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Sericea Lespedeza Control Strategies Differ in Their Impacts on Overall Range Health and Native Plant Species Composition

Abstract

Objective: The objective of this study was to evaluate the effects of sericea lespedeza (*Lespedeza cuneata*) control strategies of late summer prescribed burning and fall herbicide application on soil cover, native plant populations, and biological diversity.

Study Description: We established 16 individual units within an 80-acre native tallgrass pasture. Each unit was assigned to 1 of 4 treatments: control, spray only, burn only, or burn-plus-spray. Burn only and burn-plus-spray units were burned in early September. Spray only and burn-plus-spray units were sprayed with metsulfuron methyl (Escort XP, DuPont, Wilmington, DE) in late September. The change in soil cover and plant community composition from prior to treatment application to 1 year after treatment was measured.

The Bottom Line: The benefits of curbing a major invasion of sericea lespedeza may make burn-plus-spray a desirable short-term strategy in some instances, but widespread or extended use of the practice should be applied with caution.

Keywords

prescribed burning, sericea lespedeza, tallgrass prairie

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CATTLEMEN'S DAY 2018

KANSAS STATE UNIVERSITY CATTLEMEN'S DAY

Sericea Lespedeza Control Strategies Differ in Their Impacts on Overall Range Health and Native Plant Species Composition

G.A. Gatson, W.H. Fick, W.W. Hsu, and KC Olson

Introduction

Native grassland ecosystems are of tremendous ecological and economical value. They perform a host of critical ecosystem functions, including providing habitat for many native plants and animals, preserving biodiversity, limiting soil erosion, and providing forage for native and domestic grazing herbivores. The tallgrass prairie originally stretched across more than 160 million acres of the United States. Today, this once-expansive grassland has been reduced to less than 5% of its original area.

The largest remaining portion of the historical tallgrass prairie lies in the Kansas Flint Hills. Protected from the plow by shallow, rocky soil, the Flint Hills are largely used today for grazing beef cattle production. These grazing systems utilize abundant, nutrient-dense early-summer forage production for low-cost cattle body weight gains. The dual roles of the Flint Hills region as a valuable ecological remnant and a profitable producer of beef cattle are now both under threat of degradation by a noxious invader: sericea lespedeza (*Lespedeza cuneata*).

Sericea lespedeza is an herbaceous perennial legume that is both highly invasive to native grasslands and toxic to beef cattle. Recognizing its rapidly increasing damage to native ecosystems and grazing beef cattle production, Kansas has designated sericea lespedeza as a noxious weed. Ranchers and other land managers have employed several strategies in search of comprehensive control of sericea lespedeza. Recent research has demonstrated that late-summer prescribed burning is an effective method of sericea lespedeza control. The first portion of the present study indicated that fall herbicide application following late-summer prescribed burning may be useful to achieve rapid control of heavy sericea lespedeza infestations.

Questions remain, however, about the impact of these sericea lespedeza control strategies on non-target plant species and broader ecosystem health parameters. Restoration of degraded tallgrass prairie is the ultimate goal of strategies designed to control sericea lespedeza. Therefore, the objective of this study was to evaluate the effects of late-summer prescribed burning and fall herbicide application on soil cover, native plant populations, and biological diversity.

Experimental Procedures

A single 80-acre pasture located in Riley County, KS, was used for our study. Hay has been harvested annually from this pasture during mid-summer despite a light to moderate infestation of sericea lespedeza present throughout the pasture. We divided the pasture into 16 distinct experimental units. Where possible, existing watershed boundaries and timber breaks were used to divide the units. Within each of the 16 units, a single, permanent 100-yd transect was established. The endpoints of each transect were identified by steel fence posts accompanied by numbered concrete blocks.

Forage biomass, soil cover, and plant species composition were measured prior to treatment application in August 2016 and again 1 year after treatment in August 2017. Forage biomass was estimated at 1-yd intervals along each 100-yd transect using a visual obstruction technique. Soil cover and plant species composition were measured using a modified step-point method. Along each transect, 100 individual points were randomly selected using a step-point device. Each of these points was classified as a hit on bare soil, litter, or plant basal material. The closest rooted plant and the closest forb in a 180° arc in front of the point were also recorded. These observations were used to calculate the plant species composition of each unit. This summary of plant species composition was then used to calculate the Simpson index, a commonly-used measure of biological diversity.

We randomly assigned each of the 16 units to 1 of 4 treatments: negative control, spray only, burn only, or burn-plus-spray. On September 2-6, 2016, a prescribed burn was conducted on the burn only and burn-plus-spray units. This burn was performed when appropriate weather conditions prevailed and with permission from Riley County Emergency Management, Manhattan, KS (permit no. 1488). We then waited approximately 3 weeks for sericea lespedeza to re-emerge after burning. After this re-emergence was observed, metsulfuron methyl (Escort XP, DuPont, Wilmington, DE) was broadcasted on September 19-26, 2016, at the recommended rate of 1 oz/acre on all spray only and burn-plus-spray units.

