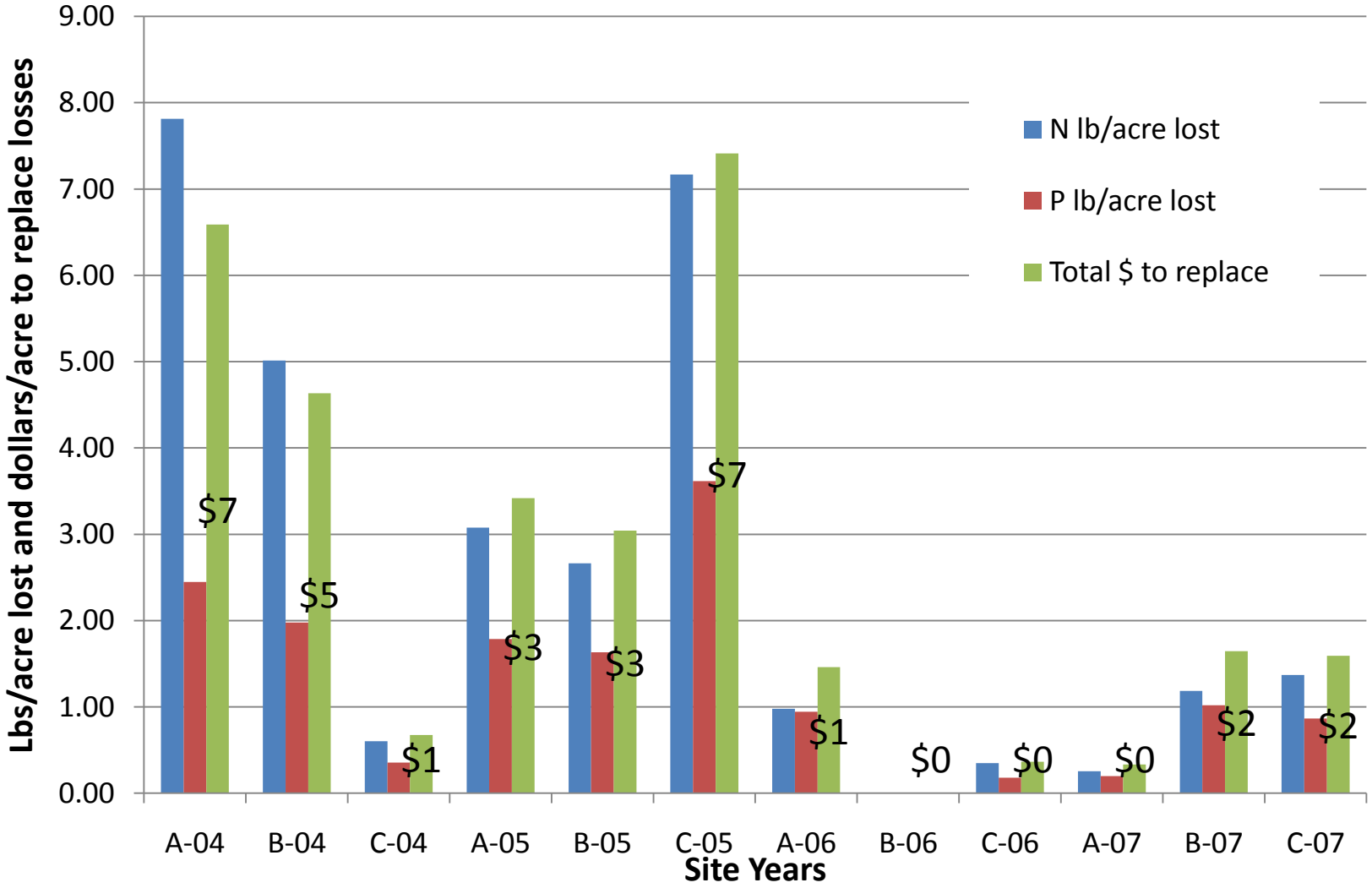
SW2, 2008

Economics of Losses



What is the distribution of runoff for various soil conditions?

