



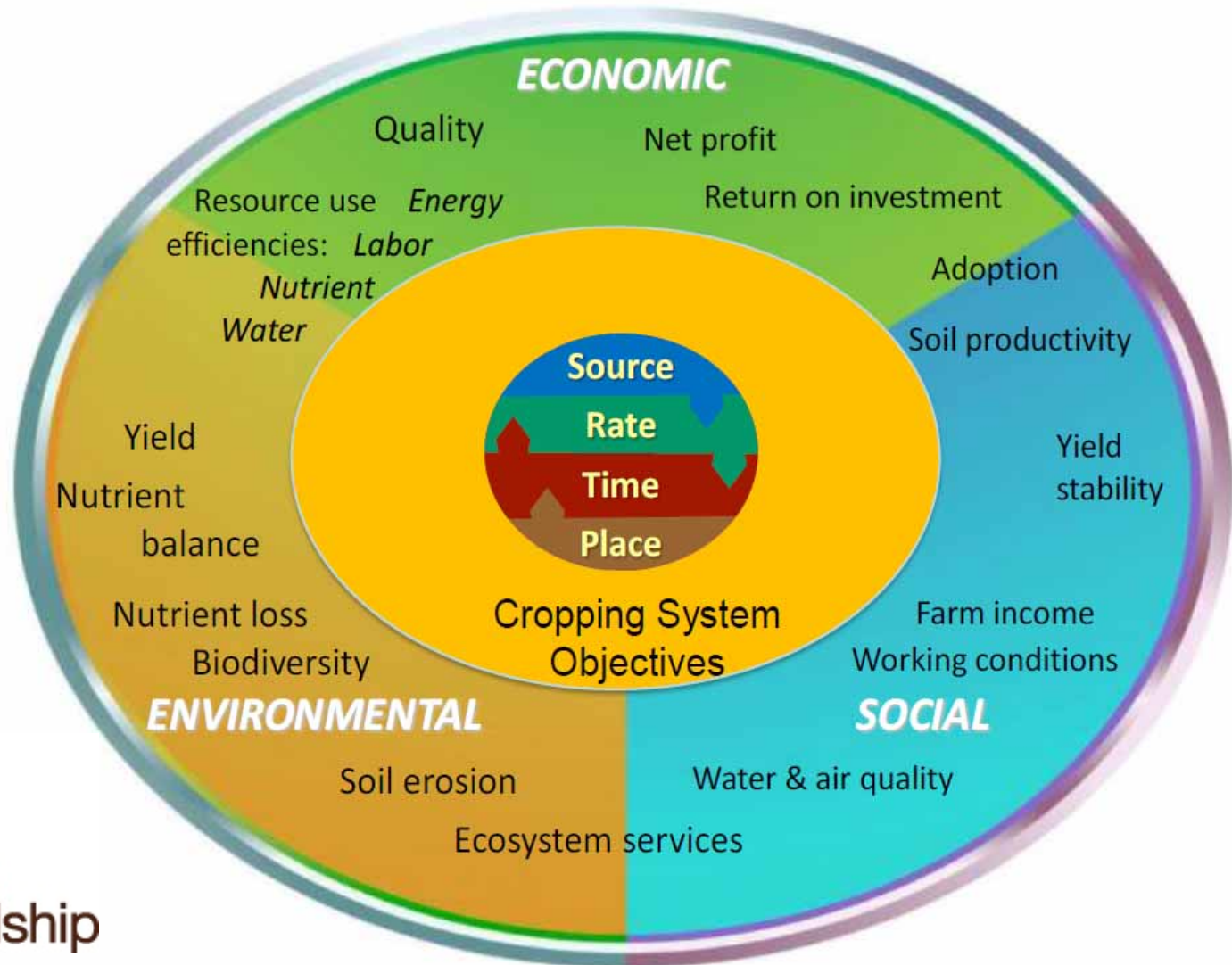
Minimizing Phosphorus Loss with 4R Nutrient Stewardship & Cover Crops

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Kansas State University



Maximizing returns and minimizing externalities



Phosphorus loss from agriculture can degrade water quality by promoting algal blooms.



Centralia Lake, KS. Photo courtesy Kevin Price, 2012

What is the right “place” for P?



