Water Quality Evaluation of Integrating Strips of Native Prairie into Rowcrop Agricultural Fields

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Introduction

Tallgrass prairie once covered more than 85 percent of the total land area of the state of Iowa. Currently less than 0.01 percent of the original ground cover remains. The remnant prairies largely exist in small blocks along railroad right-of-ways, cemetery edges, and other marginal locations. Prairie is a diverse ecosystem consisting of grasses, legumes, sedges, and non-legume forbs. In addition to the plant communities, prairie provides habitat for a wide range of native birds, mammals, and beneficial insects. Science-based Trials of Rowcrops Integrated with Prairie Strips (STRIPS) seeks to integrate conservation and rowcrop production and use science to understand the effects prairie has on the surrounding cropland. The objective of this study was to evaluate the water quality benefits provided by prairie strips.

Materials and Methods

The experiment was set up at the ISU Armstrong Farm, Lewis, Iowa, as a paired comparison trial in November 2014. A treatment field was selected as a location for the prairie strips. A control field, with similar land characteristics, same crop, and same management conditions also was chosen (Figure 1).

The proliferation of species in a native prairie numbers in the hundreds of species. Due to availability, cost, and practicality, this experiment seeks to mimic the natural system, rather than re-create. A mix of 40 native prairie species were seeded. A seed drill was used to directly seed the native species into the field stubble November 11, 2014. A nurse crop of winter rye was seeded with the prairie species to provide faster, more substantial growth in the strips and reduce competition from noxious weeds. The seed drill was operated by members of the ISU Armstrong Farm staff.

Following the seeding, instrumentation to measure surface runoff was installed. The largest piece of equipment on site is the Hydrologic flume (H-flume). The H-flume was installed at the base of the watershed where flow of water is concentrated and therefore, more easily measured and collected for nutrient and sediment analyses via autosampler (Figure 2). Collected water samples are analyzed for concentrations of total suspended solids, total nitrogen, total phosphorus, nitrates/nitrites, and orthophosphorus. Based on the size of the monitored drainage area, the team then estimated the exported load of each analyte.

Results and Discussion

Rain and surface runoff. For the last four years, rainfall during the monitoring season (approximately beginning of April to end of October) has ranged from 24.4 to 28.8 in. (Table 1). Much of this rainfall, however, has not been intense enough to cause runoff from the monitored fields. Surface runoff from the Control field has ranged from 0.14 to 0.65 in., and the Treatment field has ranged from 0.03 to 0.09 in.

Nutrient and sediment export. Mostly due to the low amount of surface water runoff, the estimates of nutrients and total suspended solids also are relatively low (Table 1). In fact, the Treatment field in 2018 never experienced runoff great enough to collect a water sample for nutrient and total suspended solids analyses (the NA's in Table 1). Overall, the treatment field with priairie strips had less runoff and sediment loss.

Acknowledgements

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Table 1. End of monitoring season totals for rain and surface runoff (in.), as well as nutrient and sediment export (lb/ac) from the field with (Treatment) and without (Control) prairie strips.

		Runoff (in.)		Nitrate-N (lb/ac)		Orthophosphate (lb/ac)		Total suspended solids (lb/ac)	
Year	Rain (in.)	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
2016	27.4	0.65	0.03	0.07	0.00	0.02	0.00	48.02	0.17
2017	24.4	0.39	0.04	0.12	0.00	0.01	0.00	30.69	0.16
2018	26.5	0.14	0.05	0.00	NA	0.00	NA	0.43	NA
2019	28.8	0.20	0.09	0.01	0.01	0.01	0.00	22.26	0.39

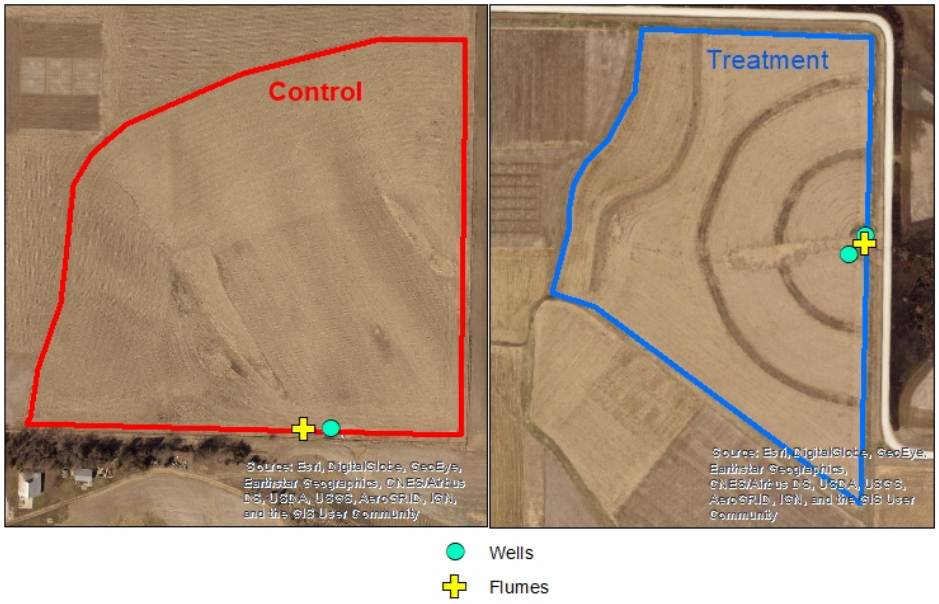

Figure 1. Monitored sites at ISU Armstrong Research Farm, Lewis, IA.

Figure 2. Flume structure at the Control site, ISU Armstrong Research Farm, Lewis, IA.