Beef Production on Native Range, Crested Wheatgrass, and Russian Wildrye Pastures

SYLVESTER SMOLIAK AND SYDNEY B. SLEN

Highlight: *Weight gains per acre of yearling steers on continuously grazed Russian wildrye were 96.2 lb, or six times the gain of 16.0 lb on native range over a 6-year period. Crested wheatgrass, native range, and Russian wildrye grazed in a rotation or free-choice system reduced the acreage requirement to 15 acres per animal-unit for 6 months from 28 acres required for native range and increased beef production per acre by 55 to 66%. The vegetation on each of the three pasture types was maintained in a more productive condition when they were grazed in rotation in individually fenced fields than when they were grazed free-choice as a single unit. Crested wheatgrass and Russian wildrye effectively extended the grazing season.*

Crested wheatgrass [*Agropyron cristatum* (L.) Gaertn. and *A. desertorum* (Fisch.) Schult.] and Russian wildrye (*Elymus junceus* Fisch.) are the most commonly used species for range reseeding in the Northern Great Plains. (Grazing studies conducted by various research institutions have shown that these grasses are well adapted for pasture use. Some grazing trials have deferred the use of native range during the spring by providing crested wheatgrass pasture (Sarvis, 1941; Williams and Post, 1945; Lang and Landers, 1960; Lodge, 1963; Whitman et al., 1963; Smoliak, 1968). Other studies reported benefits from grazing Russian wildrye during late summer and fall resulting from the provision of a more nutritious feed compared to that on native range (Lang and Landers, 1960; Rogler et al., 1962; Jefferies et al., 1967; Smoliak, 1968; Rogler and Lorenz, 1970). Further advantages of utilizing seeded pastures to complement native range are the extension of the grazing season and the reduction in the pasture acreage requirement (Lodge, 1970).

This study was initiated in 1967 to determine the productivity of native range and seeded pastures when grazed continuously, in rotation, or free-choice by yearling steers.

Authors are research scientist, Plant Science Section, and head, Animal Science Section, Research Station, Canada Department of Agriculture, Lethbridge, Alberta, Canada.

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Methods

The study was conducted from 1967 to 1972 at the Agriculture Canada Research Substation, Manyberries, Alta. Four grazing treatments were studied. They were: (1) native range grazed continuously for 6 months; (2) crested wheatgrass, native range, and Russian wildrye grazed in rotation; (3) crested wheatgrass, native range, and Russian wildrye grazed free-choice; and (4) Russian wildrye grazed continuously for 6 months. In the rotation, crested wheatgrass was grazed in the spring for about 2 months, native range during the summer for 1½ months, and Russian wildrye in the fall for about 2½ months. In the free-choice grazing system, the three types of pasture were enclosed as one field, thus allowing the yearling steers their preference throughout the 6-month grazing season.

The fields used in the rotation and free-choice system had been grazed by sheep in a previous study (Smoliak, 1968). Nearby fields of native range and Russian wildrye were used for the continuously grazed treatments. Two replications of the free-choice grazing system were possible, while one replicate was available for the rotation and the continuously grazed native range and Russian wildrye treatments. Replication of land was sacrificed in favor of larger numbers of animals per treatment with replication obtained over grazing seasons or years.

Yearling steers were placed in each treatment in early May and removed in late October. Grazing began when leaf height of crested wheatgrass averaged 4 inches and terminated in 180 days, or when the steers on any treatment lost weight between three consecutive weighings. Stocking rates (Table 1) were set to provide an average forage utilization of 55% on native range and 75% on seeded pastures. In each of the study years, 8 head of yearling steers were allotted to the rotation system, 10 head to the free-choice grazing system, and 7 head to the continuously grazed native range. In 1967, 1971, and 1972, 9 head were allotted to the continuously grazed Russian wildrye, and in 1968, 1969, and 1970, 12 head were used.

The native range used in this study has been described previously (Smoliak, 1965). The crested wheatgrass and the Russian wildrye grazed in rotation or free-choice were sown in 1955 in 6-inch rows. The continuously grazed Russian wildrye pasture was seeded in 1961 in 18-inch rows (Fig. 1).

Table 1. Stocking rates and pasture acreages of various treatments at the Manyberries Research Substation, 1967-1972.

