Nutrient Content of Sheep Diets Grazing Western North Dakota Prairie

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Competition between cattle and sheep for nutrient selection when grazing a common area may be minimal. Cook et al. (1967) reported sheep diets significantly higher in fat (ether estract), phosphorus, total protein, and lignin when compared to cattle diets. Similar results were reported for crude protein by Thetford et al. (1971), Kautz and Van Dyne (1978), and Squires (1982). Reported digestibility and cell wall content of diets from these two ruminant species have been more variable. Cook et al. (1967) and Kautz and Van Dyne (1978) found more cell wall constituents in cattle diets. Thetford et al. (1971) and Kautz and Van Dyne (1978) reported similar digestibilities in diets collected from cattle and sheep, while Squires (1982) determined that sheep maintained diets 5 to 6 percentage points higher in digestibility than cattle.

The mixed grass prairie of western North Dakota has been traditionally grazed by cattle. Botanical composition of cattle (Kirby and Parman, 1986) and sheep (Kirby and Humann, 1986) diets have been reported for the mixed grass prairie. These indicated that: 1) cattle were not efficient at harvesting the variety of vegetation present in the mixed grass prairie, especially the broad-leaved species, and 2) unlike cattle, ewes consistently selected broad-leaved forages in greater amounts than were available regardless of grazing system or management. This study determined the nutritive content of forage consumed seasonally by ewes grazing mixed-grass prairie: (1) commonly with cattle on short duration (SDG) or repeated seasonlong (RSLG) grazing treatments, and (2) commonly with cattle compared to following a cattle herd on an SDG treatment.

The study was conducted on the Dickinson Experiment Station. Annual average precipitation is 15.5 inches with 80 percent received during the growing season, April through September. In 1983 and 1984, 15.5 and 14 inches of precipitation was received, respectively.

The 640-acre study area was divided into two equal sized grazing treatments. One-half was grazed continuously seasonlong. Twenty cow-calf pairs were stocked in 1983 and 25 cow-calf pairs in 1984 on the RSLG treatment. An eight-pasture, one-herd SDG treatment was implemented on the remaining half with each equal-sized paddock radiating from a central watering facility. Thirty-five cow-calf pairs were stocked and rotated on a five-day occupation: 35-day nonuse period throughout the grazing season on the SDG treatment. Each paddock in the SDG treatment was occupied three to four times a season. The trials were initiated on June 17, 1983 and June 27, 1984 and were terminated October 26, 1983 and November 5, 1984, after 130-day grazing seasons. Stocking rates were 2.1 and 3.0 (1984) acres/AUM on the SDG and RSLG treatments, respectively.

Five range sites, silty, sandy, shallow, clayey, and thin claypan, were delineated within each grazing treatment. The range sites were not evenly distributed between treatments (Table 1). All sites were estimated to be in high fair to low good range condition. Production and disappearance of graminoids, forb, and totals were estimated using paired plots. Five portable exclosures were randomly located within each range site with two 0.25 square meter quadrats within each exclosure. Herbaceous vegetation was clipped, oven dried, then weighed. Range sites were sampled four to five times each year with exclosures moved after each clipping to estimate grazed weight of herbage produced. Disappearance of graminoids, forbs and half-shrubs was determined by calculating the weight difference between grazed and ungrazed paired plots.

Four to five esophageally fistulated ewes were used to collect diets representative of grazing sheep. Sheep were grazed during early summer (June 15-July 1), summer (July 1-August 1), early fall (August 1-September 15), and fall (September 15-November 1). Sampling was restricted to three locations in the RSLG treatment and three adjacent paddocks on the SDG treatment comprised of similar conditioned range sites. Ewes also grazed on the same three SDG paddocks immediately following the rotation of a cattle herd from these paddocks.

Sheep were fasted overnight prior to diet collection to encourage grazing during the collection period and reduce the incidence of contamination of regurgitation. Sheep were allowed to graze each site or paddock for approximately 20 to 25 minutes. Representative samples from each sheep were then frozen before drying.

Diet samples were ground in a Wiley mill prior to nutrient analyses to determine crude protein (CP) and in vitro digestible organic matter (IVDOM).

Statistical tests were used to compare graminoid, forb and total herbaceous production and disappearance between similar sites and ewe diets on the grazing treatments.

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Table 1. Forage production (lb/ac) and percentage disappearance in parentheses by class on five range sites for short duration (SDG) and repeated seasonlong (RSLG) grazing treatments.

