

# Tillage, Manure, and Winter Runoff

Melanie Stock<sup>1</sup>, Dr. Francisco Arriaga<sup>1</sup>, Dr. KG Karthikeyan<sup>1</sup>,  
Dr. Peter Vadas<sup>2</sup>, Dr. Laura Ward-Good<sup>1</sup>



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# The Grand Challenge is Manure.



- 1.28 M dairy cows in WI = 30 B lbs of milk per year (USDA/NASS 2012)
- Dairy cows produce about 8 B gal (65 B lbs) of manure per year, 70 M lbs of phosphorus (Iowa State University, 2004)

# Research Setting

## Practical & environmental balance

- Most runoff occurs on frozen soils (Good et al., 2012)
- Unincorporated manure, storage costs, emergency applications (Srinivasan et al., 2006)

## Updates to manure regulations

Limited Field Data + complicated weather, soils



jsonline.com



# Goals

1. Identify management practices that reduce runoff on frozen soils
  - Conventional fall tillage (chisel) versus no-tillage
  - Manure application timing: unmanured controls, December, and January
2. Measure the physical processes that control runoff during winter

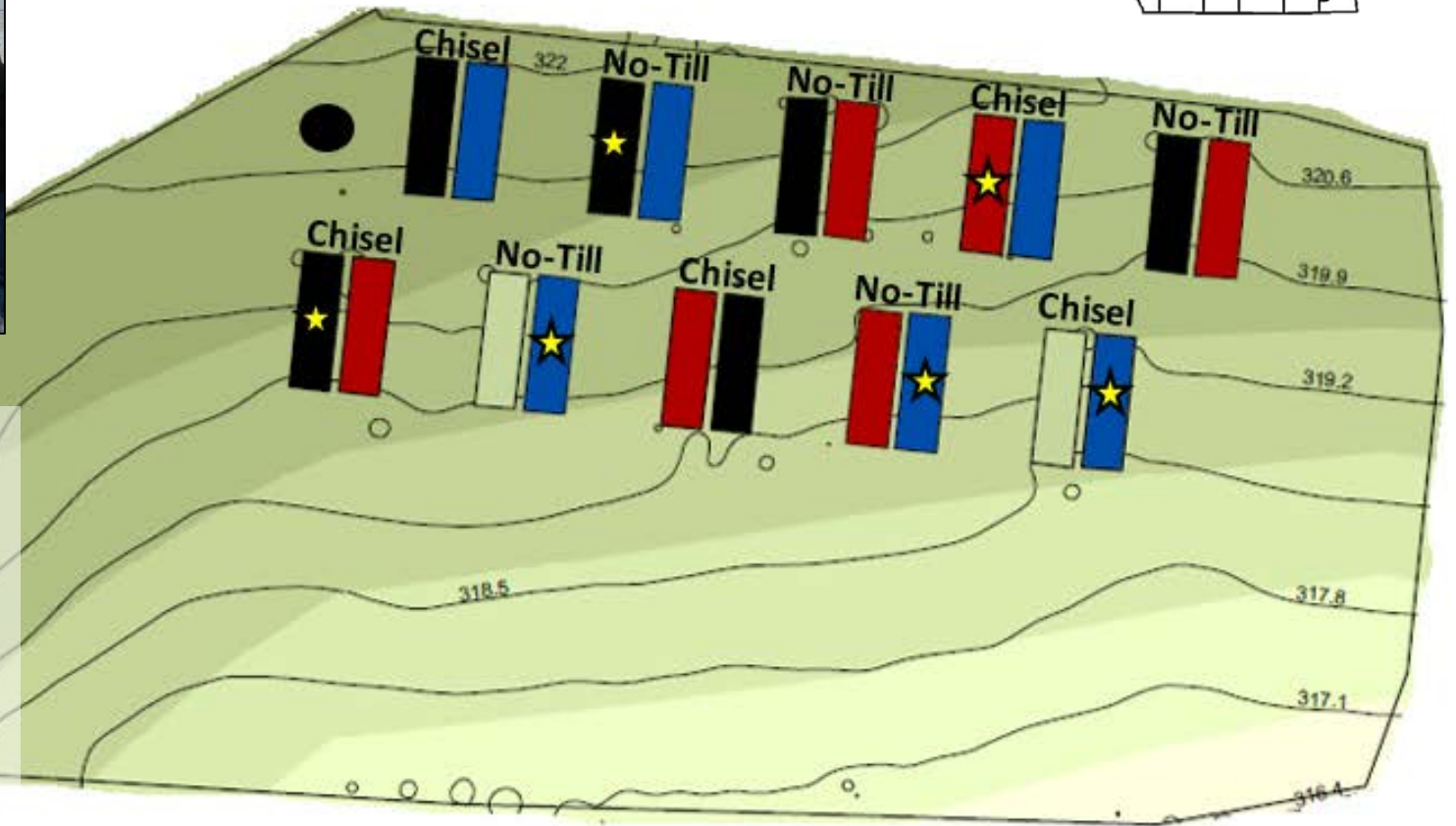


# Field Site Design

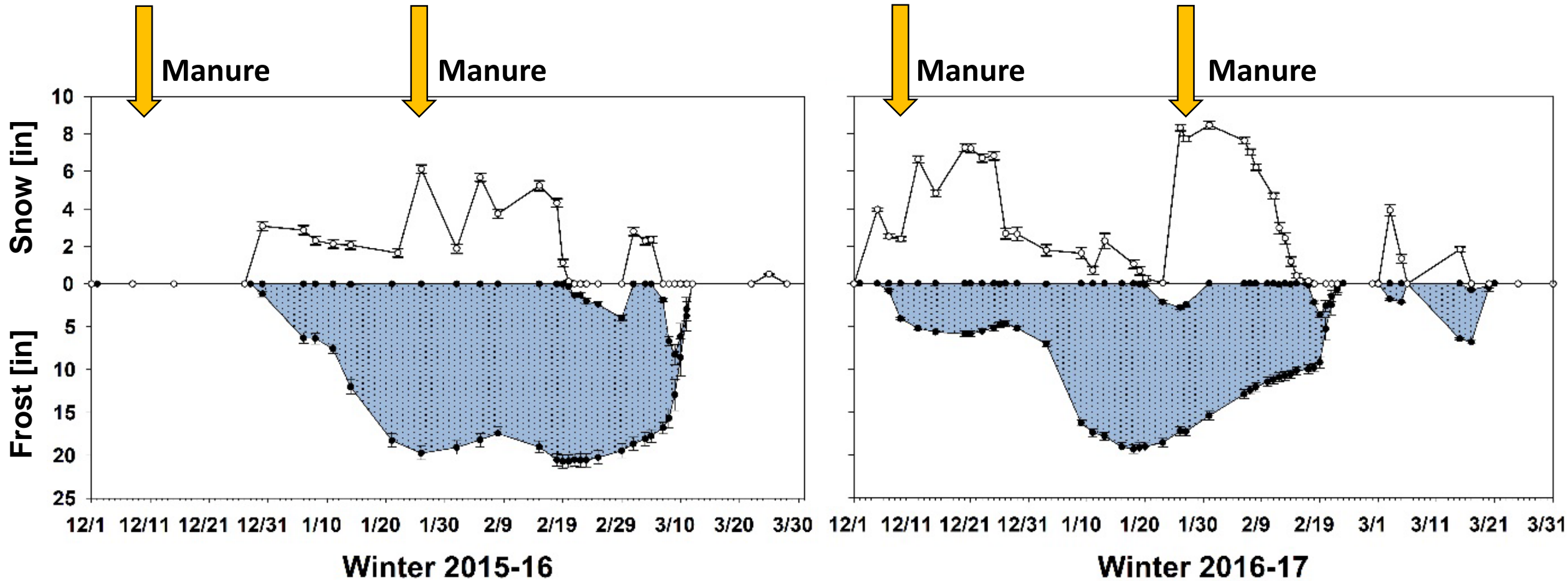


## Manure Application Timing

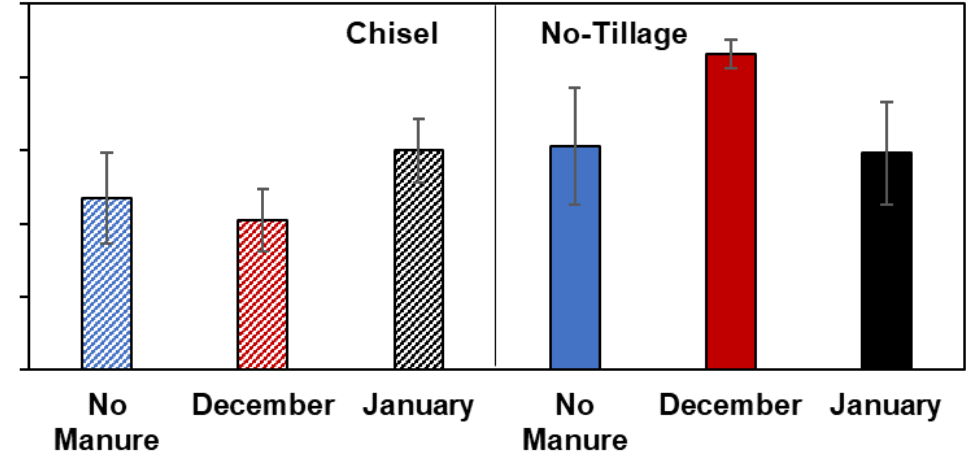
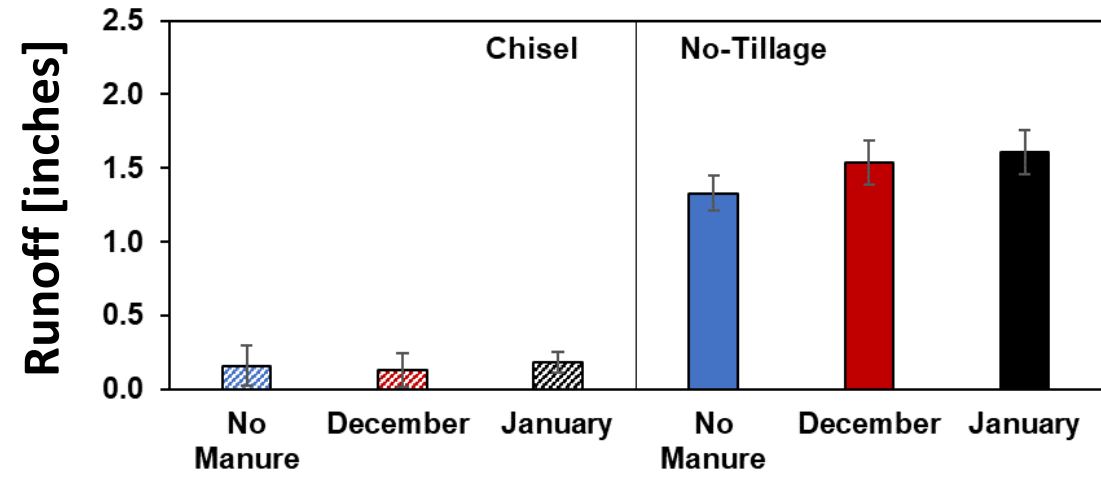
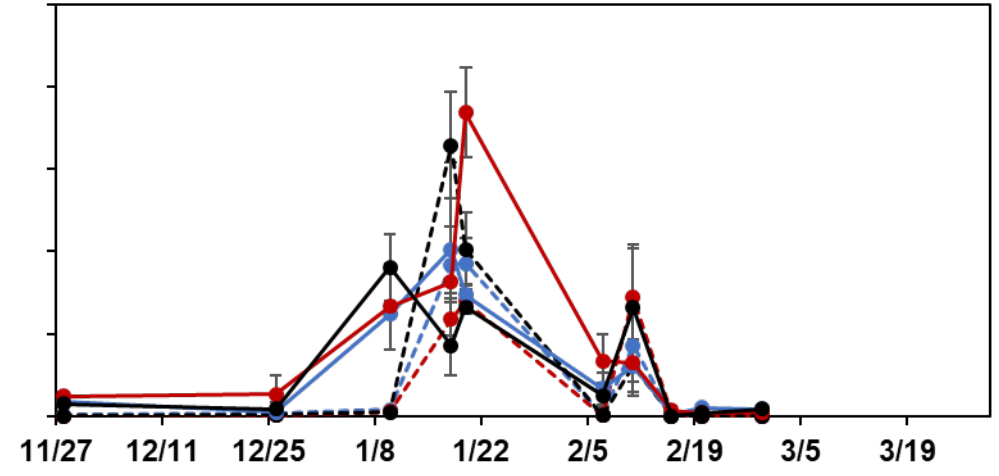
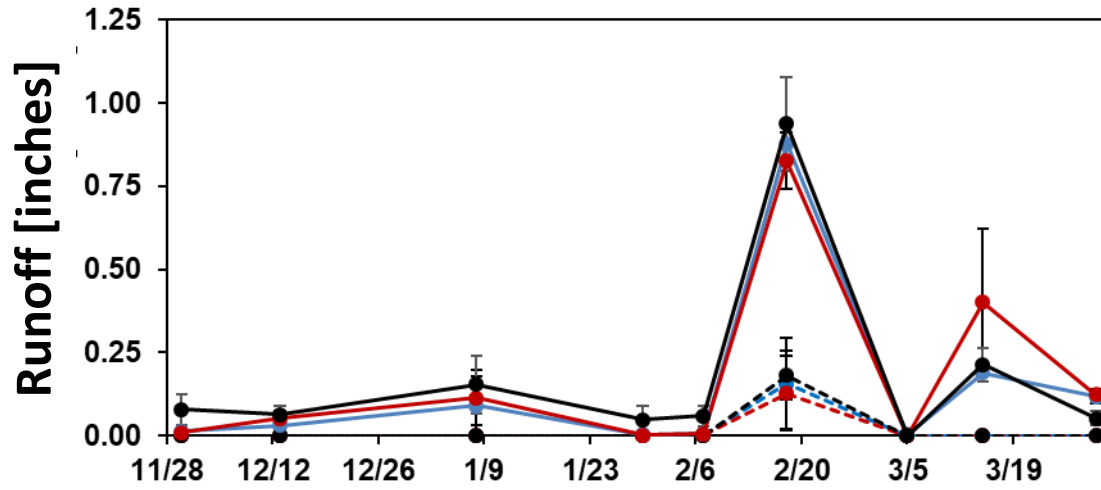
-  Control – No Manure
-  December
-  January



