Nutritive Value of Cheatgrass and Crested Wheatgrass on Spring Ranges of Utah

C. WAYNE COOK AND LORIN E. HARRIS

Associate Research Professor, Department of Range Management, and Professor of Animal Husbandry, Utah Agricultural Experiment Station, Logan, Utah

INTRODUCTION

THE abundance of cheatgrass (*Bromus tectorum*) on the foothill and semi-desert ranges throughout the Intermountain and Great Basin region make it of concern to the livestock industry of this area. It is the most abundant forage plant on many spring ranges and perhaps contributes more feed for livestock than any other range species during this period. However, the forage production from cheatgrass fluctuates greatly from year to year, depending upon moisture and growing conditions. Therefore, many believe that cheatgrass should be replaced by native or introduced perennial grasses.

The return of native perennials through light grazing is slow and the necessary reductions in livestock grazing might constitute inefficient use of the areas involved. However, on the better soils, cheatgrass ranges can be planted successfully to introduced perennial grasses. During the past twenty years crested wheatgrass has been used rather extensively for this purpose. Yet, in many areas, the soils are low in productivity, and rehabilitation through seeding is hazardous and impractical. Further, the necessity of prior eradication of cheatgrass makes seeding uneconomical in many instances. As a result, a large part of the spring ranges throughout the Great Basin area are supporting cheatgrass with scattered clumps of native grasses and browse plants (Fig. 1).

Cheatgrass areas often produce as much forage per acre as crested wheatgrass or native bunch grasses (Hull *et al.*, 1947). However, cheatgrass remains green only a relatively short time during the spring and soon after maturity becomes unpalatable. Sheep normally graze very little on cheatgrass after it becomes dry, but cattle graze dry mature cheatgrass rather extensively during the winter when furnished water and a high protein supplement (Fleming *et al.*, 1942). The palatability of crested wheatgrass for both sheep and cattle likewise decreases markedly as the plant matures. However, the perennial wheatgrass remains green much longer than the annual cheatgrass and in addition maintains an upright stature much better through heavy rains and snows.

Even though perennial grasses apparently have many advantages over cheatgrass as a forage cover, it is believed that only a relatively small portion of the cheatgrass area in the Great Basin region will be replaced by perennial bunch grasses (Fleming *et al.*, 1942). Therefore, we must recognize cheatgrass as a source of range feed and manage these areas for maximum forage and livestock production.

PROCEDURE

Digestion trials were conducted on cheatgrass and crested wheatgrass by the method described by Cook *et al.* (1951). The procedure consisted of collecting feces from seven wethers that

grazed temporary enclosures on pure stands of these species in the foothill area of north-western Utah during the spring grazing season of 1951 (Fig. 2). Both the cheatgrass and the crested wheatgrass areas were located in the same general vicinity and included similar site features such as exposure, topography, and soil development. These areas were representative of typical spring range and are normally used by sheep and cattle during the spring before going onto the summer ranges at higher elevations.

