



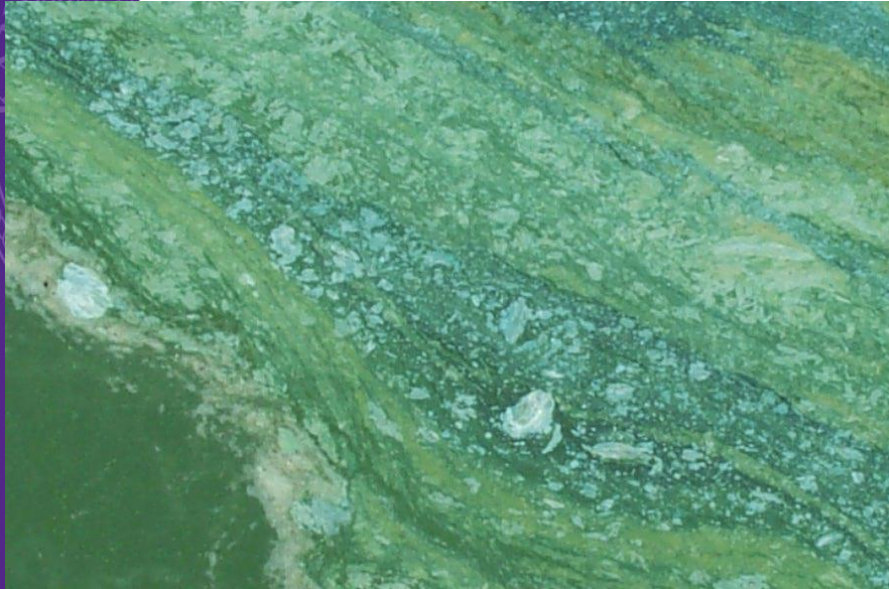
Understanding Cropland Runoff and Controlling Nutrient Losses

Nathan Nelson
Department of Agronomy

Surface water quality issues

- Primary concerns
 - sediment
 - phosphorus
 - bacteria
- Other concerns
 - pesticides/herbicides (atrazine)
 - nitrate

Phosphorus promotes eutrophication



Algal bloom in Cheney Reservoir
(photo courtesy KDHE)

Algal bloom in Centralia Lake
(photo courtesy Kevin Price)



Why would producers need to be concerned with this?

- Does water quality impact their operations?



Water quality impacts public perception of agriculture

Detroit

metrotimes

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A toxic algal bloom caused a three-day ban on water usage for a half-million residents in SE Michigan and Toledo.

Experts say it's a 'wake-up call.'

TAINED

BLOOM



by Ryan Felton

August 2014 algal bloom in Lake Erie left 400,000 people in Toledo, OH without water for 3 days.

