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Spring burning of native tallgrass pastures influences diet composition of lactating and non-lactating beef cows

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Spring Burning of Native Tallgrass Pastures Influences Diet Composition of Lactating and Non-Lactating Beef Cows

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Introduction

Diet selection is a dynamic process because of seasonal changes in animal and plant characteristics. Nutrient requirements of grazing animals are a function of physiological state; moreover, plant characteristics may be altered with prescribed spring burning of native rangelands. Prescribed spring burning is used to improve the average quality of pasture forage by removing old growth and making new plant growth more accessible to grazing cattle.

Microhistological analysis of fecal material has been a widely used method for quantifying the botanical composition of a grazing animal's diet since it was first described by Baumgartner and Martin in 1939. Little research has been conducted on how diet selection preferences of lactating beef cows with suckling calves and non-lactating beef cows are influenced by prescribed burning. We hypothesized that during the summer grazing season, lactating cows with calves and non-lactating cows would display distinctive preferences for certain species. Furthermore, we anticipated that these diet selection preferences might be influenced by prescribed burning. To that end, our objective was to characterize differences in diet selection between lactating beef cows suckling calves and non-pregnant, non-lactating beef cows grazing either burned or unburned native tallgrass prairie during summer.

Experimental Procedures

The study was conducted on 8 native tallgrass pastures (approximately 240 acres each) located at the Kansas State University Commercial Cow-Calf Unit. Four of the pastures were burned in mid-April and 4 had no recent burning history. Predominant pasture forage species at this location were big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*), which were grouped together for the purposes of microhistological analysis; sideoats grama (*Bouteloua curtipendula*); blue grama (*Bouteloua gracilis*); switchgrass (*Panicum virgatum*); indiangrass (*Sorghastrum nutans*); leadplant (*Amorpha canescens*); heath aster (*Symphotrichum ericoides*); dotted gayfeather (*Liatris punctata*); and purple prairie clover (*Dalea purpurea*). Grazing commenced May 15.

Treatments consisted of 32 mature, pregnant, lactating beef cows suckling calves (L; initial body weight = $1,248 \pm 123$ lb) with 32 mature, non-pregnant, non-lactating beef cows (NL; initial body weight = $1,215 \pm 117$ lb). Four L and 4 NL cows were grouped randomly and assigned to graze a single burned or unburned pasture for 120 days. The L and NL cows were allowed to commingle within pastures and remained in their assigned pasture throughout the study. Water, salt, and a granular, salt-based mineral

supplement (17% NaCl, 16% Ca, 8% P, 0.2% Mg, 3,300 ppm Zn, 1,200 ppm Cu, and 0.22 ppm Se) were available to cattle continually.

Cows were gathered into a corral and fecal grab samples were collected from each animal on day 30, 60, 90, and 120 of the grazing period. Each grab sample was hand-mixed to ensure homogeneity, and a 40-g subsample was retained for analysis. Samples were prepared by soaking overnight in 50% EtOH (volume/volume). After soaking, samples were homogenized and washed with deionized water through a no. 200 US standard sieve to remove contaminants. Samples were then dried and ground to pass a 1-mm screen for slide preparation.

For slide preparation, subsamples of dried, ground, and washed fecal material were soaked to soften them, rinsed with deionized water, homogenized, and rinsed a second time. Subsamples were placed on slides using an eyedropper, 1 to 3 drops of Hertwig's solution was applied, and the slide was placed over a propane flame until dry. One to two drops of Hoyer's solution was added to mount a cover slip. Slides were dried before viewing.

Slides were viewed on a compound microscope at 10× magnification. The microscope was equipped with a digital camera; each slide field was photographed for comparison with standard slides. Twenty fields per slide were selected randomly from the entire slide view and were used to measure the frequency with which plant fragments appeared. Individual plant species were identified according to their histological characteristics. Plant fragment prevalence in slide fields was assumed to be equivalent to prevalence in fecal samples and equivalent to percentage of botanical composition of the diets grazed by beef cows. Plant fragments that were not among the 10 predominant range plants for which standards were prepared were classified as either an unknown grass or an unknown forb.

Results and Discussion

Previous results suggested that lesser maintenance requirements could result in less selective foraging behaviors by non-lactating compared with lactating ruminants. Previous research also indicated lactating cows grazed more selectively than non-lactating, non-pregnant cows; however, we found no treatment differences ($P \geq 0.11$) in the botanical diet composition between lactating and non-lactating cows (Table 1). Similar findings were reported that found no differences in diet composition between lactating ewes and non-lactating ewes.

