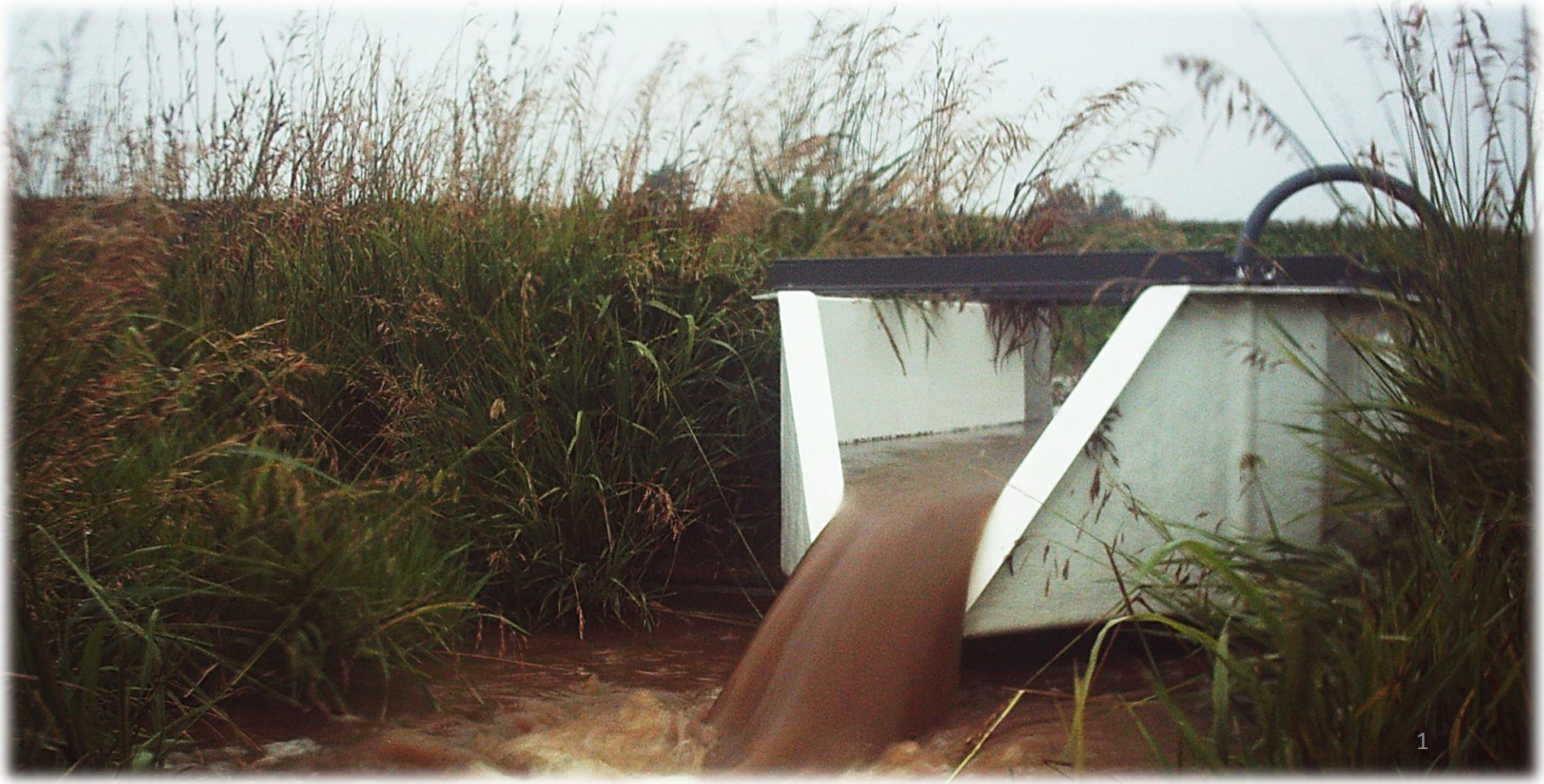
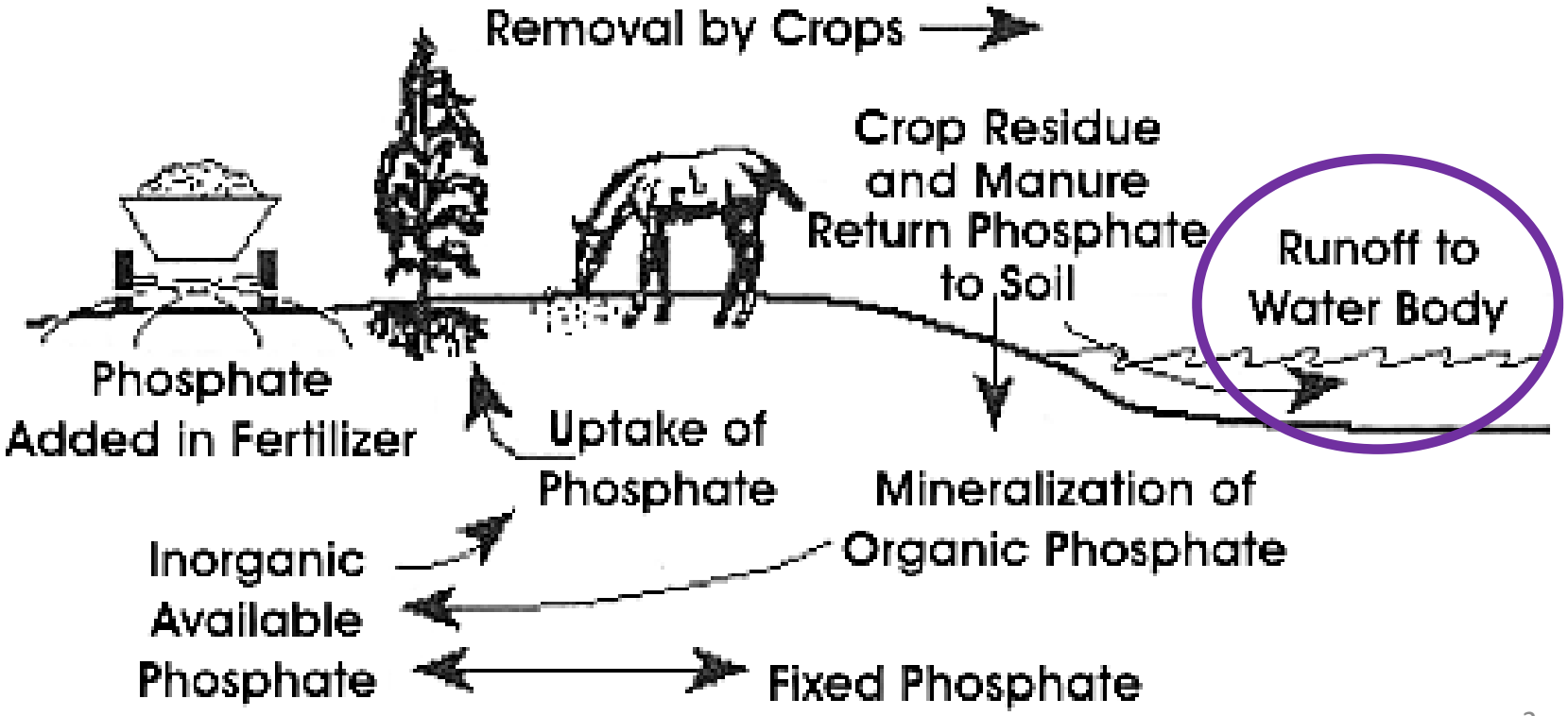
Cover Crop and Fertilizer Management Effects on Water Quality under No-till

