Nutritive Value of Browse on Montana Winter Ranges

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ALTHOUGH there has been much speculation on the value of browse as a winter feed for cattle in the Northern Great Plains region, there has been very little done in the way of a careful study of the problem.

The study reported here was to explore the possibility of a correlation between the blood nutrient levels of cattle on winter ranges in southeastern Montana and the utilization and chemical composition of some of the major browse species of the area.

In 1932, the U. S. Forest Service started a study at the U. S. Range Livestock Experiment Station to determine the effect of light, moderate, and heavy grazing on breeding cows and range vegetation. Summer and winter grazing units were established, the winter pastures being in rough, broken country to provide protection from storms. The pastures were arranged in a more or less circular pattern and watered by a central well. Weights of the breeding cows on these pastures were taken at twenty-eight day intervals (U.S.D.A. Forest Service, 1950).

In 1947, the Montana State Agricultural Experiment Station began a project on the area. The objective of this project was to determine the nutritive value of range plants and their influence in cattle nutrition. It was found that the range grasses were deficient in some nutrients, especially protein and phosphorus, during the fall and winter months. At the same time cattle did not show external symptoms of deficiencies other than energy deficiencies.

The Study Area

Average annual precipitation of the area is 13.2 inches. In all but the more severe winters the snowfall is light and that which falls remains on the ground for only a short time.

The area is considered to be within the mixed prairie association of the grassland formation. The vegetation is dominated by grass species. On the rough, broken winter pastures, various browse species are also abundant (Fig. 1).

Review of Literature

Clarke and Tisdale (1945) found that many of the shrubs are higher in nutritive value when in the cured stage than are the cured grasses, and that many of these species are utilized to a considerable extent in the winter. No other studies on the use of browse on cattle ranges in the Northern Great Plains area have come to the attention of the author. Other workers have determined, however, that browse plants generally are potentially valuable forage species (Table 1).

Of the methods described in the literature, only the one described by Aldous (1945) seemed to meet the necessary requirements. In this method, clusters of twigs were tagged at the beginning of the grazing season. The tagged twigs were measured at the beginning of the season and again at the end of the season, the difference between the total lengths before and after grazing represented the linear amount consumed. By this method, measurements could be repeated at intervals without damage to the plants.

Methods

This study was conducted during the winter grazing seasons of 1950–1951 and 1951–1952 on three winter pastures in southeastern Montana which were grazed at light, moderate, and heavy rates of stocking. In addition, an adjacent pasture, ungrazed during the winter, was used as a control.

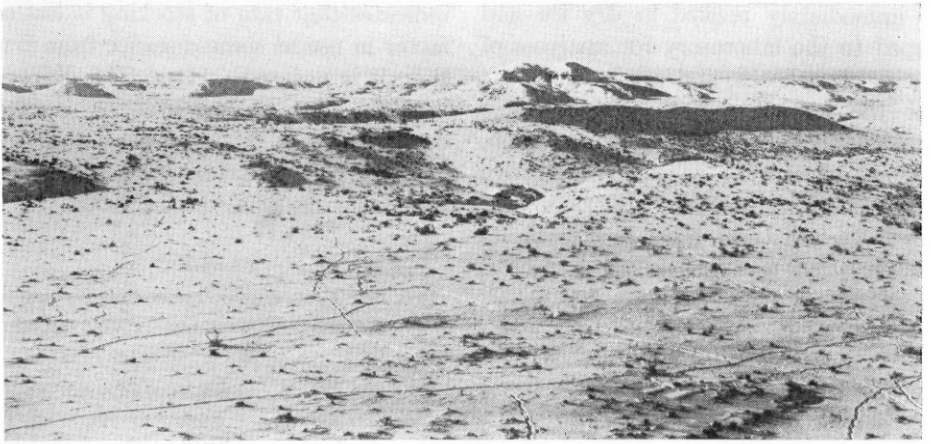

Figure 1. General view of the study area. The larger browse plants can be seen protruding through the snow.

Sampling areas were located within each of the four pastures. Each of these areas was as nearly alike as possible in regard to site potential. Each sampling area, except for the control area, was about 600 yards from water, with a second area established about 1200 yards from water during the second year.

At each sampling area, including the pasture used as a control, shadscale (*Atriplex confertifolia*), big sagebrush (*Artemisia tridentata*), winterfat (*Eurotia lanata*), and greasewood (*Sarcobatus vermiculatus*) were measured for utilization during the first season. These species were selected as being the most abundant and as being of possible forage value. Greasewood alone was studied during the second season. Plots were established for each species, these plots containing at least forty plants of the species to be measured.

Within each plot, ten plants were selected at random during the first season, and twenty greasewood plants were selected at random during the second season. The basic measurement unit of each plant was called an *observation*. In the case of winterfat, an observation included the entire plant. In the cases of shadscale, big sagebrush, and greasewood, an observation was a group of at least five twigs on a major branch which was arbitrarily selected. Each twig on each observation was measured at the beginning

TABLE 1

*Average winter protein and phosphorus content of shadscale, big sagebrush, winterfat, and greasewood**

SPECIES	PERCENT CRUDE PROTEIN	PERCENT PHOSPHORUS
Shadscale	7.64	.080
Big sagebrush	10.57	.300
Winterfat	9.46	.107
Greasewood	—	.19†

* The above figures are averages of analyses published by the following: Bidwell and Wooton (1925), Clarke and Tisdale (1945), Cook and Harris (1950), Esplin, *et al.* (1937), Idaho Experiment Station (1937), McCreary (1927 and 1939), and Wasser (1945).

