

Effects of Prescribed Fire Timing on Stocker Cattle Performance and Native Plant Composition: Year 3 of 6

Z.M. Duncan, A.J. Tajchman, M.P. Ramirez, J. Lemmon, K.J. Subr, W.R. Hollenbeck, D.A. Blasi, and K.C. Olson

Abstract

Mid- or late-summer prescribed fire can be utilized to reduce sericea lespedeza (*Lespedeza cuneata*) infestations and improve forb diversity; however, the effect of fire applied later in the year (i.e., August-October) on growth performance of yearling grazing cattle has not been evaluated. In this experiment, 18 pastures were grouped by watershed and each watershed was assigned to one of three prescribed-fire treatments (n = 6 pastures per treatment): spring (April 9 ± 5.1 days), summer (August 23 ± 4.9 days), or fall (September 29 ± 8.7 days). Yearling cattle were grazed from May to August at a targeted stocking density of 250 lb of live-weight per acre for three consecutive grazing seasons. A permanent 328-ft transect was established in each pasture and was used to determine soil cover and plant composition using a modified step-point method. All fire treatments were applied prior to grazing. Total body weight (BW) gains and average daily gains did not differ ($P = 0.22$) between spring and summer prescribed-fire treatments. Final BW were greater ($P = 0.03$) for calves that grazed spring- and summer-burned pastures compared with those that grazed fall-burned pastures. No differences ($P \geq 0.14$) in basal cover of total grasses, native grass species, total forbs, and native forb species were observed between treatments. We interpreted these results to suggest that summer-season prescribed fire did not reduce stocker cattle performance or considerably alter native rangeland plant composition when compared with spring-season prescribed fire.

Introduction

Ranchers in the Kansas Flint Hills traditionally apply annual spring-season prescribed fire to improve stocker cattle body weight gains and improve warm season grass production. Recent research has demonstrated a reduction in sericea lespedeza (*Lespedeza cuneata*) infestations when the timing of prescribed fire application is shifted from spring to late summer or early fall. Additional benefits of late-summer or early-fall prescribed fire include increased forb diversity, improved air quality by distributing smoke throughout the year, and increased flexibility of burn dates. Despite optimistic reports, ranchers have voiced concerns that cattle growth performance and native warm-season grass populations may be negatively affected when fire is applied later in the year (i.e., August-October). At this time, no direct comparisons of yearling stocker

cattle growth performance are available for cattle grazing spring-, summer-, and fall-burned rangelands; therefore, the objective of our experiment was to document the effects of prescribed-fire timing on stocker cattle performance, soil cover, and plant species composition over a six-year period.

Experimental Procedures

Our experiment was conducted at the Kansas State University Beef Stocker Unit. Eighteen pastures were grouped by watershed and each watershed was assigned to one of three prescribed-fire treatments ($n = 6$ pastures per treatment): spring (April 9 ± 5.1 days), summer (August 23 ± 4.9 days), or fall (September 29 ± 8.7 days). A permanent 328-ft transect was established in each pasture. Pre-treatment plant species composition and soil cover were measured along each transect in June 2018 using a modified step-point method, and re-evaluated in 2019, 2020, and 2021. Prescribed-fire treatments were applied prior to grazing in 2019, 2020, and 2021.

A total of 1,060 yearling cattle were grazed over three consecutive growing seasons beginning in 2019. Pastures were stocked at a targeted density of 250 lb of live weight per acre for 90-days. Three-hundred-sixty heifers [initial body weight (BW) = 621 ± 85.7 lb] were grazed from May 2 to July 31 in year one; 315 steers (initial BW = 738 ± 123.3 lb) were grazed from May 11 to August 10 in year two; and 385 steers (initial BW = 616 ± 74.4 lb) were grazed from May 5 to August 3 in year three. All calves were purchased in Texas and transported to the Kansas State Beef Stocker Unit. Upon arrival, calves were individually weighed and randomly assigned to pasture and treatment. At the start of each grazing season, calves were individually weighed to determine initial BW, vaccinated for viral respiratory and clostridial pathogens, treated for internal and external parasites, and allocated to their assigned pasture. In addition, a growth-promoting implant was given to steers in year two and year three. Following the 90-day grazing period, calves were gathered and individual BW were measured.

