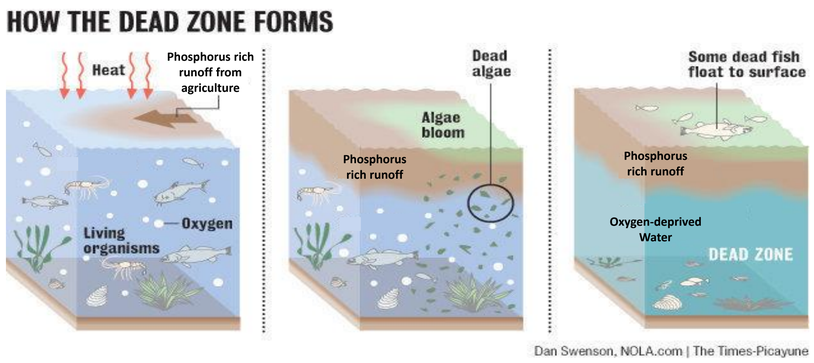
Cover Crop and Fertilizer Management to Improve Water Quality

David S. Abel, Nathan O. Nelson, Gerard J. Kluitenberg, Kraig L. Roozeboom, Philip L. Barnes

KANSAS STATE UNIVERSITY

Justification

Agriculture productions alter aquatic ecosystems when phosphorus fertilizers leave fields through surface runoff. In extreme cases this nutrient rich runoff can cause massive algae blooms that result in hypoxic zones.

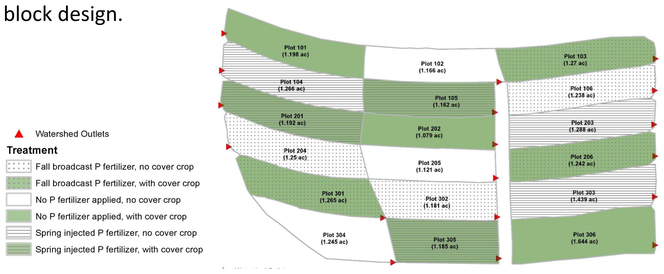


Objective

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

Methods

The Kansas Agriculture Watershed study includes 18 watersheds in a corn-soybean rotation approximately 0.5 ha in size. Treatments are arranged in a 2x3 factorial design containing two levels of cover crop and three levels of phosphorus fertilizer management replicated 3 times in a randomized block design.

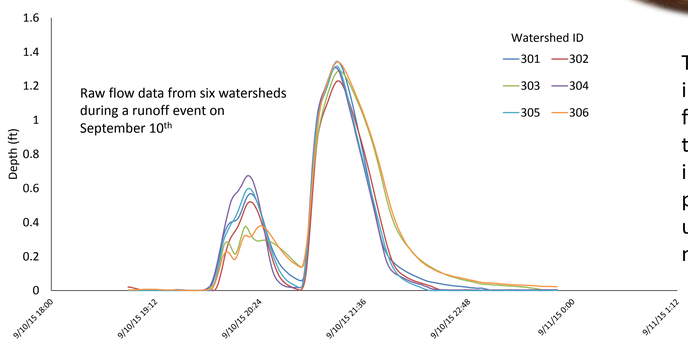


<u>Fall broadcast fertilizer</u>
Diammonium Phosphate (18-46-0)

<u>Spring injected fertilizer</u>
Ammonium Polyphosphate (10-34-0)

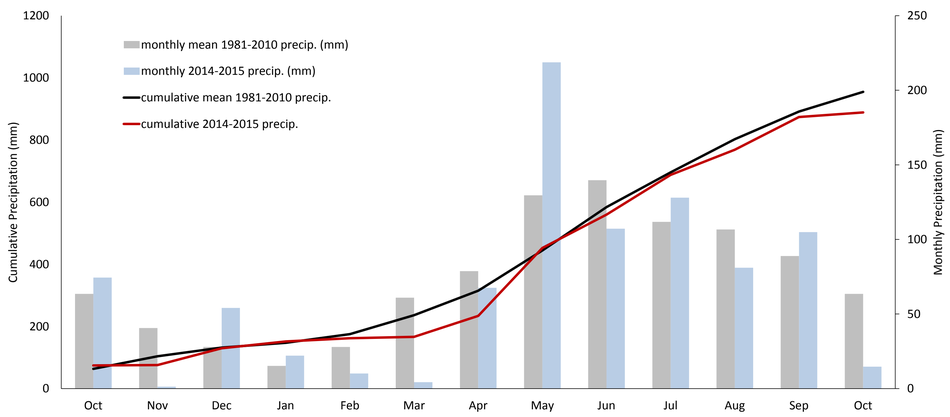
<u>Cover Crop Mix</u>
Wheat, rapeseed, hairyvetch

Each watershed is equipped with a 0.46 m H-flume, automated water sampler, and a pressure induced bubbler module to record precise flow data throughout a runoff event.

