Native Cover Crops: Germination and First-Season Cover and Biomass

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Introduction

Planting cover crops to simultaneously establish native prairie seedlings and prevent weed invasion is a common management practice. The idea is based on the assumptions that the cover plant will act as a nurse plant to the prairie seedlings and that it will have a positive effect on seedling recruitment by increasing weed suppression and by lowering the harmful effects of high evaporation and light availabilities. Furthermore, plowed ground is ideal habitat for a host of weedy species that have higher germination and early growth rates, especially above ground, than do prairie species. 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, further scientific evidence is needed on the efficacy of cover plants, whether cover plants have a facilitative or competitive effect 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, Horticulture Station, Ames and Western Research Farms, and monitored days to germination, percent cover, and biomass production during the first season. Soil moisture and light availabilities at the surface layer will also be measured beginning in the 2005 growing season to better understand how cover plants are affecting the prairie species. The establishment, species diversity, and weedy plant component of the establishing prairie will be monitored during the first (2005) and subsequent growing seasons.

Experimental plots were set up on slopes. Seed mixes containing 30 prairie species were added to plots that contain one of six cover crop treatments. Cover crop treatments include:

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

These species 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 × 5 m in size and were planted 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 establish for the rest of the growing season before other prairie mixes were introduced during fall 2004. Mowing of weeds above the cover crop seedlings was done during the first month to ensure their successful establishment. The number of days until germination were recorded for each species at each site. At the end of the first growing season, the percent cover and biomass of the cover crop, other prairie species, and the weed component were recorded in each plot. The number of seedlings were counted in 20 × 50 cm quadrants placed in the center of each plot. Aboveground biomass samples were clipped in subplots and sorted by species in each plot.

Results and Discussion

Establishment of the cover crops was much better at the mesic site (Horticulture Station in Story County) than at the drier site (Western Research Farm [WRF] in Monona County). Establishment at the WRF site was delayed, but plots have shown signs of better establishment during fall 2004. At both sites, establishment varied greatly among species and was highest in black-eyed susan and partridge pea, and lowest in Illinois bundleflower. Canada wildrye and side-oats grama establishment was intermediate. Percent cover was 14% for black-eyed susan and 6% for partridge pea. Sideoats grama and Canada wildrye had relative percent covers of 2% and 1%. The number of seedlings was not as different between sites, suggesting that it was seedling

growth that differed more strongly between sites. Seedling densities in 30 × 30 cm quadrants ranged from 26.8 for black-eyed susan, to 2.3 for Illinois bundleflower.

Seed mixes of 30 species were added to each of the plots during late fall 2004. Seed was broadcast at a rate of 10 lb/acre. Thus, together with the cover crop seed, there will be a total of 20 lb seed/acre. Seed mixes consist of common warm- and cool-season grass and forb species of mesic prairies (Ames) and drier prairies (Castana). Comparisons of establishment among species is difficult if the same number of seeds are not added to each plot. For this reason, seed mixes were created with the same number of seeds for each species, based on a previously determined seeds/g value.

Small transplants of eight prairie species were planted during July 2004 into (2 plants for each species) 2 subplots (1 × 1 m) within each plot. Planted species were bergemot, yellow or gray-headed coneflower, purple prairie clover, roundheaded bush clover, little and big bluestem, porcupine grass, and scribners panicum. One subplot per plot was harvested during fall 2004. The other subplot will be harvested during fall 2005. These transplants will be used to test whether the cover crops are helping to increase the growth of prairie species. These data will supplement the data on seedling emergence that will begin in 2005.

Beginning in the 2005 growing season, seedling densities will be estimated monthly in quadrants. Light availability at the soil surface will be measured with a 1-m-long Decagon light bar at least once during the growing season. Light and water capture by the cover crop are predicted to be major factors in either promoting or inhibiting other prairie species. All of these measurements will be made during 2005 and in subsequent growing seasons to determine how cover crops affect prairie planting success.