Results and Discussion

Although forage biomass was greater prior to treatment application than it was 1 year following treatment, this change was not different between treatments ($P=0.12$; Table 1). The difference between years is likely attributable to the decrease in summer rainfall in 2017 compared with 2016.

The change in bare soil was not different between ($P \geq 0.09$) negative control, spray only, and burn only units; however, bare soil was increased ($P=0.01$) in the burn-plus-spray treatment when compared to the negative control. Concurrently, litter cover in the burn-plus-spray units was decreased ($P=0.01$) relative to negative controls. This sharp increase in bare soil and decrease in litter cover is certainly a rangeland health concern. Bare soil may lead to decreased water infiltration, increased water runoff, and increased soil erosion. Additionally, it may provide a seedbed suitable for establishment of invasive species such as sericea lespedeza.

Although the proportion of the soil surface occupied by basal plant cover was not altered relative to controls (P=0.27; Table 1), the plant species composition of this cover differed among treatments. Spray-only units and burn-plus-spray units had increased proportions of grasses (P≤0.05) and decreased proportions of forbs (P≤0.05) compared to control and burn-only treatments. A single late-summer prescribed burn did not shift the plant species composition balance between grasses and forbs in this study. Herbicide application, however, provided preferential selection against forbs, independent of whether or not a prescribed burn was conducted.

Flint Hills native pastures are traditionally dominated by 4 perennial warm-season grass species that form the bulk of grazing cattle diets: big bluestem, little bluestem, indiangrass, and sideoats grama. In our study, the combined cover of these major warm-season grasses was not altered (P≥0.14; Table 1) by burning or spraying alone compared with the negative control but was increased (P<0.01) for the burn-plus-spray treatment compared to the negative control. We calculated the combined cover of native forb species to determine the impact of treatment on forbs other than weedy invaders such as sericea lespedeza. Native forb cover decreased (P=0.01) in burn-plus-spray units and tended to decrease in spray only units (P=0.06) but was not changed in burn only units (P=0.39) when compared to the negative control.

The change in the number of plant species recorded per 100 points was not different (P=0.62; Table 1) between treatments. This indicated that plant species richness, 1 of the 2 components of biological diversity, was not altered over a 1-year period in response to our treatments. We used the Simpson index to measure the species evenness component of biological diversity. This index decreased (P≤0.04) for the burn-plus-spray units relative to the other 3 treatments.

These results were interpreted to indicate that a single application of late-summer prescribed fire did not produce substantial changes to the overall health and vigor of native tallgrass prairie. Combining this burning with fall herbicide application, however, may be damaging to native forbs, biodiversity, and overall range health. It is also speculated that this may be the result of combining stress factors on forbs shortly before they enter seasonal dormancy. In the first portion of this study, we noted the potential use of a burn-plus-spray treatment to achieve more rapid control of a heavy infestation of sericea lespedeza. The benefits of curbing a major invasion of sericea lespedeza may make burn-plus-spray a desirable short-term strategy in some instances, but widespread or extended use of this practice should be applied with caution.

Implications

Assessing the overall impact on range health is an essential component of properly evaluating any sericea lespedeza control practice. A single application of late-summer prescribed fire did not produce substantial changes in the vigor, composition, or diversity of major range plant species. Adding a subsequent fall herbicide application, however, did result in an increase in bare soil, a loss of native forb cover, and a decrease in biological diversity.

Table 1. Response of tallgrass prairie to a single application of late summer prescribed fire and fall herbicide

Change in[1]:	Negative control	Spray only	Burn only	Burn + spray	Standard error[2]	P-value[3]
Biomass, cwt dry matter/acre	-1.0	-2.7	-8.8	-9.3	3.05	0.12
Bare soil, % of total area	-6.0[b]	5.0[a,b]	12.2[a,b]	24.6[a]	7.71	0.05
Litter cover, % of total area	6.3[a]	-5.7[a,b]	-9.2[a,b]	-28.2[b]	8.23	0.03
Basal plant cover, % of total area	-0.3	0.7	-3.0	3.6	2.89	0.27
Total grass cover, % of total basal cover	-8.3[b]	5.7[a]	-9.2[b]	9.8[a]	4.55	0.01
Major warm-season grasses,[4] % of total basal cover	0.3[b]	0.0b	-6.4[b]	9.8[a]	3.41	0.01
Total forb cover, % of total basal cover	8.5[a,b]	-5.5[b,c]	9.0[a]	-9.6[c]	4.61	0.01
Native forb cover, % of total basal cover	5.7[a,b]	-2.9[b,c]	9.1[a]	-6.5[c]	2.98	<0.01
Plant species count, number recorded	3.7	0.3	-1.6	2.8	3.61	0.62
Simpson index	0.14[a]	0.00[a]	0.10[a]	-0.15[b]	0.051	<0.01

[1]Change calculated as final observation recorded 1 year following treatment minus initial observation recorded prior to treatment application.
[2]Mixed-model standard error associated with comparison of treatment main effect means.
[3]Treatment main effect.
[4]Combined basal cover of big bluestem, little bluestem, indiangrass, and sideoats grama.
[a,b,c]Treatments within a row with unlike superscripts differ (P≤0.05) unless otherwise noted.