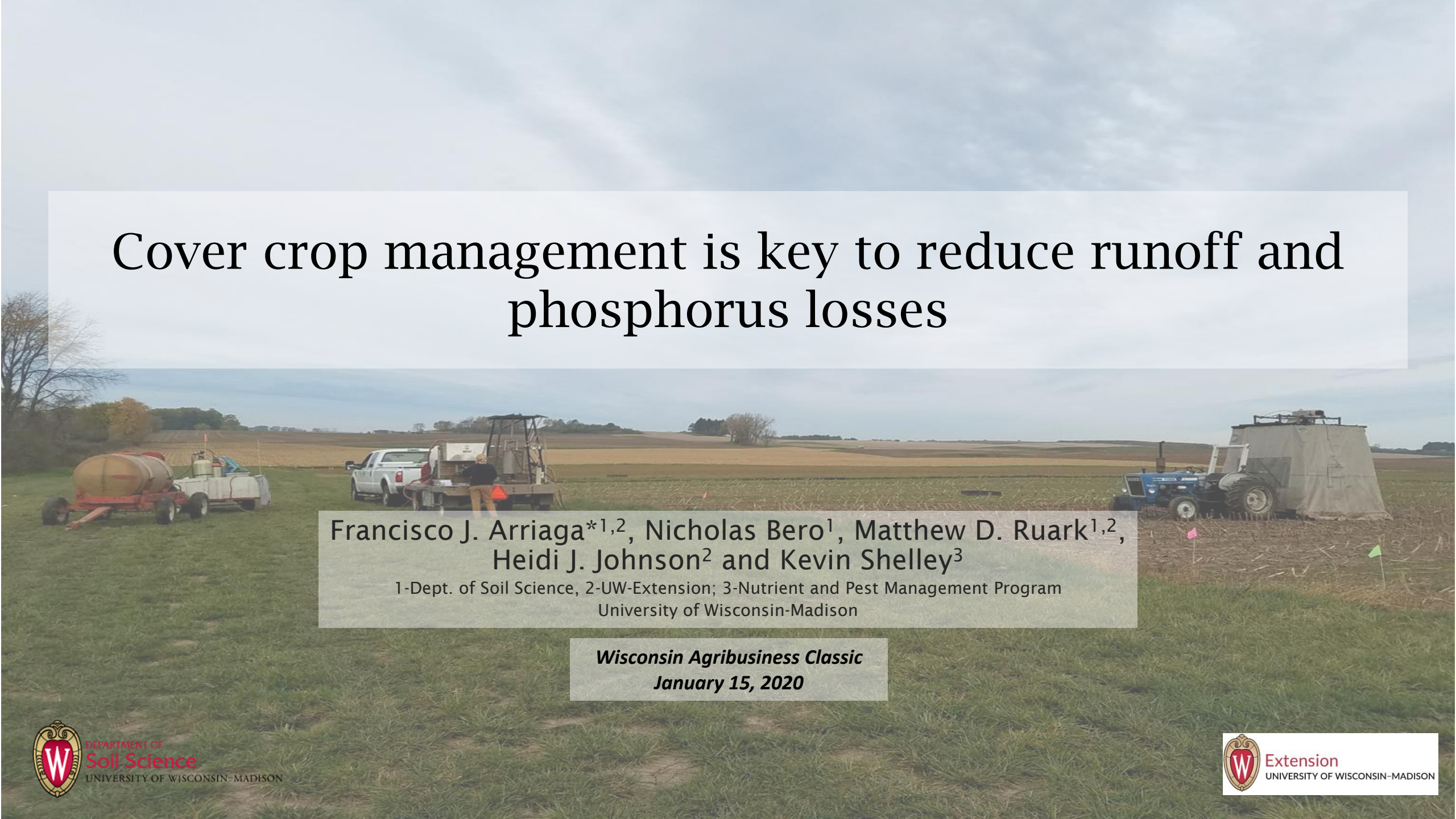
Cover crop management is key to reduce runoff and phosphorus losses



Francisco J. Arriaga*[1,2], Nicholas Bero[1], Matthew D. Ruark[1,2], Heidi J. Johnson[2] and Kevin Shelley[3]

1-Dept. of Soil Science, 2-UW-Extension; 3-Nutrient and Pest Management Program
University of Wisconsin-Madison

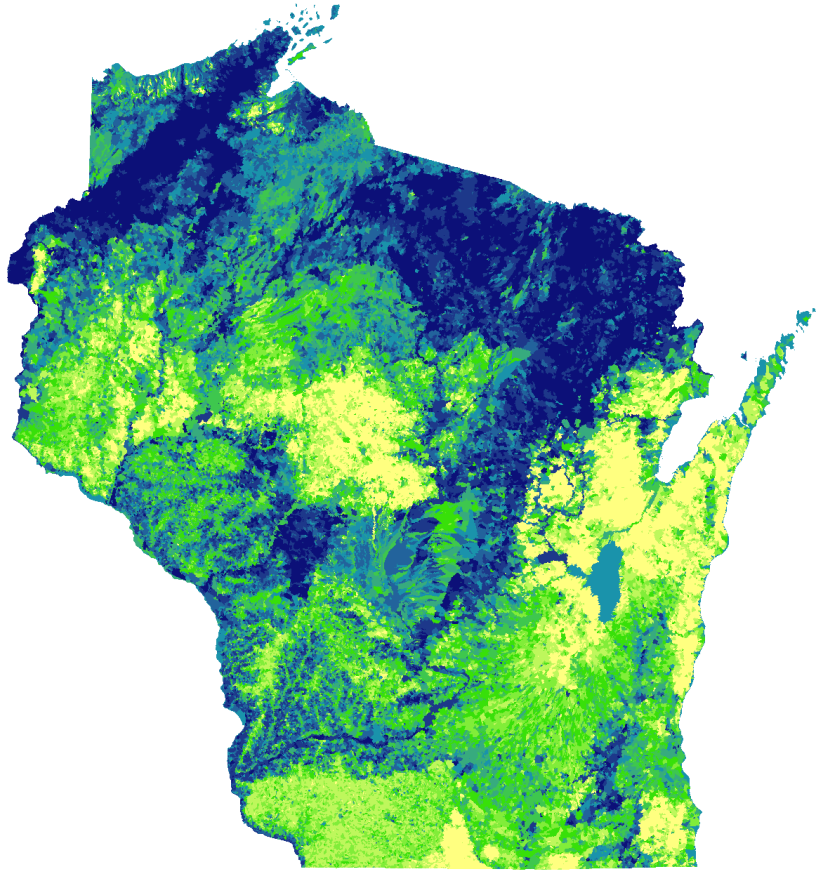
Wisconsin Agribusiness Classic
January 15, 2020

