Seasonal Beef Production from Russian Wildrye-Alfalfa Pastures[1]

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Highlight

Russian wildrye (*Elymus junceus* Fisch.)—Rambler alfalfa (*Medicago sativa* L.) pastures were grazed for 28 days by yearling steers from various starting dates of use, early May, mid-May, early June and for a longer period, June to September, to determine the influence on pasture production and beef cattle performance. Steer gain per acre from Russian wildrye-alfalfa pasture was greatest under early June grazing use. Daily gain per head was greatest when the pasture was grazed from early June. Forage production was highest from the early June and early June-summer use period pastures. The trial indicates that the most productive season of use of Russian wildrye-alfalfa pastures in southwest Saskatchewan is from early June. Such use will result in maximum production in terms of beef production either per acre or individual animal daily weight gain and in maintenance of the Russian wildrye-alfalfa stand.

Russian wildrye (*Elymus junceus* Fisch.) is an introduced bunchgrass which has shown outstanding characteristics of productivity, drought-resistance and longevity. It and crested wheatgrass (*Agropyron desertorum* (Fisch.) Schult.) are the principal grass species used in the Northern Great Plains for range reseeding. Several grazing studies (Campbell, 1961; Campbell, 1963; Smoliak, 1968; Rogler and Lorenz, 1970) indicate its usefulness for pasture. Among its demonstrated attributes is its characteristic of early spring growth which makes it valuable as spring pasture. Lodge (1970) has shown the advantages of complementary grazing systems in the management of rangelands in the Northern Great Plains. These systems are based on the use of introduced grass species as spring pasture. A study was conducted at the Research Station, Canada Department of Agriculture, Swift Current, Saskatchewan, from 1966 to 1969 to investigate the influence of various seasons of use of Russian wildrye-alfalfa pastures on pasture production and beef cattle performance.

Methods

The trial was located on a gently rolling upland typical of that which might be converted from native range to cultivated pasture. The soil of the area is a light loam. It is developed over gravelly calcareous till and has a thin 5- to 6-inch (12 to 15 cm) light brown surface horizon with an average nitrogen content of 0.19%, pH 6.5, organic matter 3.7%, and 22 ppm of available phosphorus.

Native vegetation of the area is of the mixed prairie type. Mid-grasses present include needle-and-thread (*Stipa comata* Trin. and Rupr.), western wheatgrass (*Agropyron smithii* Rydb.), thickspike wheatgrass (*Agropyron dasystachyum* (Hook.) Scribn.), and June grass (*Koeleria cristata* (L.) Pers.). Blue grama (*Bouteloua gracilis* (HBK.) Lag. ex Steud.) and dryland sedges (*Carex* spp.) are important components of the vegetation. Several forbs of which the principal one is fringed sagewort (*Artemisia frigida* Willd.) are also normally present in the vegetative cover.

The climate of southwest Saskatchewan is semi-arid. Average annual precipitation near the study area was 12.1 inches (30.7 cm) for the four years of the study compared with the 48-year average of 13.7 inches (34.7 cm). Precipitation during the study was 1966—13.0 inches (33.0 cm), 1967—12.9 inches (32.8 cm), 1968—9.4 inches (24.0 cm), and 1969—12.9 inches (32.8 cm).

The site, a cultivated field, was summer fallowed in 1959 and 1960 and seeded in August 1960 to

[1] Received December 30, 1970.

Table 1. Beef production (lb./acre) from yearling steers grazing various season of use Russian wildrye-alfalfa pastures.

Season of use	Beef production				
	1966	1967	1968	1969	Average
Early May	69 a[1]	56 b	48 a	70 a	61 a
Mid-May	92 b	30 a	53 a	66 a	60 a
Early June	93 b	94 c	77 b	83 a	87 b
Early June-summer	85 b	67 b	46 a	72 a	68 a

[1] Within each year, means followed by the same letter do not differ significantly at the 5% level (Snedecor and Cochran, 1967).

Table 2. Stocking rate (steers/acre), average (1966–69) steer weights (lb.), number of days of grazing and animal unit[1] (days/acre) provided by Russian wildrye-alfalfa pastures.

Season of use	Stocking rate	Steer weight	Days grazed	A.U.
Early May	1.2	615	27	19.9
Mid-May	1.2	630	26	19.7
Early June	1.2	655	27	21.2
Early June-summer	0.4	690	83	23.0

[1] Animal unit = A.U. = 1000 lb.

