Relationship of Utilization Intensity to Plant Vigor in a Crested Wheatgrass Seeding[1]

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Highlight

Vigor characteristics of crested wheatgrass subjected to late fall grazing at three levels of intensity were studied over an 8-year period. The indicated level of utilization for maintenance of plant vigor under conditions of this study was about 60 percent.

Successfully established crested wheatgrass (*Agropyron cristatum*) seedings have become an integral part of many livestock operations. They commonly fill an important need for spring and/or fall pasturage. Optimum grazing systems and utilization levels for these use periods have been investigated. An early study in the Southwest (Reynolds and Springfield, 1953) concluded that utilization of crested wheatgrass should not exceed 45 percent by weight each year for greatest sustained returns in total herbage. More recent work by several investigators indicates that grass production can be maintained under 65 to 70 percent utilization by cattle during the spring period (Springfield, 1963; Springfield and Reid, 1967; Frischknecht and Harris, 1968).

The season at which a seeding is used may be dictated by the needs of the operation. Thus, it may be subjected to grazing at almost any time during the year—not necessarily at the optimum time for either the health of the grass stand or the best livestock gains. Information on proper levels of utilization under less common periods of use is important to some users. Proper use of crested wheatgrass under late fall grazing by cattle was investigated in this study.

Study Area and Methods

The study was conducted on the Sterling Ranch area, Uinta National Forest, Utah, during the 8-year period 1954–1962. The study area was formerly a cultivated dry farm acquired as national forest land in 1941 and added to the Diamond Fork Cattle Allotment. It is located in the lower part of the Diamond Fork drainage at an elevation of about 5,500 feet and has a mean annual precipitation of 17–19 inches. Soils are generally deep with loam surfaces and clay loam subsoils. They are residual and derive from mixed sandstone-limestone parent materials. Records do not describe the vegetation existing on the study area prior to cultivation. However, similar adjacent sites are dominated by big sagebrush (*Artemisia tridentata*) and yellowbrush (*Chrysothamnus viscidiflorus*) along with scattered clumps and patches of oakbrush (*Quercus gambelii*).

In 1941–43, an area of some 250 acres was seeded to crested wheatgrass and smooth brome (*Bromus inermis*) and a good stand of both species was obtained. Smooth brome had disappeared from much of the stand by the time of this study (Fig. 1).

Three sites within the study area were selected for study. The sites, designated as 7A, 7B, and 7C, represented widely differing levels of utilization but were comparable in other respects. All three supported crested wheatgrass stands of good density.

Historically, the area had been used as a spring-fall holding area for cattle, except that site 7C was fenced into a horse pasture. During the years immediately before and during the study, sites 7A and 7B were heavily grazed by cattle in the fall only (October and early November). Normally, large numbers were grazed for short periods of time. Site 7C was lightly grazed by horses from October through December during the study period.

Intensity of utilization on crested wheatgrass ranged from 85–90% on site 7A and 60–70% on site 7B to 25% or less on site 7C. Utilization estimates were determined using the weight-estimate method as modified by Frischknecht and Plummer (1949).

In 1954, the study sites were selected, permanently marked, and data collected for selected vigor characteristics and ground cover. The same measurements were repeated in 1962 on the same sites.

Characteristics selected and measurement techniques used were as follows.

1. Mean height of tallest seed stalk was determined for each site by measuring to the nearest inch the tallest seed stalk in each of 30 clumps per site along a paced transect.

2. Mean dry-weight yield per square inch basal area was determined by clipping and weighing the green herbage from 100 to 800 square inches of

FIG. 1. Crested wheatgrass seeding in the oakbrush-sagebrush type in central Utah.

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Table 1. Vigor measurements for crested wheatgrass stands on three study sites.