DEPARTMENT OF Soil Science
UNIVERSITY OF WISCONSIN-MADISON

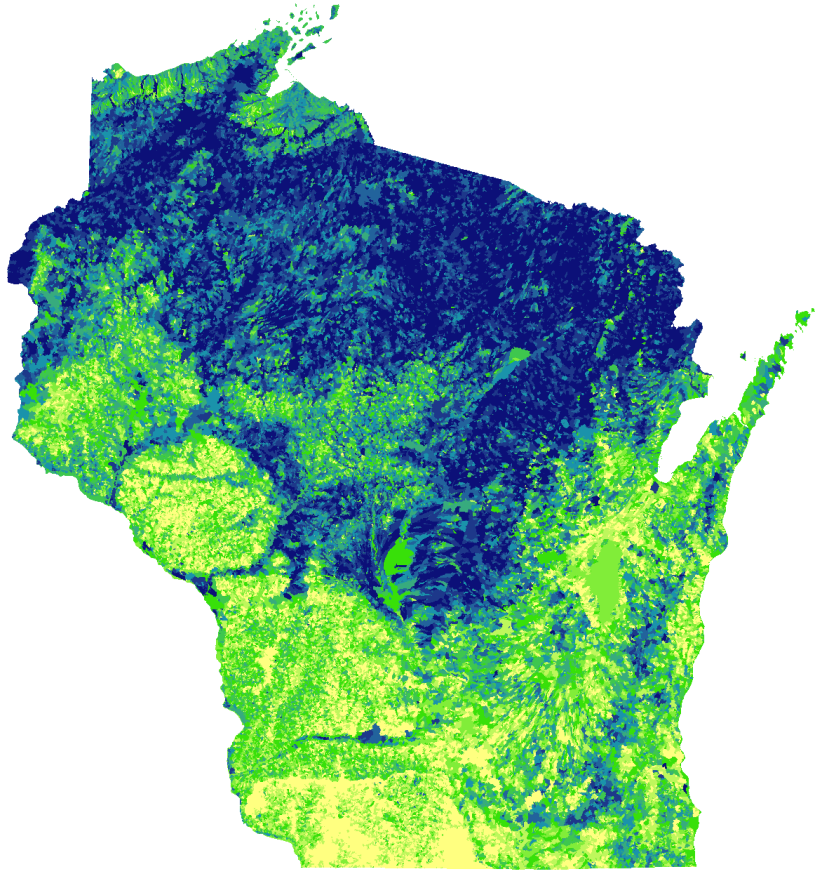
Extension
UNIVERSITY OF WISCONSIN-MADISON

Stream Total Phosphorus & Suspended Sediment

Stream Total P



Stream Suspended Sediment

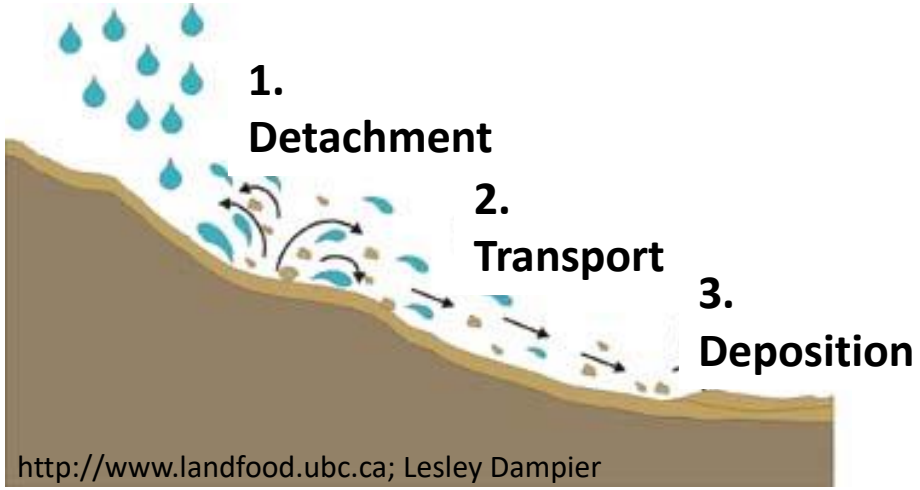


WI Integrated Assessment of Watershed Health, March 2014

A Primer on Soil Erosion

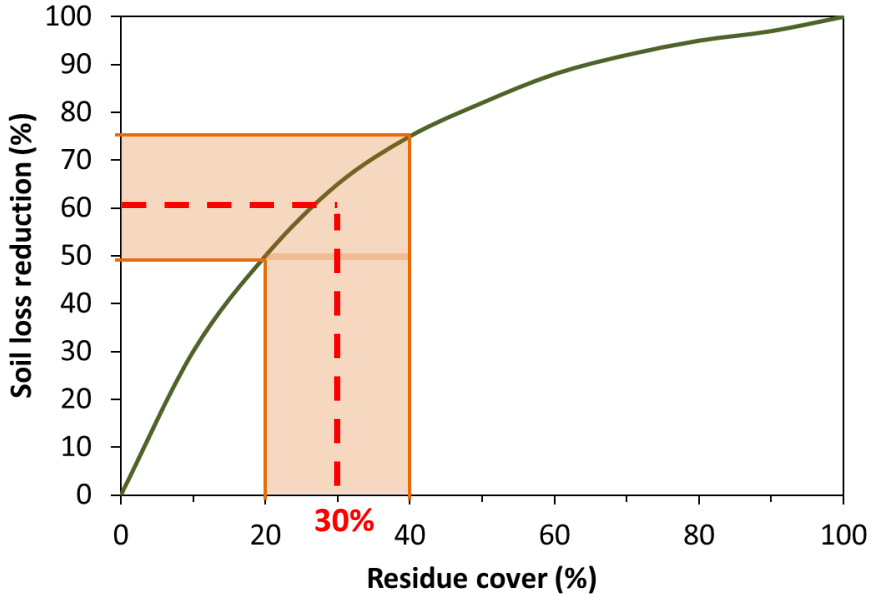
A. Erosion is a three-step process:
   1. Soil particle detachment
   2. Soil particle transport
   3. Soil particle deposition

