Clipping Effects on Seeded Foothill Ranges in Utah[1]

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Highlight

Russian wildrye produced significantly more herbage than crested wheatgrass when clipped at intensities of 25, 50, and 75% under four clipping regimes of April, May, June, and both April and June. Thin stands of Russian wildrye were more productive than thick stands of either Russian wildrye or crested wheatgrass. Clipping in both April and June yielded the most herbage, but after five years of clipping, this treatment had the least vigorous plants. Early clipping (April) caused the least damage to plant vigor, but yielded less herbage. The heavier the intensity of clipping, the greater the amount of herbage presumably available for animal consumption, but also the lower the plant vigor. Optimum tradeoffs between herbage harvested and plant vigor appear to come from Russian wildrye or crested wheatgrass clipped 50% in April and May.

Crested wheatgrass (*Agropyron cristatum* (L.) Gaetrn.) has been widely recommended for seeding on Intermountain foothill ranges. Russian wildrye (*Elymus junceus* Fisch.) is also a promising species for seeding these ranges.

Russian wildrye has been recommended for seeding on sagebrush, mountain brush and juniper sites in the Intermountain area on soils which are too alkaline for fairway or crested wheatgrass and too dry for tall wheatgrass (Hull and Holmgren, 1964). In experimental seedings on 18 areas in the salt-desert shrub region of western Wyoming, Hull (1963) found Russian wildrye was the best of 14 species tried. In these studies crested wheatgrass was slightly inferior to Russian wildrye. However, Cook (1966), in an 8 year study in Utah, found Russian wildrye did not produce as much forage on good sites as did crested wheatgrass. Hull and Holmgren (1964) found the same relationship in Idaho on good sites.

Stelfox et al. (1934), conducted studies in Canada with Russian wildrye to determine the effect of (1) row spacing, (2) fertilizer treatment, (3) association with alfalfa, and (4) early spring burning on seed production. They found that row spacing was the most important factor. Optimum spacing varied from 2 to 4 feet, depending on moisture conditions and age of the stand. Increased width of row spacing generally increased seed and forage production by Russian wildrye (Lorenz and Rogler, 1959; Lorenz and Rogler, 1964). Cook et al. (1967), however, found herbage yield was similar under any row spacing or intensity of seeding after the plants became established.

Effect of clipping frequency on productivity and root development of Russian wildrye has been studied both in the greenhouse (Thaine and Heinrichs, 1951) and in the field (Thaine, 1954). Frequent clippings reduced yield in the greenhouse, but in the field three to five clippings per growing season produced greater herbage yield than one or two clippings. Root yield and root reserves were decreased with increased frequency of clipping.

The present study was designed to test the effects of season and intensity of clipping on thick and thin stands of Russian wildrye and crested wheatgrass on a foothill range in Utah.

Study Area and Methods

The study area was located 20 miles west of Snowville in Box Elder County, Utah. The site was on the edge of the Curlew Valley floor at 4,700 ft elevation.

The soils, described by Gates et al. (1956), range in pH from 7.8 to 8.5. Organic matter content is relatively low with surface texture varying from loam to silty clay loam.

Study plots were located in a big sagebrush community which in its native condition, was dominated by big sagebrush (*Artemisia tridentata* Nutt.), with squirreltail (*Sitanion hystrix* (Nutt.) J. G. Smith), Indian ricegrass (*Oryzopsis hymenoides* (Roem. and Schult.) Ricker), western wheatgrass (*Agropyron smithii* Rydb.), and other drought-tolerant species occupying interspaces between sagebrush plants. Because of a deteriorated condition, the area contained halogeton (*Halogeton glomeratus* (Bieb.) C. A. Meyer), cheatgrass (*Bromus tectorum* L.), Russian thistle (*Salsola kali* L.) and peppergrass (*Lepidium perfoliatum* L.) in interspaces between sagebrush plants.

Precipitation in the locality is low and erratic. Forty percent of the annual precipitation falls as snow, and 30% occurs in May and June as rain. Average annual precipitation from 1960–1970 was 24.4 cm. During the study, precipitation was above average in 1965, 1967, and 1968. Precipitation was below average in 1966 and 1969.

Temperatures in the area average 5 C in January and 23 C in July. The maximum recorded tem-

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Table 1. Dry matter produced (lb./acre) by crested wheatgrass and Russian wildrye in 1969 after 5 years of clipping.

Treatment	Species	
	Crested wheatgrass	Russian wildrye
Date of clipping		
Early	202 a[1]	573 a
Early & late	163 b	359 c
Mid	176 b	424 b
Late	182 b	356 c
Intensity of clipping		
25%	212 a	456 a
50%	181 b	469 a
75%	148 b	370 b
Stand density		
Thick	196 a	376 b
Thin	165 b	484 a

[1] Numbers within the same type of treatment in same column followed by the same letter are significantly different at the .05 level.

perature is 44 C, and the minimum is 3 C. The average length of growing season is 125 days, with the last killing frost usually occurring in the spring about May 25, and the first killing frost in autumn on about October 1.