Cows consumed more ($P = 0.01$; 74.2 versus 71.8%, respectively) grasses and fewer ($P = 0.01$; 25.8 versus 28.2%, respectively) forbs on burned pastures compared with unburned pastures (Table 2). Research suggests that unburned pastures have a greater selection of forbs compared with burned pastures because burning reduced forb availability. Cows ate more ($P < 0.01$) sideoats grama and less ($P \leq 0.02$) switchgrass, leadplant, and purple prairie clover on burned pastures than on unburned pastures.

As the grazing season progressed, selection of switchgrass increased (burn × period effect, $P = 0.09$) sharply in both burned and unburned pastures, whereas selection of sideoats grama generally decreased (burn × period effect, $P < 0.01$; Table 3). Selection

of leadplant doubled (burn $\times$ period effect, $P = 0.04$) on burned pastures month-by-month, but selection was inconsistent in unburned pastures. Selection of dotted gayfeather ranged from 12.3 to 20.4% of the diet in June, July, and August and diminished to 8.5 to 8.9% in September (burn $\times$ period effect, $P = 0.05$).

Cows selected more ($P < 0.01$) switchgrass, blue grama, leadplant, and heath aster over time, whereas they selected less ($P < 0.01$) indiangrass over time (Table 4). Palatability is a major factor driving selection preferences by grazing herbivores and is reduced as plants approach reproductive maturity and dormancy. Under unrestricted grazing conditions, herbivore preference for specific forage plants is known to change over time. The cows used in our study may have modified their diets over time to select greater proportions of plants that were slower to reach maturity. Alternatively, decreased consumption over time may have been related to diminishing availability or regrowth of certain forage plants.

Consumption of all grasses and all forbs changed slightly ($P < 0.01$, Table 4) from month to month during the grazing season; however, the relative proportions of grasses and forbs remained consistently within the range of 71 to 75% grasses and 25 to 29% forbs.

Implications

The botanical composition of diets grazed by beef cows during summer in the Kansas Flint Hills was influenced by prescribed spring burning but was not influenced by lactation status. We interpreted these data to suggest that forage selection preferences of beef cows can be altered with spring burning of native tallgrass pastures.

Table 1. Effect of collection period on botanical composition of diets (%) selected by lactating cows with calves or non-lactating, non-pregnant cows grazing the Kansas Flint Hills during summer

Item	June 15	July 15	August 15	September 15	SEM	<i>P</i> -values		
						Treatment	Period	Treatment × period
Total grasses, %								
Lactating	74.1	70.8	72.3	72.7	1.03	0.18	<0.01	0.45
Non-lactating	76.7	71.3	73.6	72.4				
Big bluestem + little bluestem, %								
Lactating	6.1	12.9	13.9	10.9	1.15	0.37	<0.01	0.15
Non-lactating	8.2	11.9	13.2	11.8				
Indiangrass, %								
Lactating	50.4	37.7	35.2	29.4	1.36	0.12	<0.01	0.60
Non-lactating	51.6	37.6	38.3	31.3				
Switchgrass, %								
Lactating	4.2	4.4	7.5	10.4	0.76	0.88	<0.01	0.41
Non-lactating	3.7	5.0	7.1	10.8				
Blue grama, %								
Lactating	1.8	2.3	5.4	14.9	0.51	0.83	<0.01	0.16
Non-lactating	2.5	2.5	4.5	10.8				
Sideoats grama, %								
Lactating	8.6	11.7	8.6	4.7	0.69	0.94	<0.01	0.20
Non-lactating	7.5	11.9	8.6	5.5				
Total forbs, %								
Lactating	25.9	29.2	27.7	27.3	1.03	0.18	<0.01	0.45
Non-lactating	23.3	28.7	26.4	27.6				
Purple prairie clover, %								
Lactating	7.4	6.9	6.9	7.9	0.80	0.92	0.25	0.88
Non-lactating	7.5	6.5	6.9	8.5				
Leadplant, %								
Lactating	0.6	0.8	1.7	3.4	0.43	0.25	<0.01	0.41
Non-lactating	0.9	0.9	1.5	4.0				
Dotted gayfeather, %								
Lactating	15.5	19.8	15.9	8.8	1.02	0.11	<0.01	0.35
Non-lactating	12.7	19.5	15.1	8.6				
Heath aster, %								
Lactating	0.6	0.9	2.5	6.2	0.69	0.63	<0.01	0.07
Non-lactating	1.0	0.9	2.1	5.2				