MUSIC: Mad Decent's Flosstradamus

EAT: Campau Tower is reborn

ARTS: Pop culture on parade

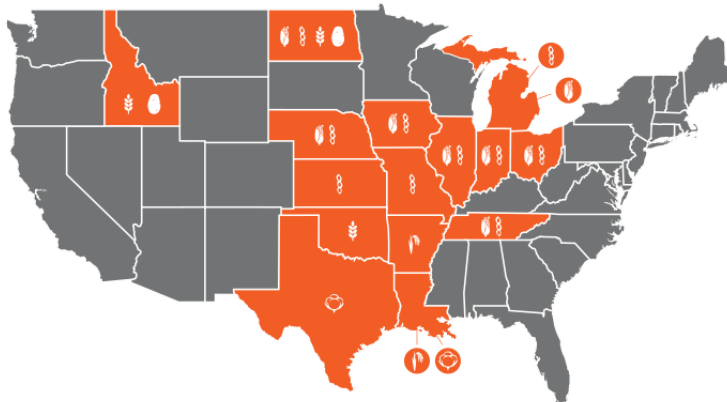
KANSAS STATE
UNIVERSITY

Public perception impacts consumer preferences

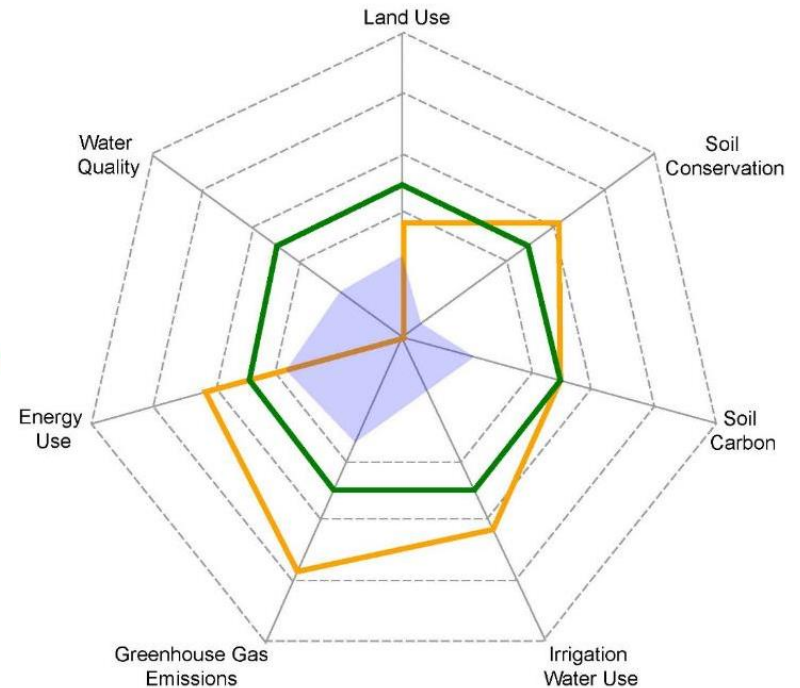


Field to Market™

The Alliance for Sustainable Agriculture



Supply Chain Partnerships in 15 States (2014)



Fieldprint Calculator

<https://fieldtomarket.org/>

How do we manage P to minimize loss to surface water?

- Control the source
 - Fertilizer source, placement, rates, timing
 - 4Rs of nutrient stewardship
- Control the transport
 - minimize erosion
 - minimize runoff
- Control source x transport interactions

4Rs OF NUTRIENT STEWARDSHIP

Economically, Environmentally & Socially
Sustainable Crop Nutrition



The 4Rs promote best management practices (BMPs) to achieve cropping system goals while minimizing field nutrient loss and maximizing crop uptake.

4R Principles of Nutrient Stewardship



RIGHT SOURCE

Matches fertilizer type to crop needs.



RIGHT RATE

Matches amount of fertilizer to crop needs.



RIGHT TIME

Makes nutrients available when crops need them.



RIGHT PLACE

Keeps nutrients where crops can use them.

Right Rate



- Match P application to crop needs
- Soil test regularly
 - No need to build soil test P beyond 20 to 30 ppm
- do not over apply manure and byproducts
 - apply meet P requirements