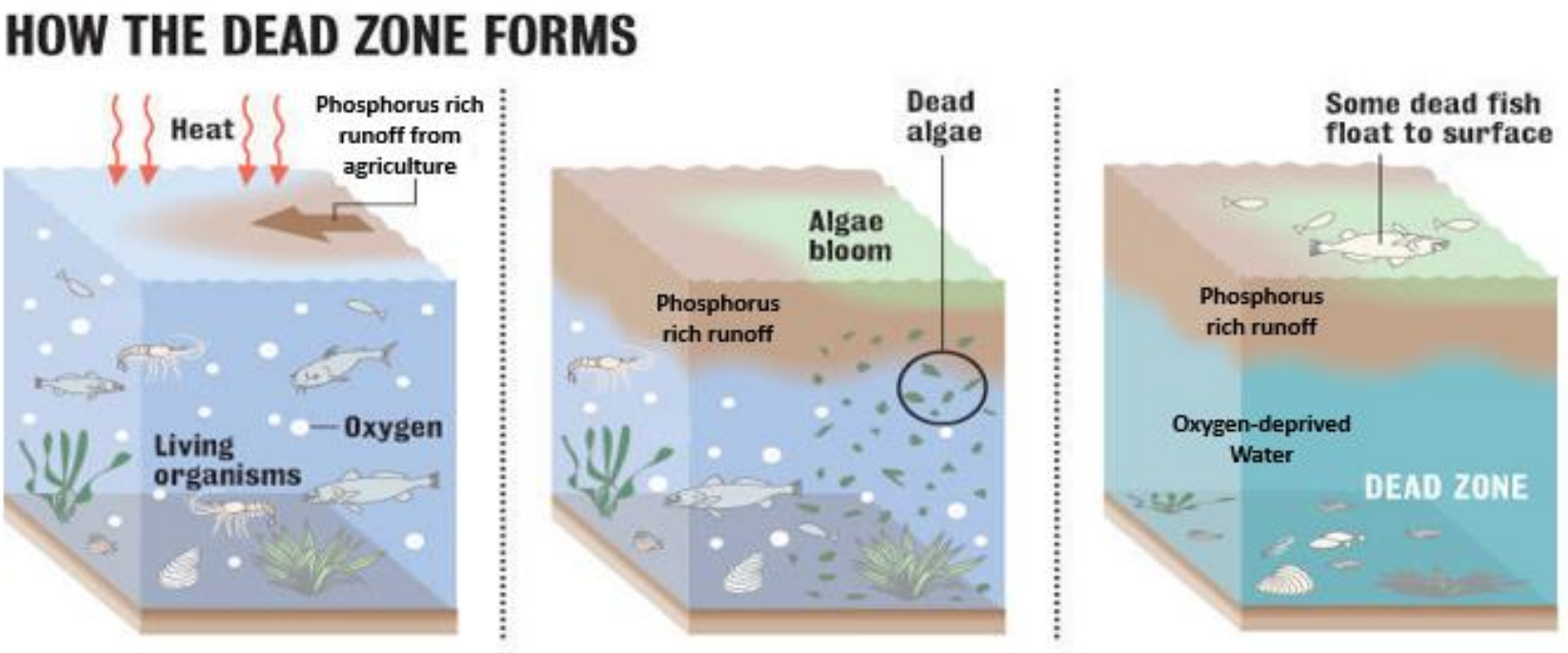
David Abel, Nathan Nelson, Kraig Roozeboom, Gerard Kluitenberg, Peter Tomlinson



The Phosphorus Cycle



Impacts of P loading



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.'