The study was conducted in stands of Russian wildrye and crested wheatgrass in both thick and thin stand densities. The number of Russian wildrye and crested wheatgrass plants per 9.6 ft² plot from thick stands averaged 5.5 and 8.0, respectively; whereas, for thin stands they averaged 3.0 and 6.0, respectively.

Clippings were made to simulate grazing from 1964 to 1968. Five plants each of Russian wildrye and crested wheatgrass in both thick and thin stands were clipped at three intensities (25, 50, and 75% by weight) at 4 dates. The dates of clipping were early spring (April 17), mid spring (May 22), late spring (June 26) and early and late spring (April 17 and June 26). Each treatment was replicated four times. Clipped samples from individual plants were placed in individually numbered bags, air dried, and weighed to determine production. Control plants were not clipped, but production was taken by ocular estimate. Vigor measurements taken each year prior to clipping included plant height and number of seedheads.

Clipped plants were allowed to grow during 1969 before final vigor measurements were taken. Vigor measurements taken after a 1-year rest from clipping included plant height, number of seedheads, crown diameter, and crown cover rating. Crown cover ratings were based on percent live material in the crown of the plant as follows: 1–10% = 1, 11–20 = 2 . . . 91–100% = 10. All production data for 1969 were taken by ocular estimate on 9.6 ft² plots.

The data were summarized and analyzed by computer. Averages reported in Tables 1, 2, and 3 are overall averages, i.e. stand density averages are confounded with date and intensity of clipping.

Results

Species and Stand Density Differences

There were significant differences ($P < 0.05$) between species and densities of stand within species. Russian wildrye produced significantly ($P < 0.05$) more herbage than crested wheatgrass (Table 1). Production per acre was greater in thin stands of Russian wildrye than in thick stands of either species. However, production of crested wheatgrass was greater in the thick stand. Crown cover ratings and crown diameter were greater in thin stands than in thick stands. Crown diameters were significantly ($P < 0.05$) greater for Russian wildrye than for crested wheatgrass (Table 2).

Crown cover rating was con-

Table 2. Final vigor data taken in 1969 after a 1-year rest following 5 years of clipping on Curlew Valley seeding study. Crown diameter and plant height measurements are reported in centimeters.

Treatment	Crown diameter		Plant height		Crown cover rating[1]		Number of seedheads	
	Crested wheatgrass	Russian wildrye	Crested wheatgrass	Russian wildrye	Crested wheatgrass	Russian wildrye	Crested wheatgrass	Russian wildrye
Date of clipping								
Early	22	36	16	31	5	6	4	21
Early and late	24	34	16	30	4	4	2	13
Mid	25	34	15	29	4	6	2	13
Late	20	34	16	30	3	5	2	17
Intensity of clipping								
25%	24	36	18	32	5	6	2	16
50%	22	40	16	30	4	6	2	18
75%	23	31	13	28	3	5	3	16
Stand density								
Thick	20	29	14	26	4	5	1	6
Thin	26	40	17	26	5	6	4	26

[1] Crown cover rating—1 = 10% live material in crown, 2 = 20%, . . . 10 = 100%.

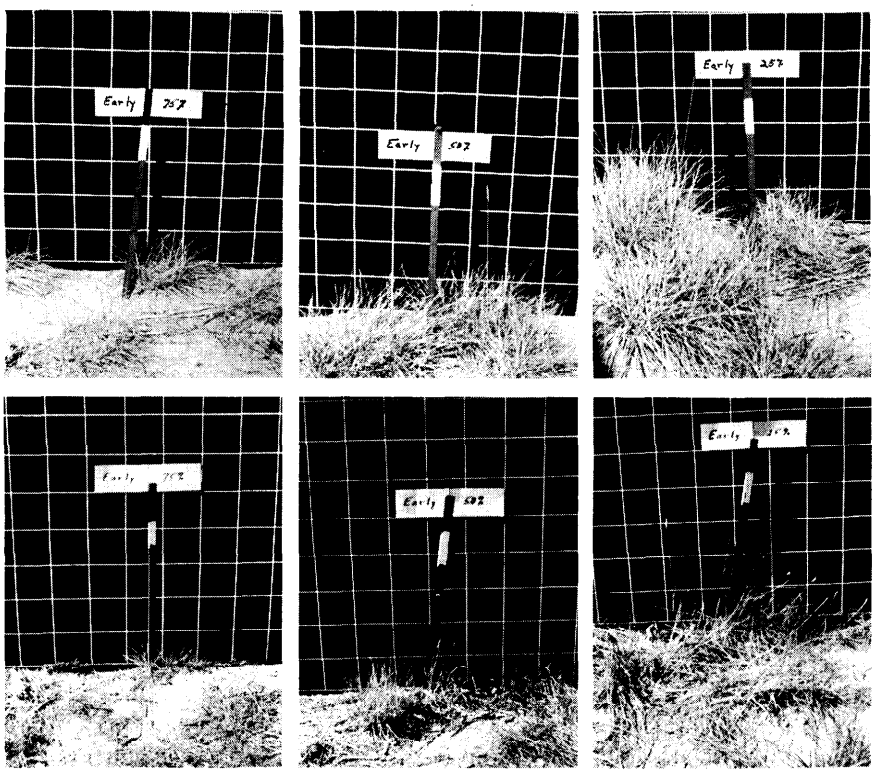

FIG. 1. Russian wildrye (upper row) and crested wheatgrass (bottow row) after five years (1964–1968) of clipping at three intensities at Snowville. Clipping percentages: left-75%; center-50%; and right-25%.

sidered the best measure of vigor. When all vigor measurements (plant height, crown diameter, etc.) were used as dependent variables (x's) and production was used as the independent variable (y), 82% of the variability in production was accounted for. Crown cover rating alone accounted for 80 percent of the variability.