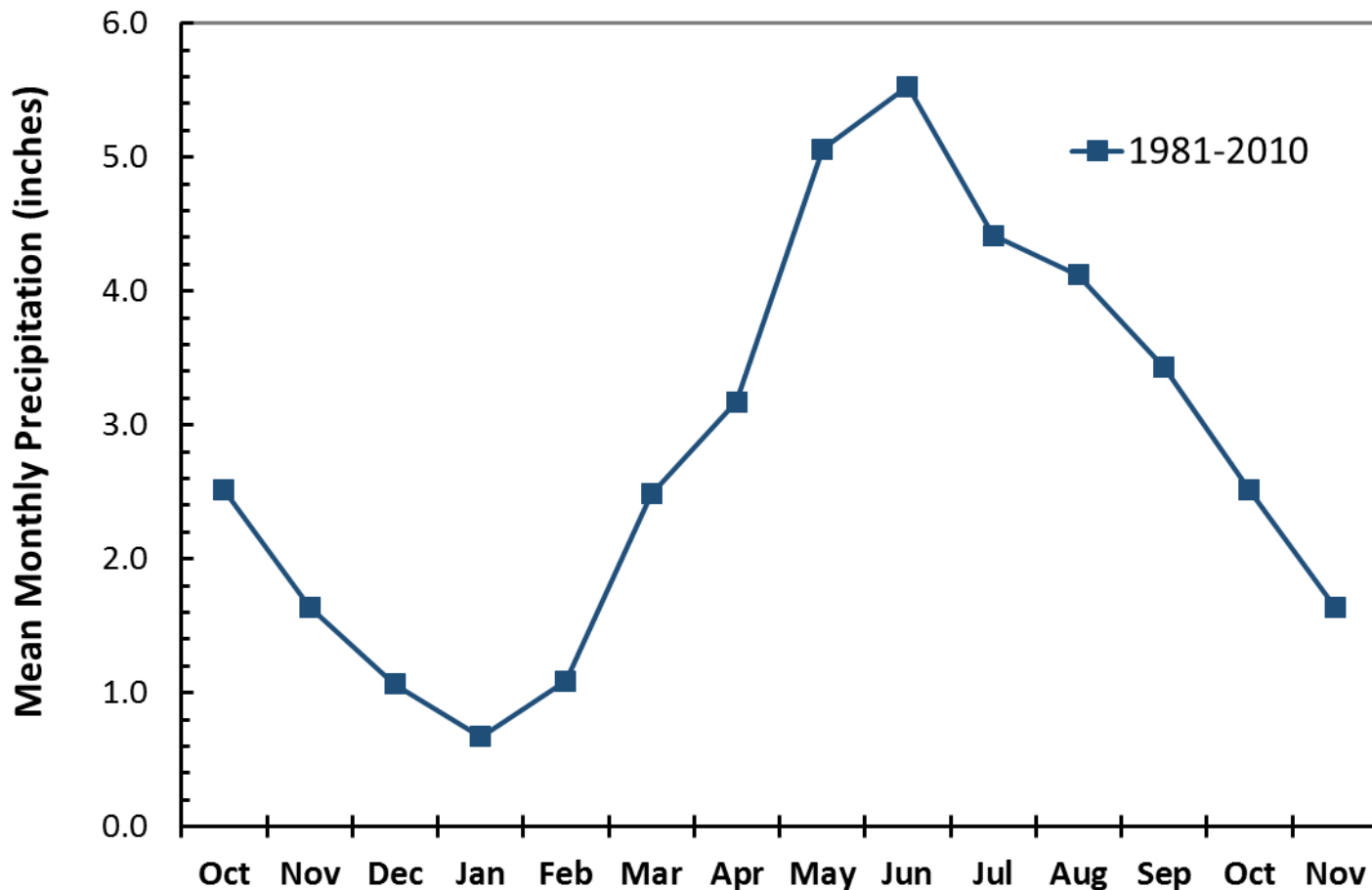
Right Time



- If surface-applying P, then apply P at a time when there is likely less runoff
 - late fall applications
 - give the fertilizer time to move into the soil
- manure and byproducts
 - may want to apply less frequently in the rotation at higher amounts. Focus on controlling losses during less-frequent applications.

When do we have the lowest risk of runoff?