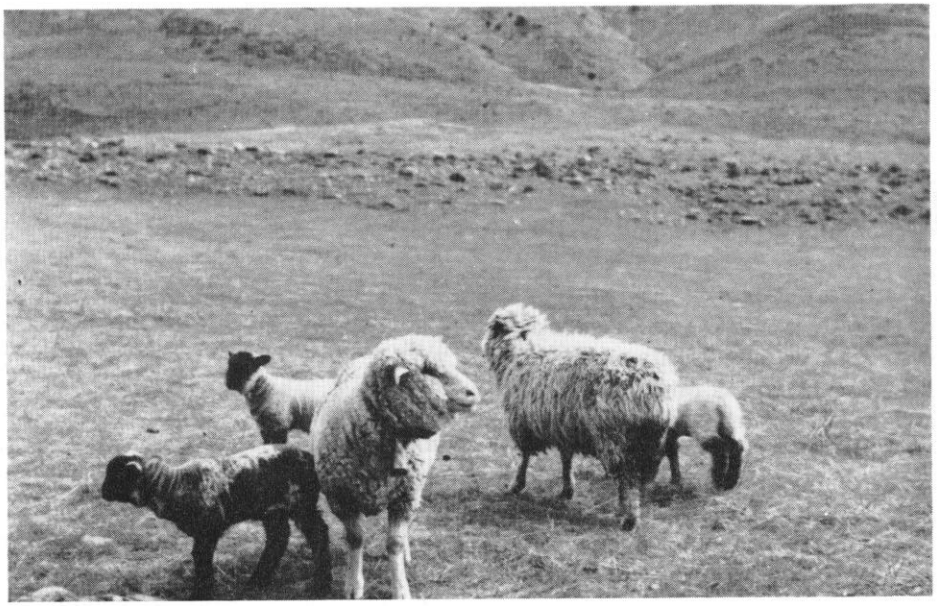

FIGURE 1. Extensive cheatgrass areas in the foothill ranges where spring lambing is carried on.

FIGURE 2. Wethers equipped with harness and fecal bags while grazing a temporary enclosure on a pure stand of crested wheatgrass.

Results and Discussion

Cheatgrass was studied from May 2 until June 21 and crested wheatgrass from June 7 until July 1, 1951. Both grasses were ready to graze by the latter part of April. However, in order to graze them at comparable stages of maturity, trials on crested wheatgrass were delayed until June. The first four periods on cheatgrass (Table 1) are comparable to the first four periods on crested wheatgrass on the basis of stage of growth for the two species of grass. However, the part of the plant eaten by the grazing animals was somewhat different during the various periods. Sheep started to show preference for leaves rather than stems on crested wheatgrass areas as early as the second period. However, this preference for leaves over stems on cheatgrass was not pronounced until the fourth period. Thus, the chemical analyses of the plant material presented in Tables 2 and 3 do not represent current years growth, but rather material being consumed by the grazing animals. As a result, the chemical changes resulting from advancement of growth are not pronounced for crested wheatgrass (Table 2). This is caused by the selectivity of the animal for the more nutritious portions of the plant, and emphasizes the important fact that animals, by selection, may in large part overcome unfavorable changes in plant nutritive value as the season progresses.

TABLE 1

Date and stage of growth for interpreting the effect of advancement of season upon chemical composition and digestibility of cheatgrass and crested wheatgrass

PERIOD	DATE	STAGE OF GROWTH	PART OF PLANT EATEN
		Cheatgrass	
1	May 2–May 8	Boot stage, plant succulent and growing rapidly	Entire plant 0.5 inch above ground level
2	May 12–May 18	In head, pollination, plant green and succulent	Entire plant 0.5 inch above ground level
3	May 22–May 28	Dough stage, plant turning purple	Entire plant 0.5 inch above ground level
4	June 5–June 11	Early seed shattering, plant turning brown	Heads and green leaves, upper portion
5	June 15–June 21	Late seed shattering, plant completely dry	Dry leaves and stems, avoiding heads
		Crested Wheatgrass	
1	June 7–June 13	Boot stage, plant green and succulent	Entire plant two inches above ground level
2	June 13–June 19	In head, anthesis, plant green and succulent	Entire plant, preference shown for leaves
3	June 19–June 25	Dough stage, plant green, becoming stemmy	Strong degree of preference shown for leaves
4	June 25–July 1	Hard seed stage, leaves turning brown	Mainly leaves, some short immature stems

Cheatgrass

There was a definite change in the nutrient content in cheatgrass as the stage of growth advanced (Table 2)

because sheep consumed the entire plant for the most part until the last period (Table 1). Ether extract, total protein, calcium, phosphorus, and gross energy decreased with plant maturity, whereas lignin and total ash increased. Cellulose and other carbohydrates made little change.