Table 2. Effects of pasture burning regime on botanical composition of diets selected by beef cows grazing the Kansas Flint Hills during summer

Item	Burned	Unburned	SEM	P-value
Total grasses, %	74.2	71.8	0.52	0.01
Switchgrass, %	5.3	7.2	0.27	<0.01
Sideoats grama, %	9.0	7.1	0.26	<0.01
Total forbs, %	25.8	28.2	0.52	0.01
Leadplant, %	1.1	1.7	0.12	<0.01
Purple prairie clover, %	6.4	8.3	0.50	0.02

Table 3. Burn regime × collection period effects on botanical composition of diets selected by beef cows grazing the Kansas Flint Hills during summer

Item	June 15	July 15	August 15	September 15	SEM	P-value
Switchgrass, %						
Burned	2.9	4.2	6.3	9.9	0.80	0.09
Unburned	5.2	5.3	8.5	11.4		
Sideoats grama, %						
Burned	10.1	13.8	8.9	5.2	0.78	<0.01
Unburned	6.4	10.0	8.4	5.0		
Leadplant, %						
Burned	0.4	0.8	1.5	3.2	0.37	0.04
Unburned	1.2	0.9	1.7	4.2		
Dotted gayfeather, %						
Burned	16.0	18.9	15.8	8.9	1.04	0.05
Unburned	12.3	20.4	15.2	8.5		

Table 4. Effect of collection period on botanical composition of diets selected by beef cows grazing the Kansas Flint Hills during summer

Item	June 15	July 15	August 15	September 15	SEM	P-value
Total grasses, %	75.5	71.1	73.0	72.5	0.71	<0.01
Indiangrass, %	51.0	37.7	36.7	30.3	0.97	<0.01
Switchgrass, %	3.9	4.7	7.3	10.6	0.51	<0.01
Blue grama, %	2.1	2.4	5.0	12.7	1.23	<0.01
Total forbs, %	24.5	28.9	27.0	27.5	0.70	<0.01
Leadplant, %	0.7	0.8	1.6	3.7	0.30	<0.01
Heath aster, %	0.8	0.9	2.3	5.7	0.61	<0.01

Increasing Protein Supply to Pregnant Beef Cows When Energy Is Limited Does Not Improve Cow or Calf Performance

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Introduction

Pre- and postpartum deficiencies of metabolizable protein have been identified as potentially limiting to productivity of beef cows and calves. Pre-partum supplementation of forage-based diets with ruminally undegraded protein has increased weight gain and breeding performance in prior studies, but the level of ruminally degraded protein fed was not known. Feeding adequate ruminally degraded protein to beef cows maximizes the productivity of microbes in the rumen, so any benefits shown in prior work could have been attributed to increased ruminal fermentation.

Our objectives were (1) to determine the value of supplementing ruminally undegraded protein when dietary ruminally degraded protein supply was estimated to be adequate to support normal ruminal fermentation, and (2) to monitor the changes in intake and digestion that precede parturition in beef cows fed low-quality, warm-season forage.

Experimental Procedures

Pregnant Angus × Hereford cows were used in 2 experiments that measured intake, digestion, and performance of beef cows and calves when provided ruminally undegraded protein in addition to ruminally degraded protein needed for optimal ruminal fermentation. Cows used in both experiments were fed 1 of 3 supplements daily that supplied similar amounts of ruminally degraded protein (0.09% of body weight) and increasing amounts of ruminally undegraded protein: 0.05% (LOW), 0.07% (MOD), or 0.09% of body weight (HI). Supplement composition is shown in Table 1.

Experiment 1

Late-gestation cows ($n = 18$; body weight = 940 lb; body condition score = 4.5 [1 = thin, 9 = very fat]) were used in a 3-treatment, randomized complete block experiment. Cows were housed individually and assigned to be fed 1 of the 3 supplements described previously. Each cow had free-choice access to low-quality prairie hay (2.1% crude protein) and supplements were fed daily. Fecal grab samples were collected daily at 8:00 a.m. Sample collection corresponded to the period spanning 14 through 5 weeks pre-partum. Hay intakes by individual animals were summarized as 10 weekly means. Proportional intakes (percentage of body weight) were expressed using individual animals' average body weight for each month of the trial.

Experiment 2

Pregnant Angus × Hereford cows ($n = 17$; body weight = 1,160 lb; body condition score = 5.2) were used in a randomized complete block experiment. Cows were stratified by weight and body condition score and assigned to receive 1 of the 3 supplements evaluated in Experiment 1.