30-yr average monthly precipitation at Manhattan, KS

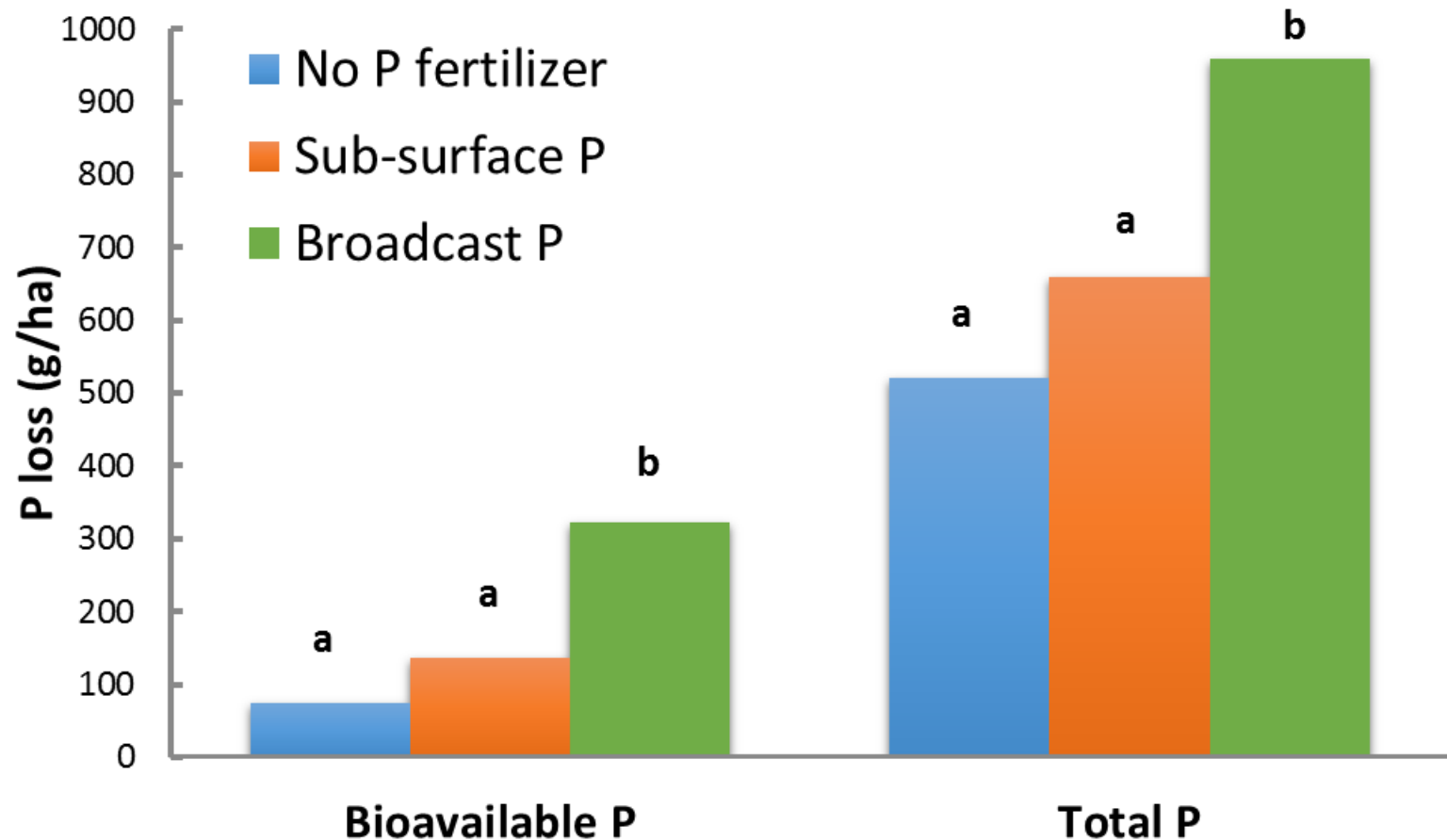


Right Placement



- minimize direct contact with runoff
 - Incorporate fertilizer when possible
 - sub-surface apply fertilizer
- manure and byproducts
 - every effort should be made to incorporate when applying large quantities of P (multiple years of application).

Surface-broadcast fertilizer can increase risk of P loss



P loss from Grain Sorghum in 1998

(Kimmell et al., 2001)