TABLE 2

Chemical composition of the foraging sheep's diet while grazing cheatgrass and crested wheatgrass

PERIOD	ETHER EXTRACT	TOTAL PROTEIN	LIGNIN	CELLULOSE	OTHER CARBOHYDRATES	TOTAL ASH	CALCIUM	PHOSPHORUS	GROSS ENERGY *Cal./kg.*
	Percent								
				Cheatgrass					
1	2.7	15.4	4.1	27.4	40.2	10.2	.64	.36	4330
2	2.1	11.1	4.4	30.6	41.5	10.3	.60	.32	4350
3	1.8	8.2	6.3	33.4	39.8	10.5	.53	.27	4220
4	1.6	7.4	8.4	28.3	43.6	10.7	.51	.26	3980
5	1.3	6.1	10.4	32.4	38.8	11.0	.56	.21	4140
				Crested Wheatgrass					
1	2.5	12.0	5.9	34.1	34.8	10.7	.63	.22	4320
2	2.8	11.0	6.0	33.8	38.4	8.0	.49	.21	4420
3	2.7	10.5	5.9	35.3	36.2	9.4	.49	.21	4180
4	3.4	10.8	6.1	32.1	37.1	10.5	.53	.21	4340

Digestibility coefficients for cheatgrass (Table 3) show that digestibility of protein, cellulose, other carbohydrates, gross energy, and dry matter decreased markedly with advancing growth stages. In addition, the pounds of dry matter consumed each day decreased with increased maturity of the forage. Sheep weighing an average of 150 pounds consumed 3.3 pounds daily during early May and only 2.0 pounds during the latter part of June (Table 3). This is an important consideration, since it reduces the quantity of the nutrients actually being consumed even if the content in the plant had remained unchanged.

Digestible protein was deficient after about the middle of May. This was further emphasized by the reduced quantity of forage consumed which was only 2.3 pounds per day. The National Research Council (1949) recommends that the forage contain about 6.2 percent digestible protein for ewes in lactation. This, of course, is a liberal allowance and perhaps higher than would be considered economical to meet with supplements under average range conditions. However, cheatgrass forage supplied only about one-half this amount after May 22 and less than one-sixth as much after June 15. Therefore, ewes with sucking lambs should have a protein supplement on cheatgrass range after the grass matures.

Analyses of cheatgrass on winter ranges before spring growth show that total protein (3.5 percent) is extremely low and phosphorus (0.04 percent) is decidedly deficient for a balanced ration. However, during the early spring grazing season there appears to be adequate phosphorus to meet the requirements of the grazing animals. In addition, cheatgrass ranges used for winter grazing

would be considered deficient in vitamin A (carotene) since there is no vitamin A obtainable from dry mature cheatgrass. Therefore, animals after grazing dry cheatgrass for 90 to 120 days would show symptoms of vitamin A deficiency (Hart *et al.*, 1933). In less time, however, they may suffer from internal disorders causing abortion, unless alfalfa, hay, or shrubs are available.

Crested Wheatgrass

In comparing the first four periods on cheatgrass with the four periods on crested wheatgrass, it is noted that while material representing ingested cheatgrass showed trend changes in digestibility of constituents as well as total content of nutrients with increasing maturity, there is little or no trend in the consumed material in the case of crested

TABLE 3

*Dry matter consumed daily, apparent digestibility and limit of error for nutrients in cheatgrass and crested wheatgrass in various stages of growth**

PERIOD	DRY MATTER CONSUMED *Lbs.*	DIGESTED						TOTAL DIGESTIBLE NUTRIENTS	DIGESTIBLE PROTEIN	DIGESTIBLE ENERGY *Cal/kg.*
		Dry matter	Ether extract	Total protein	Cellulose	Other carbohydrates	Gross energy			
		Percent								
		Cheatgrass								
1	3.3	67.4	24.8 2.1	67.9 1.0	77.9 0.4	83.5 0.6	70.8 1.2	66.9	10.5	3066
2	2.8	65.4	45.0 5.6	65.0 0.9	76.3 1.1	80.7 0.6	71.7 1.1	66.2	7.2	3119
3	2.3	51.0	41.0 2.6	46.4 0.9	63.9 1.1	68.4 1.1	56.6 2.2	54.0	3.8	2388
4	2.1	46.4	16.0 3.7	38.3 3.3	47.8 3.3	73.6 1.0	47.9 1.0	49.0	2.8	1906
5	2.0	38.7	12.6 3.0	16.1 2.9	51.3 1.6	58.5 1.2	44.4 1.0	40.7	1.0	1838
		Crested Wheatgrass								
1	2.4	53.0	20.3 3.1	59.8 0.9	64.5 1.3	67.4 1.3	55.1 3.3	53.8	7.2	2382
2	2.4	53.9	31.1 5.2	56.8 0.9	65.7 2.2	68.4 1.2	59.3 1.8—	56.7	6.3	2619
3	2.6	57.0	12.8 2.1	60.7 0.9	68.2 1.8	68.6 1.7	57.8 1.6	56.1	6.4	2417
4	2.6	53.4	24.8 2.7	62.6 0.6	39.0 1.4	66.0 0.3	56.1 1.1	52.1	6.7	2421