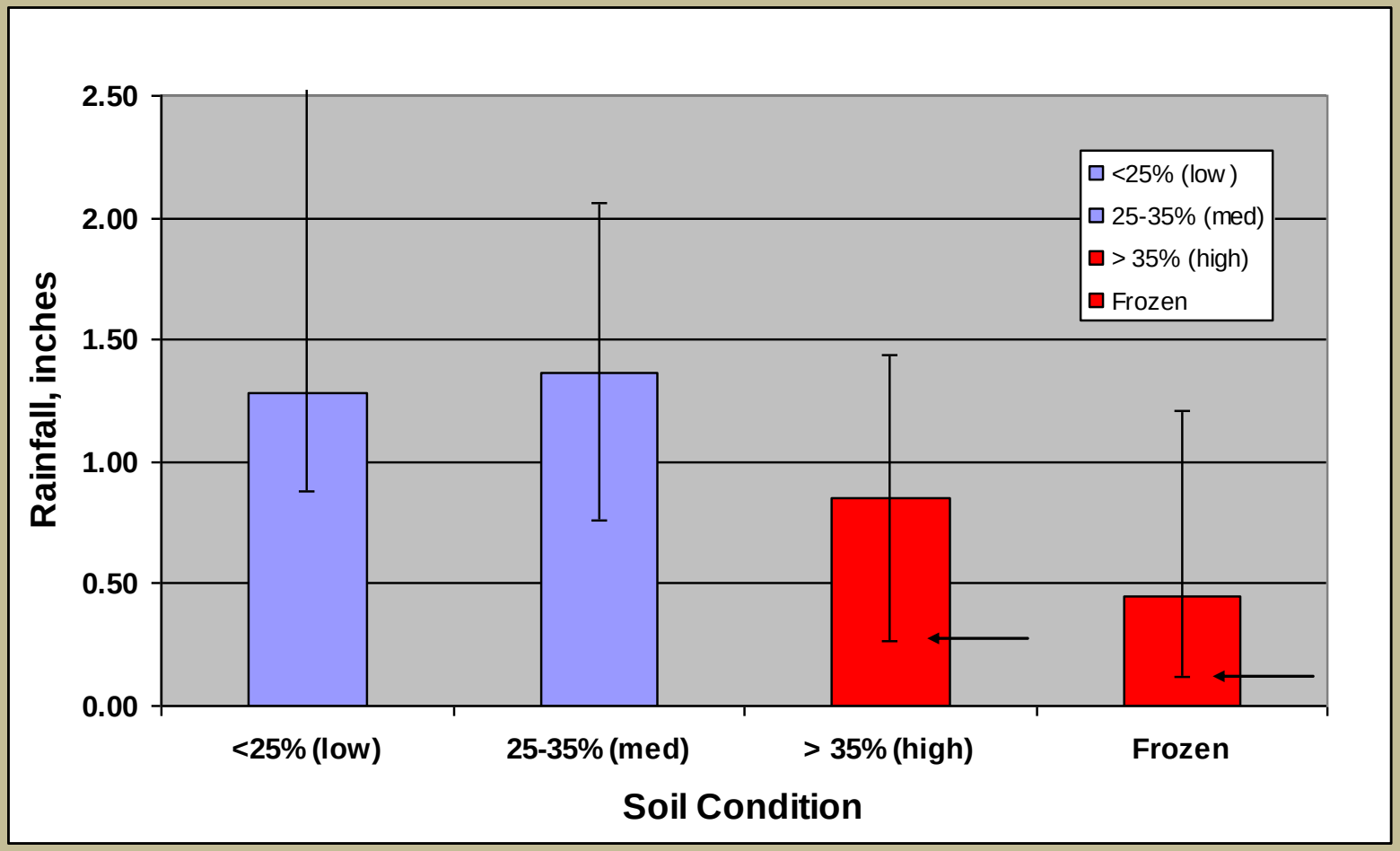
Example: No-till farm in SW Wisconsin (2003-2008)

- Frozen ground: 80%, Non-Frozen Ground: ~ 20%
  - Of the frozen ground runoff, about ¾ has occurred in February and March