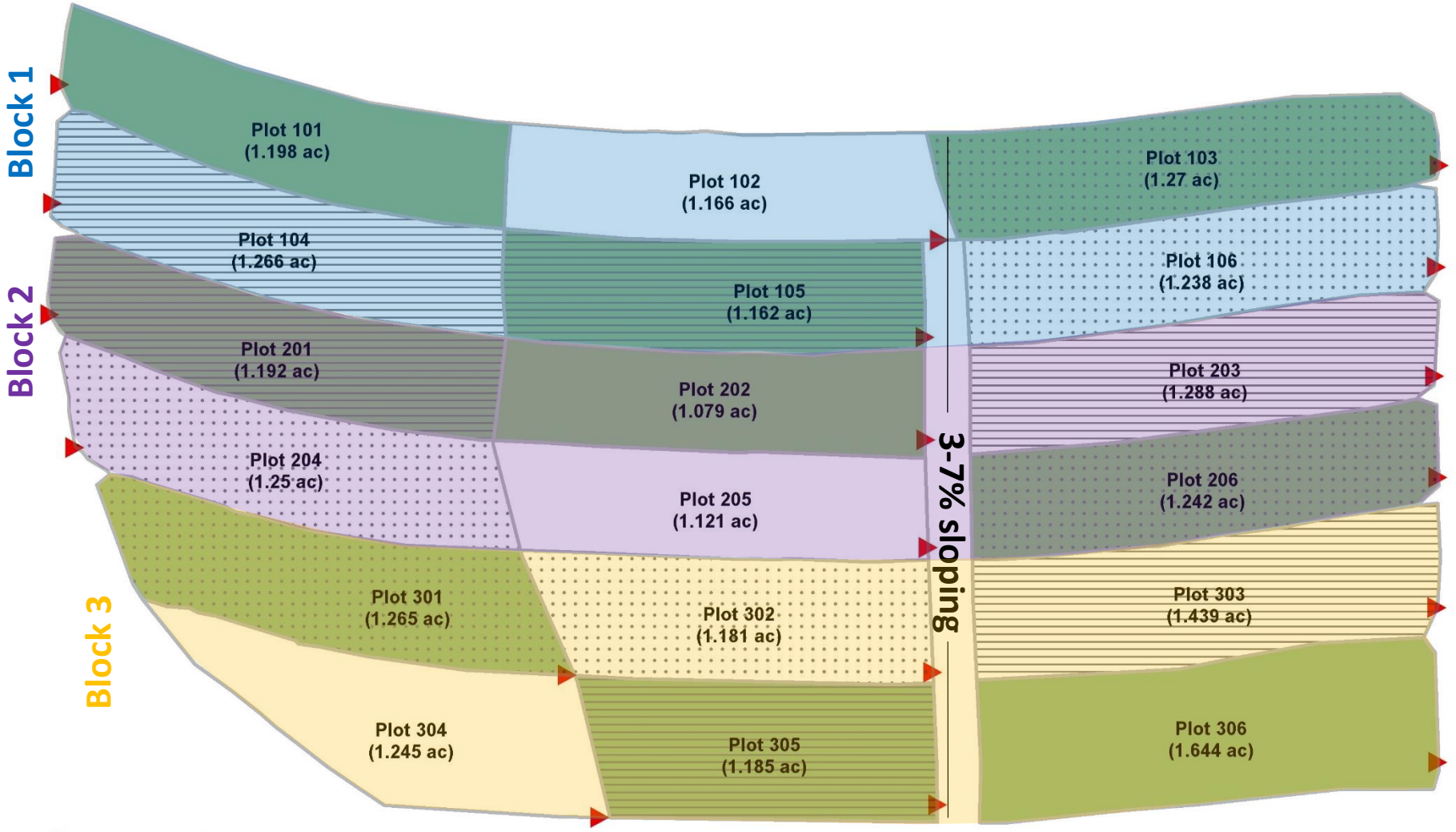
TAINTED BLOOM

by Ryan Felton

Goals & Objectives

- Understand the effect cover crops and phosphorus fertilizer management has on phosphorus loss.

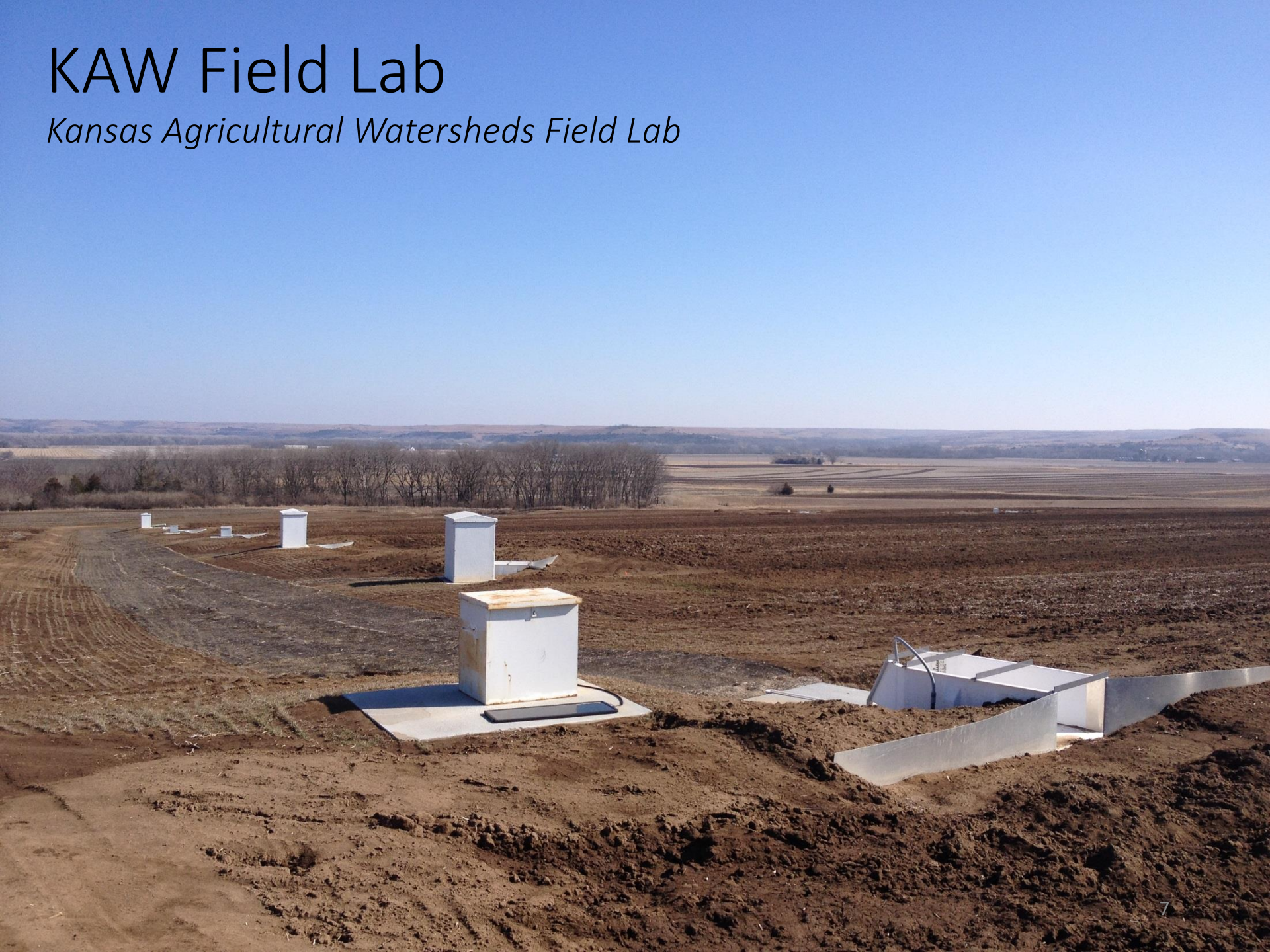
- Will cover crops reduce P loss?
  - Are P losses from fall surface-applied fertilizer with cover crop comparable to the current BMP of subsurface injecting P fertilizer?