Russian wildrye and Rambler, a creeping-rooted alfalfa (Heinrichs and Bolton, 1958). Seeding was done in cross-drilled 14-inch (36 cm rows). Crested wheatgrass was abundant in adjacent areas.

The area was not grazed in 1961, and lightly grazed from 1962 through 1965 by yearling steers. In late 1965 it was subdivided to give three replicates each containing three 2.5-acre (1.0 ha) pastures and one 7.5-acre (3.0 ha) pasture.

Four grazing use periods based on date of turn-in were used. The initial stocking was at the rate of three yearlings per pasture with the length of grazing period adjusted each year on the basis of available forage and animal gains. Grazing use for the first period began in early May when the average leaf length of Russian wildrye was 4 to 5 inches (10 to 13 cm). Dates of turn-in were; 1966—May 3, 1967—May 8, 1968—April 30, and 1969—April 29. The second period of grazing began two weeks later (about mid-May) and the third (early June) after a further two weeks. The fourth use period (early June-summer) began on the same date as the early June pastures and was stocked at the rate of one yearling steer on 2.5 acres (1.0 ha). The grazing period was to be 28 days in the early May, mid-May, and early June pastures. This was reduced to 22 and 18 days in the early May and mid-May pastures, respectively in 1966. The early June pasture was grazed for 27 days in 1966 and in 1968 for 23 days. In 1967 all three pastures were grazed for 30 days. The early June-summer pasture was grazed for 102 days in 1966, 75 days in 1967, 65 days in 1968, and 91 days in 1969.

Forage production and utilization was estimated by the difference method from the yield biweekly during the grazing period of 10 paired caged and uncaged 9.6 ft^2 (0.9 m^2) plots in each pasture.

Good commercial yearling steers overwintered on a standard ration to gain 1.0 to 1.5 lb. per day (0.45 to 0.68 kg per day) were used. Weight of steers was approximately 600 pounds (272 kg) at the start of the early May grazing period. They were weighed prior to turning the animals into the pastures and at two-week intervals while on pasture. Total digestible nutrients (TDN) for each treatment were determined by the nutritional needs of the animals for maintenance and gain in accordance with the requirements of the National Research Council (1963).

The basal area of the swards of the various treatments was estimated using the point-quadrat method of Clarke et al. (1942). Five hundred points were taken in each pasture in the fall of 1965 and in each year of the study.

Results and Discussion

During the four years Russian wildrye-alfalfa produced more liveweight gain per acre under early June grazing use than it did when grazed earlier in the spring (early May or mid-May use) or when grazed for a longer period in the late June-summer period (Table 1). In 1966 the early May period produced significantly less ($P < 0.05$) beef per acre than the other three periods. In 1967 and in 1968 the early June period produced significantly more ($P < 0.05$) liveweight gain per acre than did any other period. Growing season rainfall (May, June, and July) was below average in all four years, but there was apparently no relationship between rainfall in this period and production of beef per acre.

Russian wildrye-alfalfa pastures grazed at one-third the intensity in early June-summer for a longer period (avg 83 days) provided approximately 11% more animal unit (A.U.) days per acre (Table 2) than the average of the spring use periods (26 to 27 days).

Estimated total digestible nutrient (TDN) production per acre from Russian wildrye-alfalfa pastures when grazed from early June was greater than from the early May or mid-May pasture periods (Table 3). Estimated TDN production was 345 lb./acre (387 kg/ha) and 341 lb./acre (382 kg/ha) for early May and mid-May use, and 456 lb./acre (511 kg/ha) and 422 lb./acre (473 kg/ha) for early June and early June-summer use, respectively. Daily gain per head was greater on Russian wildrye-alfalfa pastures when grazed from early June than in the other periods.

Table 3. Average (1966–69) beef production (lb./acre), TDN production (lb./acre), and daily gain (lb./steer) from Russian wildrye-alfalfa pastures.

Season of use	Beef production	TDN production	Daily gain
Early May	61 a[1]	345 a	1.9 a
Mid-May	60 a	341 a	1.9 a
Early June	87 b	356 b	2.8 b
Early June-summer	68 a	322 b	2.2 ab

[1] Means followed by the same letter do not differ significantly at the 5% level (Snedecor and Cochran 1967).

