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Late Summer Prescribed Fire and Fall Herbicide Application Show Strong Suppressive Effects on Sericea Lespedeza Frequency and Vigor

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Late Summer Prescribed Fire and Fall Herbicide Application Show Strong Suppressive Effects on Sericea Lespedeza Frequency and Vigor

Abstract

Objective: The objective of this study was to evaluate the efficacy of a one-time application of late summer prescribed fire followed by fall herbicide application for substantially reducing sericea lespedeza frequency and vigor.

Study Description: A single 80-acre native tallgrass pasture was divided into 16 units. Each of these units was either burned in early September (burn only), sprayed with Escort XP (DuPont, Wilmington, DE) in late September (spray only), burned in early September and subsequently sprayed in late September (burn + spray), or neither burned nor sprayed (control). Sericea lespedeza frequency and vigor was measured shortly before treatment application and again 1 year following treatment application.

The Bottom Line: Applying late summer prescribed fire alone is an effective and low-cost means of sericea lespedeza control in areas of light infestation, while burning plus spraying holds promise as a useful strategy to achieve more rapid control of heavy infestations.

Keywords

herbicide, prescribed burning, sericea lespedeza

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KANSAS STATE UNIVERSITY CATTLEMEN'S DAY

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Introduction

Sericea lespedeza (*Lespedeza cuneata*) is an herbaceous perennial legume native to Asia. Beginning in the 19th century, it was introduced into the United States as both a forage crop and a soil-conservation measure. The broad adaptability of sericea lespedeza and its tolerance of poor quality soils made it a popular choice for re-seeding former strip-mining sites, highway rights-of-way, dams, and waterways. Unfortunately, the same traits that made sericea lespedeza a common selection for re-seeding projects also allowed it to invade native rangelands and pastures. Combining adaptability and hardiness with prolific seed production and allelopathy, sericea lespedeza has invaded more than 950 square miles in Kansas alone, where it was designated as a noxious weed in 2000.

This infestation is particularly pervasive within the Flint Hills region, where it has degraded native prairie ecosystems and reduced carrying capacity of rangelands for beef production. Sericea lespedeza is of little value to grazing cattle due to its high tannin content and inhibition of native grass production. Prescribed pasture burns conducted in March or April, a common component of current Flint Hills grazing systems, have not slowed the encroachment of sericea lespedeza and may have accelerated its spread. Recent research has shown that moving the application of prescribed fire from early April to August or September resulted in a decrease in sericea lespedeza frequency and vigor. Importantly, however, this required a multi-year commitment to late-season burning to achieve comprehensive sericea lespedeza control. Herbicide application alone has also proven to be inadequate to achieve complete control of sericea lespedeza. In many situations, achieving control of sericea lespedeza without the need for costly re-application of herbicide or a long-term commitment to late-season burning may be desired. Therefore, the objective of our study was to evaluate the efficacy of a one-time application of late summer prescribed fire followed by fall herbicide application for substantially reducing sericea lespedeza frequency and vigor.

Experimental Procedures

This study was conducted in Riley County, KS, on a single 80-acre native tallgrass pasture from which hay is routinely harvested during mid-summer. A light to moderate infestation of sericea lespedeza was present at the outset of this experiment. The pasture was divided into 16 units, using existing timber breaks and natural watersheds to form the boundaries of the units where possible. A single, permanent 100-yd transect was established within each unit. Transect endpoints were marked using numbered concrete blocks that remained in place for the duration of the experiment.

In late August 2016, initial measurements of sericea lespedeza frequency and vigor were taken along these transects. At 3-foot intervals, a 12 × 12-in square plot was projected alongside the transect. Within these plots, sericea lespedeza presence or absence was recorded. If sericea lespedeza was observed within a given plot, 3 additional observations were made: 1) whether multiple sericea lespedeza plants were present, 2) the stem length of the sericea lespedeza plant closest to the 1-yd mark on the transect line, and 3) the crown maturity of the closest sericea lespedeza plant. Stem length was measured by manually holding erect the sericea lespedeza stem and measuring from the ground to the tip of the stem. Crown maturity was evaluated visually. Crowns which contained senescent material or multiple stems were considered mature; all others were considered immature.

Soil cover and plant species composition were assessed in August 2016 prior to treatment application. A modified step-point technique was used to select 100 randomly-located points along each transect. At each point, ground cover was recorded (vegetation, bare soil, or litter) along with the species of the closest rooted plant within a 180° arc in front of the selected point. If the closest plant was a grass, the closest non-grass plant species within a 180° arc was recorded also. These observations were used to calculate individual plant species composition. In August 2017, sericea lespedeza frequency and vigor, ground cover, and plant species composition were again assessed along transects to determine the effects of treatment.

