Grazing Studies on Native Range, Crested Wheatgrass, and Russian Wildrye Pastures

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Highlight

Weight gains per acre of yearling ewes on continuously grazed crested wheatgrass and Russian wildrye pastures averaged 21.7 and 26.3 lb, or 2.6 and 3.2 times the gain of yearling ewes on native range (8.3 lb). On rotation and free-choice systems of grazing the gains per acre averaged 16.5 and 18.5 lb, or 2.0 and 2.2 times those on native range. Over the 10-year period the seeded pastures were stocked three times as heavily as the native range. Ewes rotated themselves on the various pastures under a free-choice system, going first to crested wheatgrass, then to native range and lastly to Russian wildrye.

The need for high producing pastures has emphasized the importance of introduced forage species. Earlier trials with introduced grasses were concerned mainly with reclaiming abandoned or formerly cultivated land. The earliest reports of grazing trials with crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.) in the Northern Great Plains area are those of Sarvis (1942) and Williams and Post (1945). More recent studies (Barnes and Nelson, 1958; Campbell, 1961, 1963; Johnson, 1959; Lang and Landers, 1960; Lodge, 1963; and Whitman et al., 1963) stressed the importance of crested wheatgrass for both seasonal and year-long grazing when compared with other grasses and native range. Grazing studies with Russian wildrye (*Elymus junceus* Fisch.) have shown that this grass compares favorably with other introduced grasses (Barnes and Nelson, 1958; Campbell, 1961, 1963; Johnson, 1959; and Lang and Landers, 1960).

This study presents the results of a 3-system, 10-year (1957–1966) grazing test on seeded pastures and native range at the Research Substation, Manyberries, Alberta.

Table 1. Grazing treatments (in triplicate) established at Manyberries, Alberta.

Grazing system	Pasture	Grazing season	Acreage
Continuous	Native range	Spring thru fall	30
	Crested wheatgr.	Spring thru fall	15
	Russian wildrye	Spring thru fall	15
Rotation	Crested wheatgr.	Spring	4
	Native range	Summer	10
	Russian wildrye	Fall	6
Free-choice	Crested wheatgr.	Spring thru fall	4
	Native range	Spring thru fall	10
	Russian wildrye	Spring thru fall	6

Methods and Procedure

Five grazing treatments, in triplicate, were established as indicated in Table 1. Crested wheatgrass and Russian wildrye were sown in spring 1955 each at 8 lb/acre in 6-inch spacings. Grazing did not begin until 1957. Native range, crested wheatgrass, and Russian wildrye were grazed under three systems; continuously, in rotation and under a free-choice system. In the free-choice system the three types of pasture were enclosed as one paddock, thus allowing the yearling ewes their preference throughout the season. The native range used in this study was described by Smoliak (1965).

Yearling ewes were placed on each treatment in late April and removed in mid-November. Grazing was not begun until leaf height of crested wheatgrass averaged 4 inches. In 1957 and 1958, six yearling ewes were allotted to each of the five grazing treatments in each replicate. This allowed ⅔ acre of native range and ⅓ acre of seeded pasture per head per month. During 1959 and 1960, the stocking rate on the seeded pastures was doubled to ⅙ acre/head/month. During 1961 to 1966 the seeded pastures were grazed at ⅔ acre/head/month. On the rotation system, the yearling ewes were allowed to graze crested wheatgrass in spring for 8 weeks, native range in summer for 8 weeks, and Russian wildrye in fall for about 14 weeks.

The ewes were weighed biweekly after a 16-hr shrink. Water was hauled every 2 or 3 days and stored in rubber troughs. The ewes were allowed free access to salt and monosodium phosphate (Fig. 1).

From 1958 to 1962 observations were made twice daily on the location of individual sheep within the free-choice paddock in each of three replicates according to the procedure of Hunter (1954). The comparative grazing intensity or index was calculated to show which pastures the sheep preferred throughout the grazing season.

Herbage was harvested from caged and grazed 9.6 ft² areas biweekly with a hand-held power mower. Dry matter yields were used to estimate forage production and consumption. Estimates of the percentage ground cover were

FIG. 1. Water troughs, mineral boxes and shelters were located in the center of each field. Shelters were particularly effective in discouraging use of fence corners for shade during hot days and aided in grazing distribution.

Table 2. Precipitation (inches) and dry matter production (lb/acre) on three pasture types, 1957–1966.

