Early Intensive Grazing, Patch Burning and Season-long Grazing

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Early season intensive grazing and patch burning are being tested as means of reducing Kentucky bluegrass (Poa pratensis L.), an invasive grass species. After three years, initial results indicate that early intensive grazing can reduce Kentucky bluegrass foliar cover and frequency. Removing cattle before the native grasses and forbs have received much grazing pressure should allow these species to increase in the community. A burn treatment was added in October 2014.

Studies have shown that burning can reduce Kentucky bluegrass for a year, but in the second year, it usually has returned to pre-burn levels. However, burning followed by grazing may help keep the Kentucky bluegrass in a reduced state and maintain the native plant community composition and productivity. This will be tested in the coming years.

Summary

Kentucky bluegrass (*Poa pratensis* L.) is a perennial cool-season grass that begins growth in the spring earlier than the native species. Its forage quality is high in the spring but decreases through the season, resulting in reduced overall forage quality during the summer (Patton *et al.* 2001). Grazing heavily while Kentucky bluegrass is growing actively may favor native species.

In this study, each of nine pastures was assigned to one of three treatments: early intensive grazing, season-long grazing and patch burning with season-long grazing. All pastures are stocked with yearling cattle at a moderate stocking rate prior to Kentucky bluegrass reaching the two-leaf stage.

The early intensive treatment is grazed for 1.2 months with a stock density of 0.96 AU/acre, equivalent to a stocking rate of 1.1 AUM/acre. The season-long and patch burning treatments are grazed for four months with a stock density of 0.29 animal units per acre (AU/acre), also equivalent to a moderate stocking rate of 1.1 animal unit months per acre (AUM/acre).

We began applying the early intensive and season-long grazing treatments in 2011. Total forage production did not differ between pastures, however, early intensive grazing has reduced foliar cover and frequency.

The first patch burning took place in the fall of 2014, and those pastures will be grazed the same as the season-long pastures in 2015. On the patch burn treatment, one-fourth of each pasture is burned in the fall, with a new portion burned each year on a four-year rotation.

Introduction

Kentucky bluegrass was introduced by early colonists along the East Coast and spread across America by settlers and natural dissemination (Carrier and Bort 1916). Kentucky bluegrass can be a problem throughout the tallgrass and mixed-grass prairies (Sather 1996).

A perennial cool-season grass, Kentucky bluegrass begins growth in the spring earlier than the native species and gains competitive advantage by using soil water and shading the later-emerging species. The forage quality of Kentucky bluegrass is high in the spring when green and actively growing, but it decreases as the summer progresses, although it can green up again in the fall if adequate moisture is available (Patton *et al*. 2001, North Dakota Department Lands 2011). The dominance of Kentucky bluegrass in the plant community results in reduced forage quality of the pasture in the summer.

The timing of grazing can have a great impact on plant species composition by reducing those species that are growing actively during the grazing period and releasing from competition those plants that are growing actively when grazing pressure is absent (Stephenson 2010).

Preliminary studies examining the impact of prescribed burns on Kentucky bluegrass give some indication that it may be an effective management technique. Fall burns in South Dakota mixed-grass prairie decreased Kentucky bluegrass the year following treatment from 33 to 13 percent (Bahm *et al*. 2011). However, two years after burning, the canopy cover was not different among treatments. Similarly, annual burns in Kansas tallgrass prairie reduced Kentucky bluegrass cover from 30 to 7 percent during a four-year period (Abrams 1988).

Burning during the spring, summer and fall seasons effectively reduced Kentucky bluegrass in North Dakota mixed-grass prairie, but the cover was not different than the unburned control two years post-fire

(Sedivec *et al.* 2014). Native plant species in the study were not harmed by fire, consistent with a previous study on native grass (Limb *et al.* 2011a). Short-term suppression of Kentucky bluegrass is consistent among burn trials, but its return to pre-treatment abundance two years after fire also is consistent. To maintain the benefits of burning, additional disturbance is needed the year following fire.

Plant community composition and vegetation structure variability through space and time need to be included in management decisions (Willis and Birks 2006). The interaction of fire and grazing increases rangeland vegetation structure and composition diversity (Fuhlendorf *et al.* 2006, Churchwell *et al.* 2008, Coppedge *et al.* 2008, Engle *et al.* 2008, Fuhlendorf *et al.* 2010).