* Limit of error is shown below average percentage and, when added to and subtracted from the average percentage, the 95 percent confidence interval is expressed.

wheatgrass (Tables 2 and 3). Compared to cheatgrass, crested wheatgrass in the first four periods was higher in ether extract, total protein, and cellulose, whereas, cheatgrass was higher in total ash, phosphorus, and other carbohydrates (Table 2). The digestible energy and total digestible nutrients (Table 3) were somewhat higher for cheatgrass than for crested wheatgrass. This is perhaps the result of the higher digestibility for cellulose and other carbohydrates in cheatgrass compared to crested wheatgrass. Both the digestible energy and total digestible nutrients are commonly used indexes for the energy supply qualities of grass forage. In either case, both species are good sources of energy for grazing animals.

Digestible protein in crested wheatgrass varied from 7.2 to 6.3 percent which is considered adequate for lactating animals. Thus, it can be stated that crested wheatgrass furnishes an adequate ration for spring grazing whereas cheatgrass is deficient in digestible protein during the latter part of this season.

It should be pointed out that crested wheatgrass, like other grasses, would be deficient in protein, phosphorus, and vitamin A (carotene) when used as winter forage when the plants are mature and dry.

The results of these trials agree with other digestion trials carried on with cheatgrass and crested wheatgrass hays when comparable stages of growth are compared (McCall, *et al.*, 1943).

Animals during all periods on both cheatgrass and crested wheatgrass gained some weight. Sheep grazing crested wheatgrass gained an average of 0.2 pounds per day compared to an average gain of 0.05 pounds per day for animals grazing cheatgrass. There was little difference in gains made on crested wheatgrass from period one to period four, whereas, sheep grazing cheatgrass gained 0.3 pounds daily during period one compared to 0.01 pounds during period five.

Summary

The widespread abundance of cheatgrass on the foothill and semidesert ranges of the Intermountain Great Basin region causes concern to range managers of this area. During the past twenty years, crested wheatgrass has been used to replace cheatgrass on some of the more favorable sites. However, many soils supporting extensive areas of cheatgrass are so low in productivity it is believed that they should be managed as an annual grass type and used for the most effective purpose which appears to be spring range for livestock.

Digestion trials were conducted in the field on both crested wheatgrass and cheatgrass areas during the spring of 1951. The procedure consisted of collecting feces from seven wethers equipped with specially constructed fecal bags and by the lignin ratio technique, calculating digestibility. These animals grazed temporary enclosures on pure stands of both species at comparable stages of maturity.

The nutritive content of the more desirable constituents and digestibility of the material consumed by sheep showed definite downward trends for cheatgrass with advancing stages of growth. However, greater selectivity for the more tender parts of the crested wheatgrass plant prevented a definite trend with increased maturity. In cheatgrass, ether extract, total protein, calcium, phosphorus and gross energy decreased with plant maturity, whereas, lignin and total ash increased. Digestibility coefficients for protein, cellulose, other carbohydrates, gross energy, and dry matter decreased

markedly in advanced growth stages. In addition, the pounds of dry matter consumed daily per sheep decreased with increased maturity of the forage in the case of cheatgrass.

Cheatgrass was considered deficient in digestible protein during the latter part of the grazing season, but furnished a balanced ration in other respects. Crested wheatgrass furnished considerably more digestible protein than cheatgrass throughout the spring season and was considered a satisfactory ration for lactating ewes.

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THE PUBLICATION OF RESEARCH—4

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Clarity is the soul of truth, and especially in science, there should be an idea behind every expression, and this idea should be stated as clearly as language permits.—*E. F. Smith.*

Whatever we conceive well we express clearly.—*Boileau.*