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Improving Prairie Restorations

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Abstract
Deciding when and how to plant prairie to simultaneously establish native prairie seedlings and prevent weed (non-prairie species) invasion can be challenging. Planting cover crops 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. This is predicted to lead to reduced weed biomass and increased prairie establishment in restoration plantings.

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Improving Prairie Restorations

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Introduction

Deciding when and how to plant prairie to simultaneously establish native prairie seedlings and prevent weed (non-prairie species) invasion can be challenging. Planting cover crops 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. This is predicted to lead to reduced weed biomass and increased prairie establishment in restoration plantings.

Planting native prairie at different times during the growing season may also affect how well it establishes or how weedy it becomes in the long term. Clearly, further scientific evidence is needed on the efficacy of cover plants, and what seeding times are best to establish prairie. As part of an ongoing project, we varied cover crop identity and timing of seeding to determine whether prairie establishment will be affected by treatments. We then added a second seed addition of prairie species seven years after the initial seeding to determine if recruitment of native plants could be improved in established restorations.

Materials and Methods

During the 2005 growing season, we established a restoration experiment at two separate sites (Horticulture Station, Ames, IA and Western Research Farm, Castana, IA) that varied the timing of seeding and species arrival order. The long-term results from these plots and a second seed addition in 2011 are in this report.

Experimental plots were set up in a split-plot design. Seed mixes containing 30 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 facilitate establishment of later emerging prairie species. Five replicate main plots were established for each treatment at each of the two sites, the Horticulture Station and the Western Research Farm. Plots were 5 x 5 m and were established on tilled areas that were formerly dominated by brome. Within each main plot, four sub-plots (2 x 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 spring after cover crops were seeded, 3) summer-seeded with prairie mix added at the same time that cover crops were established, or 4) summer-seeded with prairie mix added the following growing season in the spring.

After six years, plots seeded in the spring with the cover crop had the highest recruitment from the mix and lowest proportion of weeds. Here, we asked whether we could increase establishment of prairie species with a second

seed addition. To do this, we burned all plots at the Western Research Farm in spring 2011, the seventh year of establishment, and added the same 30-species prairie mix again to half of the plots. 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.

Results and Discussion

After seven years of establishment, cover crops did not improve establishment of native prairie species or reduce weedy species invasion (both P>0.30), which suggests planting cover crops may not be as beneficial as predicted.

We originally found that prairie grass and forbs had much better establishment when plots were seeded in spring with the cover crop than when they were seeded in the summer, or when they were seeded after a cover crop established (P<0.01). The proportion of weeds was also much lower in spring plots with the cover crop added at the same time compared with other plots (Figure 1, P<0.01).

Establishment of prairie species was slightly higher overall in plots receiving the second seed addition (P=0.03). The proportion of weedy species did not change (Figure 1, P=0.50). Despite the slight increase in prairie species with the second seed addition, however, the largest differences originated from differences in the initial timing of seeding (Figure 1), which remained strong seven years into the study.

In conclusion, we found that the most important factor for establishing native prairie species and reducing weeds is adding prairie seed as early in the process as possible. Our results suggest that it may be difficult to substantially improve established prairie restorations by adding seed in a second seed addition. Focusing further efforts on establishing native species before weeds in the initial phases of restoration will be crucial to restoration success in Western Iowa.

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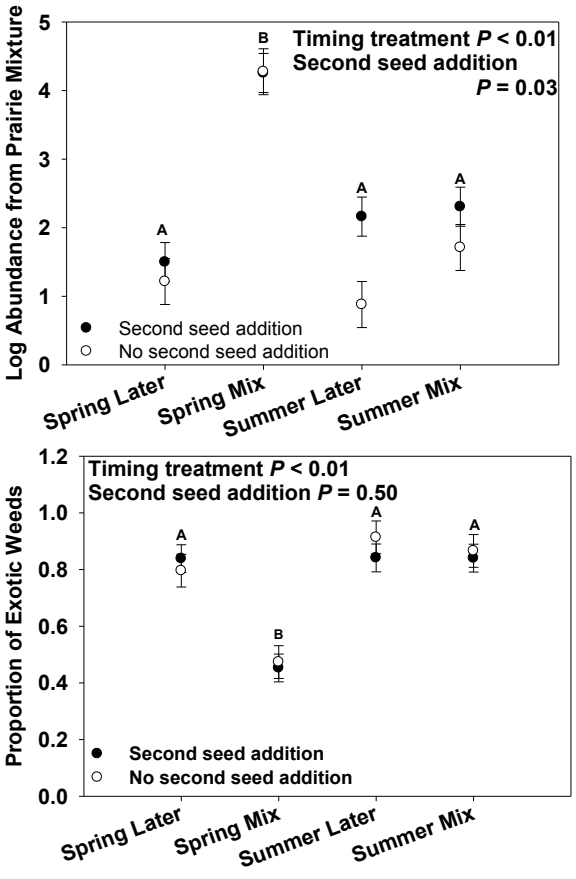

Figure 1. Changes in abundance of prairie species (top) and proportion of weeds (bottom) when timing of seed addition was altered, and comparisons between plots with a second seed addition (black circles) to no second seed addition (open circles) at Western Research Farm.