

Forage Preferences Exhibited by Cattle on a Short Duration Grazing System

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Knowledge of the various ways that range plants respond to grazing pressure is a fundamental principle of range management and the implementation of grazing systems (Mathis and Kothmann, 1971). All systems of grazing are centered around the control of frequency and severity of defoliation of individual plants (Heitschmidt and Walker, 1983). The ultimate goal with any grazing system is to maintain stability in green leaf material for better ground cover and production (Donart, 1983).

Specialized grazing systems incorporate scheduled moves of livestock from one pasture to another as a means of harvesting the forage and still securing proper regeneration of the vegetation (Holecheck, 1982). Short duration grazing (SDG) is such a specialized system.

One goal of the SDG system is to increase forage production by controlling the frequency and intensity of plant defoliation (Sharrow, 1983). Hypothetically, SDG improves the efficiency by which forage is harvested and converted to animal protein. The high animal density for a short period of time employed by SDG tends to increase grazing pressure, suppressing dietary selectivity by animals. This favors a more even utilization of all forage (Sharrow, 1983). SDG also creates better distribution and utilization of the range early in the season when forage quality is high. SDG enhances the efficiency of livestock to harvest more plant species, particularly the short-lived annual grasses and forbs (Heitschmidt et al., 1982).

In order to take advantage of the range resource, the role of forbs and browse on rangeland needs to be reevaluated. In addition to supplying considerable quantities of forage for grazing animals, forbs also furnish high quality forage. Many forbs average more than 12 percent crude protein on a yearly basis and much more when they are actively growing (Pieper and Beck, 1980). In some instances, the presence of forbs may reduce the need for supplemental feeding of range livestock. The leaves of forbs and browse yield their nutritional potential more than grass leaves and stems (Short et al., 1974). Therefore, ranges supporting a high component of palatable forbs and browse have the capacity to improve nutrient intake by cattle, particularly during periods of drought (Holecheck and Vavra, 1982).

Botanical composition of cattle diets can vary greatly within seasons and from year to year (Bohman and

Lesperance, 1967). Grasses have been reported to be the most important component of cattle diets in many studies. Fifteen studies on various types of western rangelands showed cow diets to average 75, 16 and 9 percent grass-forb-browse, respectively (Theurer et al., 1976). However, studies in New Mexico indicated forbs can consistently make up to 31 percent of the diet during the early spring (Herbel and Nelson, 1966; Allison et al., 1977).

Cattle preference for forbs increases during spring and early summer and then remains intermediate to grass and browse for the remainder of the summer (Thetford et al., 1971; Wallace et al., 1972). Forbs usually make up a higher percentage of the diet than of the herbage available in spring, which leads to high preference values.

The objectives of this study were to examine the botanical composition of cattle diets seasonally on a short duration grazing system, and determine relative preferences for forage classes and species of the mixed grass prairie exhibited by cattle on a short duration grazing system.

This study was conducted on the Dickinson Experiment Station Ranch Headquarters in Dunn County, approximately three miles southwest of Manning. The study area is part of the Missouri Slope vegetation zone and is within the Missouri River Basin. Average precipitation for this location is 15.5 in. with 80 percent of the total falling during the months of April through September. Average daily temperature for this location is 40°F with a high of 69°F in July and a low of 8°F in January. The growing season averages 120 days.

The taxa represented are typical of the mixed grass prairie (Whitman and Wali, 1975). Herbaceous cover is dominated by grasses with important species western wheatgrass (*Agropyron smithii*), junegrass (*Koeleria pyramidata*) and blue grama (*Bouteloua gracilis*). Important forb species include birds foot trefoil (*Lotus purshianus*), scarlet globemallow (*Sphaeralcea coccinea*), golden rod (*Solidago* spp.) and sweetclover (*Melilotus officinalis*).