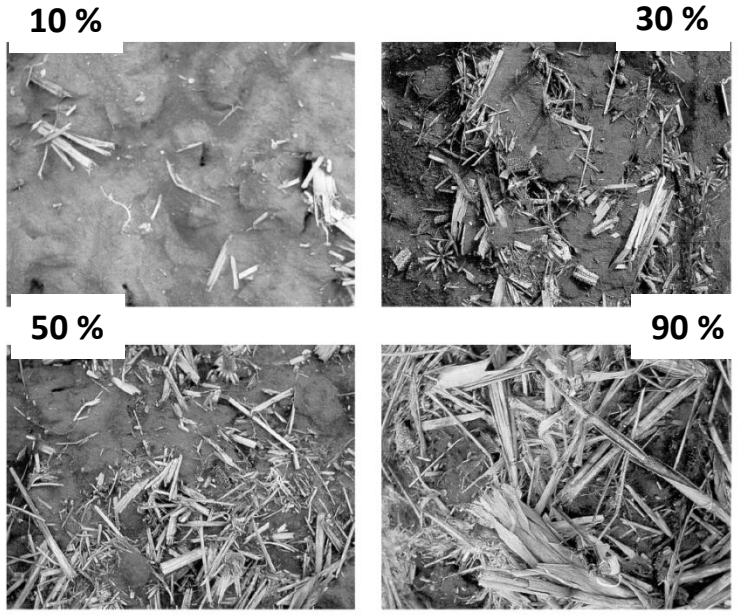
B. Preventing soil particle detachment is key, but increasing infiltration is also important.



http://www.landfood.ubc.ca; Lesley Dampier

Plant Residues on Soil Surface Reduces Detachment (and therefore, Reduces Erosion)





Source: Purdue University AT-269-W

Notice how the soil was protected under this piece of residue (soil around was washed away) after a 1-inch rainfall.

The Role of Cover Crops in Erosion Management

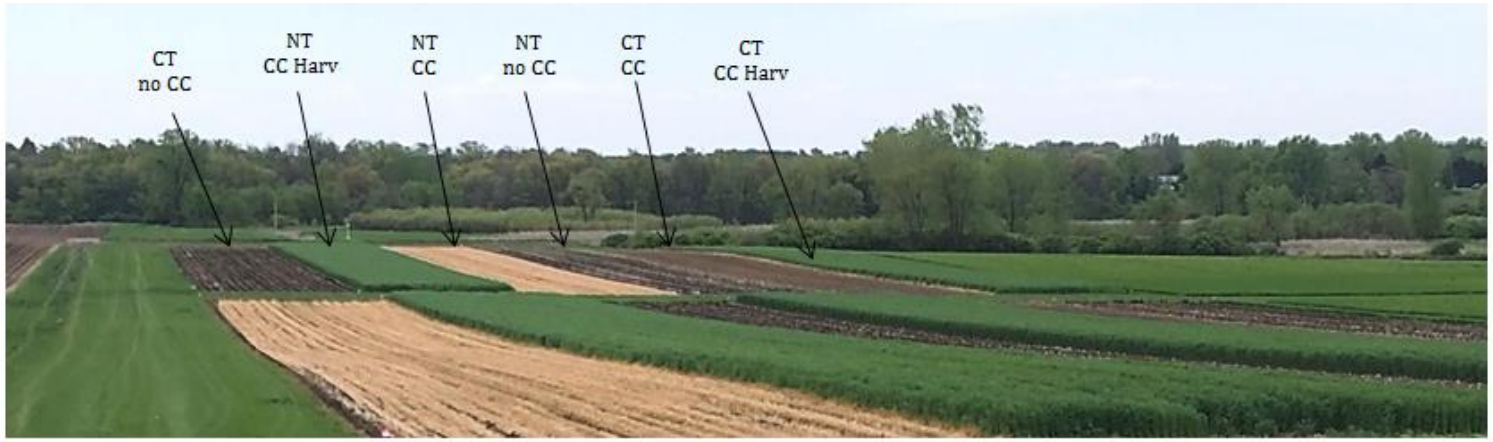
- Protect the soil surface from detachment with aboveground biomass.
- Root system anchors soil particles and aggregates.
- Improve infiltration.

http://www.foodforestfarm.com/get-the-dirt

Can cover crops reduce sediment and phosphorus losses in runoff from corn silage systems?

Picture source: https://farmwest.com/node/957

Corn Silage Production and Dairy Manure



Study Outline

- Cereal rye as a cover crop
- Different liquid dairy manure application approaches:
  - Low disturbance (5-7 cm depth)
  - Deep injection (~15 cm depth)
  - Surface application

- Treatment combinations:
  - Cover crop, no manure
  - No manure, low disturbance manure injection
  - Cover crop, low disturbance manure injection
  - Cover crop, deep manure injection
  - Cover crop, surface applied manure

- Manure application rate of ~75,000 L/ha (8,000 gal/ac) in the fall

Liquid Manure Application

Low Disturbance Injection
(aka “Injector 1”)

Deep Injection
(aka “Injector 2”)

