Cost-Effective Native Seed Mix Design and First-Year Management

RFR-A1673

Justin Meissen, research manager
Dave Williams, research manager
Laura Jackson, professor/director
Tallgrass Prairie Center,
University of Northern Iowa

Introduction

The decline of pollinators throughout the United States recently has prompted the USDA to create a conservation program designed to promote pollinator habitat. For the popular CP-42 pollinator program, conservation practice specifications intend to create forb-dominated stands of native vegetation that support pollinator use. As part of these specifications, seed mixes are required to have an overall seeding rate of 40 seeds/square ft, with a grass-to-forb ratio of 1:3 (10 seeds/square ft grass and 30 seeds/square ft forb). As interest in the CP-42 program has grown, seed vendors and other organizations have provided pre-packaged seed mixes to meet these program requirements, and practitioners have planted thousands of acres of such seed mixes over the past several years.

However, seed mixes based on the requirements and preferences of the pollinator program may not be sufficient to produce durable stands of native vegetation. For example, the preference for short-statured species to compose the grass component of mixes may result in poor establishment, because short prairie grasses are generally adapted only to dry soils. Additionally, the 1:3 grass-to-forb ratio may be too low to establish native stands capable of competing with weeds, especially if frequent first season management is not properly carried out. Ultimately, these factors may lead to poor cost effectiveness when considering high costs of seed and low potential stand establishment.

The objective was to compare native plant density, canopy cover, and cost effectiveness with and without establishment mowing for three different seed mixes that differed in grass-to-forb ratio and soil type customization.

Materials and Methods

To assess cost effective seed mix design and establishment management, a randomized complete block experiment was installed with three replicates in May 2015. Two 40 x 253 ft strips were established as blocks, each consisting of 18 plots that were 20 x 28 ft. In each plot, a combination of mowing and seed mix treatments was randomly assigned. The project manipulated mowing at two levels—unmowed and mowed—and seed mix treatments at three levels—economy grass mix, diversity mix, and pollinator mix.

Seed mix treatments varied based on grass-to-forb ratio and soil type customization. The economy grass mix ($130/ac) included 21 species at a 3:1 grass-to-forb seeding ratio, the diversity mix ($291/ac) included 71 species at a 1:1 grass-to-forb seeding ratio, and the pollinator mix ($368/ac) included 38 species at a 1:3 grass-to-forb seeding ratio. Species were selected for economy and pollinator mixes to mimic popular commercially available seed mixes, and the diversity mix was designed using species selected for mesic soil conditions at the experiment site. Each mix was seeded at an overall rate of 40 seeds/square ft to standardize the mixes. To increase the relevancy of this study to practitioners, a Truax no-till drill (commonly employed for large-scale seedings) was used to plant each mix.

Vegetation was moved frequently throughout the 2015 growing season. Plots were mowed to 4 in. when vegetation height reached 2 ft (4 total mowings). Plots were not mowed in 2016.

Plot vegetation data were collected in September 2016. To sample plant density and cover, six 1 ft^2 quadrats spaced every 3.3 ft along a 19.7 ft transect were established randomly in each plot. In each quadrat, researchers counted and identified all stems, and recorded canopy cover values for each species. Cost effectiveness was assessed by calculating the cost of seed/plot and dividing by the number of 1,000 established native stems in each plot (cost/thousand stems).

To analyze the effects of seed mix and mowing on cost-effectiveness and native plant establishment, R was used to conduct analysis of variance (ANOVA) and *post-hoc* Tukey HSD tests to compare means within treatment groups ($P < .05$).

Results and Discussion

After two growing seasons, the pollinator mix generally established poorly, while the diversity and economy grass mix established well. On average, the diversity and economy grass mixes produced four times as many native stems as the pollinator mix ($P < .0001$; $P < .0001$) (Figure 1). Native cover also was greater in the diversity and economy grass mix compared with the pollinator mix ($P < .05$; $P < .01$). The economy grass mix produced the fewest forbs (0.5 plants/ft^2) ($P < .05$), and forb density in the diversity mix (1.4 plants/ft^2) was not significantly different from the pollinator mix (1.6 plants/ft^2) (Figure 2).