Control Transport Pathways

- Minimize erosion
 - no-till
 - cover crops
 - terrace maintenance



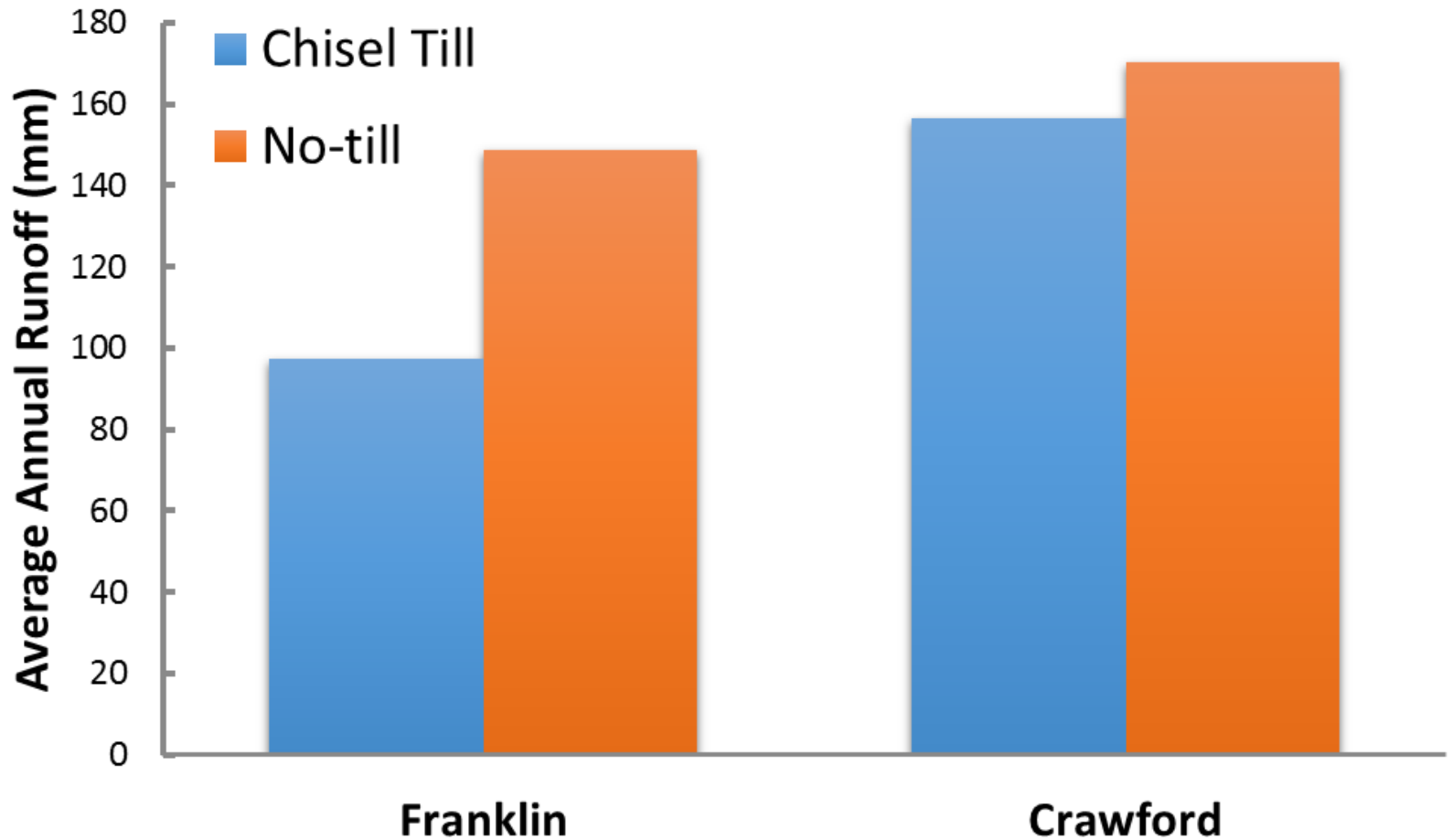
Control Transport Pathways

- Reduce runoff
 - no-till?
 - cover crops?