Site number and utilization (%)	Year	Avg. ht. tallest seed stalk (inches)	Dry wt. (g/sq inch of basal area)	Seed heads/ft²
7A (85–90%)	1954	16.8	.89	32.24
	1962	15.3	.83	23.59
7B (60–70%)	1954	20.8	1.44	35.36
	1962	18.3	1.42	39.47
7C (15–25%)	1954	13.4	.61	3.13
	1962	17.2	1.16	31.14

basal area from several representative clumps on each site. Green weight data were converted to dry weight by estimating percent dry weight from phenology/dry wt. tables (U.S. Forest Service, 1964).

3. Number of seed heads per square foot was determined by actual count of twenty .96 square-foot plots located along a paced transect on each site. The mean was calculated for each site and converted to a square foot basis.

4. Ground cover data were obtained by the ocular-estimate-by-plot method using 10–20 plots per site.

Results

Initial measurements in 1954 indicated that site 7B had the highest and site 7C the lowest vigor of the three sites. Vigor characteristics such as height of seed stalks, number of seed heads per unit area, and herbage yields per unit basal area were consistently higher on site 7B than on the other two sites. Herbage yields per unit basal area were less than half as great on site 7C as on 7B and seed head production was scarce. Narrative comments made by the author at that time speak of the apparent stagnation and loss of vigor of the crested wheatgrass stand on site 7C.

Remeasurement of vigor characteristics in 1962 revealed a decline in vigor on site 7A and a sharp increase in vigor on site 7C (Table 1). Site 7B appeared to still have the best vigor of the three sites, but site 7A had deteriorated until it was now the poorest. Perhaps the most significant change was the vast increase in seed head production on site 7C.

Measurements taken in 1962 showed a small decline in both seed stalk height and herbage yields on sites 7A and 7B, while seed stalk height on site 7C increased by about four inches and herbage yield per unit basal area nearly doubled. Number of seed heads per square foot declined by about 30 percent on site 7A, increased slightly on site 7B, and increased by ten times on site 7C.

In 1954, ground cover conditions on site 7C were the best of the three sites—due to the greater accumulation of litter (Table 2). During the 8-year study period, both basal plant density and litter cover increased on all sites with a corresponding reduction in bare ground. The net increase in litter on site 7A is surprising in view of the high degree of plant utilization to which that site was subjected during the study period.

Discussion and Conclusions

Study design does not lend itself well to quantitative analysis but subjective evaluations are possible. Also, some other variables were not measured but we do not consider these fatal to a subjective evaluation. For example, differences in precipitation and growing conditions during the two years of measurement would most likely affect quantitative changes but not the interrelationships involved.

Post-growth (late fall) utilization at the 85–90 percent level seems definitely to be excessive for this site when repeated year after year. The measured decline in vigor on site 7A was accompanied by the author's observations of trampling damage, soil loss, soil compaction, and other indications of site and stand deterioration.

In view of the improvement in vigor that occurred on site 7C under light post-growth use (25% or less), it is not clear why this site should have been in such a low state of vigor in 1954. In any event, this level of use appears to be unnecessarily low. The authors observed in 1962 that indications of stand stagnation were still present. More important, benefits to livestock through forage removal have been minimal.

The most desirable level for post-growth use on these sites falls somewhere between the two extremes. Site 7B supports this view since it is intermediate in utilization (60–70%) and supports the most vigorous plants of the three sites. Moreover, high vigor has been maintained under this level of use for many years. Pounds of forage actually harvested per acre are greater on this site than on either of the other two. Since some soil loss was observed on site 7B and litter accumulation has been slow, it is suggested that the preferred level of utilization under post-growth conditions should be slightly less than that applied here. Although repetitive grazing at the same time each year is not recommended, the most desirable level of utilization under conditions of this study would be about 60 percent.

Table 2. Ground cover (%) of crested wheatgrass on three study sites.

Site number and utilization (%)	Year	Basal cover	Litter cover	Bare ground
7A (85–90%)	1954	17	25	58
	1962	26	36	38
7B (60–70%)	1954	19	30	51
	1962	32	49	17
7C (15–25%)	1954	15	40	44
	1962	30	45	24

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