Controlling Prairie Threeawn (*Aristida oligantha* Michx.) in Central and Eastern Kansas with Fall Burning

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Highlight: Prairie threeawn, an annual, weedy grass of little or no grazing value, was controlled effectively by fall burning. Burning on dates later than early December gave no control. Mowing and raking gave some control, so mulch removal appeared to be the primary causal factor in control. Seeding native grasses on abandoned fields infested with prairie threeawn after fall burning gave excellent stands, but subsequent winter heaving reduced the stands.

Prairie threeawn (*Aristida oligantha* Michx.) occurs throughout the eastern half of the United States and is a pioneer in secondary succession in the east-central and southeastern Great Plains. It dominates the annual weed stage for 30 years or more (Booth 1941; Rice 1971). Prairie threeawn is a warm-season annual, 8–12 inches tall, with a broad base panicle containing florets with a three-awned lemma. The awns are hygroscopic and aid in planting the seed in the fall, soon after they detach from the glumes. Seed dispersal is by wind and attachment to animals by a retrorsely-barbed, sharp callus.

Since prairie threeawn has little or no grazing value for domestic livestock, its persistence is a major deterrent to abandoned fields' returning to maximum livestock production. Some central Kansas areas that were heavily grazed, and then lightly grazed, are dominated by prairie threeawn, a condition that persists indefinitely even with proper use. Native hay meadows are also problem areas. They have been invaded insidiously over several years by prairie threeawn until large areas are not harvestable. In eastern Kansas, prairie threeawn infestations are primarily in hay meadows and abandoned fields (go-back), while in central Kansas grazed pastures also are infested.

We studied burning for control of prairie threeawn in grazed pastures and abandoned fields, and seeded native grasses on a fall-burned, abandoned field site.

Materials and Methods

Prairie threeawn control was investigated on three study sites: (1) Kobbeman, (2) Deweese, and (3) Stover.

Kobbeman Site

The study area is in the Kansas Dakota Sandstone region 12 miles southwest of Lincoln, Kans. The pristine vegetation in the region was dominated by big bluestem (*Andropogon gerardi* Vitman), little bluestem (*A. scoparius* Michx.), and sideoats grama [*Bouteloua curtipendula* (Michx.) Torr.]. Present vegetation in the area was dominated by prairie threeawn, buffalograss [*Buchloë dactyloides* (Nutt.) Engelm.], blue grama [*Bouteloua gracilis* (H.B.K.) Lag. ex Steud.], western ragweed (*Ambrosia psilostachya* DC.), and Japanese brome (*Bromus japonicus* L.).

Trial 1

Fall burning (November 1, 1971), spring burning (April 26, 1972), and no burning were compared on 6 x 20-ft plots replicated four times in a randomized complete block design. Composition percentage by weight of the total herbage production was estimated over the entire plot for prairie threeawn, other grasses, and western ragweed.

Trial 2

A 140-acre hay meadow, with more than half the acreage heavily infested with annual threeawn, was broadcast burned in mid November, 1972.

Trial 3

Plots were treated in consecutive years (November 30, 1973 and November 12, 1974). Burning with a headfire (with the wind) and a backfire (against the wind), mowing and raking, and no burning were compared on 10 × 20-ft plots, replicated four times in a randomized complete block design. Prairie threeawn seedlings were counted July 1, 1974, and August 20, 1975, in eight, 2 × 12-inch subplots per main plot. Japanese brome seedlings were counted July 1, 1974. Herbage was harvested to ground level October 17, 1974, and percentage composition by weight was estimated for prairie threeawn, weeds, and other grasses.

Deweese Site

The study area is in the Kansas Flint Hills region 3 miles northeast of Leonardville, Kans. Pristine vegetation in the region was dominated by big bluestem, Indiangrass [*Sorghastrum nutans* (L.) Nash], and little bluestem. The area studied was an abandoned, eroded field with 14 to 16 inches of soil loss exposing the clayey B horizon. Present vegetation in the study area was primarily prairie threeawn, with scattered patches of buffalograss.