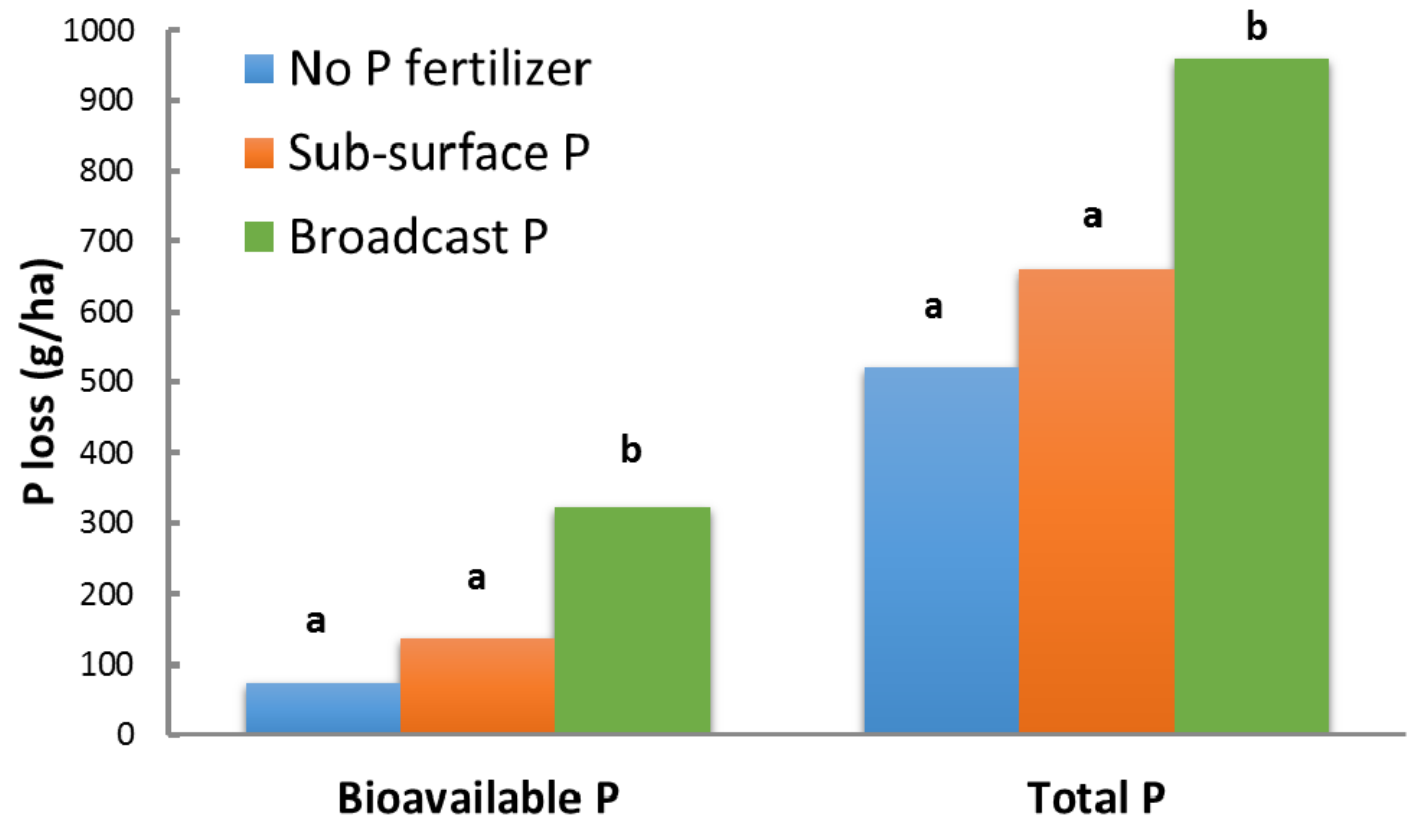
Best management practices to reduce P loss

- Reduce Erosion (no-till)



Best Management Practices to Reduce P Loss

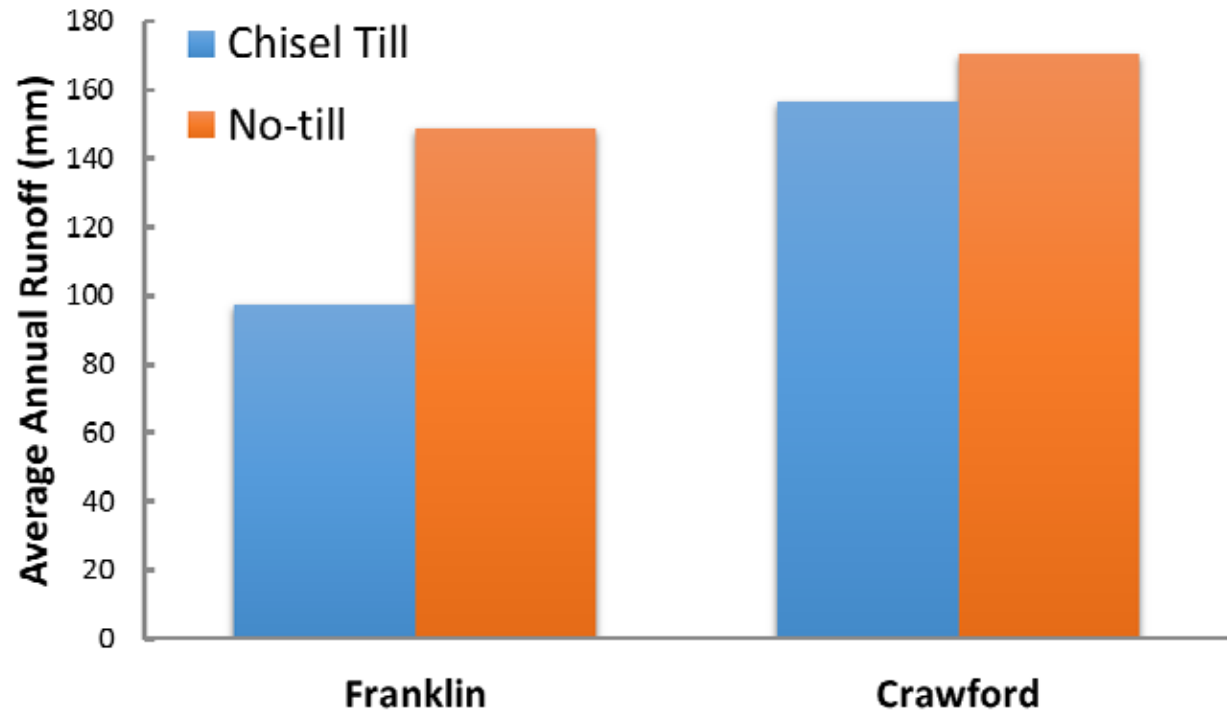
➤ Sub-surface application of P



P loss from Grain Sorghum in 1998 (Kimmell et al., 2001)

