DIET COMPOSITION AND DIGESTION IN STEERS GRAZING RANGELAND IN THE SUMMER

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Story in Brief

Fistulated beef steers grazing tallgrass range were used to monitor diet quality and ruminal digestion during four trials in the summer of 1987 (May through September). In 1987, diet crude protein decreased from 13.40% in mid May to 6.80% in mid August. Acid detergent fiber and neutral detergent fiber ranged from 40.0 to 49.7% and from 76.7 to 83.0%, respectively. In situ organic matter disappearance at 72 hour incubation decreased from 78.2 in mid May to 66.0% in late September. In situ nitrogen disappearance decreased from 83.0% in mid May to 75.2% in late June and stabilized around 61% throughout the remainder of the season. Due to the combined effects of reduced dietary protein and reduced nitrogen digestion, ruminally digestible protein declined from 11.1% in mid May to 4.0% in mid August. Cotton string digestion varied 9.5% among trials, suggesting that the decline in ruminal digestibility of grazed forage associated with advancing season is due to both indigestible forage components and changes in the ruminal environment.

(Key Words: Forage Quality, Digestion, in situ Disappearance, Rangeland.)

Introduction

The influence of advancing season on growth and nutritive value of range plants in relation to daily requirements of grazing animals is well noted. However, information concerning the relationship between diet quality, ruminal environment and nutrient utilization in grazing cattle is quite limited. A more complete understanding of these relationships will aid the development of nutrition and grazing management programs that will improve the efficiency of livestock production from forages.

Studies were conducted in 1986 and 1987 to investigate the seasonal changes in diet quality, forage intake and nutrient utilization that occur on

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tallgrass prairie rangeland in central Oklahoma. The diet quality portion of the 1987 study is discussed in this report. Diet quality and ruminal digestion results for 1986 were reported earlier (Campbell and McCollum, 1988).

Materials and Methods

Cattle were grazed on moderately stocked tallgrass prairie rangeland located 12 miles southwest of Stillwater. Range condition on the area was high fair to low excellent. The dominant grasses were big bluestem and indiangrass, little bluestem, and switchgrass.

Four 10-day trials were conducted: mid May, late June, mid August and late September. Diet samples were obtained from esophageally fistulated steers the first two days of each trial. Masticate samples were dried in a forced air oven at 50°C, ground through a 2mm screen and stored for analysis of ash, crude protein (CP), acid detergent fiber (ADF) neutral detergent fiber (NDF) and in vitro organic matter digestibility (IVOMD).

Eight ruminally cannulated beef steers (Angus X Hereford, Limousin X Hereford and Hereford) were used to monitor ruminal fermentation. Ruminal organic matter disappearance (OMD) and nitrogen disappearance (ND) were estimated by suspending duplicate dacron bags containing 2g esophageal masticate in the rumen for intervals of 72, 48, 36, 24, 18, 12 and 6 hours. Duplicate bags containing .5g of cotton string were also incubated for 72, 48, 36 and 24 hours to monitor ruminal cotton string cellulose disappearance. All bags were removed simultaneously, washed with water until effluent ran clear and dried at 55°C for 48 hours. Residual forage was removed from the bags and analyzed for ash and kjeldahl nitrogen. Strings were removed from bags, washed clean, placed in foil pans, dried at 105°C and weighed to determine disappearance.

Four steers were used to collect diet data in one trial, and three steers were used in all others, resulting in 13 observations. Diet data were analyzed by least squares procedures as a completely randomized design with trial in the model. In situ data were collected from eight steers in all four trials. Data were analyzed within incubation period by least squares procedures as a completely randomized design with trial and steer in the model.