# Year-to-Year Weather Trends

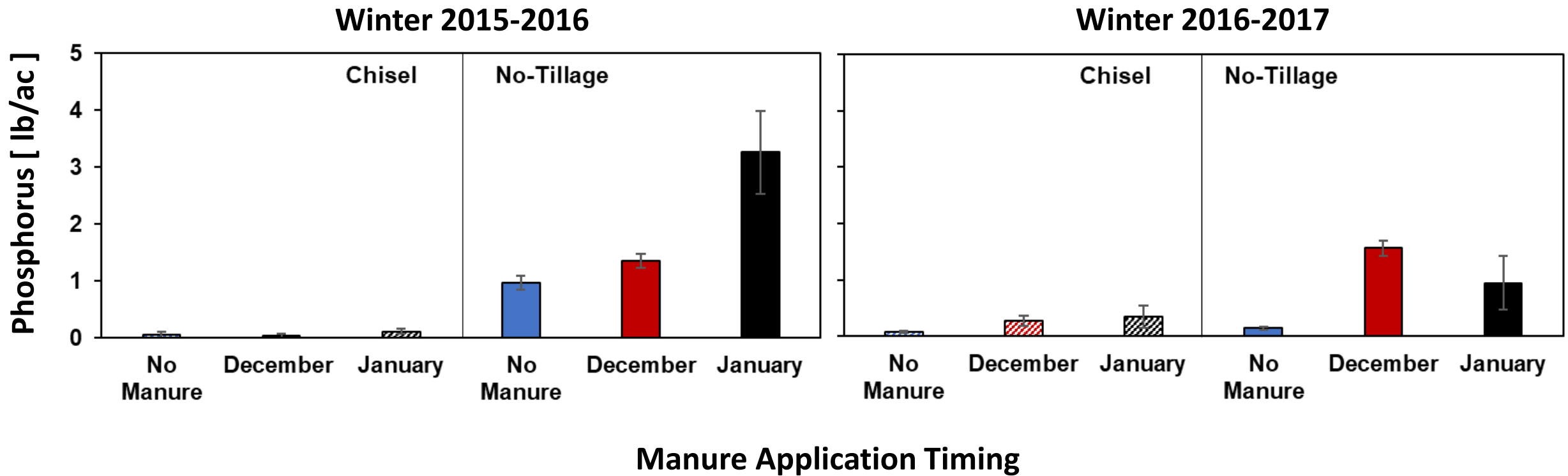


# Tillage reduced Runoff



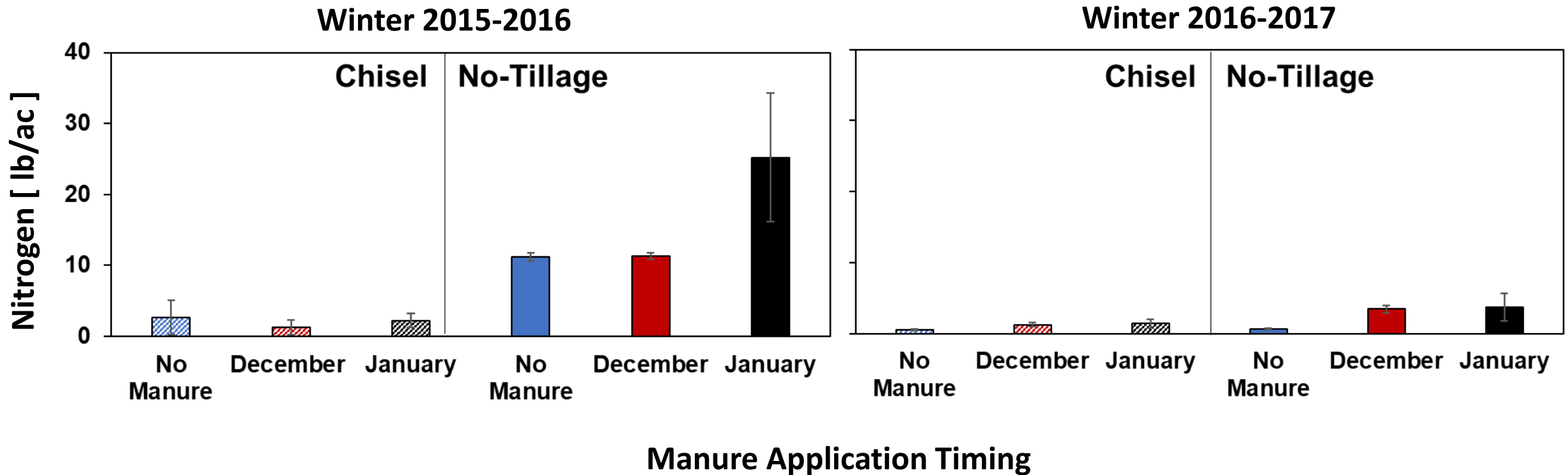
Manure Application Timing