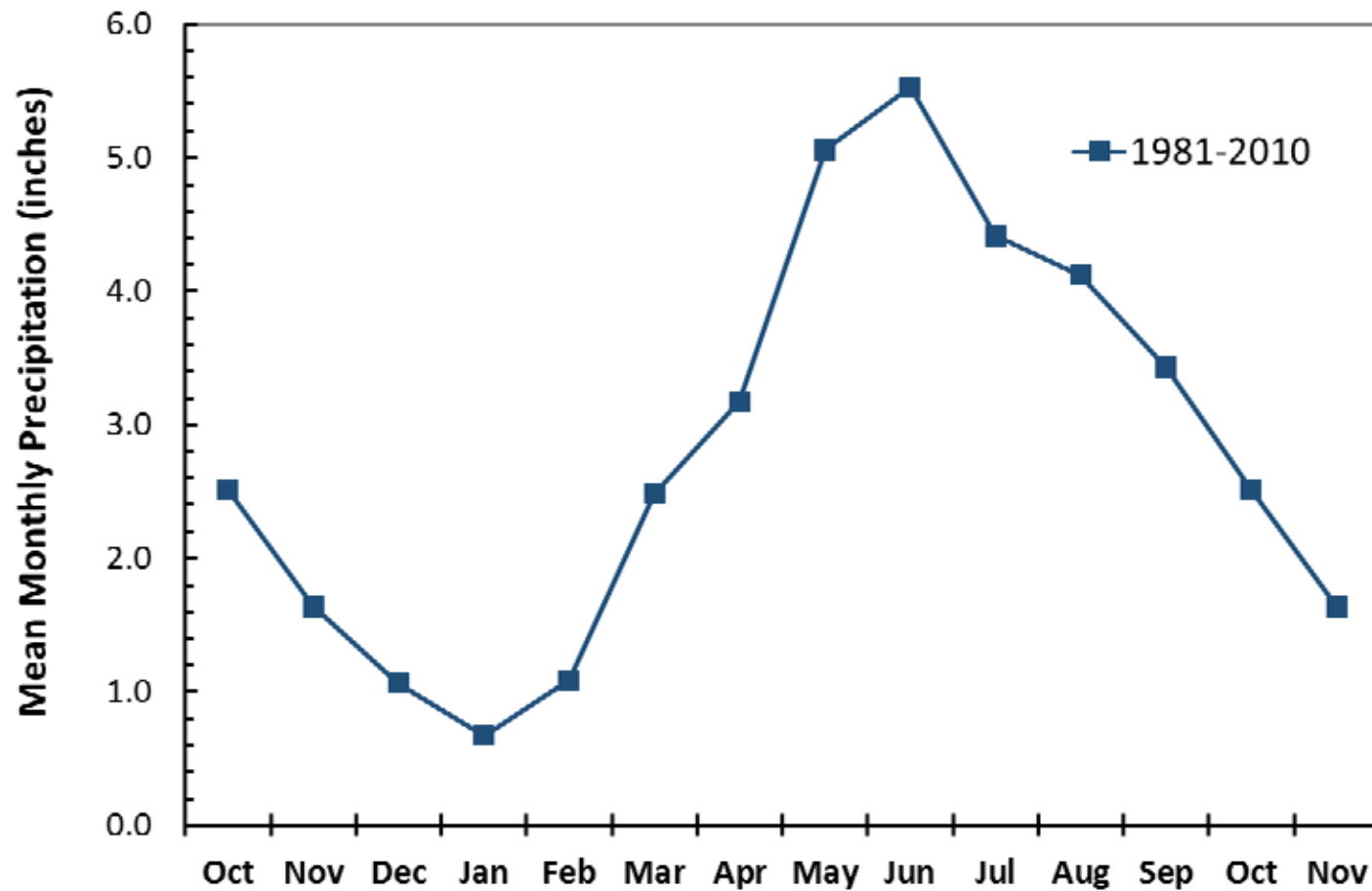
Tillage effects on runoff

- Increased runoff from no-till can confound effects of reduced erosion



*4-yr average annual runoff in sorghum-soybean cropping systems
(Zeimen et al., 2006)*

Precipitation Trends for North-east Kansas



30-yr average monthly precipitation at Manhattan, KS

Can Cover crops reduce P loss?