- Management: No-till
- Crop: Soybean
- Fertilizer rate: 54 kg P_2O_5 ha^{-1}
- Cover crop: Winter wheat

KAW Field Lab

Kansas Agricultural Watersheds Field Lab



Watershed Outlet

Field Measurements

- Runoff volume
- Sediment loss
- P loss
  - Dissolved P
  - Total P
- N loss
  - NO_3 & NH_4
  - Total N
- Yield
- Biomass
  - Nutrient content of biomass and grain
- Economic feasibility

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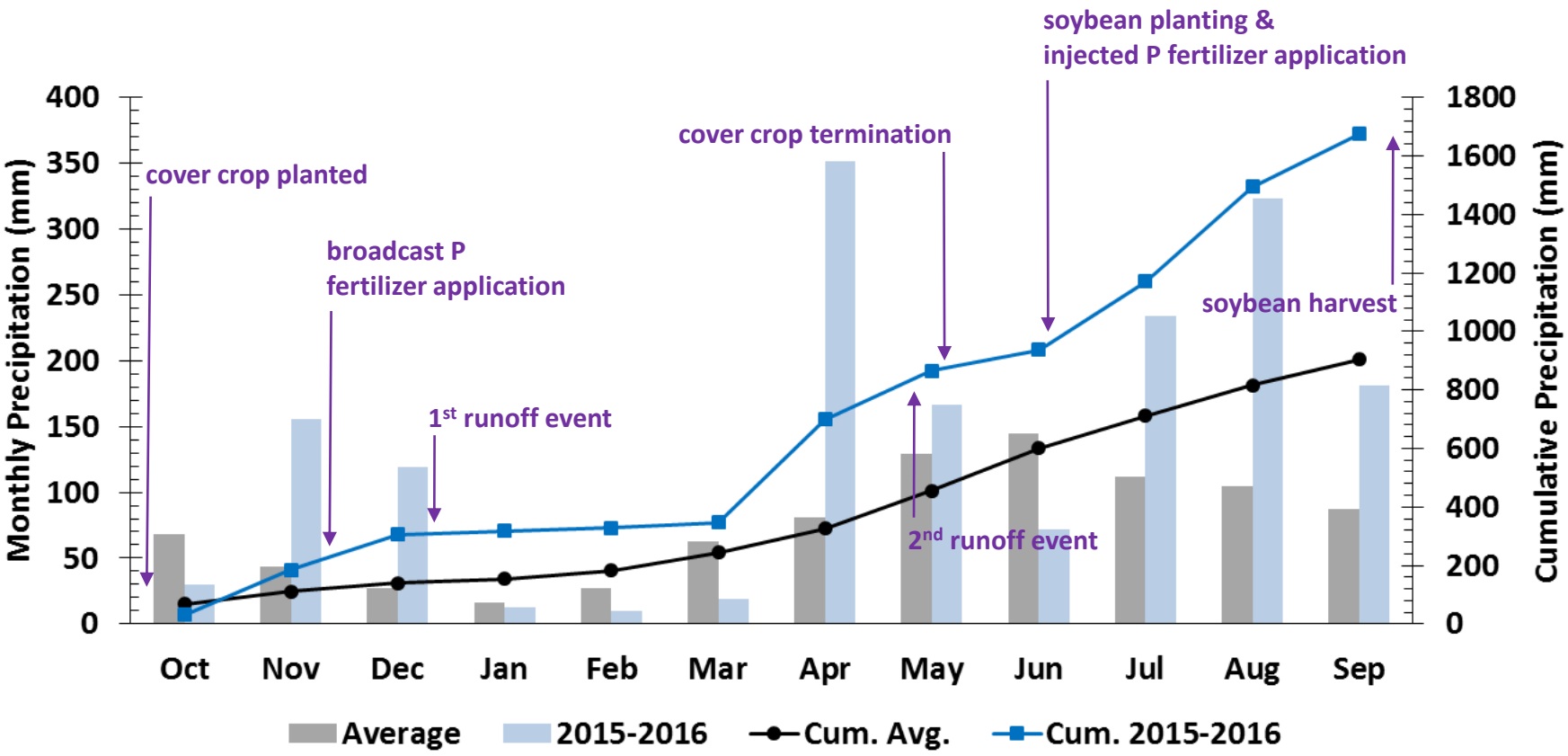
  - ~~Total N~~
- ~~Yield~~
- ~~Biomass~~
  - ~~Nutrient content of biomass and grain~~
- ~~Economic feasibility~~

Data Analysis (2015-2016)

- 486 possible measurements (18 watersheds*27 events)
- 7 runoff events produced 84% of the total runoff.
  - Remaining events were small (< 5 mm of runoff).