The different patch types create a structurally and compositionally heterogeneous landscape (Fuhlendorf and Engle 2001, 2004). Patch burning management suppressed the invasion of an exotic forage species in southern tallgrass prairie (Cummings *et al.* 2007). Further, burning vegetation increases the forage quality, and patch burn grazing can increase livestock weight gains (Limb *et al.* 2011b).

Grazing or fire alone does not yield the desired effects on suppressing or controlling Kentucky bluegrass. In this study, we combine these two disturbances to reduce Kentucky bluegrass abundance and maintain native plant community composition and productivity.

Specifically in this study, we hope to determine if: 1) early heavy grazing followed by summer rest can shift the balance to favor the native species, 2) patch burn management will promote native plant species and Kentucky bluegrass will be less abundant and productive than in season-long grazing pastures, and 3) livestock weight gain will be greater in patch burn pastures compared with season-long grazing pastures.

Procedures

This study is being conducted at the Central Grasslands Research Extension Center in Kidder County northwest of Streeter, N.D. The pastures have been used for a variety of grazing experiments in the past, but in years prior to this study, these pastures received only light grazing in the summer months. In 2009 and 2010, these pastures were stocked lightly in mid-May. Half of the animals were removed in late June or late July, and the rest remained until late September to mid-October.

Kentucky bluegrass had become dominant, with foliar cover averaging about 30 percent and frequency of occurrence (in 25- by 25-centimeter [cm] frames) averaging 90 percent in 2011 on the sites selected for vegetation monitoring.

In 2011, six pastures of about 40 acres each were assigned to one of two treatments: early intensive grazing and season-long grazing. Livestock were not rotated among pastures, and each pasture received the same treatment each year. On the early intensive treatment, 41 to 50 head of cattle were stocked in each pasture as early as possible after Kentucky bluegrass greened up (as early as mid-April) and were removed when 30 percent of the native species received some grazing (Table 1). Beginning with 2014, the cattle were removed after 1.2 months.

On the season-long treatment, 15 to 19 head were placed on each pasture in mid-May and removed between the end of August and mid-September, with the objective of grazing at a moderate stocking rate. Beginning with 2014, the cattle were placed on the season-long treatment at the same time they were stocked on the early intensive treatment. The actual stocking rates have been between 0.96 and 1.85AUMs/acre. The overall objective is to achieve a similar grazing pressure on the early intensive pastures as on the season-long pastures but in a shorter period of time (Table 1).

Table 1. Stocking history of the early intensive and season-long treatments for 2011 to 2014 at Central Grasslands Research Extension Center, Streeter, N.D.

Treatment	Year	Average head/pasture	Average starting weight (lbs.)	Date on	Date off	Days grazed	Stocking rate (AUM/ acre)
Early intensive	2011	41.7	750	May 2	June 6	35	0.98
	2012	46.0	748	April 13	May 24	41	1.26
	2013	50.0	773	May 6	June 7	32	1.10
	2014	43.6	785	April 30	June 6	37	1.19
Season-long	2011	15.0	780	May 13	Sept. 15	125	1.30
	2012	18.3	865	May 9	Sept. 21	135	1.85
	2013	15.7	694	May 23	Aug. 28	97	0.96
	2014	13.3	786	April 30	Sept. 2	125	1.23

In 2014, three pastures of about 40 acres were assigned to the patch burn treatment. These pastures were stocked briefly in 2014 to reduce fuel loads, and then one-fourth of each pasture was burned on Oct. 29, 2014. One-fourth of each pasture will be burned in the fall each year after a heavy frost so that after four years, all of each of the patch burn pastures will have been burned. The patch burn pastures will be stocked the same as the season-long pastures each year starting in 2015.

Changes in the plant community will be monitored by sampling the foliar cover of all plant species, litter and bare ground in ten 50- by 50-cm frames at each of four locations in each pasture. Forage production and utilization are determined using the cage comparison method, clipping twice per season, with standing crop on the early intensive treatment also being sampled when the cattle are removed. All samples are oven-dried and weighed.

These sampling procedures are different than those done on the early intensive and season-long pastures from 2009 to 2013 (Patton *et al.* 2014), so the results cannot be compared.

Results

Total Production and Utilization

Forage production was not significantly different *(P*>0.05) between the early intensive and the season-long grazing treatments in 2011, 2012, 2013 or 2014, and production on the patch burn treatment prior to burning was not different from the other treatments in 2014 (Table 2). At the time the cattle were taken off the early intensive treatment, they had utilized 29 to 59 percent of the forage produced so far in the season, but only 15 to 33 percent of the forage produced during the entire growing season.