Mowing throughout the first growing season greatly improved the performance of native plantings, even in the second year. Mowing more than doubled native stem density ($P < .0001$) (Figure 1), and increased native cover by twofold ($P < .0001$). However, mowing did not affect forb density.

Both seed mix and first-year mowing determined cost effectiveness in native plantings (Figure 3). The pollinator mix was least cost effective, i.e., the most costly per thousand stems established. Cost per thousand stems for this mix ($0.87 with mowing) was four times more than the diversity mix ($0.23 with mowing) ($P < .001$) and over 10 times more than the economy grass mix ($0.07 with mowing) ($P < .0001$). Mowing greatly improved cost effectiveness, i.e., lowering cost per thousand stems on average by 350 percent ($P < .0001$).

Seed mix specifications designed to promote pollinator habitat do not necessarily result in successful stands of native vegetation. The pollinator mix (1:3 grass-to-forb ratio) established poorly, which led to low or poor cost effectiveness. The economy grass mix (3:1 grass-to-forb ratio) established well, but resulted in forb densities likely insufficient to support pollinators. In contrast, the diversity mix (1:1 grass-to-forb ratio) established well, was cost effective, and produced forb density equivalent to the pollinator mix. The diversity mix maximized pollinator value, native plant density, and cover. Specifications for pollinator seed mixes might be made more cost effective by emphasizing diverse site-appropriate mixes at a 1:1 grass-to-forb ratio.

Frequent first-year mowing also is essential for establishing cost-effective, robust stands of native vegetation. The magnitude of the effect even in the second year suggests establishment mowing is likely to provide benefits in the future.

Acknowledgements

We thank Ken Pecinovsky for conducting mowing treatments and selecting research sites. The Iowa Nutrient Research Center provided funding for this project.

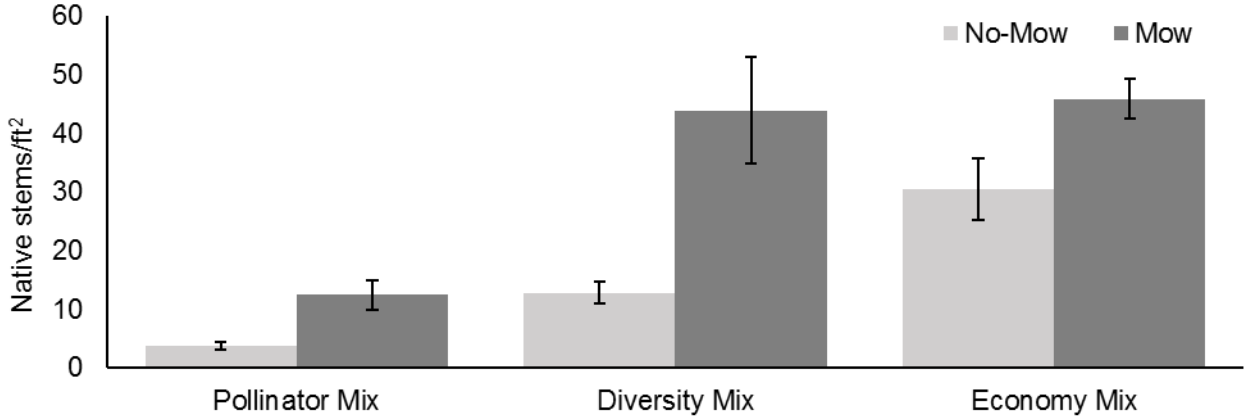

Figure 1. Average native stem density per square ft after two years for three seed mixes with and without establishment mowing. Error bars represent standard error.

