



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

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Tallgrass prairie once covered more than 85% of the total land area of the state of Iowa. Currently less than .01% of that 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. STRIPS (Science-based Trials of Rowcrops Integrated with Prairie Strips) seeks to integrate conservation and rowcrop production and to use science to understand the effects prairie has on the surrounding cropland. The objectives of this study were to evaluate the water quality benefits provided by prairie strips.

Materials and Methods

The experiment was set up at the McNay Memorial Research and Demonstration Farm as a paired comparison trial in November 2015. 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 it. A mix of 45 native prairie species were seeded. A seed drill was used to directly seed the native species into the field stubble on July 18, 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 drilling was hired and operated by a local prairie seed dealer. Following the seeding, instrumentation to measure surface runoff was installed in 2016 with monitoring beginning in 2017. 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 exported load of each analyte is estimated.



Figure 1. Monitored prairie strips site at the farm. The green highlighted area shows the contributing watershed being monitored for runoff.



Figure 2. Flume structure for monitoring runoff.

Results and Recommendations

Rain and surface runoff: For the last five years, rainfall during the monitoring season (approximately beginning of April to end of October) has ranged from 12.7 to 39.8 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 0.02 to 2.64 in., while the treatment field has ranged from 1.77 to 4.63 in. Researchers had issues with monitoring the control watershed (monitored field without prairie strips), as runoff was being diverted out of the grassed waterway and bypassing the monitoring equipment. Therefore, runoff estimates are less than what occurred at this field. This issue was addressed during the 2021 season, and the waterway now is functioning properly. Also, the treatment watershed has a side-slope seep, which has contributed to an inflated estimate of runoff from this field.

Nutrient and sediment export: Due to the missed measured surface water runoff, the estimates of exported nutrients and total suspended solids from the control watershed also are low (Table 1). Therefore, the team does not place confidence in these numbers from the control watershed, but are listing these for the sake of the report. Notice that in 2021 the runoff was greater in the control than the treatment watershed for the first time. Researchers believe this is the result of having repaired the waterway. However, the repair occurred after the spring, when nutrient and sediment exports are usually the greatest. This is an explanation for why the exported nutrients and total suspended solids estimates still are lower in the control watershed.

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Table 1. End of monitoring season totals for rain and surface runoff (inches), and nutrient and sediment export (pounds per acre) from the field with (treatment) and without (control) prairie strips.

Year	Rain, inches	Control	Treatment										
2017	13.3	1.18	1.77	2.20	5.31	3.18	5.55	0.14	0.05	0.41	0.18	192.33	66.26
2018	23.1	2.60	4.63	0.07	0.26	0.46	1.06	0.13	0.13	0.22	0.35	41.60	103.43
2019	22.0	0.66	3.86	0.80	3.03	1.40	4.28	0.10	0.28	0.24	0.62	122.92	304.78
2020	12.7	0.02	2.05	0.00	0.15	0.00	0.70	0.00	0.05	0.00	0.17	0.38	109.11
2021	39.8	2.64	2.07	0.92	1.00	1.36	1.54	0.13	0.06	0.18	0.09	19.72	24.15