Establishment, Persistence and Production of Perennial Cool-season Grasses in the Missouri Coteau Region of North Dakota

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Smooth brome (Bromus inermus Leyss.) is the dominant species in most hayland in the Missouri Coteau region. This perennial cool-season grass is productive early in the growing season; however, due to its low drought tolerance, its production decreases through the summer.

Furthermore, the forage quality of smooth brome is lower than other perennial cool-season grasses, especially when smooth brome is harvested after the late-anthesis stage. Other perennial cool-season grasses may be preferable for livestock producers. Therefore, to evaluate perennial cool-season grasses for diverse management goals, field plots of 17 species were established at the CGREC in 2011.

The comparison of selected species/cultivars with regard to their establishment, persistence and production is presented here to fill the information gap and then diversify forage production systems in this region.

Summary

All 17 screened and seeded perennial cool-season grasses showed successful establishment in the Missouri Coteau region. They were: meadow brome, smooth brome, meadow fescue, tall fescue, reed canarygrass, creeping foxtail, green needlegrass, orchardgrass, perennial ryegrass, timothy, crested wheatgrass, hybrid wheatgrass, intermediate wheatgrass, slender wheatgrass, western wheatgrass, tall wheatgrass and Russian wildrye.

However, perennial ryegrass did not survive one year after seeding, probably due to winterkill. Green needlegrass, western wheatgrass and Russian wildrye plots were invaded by Kentucky bluegrass one year after seeding.

One year after seeding, tall wheatgrass (4.84 tons/acre) was the most productive species, followed by smooth brome (4.34 tons/acre). Two years after seeding, smooth brome produced 3.25 tons/acre, followed by meadow brome (2.71 tons/acre). Meadow brome would be a good alternative to smooth brome because of its evenly distributed production through the growing season. Intermediate wheatgrass, tall wheatgrass and hybrid wheatgrass also could be used as perennial cool-season grass forages.

Introduction

Smooth brome, a perennial cool-season grass, is the dominant species in most hayland in the Missouri Coteau region. Its dominance comes from intentional seeding historically, but mostly from more recent invasions (DiAllesandro, 2011). It is productive, especially in the early growing season (Dillemuth, 2012).

However, it is not very drought-tolerant, with production showing an apparent summer depression (Sedivec et al., 2007). Furthermore, due to its low forage quality in midsummer, it is less preferred compared with other grasses, especially with regards to in vitro digestibility when harvested after the late-anthesis stage (Coleman et al., 2010).

Perennial cool-season grasses are of interest to livestock producers in the Missouri Coteau region for several reasons. These grasses can be used to renovate abused and degraded natural prairie vegetation, extend the grazing season in the late fall and early spring, and supplement forage resources for livestock in the winter (Coleman et al., 2010). Therefore, a long-term study of perennial cool-season grasses was initiated in 2011 at the CGREC near Streeter, N.D. Specific objectives were to establish and monitor perennial cool-season grass species for their establishment, persistence and productivity.

Procedures

The study was carried out at the Central Grasslands Research Extension Center from 2011 through 2013. Nineteen perennial cool-season grass species/cultivars were seeded in mid-May 2011 (Table 1). Each species/cultivar was drilled into 20- by 20-foot field plots that were prepared by disking and harrowing.

Each plot was harvested in a multi-cut system when smooth brome was at the early anthesis stage. Oven-dried samples were collected to calculate forage production on a dry-matter basis. During establishment, mowing was employed to control common weeds. Herbicide (2,4-D) was applied to the plots to control undesirable broadleaf weeds when necessary.

Each plot was evaluated visually for seeded species establishment. The establishment scale was: failed (no seedlings of seeded species present and plots covered by weeds), poor (sparse seedlings of seeded species and plots covered by weeds at least 50 percent), fair (regularly spaced seedlings of seeded species and covered by weeds at most 50 percent) and excellent (dense seedlings of seeded species and covered by weeds at most 25 percent).

Results

All 17 perennial cool-season grasses showed successful establishment at the CGREC. They were: meadow brome, smooth brome, meadow fescue, tall fescue, reed canarygrass, creeping foxtail, green needlegrass, orchardgrass, perennial ryegrass, timothy, crested wheatgrass, hybrid wheatgrass, intermediate wheatgrass, slender wheatgrass, western wheatgrass, tall wheatgrass and Russian wildrye (Table 1).

However, perennial ryegrass did not survive one year after seeding, probably due to winterkill. Green needlegrass, western wheatgrass and Russian wildrye plots were invaded by Kentucky bluegrass one year after seeding.

We found no significant differences among all species evaluated for the June 2012 harvest (Table 2). However, for the September 2012 harvest, tall wheatgrass (3.17 tons/acre) produced the most biomass (Table 2). We only have one year's data for the multi-harvest regime.

From the results, meadow brome, meadow fescue, tall fescue, reed canarygrass, hybrid wheatgrass and intermediate wheatgrass appear to have had an even distribution of production through the growing season (Table 2). However, smooth brome, creeping foxtail, timothy, slender wheatgrass and crested wheatgrass had their most production early in the season.

In comparison, orchardgrass and tall wheatgrass had their most production late in the growing season. In 2013, a dry year (see page 48), meadow fescue, tall fescue, reed canarygrass and orchardgrass production decreased significantly from 2012. Crested wheatgrass and smooth brome, the early season growing species, produced well, however.