Parameter and treatment	Pasture		
	Native range	Russian wildrye	Crested wheatgrass
Stocking (acre/AUM)[1]			
Rotation	4.7	1.6	1.6
Free-choice	4.7	1.6	1.6
Continuous	4.7	0.83	–
Area of pastures (acres)			
Rotation	40	21	19
Free-choice	50	27	23
Continuous	130	35	–

[1] Acres per Animal Unit Month.

Fig. 1. *Russian wildrye pasture seeded in 18-inch rows was more productive and more heavily stocked than when seeded in 6-inch rows.*

The steers were weighed biweekly after being penned overnight without feed and water. Initial weights averaged about 490 lb in early May.

Herbage was harvested from 10 caged and 10 adjacent grazed 9.6-ft^2 areas in each pasture at the end of each grazing season. Dry matter yields were used to estimate forage production and consumption. Estimates of ground cover were obtained by the point-quadrat method (Clarke et al., 1942). A total of 2,100 points were taken in each pasture type in June 1966 and 1973.

Annual precipitation near the grazing trial averaged 13.0 inches for the 6 years (1967-1972) of the trial, compared with the 44-year average of 12.4 inches. Annual precipitation during the study was 16.9 inches in 1967; 12.5 inches in 1968; 9.6 inches in 1969; 13.9 inches in 1970; 12.4 inches in 1971; and 13.1 inches in 1972.

The data on steer gains were analyzed by the method of least squares for unequal subclass numbers, using initial weight as a covariate. As there were no differences in gains in the two replicates of the free-choice grazing system, the means are reported in this study. Tukey's test was used to test for significance of differences between treatments. Comparisons termed "different" imply statistical significance at the 0.05 level of probability.

Results

During the 6 years (1967-1972), yearling steers gained significantly more liveweight on continuously grazed Russian wildrye than those on the rotation or free-choice systems (Table 2). Liveweight gains of steers on continuously grazed native range (297.8 lb) were similar to those of steers on Russian wildrye (317.2 lb) and on the free-choice system (266.5 lb), but were significantly greater than those of steers on the rotation system (248.5 lb). During the spring grazing season, steer gains were greatest on the continuously grazed Russian wildrye and lowest on crested wheatgrass on the rotation system. During the summer grazing period, there were no differences in steer gains on the various pastures. During the fall grazing season, steers on the continuously grazed native range and Russian wildrye pastures gained significantly more liveweight than those on the free-choice system or on the Russian wildrye on the rotation system.

There were no differences in the initial weight of the steers on the various treatments. However, there were differences in initial weight between years. The initial weights averaged 497.4 lb in 1967; 427.6 lb in 1968; 464.4 lb in 1969; 462.9 lb in 1970; 520.7 in 1971; and 535.8 lb in 1972.

Steer gains per acre were significantly greater on Russian wildrye pastures than on the other pastures (Table 3). Over the 6-year period, steer gains per acre on Russian wildrye averaged 96.2 lb, which was six times that on native range pastures (16.0 lb). Gains per acre on the rotation (24.8 lb) and free-choice (26.6 lb) grazing system were about 1.5 times the gains on native range pastures, but these differences were not significant. When adjusted for initial weight, year differences in gain per acre were not significant but the treatment × year interaction was significant and is attributed to variations in precipitation during the season of plant growth, which affected feed quality.

The lower gains per acre in 1971 and 1972 reflected the lower total liveweight gains. Liveweight gains of the steers averaged 273.8 lb in 1967; 350.3 lb in 1968; 304.1 lb in 1969; 320.2 lb in 1970; 209.6 lb in 1971; and 217.8 lb in 1972. The liveweight gains of the steers during 1971 and 1972, the last 2 years of the study, were significantly lower than during the first 4 years. In 1971, the steers lost weight during the last 4 weeks of the trial. During this period, the steers lost on the average 37.6 lb on the continuously grazed native range, 53.0 lb on the rotation, 43.9 lb on the free-choice grazing system, and 14.8 lb on the continuously grazed Russian wildrye. During the last 2-week period in 1972, the steers lost on the average 12.8 lb on the rotation and 1.2 lb on the free-choice grazing system, but gained 8.9 lb on continuously grazed native range and 18.2 lb on Russian wildrye.

