Integrating Strips of Native Prairie into Rowcrop Agriculture Fields

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Tim Youngquist, agricultural specialist
Department of Agronomy

Introduction

Tallgrass prairie once covered more than 85 percent of the total land area of the state of Iowa. Currently less than .01 percent 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. In 2016, the dominant land use in Iowa is agriculture with over 75 percent of the total area of the state planted to corn and soybean. 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.

Materials and Methods

The experiment was set up at the ISU Armstrong Farm, Lewis, Iowa, as a paired-comparison trial in November 2014 and as a field demonstration at the ISU Neely-Kinyon Farm, Greenfield, Iowa, in June 2016. At the Armstrong Farm, 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.

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. At both farms a mix of 40 native prairie species were seeded. A seed drill was used to directly seed the native species into the field stubble on November 11, 2014, at the Armstrong Farm and June 15, 2016 at the Neely-Kinyon Farm. At Armstrong, 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. At Neely-Kinyon, the native seed was blended with a cover crop of oats. The seed drill was operated by members of the Armstrong Farm staff at both sites.

Following the seeding at Armstrong, instrumentation to measure water and runoff and populations of native species 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 an autosampler captures and retains water samples before these exit the field. Ground water wells were installed at a depth of one meter in various locations throughout the field to monitor shallow groundwater flow. Cover boards have been installed to monitor presence of snakes, reptiles, and amphibians. Automated recording units (ARUs) were deployed throughout the field, which activate for three hours at dusk and dawn to record all nearby audio. The ARUs then are analyzed to determine bird populations in and around the strips. The control field, located near the prairie strips field, has been outfitted with the same instrumentation. Both fields have similar slope, soil type, are planted to the same crop, and are under the same management conditions. Research and monitoring will hopefully continue for a period of 10 years.

Results and Discussion

The deep roots, stiff-upright plant stems, and diversity of species within the prairie make it uniquely well-suited to filter water and trap sediment before it has a chance to reach surface water. Using a combination of in-field contour strips and a filter strip at the field edge, other long-term experiments conducted by the research team have yielded encouraging results. Converting 10 percent of the tillable area of a field into prairie will reduce nutrient and sediment export. Our research at the Neal Smith National Wildlife Refuge in Jasper County has shown the amount of key nutrients—nitrogen and phosphorous—travelling out of the field in surface water are reduced by 84 percent and 89 percent, respectively. Sediment export is reduced by 90 percent and overall water retained is increased by 40 percent.

Native prairie takes time to reach full maturity. During the first two years after seeding, prairie plants place most of their energy towards creating underground biomass in the form of 8-10 ft-deep roots. The third year after seeding is when the plant community begins to reach maturity, and many of the prairie plants will bloom for the first time. The strips at Armstrong were seeded in the winter of 2014 and research on their effect is ongoing. Early data suggests a link between native, perennial vegetative cover and a reduction in the amount of topsoil moving throughout the field (Figure 1). The research team at Iowa State University will continue to study this and many other aspects of the plantings.

Agriculture is an essential component of Iowa's past, present, and future. Prairie strips are a conservation tool that can be used to increase biodiversity, create habitat, and reduce nutrient and sediment runoff, while simultaneously retaining high productivity of our rowcrop land.

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Figure 1. Bean field with 2nd year prairie strips at the ISU Armstrong Farm, June 30, 2016. The native, perennial vegetation is coming in beautifully at Armstrong, due to the diligent maintenance mowing performed by the farm staff. The species richness and diversity will increase as the planting matures.