Native Cover Crops: Effects on Weed Invasion and Prairie Establishment

Brian Wilsey, assistant professor
Andrea Blong, graduate assistant
Department of Ecology, Evolution, and Organismal Biology

Introduction

Planting cover crops to simultaneously establish native prairie seedlings and prevent weed invasion is an increasingly common management practice. The idea is based on the assumptions that the cover plant will act as a nurse plant to prairie seedlings and that it will have a positive effect on seedling recruitment by suppressing weeds and by lowering the harmful effects of high evaporation and light availability. Cover crops could also potentially reduce the amount of soil erosion that occurs during planting. However, the evidence supporting the benefits of cover crops is mostly anecdotal and has been challenged. Clearly, there is a need for further scientific evidence on the efficacy of cover plants, their possible facilitative or competitive effects on prairie seedlings, as well as how these processes work. Of particular interest is whether the nurse plant effect is caused by light suppression or water uptake.

Materials and Methods

There are several native species that have great potential as cover crops. During the 2004 growing season, we established five native species as cover crops at two separate sites, the Horticulture Station and the Western Research Farm, and monitored days to germination, percent cover, and biomass production during the first and second season. Cover crop establishment, weedy plant invasion, soil moisture, and light availability were measured during the 2005 growing season to better understand how cover plants are affecting weed and prairie species establishment. A second experiment involved planting cover crop species during spring or summer with a prairie seed mix, either added with the cover crop seed or during the year following. This second experiment will be discussed in future reports.

Experimental plots were set up on slopes. Seed mixes containing 29 prairie species were added to the plots that contained one of six cover crop treatments. Cover crop treatments included the following:

1. Canada wildrye (*Elymus canadensis*)
2. Partridge pea (*Chamaecrista fasciculata*)
3. Illinois bundleflower (*Desmanthus illinoensis*)
4. Black-eyed Susan (*Rudbeckia hirta*)
5. Side-oats grama (*Bouteloua curtipendula*)
6. No cover crop (control)

These are all early-emerging species that have the potential to facilitate establishment of later-emerging prairie species. Six replicate plots were established for each treatment. Plots are 5 m × 5 m in size and were established in tilled areas that were formerly in brome.

The cover crops were seeded during early April 2004 at a rate of 10 lb/acre and were allowed to become established for the rest of the growing season before the prairie mix was added during fall 2004 and fall 2005.

Results and Discussion

Establishment of the cover crops was much

quicker at the mesic site, the Horticulture Station in Story County, than at the drier site, the Western Research Farm (WRF) in Monona County. Establishment at the WRF site was delayed, but plots showed signs of "catching up" during fall 2005. At both sites, establishment varied greatly among species and was highest in Black-eyed Susan, Canada wildrye, and side-oats grama, and was lowest in Illinois bundleflower plots. The annual species partridge pea had the lowest self-seeding rates during the second year (Table 1). There was no significant difference in soil moisture among the cover crop treatments.

The amount of weed biomass varied significantly across cover crop treatments ($P<0.05$) during 2005 (year 2). Weed biomass was highest in partridge pea plots and was lowest in Black-eyed Susan plots. Cover crops had a larger effect on perennial weeds than on annual weeds. The amount of cover crop biomass across treatments was a good predictor of perennial weed invasion ($P<0.05$), accounting for 58% of the variation in weeds. However, annual weed invasion was not significantly affected by cover crop biomass. Control plots did not have a consistently higher amount of weeds than cover crop plots (Table 1).

Prairie species such as hoary vervain (*Verbena stricta*), big bluestem (*Andropogon gerardii*), compass plant (*Silphium laciniatum*), and switchgrass (*Panicum virgatum*) became established in plots in late 2005. Prairie plant establishment will be estimated and reported during 2006.

In conclusion, weed biomass was much lower in Black-eyed Susan plots. Thus, it can be said that this species prevented weed establishment better than other cover crop species. However, this species may also prevent establishment of other prairie species. This hypothesis will be tested in 2006.

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Table 1. Mean percent cover of cover crops, invading weed biomass, and percent soil moisture during June 2005.

Site Treat	Total Cover (%)	Weed Biomass (%)	Soil Moisture (%)
Hort			
BS	28.6	42.89	23.37
Can.	32.3	68.65	23.65
SO	34.6	101.88	20.01
Illin.	14.0	99.80	22.42
PP	0.3	166.69	20.90
Cont.		39.61	19.38
WRF			
BS	60.0	31.36	18.01
Can.	24.1	60.94	19.95
SO	6.6	61.70	17.60
Illin.	0.0	59.17	19.65
PP	0.6	72.13	18.68
Cont.		70.84	18.83

Abbreviations: Hort=Horticulture Station; WRF=Western Research Farm; BS=Black-eyed Susan; Can.=Canada wildrye; SO=side-oats grama; Illin.=Illinois bundleflower; PP=partridge pea; and Cont.=control (no cover crop).