Fall burning and no burning were studied with eight plots burned November 10, 1972, and again November 1, 1973, and eight plots with no burning in a completely random design. Another set of 16 plots adjacent to and similar in design was burned November 1, 1973, and eight plots were left unburned. April 20, 1974, four burned and four unburned plots in the two sets of plots were seeded with a modified grass drill having spring-loaded press wheels. Big bluestem, Indiangrass, little bluestem, and switchgrass (*Panicum virgatum* L.) were planted in two 20-ft rows per species per plot at 20 pure live seeds per linear foot of row. Seedlings of each species were counted in 6-ft segments of each planted row June 18, 1974.

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Stover Site

The study site is in the transitional area between True Prairie and Mixed Prairie 7 miles southeast of Bridgeport, Kans. Pristine vegetation was dominated by big and little bluestem. The area studied was an abandoned field with only slight soil loss. Vegetation was primarily prairie threeawn and tall dropseed [*Sporobolis asper* (Michx.) Kunth].

Burning December 13, 1974, January 9, 1975, February 12, 1975, March 5, 1975, and no burning were compared on 15 × 15-ft plots replicated three times in randomized complete block design. Prairie threeawn seedlings were counted August 4, 1975, in four 2 × 5-inch subplots per main plot.

Plant census was estimated from 50 random points per plot wth a modified step-point sampler (Owensby 1973). The data were subjected to analysis of variance and least significant differences (*LSD*) determined.

Results and Discussion

Kobbeman Site

Trial 1

Estimates of relative herbage production in the stands indicated that fall burning significantly reduced prairie threeawn compared with no burning or spring burning (Table 1). Perennial grass production made up a greater percentage of the total on the fall-burned plots than on the spring-burned or unburned ones. Western ragweed percentages of the total were similar for all three treatments.

Table 1. Percentages of total herbage production in fall, 1972, with no burning, fall burning, and spring burning.

	Annual threeawn	Perennial grasses	Western ragweed
Unburned	73.7	21.2	5.0
Spring[1]	84.0	14.0	2.0
Fall[2]	13.7	75.8	7.0
$LSD_{.05}$	21.6	18.2	NS

[1] Burned 4-27-72.
[2] Burned 11-8-71.

Trial 2

Information from Trial 1 at the Kobbeman site suggested that we burn (in early fall) a native hay meadow more than half heavily infested with prairie threeawn. Control was excellent; all the hay meadow was harvestable the next season. Where the mulch had not been consumed by the fire, prairie threeawn persisted. Trial 3 was designed to test the hypothesis that removing mulch was the key to control.

Trial 3

Headfire, backfire, and mow-and-rake plots had similar numbers of prairie threeawn seedlings in 1974 and 1975 after treatment the previous fall, but no-treatment plots had significantly more threeawn than previously (Table 2). Apparently, mulch removal was the key to prairie threeawn control.

Japanese brome was reduced more on burned plots than on the unburned ($P<.05$). Burned plots averaged 8.6 seedlings/ft^2 and unburned ones, 65.5. Burning in November occurred after the Japanese brome had emerged and was susceptible to injury.

Total herbage production was greater on the no-treatment plots than on backfire or mow-and-rake ones, but not greater than that on headfire plots (Table 3), even though total herbage did not differ statistically among headfire, backfire, and mow-and-rake plots. Perennial grass yields were similar for the headfire, backfire, and mow-and-rake treatments. Both burning treatments increased perennial grass production over that from no-treatment plots, but the perennial grass production on mow-and-rake plots did not differ statistically from the no-treatment plots. Prairie threeawn production was similar from headfire, backfire, and mow-and-rake plots. Both burning treatments reduced prairie threeawn. Statistically, mow-and-rake plots did not differ in threeawn production from either the burned plots or the no-treatment plots. Weed yields were comparable for all treatments.

Table 2. Prairie threeawn seedlings (no./ft^2) July 1, 1974, and August 20, 1975, for indicated treatments. Burn and mow-rake treatments were applied on November 30, 1972, and November 12, 1974.