Results and Discussion

After three consecutive grazing seasons, total BW gains (BWG) and average daily gains (ADG) did not differ ($P = 0.22$; Table 1) between calves that grazed spring- and summer-burned pastures; however, calves assigned to the fall prescribed-fire treatment had lower ($P \leq 0.01$) total BWG and ADG compared with calves assigned to the spring prescribed-fire treatment. Total BWG and ADG tended to be greater ($P = 0.09$) in the summer prescribed-fire treatment compared with the fall prescribed-fire treatment. As a result, final BW were greater ($P = 0.03$) for calves assigned to spring- and summer-burned pastures compared with those assigned to the fall-burned pastures. Final BW were 896, 894, and 872 lb for the spring, summer, and fall prescribed-fire treatments, respectively.

When soil cover was evaluated, proportions of bare soil were greater ($P \leq 0.01$; Table 2) in pastures burned in the spring compared with pastures burned in the summer and fall. Conversely, proportions of litter on the soil surface were greater ($P \leq 0.01$) in the summer and fall prescribed-fire treatments when compared with the spring prescribed-fire treatment. No differences ($P = 0.11$) in total basal vegetation cover were observed between treatments. In addition, basal cover of total grasses, native grass species, total

forbs, and native forb species did not differ ($P \geq 0.14$) between spring-, summer-, or fall-burned pastures. Conversely, basal cover of total shrubs tended to be greater ($P = 0.07$) in the fall prescribed-fire treatment compared with the spring prescribed-fire treatment, whereas the summer prescribed-fire treatment was intermediate and not different ($P = 0.56$) from either spring or fall treatments; however, basal cover of increaser shrubs (i.e., shrubs that tend to proliferate in response to grazing) did not differ ($P = 0.11$) between prescribed-fire treatments.

Implications

We interpreted these data to suggest that land managers could use summer-season prescribed fire to manage sericea lespedeza infestations without reducing grazing performance of yearling cattle or damaging the vigor of native warm-season plant populations.

Table 1. Effects of prescribed-fire timing on stocker cattle performance in the Kansas Flint Hills

Item	Prescribed-fire season			SEM ¹	P-value
	Spring	Summer	Fall		
Initial BW, ² lb	658	662	653	8.6	0.56
Final BW, lb	896 ^a	894 ^a	872 ^b	8.9	0.03
Total BWG, ³ lb	237 ^a	230 ^{ab}	219 ^b	5.9	0.02
ADG, ⁴ lb/day	2.64 ^a	2.56 ^{ab}	2.44 ^b	0.065	0.02

¹Standard error of the mean.

²Body weight.

³Body weight gain.

⁴Average daily gain.

^{ab} Within rows, means with unlike superscripts differ ($P \leq 0.05$).

Table 2. Effects of prescribed-fire timing soil cover and plant species composition in the Kansas Flint Hills

Item	Prescribed-fire season			SEM ¹	P-value
	Spring	Summer	Fall		
Soil cover, % of total area					
Bare soil	66 ^a	52 ^b	55 ^b	3.1	< 0.01
Litter cover	19 ^b	35 ^a	30 ^a	3.0	< 0.01
Total basal vegetation cover	15	13	15	1.0	0.11
Basal cover, % of total basal vegetation cover					
Total grass cover	89	90	85	2.7	0.22
Native grass species	85	86	79	3.5	0.14
Total forb cover	10.2	8.9	13.2	2.65	0.29
Native forb species	10.1	8.8	13.2	2.53	0.24
Total shrub cover	0.5 ^y	1.2 ^{yz}	1.4 ^z	0.41	0.07
Increaser shrubs ²	0.02	0.12	0.23	0.100	0.11

¹Standard error of the mean.

² Shrubs that tend to proliferate in response to grazing.

^{ab} Within rows, means with unlike superscripts differ ($P \leq 0.05$).

^{yz} Within rows, means with unlike superscripts tend to differ ($P \leq 0.10$).