At the time the cattle were taken off the season-long treatment, they had utilized 45 to 63 percent of the forage produced during the growing season. End-of-season utilization on the patch burn pastures averaged 36 percent in 2014 (Table 2). The differences in total utilization were significantly different between the early intensive and season-long treatments each year, but utilization on the patch burn treatment prior to burning was not different from either of the other treatments in 2014 ($P \leq 0.05$).

Foliar Cover

Figure 1 shows the relative foliar cover on the early intensive, patch burn and season-long treatments in 2014. This is baseline data for this study, and we will be watching for changes in these classes of cover as well as the other individual plant species on the sites as the study continues.

It may be noted that Kentucky bluegrass cover is less and litter cover is greater on the early intensive treatment than on the season-long treatment. This is supported by previous work comparing these treatments (Patton et al. 2014), but many of the differences in cover may have been present before the treatments were established, so we will look for changes in species cover through time when comparing the treatments.

Table 2. Total crop year precipitation (Oct. 1 to Sept. 30), peak total above-ground biomass production, and percent of forage utilization on the early intensive, season-long and patch burn treatments from 2011 to 2014.

Year	Precipitation	Early Intensive			Season-long		Patch Burn		All Sites
		Above-ground biomass	Utilization when removed	Utilization at end of season	Above-ground biomass	Utilization at end of season	Above-ground biomass	Utilization at end of season	Average production
	(inches)	(lbs/acre)	(percent)	(percent)	(lbs/acre)	(percent)	(lbs/acre)	(percent)	(lbs/acre)
2011	25.01	7,847	59	20[b1]	6,348	47[a]	N/A	N/A	7,098
2012	18.21	8,387	49	31[b]	6,545	63[a]	N/A	N/A	7,466
2013	16.97	6,314	42	33[b]	5,556	45[a]	N/A	N/A	5,935
2014	23.90	5,395	29	15[b]	5,786	52[a]	5,281	36[ab]	5,487
4-year average	21.02	7,516	50	28	6,150	52	N/A	N/A	6,497

[1]Means in the same row followed by the same letter are not significantly different at *P*=0.05.

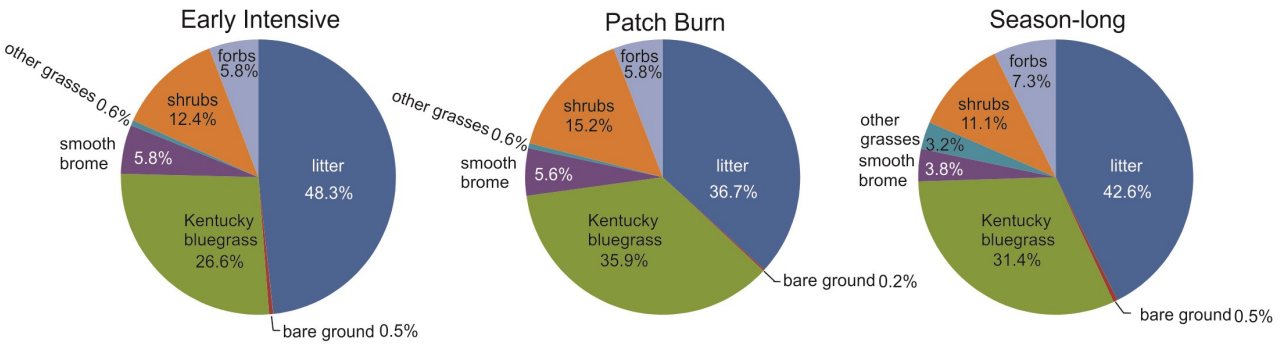

Figure 1. Relative cover on the early intensive, patch burn and season-long treatments in 2014.

Discussion

Kentucky bluegrass begins growth early, and early grazing appears to reduce its abundance in the community and favor other grasses and forbs. Fire removes senescent vegetation and promotes early green-up. This should concentrate grazing on the burned part of the patch burn pastures in 2015 early in the season and may help reduce Kentucky bluegrass. However, five to 10 years of grazing treatments will be required to change the plant species composition fundamentally.

At this early stage in the project, Kentucky bluegrass still makes up a large part of the plant community, and if early grazing ceased, Kentucky bluegrass would recover quickly. We will continue to monitor the impact of these treatments during the next several years.

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