	Treatment				LSD	
Seedlings	Headfire	Backfire	Mow-and-rake	No treatment	.05	.10
1974	18.7	21.7	14.2	41.2	18.0	14.5
1975	0.6	4.2	6.5	17.2	13.2	10.9

Table 3. Herbage production (lb D.M./acre) for indicated yield components and treatments. Burn and mow-rake treatments were applied November 30, 1973, and harvested October17, 1974.

	Treatment				LSD	
Yield component	Headfire	Backfire	Mow-and-rake	No treatment	.05	.10
Perennial grass	1738	1586	1309	932	700	567
Prairie threeawn	78	443	689	1492	990	803
Weeds	778	257	298	684	NS	NS
Total	2594	2332	2296	3108	803	650

Apparently, removing mulch was a major factor in controlling prairie threeawn. Headfire and backfire produced almost twice as much useable forage as no treatment did.

Stover Site

Plots burned in early December had fewer prairie threeawn seedlings than plots not burned or burned in January, February, or March (Table 4). Burning in early February increased numbers of threeawn seedlings above those of plots not burned. Burning later than early December either failed to control prairie threeawn or increased number of seedlings. Reducing prairie threeawn seedlings with a December burn resulted in tall dropseed and perennial forbs asserting themselves (Table 5).

Table 4. Threeawn seedling densities (no./ft^2) for indicated burning dates at the Stover site August 4, 1975.

	Burn date					LSD	
	No treatment	Dec. 13 1974	Jan. 9 1975	Feb. 12 1975	Mar. 5 1975	.05	.10
Threeawn seedlings	99.1	31.6	129.4	156.2	121.1	55.1	43.4

Table 5. Composition percentages of basal cover for indicated species after indicated burning dates at the Stover site August 4, 1975.

	Burn date					
Species	No treatment	Dec. 13 1974	Jan. 9 1975	Feb. 12 1975	Mar. 5 1975	LSD .05
Tall dropseed	6.7	28.3	10.0	10.0	10.0	10.2
Other perennial grasses	10.0	8.3	11.7	1.7	1.7	NS
Prairie threeawn	65.0	28.3	61.7	68.3	70.0	29.0
Perennial forbs	11.7	26.7	11.6	11.6	11.6	10.4
Annual forbs	3.3	6.7	1.7	3.3	5.0	NS
Sedges	1.7	1.7	—	3.3	—	NS
Other species	1.6	—	—	—	—	NS

Table 6. Seedling establishment (no./ft²) of native species seeded on an abandoned field dominated by prairie threeawn after fall burning 1 and 2 years.

Treatment	Big bluestem	Little bluestem	Indiangrass	Switchgrass
Burned 1 year				
Burned	4.00	4.65	6.38	1.29
Unburned	0.83	0.77	1.31	0.44
Burned 2 years				
Burned	2.83	3.04	4.60	1.17
Unburned	0.27	0.31	0.75	0.00
$LSD_{.05}$ = 1.52				

Deweese Site

Big bluestem, little bluestem, and Indiangrass seedling numbers were greater on fall-burned than on unburned plots (Table 6). Switchgrass establishment was similar on both burned and unburned plots, as was Indiangrass establishment. Indiangrass established better on burned plots than did big and little bluestem, which established better than switchgrass. Seedling establishment, regardless of species, was better on plots burned only 1 year than on plots burned 2 years.

Prairie threeawn control was excellent on the fall-burned plots and there was little competition for seeded species. However, winter heaving on the heavy clay soil reduced stands considerably the winter after productive grasses were seeded. Switchgrass was least affected by heaving. A less severely eroded site with a lower clay content probably would not heave so severely during winter.

Conclusions

1. Fall burning reduced prairie threeawn seedlings the next year.
2. On areas with a residual stand of desirable native grasses reducing prairie threeawn by fall burning increased production by desirable plant species.
3. Removing mulch seemed to be the key to controlling prairie threeawn.
4. Burning later than early December did not control prairie threeawn.
5. Seeding native species the spring after fall burning of abandoned fields infested with prairie threeawn produced satisfactory stands, but winter heaving adversely affected stand maintenance.

Literature Cited

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