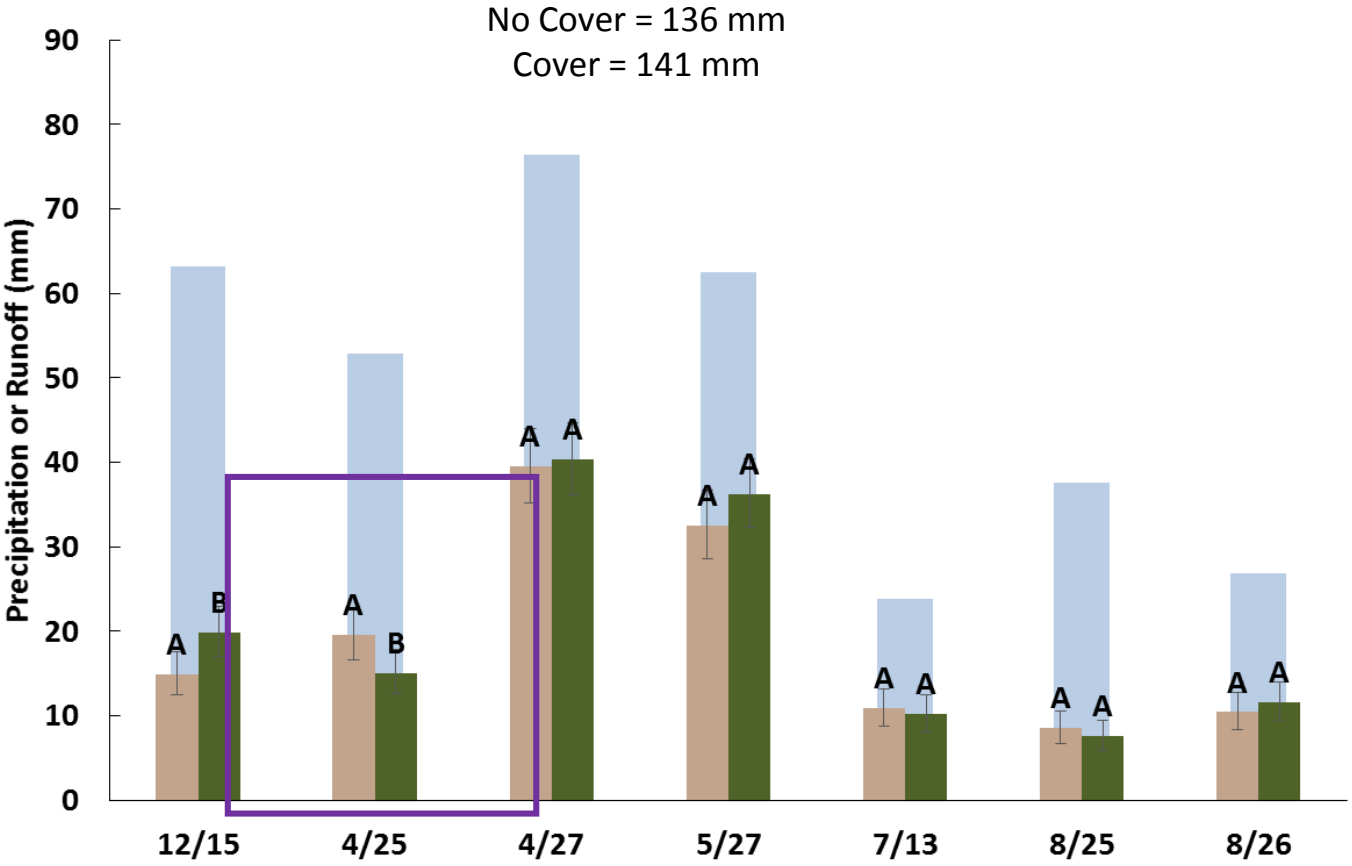
- Non-normally distributed data required transformations
  - Runoff – square root transformation
  - Total P, dissolved P, and sediment – $\log_{10}$ transformation

Precipitation (2015-2016)



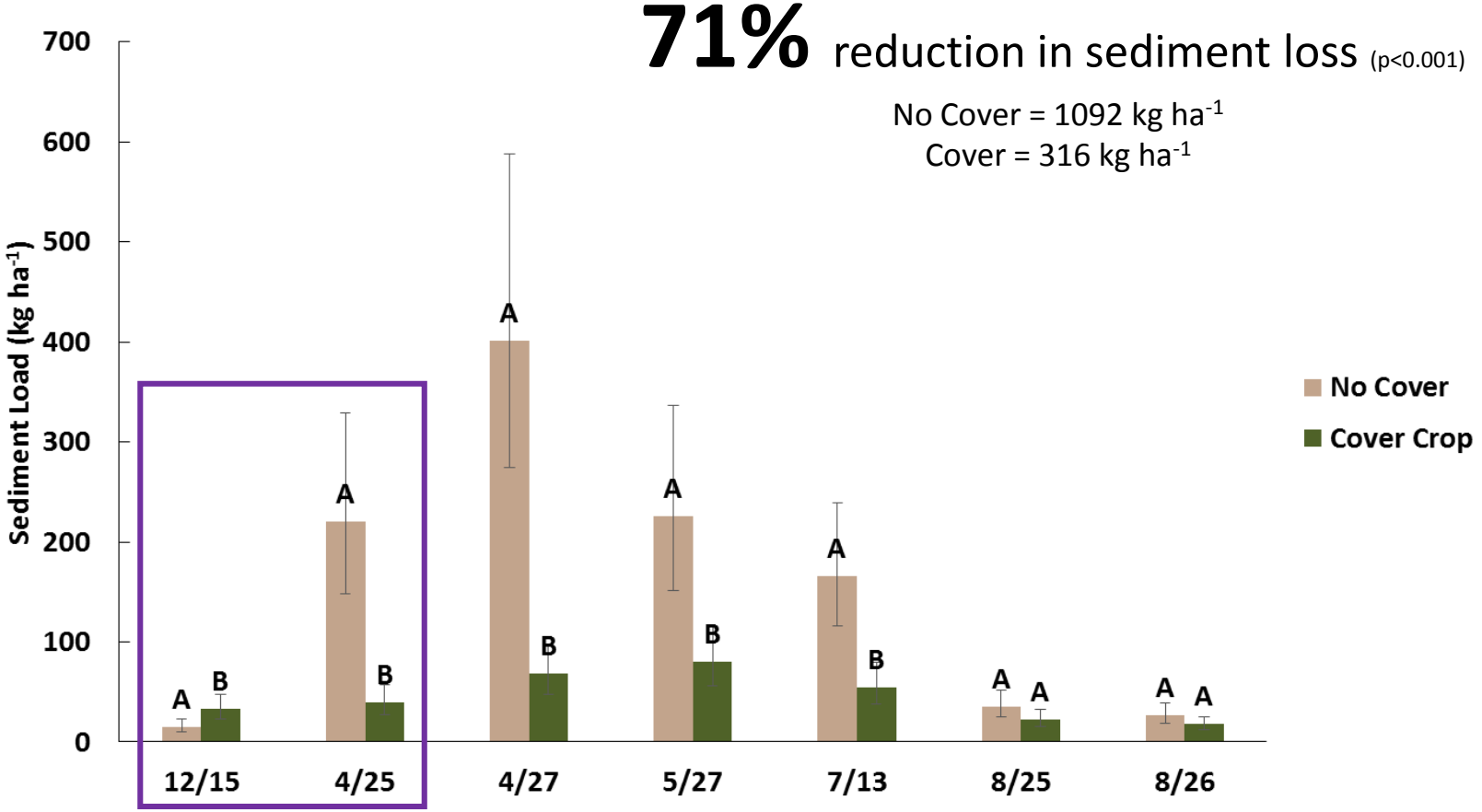
Cover Crop Impact on Runoff (2015-2016)

No Significant Effect (p=0.778)