# Tillage reduced Phosphorus Loss

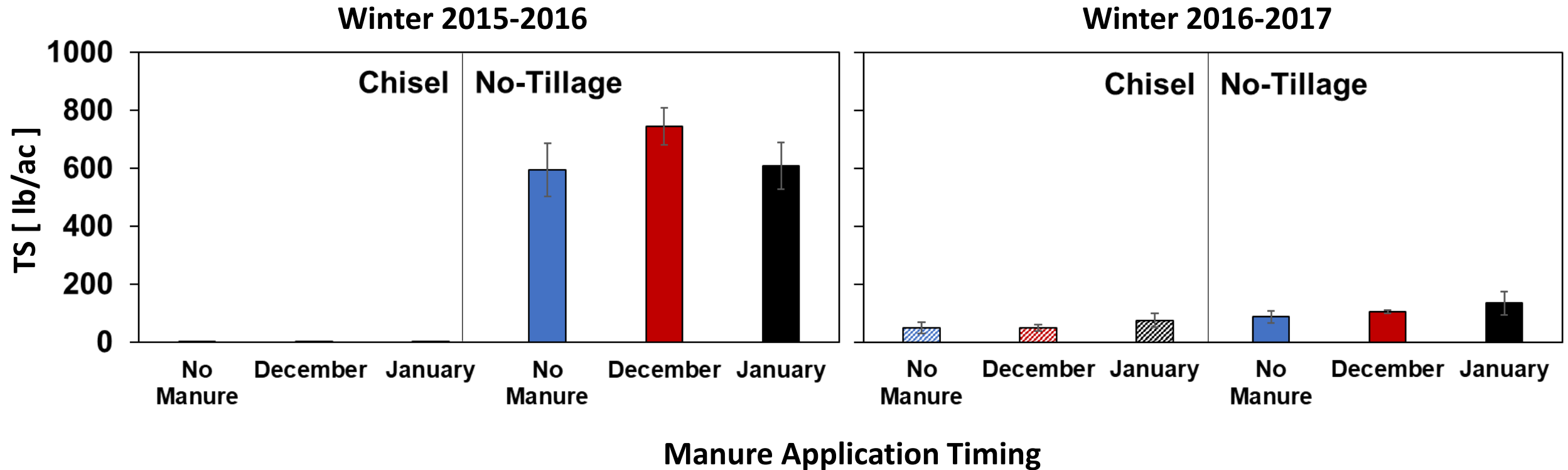




# Tillage reduced Total Nitrogen Loss



# Tillage reduced Total Solids Loss

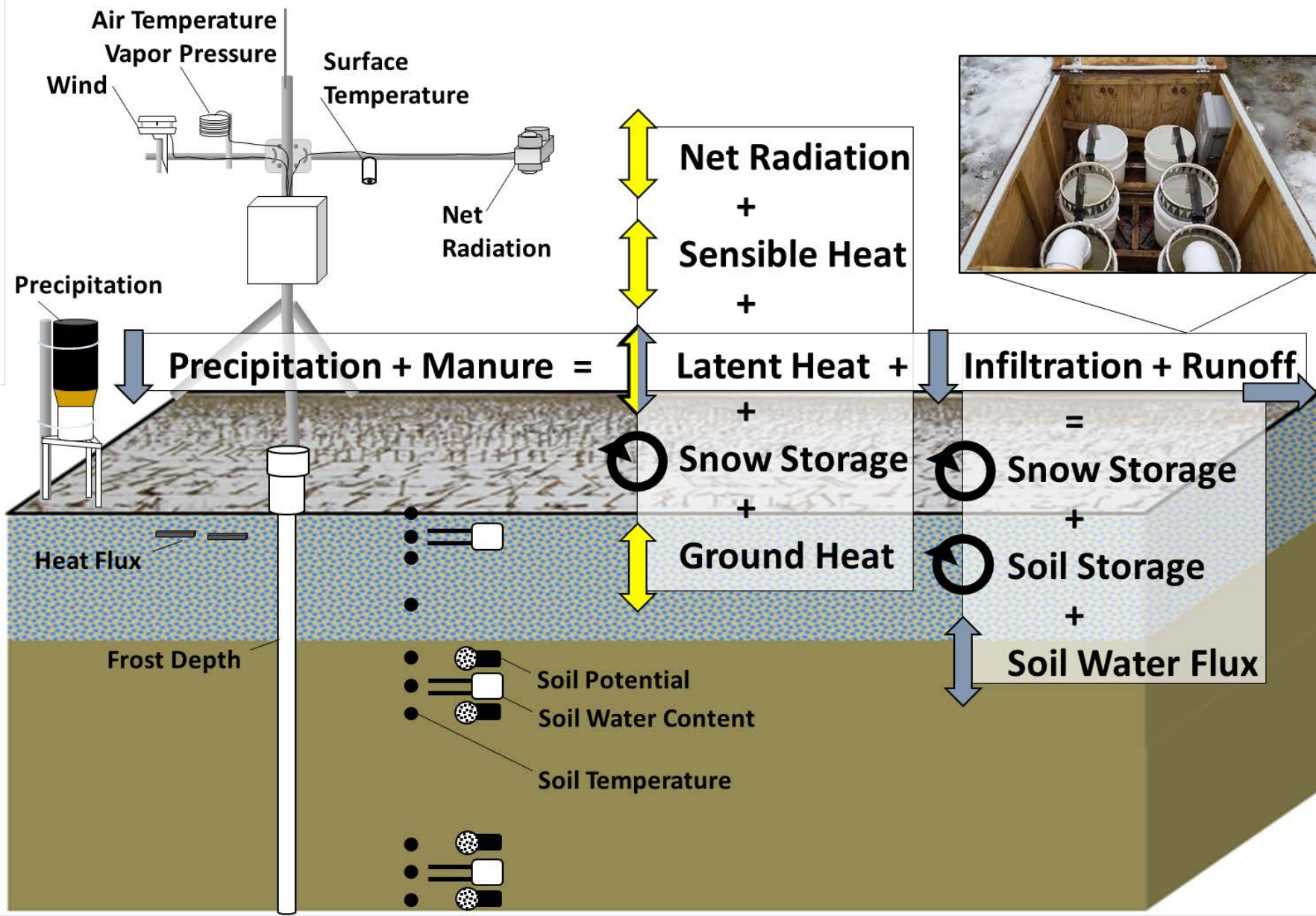


# Goals

1. Identify management practices that reduce runoff on frozen soils
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2. **Measure the physical processes that control runoff during winter**