A wooded draw composed mainly of green ash (*Fraxinus pennsylvanica*) traverses the half-section. A secondary woody layer in the draw is characterized by western snowberry (*Symphoricarpos occidentalis*) and prairie wild rose (*Rosa arkansana*).

Five range sites, thin claypan (Tc), shallow (Sh), sandy (Sa), silty (Si) and clayey (Cl), comprised nearly all of the study area. The SDG system was comprised of 50, 32, 3, 8 and 7 percent, respectively, of these five range sites.

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Grazing Treatment

The SDG treatment consisted of an eight-pasture, one herd system implemented on 320 acres. The eight equal sized pastures radiated out from a central water and handling facility. The cows were moved on a five-day graze: 35-day rest schedule. Each pasture was grazed three to four times per season. Grazing began in June both years and continued until late October.

Herbaceous Availability

Five range sites were delineated within the SDG treatment. Seasonal availability of grass by class and forbs by class and species was estimated by applying double sampling and regression. Ten portable enclosures were randomly located within each site, and two 1.5 square foot plots were located within each enclosure. Sites were sampled four times each year in early summer, summer, fall and late fall.

Browse Availability

The SDG treatment was subdivided into 130, 2.5-acre quadrats and 20 of these quadrats were randomly selected for browse availability determinations. Within each quadrat, three 10 ft. radius circular plots were located and all stems of western snowberry and prairie wild rose were counted. Current year's growth of representative western snowberry and prairie wild rose stems were clipped and dried and production was estimated in pounds per acre.

Dietary Collection

Four to six esophageally fistulated cows were used to collect diets representative of grazing cattle. Diets were collected four times during the grazing season to coincide with forage availability determinations. Cows were fasted overnight before diet collection and sampled at 7 am for two successive half hour periods on each pasture.

Botanical Analysis and Relative Preference

Botanical composition of cow diets was determined using a microscope analysis technique (Kothmann, 1968). Yearly and seasonal contributions to the diet were estimated for grass by class and forbs and browse by class and species.

Relative preference ratings were also determined yearly and seasonally for grass by class and forbs and browse by class and species using the equation described by Durham and Kothmann (1977). Ratings of +10 and -10 are maximum and minimum preferences values, while 0 indicates selection in proportion to availability. Preference values -4 or less were considered avoidance.

Results and Discussion

Dietary composition by class of forage in 1982 and 1983 is shown in Table 1. Grass dominated the diets for all seasons both years of the study. However, the grass component of the diet was significantly lower during the early summer grazing period than the other three periods in 1982 and significantly lower than the fall and late fall periods in 1983. This was due to the relatively large contribution that forbs made to the diet during this grazing period. The greater forb contribution during the early summer period supports the contention that cows will consume a greater quantity of forbs early in the grazing season when they are more nutritious and palatable and that forb use decreases subse-

quently (Thetford et al., 1971; Wallace et al., 1972). Browse averaged less than 5 percent of the diet in all periods, both years, and was not significantly different for any of the grazing periods.

Table 1. Botanical composition (%) of diets and relative preference indices¹ in parentheses for cattle grazing a short duration grazing system on the Dickinson Experiment Station, Ranch Headquarters.

Plant Class	Season			
	Early Summer	Summer	Fall	Late Fall
1982				
Grass	72b ² (1)	82a (1)	87a (2)	87a (3)
Forb	24d (0)	14e (-2)	9e (-5)	9e (-6)
Browse	4g (-3)	4g (-2)	4g (-4)	4g (-6)
1983				
Grass	86a (1)	88ab (1)	93bc (1)	95c (1)
Forb	13d (1)	11de (1)	6ef (0)	4f (-2)
Browse	1g (-8)	1g (-8)	1g (-9)	1g (-9)

¹Relative preference = $\frac{\% \text{ in diet} - \% \text{ available}}{\% \text{ in diet} + \% \text{ available}} \times 10$

²Dietary means in the same row followed by a common letter are not significantly different ($P > 0.05$), Duncan's multiple range test.