Different letters indicate significant difference within event at p<0.05

Cover Crop Impact on Sediment Loss (2015-2016)



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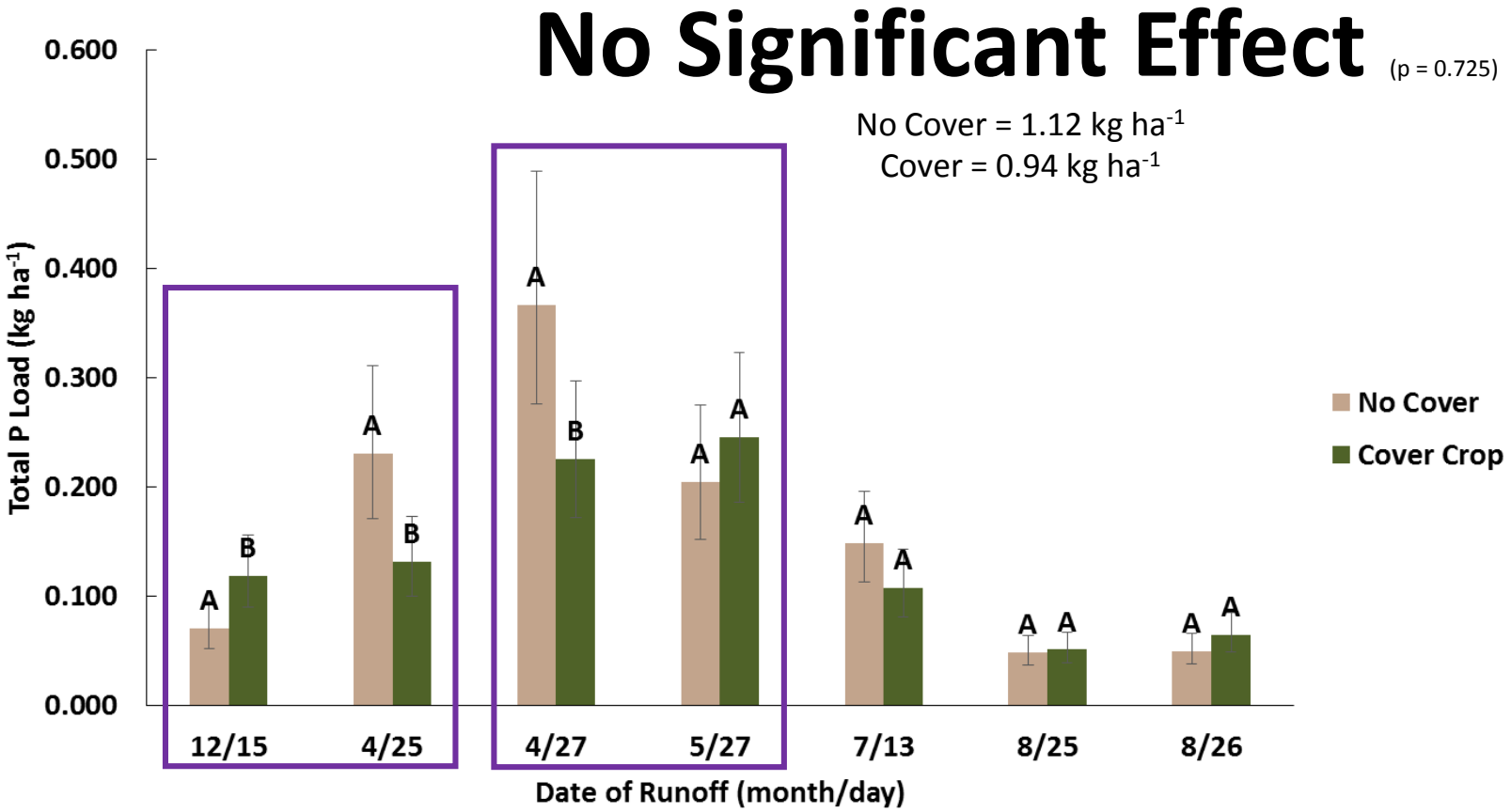
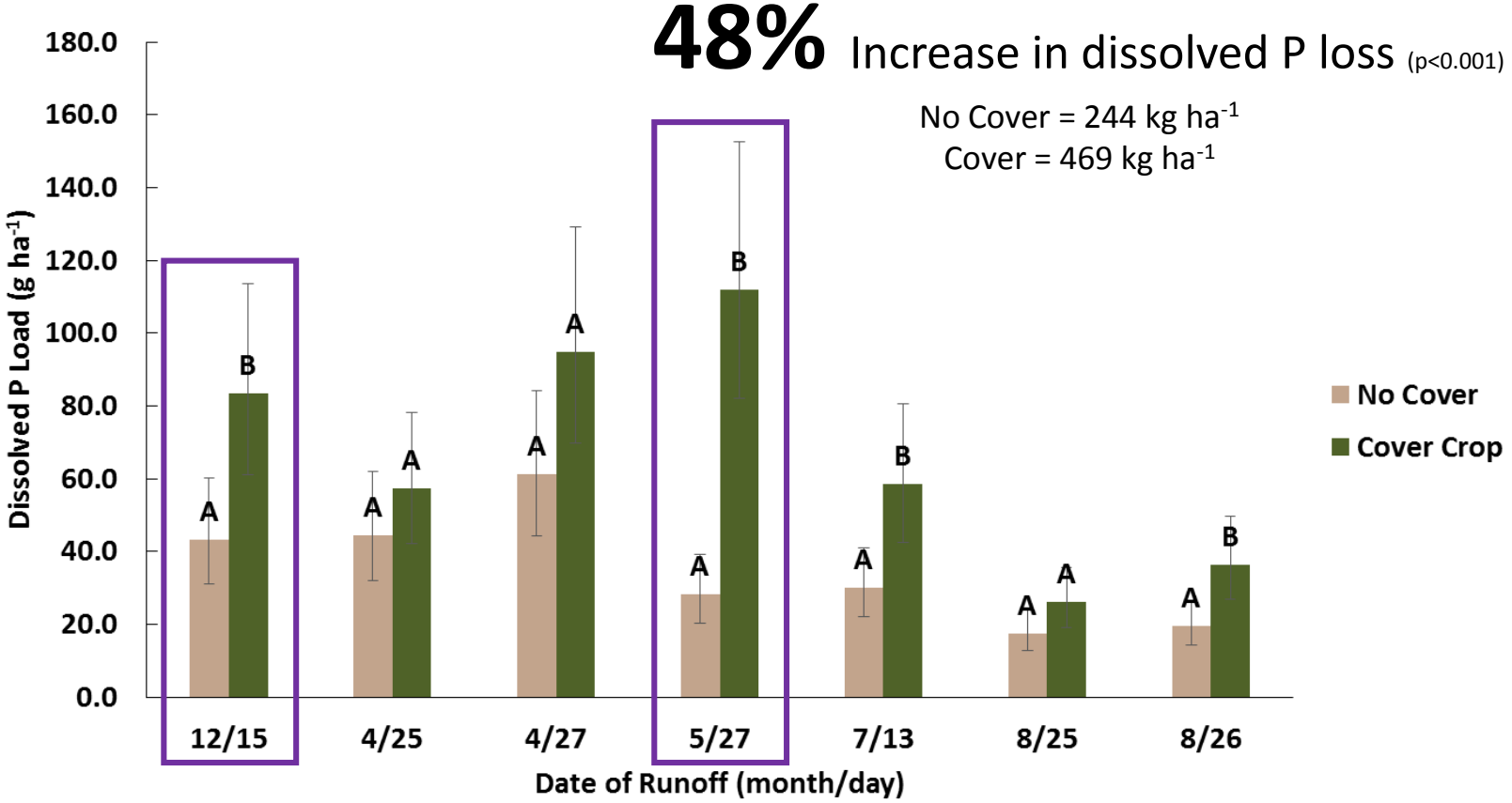
Cover Crop Impact on Total P Loss (2015-2016)