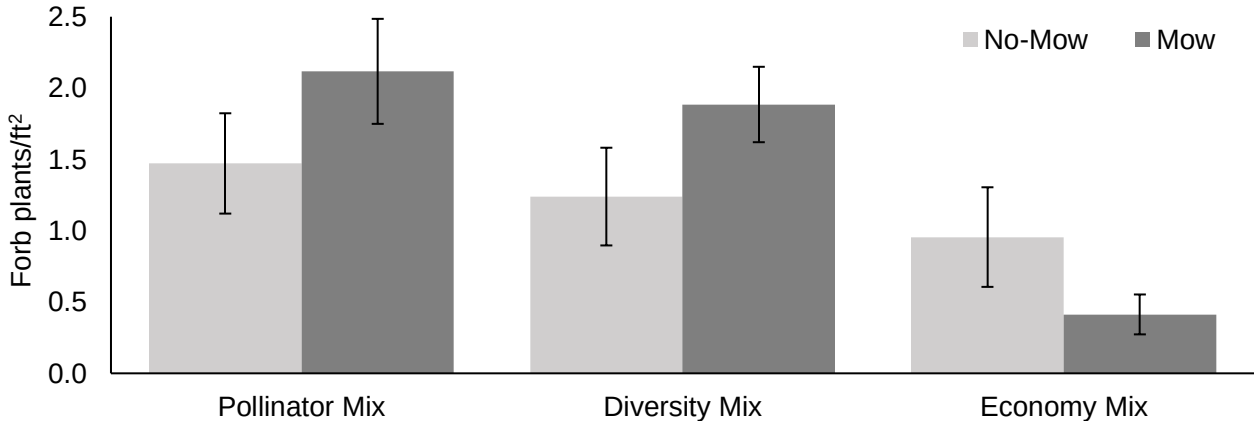

Figure 2. Average native forb density per square ft after two years for three seed mixes with and without establishment mowing. Error bars represent standard error.

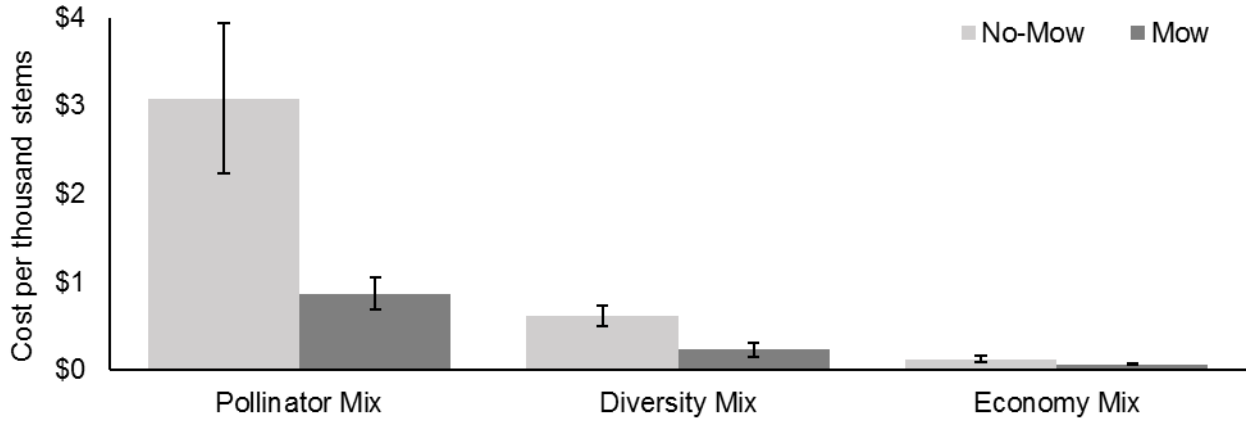

Figure 3. Average cost to produce 1,000 native stems after two years for three seed mixes with and without establishment mowing. Error bars represent standard error.