Range Site	Forage class					
	Graminoid		Forb		Total herbaceous	
			1983			
	SDG	RSLG	SDG	RSLG	SDG	RSLG
Sandy	1556 (78a)[1]	1586 (50b)	130 (14)	246 (8)	1686 (73a)	1832 (42b)
Thin claypan	584 (47)	605 (41)	119a (48)	575b (15)	703a (47)	1180b (28)
Silty	1859 (44)	2167 (55)	257 (11)	222 (7)	2116 (40)	2389 (50)
Shallow	1080 (38a)	1301 (59b)	129 (18)	151 (23)	1209 (36a)	1452 (55b)
Clayey	1273 (79a)	1652 (31b)	154 (22)	104 (15)	1427 (73a)	1756 (31b)
Weighted average	921a (49)[2]	1515b (48)	135 (21)	205 (14)	1056a (46)	1720b (43)
			1984			
Sandy	1060 (71)	1254 (62)	96 (45)	127 (47)	1156 (69)	1381 (60)
Thin claypan	421 (70)	502 (64)	133 (28)	212 (40)	554 (60)	714 (57)
Silty	1331 (62)	1466 (59)	196 (54)	279 (57)	1527 (60)	1745 (59)
Shallow	1061a (60a)	1336b (64b)	93 (41)	63 (57)	1154a (58a)	1399b (63b)
Clayey	1459a (66a)	1180b (58b)	206 (49)	176 (68)	1665a (64a)	1356b (59b)
Weighted average	790a (63)	1208b (61)	128 (52)	163 (56)	918a (60)	1371b (60)

[1]Means for production and disappearance in the same year, range site and forage class or total followed by a different letter are significantly different (P 0.05, t-test).

[2]Weighted averages were determined by summing the production from each range site multiplied by the percent each site comprises of the total area within each treatment. Percentage of sandy, thin claypan, silty, shallow, and clayey range sites for the SDG and RSLG treatments were 3, 45, 8, 37, 7 and 4, 12, 20, 32, 32, respectively.

RESULTS

Graminoid, forb and total herbaceous availability varied between range sites both years of the study (Table 1). Graminoid and total herbaceous availability were usually lower on the SDG treatment both years of the study. This can be attributed to a greater perentage of the higher producing range sites, sandy, silty, and clayey, on the RSLG treatment when compared to the SDG treatment. Each year forbs contributed approximately 15 percent to total herbaceous production on both treatments.

Disappearance of graminoid and total herbaceous forage was also quite variable among range sites both years (Table 1). Each year significant differences in total herbaceous disappearance occurred between similar sites on the grazing treatments. However, mean herbaceous disappearance was similar between treatments each year despite a greater stocking rate on the SDG treatment.

Dietary CP generally decreased as seasons progressed on both grazing treatments each year (Table 2). However, significant seasonal differences in 1983 occurred only on the SDG treatment in which percentage CP selected in early fall diets was lower than that selected in early summer and summer. Fall dietary CP was lower than that selected in summer diets.

One difference in dietary CP was noted between SDG and RSLG treatments in 1983 (Table 2). Summer dietary CP was significantly higher, 13.0 percent, on the SDG treatment when compared to the RSLG treatment, 10.7 percent. However, this difference is not very meaningful when considering a ewe's maintenance requirement for CP is 8.9 percent.

Table 2. Crude protein and in vitro digestible organic matter in diets of sheep on short duration (SDG) and repeated seasonlong (RSLG) grazing treatments.

Year	Treatment	Season			
		Early summer	Summer	Early fall	Fall
		crude protein (%)			
1983	SDG	11.6bc[1] ±.60[2]	13.0ab ±.57	9.3d ±.45	9.7cd ±.29
	RSLG	10.1cd ±.25	10.7cd ±.29	9.5d ±.28	8.8de ±.29
1984	SDG	13.0ab ±.58	10.7cd ±.44	8.8de ±.30	7.0ef –.32
	RSLG	14.3a ±.65	9.7cd ±.43	9.0de ±.38	6.0f ±.15
		in vitro digestible organic matter (%)			
1983	SDG	61bcd ±1.7	61bdc ±2.2	55cd ±2.0	52cd ±1.9
	RSLG	69b ±2.9	59cd ±2.4	53cd ±2.6	52cd ±2.5
1984	SDG	78a ±1.2	56cd ±1.7	51d ±1.0	36f ±1.6
	RSLG	78a ±1.2	55cd ±0.9	51d ±0.8	39f ±1.3

[1]Means within nutrients followed by a different letter differ at the 0.05 level.

