Sheep grazing behavior as affected by supplementation

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Abstract

Behavioral characteristics of supplemented (S; 23% crude protein, 3.41 mcal DE/kg) and nonsupplemented (N) ewes grazing native New Mexico rangeland were monitored from December 1983 to August 1984. Four marked ewes were observed per treatment group. Behavioral data were collected by simultaneous observations of both treatment groups by 2 observers starting 0.5 hour before sunrise, and continuing until 0.5 hour after sunset. Trials were conducted during the winter breeding season while ewes grazed dormant forage, during spring lambing that coincided with the onset of active forage growth, and during summer lactation, during both a quiescent period and active forage growth. Supplement was not fed during the summer. Total grazing (min/day) was less ($P=0.01$) in winter, equal in spring, and greater ($P=0.01$) in summer for S than N ewes. Mean daily periods of loafing for S ewes was greater ($P=0.01$) in winter; equivalent in spring, and less ($P=0.01$) in summer than for N ewes. Daily travel time did not differ between S and N ewes during the winter; however, S ewes traveled more ($P=0.02$) in spring and less ($P=0.01$) in summer than N ewes. Supplemented ewes tended ($P=0.06$) to weigh less after the winter breeding season, and weaned similar, but slightly heavier, lambs ($P=0.14$) than N ewes. There were no differences ($P>0.22$) in ewe live weights during the remainder of the study. Mean fleece weights were not different ($P=0.52$) between S and N ewes. Supplemental feeding of range ewes, under the conditions of this study, did not appear to improve overall production by S ewes. Slower weight gains for S ewes during breeding may have resulted from reduced grazing time noted for this period.

Key Words: range ewes, lambs, supplementation, activities

Behavior is the animal's response to its total environment. Therefore, management can alter behavior by altering the environment of a grazing animal. One alteration tactic is supplemental feeding. For example, protein supplementation can improve crude protein digestion (Coleman and Wyatt 1982) and increase forage intake (Cook and Harris 1968, Leibholz and Kellaway 1984). Whereas energy supplementation can reduce forage intake (Clanton et al. 1971). Effects of supplemental feeding on grazing time also may be influenced by social interactions within the herd (Holder 1962). Hence, supplemental feeding may effect behavioral as well as nutritional characteristics. The present study was conducted to determine the effects of a supplemental feed on grazing behavior of range sheep.

Methods

Study Area

Trials were conducted at the Fort Stanton Experimental Ranch, which is located at an elevation between 1,950 and 2,250 m in the foothills between Sierra Blanca and the Capitan Mountains of southcentral New Mexico. Long-term (80 years) mean annual

ambient air temperature is 11.1° C, with a minimum of -6.7° C in January and a maximum of 28.8° C in July (Pieper et al. 1978). The 80-year (mean) annual precipitation is 347.8 mm (U.S. Weather Bureau 1970), with about 60% of the precipitation falling between June and September. The major forage species at Fort Stanton is blue grama (*Bouteloua gracilis* [H.B.K.] Lag), which is either the dominant or co-dominant species on all sites. Other important grasses are wolftail (*Lycurus phleoides* H.B.K.), sideoats grama (*Bouteloua curtipendula* [Michx.] Torr.), muhly grasses (*Muhlenbergia* spp.), and galleta (*Hilaria jamesii* [Torr.] Benth.). Common forbs include carruth sagewort (*Artemisia carruthii* Carruth.) and globemallow (*Sphaeralcea coccinea* [Pursh.] Rydb.). Walking-stick cholla (*Opuntia imbricata* [Haw.] D.C.) and winterfat (*Ceratoides lanata* [Persh.] Rog.) are scattered on many of the open areas (Pieper et al. 1978).

The study area was a 140-ha pasture divided into 2 equal 70-ha pastures, enclosed by a seven-wire electric fence. Before collection of behavioral data, the study area was mapped and 3 major vegetation/topographic sectors were defined. These sectors included a south aspect open grassland, pinyon-juniper (*Juniperus* spp.; *Pinus adalidis* Eng. elm.) dominated upland, and a north aspect open grassland.

Feed bunks for the supplement (S) ewes were placed in the corral located on the division fence between the 2 pastures in the north aspect grassland. The 2 pastures were very similar in quantity of area defined as 1 of the 3 vegetation/topographic sectors. Analysis of plant frequency data, obtained before collection of behavioral data, and subsequent herbage availability data, collected during the spring and summer, indicated that the pastures were very similar in plant composition and availability (Hatfield 1985). By placing S and nonsupplemented (N) ewes in separate pastures, treatment and pasture were confounded. However, by separating S and N ewes, the effect of supplemental feeding on grazing, loafing, and traveling times would be more distinct, rather than becoming over-whelmed by the gregarious grazing behavior of sheep.

