Kansas Agricultural Experiment Station Research Reports

Volume 3
Issue 1 *Cattlemen's Day*

Article 2

January 2017

Effects of Growing-Season Prescribed Burning on Vigor of Sericea Lespedeza in the Kansas Flint Hills: II. Plant-Species Composition

J. A. Alexander
Kansas State University, Manhattan, jaalexan@k-state.edu

W. H. Fick
Kansas State University, Manhattan, whfick@ksu.edu

J. Lemmon
Kansas State University, Manhattan, lemmon08@k-state.edu

See next page for additional authors

Recommended Citation

Alexander, J. A.; Fick, W. H.; Lemmon, J.; Gatson, G. A.; Preedy, G. W.; and Olson, K C. (2017) "Effects of Growing-Season Prescribed Burning on Vigor of Sericea Lespedeza in the Kansas Flint Hills: II. Plant-Species Composition," *Kansas Agricultural Experiment Station Research Reports*: Vol. 3: Iss. 1. https://doi.org/10.4148/2378-5977.1336

Effects of Growing-Season Prescribed Burning on Vigor of Sericea Lespedeza in the Kansas Flint Hills: II. Plant-Species Composition

Abstract

Fire has, for centuries, been a key force for sustainability of native ecosystems in the Kansas Flint Hills. Prior to the arrival of European settlers, prescribed and wild fires occurred at less than 3-year intervals in the tallgrass prairie region. As a result, native tallgrass plant communities adapted to fire at regular intervals and plant-species composition became stable on a geologic time scale.

Currently, prescribed fire is used in the Kansas Flint Hills as a treatment for control of woody-stemmed invasive species such as eastern red cedar, honey locust, and roughleaf dogwood. These fires are generally applied in March and April and have become an integral part of the most common grazing management practice in the Kansas Flint Hills: annual spring burning in April followed by intensive grazing with yearling beef cattle for a relatively short period of time from late April to early August. Annual burning reportedly results in 0.2 to 0.3 lb of additional daily weight gain for yearling cattle when used in that way. In contrast, prescribed and wild fires during the presettlement era were not concentrated during any particular season of the year.

Use of prescribed burning that is limited to a short interval during the spring has coincided with a steady increase of an invasive, non-woody, perennial legume known as sericea lespedeza (*Lespedeza cuneata*). Introduced into North America during the late 19th century, sericea lespedeza has proven highly adaptable to Flint Hills soils and climate. Prolific seed production appears to be the primary means of invasion. Seeds of sericea lespedeza are not wind-borne but are easily transported via the digestive tract of tannin-resistant herbivores and via machinery.

Until recently, control of sericea lespedeza has relied heavily on costly, repeated application of herbicides, which has not checked the spread of the plant. We previously reported that prescribed burning during the months of August and September had strong suppressive effects on stand vigor and seed production of sericea lespedeza at a greatly reduced cost compared with herbicide. Questions remain, however, about the effects of growing-season prescribed burning on non-target plant species and soil cover. Therefore, the objective of this study was to evaluate the effects of growing-season prescribed fire on soil cover and populations of native grasses, forbs, and shrubs.

Keywords

sericea lespedeza, prescribed burning, growing season

Authors

J. A. Alexander, W. H. Fick, J. Lemmon, G. A. Gatson, G. W. Preedy, and K C. Olson

K-STATE Research and Extension

CATTLEMEN'S DAY 2017

KANSAS STATE UNIVERSITY CATTLEMEN'S DAY

Effects of Growing-Season Prescribed Burning on Vigor of Sericea Lespedeza in the Kansas Flint Hills: II. Plant-Species Composition

J.A. Alexander, W.H. Fick, J. Lemmon, G.A. Gatson, G.W. Preedy, and K.C. Olson

Introduction

Fire has, for centuries, been a key force for sustainability of native ecosystems in the Kansas Flint Hills. Prior to the arrival of European settlers, prescribed and wild fires occurred at less than 3-year intervals in the tallgrass prairie region. As a result, native tallgrass plant communities adapted to fire at regular intervals and plant-species composition became stable on a geologic time scale.

Currently, prescribed fire is used in the Kansas Flint Hills as a treatment for control of woody-stemmed invasive species such as eastern red cedar, honey locust, and roughleaf dogwood. These fires are generally applied in March and April and have become an integral part of the most common grazing management practice in the Kansas Flint Hills: annual spring burning in April followed by intensive grazing with yearling beef cattle for a relatively short period of time from late April to early August. Annual burning reportedly results in 0.2 to 0.3 lb of additional daily weight gain for yearling cattle when used in that way. In contrast, prescribed and wild fires during the pre-settlement era were not concentrated during any particular season of the year.

Use of prescribed burning that is limited to a short interval during the spring has coincided with a steady increase of an invasive, non-woody, perennial legume known as sericea lespedeza (*Lespedeza cuneata*). Introduced into North America during the late 19th century, sericea lespedeza has proven highly adaptable to Flint Hills soils and climate. Prolific seed production appears to be the primary means of invasion. Seeds of sericea lespedeza are not wind-borne but are easily transported via the digestive tract of tannin-resistant herbivores and via machinery.

Until recently, control of sericea lespedeza has relied heavily on costly, repeated application of herbicides, which has not checked the spread of the plant. We previously reported that prescribed burning during the months of August and September had strong suppressive effects on stand vigor and seed production of sericea lespedeza at a greatly reduced cost compared with herbicide. Questions remain, however, about the

effects of growing-season prescribed burning on non-target plant species and soil cover. Therefore, the objective of this study was to evaluate the effects of growing-season prescribed fire on soil cover and populations of native grasses, forbs, and shrubs.