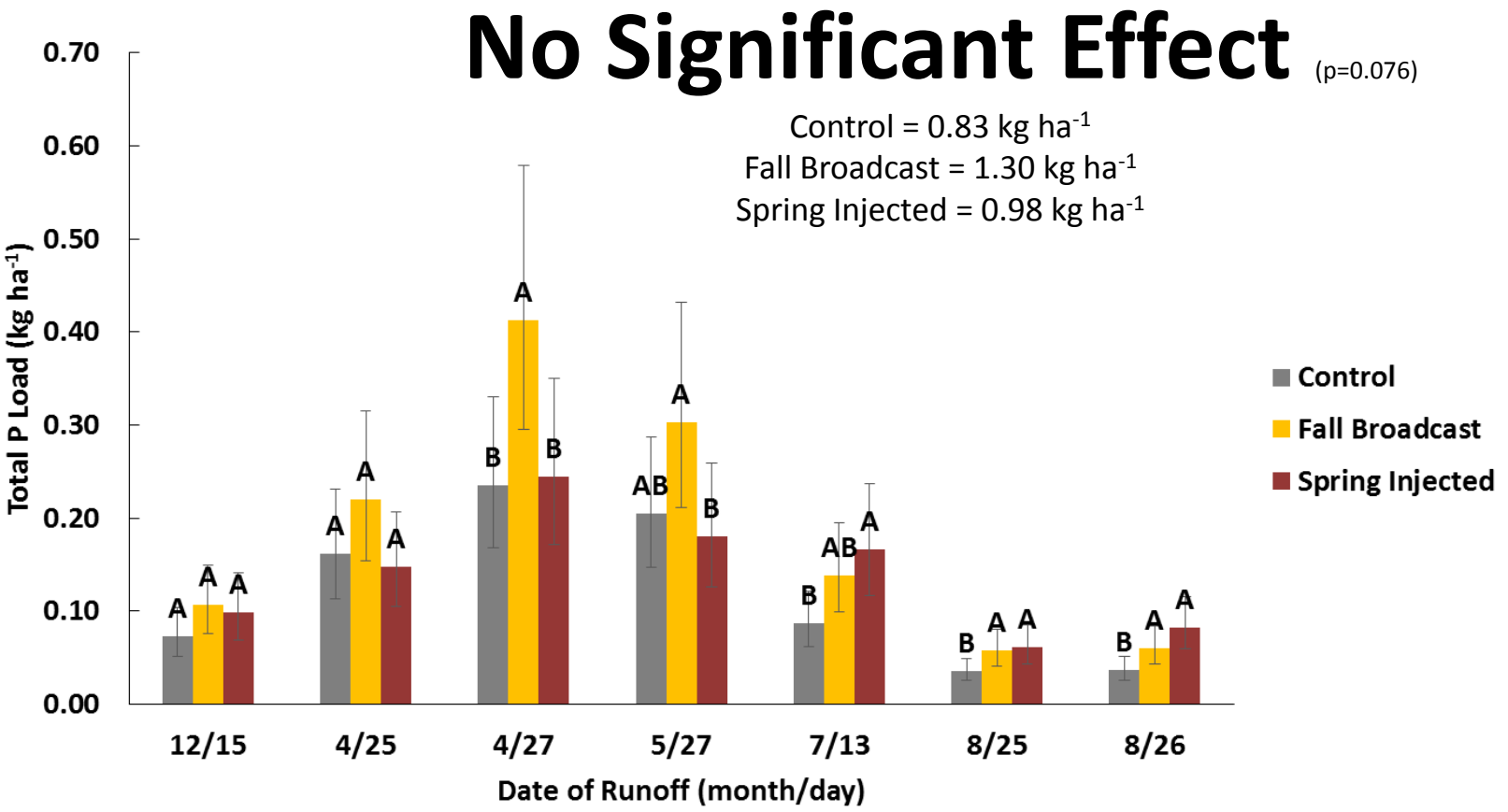
Different letters indicate significant difference within event at p<0.05

Cover Crop Impact on Dissolved P Loss (2015-2016)



Different letters indicate significant difference within event at p<0.05

Fertilizer Placement Impact on Total P Loss (2015-2016)

