EFFECT OF PRESCRIBED BURNING ON FORAGE DIGESTION, RATE OF PASSAGE, AND INTAKE OF NATIVE GRASS BY BEEF COWS

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Story in Brief

Eight ruminally cannulated beef cows grazed either burned or unburned rangeland to evaluate the effects of prescribed spring burning on forage digestion, particulate passage, and intake. Pastures were burned April 6 and grazed from April 29 through July 27. Initial crude protein content of diet samples was higher for burned forage, but declined rapidly. Thus, protein content of control forage was higher by the end of the trial. Forage from burned pasture was digested more rapidly and remained in the rumen longer than forage from unburned pasture. Consequently, digestibility of burned forage was higher than control forage throughout the study. Cows grazing burned range consumed more organic matter and digestible organic matter than cows grazing unburned range. In contrast, control cows attempted to compensate for low forage quality with increased indigestible organic matter intake and rate of passage, however, their adaptability was limited by the decreased digestibility of the forage. These results indicate that the primary response to burning is faster rate of forage digestion. This allows cattle to consume a larger quantity of more digestible forage which results in increased performance.

(Key Words: Beef Cattle, Rangeland, Burning, Digestion, Intake)

Introduction

Prescribed spring burning of rangeland removes standing, dormant forage thereby promoting palatable, higher quality regrowth. Increased protein content of burned forage is transient, however, and differences in chemical composition of burned and unburned forage are small. Increased performance of cattle grazing burned range (Scott et al., 1986) must be attributed to increased forage digestibility and/or intake. Similar intake of unburned and burned forage has been reported in Kansas (Smith et al., 1960). Rao et al. (1973) observed increased digestible energy intake for steers grazing burned rangeland even though protein content was similar to unburned range. Therefore, the objective of this study was to characterize the effects of prescribed burning on forage digestion, rate of passage and intake by beef cattle.

Materials and Methods

Three trials were conducted at the Southwest Livestock and Forage Research Laboratory located at El Reno, Oklahoma in 1986: May 9 to 18 (Period 1), June 13 to 22 (Period 2), and July 18 to 27 (Period 3). Tallgrass rangeland was dominated by little bluestem with smaller quantities of big bluestem, switchgrass, and indiangrass. Pastures were

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burned on April 6, 1986. Grazing was initiated on April 29 when burned pasture regrowth was 4 to 6 inches in height and concluded August 6.

Four mature, nonpregnant Hereford cows and four mature Angus x Hereford heifers fitted with ruminal cannulae were blocked by breed and weight and assigned to an unburned (control) or burned pasture. An additional nonpregnant Hereford cow grazed the control pasture and was utilized to estimate burning effects on rate of forage digestion. Both pastures were stocked with 325 lb calves at 3.2 acres/animal unit during the study.

Ytterbium-labeled prairie hay was ruminally dosed on days 1 through 6 of each period to estimate fecal output. Fecal grab samples were obtained 6 times over a 48 h period on days 5 and 6 and composited by animal. Fecal samples were dried, ashed, and subjected to Yb analysis by EDTA extraction. Fecal output was calculated as Yb dose divided by fecal Yb concentration.

Esophageal masticate was collected from each pasture on day 1 of each period. Masticate was washed with tap water and labeled with dysprosium. Labeled masticate was then pulse-dosed at 0900 on day 7 to estimate ruminal particulate passage rate. Samples of ruminal contents were obtained at 12, 24, 36, and 48 h postdosing. Particulate passage rate was estimated from regression of the natural logarithm of Dy concentration over time.

To evaluate the effect of burning on rate of forage digestion, 1 g ground masticate (burned or control) was placed in duplicate dacron bags and suspended in the rumen of the extra Hereford cow grazing the control pasture. Bags were incubated for 4, 12, 24, 36, 48, and 72 h. Organic matter solubility, potential digestibility, and rate of disappearance were predicted from bag washout, 72-h residues and the regression of organic matter residue against time, respectfully. Forage organic matter digestibility was estimated from the equation: $a + [b \times c/(c + k_d)]$ where a is the soluble component, b is potential digestibility, c is rate of disappearance, and k_d is particulate passage rate (Ørskov and McDonald, 1979).

Data were analyzed by least squares procedures with period, treatment, cow nested within treatment, and period by treatment interaction included in the model. Treatment differences within each period were evaluated by t-test. Seasonal trends were characterized by regression analysis for linear and nonlinear effects.

Results And Discussion

Crude protein content of the control pasture decreased linearly ($P<.01$) as the season progressed (Figure 1). Initially, crude protein content of burned pasture was higher ($P<.01$) than the control pasture, but declined more rapidly (nonlinear, $P<.01$). Consequently, the protein content of burned pasture was lower ($P<.01$) than the control pasture in periods 2 and 3. Rapid declines in protein content suggests that burned forage may grow faster and mature more rapidly than unburned forage.