Treatments and Data Collection

Behavioral data were collected in 1983 and 1984 by recording activities of 4 marked ewes in each of the 2 treatment groups containing 16 ewes. Activities were evaluated during 3 seasons, beginning with winter breeding (9 December to 4 January), followed by spring lambing (16 May to 24 June), and ending with summer lactation (18 July to 3 August). During winter and spring, S ewes were group fed in the morning 200 g • head⁻¹ • d⁻¹ of a pelleted supplement containing 23% crude protein (CP) and 3.41 mcal/kg digestible energy. The supplement consisted of 40% corn, 32% cottonseed meal, 10% soybean meal, 9% alfalfa, 5% molasses, 3% dicalcium phosphate, and 1% trace mineral salt. Supplemented ewes were not driven to the corral area where the supplement was fed. The supplement was placed in the bunk either the preceding night or before sunrise. Hence, supplemented ewes traveled to the corral area and consumed the supplement at their leisure.

Four ewes were selected randomly from each treatment group and branded individually with different colors of paint. Simultaneous observation of activities were recorded by 1 observer for each treatment group. Periodic night observations, and observa-

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Table 1. Time (min) spent by supplemented (S) and non-supplemented (N) ewes grazing, loafing, and traveling during winter, spring, and summer.

Activity	Season											
	Winter				Spring				Summer			
	S	N	SE	P Value ¹	S	N	SE	P Value	S	N	SE	P Value
Grazing												
Morning	101	160	0.4	0.01	171	186	7.0	0.23	183	164	11.6	0.35
Afternoon	141	149	1.2	0.02	218	196	10.2	0.23	235	120	1.8	0.01
Total	242	309	1.1	0.01	389	382	16.0	0.77	418	284	10.0	0.01
Loafing												
Morning	188	131	1.2	0.01	162	156	7.9	0.60	199	197	2.4	0.61
Afternoon	183	173	1.1	0.01	178	210	9.7	0.10	276	323	10.3	0.01
Total	371	304	2.1	0.02	340	366	16.4	0.34	475	570	8.4	0.01
Traveling												
Morning	44	41	0.8	0.10	26	21	1.9	0.15	11	21	0.9	0.01
Afternoon	16	19	0.7	0.08	22	4	1.9	0.01	3	3	0.7	0.66
Total	60	60	1.4	0.89	48	25	3.7	0.02	14	24	1.3	0.01

¹P value for hypothesis of no difference between treatment means.

tions of the location of sheep in the morning following the previous evening observations, supported conclusions of Rogers (1980) and Squires (1981) that sheep exhibit minimal grazing activity between sunset and sunrise, thereby supporting our observations for grazing activity only during daylight.

Observations started 0.5 hour before sunrise and continued until 0.5 hour after sunset. Observed behaviors were recorded every 10 minutes. This frequency was based on Nelson and Furr's (1966) findings that observations at 15-min intervals or longer failed to give reliable estimates of animal activities.

During winter breeding, there were 6, two-day periods of observations: 9–10 December, 14–15 December, 20–21 December, 26–27 December, 30–31 December, and 3–4 January. During spring lambing, there were 3 periods of observations: 16–18 May, 1–5 June, and 21–24 June. During summer lactation, when the S ewes were no longer supplemented because of higher forage availability and lower nutritional demands by the ewes, there were only 7 days of behavioral observations: 18–21 July and 1–3 August.

Data Analysis

Behavioral data collected included grazing, loafing, and traveling times analyzed as morning, afternoon, and day events. Grazing was defined as the amount of time involved in selection of herbage, its prehension, mastication, and swallowing. Loafing included idle and rumination time. Travel was defined as motion without grazing.

Effects of supplemental feed were tested within each period by analysis of variance, using marked animals within pasture as the error term. Because pasture could not be replicated, ewes were considered the experimental unit, although it is recognized that sheep react more as a group than as individuals.

Ewe bodyweights, lamb weaning weights, and fleece weights also were recorded. Ewe bodyweights were taken at the beginning of breeding (11 November 1983), end of breeding (6 January 1984), beginning of lambing (12 April 1984), end of lambing (3 June 1984), and lamb weaning (14 August 1984). Sheep were weighed after an overnight shrink without feed or water. Lambs were weighed at weaning (4 August 1984), and ewe fleece weights were taken at shearing (12 April 1984). All weights were compared using analysis of variance techniques (SAS 1985).

Results

Grazing

Mean grazing time (min) for S ewes was less (<0.02) in the

morning, afternoon, and on a daily basis than for N ewes during winter breeding (Table 1). Although N ewes grazed slightly more in the morning than afternoon (160 and 149 min, respectively), S ewes had a definite preference for afternoon grazing (141 min) compared with morning grazing (101 min). No differences ($P>0.23$) between S and N ewes were noted for mean daily, morning or afternoon grazing times during the spring (Table 1). Supplemented ewes continued to show a preference for afternoon vs morning grazing (218 and 171 min, respectively), while N ewes grazed slightly more in the afternoon than the morning (186 and 196 min, respectively).

Supplement was not fed to ewes during summer lactation. Daily mean grazing time for S ewes was 134 min greater ($P=0.01$) than for N ewes during summer lactation (Table 1). Further, supplemented ewes grazed 115 min longer ($P=0.01$) than N ewes during the afternoon. Morning grazing time of S and N ewes did not differ ($P=0.35$) during summer lactation (Table 1).