Year	Precipitation		Dry matter production		
	April to July	Annual	Native range	Crested wheatgrass	Russian wildrye
1957	4.40	13.77	630	752	705
1958	5.05	13.17	592	1214	862
1959	5.82	12.07	472	1292	910
1960	5.38	11.21	398	626	579
1961	3.07	8.48	243	503	437
1962	6.58	11.31	255	699	473
1963	5.76	10.46	280	701	470
1964	6.26	15.12	267	717	405
1965	16.48	23.67	488	1014	919
1966	6.10	13.57	302	806	703
Average	6.49	13.28	393	832	646

obtained by the point-quadrat method (Clarke et al., 1942) during August 1957 and 1966.

Precipitation during the 10-year grazing trial (Table 2) ranged from less-than-average (1957 and 1961) to much-above-average (1965). The study period included the driest (1961) and the wettest (1965) years recorded at Manyberries.

Results

Liveweight gains of yearling ewes were greater on Russian wildrye and on the free-choice pastures than on native range pastures (Table 3). Crested wheatgrass pasture produced the lowest liveweight gain in 7 out of 10 years. In 9 of 10 years greatest liveweight gains per ewe were recorded on continuously grazed Russian wildrye pasture and on the free-choice system of grazing. Liveweight gains on native range pastures exceeded those on other pastures in only one year (1962). Although liveweight gains per head varied between years, the differences were not statistically significant. Initial weights of ewes varied in some years, but gains when adjusted by covariance to a common initial weight still differed significantly ($P < 0.01$). Differences between replications in weight gains of ewes were not significant; mean ewe gains on replicates 1, 2, and 3 were 42.3, 42.7, and 39.4 lb.

Table 3. Average total and daily gain in lb/yearling ewe in spring, summer, and fall, 1957–1966.

Pasture	Total gain 197 days	Average daily gain		
		Spring 58 days	Summer 53 days	Fall 86 days
Native range	41.7	0.35	0.26	0.08
Crested wheatgr.	36.0**	0.38**	0.19**	0.05**
Russian wildrye	45.6**	0.35	0.26	0.13**
Rotation	41.4	0.35	0.18**	0.13**
Free-choice	46.1**	0.38**	0.24	0.13**

**Significantly ($P < 0.01$) different than on native range.

Differences in liveweight gain between seasons of use were highly significant ($P < 0.01$). This is best illustrated by daily gain per ewe (Table 3). Greatest gains were made during the spring grazing season. Differences between treatments during the spring, summer, and fall grazing periods were highly significant ($P < 0.01$). Daily gains declined with advancing season of use; this decline is attributed to decreasing nutritive values of the forage (Smoliak and Bezeau, 1967). Lowest daily gains during the summer period were recorded on the continuously grazed crested wheatgrass and on the rotation system when native range was utilized. Daily gains in fall were greatest on grazing systems containing Russian wildrye. There were highly significant ($P < 0.01$) differences in daily gain between years for all grazing periods.

Ewe gains per acre show the superiority of Russian wildrye (Table 4). Gains per acre of ewes on continuously grazed Russian wildrye ranged from 38.9 lb (1960) to 16.9 lb (1966), and averaged 26.3 lb or 3.2 times those from native range pastures (8.3 lb). Continuously grazed crested wheatgrass pasture produced the next highest ewe

Table 4. Average gain in lb/acre of yearling ewes on three grazing systems, 1957–1966.

Year	Pasture season	Continuous			Rotation	Free-choice
		Native range	Crested wheatgrass (C.W.G.)	Russian wildrye (R.W.R.)	C.W.G.–Native –R.W.R.	C.W.G. + Native + R.W.R.
1957	Apr. 30–Nov. 12	6.7	15.4	17.3	12.3	13.5
1958	Apr. 22–Nov. 17	7.6	12.2	16.8	11.9	11.8
1959	Apr. 21–Nov. 16	7.1	29.0	35.6	17.8	21.7
1960	Apr. 18–Nov. 15	8.7	23.6	38.9	21.2	23.7
1961	May 2–Nov. 14	6.4	17.5	21.5	11.8	14.8
1962	May 7–Nov. 13	10.6	18.3	25.6	17.5	19.2
1963	Apr. 23–Nov. 12	12.2	29.3	35.3	22.0	24.5
1964	May 12–Nov. 10	11.1	30.4	23.9	22.1	22.4
1965	May 6–Nov. 13	10.6	29.7	31.4	20.1	23.2
1966	May 10–Nov. 15	2.4	11.2	16.9	8.5	10.2
Mean	Apr. 30–Nov. 14	8.3	21.7**	26.3**	16.5**	18.5**

