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Comprehensive Control of Sericea Lespedeza with Four Consecutive Years of Prescribed Fire During Summer

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Abstract

Objective: The objective of this study was to evaluate the effects of annual prescribed burning applied during the growing season on vigor of sericea lespedeza (*Lespedeza cuneata*) infesting native tallgrass range.

Study Description: We burned nine fire-management units (14 ± 6 acres) at one of three prescribed-burning times: early spring (April 1), mid-summer (August 1), or late summer (September 1). Effects on sericea lespedeza were evaluated annually on July 10, October 10, and November 1.

The Bottom Line: Compared to traditional spring, dormant-season burning, burning during the summer months over four consecutive years resulted in significant decreases in aerial frequency, stem length, seed production, and biomass of sericea lespedeza. Growing-season prescribed burning is an inexpensive and comprehensive means to control sericea lespedeza propagation and invasion.

Keywords

sericea lespedeza, prescribed burning

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Introduction

Sericea lespedeza (*Lespedeza cuneata*) is a highly fecund noxious weed in Kansas and surrounding states. Individual sericea lespedeza stems are capable of producing more than 700 seeds annually. Because of prolific reproductive capabilities, sericea lespedeza can rapidly infiltrate native and cultivated grasslands; seed can be transported great distances via farm machinery and the alimentary canal of wild and domestic herbivores. Sericea lespedeza infests more than 900 square miles of pasture in Kansas alone, primarily in the Flint Hills region. Resulting degradation to native habitats for wildlife and pasture conditions for domestic herbivores has been devastating.

Traditional management practice in the Kansas Flint Hills involves annual spring burning in April followed by grazing with yearling beef cattle from late April to August. During seasonal grazing, 40 to 60% of annual graminoid production is removed and grazing lands remain idle for the remainder of the year. Under these management practices, sericea lespedeza has steadily expanded into the tallgrass prairie biome. Previous research reported that dormant-season, spring fires may stimulate sericea lespedeza seed germination. Additionally, application of growing season fire at three-year intervals decreased the rate of sericea lespedeza invasion. Therefore, the objective of our study was to evaluate the effects of annual prescribed burning applied during the growing season on vigor of sericea lespedeza infesting native tallgrass range.

Experimental Procedures

A 125-acre native tallgrass pasture located in Geary County, KS, was used for our study. The site was historically grazed during the winter and spring by beef cattle; moreover, the infestation of sericea lespedeza on the site was problematic for the 20-year period preceding our study. This site was divided along watershed boundaries into nine fire-management units (14 ± 6 acres). Unit boundaries were delineated by mowing fire-breaks (≈ 20-ft wide) around each perimeter. Units were assigned randomly to one of three prescribed-burning times (n = 3/treatment): early spring (April 1), mid-summer (August 1), or late summer (September 1). Prescribed burns were carried out on or near target dates when appropriate environmental conditions prevailed: surface wind speed < 15 mph; surface wind direction = steady and away from urban areas; mixing height > 1800 ft; transport wind speed > 8 mph; relative humidity = 40 to 70%; ambient temperature = 50 to 100°F; and Haines index ≤ 4. All prescribed burning activities were carried out with the permission of Geary County Emergency Services, Junction City, KS (permit no. 348).

Permanent 100-yd transects were established in each fire management unit. Aerial frequency of sericea lespedeza frequency and stem length were measured along each transect (100 × 12-in^2 plot points/transect). Data were collected along transects on average dates July 19 and October 10. Biomass was estimated at 3-ft intervals along transects using a visual obstruction technique. In addition, a 12 × 12-in plot was projected on the side of transects at each point of measurement. Aerial presence of sericea lespedeza was noted on each measurement (e.g., yes or no). If sericea lespedeza was present, stem length was measured in inches from the surface of the soil to its maximum length by manually holding the sericea lespedeza stem erect.

A total of 100 mature sericea lespedeza plants were collected adjacent to permanent transects in each burn-management unit immediately after the first killing frost (approximately November 1). Plants were clipped at ground level and placed into a labeled paper bag. Bagged samples were dried using a forced-air oven. Individual plants in each sample were defoliated by hand. Resulting seeds, chaff, and stems were also separated by hand. The total amount of seed recovered from each sample was weighed to the nearest milligram. Seed weight was converted to seed count, assuming a density of 770 seeds/g. Average seed production was calculated by dividing the number of seeds by the number of sericea lespedeza plants in each sample (n = 100).

In the final year of the experiment, 10 randomly-placed, quarter-meter plots were harvested via clipping along each transect to determine sericea lespedeza biomass within our prescribed-fire treatments. Clipped material was hand sorted into sericea lespedeza biomass and non-sericea lespedeza biomass, dried, and weighed.

Results and Discussion

Canopy frequency and average stem length of sericea lespedeza were not influenced by time of measurement; therefore, main effects of treatment were reported (Table 1). Following four years of treatment, average stem length, and aerial frequency of sericea lespedeza were less ($P \leq 0.01$) in mid- and late summer treatments than in the early spring treatment.

Whole-plant dry matter weight of sericea lespedeza at dormancy and seed production per sericea lespedeza plant were greatly diminished ($P < 0.01$) in mid- and late summer treatments compared with the early spring treatment (Table 1). Seed production in areas treated with mid-summer fire was less than 5% of that in areas treated with dormant-season spring fire. In areas treated with late-summer fire, seed production was less than 0.1% of areas treated with dormant-season spring fire. Clearly, the capability of sericea lespedeza to reproduce via seed was sharply curtailed under a growing season fire regime.

The total amount of sericea lespedeza biomass in all treatments, as measured via manual harvest during July of 2017, is shown in Table 1. Biomass of sericea lespedeza in the early treatment was 901 lb dry matter/acre, or 17% of the total biomass. Biomass of sericea lespedeza in the mid- (394 lb dry matter/acre) and late summer treatment (86 lb dry matter/acre) was much less ($P \leq 0.01$) than in the early spring treatment (7% and 2% of total biomass for the mid- and late summer treatments, respectively).

Implications

Burning during the summer months for 4 consecutive years resulted in significant decreases in aerial frequency, stem length, seed production, and biomass of sericea lespedeza compared to traditional spring, dormant-season burning. Growing-season prescribed burning is an inexpensive and comprehensive means to control sericea lespedeza propagation and invasion. At the time of this writing, prescribed burning in the Kansas Flint Hills had a cash cost of less than $1/acre, whereas fall application of herbicide was estimated to cost > $18/acre.

Table 1. Effects of prescribed fire timing on stem length, aerial frequency, whole-plant dry matter weight, seed production, and biomass of sericea lespedeza on native tallgrass range

Sericea lespedeza measurements	Early spring (April 1)	Mid-summer (August 1)	Late-summer (September 1)	Standard error[1]	P-value
Mean stem length,[2] in	11.6[a]	4.8[b]	3.1[b]	3.37	< 0.01
Aerial frequency,[2] % of all plots	51.2[a]	31.2[b]	18.9[c]	5.95	≤ 0.04
Whole-plant dry matter weight, mg/plant	3,954[a]	460[b]	163[b]	561.10	< 0.01
Seeds, number/plant	710.8[a]	32.6[b]	0.5[b]	117.82	< 0.01
Biomass, lb/acre	901[a]	394[b]	86[b]	201.10	< 0.01

[1] Mixed-model standard error associated with comparison of treatment main effect means.
[2] Treatment main effect.
[abc] Means within a row with unlike superscripts are different ($P \leq 0.04$).