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Buzzsod: A Cool-Season Grass Dominant Meadow Mix for Wildflower Sod Production

John Kaszan[1], Erik Ervin[1], Sue Barton[1], and Deborah Delaney[2]

[1]University of Delaware, Plant and Soil Science, Newark, Delaware 19716; [2]University of Delaware, Entomology and Wildlife Conservation, Newark, Delaware 19716 U.S.A.

jkaszan@udel.edu

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INTRODUCTION

Most meadow plantings tend to be warm-season grass dominant (Weaner and Christopher, 2016). There are more species of native cool-season grasses, however, found in mid-Atlantic meadows (Latham and Thorne, 2007). Replacing native warm-season grasses as the dominant grass type in meadow mixes with native cool-season grasses may open new methods of production for meadow establishment. When establishing meadows, weeds can be a massive hindrance (Weaner and Christopher, 2016). A well-developed wildflower sod root mass may ease the burden that weeds put on the establishment of native plant communities. Even if cool-season grasses cannot persist in a wildflower sod, they may allow for new means of propagating and establishing native plant communities.

There is market interest for a native wildflower sod. Focus groups were used to determine the market viability of wildflower sod amongst homeowners and landscape professionals (Barton et al, 1996). Weed pressure was one of the main concerns of both homeowners and landscape professionals (Barton et al, 1996). Wildflower sod development has been documented with articles published detailing various stages of wildflower sod production species selection (Johnson and Whitwell, 1997), soil types (O'Brien and Barker, 1997), and relevant patents that have been granted by the US Patent and Trademark Office (Milstein, 1987; Molnar, 1991). Neither patent seems to have yielded any lasting investment in the products.

Preliminary trials of wildflower sod have utilized species that lack taproots (Johnson and Whitwell, 1997). Given the depth of roots common to many grassland/meadow plants (USDA-National Resource Conservation Service, 2004), this considerably reduces the number of viable species for wildflower sod production. Still, several species have been identified as suitable for sod production (Johnson and Whitwell, 1997), however, these species were not being used as part of a mix.

One method that has proven useful in the harvest and production of sod is growing on plastic (Fig. 1). Utilizing plastic underneath of a fertilized compost based growing media was able to reduce the production time of several warm-season grass sod species (Cisar and Snyder, 1992). Sod grown over plastic also transplanted faster, developing greater root mass faster, and had root mass similar to that of field grown sod at the time of harvest (Cisar and Snyder, 1992).

Figure 1. Sod over plastic 3 months after sowing. Sod is between red lines.

Additionally, bermudagrass sod grown on plastic was found to have greater tensile strength than conventionally produced field grown bermudagrass of the same cultivar (Penn State Center for Sports Surface Research, 2014). The proven success of growing over plastic in sports field turf production show promise in for wildflower sods by increasing the concentration of roots, as well as providing a less invasive method of harvest. Utilizing plastic should also prevent the majority of weed seed from contaminating the wildflower sod during production.

MATERIALS AND METHODS

Two meadow mixes were designed using *Festuca rubra* L. ssp. *rubra* (creeping red fescue) and *Poa palustris* L. (fowl bluegrass) as a cool-season grass foundation to accompany several species of native forbs. Besides the two cool-season grasses, all other species included in both mixes were present at the same rates. Mixes were sown at a ½×, 1×, and 2× of the suggested rates in October using a completely randomized design on 4 m^2 plots.

Rates were calculated using the recommended rate of seed to establish a stand by the NRCS (2009). A quarry blended sandy loam was spread to 3 cm depth overtop of 4 mil plastic as a growth medium and to reduce weed pressure. Similar methods are used in the production of sports turf, primarily using bermudagrass (Penn State Center for Sports Surface Research, 2014). The sowing was covered with a row cover from October until mid-March. There were four replications of each treatment. The complete mixes can be seen in Table 1.

Table 1. The amount of Pure Live Seed (PLS) applied per plot for each of the rates of seed. Mixes including one of the cool-season grasses are shown in green.

Species	Common Name	kg PLS per ha	Rate	1x PLS per plot (mg)	1/2x PLS per plot (mg)	2x PLS per plot (mg)
Poa palustris	Fowl Bluegrass	3.4	60.00%	816.00	408.00	1632.00
Festuca rubra	Creeping Red Fescue	13.5	60.00%	3240.00	1620.00	6480.00
Coreopsis lanceolata	Lanceleaf Coreopsis	7.8	3.50%	109.20	54.60	218.40
Echinacea purpurea	Purple Coneflower	13.5	6.00%	324.00	162.00	648.00
Gaillardia pulchella	Indian Blanket	13.5	2.50%	135.00	67.50	270.00
Monarda fistulosa	Wild Bergamot	4.0	3.50%	56.00	28.00	112.00
Penstemon digitalis	Foxglove Beardtongue	11.2	6.00%	268.80	134.40	537.60
Solidago nemoralis	Gray Goldenrod	11.2	3.00%	134.40	67.20	268.80
Rudbeckia hirta	Black-eyed Susan	0.5	2.50%	5.00	2.50	10.00
Pycnanthemum virginianum	Virginia Mountainmint	11.2	3.50%	156.80	78.40	313.60
Agastache foeniculum	Anise Hyssop	11.2	2.50%	112.00	56.00	224.00
Symphyotrichum laeve	Smooth Aster	11.2	6.00%	268.80	134.40	537.60
Schizachyrium scoparium	Little Bluestem	11.2	1.00%	44.80	22.40	89.60

Sod sown using the ½× rate failed to produce viable transplants, so only the 1× and 2× rates were transplanted. Sod that was deemed suitable for harvest was cut into 46 cm × 224 cm strips and transplanted on a silt loam that was prepared with glyphosate (two applications at a 2% solution of 48.8% glyphosate) and dethatched. Supplemental water (8 cu. cm) was provided for the first 2 weeks after transplant and was only provided once during drought conditions in August.

