INFLUENCE OF SEASON ON DIETARY COMPOSITION, INTAKE, AND DIGESTION BY BEEF STEERS GRAZING MIXED GRASS PRAIRIE IN WESTERN NORTH DAKOTA

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SUMMARY

Chemical and botanical composition data, when combined with estimates of intake and digestibility, contribute considerably to supplementation practices and sound nutritional programs of grazing cattle. Data in this regard is needed in western North Dakota and should result in improved supplementation strategies. Six cannulated beef steers are currently being used to evaluate changes in dietary composition of rangeland grazed by cattle in western North Dakota. Collections began June 16, 1995, and will run through December 16, 1995, for a total of six collection periods. Four collections have been completed. Seasonal changes in dietary composition, forage intake, and digestibility are being monitored. These values, in conjunction with data from the late fall and winter collections, should provide useful information for livestock producers to determine the appropriate times and rates of rangeland supplementation.

Current data suggests that nutrient quality of grazed forage declines ($P<.10$) from mid June to early September. Forage organic matter intake (% of BW) was higher ($P<.10$) in mid June compared with late July and early September. In vitro digestibility of grazed forage declined with advancing season. These data suggest that cattle grazing native range in western North Dakota from mid June to early September are consuming diets adequate for lactating beef cows. Late fall and winter data are yet to be collected and analyzed.

INTRODUCTION

North Dakota has over 13 million acres of grazing lands. Much of this area is located in the western half of the state. Many livestock producers in western North Dakota graze cattle on native range into late fall and early winter. In these situations supplementation is often practiced to offset forage quality and (or) quantity short falls, and to maintain livestock performance. Unfortunately, data regarding diet composition, intake, and digestion by cattle grazing western North Dakota rangelands is limited.

Research in the area of dietary composition of grazing cattle diets has been conducted at several locations in the United States (Funk et al., 1987; Kirby et al., 1986; Olson et al, 1994). This type of information, when coupled with estimates of intake and digestibility, is the foundation of late fall and winter supplementation practices and sound nutritional programs. Data in this regard is needed in western North Dakota and should result in improved supplementation strategies. Data collected from previous studies when updated with present information should provide a stronger data base from which to make sound management decisions. Therefore, our objectives are to determine seasonal patterns of dietary composition, intake, ruminal fill, digestibility, and rate of in situ NDF and protein degradability in beef cattle grazing mixed grass prairie in western North Dakota.

MATERIALS AND METHODS

This study is being conducted on approximately 120 acres of mixed grass prairie located 1 mile west of Dickinson, North Dakota. Collections were taken June 16-26, July 21 to August 1, September 1-10, and September 28 to October 7,1995. Two more collections are scheduled for November 9-18, and December 7-16, 1995, weather permitting. Six Angus X Hereford steers with an initial weight of 840 lb are being used to characterize seasonal dietary composition changes.

Collections begin on d 1 with ruminal evacuation of six cannulated beef steers. Ruminal contents are weighed and subsampled to determine DM and fluid fill. Omasal samples are also taken to determine escape protein concentration. Animals are then allowed to graze for 60 min. Rumens are evacuated again to collect a representative diet sample and original ruminal contents returned to the rumen. Diet samples are divided into two parts. The first is used for determining chemical and botanical composition of the diet. Chemical analysis includes DM, organic matter (OM), total N, ADF, neutral detergent fiber (NDF), soluble and insoluble nitrogen, and in vitro digestibility. The second portion of the diet sample is used for in situ degradabilities using Dacron bags. Bags are incubated for 0, 4, 8, 12, 16, 24, 36, 48, and 72h. Rates of degradation will be calculated from this data.

During five days of each collection period, animals fitted with fecal bags were used for total fecal collection. Total intake was calculated by dividing fecal output by the diet in vitro indigestibility. Data was analyzed for seasonal effects using the GLM procedure of SAS (1985). Means were separated by the method of least significant difference.

RESULTS AND DISCUSSION

Organic matter (OM) intake decreased (P<.10) from 1.7% of body weight (BW) in mid June to 1.4% of BW in early September (Table 2). These values agree with Krysl et al. (1987), who reported voluntary intake in grazing steers averaged 1.5% of BW during dormancy and 2.2% of BW while plants were actively growing. Fecal output increased from late July to early September (P<.01; Table 2). Ruminal fill (% of BW) increased from June to July (.92 vs 1.39, respectively) and indicates that steers grazing range forage in July are consuming a more fibrous diet that is likely to pass to the lower tract at a slower rate when compared to steers grazing in June.

Ruminal in situ dry matter disappearance (ISDMD) for 12, 16, 36 and 48h incubation times was significantly higher (P<.10) for June and July than September and October (Table 3). Extent of ISDMD (as measured at 72h incubation) was highest during June which agrees with the results of Caton et al. (1993), and Olson et al. (1994).