[2]Standard error.

Crude protein in ewe diets decreased each season on both grazing treatments in 1984. Early summer dietary CP under SDG was greater than the remaining seasonal dietary collections. Summer diets had significantly higher percentage CP than those selected in fall. Percentage CP in diets selected on the RSLG treatment was different each season with the exception of summer and early fall dietary collections. No difference in dietary CP between treatments was found in 1984.

Each year dietary IVDOM decreased seasonally on both grazing treatments (Table 2). Percentage IVDOM on the SDG treatment did not differ in 1983. Diets selected in early summer on the RSLG treatment had greater percentage IVDOM decreased each season in 1984, with the exception of summer and early fall, on both grazing treatments.

Percentage IVDOM decreased in diets each season on both grazing treatments in 1984 (Table 2). No differences in dietary IVDOM occurred between the grazing treatments in any season of 1984.

Dietary CP selected by ewes tended to decrease seasonally both years regardless of whether ewes grazed commonly with or following cattle under SDG (Table 3). Only one significant decrease in dietary CP was found between diets collected with a cattle herd or following this herd. Summer diets of ewes in 1983 were higher in percentage CP when the ewes grazed in common with the cattle herd. However, dietary CP met or exceeded ewe maintenance requirements for CP, regardless of season or period of collection, both years of the study.

Percentage IVDOM decreased seasonally in diets of ewes both years of the study regardless of whether diets were collected with or following cattle. A significant seasonal decrease in dietary IVDOM occurred when ewes followed cattle in 1983. However, no difference in dietary IVDOM was found between diets of ewes grazing with or following a cattle herd either year of the study.

Table 3. Crude protein and in vitro digestible organic matter in diets of sheep grazing commonly with or following cattle on a short duration grazing system.

Year	Collection period	Season: Summer	Season: Early fall
		crude protein (%)	
1983	In common	13.0a[1] ±.56[2]	9.3b ±.45
	Following	10.5b ±.26	10.3b ±.39
1984	In common	10.7b ±.44	8.8b ±.30
	Following	8.9b ±.46	8.8b ±.24
		in vitro digestible organic matter (%)	
1983	In common	61ab ±2.2	55bc ±2.0
	Following	65a ±2.2	56bc ±1.7
1984	In common	56bc ±1.7	51cd ±1.0
	Following	53bcd ±1.1	46d ±1.2

[1]Means within nutrients followed by a different letter differ at the 0.05 level.

[2]Standard error.

DISCUSSION

While cattle are the predominant grazers of range and pasture in the Northern Great Plains, sheep offer a significant untapped potential use of this diverse grazing resource. Only 215,000 ewes and lambs were reported on North Dakota farms and ranches in 1985 (USDA 1985). Since the mixed grass prairie provides an abundant variety of classes and species of vegetation, we questioned whether one class of livestock could make efficient use of this varietal abundance. Examination of the quality of ewe diets seasonally and across grazing management treatments was necessary to assess the productivity potential of ewes when stocked with cattle in the mixed grass prairie.

The typical production cycle, breeding, gestation, and lactation, of ewes compares favorably with the quality of forage selected seasonally by ewes in this study. Percentage CP and digestibility of forage was high in early summer and summer when ewes were lactating. Ewes are near termination of lactation following summer, so forage quality requirements are less, which coincides with a decrease in forage quality in early fall. Lambs are weaned and ewes bred in the fall when dietary quality and nutrient requirements are both low. In dryer years such as 1984, fall supplementation may be desirable to improve ewe body condition just prior to breeding.

We hypothesized that a prior grazing by cattle on our SDG treatment should result in no change or an increase in nutrient quality of forage available ewes. This hypothesis was based upon the assumptions that cattle would: 1) remove the coarser herbage and expose tender, nutritious forage, 2) concentrate on graminoids allowing ewes to graze broad-leaved forages, and 3) not harvest forage as efficiently (i.e., graze forage close to the soil surface) as ewes.

No consistent trend in nutrient quality of forage selected by ewes following a cattle herd was evident under SDG. Percentage CP in diets was higher in summer 1983, when ewes were grazed in common with cattle; however, diets of ewes grazing in common or following cattle exceeded CP maintenance requirements of ewes. No meaningful differences in digestibility of diets were found. Therefore, dietary quality data from this study suggests a choice is possible when stocking cattle and ewes under SDG. Since increases in facilities and labor may be necessary when managing separate livestock herds, stocking a single cattle-sheep herd may be more efficient.

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