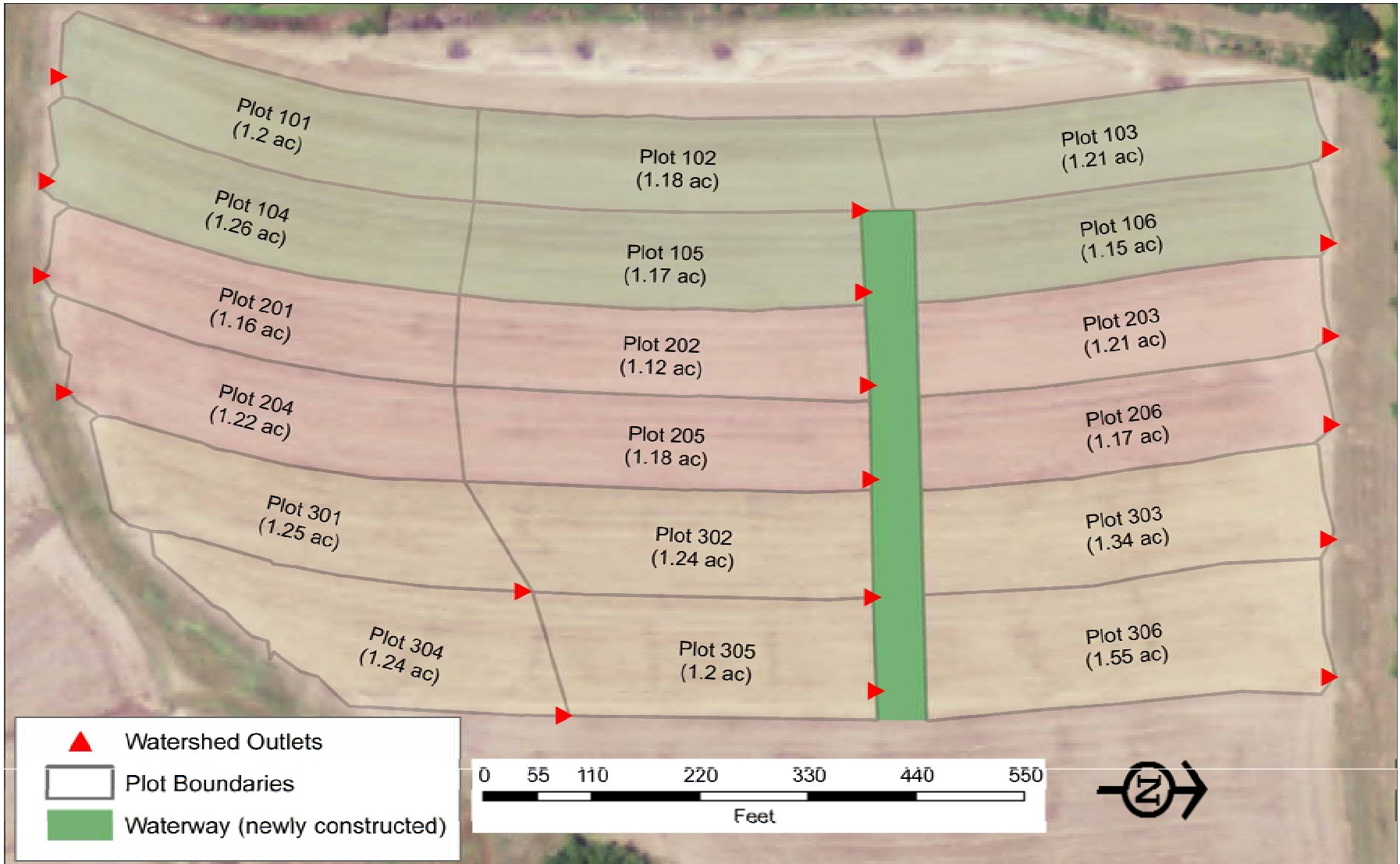


Research Questions (Objectives)

- How does P loss from fall surface-applied fertilizer compare to spring injected P fertilizer (current recommended BMP)?
 - How does this impact crop production, nutrient use efficiency, and profitability?
- Will cover crops reduce P losses?
 - What are the agronomic, environmental, and economic effects of winter cover crops in corn-soybean rotations?
- Will cover crops reduce P losses from fall surface-applied fertilizer?

KAW Field Lab

Kansas Agricultural Watersheds Field Lab



Constructed a new waterway

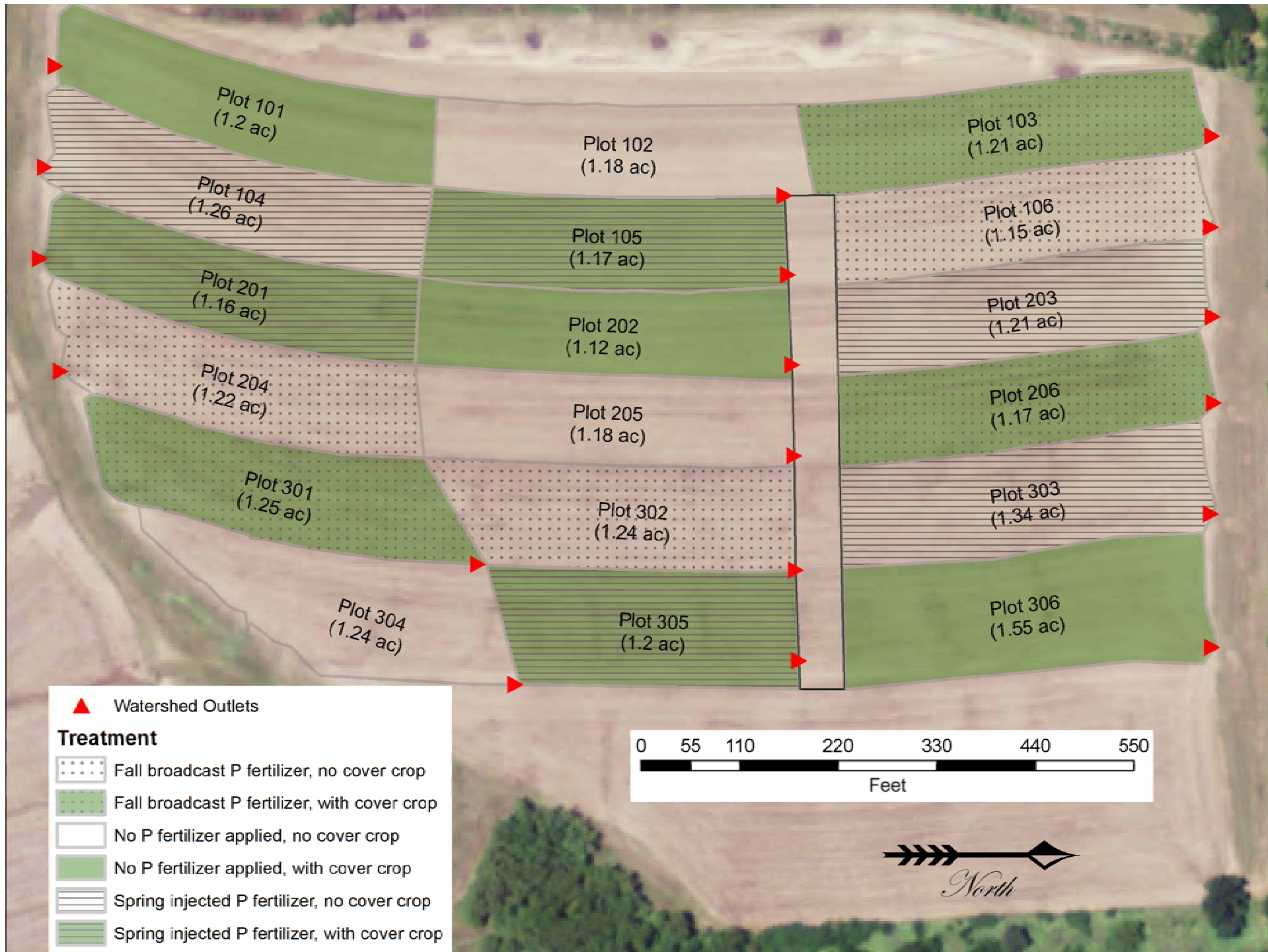


Re-grade and rebuild terraces



Installed pipe outlets





Installed flumes



Installed flumes



Methods

- Small watershed/field-scale study with natural rainfall
- No-till corn-soybean rotation (5 year duration)
- Factorial treatment structure
 - P fertilizer
 - 0 lbs P_2O_5 /ac
 - 50 lbs P_2O_5 /ac applied in 2x2 placement
 - 50 lbs P_2O_5 /ac broadcast in fall
 - With or without winter cover crop