Key words: sericea lespedeza, prescribed burning, growing season

Experimental Procedures

A 125-acre native tallgrass pasture located in Geary Co., 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. The study site was divided along natural watershed boundaries into 9 fire-management units (12 ± 6 acres). Unit boundaries were delineated by mowing firebreaks (≈ 20 ft wide) around each perimeter. Units were assigned randomly to 1 of 3 prescribed-burning times (n = 3 / treatment): early spring (April 1), mid-summer (July 30), or late summer (September 1). Prescribed burns were carried out on or near target dates when appropriate environmental conditions prevailed (surface wind speed = 10 to 15 mph; surface wind direction = steady and away from urban areas; mixing height greater than 1800 ft; transport wind speed = 8 to 20 mph; relative humidity = 40 to 70%; ambient temperature = 75 to 100°F; and Haines index ≤ 4). All prescribed burning activities were carried out with the permission of Geary Co. Emergency Services, Junction City, KS (permit no. 348). Fires were applied during 2014, 2015, and 2016.

Plant species composition and soil cover were measured along permanent 100-yd transects in each fire-management unit. Transects were laid out on a southwest-to-northeast gradient; transect ends were marked using steel fence posts. Composition and cover were assessed in mid-July for 3 consecutive years using a modified step-point technique. One hundred points adjacent to each transect were evaluated for bare soil, litter cover, or basal plant area (percent of total area). Plants were identified by species, and basal cover of individual species was expressed as a percentage of total basal plant area.

Results and Discussion

Bare soil, litter cover, and basal vegetation cover, expressed as a percent of total land area, were not different ($P \geq 0.38$) among treatments and averaged 40.3, 49.0, and 10.7%, respectively (Table 1). Cover values were indicative of normal, healthy soils and tallgrass plant communities. Total grass cover, major warm season grass species cover, total forb cover, and total shrub cover were not influenced ($P \geq 0.36$) by the timing of prescribed burning. We interpreted these data to indicate that prescribed burning during April, August, or September produced similar effects on soil cover and plant species composition.

Prior to our study, basal sericea lespedeza cover on all burn management units was not different ($P \leq 0.52$) between treatments (Table 1). Sericea lespedeza basal cover trended ($P = 0.18$) downward over the 3-year course of our study and averaged 4.89, 3.46, and 1.55% for April, August, and September prescribed burns, respectively. In addition, basal area of Baldwin's ironweed and western ragweed were greater ($P \leq 0.01$) on areas burned in April than those burned in August.

Smooth sumac basal cover was lesser (P=0.04) in areas treated with prescribed fire in August than those treated with prescribed fire in April; moreover, roughleaf dogwood basal cover was lesser (P=0.04) in areas treated with prescribed fire in August and September than those treated with prescribed fire in April. Treatments had no effect (P≤0.50) on basal cover of buckbrush or leadplant; however, New Jersey tea basal cover (a preferred diet component for beef cattle) was greater (P=0.04) in areas treated with prescribed fire in August and September than those treated with prescribed fire in April.

Implications

In contrast to published reports involving herbicide application, control of sericea lespedeza using growing-season prescribed burning did not result in measurable collateral damage to non-target plant species. Growing-season prescribed burning decreased basal cover of undesirable plants such as Baldwin's ironweed, western ragweed, smooth sumac, and roughleaf dogwood compared with conventional spring burning. In contrast, soil cover, grass basal cover, and forb basal cover were not affected by the timing of prescribed burning. Herbicide control of sericea lespedeza is known to be expensive (≈ $18 USD/acre annually) and tedious and can negatively affect non-target plant species. In contrast, growing season prescribed burning costs less than $1 USD/acre and strongly hindered vigor and seed production of sericea lespedeza and tended to decrease basal cover of sericea lespedeza in our study.

Table 1. Effects of prescribed-burn timing of native tallgrass rangeland on graminoid basal cover, forb basal cover, occurrence of bare soil and litter cover during the middle of the growing season

Item	Early spring burn (April 1)	Mid-summer burn (July 30)	Late-summer burn (September 1)	Standard error*	P-value†
Bare soil, % of total area	40.4	42.2	38.2	10.12	0.92
Litter cover, % of total area	49.3	47.9	49.9	10.09	0.98
Basal vegetation cover, % of total area	10.3	9.9	11.9	1.48	0.38
Total grass cover, % of total basal cover	84.4	86.2	88.0	2.71	0.44
Major warm-season grasses‡, % of total basal cover	55.2	51.2	55.6	5.53	0.69
Total forb cover, % of total basal cover	13.7	11.8	9.6	2.83	0.36
Total shrub cover, % of total basal cover	1.87	1.94	2.44	0.605	0.60
Western ragweed, % of total basal cover	3.34[a]	1.20[b]	1.15[b]	0.844	0.02
Baldwin's ironweed, % of total basal cover	0.78[a]	0.23[b]	0.49[a, b]	0.217	0.06
Sericea lespedeza, % of total basal cover	4.89	3.46	1.55	1.753	0.18
Smooth sumac, % of total basal cover	0.34[a, b]	0.14[b]	0.44[a]	0.113	0.04
Roughleaf dogwood, % of total basal cover	0.19[a]	0.05[b]	0.02[b]	0.065	0.04
Leadplant, % of total basal cover	0.80	1.19	1.38	0.490	0.50
New Jersey tea, % of total basal cover	0.00[a]	0.19[b]	0.01[c]	0.081	0.04
Buckbrush, % of total basal cover	0.48	0.35	0.50	0.209	0.74

* Mixed-model standard error associated with comparison of treatment main effect means.

† Treatment main effect.

‡ Combined basal cover of big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyium scoparium*), indiangrass (*Sorghastrum nutans*), and sideoats grama (*Bouteloua curtipendula*).

[abc] Means within row having unlike superscripts differ (P≤0.05).