Each unit was randomly assigned to 1 of 4 treatments: negative control, spray only, burn only, or burn-plus-spray. Prescribed burns were conducted on burn only and burn-plus-spray units with permission from Riley County Emergency Management, Manhattan, KS (permit no. 1488), and in accordance with responsible fire management techniques on September 2-6, 2016. Following post-fire re-emergence of sericea lespedeza (approximately 3 weeks), metsulfuron methyl (Escort XP, DuPont, Wilmington, DE) was broadcast applied at the recommended rate of 1 oz per acre on both spray only and burn-plus-spray units on September 19-26, 2016.

Results and Discussion

Prior to treatment application, sericea lespedeza comprised 1.1% of total basal cover and was not different between treatments (P=0.38; Table 1). One year later, sericea lespedeza had increased approximately three-fold to 4.0% of basal cover in control units. This dramatic 1-year increase highlights the invasive capabilities of sericea lespedeza when it remains untreated. Spray only, burn only, and burn-plus-spray units had substantially less sericea lespedeza than controls at the conclusion of the study

(P=0.04). Interestingly, these 3 treatments were not different from one another in final sericea lespedeza frequency (P≥0.95).

When initial measurements were obtained, the proportion of individual 12 × 12-in plots containing sericea lespedeza, multiple stems of sericea lespedeza, and mature sericea lespedeza stems were not different between treatments (P≥0.16; Table 1). Following treatment, each of these three parameters followed a similar pattern to one another. The number of plots containing sericea lespedeza, multiple sericea lespedeza stems, and mature sericea lespedeza stems were not different between spray only, burn only, and burn-plus-spray units (P≥0.50); however, they were less than control units for all 3 measures (P≤0.03). The burn-plus-spray treatment was more effective at reducing sericea lespedeza stem length than were the other treatments. The weighted average sericea lespedeza stem length in burn-plus-spray units was the greatest at the outset of the experiment (P=0.03) but was less than in the control units following treatment application (P<0.01). The other treatments were not different (P≥0.10) from controls.

We interpreted these data to suggest that the efficacy of spraying only, burning only, or burning plus spraying for the control of sericea lespedeza was not substantially different in this study. Notably, the level of initial sericea lespedeza frequency in spray-only and burn-only units was low. Therefore, it is plausible that the combination of fall burning and herbicide application is a more effective treatment for rapidly reducing heavy sericea lespedeza infestations. We suspect that this may be the case.

Achieving comprehensive control over sericea lespedeza is only one facet of the restoration process for Flint Hills pastures invaded by this weed. Additionally, a suitable treatment must be cost-effective and have limited detrimental effects on desirable, non-target native plant species. On the basis of cash costs alone, the burn only option is certainly less expensive at approximately $0.75/acre than alternatives that involve herbicide application. The effects of each of these treatments on non-target plant species is the subject of the second portion of this study.

Implications

Restoring pastures degraded by sericea lespedeza encroachment is crucial to protecting and enhancing Flint Hills grazing lands. Applying late summer prescribed fire, with or without fall herbicide application, results in strong suppression of sericea lespedeza. Burning alone appears to be both an effective and low cost means of sericea lespedeza control in areas of light infestation, while combining burning with spraying holds promise as a useful strategy to achieve more rapid control in pastures with heavy sericea lespedeza infestations.

Table 1. Effects of prescribed fire and fall herbicide application on frequency and vigor of sericea lespedeza

Item	Negative control	Spray only	Burn only	Burn + spray	Standard error[1]	P-value[2]
Sericea lespedeza, % of basal cover						
Initial[3]	1.4	0.2	0.2	2.2	1.11	0.38
Final[4]	4.0[a]	0.1[b]	0.1[b]	0.2[b]	1.05	0.04
Plant canopies containing sericea lespedeza, % of plots						
Initial[3]	37.3	21.0	6.8	21.0	9.81	0.16
Final[4]	21.3[a]	0.7[b]	1.2[b]	5.2[b]	5.32	0.05
Weighted average sericea lespedeza stem length, in						
Initial[3]	4.4[bc]	3.7[c]	6.2[b]	8.7[a]	1.01	<0.01
Final[4]	7.0[a]	4.5[ab]	7.0[ab]	4.0[b]	2.82	0.02
Multiple sericea lespedeza stems present, % of plots						
Initial[3]	33.3	19.7	6.4	18.6	9.70	0.23
Final[4]	19.7[a]	0.7[b]	1.2[b]	4.4[b]	4.92	0.05
Mature sericea lespedeza crown closest, % of plots						
Initial[3]	24.7	10.7	5.6	14.8	8.67	0.40
Final[4]	15.7[a]	0.0[b]	0.4[b]	0.4[b]	4.20	0.05

[1]Mixed-model standard error associated with comparison of treatment main effect means.
[2]Treatment main effect.
[3]Initial observations recorded August 2016 prior to treatment application.
[4]Final observations recorded August 2017, 1 year after treatment application.
[a,b,c]Treatments with unlike superscripts differ (P≤0.05) unless otherwise noted.