Discussion

It is well-known that perennial cool-season grasses are easy to establish in the northern Great Plains (Sedivec et al., 1997). The only concern that arose in our study was the invasion by perennial cool-season grass "weeds" such as Kentucky bluegrass. Seedbed preparation is very critical to control these weeds. Glyphosate should be used before seeding to control any weeds in the plots.

Green needlegrass and western wheatgrass establishment in our study was only marginal successful compared with other species. We seeded these two species in other plots in 2013, and their establishment was excellent, so we suspect that weed competition was the cause for their poor establishment in 2011. The difficulty we had establishing Russian wildrye may relate with low seeding rates or seed quality. The literature shows mixed results for wildrye establishment. Perennial ryegrass is a very popular forage species in the southern part of the United States. It can establish well in the seeding year, however, it did not overwinter in our study.

The perennial cool-season grasses showed little variability in production. Even though there is some significant difference between species, the magnitude is not great. However, different species showed considerable variety in growth pattern through the growing season. We can classify perennial cool-season grasses into different categories based on their phenology. Livestock producers can use this information to design their production systems to fit their specific management objectives. Furthermore, although production totals may not be different, quality may be. Further studies will focus on evaluating quality parameters.

References

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Table 1. Perennial cool-season grass species/varieties screened and evaluated at the CGREC seeded in 2011 and evaluated in 2012 and 2013.

Common Name	Latin Name	Variety[1]	Seeding Rate[2]	Establishment[3]
Crested wheatgrass	*Agropyron cristatum* (L.) Gaertn.	Fairway	13.08	Excellent
Creeping foxtail	*Alopecurus arundinaceus* Poir.	Garrison	6.98	Excellent
Meadow brome	*Bromus biebersteinii* Roem. & Schult.	Paddock	17.44	Excellent
Smooth brome	*Bromus inermis* Leyss.	VNS	26.17	Excellent
Orchardgrass	*Dactylis glomerata* L.	Pennlate	20.93	Excellent
Hybrid wheatgrass	*Elymus hoffmannii* K. B. Jensen & K. H. Asay	NewHy	19.19	Excellent
Slender wheatgrass	*Elymus trachycaulus* (Link) Gould ex Shinners	Revenue	26.17	Excellent
Perennial ryegrass	*Lolium perenne* L.	Linn	52.33	Excellent
Green needlegrass	*Nassella viridula* (Trin.) Barkworth	Lodorm	8.72	Fair
Western wheatgrass	*Pascopyrum smithii* (Rydb.) Å. Löve	Flintlock	17.44	Fair
Western wheatgrass	*Pascopyrum smithii* (Rydb.) Å. Löve	Recovery	17.44	Fair
Reed canarygrass	*Phalaris arundinacea* L.	Palaton	17.44	Excellent
Timothy	*Phleum pratense* L.	Kootenai	17.44	Excellent
Russian wildrye	*Psathyrostachys juncea* (Fisch.) Nevski	Bozoisky	6.98	Fair
Tall fescue	*Schedonorus arundinaceus* (Schreb.) Dumort.	VNS	26.17	Excellent
Meadow fescue	*Schedonorus pratensis* (Huds.) P. Beauv.	VNS	60.06	Excellent
Intermediate wheatgrass	*Thinopyrum intermedium* (Host) Barkworth & D. R. Dewey	Oahe	13.08	Excellent
		Manska	19.19	Excellent
Tall Wheatgrass	*Thinopyrum ponticum* (Podp.) Z.-W. Liu & R.-C. Wang	Alkar	34.89	Excellent

[1] VNS: variety not stated.
[2] Pounds pure live seed per acre.
[3] Establishment level was evaluated visually one year after seeding in the early spring on a scale of 0 – 3: 0 – failed (no seedlings found); 1 – poor (sparse seedlings found); 2 – fair (regularly spaced seedlings found); 3 – excellent (dense seedlings found and few or no weeds found).

Table 2. Forage yield (tons/acre) of established perennial cool-season grass species/varieties at the CGREC seeded in 2011.

Species	Variety	2012			2013
		June	Sept.	Total	June
Meadow brome	Paddock	1.83	1.96bc[1]	3.76	2.71ab
Smooth brome	VNS	2.92	1.42b-e	4.34	3.25a
Meadow fescue	VNS	1.69	1.78b-d	3.47	1.62cd
Tall fescue	VNS	1.30	1.29b-e	2.59	0.97d
Reed canarygrass	Palaton	1.89	1.98bc	3.86	2.05bc
Creeping foxtail	Garrison	1.30	0.76de	2.06	2.18bc
Orchardgrass	Pennlate	0.91	2.07b	2.98	1.61cd
Timothy	Kootenai	1.82	0.71de	2.53	2.30bc
Crested wheatgrass	Fairway	1.41	0.67e	2.08	2.61ab
Hybrid wheatgrass	NewHy	1.99	1.77b-d	3.75	2.68ab
Intermediate wheatgrass	Manska	1.74	1.15b-e	2.89	2.39abc
	Oahe	1.13	1.90bc	3.04	2.75ab
Slender wheatgrass	Revenue	1.45	0.95c-e	2.40	2.12bc
Tall wheatgrass	Alkar	1.67	3.17a	4.84	2.58ab

[1] Forage yields in column followed by same letters were not statistically different at $p \leq 0.05$.