In vitro organic matter disappearance (IVOMD) decreased from mid June to early September (P<.01). Similar results were observed by Kirby and Parman (1986), and Olson et al. (1994). These data demonstrate a decline in forage quality with advancing season.

ADF values increased from June to September (P<.10), which agrees with results from Krysl et al. (1987), Campbell and McCollum (1989), and Olson et al. (1994). Crude protein values increased from mid June to late July (P=.02). This disagrees with the findings of Kirby and Parman (1986), and Olson, et al. (1994), who found a decrease in dietary CP levels for this same period. These higher values may have resulted, in part, from higher than average precipitation during July delaying the onset of plant dormancy. Levels of CP for both mid June and late July were significantly higher than early September values (P<.01) which agrees with results of Kirby and Parman (1986).

Escape protein percentage of the diet (as determined by 16h Dacron bags) was lower in late July compared with mid June. However, percentage of escape protein in the diet was high during both mid June and late July indicating that steers were receiving plenty of escape protein. These values suggest that ruminal degradable protein (total CP-escape CP) may be marginal for optimal microbial growth and livestock performance. These data agree with Olson et al. (1994) who reported suboptimal ruminal ammonia levels in steers grazing mixed grass prairie during late July and August.

Identification of deficiencies in diet and ruminal digestive capacity of grazing cattle is useful to determine specific supplementation needs (Olson et al., 1994). Being aware of seasonal trends in diet nutrient composition can enable a producer to make appropriate supplementation decisions in order to maintain animal performance. These preliminary data suggest that nutrient quality is adequate for cattle grazing rangeland in western North Dakota from mid June to early September. Moreover intake declines as the season advances. Data evaluating CP and escape protein levels in forage indicate that ruminal degradable protein may be marginal. Additional collection periods throughout the late fall and winter will add to this data base.

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Table 1. Influence of advancing season on chemical composition of mixed grass diets grazed by beef cattle in western North Dakota (DM basis).

Item	Mid June	Late July	Early September	SE
No. of observations	6	6	6	---
OM	79.77[a]	86.30[a]	86.85[b]	.51
CP	12.89[a]	13.82[b]	9.89[c]	.26
Escape Protein[d]	10.73[a]	9.57[b]	---	.41
ADF	35.71[a]	34.82[a]	40.28[b]	.59
NDF	59.50	---	---	1.0
In vitro digestibility	64.64[a]	57.45[b]	52.49[c]	.9

[abc]Means in a row that do not have common superscripts differ (P<.10).

[d]Estimated from omasal samples

Table 2. Influence of advancing season on organic matter (OM) intake, fecal output (OM basis) and ruminal fill (OM basis) by beef steers grazing mixed grass prairie in western North Dakota.				
Item	**Mid June**	**Late July**	**Early September**	**SE**
Fecal output, lb	4.61[a]	4.94[a]	6.56[b]	.23
% BW	.55[a]	.53[a]	.64[b]	.02
OM intake, lb	14.44[a]	12.55[b]	14.8[a]	.59
% BW	1.72[a]	1.35[b]	1.44[b]	.06
Ruminal fill, lb	7.64[a]	13.01[b]	---	.74
% BW	.92[a]	1.4[b]	---	.07
Steer wt, lb	840[a]	934[b]	1028[c]	20.60
[abc]Means in a row that do not have common subscripts differ (P<.10), n=6.				

Table 3. Influence of advancing season on in situ dry matter (DM) disappearance (%) in beef steers grazing mixed grass prairie in western North Dakota.					
Incubation Time, h	**Mid June**	**Late July**	**Early September**	**Early October**	**SE**
0	16.5[a]	21.9[b]	15.8[a]	21.0[b]	1.10

4	24.0^{a}	27.6^{b}	20.7^{c}	25.1^{ab}	1.20
8	37.2^{a}	40.6^{a}	27.7^{b}	33.9^{ac}	1.44
12	48.6^{a}	50.3^{a}	37.6^{b}	41.1^{b}	1.57
16	53.9^{a}	55.1^{a}	45.8^{b}	45.2^{b}	1.95
24	64.5^{ab}	57.7^{ab}	55.9^{abc}	56.2^{bc}	3.38
36	72.4^{a}	69.9^{a}	63.0^{b}	63.5^{b}	1.40
48	77.0^{a}	72.4^{b}	67.1^{c}	67.5^{c}	1.24
72	80.2^{a}	75.3^{b}	70.3^{c}	70.4^{c}	1.18
^{a,b,c}Means in a row that do not have common superscripts differ (P<.10), n=6.					

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