Nutritive Value of Clipped and Grazed Range Forage Samples[1]

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Highlight

Esophageal-fistulated yearling steers were grazed on short-grass range units under a rotation and a seasonlong system. The digestibility and protein values of clipped grasses and sedges were compared to fistula samples from the two units. In a dry year clipped forages contained protein levels comparable to those found in fistula samples. In a year with abundant early moisture, annual forbs were produced in abundance. These forbs were grazed readily and brought about higher protein levels and dry matter digestibilities in fistula samples than in clipped samples, especially during the early part of the grazing season.

Forage nutrient evaluations in the past have been conducted using clipped samples. There is a question as to whether or not these data are actually representative of the forage grazed.

This paper reports nutrient evaluations of clipped samples and samples obtained from esophageal-fistulated steers during the summers of 1966 and 1967.

Most studies comparing fistula samples and clipped forage samples have evaluated protein and ash contents. Ash content was usually greater in fistula samples and this increase has been attributed to saliva contamination (Cook 1964).

Cable and Shumway (1966) studied the crude protein levels of rumen fistula samples as compared to hand clipped samples of two major grasses in Arizona, Arizona cottontop (*Trichachne californica*) and Lehman lovegrass (*Eragrostis lehmanniana*). They found the protein content of the fistula samples followed the same general pattern as that of the clipped grasses. However, protein contents of rumen samples were 1.82 times as high as the whole plant clippings. Animals selected the green portions of plants and high protein forbs and shrubs when available.

Lesperance et al. (1959, 1960) in studies on irrigated pastures found little agreement between nutrient levels of fistula samples and forage harvested from caged plots or handclipped samples. Protein

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decreased and crude fiber increased in fistula samples with the length of the grazing period.

Weir and Torrel (1959) compared the chemical composition of clipped forage samples with those collected from esophageal-fistulated sheep. Protein contents were higher in the fistula samples. Crude fiber was higher in clipped samples of ungrazed forage than in fistula samples obtained from the same areas.

Methods of Procedure

The study area was located at the Archer Substation in southeastern Wyoming. The pastures from which both clipped and fistula samples were obtained were located in the rolling shortgrass plains area. The vegetation was dominated by blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), western wheatgrass (*Agropyron smithii*), and needleleaf sedge (*Carex eleocharis*). Forbs made up a very minor component of the vegetation.

Esophageal-fistulated steers were grazed along with nonfistulated steers on two range units. One unit was grazed seasonlong (June 1–September 1). The second unit was divided into three pastures which were grazed in a rotation system. In 1966 fistula samples were collected during four-day periods near the middle of each month. In 1967 samples were obtained at the beginning and end of each rotation period, as well as during the middle of each month. Two fistulated steers were grazed on each unit in 1966 and three on each unit in 1967.

Forage samples were clipped during the same periods that fistula samples were obtained. The species clipped were blue grama, buffalograss, western wheatgrass, needleleaf sedge, needelandthread (*Stipa comata*), prairie junegrass (*Koeleria cristata*), Sandberg bluegrass (*Poa secunda*), and threadleaf sedge (*Carex filifolia*). Entire plants of each species were clipped to one inch stubble heights.

Both the clipped samples and fistula samples were dried and ground to pass a 40-mesh screen. Nitrogen analyses followed A.O.A.C. procedures (1960). In 1967 samples were digested in an artificial rumen using the technique described by Smith et al. (1965).

Utilization expressed as a percentage of weight removed was estimated, using the ocular estimate-by-plot technique (Pechanec and Pickford, 1937). Utilization estimates were made on both grazing units during the midmonth sampling periods and at the end of each month.

Results and Discussion

Protein Content

In 1966, early summer moisture (April 1–July 1) was quite restricted. A limited amount of growth was made by the cool season species, but the warm season grasses produced very little growth until late July.

Table 1. Percent crude protein (%) in range grasses and sedges during the summer grazing season, 1966.