Forage production estimates from clipped plots indicate considerable variation in dry matter production and utilization among pasture types and years (Table 4). The Russian wildrye pasture produced about twice as much dry matter when seeded in 18-inch

Table 2. Average initial weight and seasonal and total gain (lb) of yearling steers on four grazing treatments, 1967-1972.

Measurement	Continuous native range	Rotation	Free-choice	Continuous Russian wildrye
Initial weight	495.6 a[1]	490.2 a	492.2 a	495.4 a
Spring gain	143.5 ab	131.4 b	141.6 ab	156.8 a
Summer gain	82.5 a	76.2 a	84.6 a	83.9 a
Fall gain	71.8 a	40.9 b	40.3 b	76.5 a
Total gain	297.8 ab	248.5 c	266.5 bc	317.2 a

[1]Means followed by the same letter do not differ significantly within rows at the 5% level (Tukey's test).

Table 3. Beef production (lb/acre) from yearling steers on four grazing treatments, 1967-1972.

Year	Pasture season	Continuous native range	Rotation	Free-choice	Continuous Russian wildrye
1967	May 11-Nov. 9	15.7	26.1	24.5	84.5
1968	May 2-Oct. 30	18.1	32.6	35.5	125.4
1969	May 1-Oct. 30	18.0	27.6	29.2	110.3
1970	May 12-Oct. 27	18.9	28.4	31.1	115.1
1971	May 6-Oct. 27	12.7	18.2	19.1	67.7
1972	May 11-Sep. 28	12.8	16.0	20.6	74.2
Mean	May 7-Oct. 25	16.0 b[1]	24.8 b	26.6 b	96.2 a

[1] Means followed by the same letter do not differ significantly at the 5% level (Tukey's test).

rows (1,120 lb/acre) as when seeded in 6-inch rows (480 lb/acre). Average dry matter yields were 305 lb/acre on native range and 750lb/acre on crested wheatgrass.

Utilization of forage during the study period ranged from 49 to 95% on native pastures, 31 to 87% on crested wheatgrass, and 49 to 97% on Russian wildrye (Table 4).

Forage production declined and utilization increased on each pasture type and on each grazing system during the trial. The highest yields on native range were recorded in 1968 and on crested wheatgrass and Russian wildrye in 1967. The lowest yields were recorded in all fields in 1972, the last year of the study.

The steers made greater use of native range when grazed free-choice than they did on native range grazed continuously or during the summer when grazed in a rotation. More crested wheatgrass was consumed when grazed in a rotation than when grazed free-choice. Equal amounts of Russian wildrye were consumed when grazed in a rotation or free-choice.

The basal area of the grasses on the three pasture types under three grazing systems did not vary greatly between 1966 and 1973 (Table 5), except on the rotation crested wheatgrass where a 30% reduction was recorded. The native range pastures grazed free-choice showed a decrease in basal area of needleandthread (*Stipa comata* Trin. & Rupr.) and the wheatgrasses (*Agropyron* spp.) and an increase of Junegrass (*Koeleria cristata* (L.) Pers.). Blue grama (*Bouteloua gracilis* (HBK) Lag.) remained rather constant in basal area on all native range pastures. The basal area of forbs and shrubs decreased on all native range pastures, on the crested wheatgrass grazed free-choice, and on the Russian wildrye pastures grazed in rotation and free-choice, but increased on the crested wheatgrass pasture grazed in rotation. There was a decrease in basal area of Russian wildrye when grazed continuously or free-choice, but a slight increase when grazed in a rotation system.

Discussion

Russian wildrye and crested wheatgrass, two introduced grasses, have been effective in increasing beef production. Established pastures of Russian wildrye produced from five to seven times as much gain per acre as did native range when grazed by yearling steers during a 6-month grazing season. The combination of crested wheatgrass, Russian wildrye, and native range produced from 1.3 to 1.8 times as much gain per acre as native range.

The low gains per acre recorded for the yearling steers on the rotation and the free-choice grazing systems may reflect the lower production and availability of feed. The decline in forage production from 1967 to 1972 may be attributed in part to prior grazing by sheep for a 10-year period and in part to dry conditions in the spring season. Total precipitation in March, April, and May was less than normal from 1968 to 1972 (long-term average is 3.3 inches).