Russian wildrye was more vigorous than crested wheatgrass under any clipping treatment (Table 2). Average crown diameter for Russian wildrye was 34 cm and for crested wheatgrass it was 22 cm. Average crown cover rating for Russian wildrye was 5, and for crested wheatgrass it was 4. Plant height and leaf length for Russian wildrye were significantly greater than for crested wheatgrass.

Effects of species and density of stand are clearly reflected in the number of seedheads produced (Table 2). At both stand densities Russian wildrye produced more seedheads than crested wheatgrass. Both species produced more seedheads in thin stands than in thick stands, but the difference is more pronounced from the thin to thick stands of Russian wildrye. Russian wildrye produced most seedheads in the thin stand when clipped early at 50%.

Season of Herbage Removal

To properly evaluate the effects of season of clipping on forage production, two factors must be considered: (1) amount of herbage removed at clipping and (2) effect of herbage removal on plant vigor. Clipping both early and late produced the most herbage (Table 3), but had the lowest vigor after 5 years of treatment (Table 2). However, plants clipped twice the same year produced less ($P < 0.05$) herbage during the last 2 years of study. Late clipping also decreased vigor and yield as treatment progressed through the years. Least forage was produced from early clipping

Table 3. Dry matter (g/plant) clipped from crested wheatgrass and Russian wildrye during 4 years at Snowville seeding.

	1965		1966		1967		1968	
Treatment	Crested wheatgrass	Russian wildrye	Crested wheatgrass	Russian wildrye	Crested wheatgrass	Russian wildrye	Crested wheatgrass	Russian wildrye
Date of clipping								
Early	5.2	9.6	4.6	14.4	3.8	9.4	2.8	12.5
Early & late	9.1	20.8	8.8	27.1	10.5	21.0	5.3	16.2
Mid	9.0	19.9	7.7	22.9	5.6	11.9	4.0	16.7
Late	8.8	15.6	5.7	21.1	12.7	18.9	7.6	11.6
Intensity of clipping								
25%	5.5	10.0	5.4	15.1	7.1	10.8	4.7	10.9
50%	7.4	17.5	6.9	23.8	9.3	16.3	5.7	15.9
75%	11.2	21.9	7.9	25.1	7.9	18.7	4.5	15.9
Stand density								
Thick	4.9	8.9	3.1	9.9	3.9	7.4	2.9	7.0
Thin	11.1	23.9	10.4	32.9	12.4	23.2	6.9	21.4

but this clipping caused least reduction in plant health.

Effects of season of clipping upon vigor were most apparent in thick stands of both species in 1969. Crown cover ratings were lowest in both species due to clipping the same plant early and late. Plant vigor was reduced least by early clipping. There was a decline in crown cover rating from 1965 to 1969.

Crown diameters increased from 1965 to 1969 but the density of growth in the crown decreased. The greatest increase in crown diameter occurred in plants clipped early, and the least increase occurred in plants clipped late.

Intensity of Clipping

The heavier the intensity of clipping, the greater the amount of herbage available for animal consumption (Table 3), but plants clipped the heaviest were lowest in vigor (Table 2). There was a reduction in crown cover and an increase in crown diameter with increased intensity of harvesting. Changes were greatest on plants clipped most heavily. The effects of clipping intensity are shown readily in a series of photographs (Fig. 1).

Conclusion

The thin stand of Russian wildrye performed extremely well under all seasons and intensities of clipping. Under the harsh conditions of the big sagebrush site, it out-performed crested wheatgrass. Russian wildrye produced more forage and maintained vigor better under all defoliation treatments than did crested wheatgrass. Production of Russian wildrye was 3 to 4 times that of crested wheatgrass under all treatments. At the end of 5 years of clipping, the thin stand of Russian wildrye had at least 10% more live material per plant than the thin stand of crested wheatgrass. The thin stand of Russian wildrye produced 2 to 3 times more seedheads per unit area than crested wheatgrass.

If recommendations were to be made from these data, it appears that early and mid season clipping intensities were less detrimental to vigor of either species than late defoliation or harvesting twice, early and late. It also appears that lower rates of seeding (thin stands) are preferable on dry foothill sites. The optimum tradeoff between harvested herbage and plant vigor appears to come from herbage removal on Russian wildrye or crested wheatgrass during early or mid spring at a moderate intensity.

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