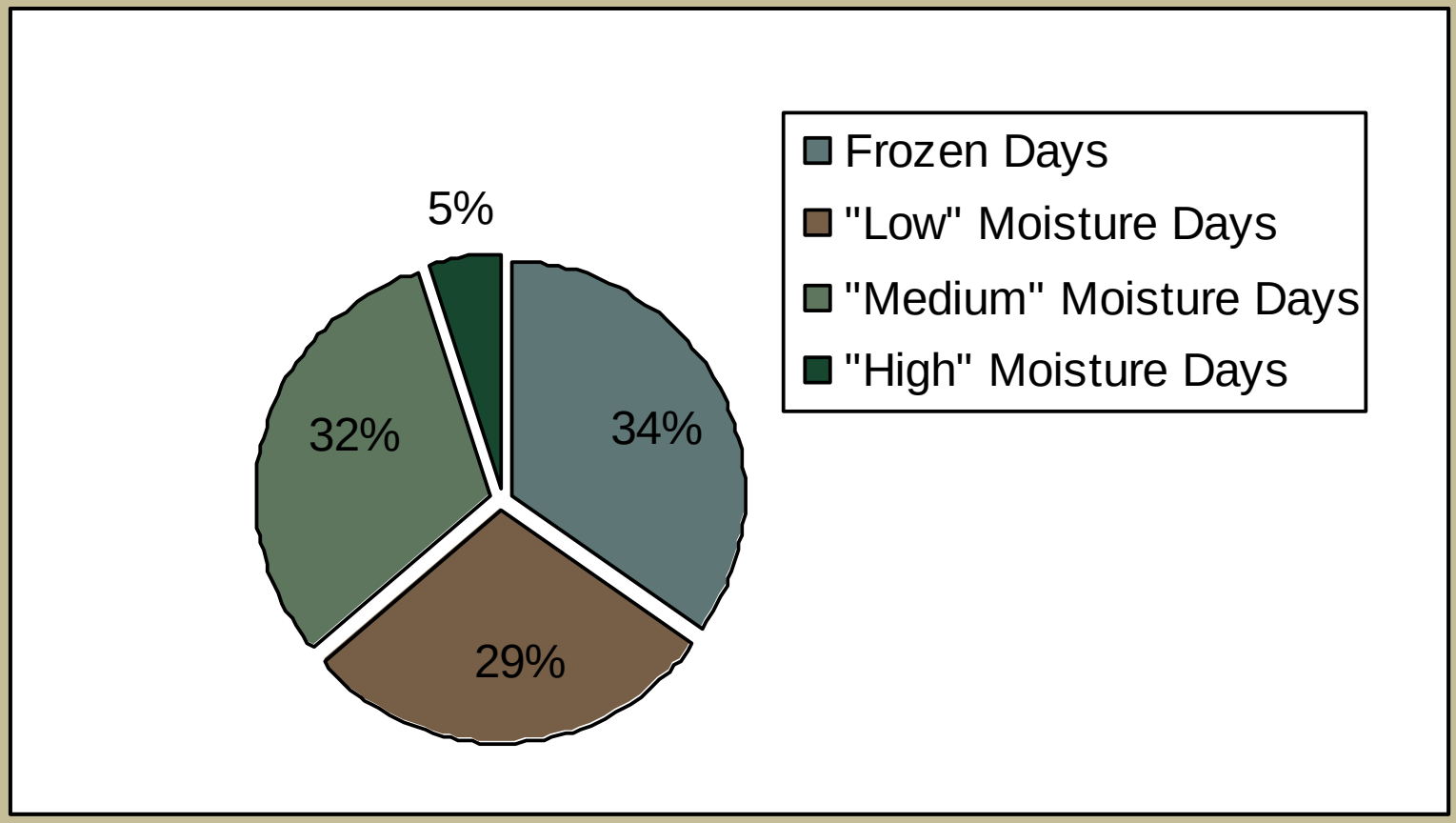
- Of the non-frozen ground runoff:
  - 83% occurred when soils were “Wet” (>35%)
  - 10% occurred when soils were “Medium” (25-35%)
  - 7% occurred when soils were “Dry” (<25%)