Loafing

Supplemented ewes loafed more than they grazed, and loafed more ($P<0.02$) than N ewes (morning, afternoon, and daily) during the winter (Table 1). Observations during winter breeding indicate that S ewes interrupted their morning grazing period to consume supplement, and loafed immediately thereafter.

During spring, there was no difference ($P>0.10$) in loafing time between S and N ewes (Table 1). However, mean daily and afternoon loafing time of S ewes was less ($P=0.01$) than that of N ewes during the summer.

Traveling

Because of the small pastures used in our study, S and N ewes usually incorporated movement to water and feed bunks with grazing. During winter breeding (Table 1), both S and N ewes traveled an average of 60 min daily.

During the spring, mean daily travel time (48 min) for S ewes was greater ($P=0.02$) than for N ewes (25 min; Table 1). There was no difference ($P=0.15$) between S and N ewes for mean morning travel time; however, S ewes had a mean afternoon travel time of 22 min, which was greater ($P=0.01$) than for N ewes (4 min).

During summer lactation, mean daily travel time of N ewes (24 min) and mean morning travel time (21 min) were greater ($P=0.01$) than mean daily and morning travel times of 14 and 11 min, respectively, for S ewes. Both S and N ewes traveled a mean of 3 min in the afternoon during summer lactation.

Animal Performance

Supplemented ewes tended ($P=0.06$) to weigh less at the end of the breeding season, and wean similar, but slightly heavier lambs ($P=0.14$) than N ewes (Table 2). There were no differences ($P>0.22$) in ewe live weights during the remainder of the study. Mean fleece weights were not different ($P=0.52$) between S and N ewes.

Table 2. Bodyweight of ewes and lambs and fleece weights (kg/head) for selected dates throughout the study.

		Ewe Weights			
Animal-activity	(Date)	Supple-mented	Non-Sup-plemented	SE	P value ¹
<u>Ewes</u>					
Breeding					
Beginning	(11-11-83)	49.9	51.8	1.12	0.22
End	(01-06-84)	51.8	54.9	1.21	0.06
Lambing					
Beginning	(04-12-84)	59.4	57.2	1.27	0.22
End	(06-03-84)	60.1	58.2	1.55	0.39
Weaning					
End of study	(08-14-84)	55.5	55.7	1.67	0.92
<u>Lambs</u>					
Weaning	(08-14-84)	30.2	28.1	1.07	0.14
<u>Fleece</u>					
	(04-12-84)	6.6	6.8	0.18	0.52

¹P value for hypothesis of no difference between treatment means.

Discussion

Cook and Harris (1968), Rittenhouse et al. (1970), Clanton et al. (1971), and Huston (1983) concluded that high energy supplements decreased forage intake. Assuming grazing time was indicative of forage intake, results from winter observations confirm these findings. In addition, N ewes gained more weight in this period than S ewes, indicating that any advantage from supplemental feeding was diminished by reduced grazing time.

Supplemented ewes grazed about the same amount of time as did N ewes during the spring, which is not consistent with the theory that energy supplements reduce forage intake. In addition, S ewes spent more time traveling than N ewes during the spring. Travel may have been directed to vegetation site selection, resulting in a higher quality diet for S ewes during the spring. In a companion study (Hatfield 1985), esophageally fistulated ewes that received supplement selected a diet greater in crude protein (CP) and available nitrogen (AN) during this period than nonsupplemented esophageally fistulated ewes. The greater contents of CP and AN in diets of supplemented esophageally fistulated ewes during lambing might have had a positive effect on forage intake, thereby overriding possible negative effects of energy supplements. Research conducted by Elliott (1967) tends to support such a theory, in that intake of hay containing 3.4% CP increased when digestible protein was increased from 1.3 g/kg⁷⁵ to 2.6 g/kg⁷⁵ of bodyweight.

Although S ewes grazed more than N ewes during summer lactation, S ewes grazed only 29 min more than they grazed during the spring, while N ewes grazed 98 min less during the summer compared with their mean grazing time in the spring. Increased grazing time by S ewes was possibly a compensatory activity to offset the absence of supplement. Neither the increase in S nor the decrease in N mean grazing time appeared to influence ewe bodyweights (Table 2).

Both groups of ewes followed a bimodal activity routine similar to that shown by Rogers (1980) and Squires (1981). During winter, spring, and summer, the major midday loafing period was preceded by early morning grazing and followed by late afternoon grazing. Midday loafing was longer during spring and summer than winter because of day length and greater ambient air temperature. Bowns (1971) indicated that gut fill was perhaps the most important factor controlling the relation of loafing to grazing time. However, S ewes typically began their morning loafing immediately after consuming the supplement; thus gut fill may not have been a primary factor influencing the relation of loafing to grazing time. Possibly, short-term chemostatic regulatory factors caused by ingesting a high energy feed caused a suspension of forage intake.

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