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TALL FESCUE RESPONSE TO FIRE

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ABSTRACT.--Application of fire to tall fescue stands in the Ozarks caused significant changes in forage yields, seedstalk numbers, and stand composition.

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Converting tree and brush stands to tall fescue (*Festuca arundinaceae* Schreb.) grassland is common practice in the Ozarks (Crawford and Bjugstad 1967), but, maintenance of the grassland is hampered by invasion of woody plants. Fire has been used as a followup treatment to suppress top growth of woody plants in tall grass prairie (Kucera *et al.* 1963). Fire has also been used on native grassland to reduce competition from woody vegetation (Dalrymple 1969) and competition from undesirable bluegrass invasion (McMurphy and Anderson 1965). But the effect of fire on tall fescue in the Ozarks has not been investigated. So we designed a study to measure the response of tall fescue forage yields, seedstalk numbers, and stand composition to season of burning.

METHODS

A uniform tall fescue stand located on the Mark Twain grazing allotment on the Ava Ranger District of the Mark Twain National Forest in Missouri was subjected to four different burning times (four applications) and a no-burn control. The burning times were: late winter (February) before dormancy of the vegetation was terminated; early spring (April) immediately after dormancy was terminated; midsummer (August) during the period when tall fescue is inactive; and late fall (November) just before the herbaceous vegetation becomes dormant. Dormancy here refers to the time when fescue is not actively growing because this species tends to remain green yearlong. A control plot was mowed each time burning was done, so that burned and unburned stands could be compared. The burning times were selected to realistically represent management: they coincided with periods when both damage to the herbaceous vegetation and the time required for regrowth and return to grazing would be minimal.

Fire temperature was estimated by means of a graded series of thermal sensors (Probasco *et al.* 1976) to determine the temperatures associated with burning fescue stands and to find out if the temperature generated was above the minimum lethal threshold for woody vegetation. Byram (1958) reported that killing temperatures are time dependent. However, short-duration temperatures in the range of 60° C to 65.6° C usually kill vegetation. Data were collected at 2.5 cm (1 inch) below the soil surface, at the soil surface, and at 5 cm (2 inches), 15 cm (6 inches), and 61 cm (24 inches) above the soil surface. The respective temperatures for the graded sen-

sors at each collection point were 37.8, 65.6, 149, and 232° C.

Forage yields were measured by the double-sampling technique (Wilm *et al.* 1944). Twenty 4.8 ft^2 quadrat samples were taken on each plot during June and October of the year following the burning.

RESULTS AND DISCUSSION

The fire was consistently more intense at the midrange height, 5 cm to 15 cm (table 1). Intensity varied at the upper and lower heights; greater intensity was attained at the lower heights early in the year and at the upper heights late in the year. The sensors set 2.5 cm below the soil surface were unaffected by the heat.

Table 1.--*Thermal sensors responding to heat treatment (a total of 40 tubes was possible at each point)*
(In percent)

Sensor heights (cm above soil)	Sensor temperature (°C) : 37.8	65.6	149	232
LATE WINTER				
0	93	88	75	48
5	100	100	93	78
15	100	100	93	60
61	98	53	5	0
EARLY SPRING				
0	100	95	73	43
5	100	98	80	63
15	100	100	80	63
61	100	73	5	3
MIDSUMMER				
0	68	53	25	5
5	100	95	83	60
15	100	95	95	78
61	100	100	90	45
LATE FALL				
0	85	85	30	13
5	100	98	90	55
15	98	98	90	73
61	100	100	60	13

There were no significant differences in forage yields among the four treatments. However, tall fescue yields did differ significantly between burning treatments applied during the dormant or inactive growing period and those applied during active growing periods. Dormant burning did not reduce yield: yield averaged 3,083 lb/acre, which compares favorably to the 2,893 lb/acre produced on the unburned plots. However, burning during active growth significantly reduced production to 2,529 lb/acre.

Tall fescue seedstalk numbers were stimulated by the midsummer burn: numbers per square foot ranged from 8 for the early spring burn to 31 for the midsummer burn. Ehrenreich (1959) reported that similar treatments stimulates seed production of native grasses in Iowa.

Red clover (*Trifolium pratense* L.) was a rather insignificant component in the grass stand before the burns but increased substantially in plots burned in late winter or early spring (table 2).

After 1 year of study it appears that when burning only for tall fescue stand maintenance, fire should be applied during a dormant or inactive period, either late winter or midsummer. For renovating a red

Table 2.--*Tall fescue and red clover production and density related to burning treatment*

Burning season	Tall fescue		Red clover	
	Lb/acre	*Seedstalks/ft^2*	*Lb/acre*	*Plants/ft^2*
Late winter	[2]2,856a	[1]20f	[1]183d	8d
Early spring	2,406a	8g	187d	11d
Midsummer	3,312a	31h	1e	1e
Late fall	2,651a	22f	3e	1e
No burn	2,893a	16i	2e	1e
Active growth period $\frac{(ES+LF)}{2}$	[3]2,529			
Inactive growth period $\frac{(Lw+Ms)}{2}$	[3]3,083			

[1]Means followed by the same letter were not significantly different at the 0.05 level, Duncan's New Multiple Range Test.
[2]Letters denote no significant differences at 0.10 level based on standard analysis of variance techniques.
[3]Active growth period yields vs. inactive growth period yields were significantly different at the 0.10 level based on standard analysis of variance techniques.

clover stand, burn in either late winter or early spring. When considering both tall fescue and red clover, burn in late winter. When interested in tall fescue seed production, burn in midsummer.

Finally, a few precautions about the use of fire. Fire is an efficient and economical management tool, but its use calls for thorough planning and organization. Local fire authorities must be notified. Weather information, before, during, and immediately after the burn should be obtained. Adequate education as to the proper use and behavior of fire is also important to the success of any prescribed burn.

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