Table 4. Average (1966–69) forage production (DM lb./acre), utilization (DM lb./acre) and utilization (%) of Russian wildrye-alfalfa pastures.

Season of use	Forage production	Forage utilization	Utilization
Early May	695 a[1]	450 a	65 a
Mid-May	800 a	500 a	62 a
Early June	1075 b	650 b	60 a
Early June-summer	1275 b	1080 c	85 b

[1] Means followed by the same letter do not differ significantly at the 5% level (Snedecor and Cochran 1967).

Forage production estimates from clipped plots indicate considerable differences in average forage production and utilization (DM lb./acre) from different periods (Table 4). The early May use pastures produced the least forage, and the early June and early June-summer pastures the most. Utilization as a percent of production was approximately equal for the three spring season-of-use pastures but it was greater under early June-summer use.

The results of the point-quadrat analysis of percent basal area and percent composition of Russian wildrye-alfalfa pastures in 1965 and 1969 are given in Table 5. Basal area of Russian wildrye increased under all period uses. In view of the age of the stand, the high initial basal area percentage of Russian wildrye resulting from the narrow row space seeding and cross-seeding and the below average rainfall during the trial period, the increase in percent basal area of Russian wildrye is of interest. It suggests that the potential productivity of the swards was reduced by intraplant competition. The value of wider row spacings in increasing forage yields of Russian wildrye has been shown by Kilcher (1961). Alfalfa basal area percentage generally decreased when subjected to the several periods of use. In 1969, alfalfa was, however, more abundant in the swards of the early May and mid-May use pastures than in those of the early June and early June-summer use pastures. This did not affect rate-of-gain of the steers. Crested wheatgrass, an invader from adjacent swards, increased in percent basal area in swards subjected to early May grazing and was reduced under the other three periods of use. Russian wildrye appears to be less competitive to crested wheatgrass when used early in the spring than when used after the first of June.

Comparison of the changes in sward composition between the area in 1965 and those of the pastures after being subjected to the various periods of use for four years indicates an increase in the proportion of Russian wildrye with the greater increase being under early June and early June-summer grazing use (Table 5). Alfalfa decreased in its contribution to total composition under all periods of use. Crested wheatgrass was less abundant in 1969 than in 1965 except in the early May period. Under all season-of-use periods studied crested wheatgrass invasion was not serious.

The swards did not have a high protein content at any time (Table 6). The variation in crude protein content from early spring through summer was similar to that reported by Campbell (1961) for comparable Russian wildrye-alfalfa swards. Higher percentage levels of crude protein in the early May use pastures did not increase the liveweight gains of the animals grazed thereon. There were no significant differences between protein content of grazed and ungrazed herbage.

Conclusions

During a four-year period (1966 to 1969) of below average rainfall, Russian wildrye-alfalfa pastures produced more gain per acre under early June grazing use than when grazed in early May,

Table 5. Basal area (%) and composition (%) of vegetation of Russian wildrye-alfalfa pastures grazed by yearling steers.

	Basal area					Composition				
	1965	1969				1965	1969			
Species		Early May	Mid-May	Early June	Early June-summer		Early May	Mid-May	Early June	Early June-summer
Russian wildrye	8.8	11.6	10.2	10.4	11.3	76.9	85.7	89.1	92.5	92.0
Alfalfa	1.9	1.1	1.1	0.6	0.7	17.0	8.2	9.7	5.0	5.7
Crested wheatgrass	0.7	0.8	0.1	0.3	0.3	6.1	6.1	1.2	2.5	2.3
Totals	11.4	13.5	11.5	11.2	12.3	100.0	100.0	100.0	100.0	100.0

Table 6. Crude protein content (%) of herbage of Russian wildrye-alfalfa pastures as influenced by season of use and grazing.

	Date sampled								
	April-May			June		July		Aug.	Sept.
Season of use	29–5	12–18	24–29	7–13	21–28	7–13	21–30	13–19	13–20
Early May									
ungrazed	14.0[1]	13.6	13.4						
grazed		13.6	13.2						
Mid-May									
ungrazed		13.3	12.1	11.1					
grazed			11.9	10.3					
Early June									
ungrazed			12.0	10.9	8.6				
grazed				10.4	8.1				
Early June-summer									
ungrazed			11.4	10.1	9.0	8.1	8.9	8.0	9.2
grazed				10.0	9.2	8.3	8.0	7.3	7.4

[1] Each figure is a mean of harvests from three replicates in each year 1966 through 1969.

mid-May, or for a longer period under early June-summer use.