Field Measurements

- Grain Yield
- Water Loss (runoff)
- Sediment loss
- P loss
 - Dissolved
 - Total P
- N loss
 - NO_3 & NH_4
 - Total N

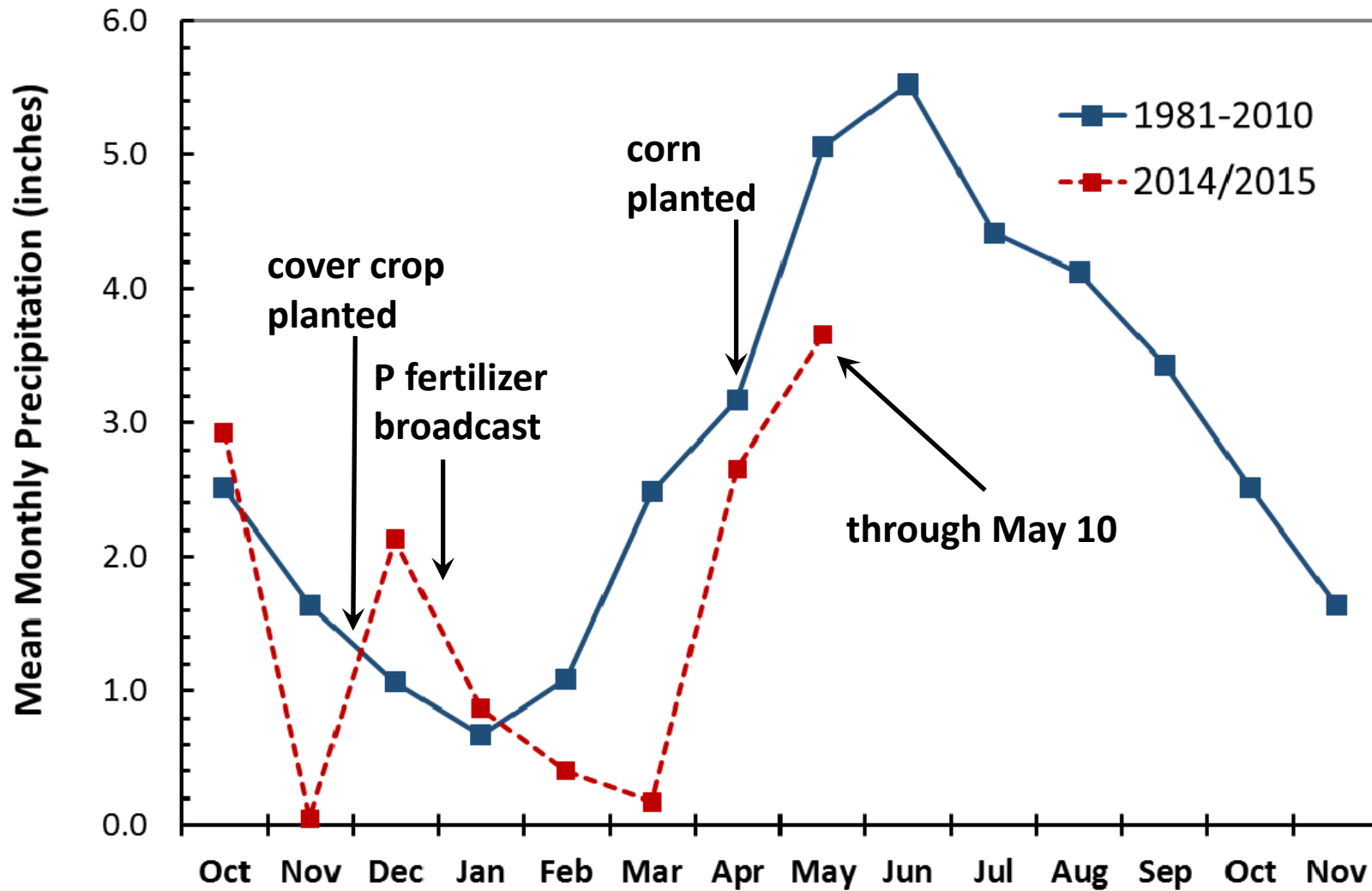


Field Measurements

- Biomass production (crop and cover crop)
 - Nutrient content of biomass and grain
- Nutrient uptake (crop and cover crop)
 - Nutrient use efficiency – various computations
 - Environmental efficiency – (Nutrient loss/grain yield)
- Economic profitability