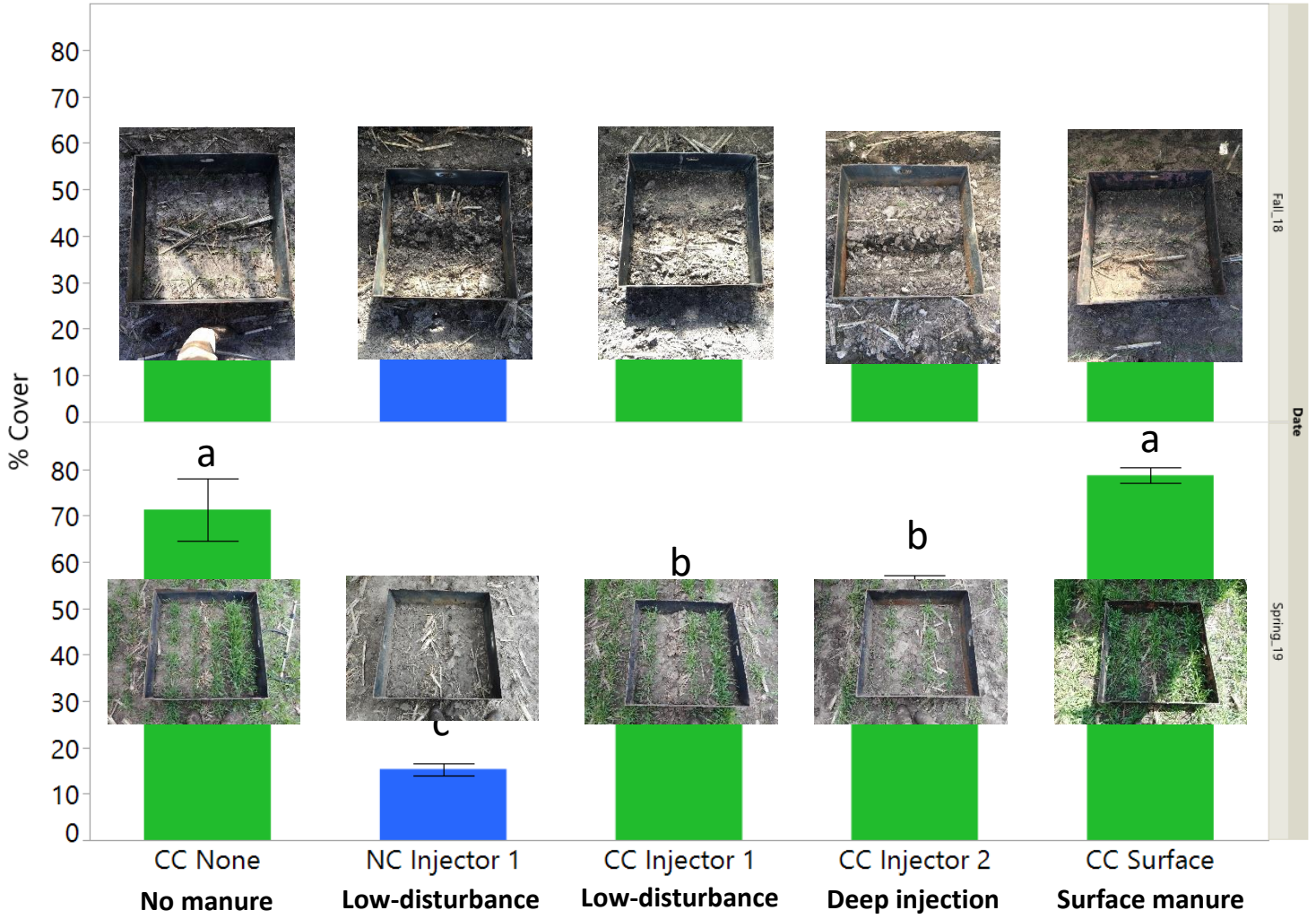
Surface Application
(aka “Surface”)

Rainfall Simulations Three Times Within a “Year”

Fall: ~4 weeks after drilling rye (Oct. 2018)