The increased grass and decreased forb levels found in diets between 1982 and 1983 portray the differences in amount and timing of growing season precipitation. Rainfall in 1983 was half of 1982 and came in late June and early July, too late to benefit forb production. However, the 1983 relative preference indices for grass and forbs show some similarities to those of the previous year. The increased availability of grass from 1982 to 1983 prevented the preference values for grass from ever exceeding '1' during 1983. The indication is, however, that cows choose these forage classes in the approximate proportion to their availability from one year to the next.

The percent availability, percent in diet, and a relative preference index for all classes of forage and species of forbs and browse are summarized in Table 2. Only forb and browse species that occurred in at least 15 percent of microscope grids and 15 percent of plots clipped for availability are included.

During the 1982 early summer grazing period, grass was selected slightly higher in diets than its availability. Grass is usually the greatest forage component of rangeland in the mixed grass prairie; therefore, relative preference values for grass usually would not exceed '2' with values greater than '1' indicating a strong preference for this forage class. Forbs as a class were selected by cattle proportional to their availability for this grazing period. Cows showed a preference for bird's foot trefoil, daisy fleabane and American vetch. Browse was a nonpreferred forage class during this grazing period; however, western snowberry was determined to have a positive preference value.

The relative preference indices for grass and forbs for the early summer grazing period of 1983 were '1', indicating a preference for both classes. Sweetclover was the dominant forb species in the diet, comprising 7 percent of the total diet

Table 2. Seasonal composition of available forage and cow diets, and relative preference¹ in parentheses of forage by class and species exhibited by grazing cattle on a short duration grazing system at the Dickinson Experiment Station, Ranch Headquarters.

Plant class and species	Early summer			Summer			Fall			Late fall		
	A ² %	D %	(RP)	A %	D %	(RP)	A %	D %	(RP)	A %	D %	(RP)
1982												
Grass	67	72	(1)	73	82	(1)	64	87	(2)	50	87	(3)
Forb	25	24	(0)	21	14	(-2)	27	9	(-5)	35	9	(-6)
American vetch	0.8	1.2	(2)									
Birds foot trefoil	4.7	6.3	(2)	5.7	4.4	(-1)	4.3	4.1	(0)	3.6	2.8	(-1)
Daisy fleabane	0.8	1.5	(3)									
Alkali plantain	4.6	2.7	(-3)	2.6	1.2	(-4)	4.9	0.9	(-7)	4.9	1.1	(-6)
Goldenrods	2.2	1.2	(-3)									
Peppergrass	1.4	1.2	(-1)	0.8	0.7	(-1)						
Scarlet globemallow				0.8	0.4	(0)	0.7	0.6	(-1)			
Purple coneflower				1.1	1.1	(0)				5.3	1.5	(-6)
White aster							4.5	0.7	(-7)			
Unknown forbs	1.0	3.2		0	2.9		0	1.4		0	1.8	
Miscellaneous forbs	9.5	6.7		10	2.9		12.6	1.3		21.2	1.8	
Browse	8	4	(-3)	6	4	(-2)	9	4	(-4)	15	4	(-6)
Western snowberry	2	3	(2)	3	3.1	(0)	4.5	2.1	(-4)	8.5	3.9	(-4)
Miscellaneous browse	6	1		3	0.9		4.5	1.9		6.5	0.1	
1983												
Grass	77	86	(1)	79	81	(1)	79	93	(1)	79	95	(1)
Forb	11	13	(1)	9	11	(1)	6	6	(0)	6	4	(-2)
Birds foot trefoil	0.7	0.3	(-1)	0.4	0.8	(3)						
Alkali plantain	1.3	0.4	(-5)				0.2	0.3	(2)			
Goldenrods	0.4	0.7	(3)	1.4	1.8	(2)	1.2	1.3	(1)	1.2	0.9	(-6)
Scarlet globemallow	0.7	1.1	(2)	0.6	2.8	(6)	0.3	1.1	(6)	0.3	1.4	(6)
White aster							0.4	0.2	(-3)			
Sweetclover	0.2	7.0	(9)									
Unknown forbs	0	1.5		0	1.7		0	1		0	0.4	
Miscellaneous forbs	8	2		6.6	3.9		3.9	2.1		4.5	1.5	
Browse	12	1	(-8)	12	1	(-8)	15	1	(-9)	15	1	(-9)
Western snowberry	5.4	0.7	(-8)	5	0.9	(-7)	7	1	(-8)	7	0.9	(-8)
Miscellaneous browse	6.6	0.3		7	0.1		8	0		8	0.1	