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

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

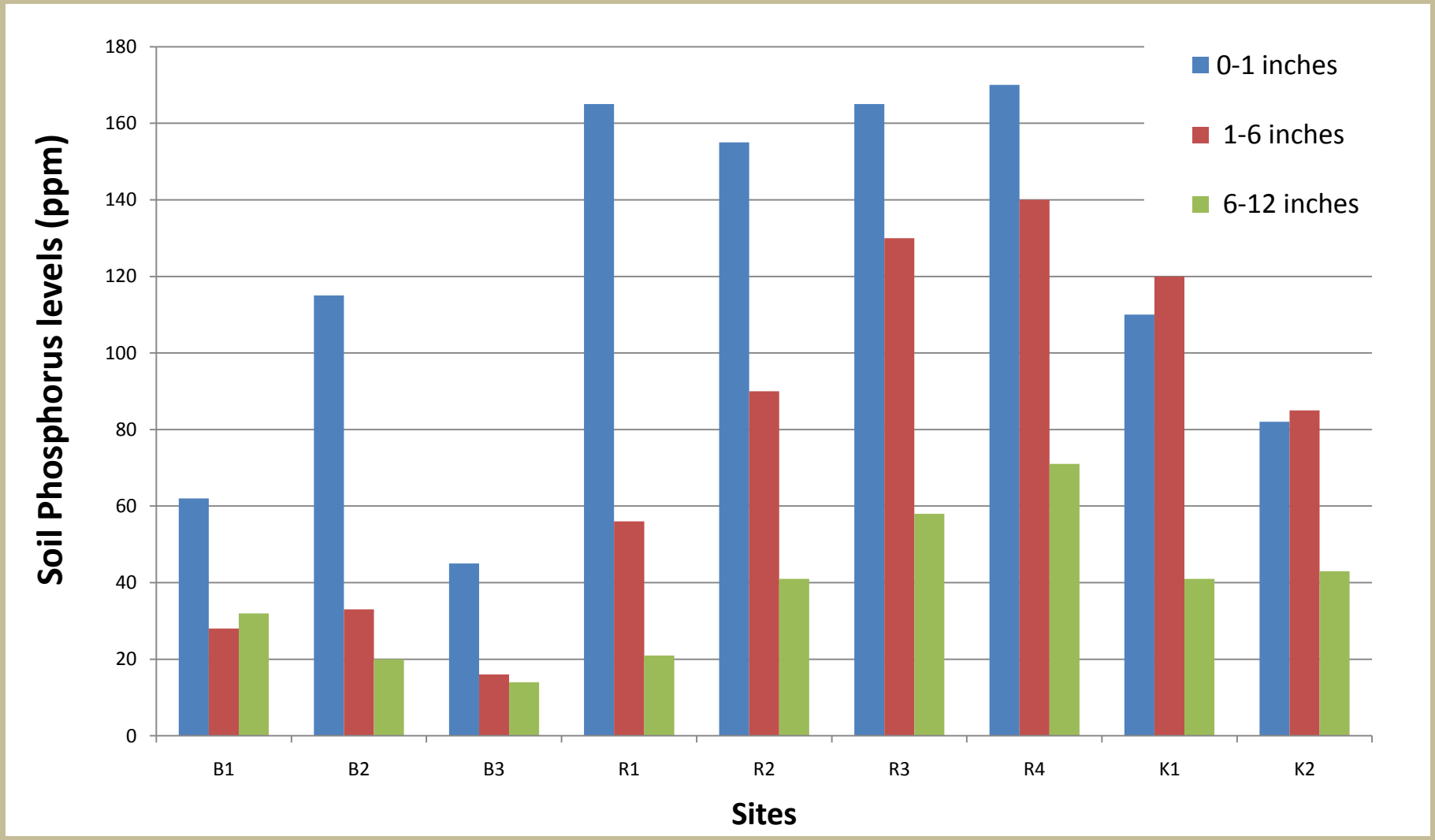


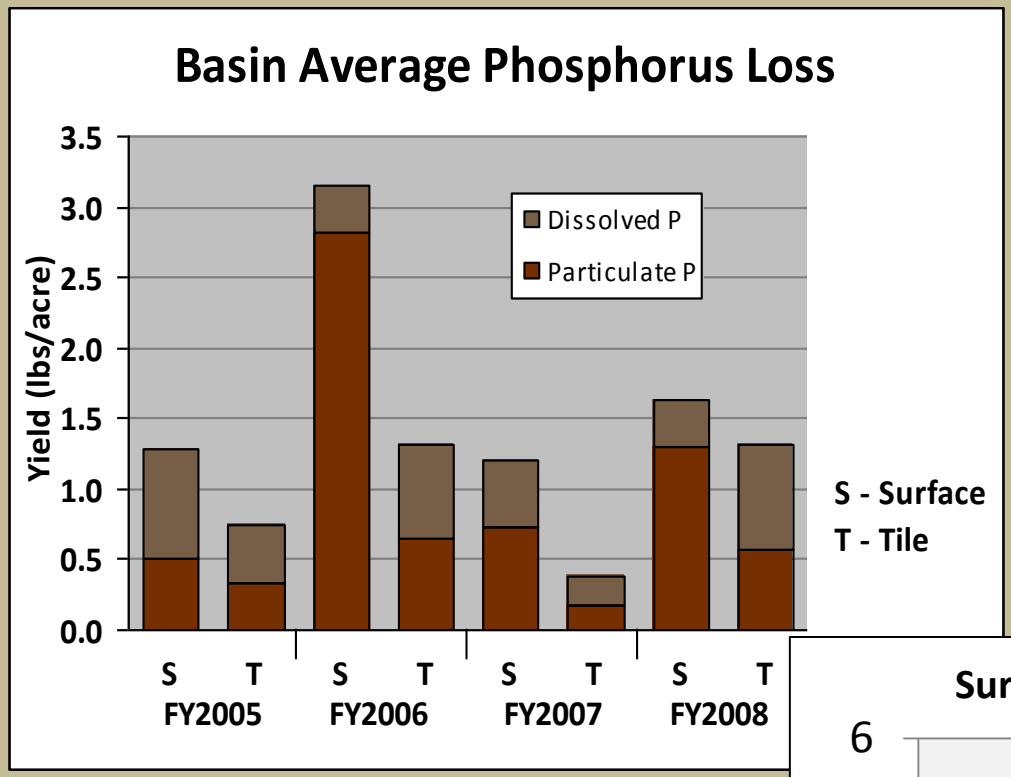
Field Conditions

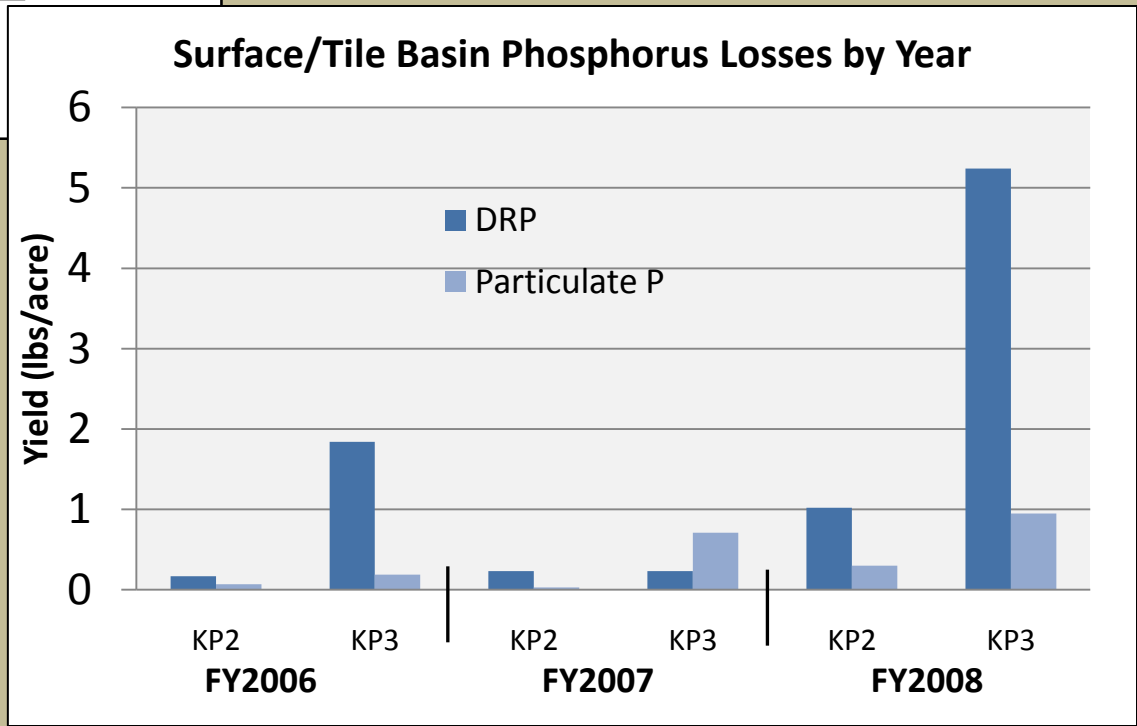


Manure and Tile Drainage

P Stratification in No Till




Basin Average Phosphorus Loss
Yield (lbs/acre)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Dissolved P
Particulate P
S - Surface
T - Tile
S T S T S T S T
FY2005 FY2006 FY2007 FY2008


Surface/Tile Basin Phosphorus Losses by Year
Yield (lbs/acre)
6
5
4
3
2
1
0
DRP
Particulate P
KP2 KP3 KP2 KP3 KP2 KP3
FY2006 FY2007 FY2008

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

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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

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Questions?

Thank you!

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