Results and Discussion

Diet crude protein was different ($P<.05$) among trials, declining from 13.40% in mid May to 6.80% in mid August, and increasing to 8.03% in late September. Cell wall constituents in the diets increased from mid May to

late June and then declined between mid August and late September. Acid detergent fiber, representing the less digestible cell wall constituents, increased ($P<.05$) from mid May to mid August and remained relatively stable through late September. In situ organic matter disappearance reflected changes in both fiber fractions. Potential disappearance (72 h in situ bags) declined ($P<.05$) from 78.2% in mid May to 67.9% in mid August, and remained around 66% through late September (Table 2). Rate of organic matter disappearance, as indicated by short term disappearance values (6, 12 and 18 h) was slower for the mid August trial. A similar trend was noted for nitrogen disappearance. Potential nitrogen disappearance (72 h in situ bags) was lowest in mid August and late September. Potentially digestible nitrogen varied 28.4%, ranging from 83.0% in mid May to 59.4% in mid August. Combining values for diet protein (Table 1) with values for 72 hour nitrogen disappearance (Table 3) yielded ruminally digestible protein

Table 1. Nutrient composition of esophageal masticate.

Component[a]	Trial			
	Mid May	Late June	Mid August	Late September
	% of organic matter			
CP	13.40[b]	10.59[c]	6.80[d]	8.03[d]
ADF	40.01[b]	44.08[c]	49.72[d]	47.89[d]
NDF	76.72[b]	82.35[c]	83.03[c]	80.53[b]
IVOMD	56.32[b]	54.78[b]	49.40[c]	44.20[d]

[a]CP is crude protein, ADF is acid detergent fiber, NDF is neutral detergent fiber and IVOMD is in vitro organic matter digestibility.
[b,c,d]Means with different superscripts are different ($P<.05$).

Table 2. In situ disappearance of organic matter in esophageal masticate samples.

Hours of incubation	Trial			
	Mid May	Late June	Mid August	Late September
6	25.17[a]	21.92[b]	15.49[c]	26.26[a]
12	38.21[a]	36.05[ab]	27.24[c]	34.77[b]
18	47.15[a]	43.05[a]	37.64[b]	45.23[a]
24	56.95[a]	53.78[ab]	44.80[c]	49.92[bc]
36	68.80[a]	62.39[b]	57.09[b]	58.84[b]
48	74.39[a]	70.26[b]	61.74[c]	63.68[c]
72	78.19[a]	75.34[b]	67.91[c]	66.02[c]

[a,b,c]Row means with different superscripts are different ($P<.05$).

Table 3. In situ disappearance of nitrogen in esophageal masticate samples.

Hours of incubation	Trial			
	Mid May	Late June	Mid August	Late September
6	22.70^{bc}	25.28^{b}	20.77^{c}	34.57^{a}
12	40.14^{b}	34.51^{bc}	31.43^{c}	49.64^{a}
18	49.85^{a}	40.87^{b}	38.17^{b}	48.79^{a}
24	60.67^{a}	49.68^{bc}	43.69^{c}	52.28^{b}
36	73.18^{a}	62.44^{b}	56.79^{bc}	53.33^{c}
48	79.53^{a}	69.09^{b}	57.00^{c}	61.34^{c}
72	83.01^{a}	75.25^{b}	59.43^{c}	62.90^{c}

^{a,b,c}Row means with different superscripts are different (P<.05).

estimates of 11.1% in mid May, 8.0% in late June, 4.0% in mid August and 5.1% in late September.

In 1986, in situ dry matter disappearance and nitrogen disappearance at 72 h incubation decreased from 74.5 and 72.6% in mid May to 57.6 and 39.1% in late September. However, no differences (P>.05) were noted among trials for cotton string cellulose disappearance. Results from this portion of the 1987 study tend to agree with 1986 data, however, there was a tendency for string disappearance to decline with season (Table 4).

Table 4. In situ disappearance of cotton string cellulose.

Hours of incubation	Trial			
	Mid May	Late June	Mid August	Late September
24	26.09^{bc}	29.43^{ab}	21.62^{c}	31.95^{a}
36	53.22^{ab}	39.34^{b}	47.26^{b}	63.75^{a}
48	71.10^{ab}	64.53^{b}	69.24^{b}	79.85^{a}
72	95.44^{a}	96.95^{a}	92.47^{ab}	87.71^{b}

^{a,b,c}Row means with different superscripts are different (P<.05).

Literature Cited

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