# A Water-Energy Balance

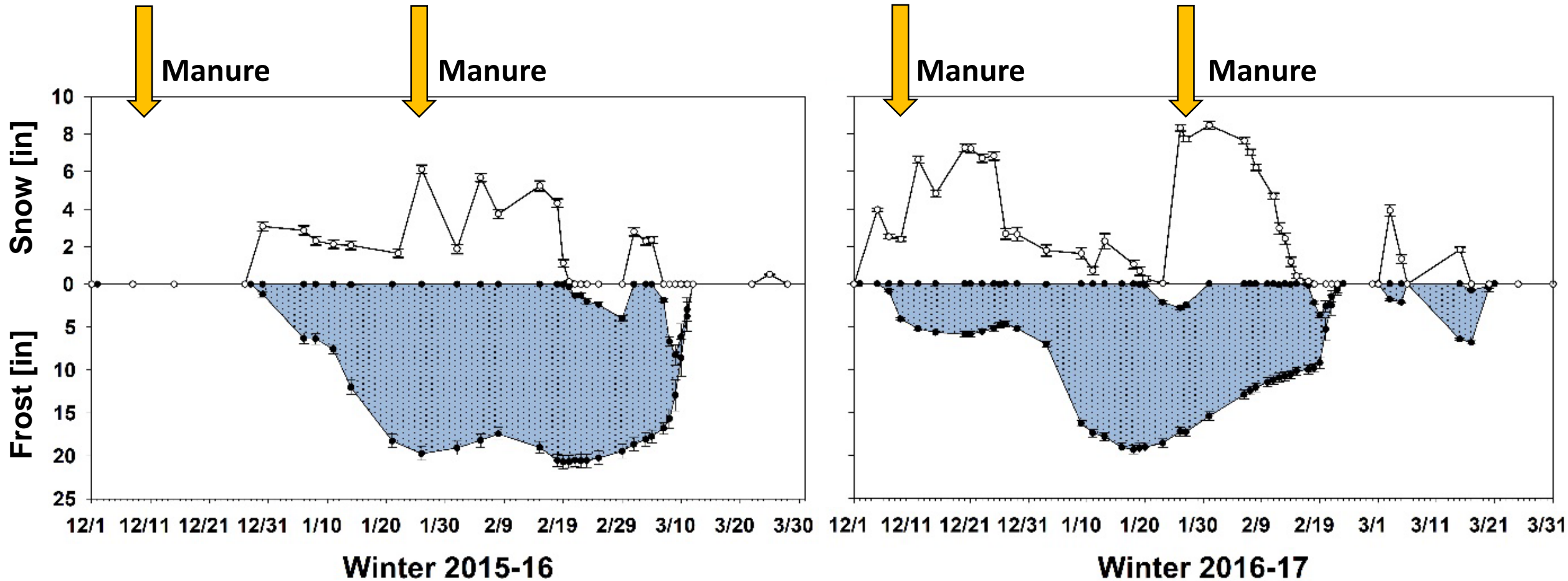


# Results: 'Slow the Flow' is key!

- Fall tillage created depressions on the soil surface, which increased the time for water to infiltrate frozen soils
- Manure accelerates snowmelt by absorbing sunlight



# No-Tillage + Frozen Soil = Risky



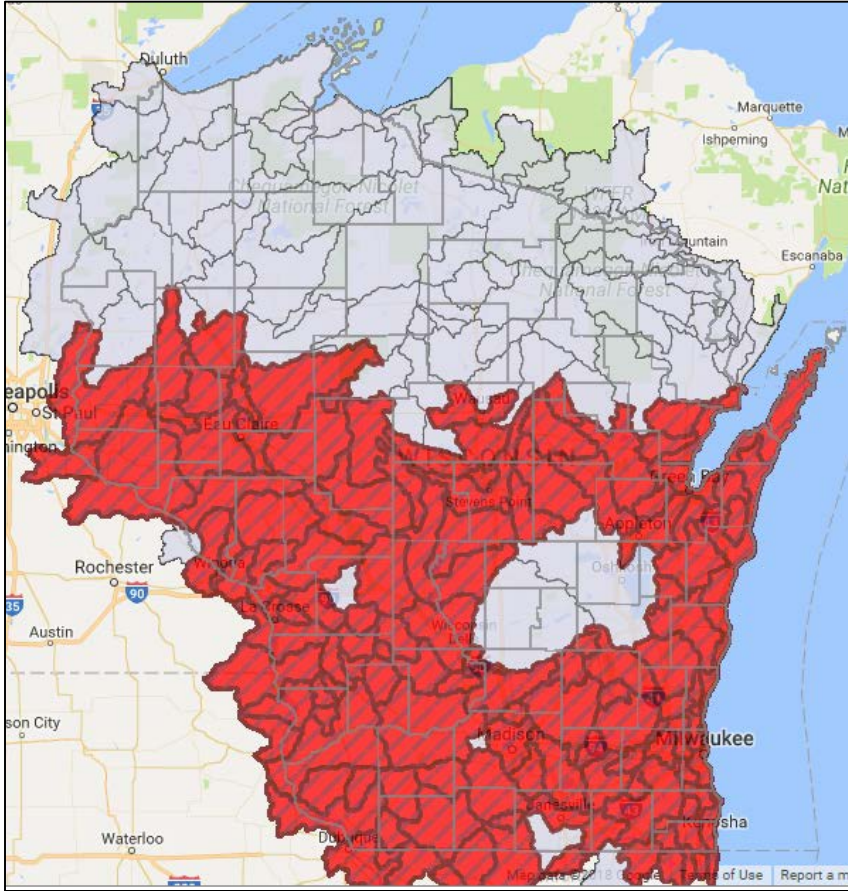
# Summary of Winter Findings

## Assumptions from the growing season may not be appropriate

- No-tillage is risky when the soil is frozen
- Fall chisel tillage *on the contour* reduced runoff by ponding meltwater, which increased the time for water and manure to infiltrate frozen soil
- Manure application on top of snow accelerated snowmelt



# Updating Management Tools



## Runoff Risk Advisory Forecast Wisconsin Manure Management Advisory System

### Winter Risk (10 day)



Frozen  
Soil



Runoff



Snowmelt  
Runoff



DISCOVERY  
FARMS  
WISCONSIN



**LW**  
**Extension**  
University of Wisconsin-Extension





# Thank you



I am happy to answer any questions!

Contact Information: Melanie Stock, [melanie.n.stock@gmail.com](mailto:melanie.n.stock@gmail.com)