- Easier said than done
 - cover can reduce surface crusting and increase infiltration
 - cover reduces evaporation, and increases soil moisture

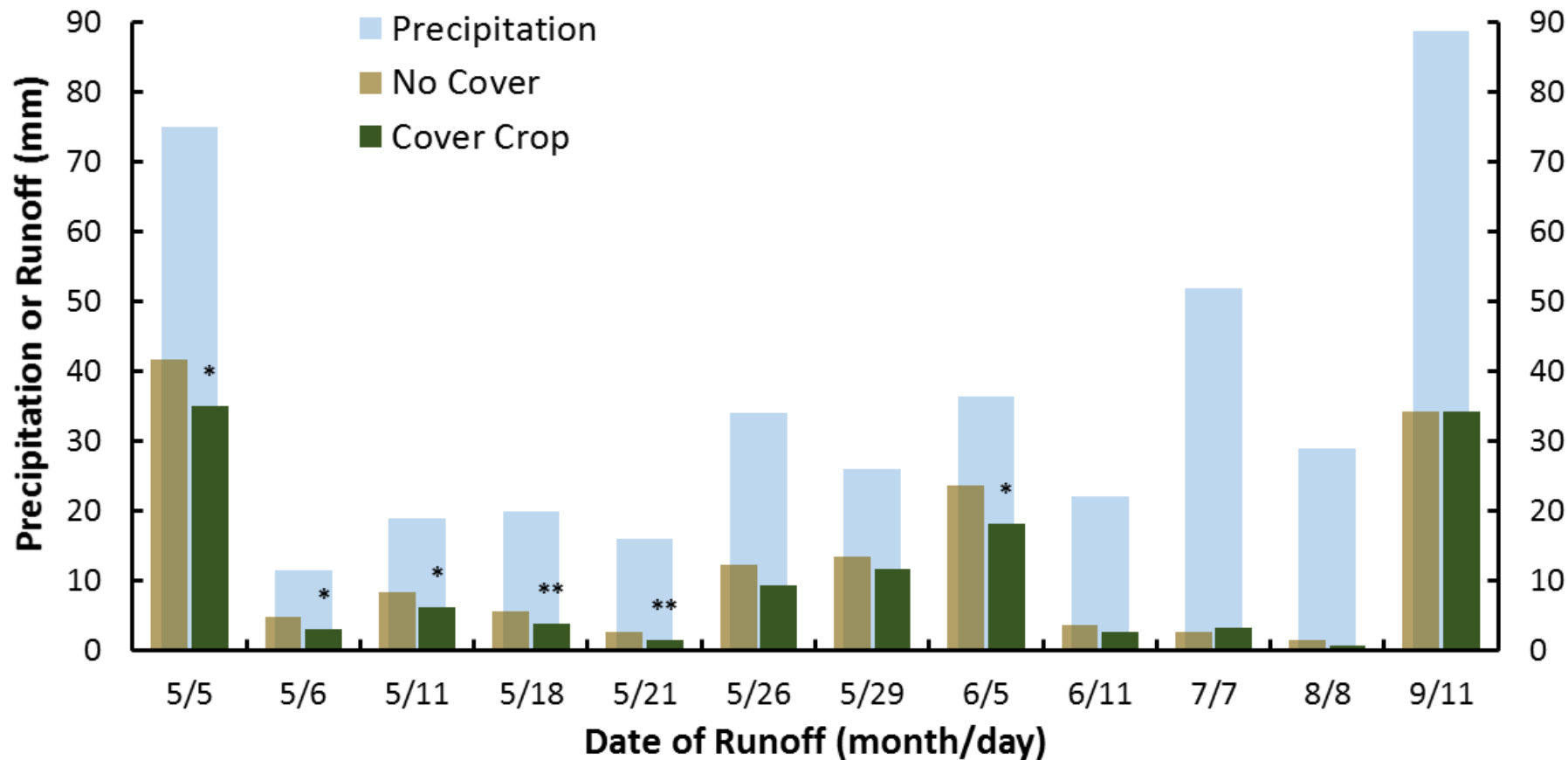
No-till reduces erosion, but can increase runoff.