The steers with a free-choice generally preferred native range to crested wheatgrass. Native range grazed free-choice was more heavily utilized than when grazed in rotation or continuously. Crested wheatgrass grazed in rotation was more heavily utilized than when grazed free-choice. Russian wildrye was heavily utilized in both the rotation and the free-choice system of grazing. This suggests that better control of grazing was obtained when the three pasture types, crested wheatgrass, native range, and Russian wildrye, were fenced separately and grazed in a rotation. In a previous study, Smoliak (1968) showed that sheep rotated themselves on the various pasture types.

Table 4. Dry matter production (lb/acre) and utilization (%) of forage on three pasture types under four grazing treatments, 1967-1972.

Year	Measurement	Native range			Crested wheatgrass		Russian wildrye		
		Continuous	Rotation	Free-choice	Rotation	Free-choice	Continuous	Rotation	Free-choice
1967	Production	465	420	445	1,070	1,120	2,260	690	610
	Utilization	57	49	54	58	31	47	56	49
1968	Production	465	515	510	685	925	815	635	585
	Utilization	56	63	62	82	45	77	73	82
1969	Production	330	315	310	660	700	760	610	445
	Utilization	60	56	70	71	67	90	90	95
1970	Production	200	215	220	735	805	1,155	485	365
	Utilization	70	61	66	71	65	90	81	74
1971	Production	260	190	210	595	655	1,080	345	410
	Utilization	77	75	86	77	69	89	92	91
1972	Production	135	130	120	480	605	660	325	290
	Utilization	75	82	95	87	82	92	97	95
Mean	Production	310	300	305	705	800	1,120	515	450
	Utilization	66	64	72	74	60	81	82	81

Table 5. Changes in basal area (%) of vegetation on three pasture types under four grazing treatments, 1966-1973.

Pasture type and species	Continuous		Rotation		Free-choice	
	1966	1973	1966	1973	1966	1973
Native range						
Blue grama	3.8	3.8	3.3	3.3	3.2	3.4
Needleandthread	3.2	3.1	3.8	3.7	3.1	2.3
Junegrass	0.9	1.5	0.8	1.1	0.9	1.8
Wheatgrasses	1.4	1.0	0.5	0.4	1.0	0.5
Other grasses and sedges	1.8	1.3	3.2	2.3	1.6	1.7
Total	11.1	10.7	11.6	10.8	9.8	9.7
Forbs and shrubs	2.2	2.0	2.8	2.3	1.9	1.7
Crested wheatgrass						
Crested wheatgrass	–	–	11.1	7.7	10.3	9.1
Other grasses	–	–	0.0	0.0	0.0	0.0
Forbs and shrubs	–	–	0.3	0.8	0.3	0.0
Russian wildrye						
Russian wildrye	9.8	8.2	9.9	10.6	10.0	8.6
Other grasses	0.0	0.0	0.7	0.1	0.1	0.1
Forbs and shrubs	0.0	0.0	0.8	0.0	0.4	0.0

Under the rotation and free-choice grazing system, the acreage requirement for a 6-month grazing period was reduced to 15 acres per animal-unit compared to 28 acres required on continuously grazed native range. The continuously grazed Russian wildrye, in 18-inch rows, provided 5.0 acres per animal-unit for 6 months of grazing.

Stocking rates on Russian wildrye pastures varied from 0.83 to 1.6 acres per AUM, depending on row spacing and forage production, and were from about 3 to 5.5 times heavier than on native range. The Russian wildrye seeded in 18-inch rows produced more dry matter and had a greater carrying capacity than when seeded in 6-inch rows. This confirms the results of Rogler and Lorenz (1970) who showed that dry matter, beef production, and stocking rates were greater on Russian wildrye seeded in 36-inch rows compared to solid stands seeded in 6-inch rows.

The results of this study indicate that both Russian wildrye and crested wheatgrass are suitable for range reseeding and are effective in reducing the acreage requirement and extending the grazing season. Trlica and Cook (1972) concluded in their study of carbohydrate reserves in the two grasses that "both crested wheatgrass and Russian wildrye are physiologically adapted for fall or early spring grazing and possibly for spring-fall range." Our study suggests that crested wheatgrass should be grazed during the spring period, while Russian wildrye should be grazed in the fall or throughout the grazing season.

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