† One analysis.

of the grazing season and at twenty-eight day intervals thereafter until spring.

From the plants chosen for measurement of utilization, a twelve gram composite sample for each study area, except the control, was clipped at each twenty-eight day interval. In the case of winterfat, since the entire plant was measured for utilization, nearby plants were used for collection of the samples. The material was immediately packed in dry ice and shipped to the laboratory for analyses of protein, phosphorus, and carotene.

At the same dates that the browse samples and measurements were taken, blood samples were collected from five animals in each pasture. The same five animals were bled each time. These samples were analyzed for phosphorus, carotene, and vitamin A.

TABLE 2

Percentage twig length removed by cattle during the winter grazing season, 1950–1951

RATE OF STOCKING	SPECIES			
	Winterfat	Greasewood	Shadscale	Big sagebrush
Heavy	63	52	0	0
Light	13	16	3	1
Moderate	15	17	22	1

Results and Discussion

Table 2 shows the season-long utilization by cattle of the four species measured. Winterfat and greasewood show heavier use under heavy stocking. Appreciable use of shadscale occurred only under moderate stocking. By observation cattle were seen utilizing shadscale twigs which still held their fruits, but avoided those which had shed their fruits. It is felt that the reason for heavier use of shadscale under moderate stocking is that the particular plants measured had retained more fruit than the plants measured in the other pastures. Big sagebrush utilization was negligible, being no more than 1 percent in any of the pastures.

Utilization of Greasewood, 1951–1952

Table 3 shows a considerable difference in utilization at 600 yards from water, the greatest use occurring under heavy stocking. At 1200 yards from water, however, utilization of greasewood was not greatly different between pastures. This indicates that rate of stocking is less of a factor in use at some distance from water than it is nearer to water. The difference between locations was probably due to a combination of distance, cold, and snow. These last two factors encouraged stock to remain near hay and shelter.

TABLE 3

Percentage twig lengths removed from greasewood by cattle during the winter grazing season, 1951–1952

YARDS FROM WATER	RATE OF STOCKING			LOCATION MEANS
	Heavy	Light	Moderate	
600	56	19	33	36
1200	10	16	8	11
Pasture means:	33	18	21	

Chemical Composition of Browse Plants, 1950–1951

Protein

Greasewood had an average crude protein content of 8.4 percent. This is considerably above the minimum recommended for adequate cattle nutrition by the National Research Council (Guilbert *et al.*, 1950). Winterfat and shadscale had about 1 percent less protein than greasewood, and big sagebrush was the lowest with 6.4 percent protein.

Phosphorus

Big sagebrush had the highest phosphorus content with .104 percent, the other

species having about .075 percent phosphorus. The phosphorus content of big sagebrush is considerably lower than the average winter phosphorus content of this species found by other workers (Table 1). The relationship of big sagebrush phosphorus content to phosphorus of the other browse species is similar to that reported in other experiments. The phosphorus content of all species was too low for adequate nutrition of cattle (Guilbert *et al.*, 1950).

Carotene

Average carotene content of the four species was 9 mcg./gm. on November 30, rising to 20 mcg./gm. by January 3, and dropping to 5 mcg./gm. by February 22. It is of particular interest to note that no significant correlation was observed between temperature changes and carotene content of the browse to account for the higher values of the January samples. The November and January values were well above the 6.7 mcg./gm. minimum recommended for adequate cattle nutrition by the National Research Council (Guilbert *et al.*, 1950).

Chemical Composition of Greasewood, 1951–1952

Protein and Phosphorus

Greasewood protein was higher than the previous year, being 9.0 percent as compared to 8.4 percent. Phosphorus was considerably higher than during the previous year, being .087 percent as compared to .075 percent. The reason for these differences between years is not known.

Carotene

The trend of carotene through the season was very similar to that observed the previous season, rising from an early winter value of 12 mcg./gm. to 21 mcg./gm. by January 24, and dropping to 2.5 mcg./gm. by February 21. Repetition of this rise in carotene is of special interest. The original thought that temperature change was a factor seems unlikely since weather records show no appreciable rise in temperature during the month of January. There has been no other plausible explanation of this phenomenon suggested from the data available.

Blood Nutrient Analyses

Phosphorus

Average blood phosphorus levels for the two winter seasons was 3.02 mg./100 ml. This is considered to be low enough to produce external signs of phosphorus deficiency. However, none of the usual symptoms of a phosphorus deficiency were observed. The hay which was fed during severe weather had a much higher phosphorus content than did either the range grasses or browse, and blood phosphorus levels were higher during the time hay was fed than during most of the rest of the winter season.

Carotene

Carotene began a rapid decline early in each season, but declined less rapidly in mid-winter. Averages of the two years showed blood carotene to be 46 mcg./100 ml. on December 28, 36 on January 24, and 35 on February 22.

Vitamin A

Vitamin A continued to decline throughout the winter, but did not become dangerously low (Thomas, 1951). No external symptoms of vitamin A deficiency were observed. The vitamin A decline is probably due to the dwindling body reserve (Thomas, 1951).

The high levels of carotene in the browse in the early part of the season, combined with the utilization of the browse, may have had some tendency to reduce the rate of decline of blood carotene and vitamin A.

Conclusions

Winterfat, greasewood, and shadscale were important as winter feed sources on the study pastures, whereas big sagebrush had very little use.

Abundant, palatable browse plants on winter ranges should provide some nutrients which are deficient in range grasses during the winter months. On this experimental area, the palatable shrubs had some value as sources of protein and carotene, but were not valuable as a phosphorus source.

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