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

Cover crop effect on runoff in conventional till (2015 KAW)

16% reduction in total runoff ($p=0.016$)

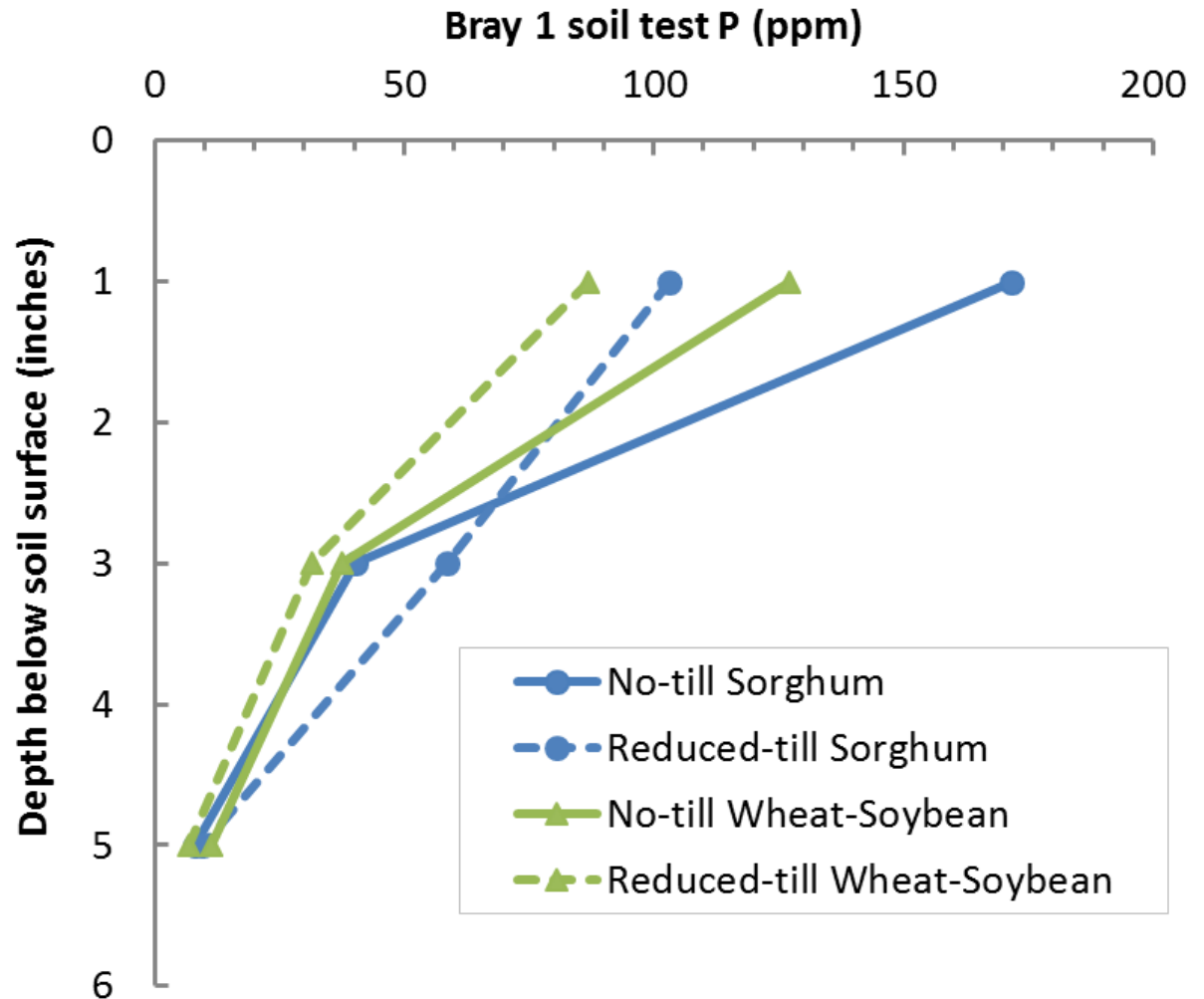


, **, * Indicates significant difference at $p<0.05$, $p<0.01$, $p<0.001$*

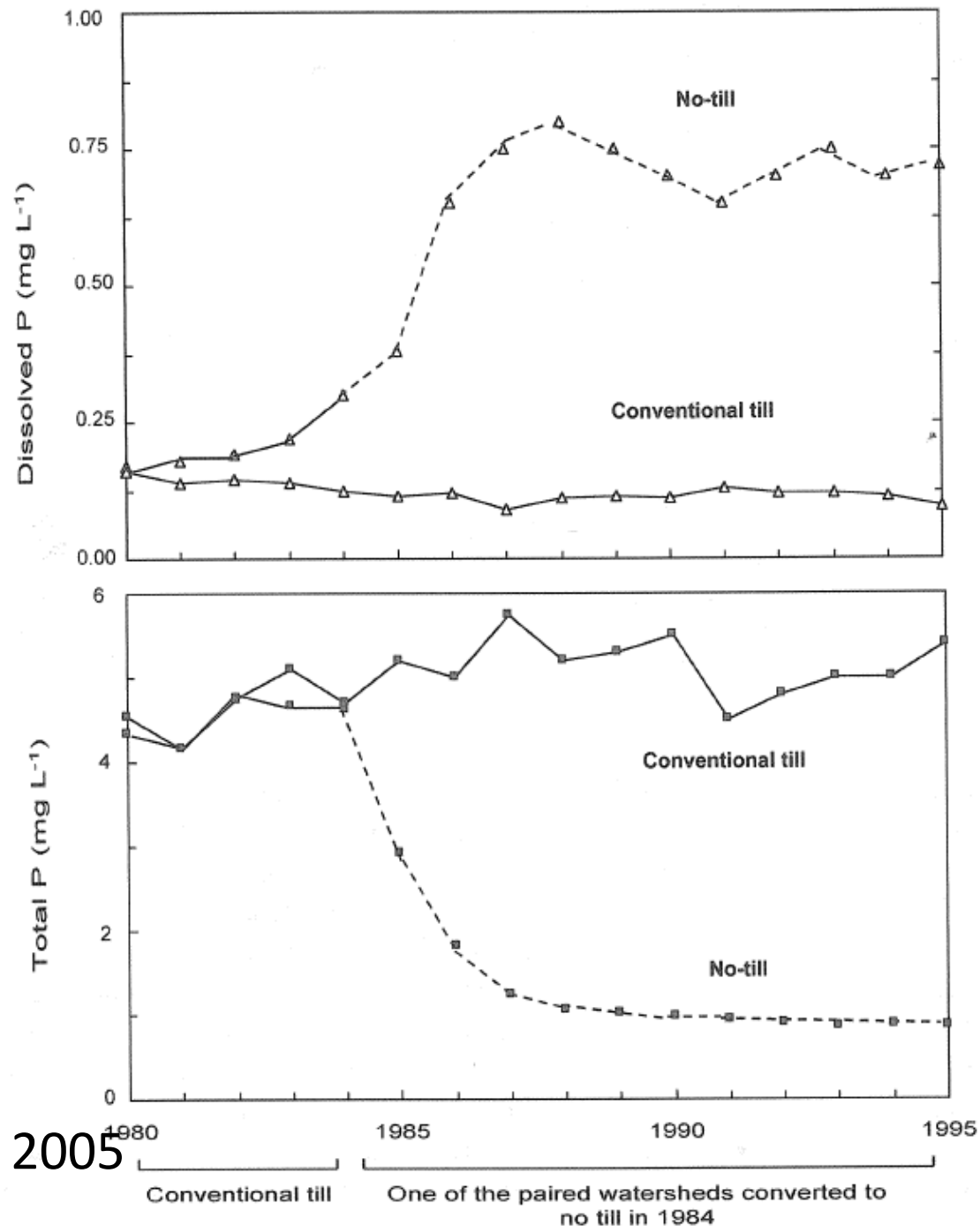
Challenges with P management

Soil test P in long-term tillage plots at Hesston KS (20 years)

35 lbs P_2O_5 /ac/yr



No-till conversion may result in higher dissolved P loss



Sims and Kleinman, 2005

Challenges

- No-till
 - We reduce sediment loss, but...
 - increase stratification
 - may increase runoff?
 - may have surface-applied P fertilizer
- What do we suggest

Challenges

- What are some challenging cropping systems in your area