Developing Perennial Cover Cropping Systems for Maize Grain and Biomass Production

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Introduction

This study investigates the potential of several cool-season turfgrass varieties as perennial cover crop in maize production systems. The first objective was to screen modern turfgrass cultivars as candidates. The second objective aimed to identify unique germplasm from varieties obtained from the USDA-Germplasm Resources Information Network (GRIN). This report summarizes the field activities and preliminary results of maize production during the 2019 growing season.

Methods and Materials

Plots for both the first and second objectives were planted in 2017. The first objective consisted of 20 cultivars across seven species: Kentucky bluegrass (A05-219, Award, Blue Coat, Camas, Everest, Midnight, and SPF30), red fescue (Autobahn, Boreal, and Lighthouse Slender), sheep fescue (Blue Ray, Marco Polo, and Quattro), tall fescue (Flame, JT-783, Summer, and Titanium), Sandberg bluegrass (MT-1), western wheatgrass (Arriba), and intermediate wheatgrass (Rush). All grasses were broadcast seeded in 10 ft x 22.5 ft plots, replicated three times with no-grass controls. Maize was planted conventionally into strip-tilled zones in each plot.

The second objective consisted of transplanted grass plugs in alternating rows of conventional maize. The grasses planted represent 20 unimproved accessions each of Kentucky bluegrass (KBG), Sandberg bluegrass (SBG), and red fescue (RF) obtained from the USDA-GRIN.

The lateral spread of each plot of grass was measured on a visual scale from 0-9, with 0 representing no grass present and 9 representing full coverage between the maize rows. Maize grain yield was determined at harvest, and maize plant height was taken only for the first objective. Yield was analyzed using PROC MIXED in SAS version 9.4 for statistical differences at the 0.05 probability level.

Results and Discussion

Most grass species in the first objective maintained ratings above 6 throughout the 2019 season. Western and intermediate wheatgrass suffered wheel traffic damage early in the season, leading to lower-than-expected spread. Figure 1 presents the average grass spreads in the first objective in 2019. All grass treatments negatively affected maize plant height, though the differences between grass treatments were minimal. Maize grain yields were much lower than in previous years, likely due to extreme rain events that delayed planting. Plots of western and intermediate wheatgrass yielded relatively high, though this is likely due to reduced competition as a result of reduced ground coverage. Overall grain yields are presented in Table 1.

In the second objective, maize plant heights were not taken due to extreme variability among and within replications. This is likely due to excessive moisture and extreme weed pressure. Visual ratings for spread still were

taken and are presented in Figure 2. The KBG accessions experienced an initial increase in coverage followed by decline in the summer and regrowth in the fall. The RF accessions remained relatively stable throughout the season and maintained high coverage. The SB accessions maintained ratings lower than 4 on average for most of the season. On average, plots of KBG and RF yielded considerably lower than the no-grass control and SB yielded higher than the no-grass control. Overall yields are presented in Table 2.

Table 1. Average maize grain yield in Objective 1 in 2019. Preliminary data and analysis.

Cultivar	Species	Average yield (bu/a)
Control	No-grass	146.96a[*]
Summer	Tall fescue	110.32ab
Rush	Intermediate wheatgrass	104.85abc
JT-783	Tall fescue	104.66abc
Arriba	Western wheatgrass	95.15bcd
Boreal	Red fescue	88.94bcd
Everest	Kentucky bluegrass	87.38bcd
Marco Polo	Sheep fescue	87.04bcd
Quattro	Sheep fescue	83.22bcd
Blue Ray	Sheep fescue	82.42bcd
Camas	Kentucky bluegrass	79.34bcd
Autobahn	Red fescue	77.55bcd
Midnight	Kentucky bluegrass	77.36bcd
MT-1	Sandberg bluegrass	74.28bcd
Award	Kentucky bluegrass	74.00bcd
SPF30	Kentucky bluegrass	71.72bcd
Lighthouse	Red fescue	69.41bcd
Blue Coat	Kentucky bluegrass	65.61bcd
Flame	Tall fescue	61.501cd
Titanium	Tall fescue	58.45cd
A05-319	Kentucky bluegrass	55.36d

[*]Yield significantly different with different letters at the 0.05 probability level as determined by LSD.

Table 2. Average maize grain yield in Objective 2 in 2019. Preliminary data and analysis.