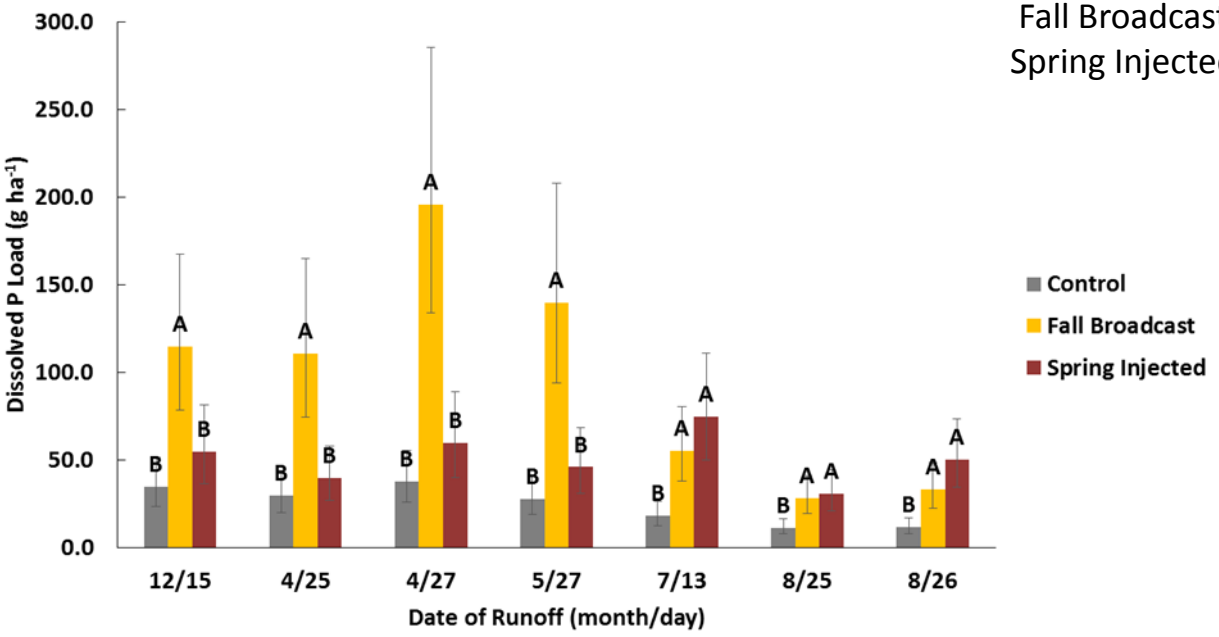


Different letters indicate significant difference within event at p<0.05

Fertilizer Placement Impact on Dissolved P Concentration (2015-2016)

2x increase in dissolved P concentration with broadcast fertilizer over injected ($p < 0.001$)

Control = 126 µg L^{-1}
Fall Broadcast = 511 µg L^{-1}
Spring Injected = 289 µg L^{-1}



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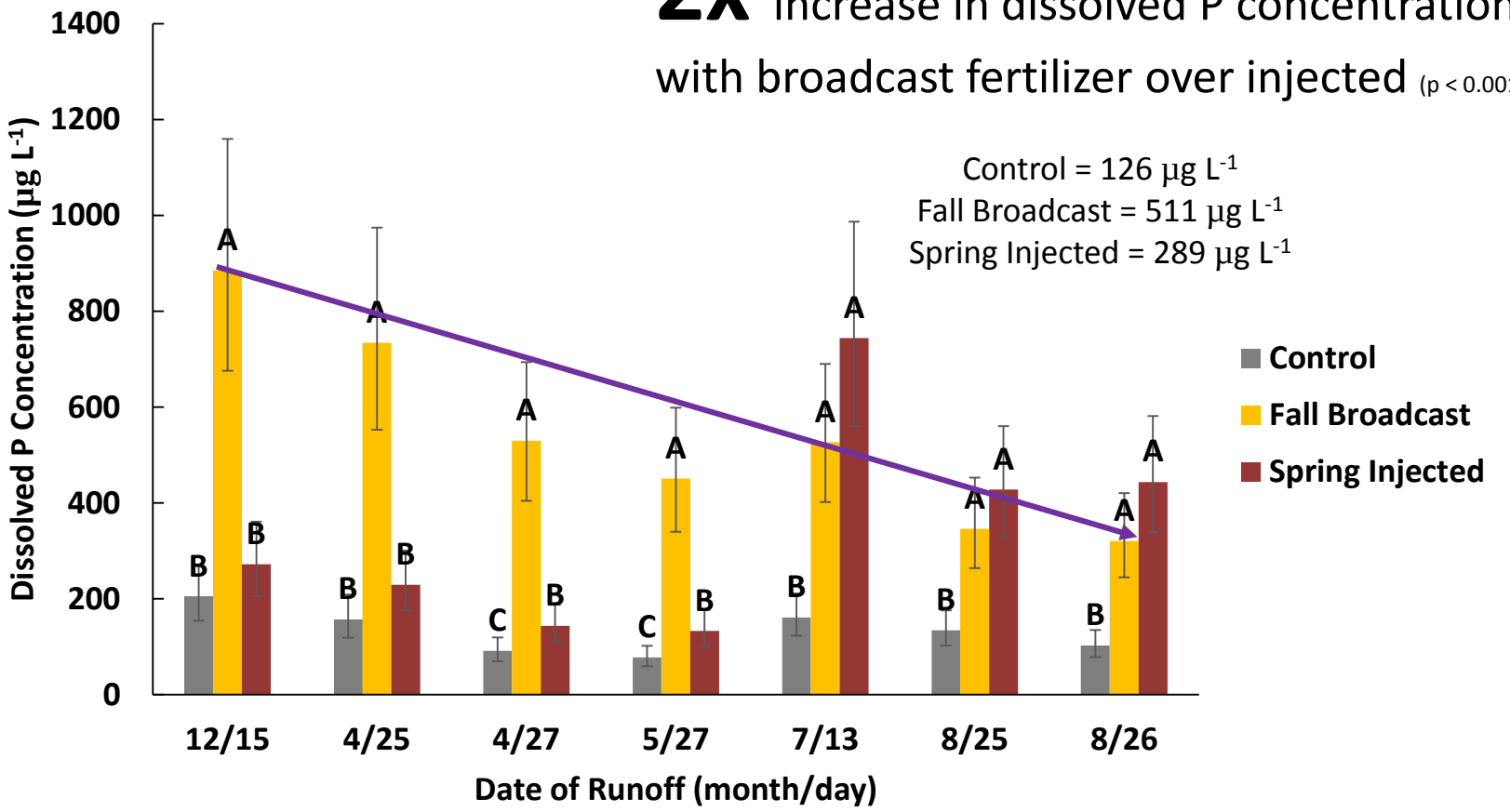

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Conclusions

- The cover crop effectively reduced erosion but increase dissolved P loss.
- Injecting P fertilizer reduces dissolved P loss particularly early on compared to broadcast.
- Neither cover crop or fertilizer effected total P loss overall.