Spring: April 2019

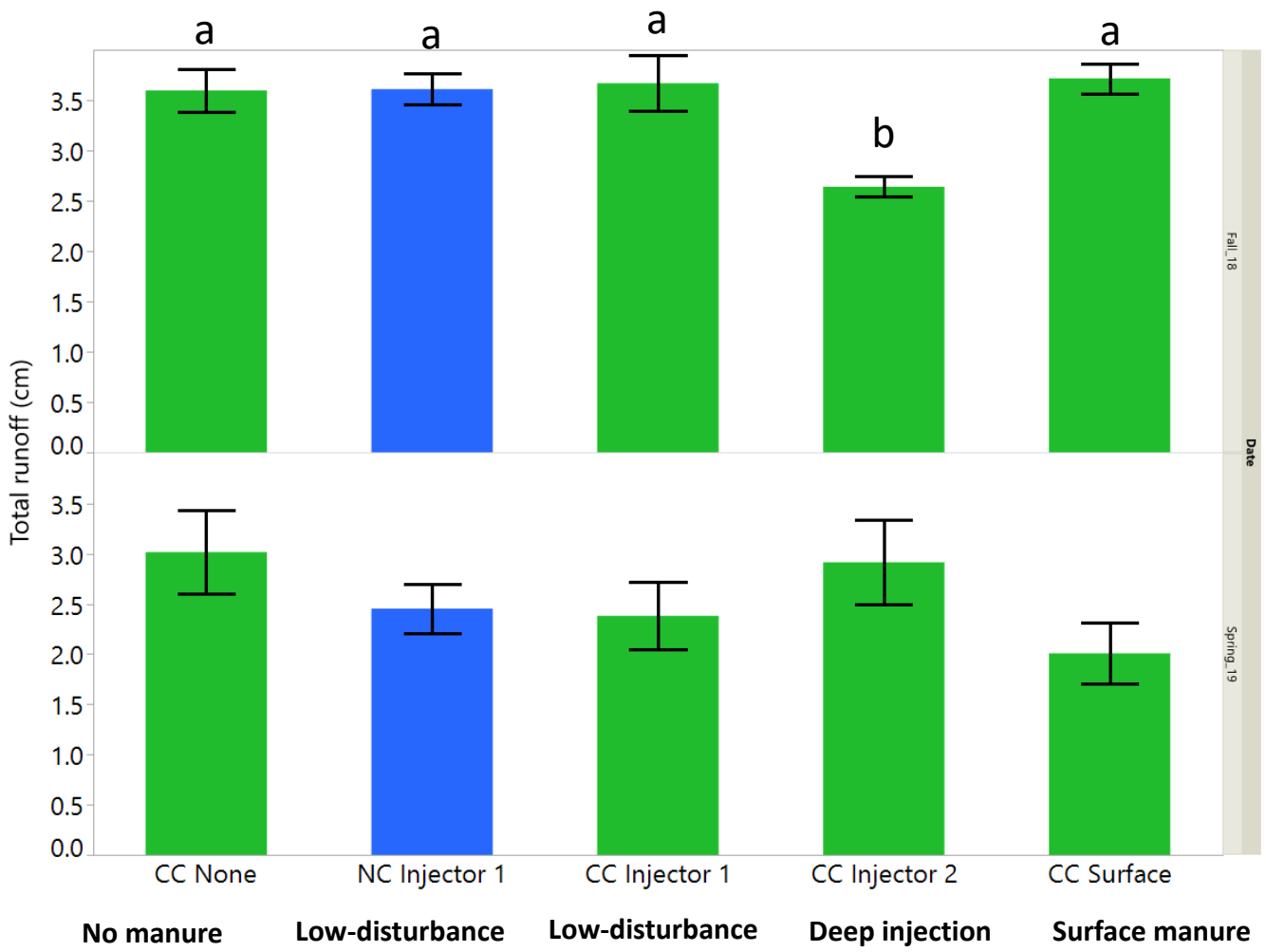
Percent Surface Cover



P=0.0002

P<0.001

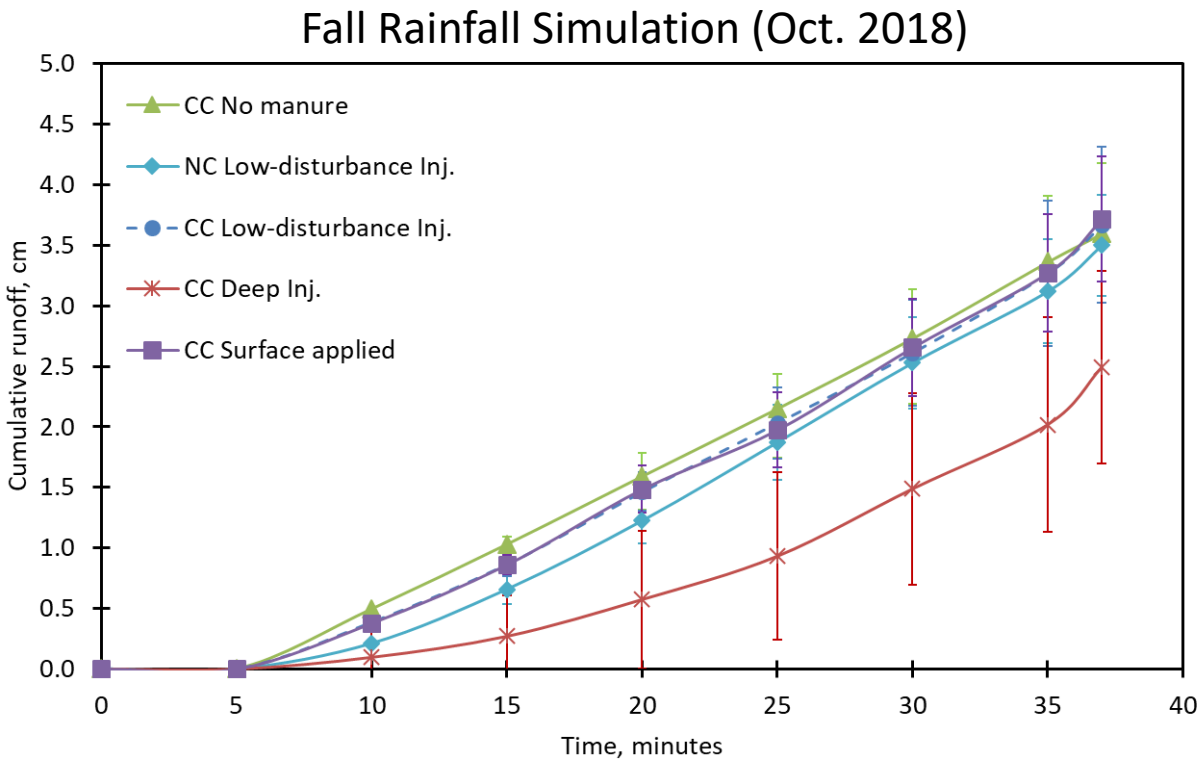
Total Runoff

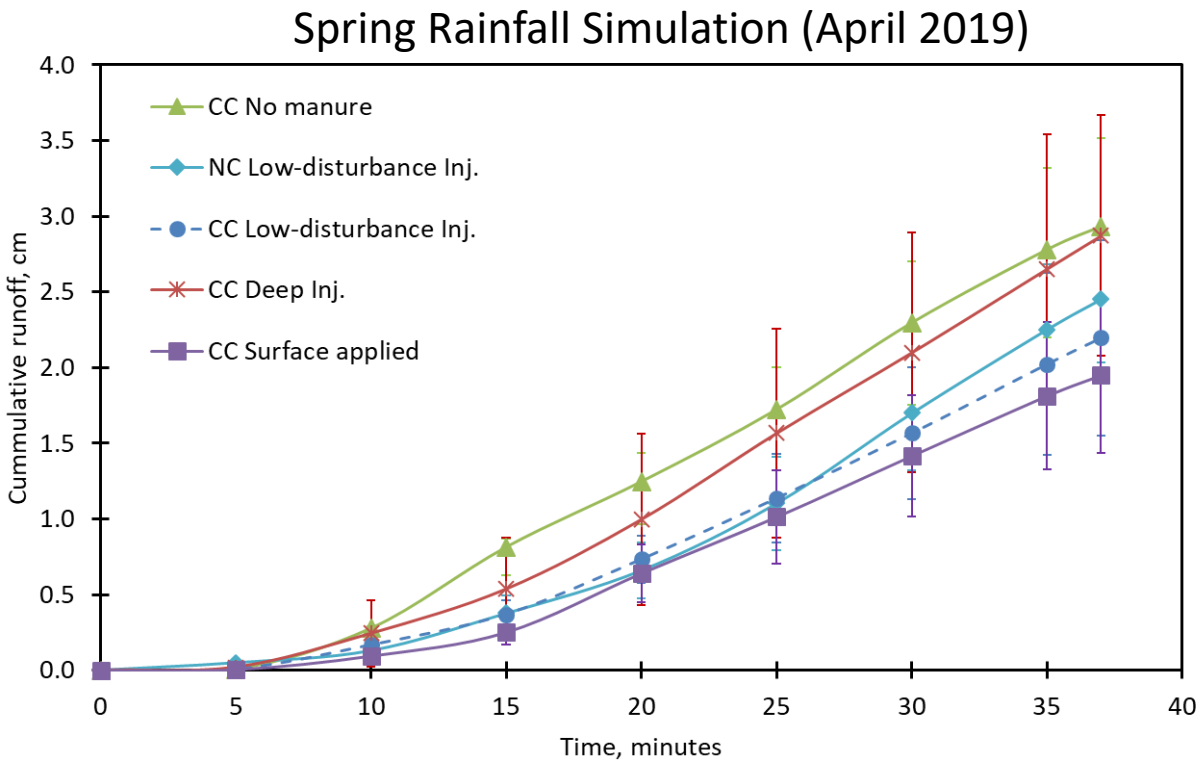


P=0.011

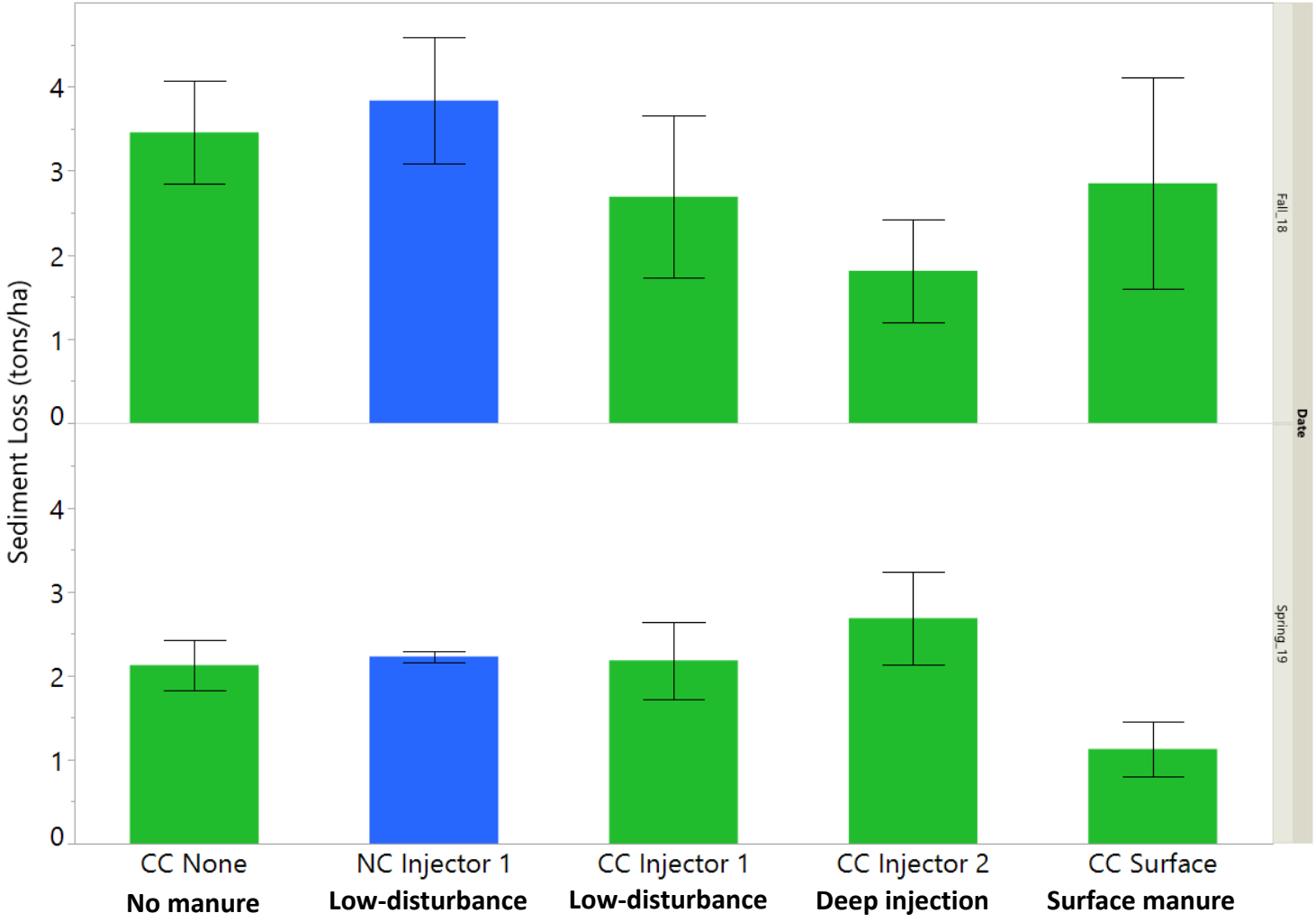
P=0.385

Cumulative Runoff