**Significantly different ($P < 0.01$) than on native range.

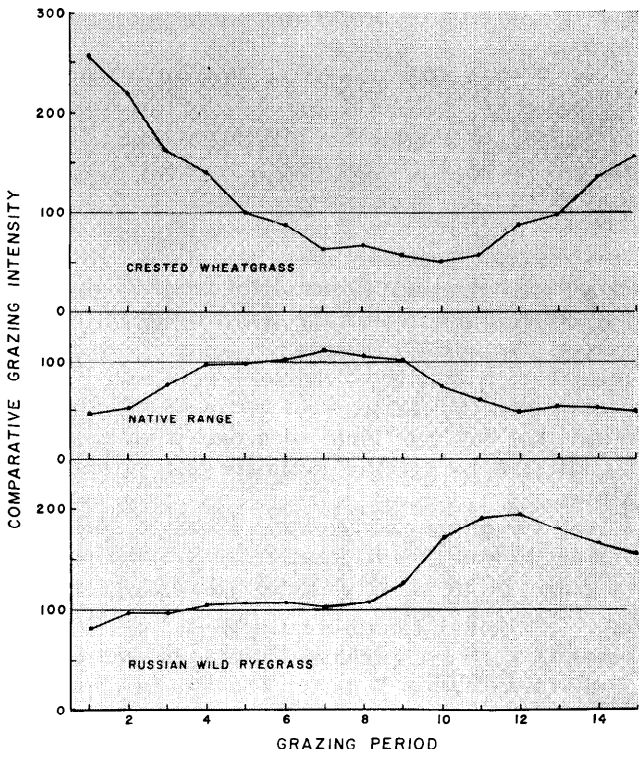

FIG. 2. Comparative grazing intensity or preference of ewes for one pasture type or another by biweekly periods from April 26 to November 15 (1958–1962). Ratings above the grazing intensity of the area, or 100, indicate preference.

gain per acre (21.7 lb), or 2.6 times the gain on native range. Rotation and free-choice grazing systems produced 16.5 lb and 18.5 lb, or 2.0 and 2.2 times the gain produced on native range over the 10-year period.

The number of days during each grazing season varied, but means averaged 58, 53, and 86 days during spring, summer, and fall periods. In 4 years out of 10, grazing began during the third week of April; in another 4 years grazing had to be delayed until after the first week of May.

Daily observations on the grazing habits of yearling ewes on the free-choice system showed that the ewes rotated themselves on the various pasture types during the grazing season (Fig. 2). Ewes preferred crested wheatgrass from initiation of grazing until the third week of June and then moved to Russian wildrye for about 3 weeks. They preferred native range from mid-July to mid-August and Russian wildrye from mid-August to late October. Towards the end of the grazing season ewes preferred crested wheatgrass, but this preference usually coincided with periods of deep snow and cold weather.

Consumption of salt and monosodium phosphate showed highly significant differences ($P < 0.01$) between years. Treatment differences in consumption of salt were highly significant ($P < 0.01$). Ewes on native range consumed more salt than ewes on other grazing treatments. Over a 10-year period the average salt consumption by ewes on native range, crested wheatgrass, Russian wildrye, rotation pastures, and free-choice pastures was 1.5, 1.1, 1.0, 1.3, and 1.0 lb, respectively. The amount of monosodium phosphate consumption averaged about ⅛ lb.

Table 5. Changes in percentage basal area of vegetation on three types of pasture under three grazing systems, 1957–1966.

Pasture type and species	Continuous		Rotation		Free-choice	
	1957	1966	1957	1966	1957	1966
Native range						
Blue grama	3.47	3.22	4.18	3.67	4.16	4.44
Needle & thread	2.16	2.61	1.84	2.50	1.78	2.06
Junegrass	1.05	0.67	1.00	1.11	1.02	0.56
Wheatgrasses	0.95	1.44	0.87	1.22	0.53	1.17
Other grasses and sedges	0.79	2.22	1.11	2.06	0.98	1.66
Total	8.42	10.16	9.00	10.56	8.47	9.89
Forbs & shrubs	2.23	2.62	1.87	1.84	1.23	1.58
Crested wheatgrass						
Crested wheatgr.	5.82	10.22	5.62	10.78	5.55	10.44
Forbs & shrubs	0.18	0.45	0.17	0.33	0.22	0.22
Russian wildrye						
Russian wildrye	6.36	9.94	6.35	10.28	6.20	8.94
Other grasses	0.02	0.12	0.07	0.39	0.06	0.29
Forbs & shrubs	0.60	0.33	0.78	0.84	0.44	0.83