	Sampling Periods		
	June	July	August
Blue grama	6.8	8.8	13.9
Buffalograss	—	6.3	8.9
Western wheatgrass	8.3	7.4	11.5
Prairie junegrass	9.6	8.2	—
Needleandthread	6.4	—	11.3
Threadleaf sedge	—	9.1	12.4

Average crude protein contents of forage samples clipped in 1966 are shown in Table 1. Protein levels were highest during the August sampling period following July rains. Old plant material interspersed with the current season's growth undoubtedly tempered analytical values. Old plant material was not removed from the samples since observations of both forage stubble and fistula samples indicated that cattle were either taking all of the plant material or leaving it entirely. There was no apparent selection by the animals to avoid the old material.

Protein contents of fistula samples obtained during 1966 are given in Figure 1. These values followed the data for individual forages quite closely.

Utilization data indicated that the major components of the steer diets were western wheatgrass during the June period and western wheatgrass with blue grama and needleleaf sedge during the July and August periods.

Crude protein levels in the forage samples clipped in 1967 are shown in Table 2. There was a relatively uniform decline in protein content throughout the grazing season. Protein content declined from a range of 12.5 to 19.6% on June 1 to a range of 3.4 to 7.9% on August 31.

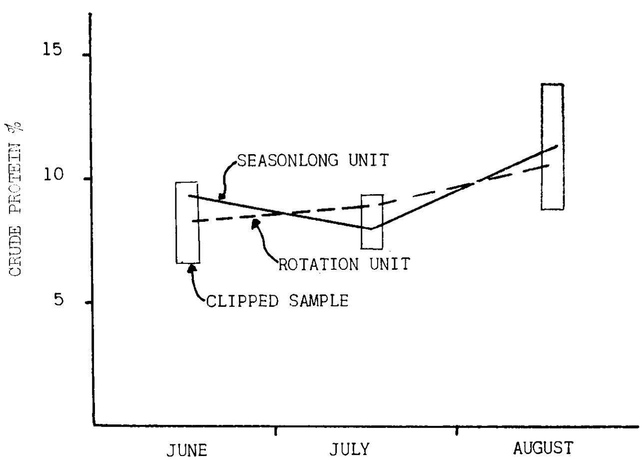

FIG. 1. Average crude protein content of fistula samples from seasonlong and rotation units compared with ranges of protein values for clipped grasses and sedges, 1966.

Table 2. Average crude protein content (%) of range grasses and sedges, 1967.

	June 1	June 15	July 1	July 15	July 28	Aug. 15	Aug. 31
Western wheatgrass	16.3	14.5	8.2	10.2	8.0	6.3	4.7
Blue grama	16.3	14.8	9.4	12.9	7.9	7.1	6.0
Buffalograss	19.6	12.7	13.3	10.2	8.6	3.3	6.1
Needleandthread	15.2	11.6	8.1	6.7	5.5	3.4	3.4
Sandberg bluegrass	12.5	9.7	7.6	7.1	6.8	5.6	6.3
Prairie junegrass	13.3	10.6	9.4	7.9	7.5	5.9	4.7
Needleleaf sedge	16.9	13.6	11.8	12.4	9.6	7.9	7.9
Threadleaf sedge	15.1	12.4	11.4	10.4	7.6	2.9	5.9

The early summer rainfall during 1967 was three times that during the same period in 1966. With this higher rainfall, a large amount of annual forbs developed. The steers sought and grazed the annual mustards (*Cruciferae*), fireweed summercypress (*Kochia americana*), and Russian thistle (*Salsola kali*). Annual forbs such as these are high in protein while green and growing. Crude protein in the fistula samples generally exceeded protein levels in the clipped grasses and sedges (Figure 2).

The discrepancies between the protein levels of steers grazing under the two systems were largely a function of the availability of annual forbs. When the steers were first introduced into a previously ungrazed pasture, the quantity of forbs grazed was large and the protein content in the diet was high. At the end of each rotation period, the animals were afforded little opportunity for selection and their diets contained less protein than diet samples from the seasonlong unit.