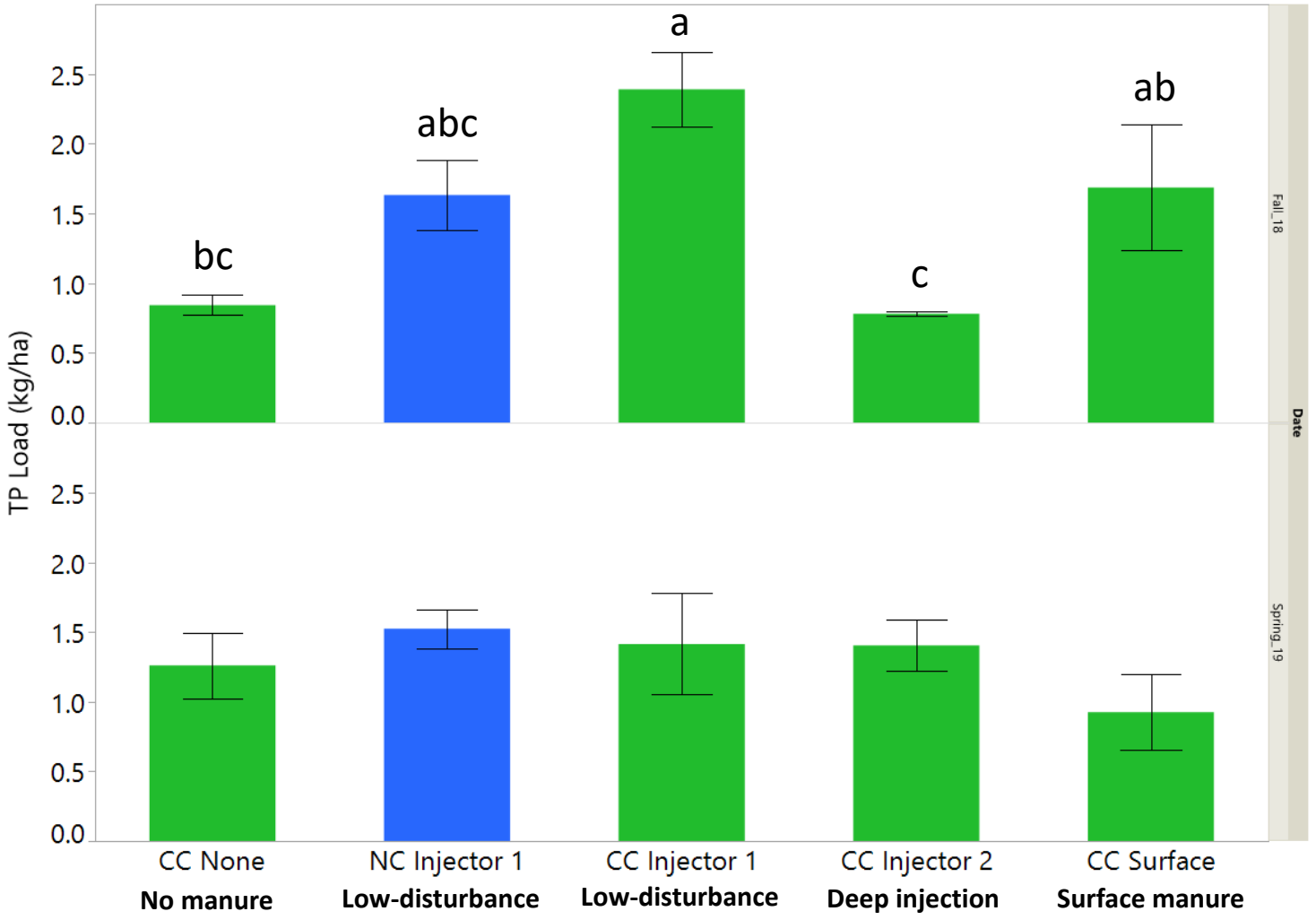
Sediment Losses



P=0.652

P=0.209

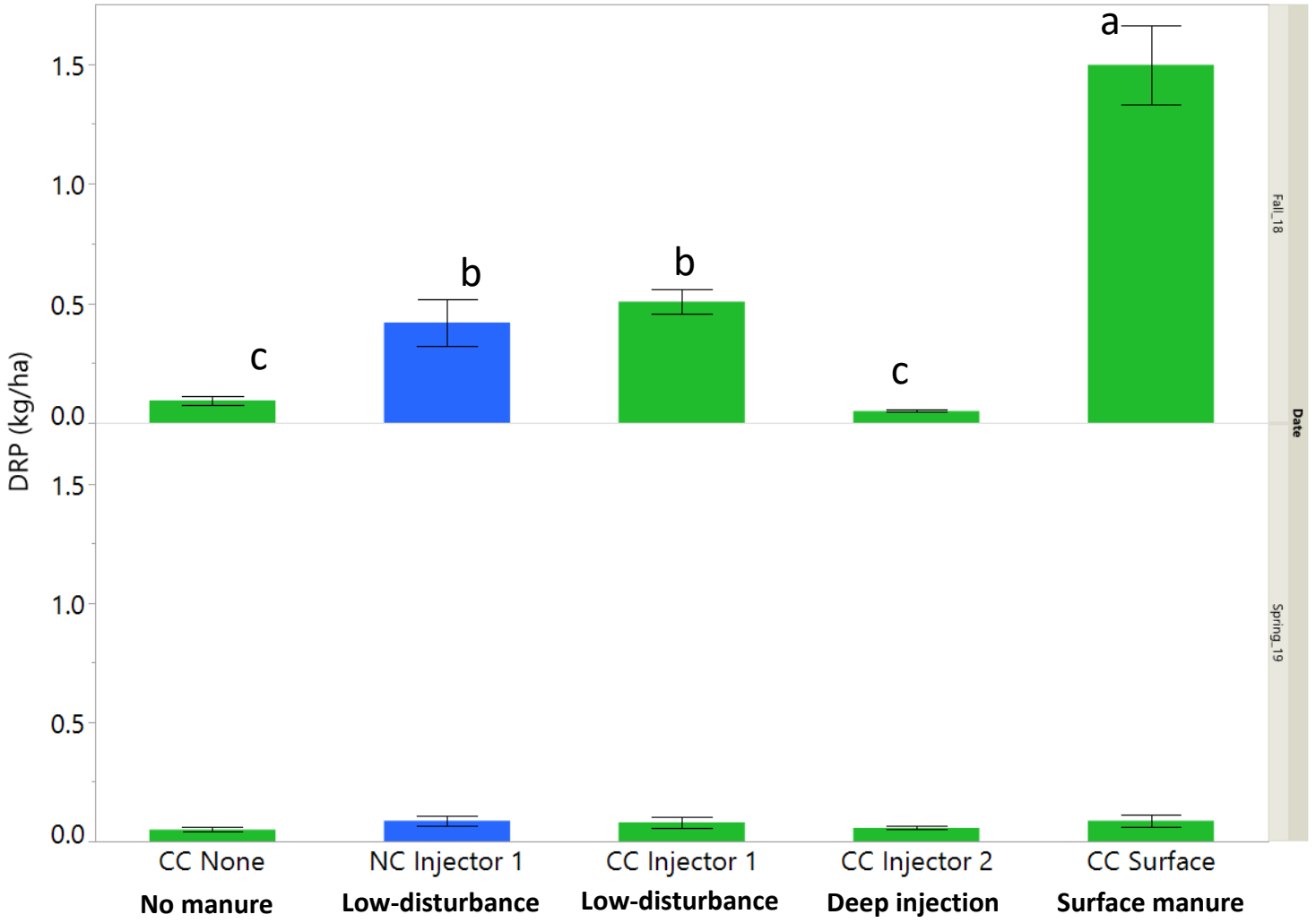
Total Phosphorus Losses



P=0.0135

P=0.599

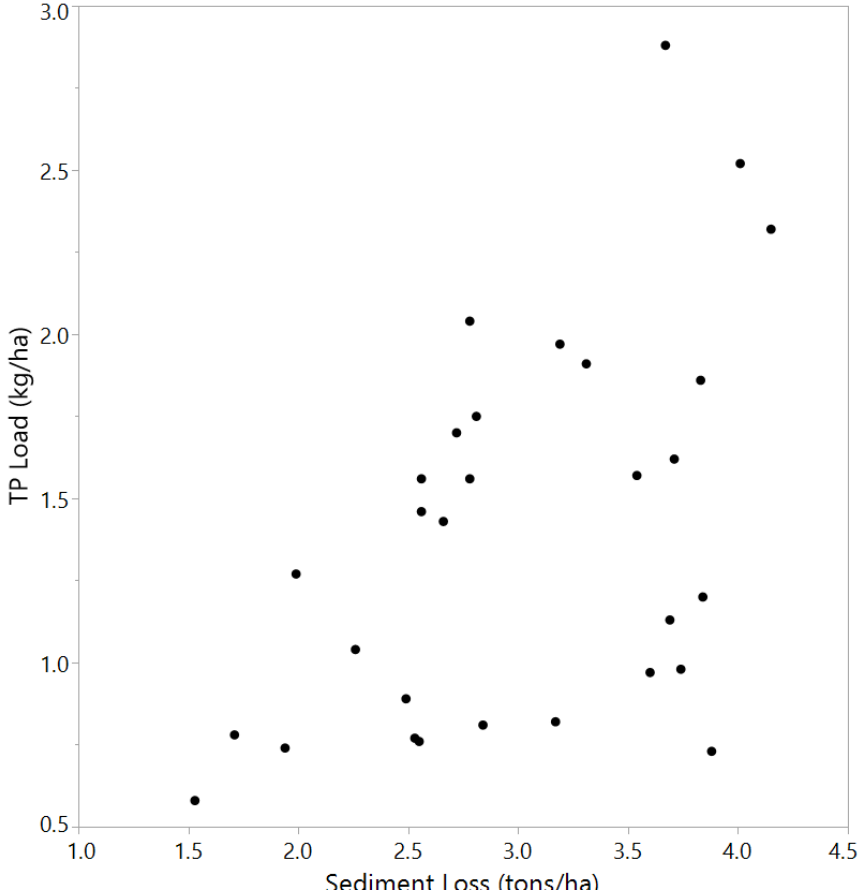
Dissolved Reactive Phosphorus Losses

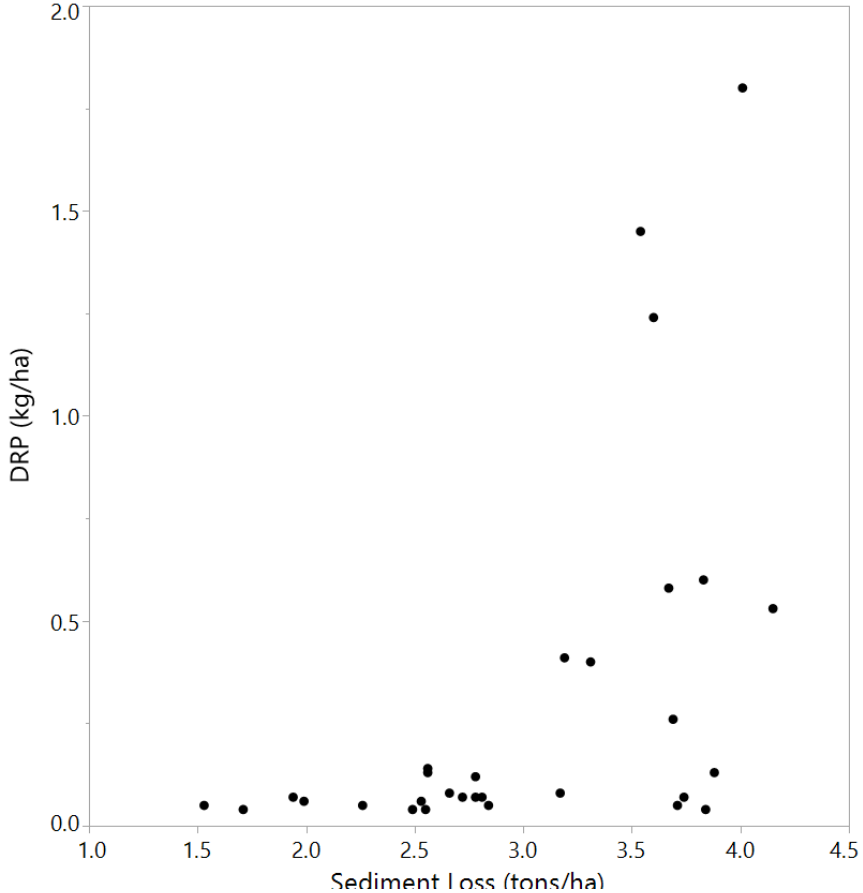


P<0.001

P=0.545