Rate of forage OM digestion for burned forage was higher (.9 to 1.1 percentage units, $P<.10$) than control forage on all sampling dates (Table 1). In addition, digestion rates decreased as the forage matured. Forage organic matter digestibility decreased for both pastures as the season progressed. Organic matter digestibility of burned forage was consistently higher than control forage. Increased rate of forage OM digestion for burned forage and decreased passage rates combined to increase total digestibility.

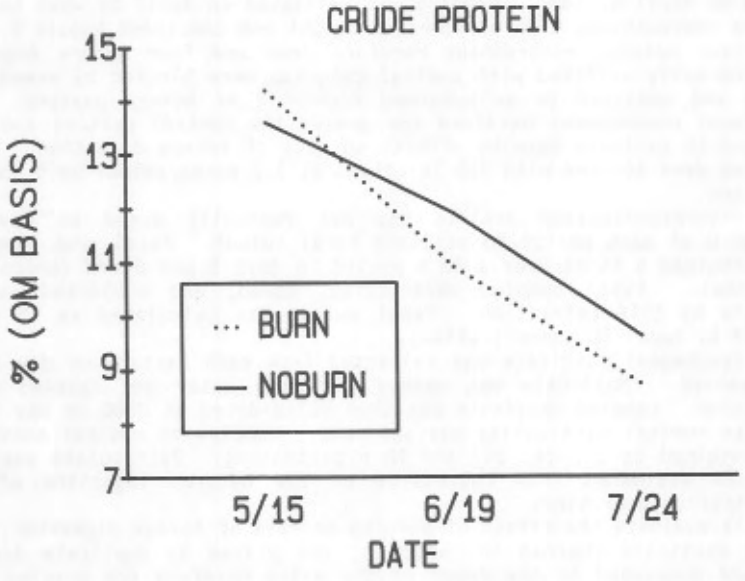

Figure 1. Crude protein content (OM basis) of burned and unburned tallgrass range.

Forage organic matter intake was highest in May when forage quality and digestibility were high and declined as the season progressed (Table 1). Cows grazing burned range consumed more forage organic matter at all sampling dates. In addition, cows on burned forage consumed more ($P<.05$) digestible organic matter throughout the study. This response represents an 18 to 30% increase in energy intake which explains increased performance of cattle grazing burned range (Scott et al., 1986).

Particulate passage rate tended to be higher for control forage at all sampling times (Table 1). Particulate passage rate tended to decrease as the season progressed. In addition, indigestible organic matter intake was higher for cows grazing control forage. These relationships suggest that cows grazing control forage attempted to increase forage intake to compensate for inadequate energy intake. In spite of these adaptive changes, control cows were unable to achieve a level of energy intake comparable to cows grazing burned range.

Cattle grazing burned range have access to improved quality forage as evidenced by increased performance (Scott et al., 1986). Differences in the chemical composition of burned and control forages are small (Woolfolk et al., 1975), however, and do not account for improved performance. In addition, crude protein content of burned forage fell below control forage after mid-June. Protein content does not explain increased cattle performance on burned range. The major response to burning in this study appeared to be increased rate of forage digestion. Increased digestion rate allowed cows grazing burned forage to consume a

Table 1. Forage digestion, rate of passage, and intake of cows grazing control and burned range.

Item	Period			SEM[a]
	May	June	July	
Organic matter				
Rate of digestion, %/h				
Control	6.4[b]	6.1[b]	5.4[d]	.05
Burn	7.3[c]	7.1[c]	6.5[e]	.05
Digestibility, %				
Control	51.8	44.2[b]	45.4	.85
Burn	58.0	53.8[c]	52.7	.85
Organic matter intake, % body weight				
Total				
Control[f]	2.14	1.77	1.62[b]	.076
Burn[g]	2.25	1.87	1.80[c]	.076
Digestible				
Control[g]	1.11[d]	.78[d]	.73[d]	.039
Burn[g]	1.31[e]	1.00[e]	.95[e]	.039
Indigestible				
Control[f]	1.03[b]	.99[d]	.88	.037
Burn[f]	.94[c]	.86[e]	.85	.037
Particulate passage rate, %/h				
Control	5.5	4.4	4.7	.50
Burn	4.5	4.1	4.2	.43

[a]SEM=standard error of least square means.
[b,c]Means within columns differ (P<.10).
[d,e]Means within columns differ (P<.05).
[f]Linear period response (P<.05).
[g]Nonlinear period response (P<.05).

larger quantity of more digestible forage. Consequently, total energy intake increased. In contrast, slower digestion rate for control forage forced cows to increase passage rate and indigestible organic matter intake in an attempt to increase energy intake.

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