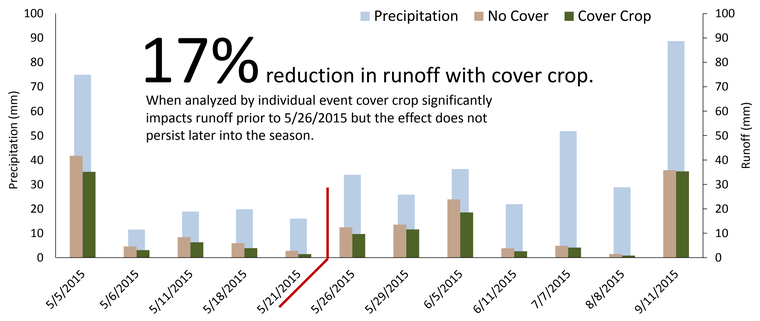


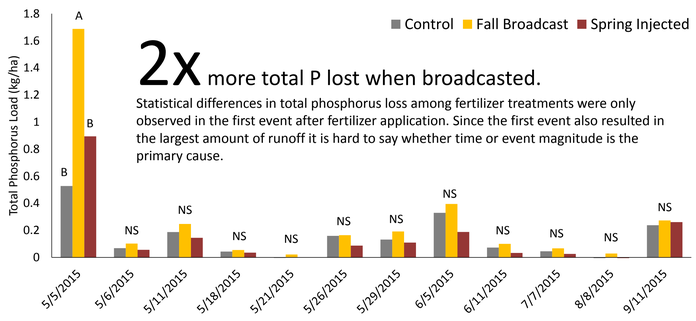
The cover crop was planted in November of 2014 following soybean and terminated at corn planting in 2015. Prior to cover crop planting the study was under conventional tillage management.

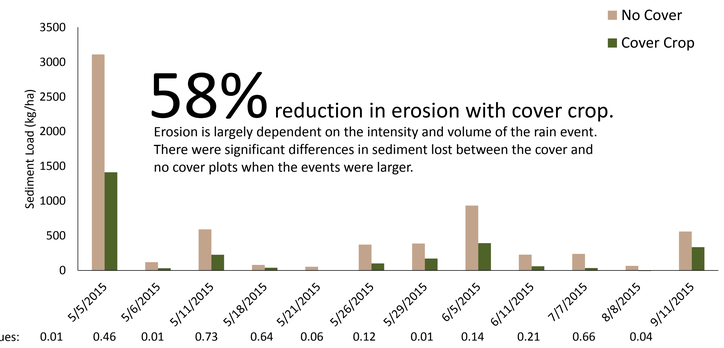
A wet spring in 2015 resulted in 12 runoff events. There were three days in which Ashland Bottoms received over 60 mm of precipitation generating a lot of runoff.