Estimated TDN/acre production was highest when Russian wildrye-alfalfa pastures were used after early June or early June-summer. Daily gain per head was greater when pastures were grazed from early June than when grazed after early May, mid-May, or in early June-summer periods.

There were significant differences in forage production between periods of use. Forage production was highest from the early June and early June-summer use periods and lowest from the mid-May and early May period use pastures. Average percentage utilization ranged from 60 to 65 on the early May, mid-May, and the early June use periods and 85% under the early June-summer use period.

Protein content of the forage of these Russian wildrye-alfalfa pastures was generally adequate. Protein content ranged from an average high of 14.0% in late April and early May to less than 8.0% after mid-June. Lawrence and Troelsen (1964) found that the average crude protein content of Russian wildrye was lower (12.4%) in 1961 a dry year than in 1960 (17.9%) a year of normal precipitation.

The nutritive value of the forage as measured by crude protein content levels in the three spring use pastures appeared to be adequate for beef production. In the later part of the early June-summer use period low nutritive value reduced beef production.

Increased beef production per acre appeared to be a function of higher daily rate of gain for individual animals. Higher daily rate of gain was related to availability of forage providing the nutritive content of the forage was adequate.

Point-quadrat analysis of the sward indicated that Russian wildrye increased in basal area under all periods of use. Alfalfa basal area decreased under all periods of use. It remained more abundant in the early May and mid-May treatments. Bloat did not occur during the course of the trial. However, it is sometimes a problem in grass-alfalfa pastures in the area. The relative abundance of alfalfa in the pastures was related to the period of use being less under early June and early June-summer use periods. The reaction of alfalfa to different seasons of use in this trial suggest that grazing management which includes early May use might increase the bloat hazard. Crested wheatgrass invasion from adjacent stands occurred. Russian wildrye was less competitive to crested wheatgrass when subjected to early May use, but crested wheatgrass invasion was not significant.

The trial indicates that the optimum season of use of Russian wildrye-alfalfa pastures in southwest Saskatchewan is in June. Use at this time will result in maximum production in terms of steer gains either per acre or individual animal daily weight gain and in maintenance of the Russian wildrye-alfalfa stand.

Literature Cited

CAMPBELL, J. B. 1961. Continuous versus repeated seasonal grazing of grass-alfalfa mixtures at Swift Current, Saskatchewan. J. Range Manage. 14:72–77.

CAMPBELL, J. B. 1963. Grass-alfalfa versus grass-alone pastures grazed in a repeated seasonal pattern. J. Range Manage. 16:78–81.

CLARKE, S. E., J. A. CAMPBELL, AND J. B. CAMPBELL. 1942. An ecological and grazing capacity study of the native grass pastures in Southern Alberta, Saskatchewan and Manitoba. Can. Dep. Agr. Pub. 738.

HEINRICHS, D. H., AND J. L. BOLTON. 1958. Rambler alfalfa. Can. Dep. Agr. Pub. 1030.

KILCHER, M. R. 1961. Row spacing affects yields of forage grasses. Can. Dep. Agr. Pub. 1100.

LAWRENCE, T., AND J. E. TROELSEN. 1964. An evaluation of 15 grass species as forage crops for Southwestern Saskatchewan. Can. J. Plant Sci. 44:301–310.

LODGE, R. W. 1970. Complementary grazing systems for the Northern Great Plains. J. Range Manage. 23:268–271.

NATIONAL RESEARCH COUNCIL. 1963. Nutrient requirements of beef cattle. Nat. Res. Council, Washington. 1137:1.

ROGLER, G. A., AND R. J. LORENZ. 1970. Beef production from Russian wildrye (*Elymus junceus* Fisch.) in the United States. Proc. XI Int. Grassland Congr. 835–838.

SMOLIAK, S. 1968. Grazing studies on native range, crested wheatgrass and Russian wildrye pastures. J. Range Manage. 21:47–50.

SNEDECOR, G. W., AND W. G. COCHRAN. 1967. Statistical methods, p. 273. 6th ed. Iowa State Univ. Press, Ames, Iowa.