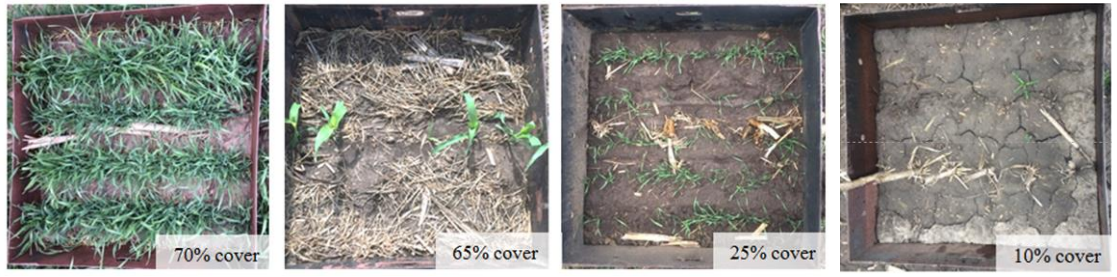
Sediment Loss and Phosphorus Losses





Overall Summary

- Cover crops can help reduce overall erosion (i.e. water runoff, sediment, and phosphorus losses), but…
- …reductions depend on the total amount of above-ground biomass.
- Therefore, proper cover crop management is needed to optimize growth, and other management need to be considered as well.



DEPARTMENT OF Soil Science
UNIVERSITY OF WISCONSIN-MADISON

Funding support: Wisconsin Fertilizer Research Council, UW CALS Hatch Program, Agronomic Science Foundation, and the Bayer-Monsanto Corporation.