Native Cover Crops and Timing of Planting: Effects on Weed Invasion and Prairie Establishment

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Introduction

Planting cover crops to simultaneously establish native prairie seedlings and prevent weed invasion is an increasingly common management practice for prairie plantings. The idea is based on the assumption that the cover plant will act as a nurse plant to prairie seedlings, and will have a positive effect on seedling recruitment by increasing weed suppression and by lowering the harmful effects of high evaporation and light availabilities. Cover crops could also potentially reduce the amount of soil erosion that occurs during planting. This is predicted to lead to reduced weed biomass and increased prairie establishment in restoration plantings.

However, the evidence supporting these benefits is mostly anecdotal and has been challenged by some. Clearly, further scientific evidence is needed on the efficacy of cover plants, whether they reduce weed biomass, and whether cover plants have a facilitative or competitive effect on prairie establishment. As part of an ongoing project, we have varied cover crop identity and timing of seeding to determine whether prairie establishment will be affected by treatments.

Materials and Methods

There are several native species that have great potential as cover crops. During the 2005 growing season, we established five native species as cover crops at two separate sites (ISU Horticulture and Western Research Farms) and measured weed and prairie establishment during the second and third growing season. Here we present data from the third growing season.

Experimental plots were set up in a split-plot design. Seed mixes containing 29 prairie species were added to main plots that contain one of six cover crop treatments. Cover crop treatments include:

1. Canada wildrye (*Elymus canadensis*)
2. Partridge pea (*Chamaecrista fasciculata*)
3. Black-eyed susan (*Rudbeckia hirta*))
4. Side-oats grama (*Bouteloua curtipendula*)
5. No cover crop (control)
6. All four cover crop species combined

These species are all early emerging species that have the potential to reduce weed establishment and help to facilitate establishment of later emerging prairie species. Five replicate main plots were established for each treatment at each of the two sites. Plots are 5 × 5 m and were established on tilled areas that were formerly dominated by brome. Within each main plot, four sub-plots (2 × 2 m) were established to receive one of four seed timing treatments: 1) spring-seeded with prairie mix added at the same time that cover crops were established, 2) spring-seeded with prairie mix added the following growing season in the spring, 3) fall-seeded with prairie mix added at the same time that cover crops were established, or 4) fall-seeded with prairie mix added the following growing season in the spring. Seeding time treatments were established to determine if prairie establishment and cover crop effects would vary between times. Biomass of prairie and weed species was estimated with point intercept sampling, which involved counting plant contacts with a metal pin dropped through the canopy in the middle of each plot during July 2007.

Results and Discussion

Cover crops reduced weed biomass in both spring and fall plantings (Table 1), and reductions were greatest when treatments matched the optimal growing period of each cover crop. In spring plantings, weed reduction occurred only in plots with Canada wild-rye, side-oats grama, and all cover crops combined ($P < 0.05$). All cover crop treatments reduced weed biomass in fall plantings. However, cover crops had no benefit to prairie grass and forb species establishment. Cover crops had no effect on prairie establishment in spring plantings, and actually reduced prairie establishment in fall plantings ($P < 0.05$).

Prairie grass and forbs had much better establishment when plots were seeded in the spring than when they were seeded in the fall (Table 1, $P < 0.01$). Abundant prairie species included big bluestem, Indian grass, switchgrass, compass plant, narrow-leafed purple coneflower, and oxe-eye. Prairie species establishment was also much higher when the prairie mix was added at the beginning of the experiment than when it was added during the following year.

In conclusion, we found that cover crops had some benefits by reducing weed biomass, but this was counteracted by their tendency to directly compete with prairie species. Thus, we suggest that prairie establishment will be best with spring plantings without a native cover crop. Very little prairie establishment occurred when cover crops were over-seeded during the following growing season.

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Table 1: Biomass index (point intercept hits) for forb species from the prairie mix, grasses from the prairie mix, and non-native unplanted species (weeds) with either spring or fall planting, with or without various cover crop species.

Treatment[1]	Weeds	Grasses	Forbs
Spring			
BS	31.4	2.7	13.0
Can.	23.8	7.2	8.2
SO	21.2	2.3	6.9
PP	30.2	6.8	12.8
Comb.	22.7	4.3	8.9
Cont.	30.8	9.3	15.7
Fall			
BS	29.3	1.6	3.0
Can.	18.2	0.2	6.5
SO	31.9	0.2	3.4
PP	29.6	0	6.2
Comb.	33.2	0.2	2.6
Cont.	40.5	0.3	5.5
S.E.[2]	3.1	1.4	2.1

[1]BS = Black-eyed Susan, Can. = Canada Wild Rye, SO = Sideoats Grama, PP = Partridge Pea, Comb = all four cover crops combined, and Cont. = Control (no cover crop).
[2]S.E. = standard error.