Impacts of cover crops on nutrient loading in streams on a paired watershed

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Introduction

The impact of agricultural runoff on nutrient loading in nearby streams has been well documented in the agricultural and water resources fields. There are many best management practices (BMPS's) that have been implemented to mitigate these issues, one being cover crops. This paired watershed study examines the impacts of cover crops in no-till corn (*Zea mays*) and soybean (*Glycine max*) fields in southern Illinois and the dissolved reactive phosphorus (DRP), ammonium (NH^{-4}-N), and total suspended solids (TSS) after the implementation of cover crops in 2010 to 2021.

Study Site

The study site is located at Southern Illinois University's research farms in Jackson County, Illinois, southwest of Carbondale (SW, Sec, 30 TS9, RW1) (Figure 1). The fields are split into two watersheds, cover crop (CC) and no cover crop (no-CC) (Figure 2). Both the CC and no-CC are split into 3 sub watersheds (Figure 2).

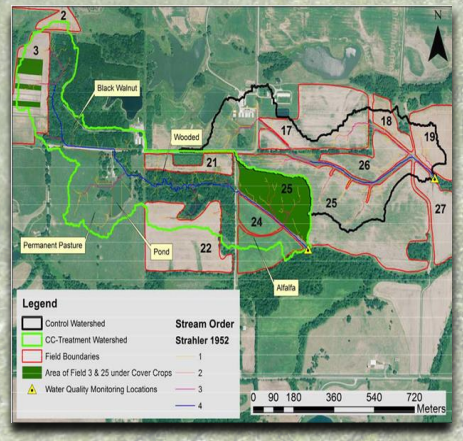

Figure 1

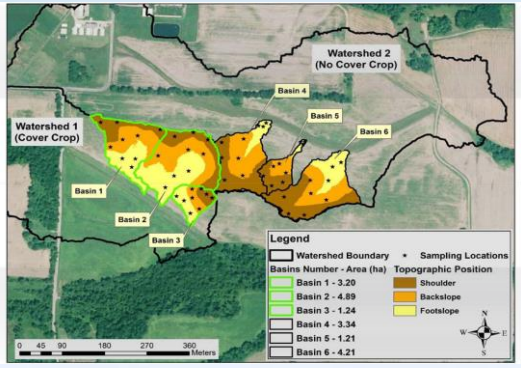

Figure 2

Methods

- Runoff samples were collected from Parshall Flumes using ISCO automated samplers when stream stage height exceeded 0.35 ft (Figures 3&4).
- Hydrograph data from the ISCO's was recorded
- Sample bottles were composited according to the rise, peak, and falling limb of the hydrograph.
- ISCO samples were analyzed with a Perkin Elmer Spectrophotometer to determine the concentrations of ammonium and (DRP).
- TSS was determined via a vacuum filtration method.

Figure 3

Figure 4

Results

- The comparison between 2021 and the base line calibration study of 2007-2010 showed differences in EMCs and in nutrient loading between the two watersheds
- TSS EMCs were 28.1% lower than predicted and the approximate loading was 5.35 kg/ha for CC watershed and 6.79 kg/ha no-CC watershed (Figure 5).
- Stream discharge was reduced by 51% in the cover crop watershed compared to the predicted amount (Table 1)
- DRP had an 80.8% increase more than predicted and loading was 7.21 kg/ha in the CC watershed and 17.75 kg/ha in the no-CC watershed ($p=1.07e^{-5}$, F= 21.05).
- Ammonium concentrations were 15.4% higher than predicted ($p=1.4e^{-4}$, F=15.74). CC was 0.18 kg/ha/yr and non-CC was 0.16 kg/ha/yr (Table 1).

Period	Watershed	TSS g L^{-1} EMC	NH_4^+-N mg L^{-1} EMC	DRP mg L^{-1} EMC	Storm Q* (m^3)
Calibration					
	Control	0.322	0.352	1.721	9149
	Treatment	0.564	0.293	0.743	16911
Treatment					
	Control	0.128	0.302	0.727	3469
	Treatment	0.359	0.218	0.575	2588
	Predicted	0.499	0.189	0.318	5214
Percent change from predicted values		-28.11	15.42	80.81	-50.36

Table 1: 2021 EMC predicted versus observed. (Singh 2018)

Discussion

The implementation of cover crops reduced overall discharge as well as TSS. This shows an improvement in runoff into the stream. While there was not a decrease in nutrient concentration, cover crops still showed a positive impact on stream health. More analysis will need to be done over the entire period of sampling and infiltration rates to see the full effects of cover crops

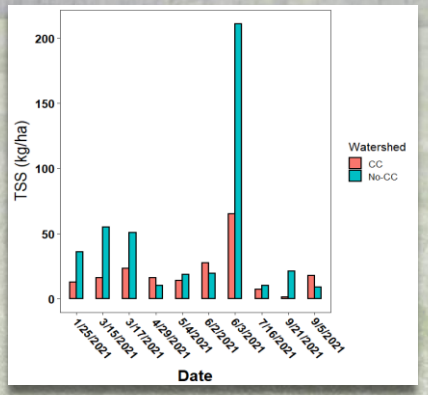

Figure 5

References

Singh G. Schoonover. J. Williard. K. 2018. Cover Crops for Managing Stream Water Quality and Improving Stream Water Quality of Non-Tile Drained Paired Watersheds. Water 10 (521). Pages 1-19

Acknowledgments

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