In Vitro Digestion

Clipped forage samples were digested in an artificial rumen (Table 3) and in vivo dry matter digestibilities were predicted from the results. Statistical analysis indicated significant differences between some species, although the actual differences were small. There was no appreciable decline in digestibility observed with advancing plant maturity over the period included in this study.

Table 3. Dry matter digestibility (%) of major grasses and sedges estimated from in vitro digestion, 1967.[1]

Species	June 1	July 15	June 30	July 15	July 28	Aug. 15	Aug. 31	X̄
Threadleaf sedge	60.2	62.3	62.4	60.3	59.8	62.5	61.2	61.2[a]
Western wheatgrass	65.9	60.5	61.7	60.4	59.7	61.1	58.3	61.1[a]
Blue grama	63.2	56.5	62.2	60.5	61.5	61.0	60.3	60.7[ab]
Buffalograss	57.7	56.0	62.2	60.5	61.5	61.0	60.3	60.7[ab]
Needleleaf sedge	60.7	58.4	61.0	58.3	60.1	62.6	60.4	60.2[bc]
Sandberg bluegrass	60.4	58.4	60.0	60.2	59.2	60.0	58.8	59.6[c]
Prairie junegrass	61.5	58.8	60.6	57.8	58.9	59.5	58.9	59.4[c]
Needleandthread	60.1	60.0	59.0	58.3	57.0	57.3	57.7	58.5[d]
X̄	61.2	58.9	61.1	59.4	59.4	60.6	59.5	

[1] Values not followed by the same letter are significantly different (.05 level).

Predicted digestibilities of fistula samples showed greater variability than was found in the clipped forage samples (Figure 3). Increases in digestibilities were found in diet samples from the rotation unit when the steers were moved to a new pasture. Undoubtedly, these reflect the selection of annual forbs. As the opportunity for selection of the diet decreased due to heavier use, diets from the two grazing systems showed closer agreement. Digestibility of fistula samples did not decline appreciably with advancing plant maturity.

Summary and Discussion

Protein content and digestibility of fistula samples were compared to those of clipped range grasses

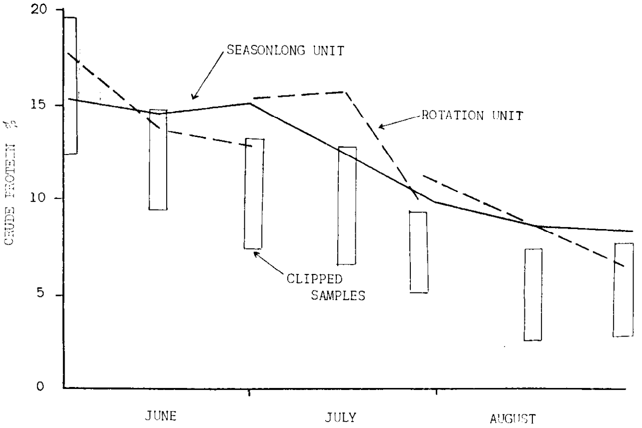

FIG. 2. Average crude protein content of fistula samples from seasonlong and rotation grazing units compared with ranges of protein values for clipped grasses and sedges, 1967.

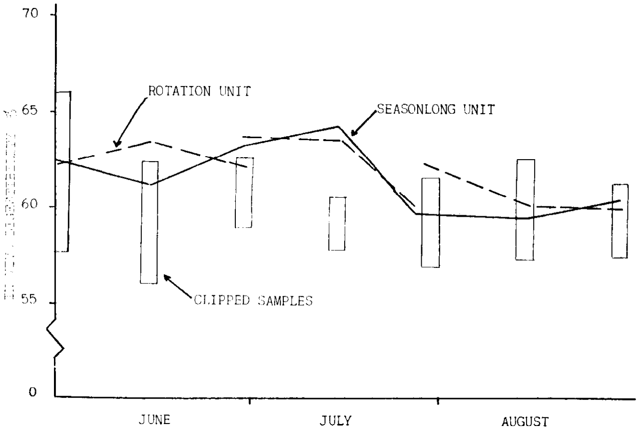

FIG. 3. In vivo dry matter digestibility of fistula samples compared to clipped grasses and sedges, 1967. In vivo values predicted from in vitro digestion.