Average dry matter production per acre was: crested wheatgrass, 832 lb; Russian wildrye, 646 lb; and native range, 393 lb (Table 2). The two seeded grasses and the native pastures declined in productivity during this study, but productivity was closely related to available moisture. Recovery of productivity of the native range pastures on the free-choice system, after the dry year 1961, was not as rapid as on other grazing systems. On the rotation system the deferred native range pasture consistently produced more dry matter per acre than the other native pastures.

Percentage consumption of forage on the native range pastures averaged 47, 49, and 52, on the continuous, rotation, and free-choice grazing systems. In the last six years of the trial, utilization of native range pastures generally was greater under the free-choice grazing system than under the continuous or rotation grazing regime. Percentage consumption of forage on the Russian wildrye pastures averaged 63, 65, and 63 on the continuous, rotation, and free-choice grazing systems and appeared to be optimum. Utilization of crested wheatgrass pastures averaged 40, 46, and 32% on the continuous, rotation, and free-choice systems.

Basal areas of crested wheatgrass and Russian wildrye were low in 1957, at the initiation of the trial, but increased on all fields by 1966 (Table 5). While there was some invasion by native grasses

on the Russian wildrye fields, none was evident on the crested wheatgrass fields. Fringed sage decreased on the crested wheatgrass fields grazed continuously and free-choice but increased on the rotation fields. Fringed sage decreased on the continuous and rotation Russian wildrye fields but remained unchanged on the free-choice field.

Total basal area of grasses and sedges increased on the native range fields under all systems of grazing. Blue grama grass increased in basal area under free-choice grazing but decreased on the fields grazed continuously or in rotation. Total basal area of forbs and shrubs increased on fields grazed continuously and free-choice but decreased slightly on fields grazed in rotation.

Discussion

The use of introduced grasses for early spring or late summer and fall grazing was justified by increased pasture productivity. Yield of herbage was increased 2 to 3 times and liveweight gains per acre were increased 2 to 7 times over those of good adjacent native range. In spring all pasture types were adequate in terms of animal gain, although crested wheatgrass was slightly better than the others. In late summer and fall Russian wildrye was invaluable in maintaining animal gains. In this study any grazing system that provided Russian wildrye as fall pasture was satisfactory.

The advantage of grazing three pasture types within one paddock was expressed in greater gain in weight of ewe. Percentages of area in crested wheatgrass, native range, and Russian wildrye were 20, 50, and 30, respectively. The lower production of forage and the increase in basal area of blue grama grass on the native range field indicated that this field could have been proportionately larger than the fields of the introduced grasses. However, the distribution of the ewes over the three pasture types appeared adequate on the basis of percentage utilization of the forage.

The biweekly index of preference for a certain type of herbage was influenced not only by its productivity, but also by its palatability and seasonal availability. Seasonal movement of animals, which Hunter (1954) showed to be a factor influencing preference, was not a factor in this study.

The low amounts of salt consumed by the yearling ewes grazing crested wheatgrass and Russian wildrye pastures may indicate that the forage available was adequate to balance their requirements. Smoliak and Bezeau (1967) have shown that the introduced grasses, and especially Russian wildrye, contained greater amounts of non-silica ash and phosphorus than did the native grasses.

The productivity of the seeded pastures varied with available moisture (Table 2) throughout the 10-year grazing trial. A decline in productivity was shown in other studies (Campbell, 1961, 1963; Barnes and Nelson, 1958; and Johnson, 1959). In another study Smoliak et al. (1967) showed that 26- to 38-year-old stands of crested wheatgrass responded to favorable amounts of precipitation and that these stands were still productive. Thirty-year-old Russian wildrye stands at Manyberries are productive in spite of years of heavy spring grazing.

Heavy utilization of Russian wildrye during dry years did not seriously affect the stand. In those years forage consumption ranged from 76 to 98%. With adequate moisture the stand resumed normal growth. Apparently Russian wildrye, like crested wheatgrass, is able to withstand severe use. This is substantiated by the work of Johnson (1959) who found that herbage yield of Russian wildrye was not affected by grazing intensity but varied with rainfall.

Leaf height measurements obtained prior to grazing showed that in most years Russian wildrye was ahead of, or as early as, crested wheatgrass.

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