Species richness (of species from the mixes) was measured at harvest and four months after transplant and was compared using a student's t-test at α=.05. Transplanted sod received one mowing to a height of 13 cm 2 weeks after transplant. Biomass of spontaneous vegetation was taken from 5 cm above the crown and dried for 6 days. Only vegetation within the treatments was sampled. Spontaneous vegetation (primarily weeds) that appeared between different treatments was not considered when calculating spontaneous vegetation biomass.

RESULTS

The rate of seed had no effect on biomass of spontaneous vegetation that occurred among the transplanted sod. The dominant grass species of the two mixes did affect the impact of spontaneous vegetation (p=0.025), seen in Figure 2. Spontaneous vegetation species richness was not found to differ significantly between treatments (p=0.3761). All treatments were just as likely to see the same number of species in the spontaneous vegetation.

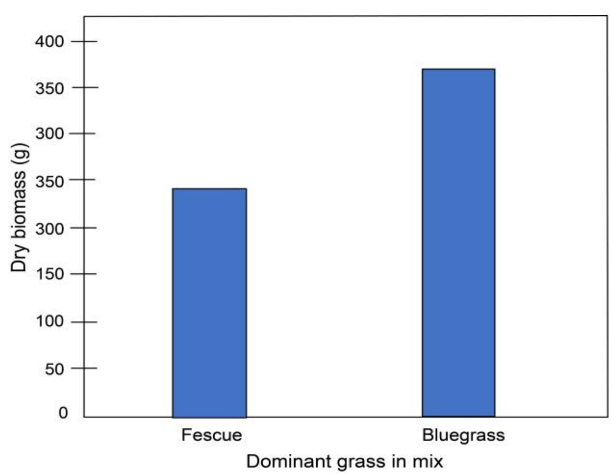

Figure 2. Difference in end of season biomass of spontaneous vegetation between the two mixes. α=.05

Differences in species richness at the time of harvest were not found to be significant (p=.1256). Species richness was found to be significantly different between mixes at the end of the study (p=.0306) with a mean richness of 2.18 for the fescue mix and 3.75 for the bluegrass mix. When species richness was examined under a single model, the mix (p=.004) and the mix*rate interaction (p=.0406) were found to be significant (Figure 3). The month was not found to be significant (p=.3816), showing that there was not a significant decrease in species richness between transplant and our final observations. Utilizing more seed did not help establish a more species rich sod in all cases.

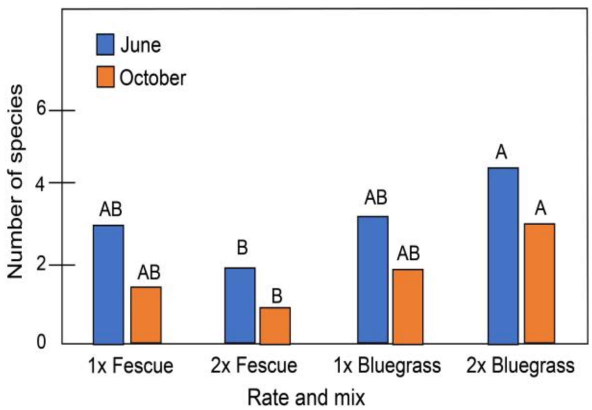

Figure 3. Species richness of transplanted sod at transplants (June) and at the end of season (October). Only species from the mixes were considered. α=.05

DISCUSSION

The fall sowing time strongly favored cool-season grass establishment while on the plastic. Though there were numerous forbs that germinated early on, we hypothesize that they failed to survive the winter due to the constant freezing and thawing of the shallow soil base overtop the plastic (Fig. 4). The experiment will be repeated with a spring sowing (mid-March) to see if forb establishment is more successful. A longer observation period is also worthwhile to test the durability of species richness.

Figure 4. Numerous forbs can be seen within the fescue mix. This photo was taken 3 months after sowing. Most of these forbs did not survive the winter.

The data suggests that the experiment would likely benefit from more repetitions all utilizing the 1× rate, as the 2× rate did not provide any reliable benefits compared to the 1× rate. Though the bluegrass dominant mix had contained higher biomass levels of spontaneous vegetation, this may be due to the transplant shock it suffered, or due to how the fescue began to lay flat under its own weight, further obscuring the soil surface from the light that weed seeds would require to germinate (Fig. 5).

Other methods of preparing the transplant site, such as preemergent weed control, could also be investigated to see how they may interact with newly transplanted wildflower sod. There are still a lot of unanswered questions and methods to be investigated before we can confidently establish wildflowers in sod for restoration or commercial use. However, we demonstrated enough success to indicate that sod remains a viable possibility for future wildflower meadow establishment.

Figure 5. Bluegrass (left of flag) and fescue (right of flag) sod two months after transplant. The bluegrass can be seen going dormant, while the fescue becomes matted. Several forb species can be seen in the bluegrass dominant sod. Weeds (primarily *Digitaria* sp.) can be seen gaining a foothold as well. Species pictured include *Solidago nemoralis* Aiton, *Monarda fistulosa* L., *Agastache foeniculum* (Pursh) Kuntze, *Symphyotrichum laeve* (L.) Á. Löve and D. Löve, and *Pycnanthemum virginianum* (L.) T. Dur. and B.D. Jacks. ex B.L. Rob. and Fernald.

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