and sedges. Samples were collected at monthly intervals during June, July and August of 1966 and at two week intervals during the same period in 1967. The clipped forages represented the major grasses and sedges found on the shortgrass rangeland. The fistula samples were obtained from a study comparing the nutrient intake of steers under seasonlong and rotation grazing.

Protein contents were determined from nitrogen analyses of all samples. In vitro digestion (artificial rumen) was used to estimate dry matter digestibilities of samples collected in 1967.

In 1966 protein levels of fistula samples were very similar to those of clipped samples. Early summer rainfall was limited and growth of the warm season grasses did not commence until late July. Highest protein levels in both clipped and fistula samples were observed during the August period.

In 1967 rainfall during the early summer period was high and large quantities of annual forbs developed. Fistula samples reflected the grazing of these forbs with protein levels generally higher than those found in the clipped grasses and sedges. Fistula samples from steers grazing under the rotation system indicated the effect of grazing intensity on forage selection. At the beginning of each rotation period these fistula samples were higher in protein and digestibility than samples from the season long unit. At the end of each rotation period, protein and digestibility were equal or lower. Digestibility of fistula samples tended to be higher than for clipped samples during June and July and were similar during August. Little decline in the digestibility of clipped or fistula samples was noted during the sampling period.

It appears that during a year of average or below average precipitation nutrient analyses of clipped grasses and sedges reasonably approximated nutrient values on shortgrass ranges. In a year of above average precipitation, cattle diets changed and analyses of clipped forage underestimated nutrient values.

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Competitive Uses of Nevada's Range Forage by Livestock and Big Game

The following comments are condensed from a report by A. L. Lesperance and Paul T. Tueller which appeared in the January 1969 issue of RNR Reports, published by the Renewable Resource Center, University of Nevada Cooperative Extension Service.

Primarily because of increased public recreational demands, considerable recent emphasis has been placed on the competition between livestock and big game species. A better understanding of this problem is urgently needed if the range livestock industry is to hold its position in multiple use management of public lands.

Total forage requirements of meat animals (sheep and cattle) are 7.9 million AUMs, one AUM being here defined as 600 lbs. of forage. Approximately 52% of this forage comes from range sources, the remainder from irrigated lands. Of the total range forage requirements, about 53% comes from BLM lands, 6% from National Forests, and 41% from private sources.

Forage utilization by big game cannot be clearly defined, but it is projected that big game species utilize 0.75 million AUMs of range forage annually.

In 1967 the meat animal industry in Nevada generated $77.4 million into the state economy; it is estimated that big game hunting contributes $4.6 million annually. It appears, therefore, that livestock contributes about 17 times more to the economy of Nevada than does big game, but uses less than 6 times as much range forage to do it.

A review of the literature on grazing habits suggests that on grass-brush vegetative types, livestock will consume primarily grass while big game species strongly prefer browse. Research on the botanical composition of cattle and deer diets indicates the following percentages of grass, browse, and forbs respectively in the diets:

Cattle	73%	19%	8%
Deer	6%	80%	13%

The data also indicate that these two animal species do not necessarily consume the same browse species—50% of the browse species consumed by deer have yet to be found in the diets of grazing cattle, and 25% of the deer diet consists of browse species only occasionally taken by cattle. Bitterbrush generally appears to be the most important browse species selected in common by cattle and deer. However, data from California foothill ranges indicate that proper cattle management can improve bitterbrush stands.

The successful management of (*cont'd on p.* 215)