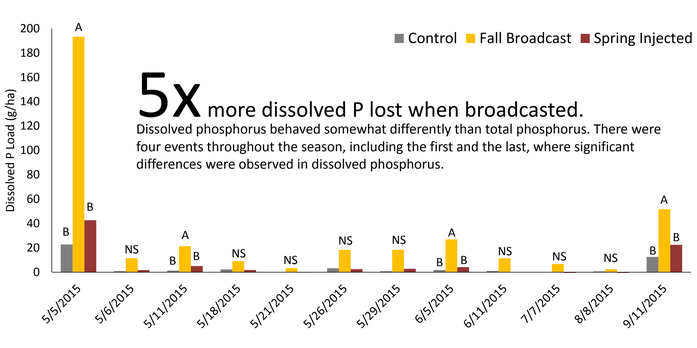
Results

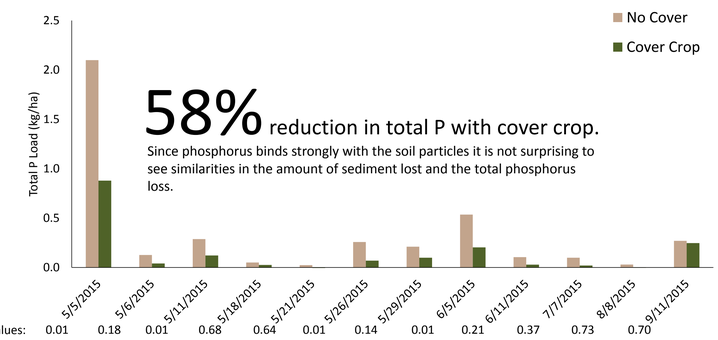




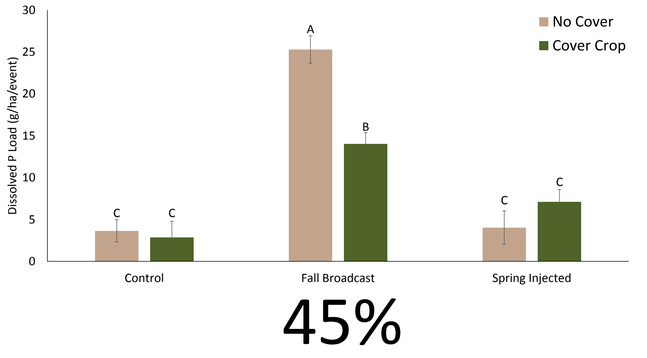


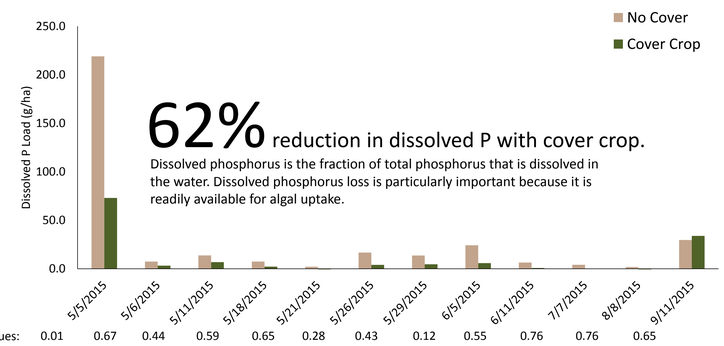
P-values: 0.01 0.46 0.01 0.73 0.64 0.06 0.12 0.01 0.14 0.21 0.66 0.04





P-values: 0.01 0.18 0.01 0.68 0.64 0.01 0.14 0.01 0.21 0.37 0.73 0.70





P-values: 0.01 0.67 0.44 0.59 0.65 0.28 0.43 0.12 0.55 0.76 0.76 0.65

	Runoff	Total Suspended Solids	Total P	Dissolved P	Sediment Load	Total P Load	Dissolved P Load
Analysis for main effect utilizing all 12 runoff events							
Cover	0.0061	0.0053	0.0003	0.1745	<.0001	<.0001	0.0023
Event	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Event*Cover	0.1588	0.0005	<.0001	0.0193	<.0001	<.0001	<.0001
Fertilizer	0.9285	0.8318	0.247	<.0001	0.6464	0.0545	<.0001
Event*Fertilizer	0.9994	0.65	0.1906	<.0001	0.0749	<.0001	<.0001
Analysis for interactions utilizing 5 runoff events. Complete factorial analysis could not be conducted over all events due to missing data.							
Fertilizer	0.5277	0.4751	0.328	<.0001	0.6414	0.3508	<.0001
Cover	0.0922	0.0127	0.0161	0.0717	0.0218	0.0112	0.0321
Fertilizer*Cover	0.684	0.5124	0.8917	0.0086	0.5949	0.6185	0.002
Event	<.0001	<.0001	<.0001	0.0439	<.0001	<.0001	<.0001
Event*Fertilizer	0.9506	0.5052	0.3295	0.0104	0.5864	0.8707	<.0001
Event*Cover	0.94	0.0156	0.1026	0.4862	0.0828	0.1096	0.6277
Event*Fert.*Cover	0.9977	0.3873	0.8713	0.8384	0.5702	0.8815	0.8085

Results from the analysis of variance tests of fixed effects (p-values) for selected water quality related parameters. ANOVA computed by SAS proc mixed using repeated measures analysis, where runoff "event" was the repeated effect.

Conclusions

- Cover Crop reduced total runoff volume, sediment, total phosphorus, and dissolved phosphorus losses in a conventional-till corn crop.
- Initial results indicate that including a cover crop in a conventional-till cropping system may be a best management practice for reducing P loss from fall-broadcasted fertilizers.
- Phosphorus loss was affected by the magnitude of the rain event, the time from phosphorus application, the way phosphorus was applied, and the cropping system.
- More research over multiple water years is needed in order to better understand these relationships and how they relate to other weather and cropping system factors.

Acknowledgments

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