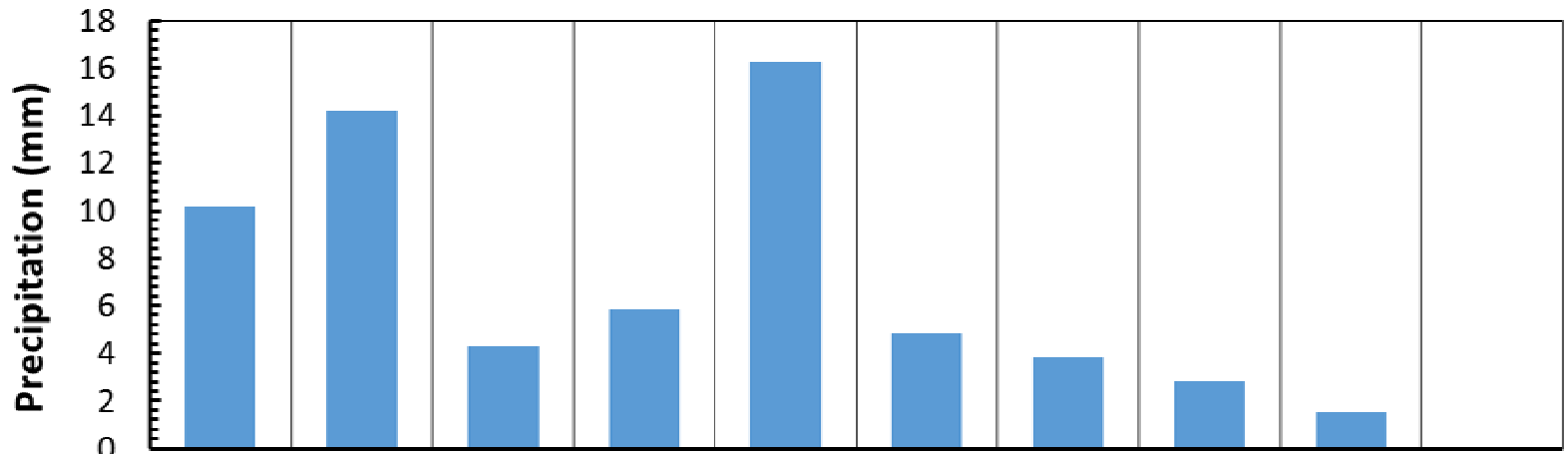


Precipitation

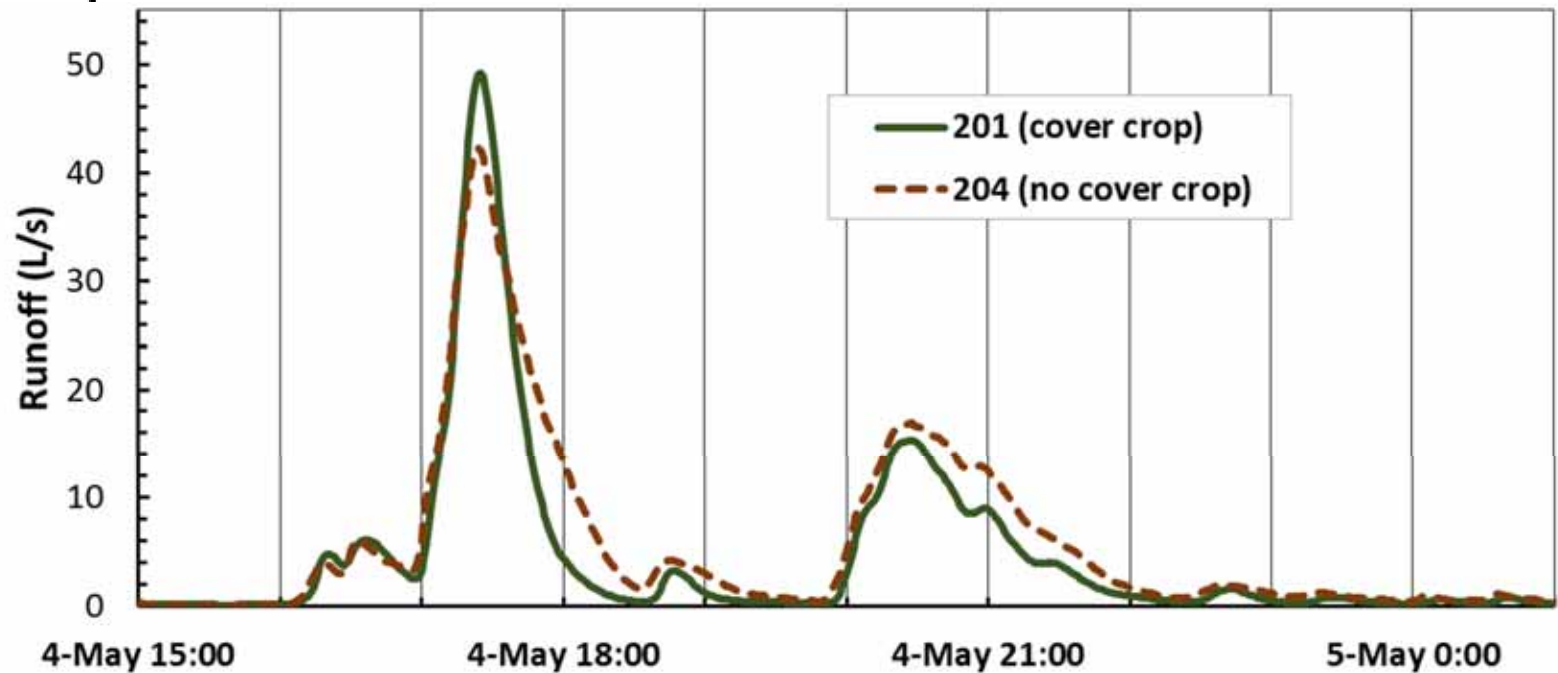


Runoff data from May 5, 2015

74.9 mm
total precip.