Species[1]	Average yield (bu/a)
SBG	78.03a[*]
Control	69.48ab
KBG	49.63b
RF	44.63b

[1]SBG = Sandberg bluegrass, KBG = Kentucky bluegrass, RF = red fescue.
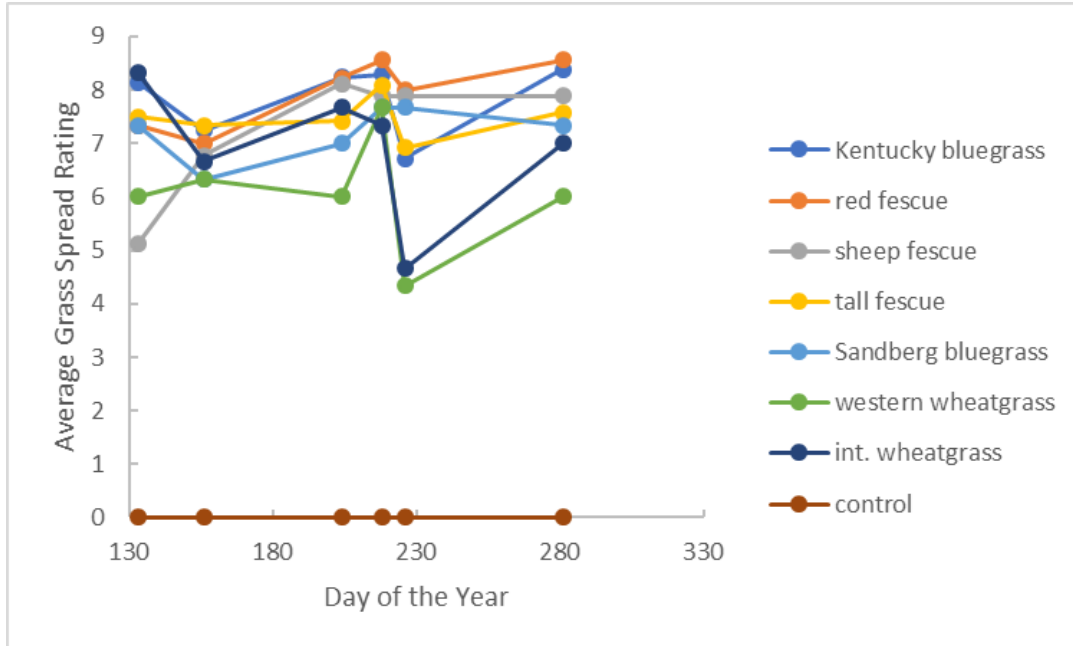[*]Yield significantly different with different letters at the 0.05 probability level as determined by LSD.

Figure 1. Average rating of grass spread across the seven grass treatments in Objective 1 of 2019.
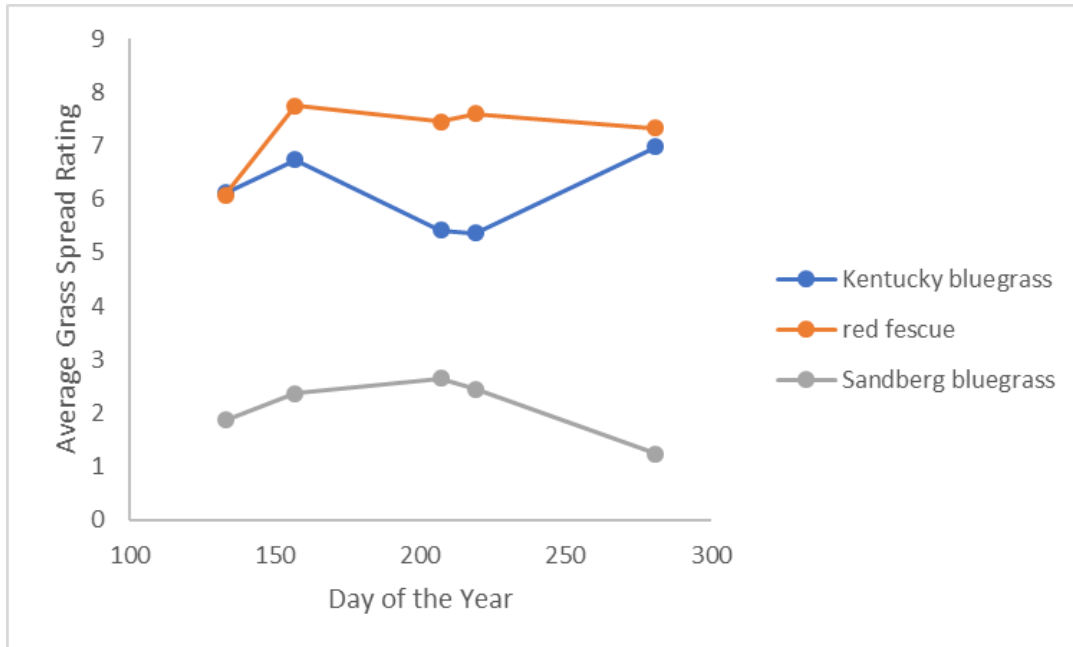

Figure 2. Average rating of grass spread across the three species in Objective 2 of 2019.