$$^1\text{Relative preference} = \frac{\% \text{ in diet} - \% \text{ available}}{\% \text{ in diet} + \% \text{ available}} \times 10$$

²A, D, and RP are abbreviations for available forage, dietary forage and relative preference.

and nearly 60 percent of the forb portion of the diet. Other preferred forb species were goldenrods and scarlet globemallow. An avoided species was alkali plantain. Browse was strongly avoided.

During the 1982 summer grazing period, grass increased 10 percentage points and the forb component decreased 10 percentage points in the diets compared to their early summer values. Forbs had become less palatable and less abundant, and the cows responded by selecting more grass. Scarlet globemallow and purple coneflower were selected in proportion to their availability, while alkali plantain was avoided. Even though birds foot trefoil and alkali plantain had negative preference values, they were the two species contributing most to the forb component of the diet. Their negative preference values stem from the relative abundance of these two species.

In the summer grazing period of 1983, an increase in percentage grass and a decrease in percentage forbs in the diet occurred again. Sweetclover, at 1.7 percent, was a major contributor to the diet as in the early summer period. A calculated preference index was not possible, due to its absence in plots clipped for availability. Browse was avoided for this period in 1983.

The fall dietary collection period of 1982 saw the grass component rise to 87 percent while the forb component fell to 9 percent. The availability of forbs had actually increased from the late summer collection to the fall, so the decrease in forb use can be entirely attributed to the loss of forb palatability. Birds foot trefoil made up 4 percent of the total diet and contributed nearly 50 percent to the total forbs found in the diet.

Fall diets in 1983 were consistent with expected trends. Forbs dropped to 6 percent of the total diet; however, forbs comprised only 6 percent of available forage, hence a preference index of zero. Goldenrods, scarlet globemallow and alkali plantain were preferred even at this late date. White aster had a negative preference index.

Late fall diets in 1982 were similar to the fall period diets. An increase in forb and decrease in grass availability increased the relative preference value for grass during this period to '3' and decreased the value for forbs to '-6'. Purple coneflower and alkali plantain were avoided. Western snowberry made up 98 percent of the browse contribution to the diet but was still avoided with a preference value of '-4'. In 1983, late fall diets consisted of 95 percent grass and only 4 percent forbs. Only scarlet globemallow was preferred. Browse comprised only 1 percent of the diet.

Conclusions

Forbs as a class of forage are important contributors to cattle diets in the early portion of grazing season. When dealing on a species level, however, the results are far less conclusive. The precise seasonality of many forb species and the variable production capabilities of forbs from year to year prohibit any strong conclusions on a species level.

Preference values for forage encountered during the 1982 grazing season were evident in 1983 as well. Despite the increased grass and decreased forb levels found in the diet between 1982 and 1983, the relative preference indices were similar. This indicates cattle may choose these forage classes in the approximate proportion to their availability from one year to the next.

Under proper grazing, forbs and browse can provide a considerable amount of nutritious, seasonal forage for livestock. Despite the increased use, total forb and browse utilization was still low. A ruminant, such as sheep, that prefers broad-leaved plants would need to be incorporated into any long-range management schemes in order to effectively utilize all available forage resources on diverse rangeland such as the mixed grass prairie of central and western North Dakota.

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