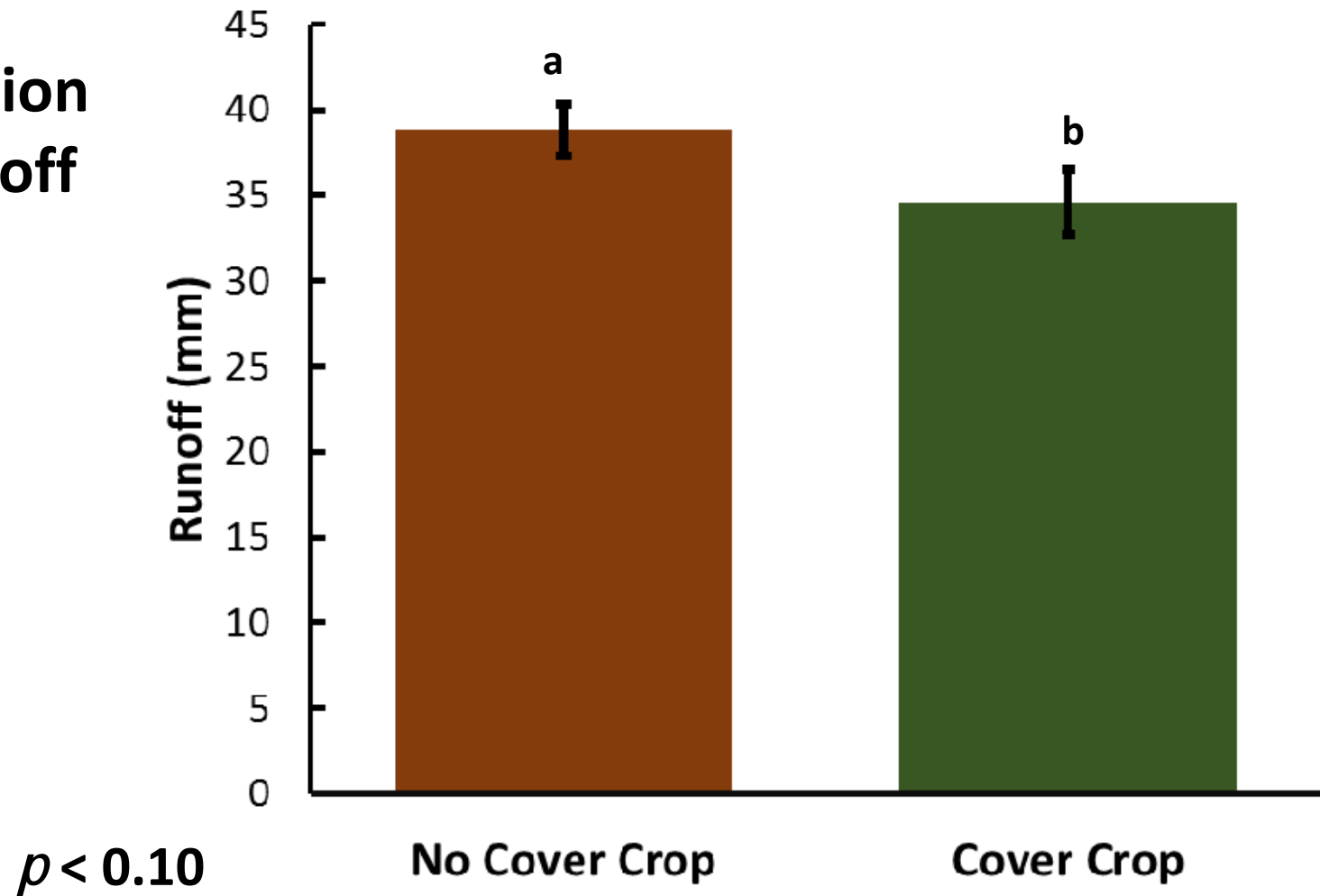


31 to 41 mm
total runoff

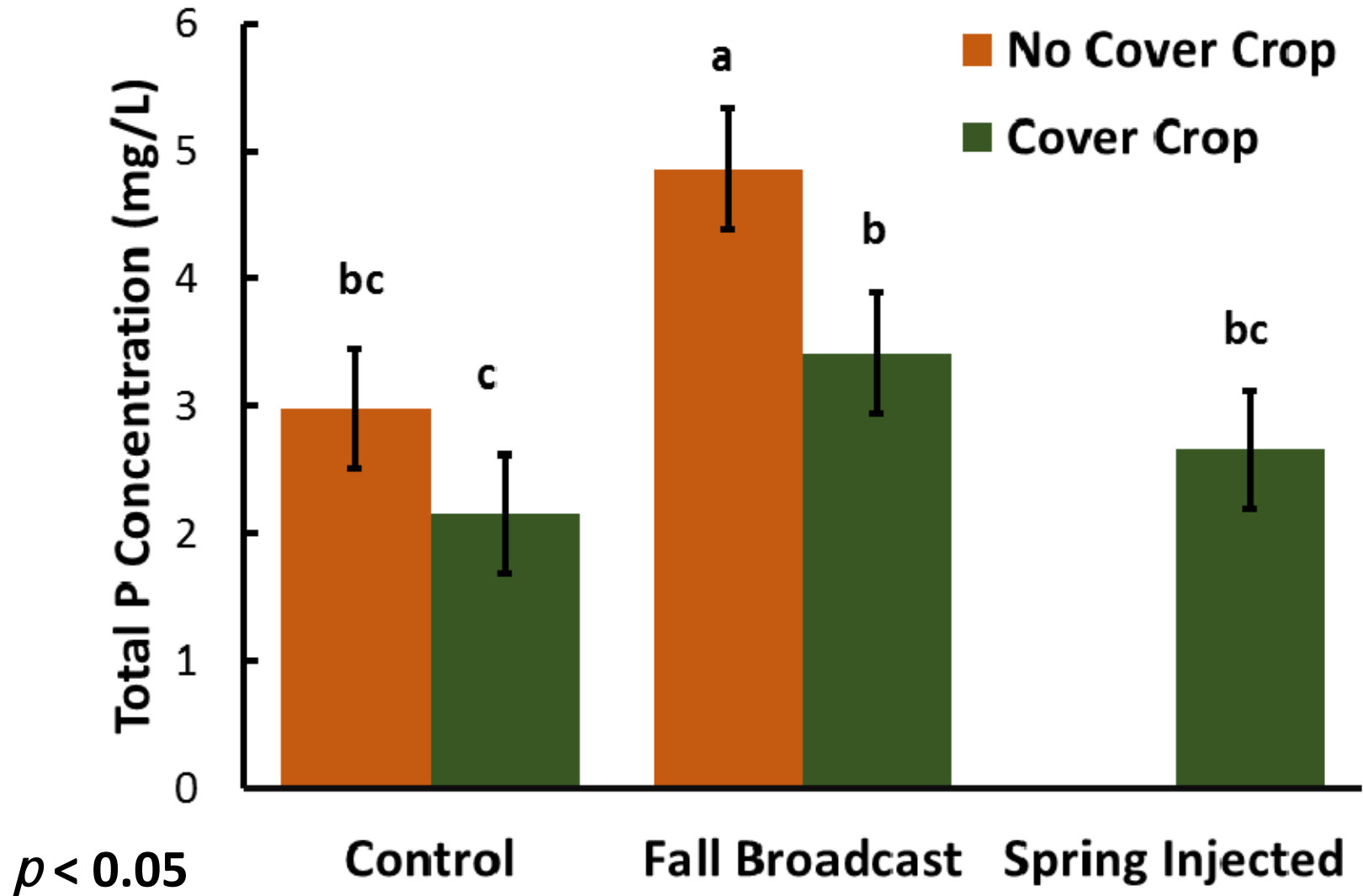


Runoff data from May 5, 2015

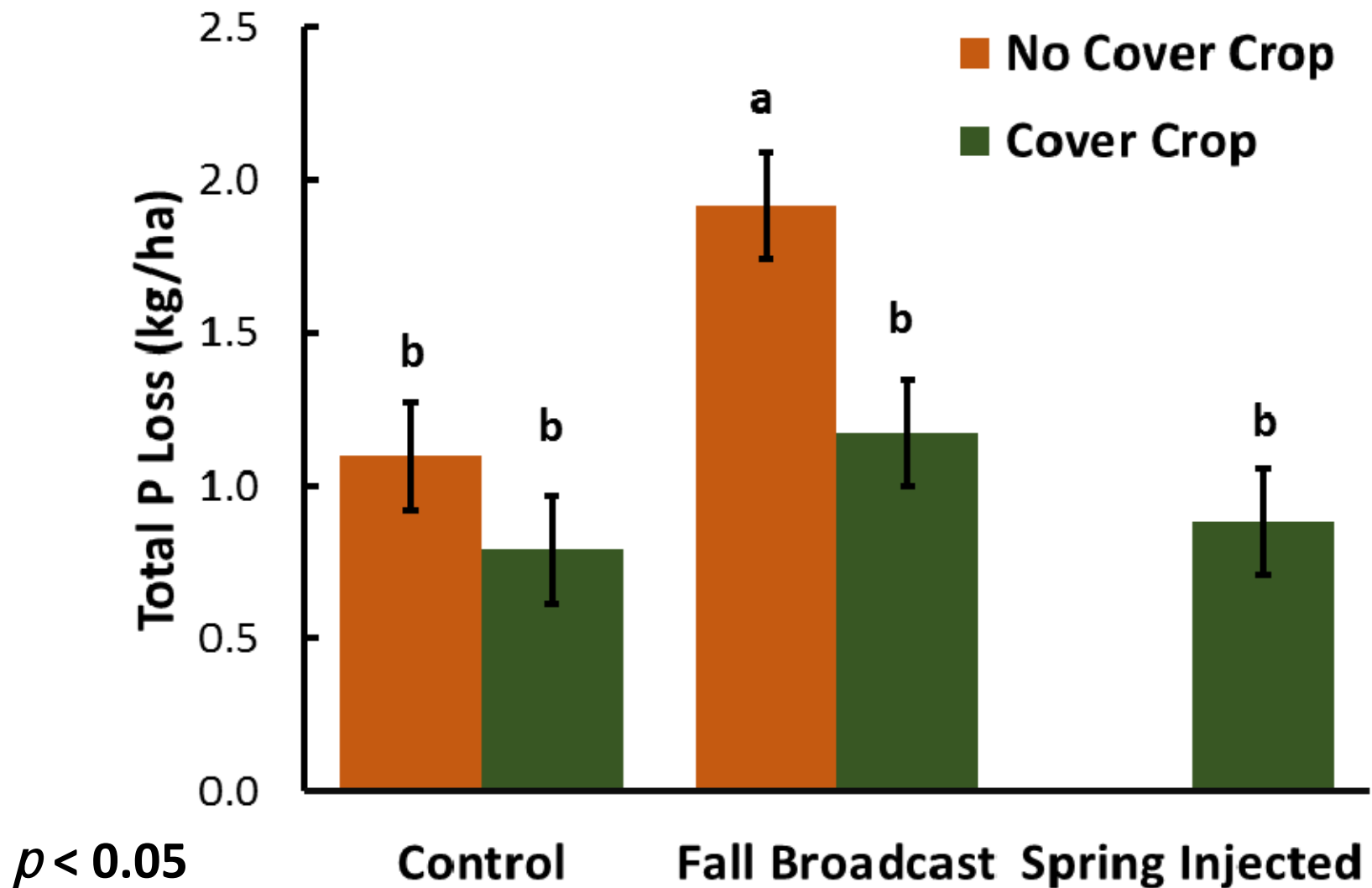
**10% reduction
in total runoff**



Total P concentration in runoff (5/5/15)



Total P load in runoff (5/5/15)



Summary

- Too early for any conclusions (preliminary or otherwise)
- Results are highly dependent on rainfall
 - Requires long-term studies to determine trends
- Data collection will continue for 5 years



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