TECHNICAL NOTES

Establishment of Russian Wildrye on Foothill Ranges in Utah

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Highlight: *Seedings of Russian wildrye were made in Tintic Valley, Utah, to determine the effects of seeding method, seeding rate, season of planting, and seed type on stand establishment. After 3 years, more plants were established by commercial seed than by seeds of the improved Vinall strain. Initially the 12-pound rate of seeding established more plants than either the 6 or 9 pound rate, and drilling established more plants than broadcast seeding. However, by the third year little difference among seeding methods was evident. Use of a heavy seeding rate of 24 lb/acre in an attempt to have viable seed in the soil for more than one growing season was a failure.*

Russian wildrye (*Elymus junceus*) is a long-lived perennial bunchgrass introduced into the United States from Siberia in 1927. It is now widely distributed throughout the northern Great Plains and Intermountain area of the United States (Rogler and Schaaf, 1963). Although Russian wildrye is apparently adapted to the Northern Great Plains (Rogler and Schaaf, 1963), and although it is recommended for seeding on foothill ranges (Plummer et al., 1955) it is often difficult to establish in the Intermountain area. In Utah, Cook (1966) observed that seedlings of Russian wildrye were weak and subject to high mortality on foothill ranges. Attempts to interseed Russian wildrye into deteriorated native shortgrass rangeland in Wyoming also demonstrated establishment problems (Rauzi et al., 1963, 1965).

Schaaf (1961) studied the effect of planting date on survival and seed production of Russian wildrye and found that spring plantings produced seed the next year. Fall plantings were found to produce seed only after the second growing season, but were preferable to spring plantings because of better establishment.

Because Russian wildrye has been recommended for seeding in Utah and because establishment has been difficult, this study was initiated to investigate some of the problems concerned with establishment and survival of Russian wildrye on foothill ranges in Utah.

Study Area

The Tintic Valley Cooperative Research Area is located 9 miles south of Eureka, Utah, at 6000 ft on gently rolling ground near the steeper slopes of the foothills. The soil and vegetation are typical of foothill sagebrush communities of the Intermountain area and are adequately described by Cook (1958).

Mean annual precipitation for the study area during the period 1946-1964 was 13.31 inches (Cook, 1958, 1966) with about 30% occurring as snow from December through February. The remainder comes in erratic rain showers during spring, summer, and fall. Forty percent of these showers occur during March, April, and May. Low, erratic summer precipitation coupled with a high evaporation rate reduces the effectiveness of the moisture received.

Table 1. Average number of Russian wildrye (Elju) plants per square foot and number or cover (%) of weeds at three dates in Russian wildrye seeding made in 1966 and 1967 on a foothill area at Eureka, Utah.

Treatment	1967		1968		1969	
	No. of Elju	No. of weeds	No. of Elju	Weed cover	No. of Elju	Weed cover
Commercial seed	1.7	1.5	1.4	32	0.8	28
Vinall seed	1.3	1.7	1.1	26	0.6	30
6 lb/acre	1.2	1.5	1.0	34	0.6	30
9 lb/acre	1.5	1.6	1.2	28	0.7	28
12 lb/acre	1.8	1.7	1.6	25	0.8	26
Drilled	1.7	1.6	1.4	31	0.7	27
Broadcast	1.4	1.6	1.1	28	0.7	30
Fall 1966	1.5	1.8	1.3	30	0.7	26
Spring 1967	1.5	1.4	1.2	29	0.7	30
Overall average	1.5	1.6	1.3	29	0.7	28

Table 2. Mean values of vigor data taken in 1958 for Russian wildrye seeding made in 1966 and 1967 on a foothill area at Eureka, Utah.

Treatment	Plant height (cm)	No. leaves per tiller	No. tillers per plant	Leaf length (cm)	Production (lb/acre)
Commercial seed	20.2	4.3	2.7	15.2	424
Vinall seed	20.7	4.1	2.3	15.7	314
6 lb/acre	20.1	4.0	2.5	15.0	322
9 lb/acre	20.2	4.2	2.6	15.4	388
12 lb/acre	20.9	4.3	2.4	16.1	415
Drilled	20.6	4.2	2.5	15.5	402
Broadcast	20.2	4.1	2.5	15.4	336
Fall 1966	20.9	4.2	2.8	15.9	418
Spring 1967	19.9	4.2	2.2	15.0	319

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Table 3. Mean values of vigor data taken in 1969 for Russian wildrye seeding made in 1966 and 1967 on a foothill area at Eureka, Utah.

Treatment	Plant height (cm)	Crown diameter long (cm)	Crown diameter short (cm)	Leaf length (cm)	No. of seedheads	Production (lb/acre)
Commercial seed	45.1	10.9	8.1	17.8	6.4	586
Vinall seed	47.3	9.7	7.4	19.0	6.9	533
6 lb/acre	48.0	10.0	7.8	18.8	7.1	556
9 lb/acre	46.3	10.6	8.0	18.5	7.1	551
12 lb/acre	44.4	10.2	7.6	18.0	5.9	572
Drilled	46.6	10.2	7.5	18.5	6.4	570
Broadcast	45.8	10.4	8.0	18.4	7.5	592
Fall 1966	47.1	10.9	8.2	18.8	7.5	592
Spring 1967	45.3	9.6	7.4	18.0	5.9	526

Throughout the study, precipitation was erratic as is typical of the area during the period of seed germination and early growth. During the study, precipitation totals were 11.66 inches in 1966, 15.88 inches in 1967, and 15.31 inches in 1968.

Methods

A factorial randomized block design experiment with three replications was set out to study effects of planting methods, rates of seeding, seasons of planting, and seed types on establishment of Russian wildrye. Seeds were drilled and broadcast with a grain drill equipped with semideep, single disc footpieces set for 12-inch row spacings. Planting depth varied from ¼ to 1 inch. Broadcasting was done by removing the spouts from disc footpieces and allowing seed to fall onto the bare ground. Six, nine, and twelve pounds of seed per acre were planted by both methods. Both commercial and Vinall, a strain with improved seed production (Rogler and Schaff, 1963), seed were planted at each rate and by each method during fall (October 20, 1966) and spring (April 16, 1967). Vinall seed was used in hope that an improved strain would produce more vigorous seedlings.

Data on seedling establishment and vigor were collected in 1967, 1968, and 1969. Vigor measurements included plant height, crown diameter, leaf length, number of seedheads per plant, and number of plants per plot. Percent weed cover was estimated in each frame in both 1968 and 1969.

During 1969, a second study was initiated at the Tintic Research Area in an attempt to determine a better method of establishing Russian wildrye. Fall 1968 and Spring 1969 plantings were made of the following treatments in a factorial randomized block design with three replications: (1) three rates of seeding–6, 12 and 24 lb/acre and (2) three rates of broadcast nitrogen fertilizer–15, 30 and 45 lb/acre. Since establishment was a problem, heavy rates of seeding were employed to perhaps have viable seed in the soil for more than one season. Nitrogen was applied to determine if, upon germination, seeding vigor and survival were improved with fertilizer.

Seedling establishment in the 1969 study was limited because of low soil moisture. No germination occurred in the spring in either the fall or spring seedings. Therefore, 15 seed samples were dug in each of the rate-of-seeding treatments to determine why germination was so low. One-foot sections of drill row were randomly located within the plot and were excavated to a depth of 1 inch and to 1 inch on either side of the drill row. Soil and seeds were taken to the lab, seed was separated from the soil by sieving, and Russian wildrye seed was removed and treated with a fungicide; seeds were then germinated in petri dishes in a growth chamber at 25°C in the dark.

Table 4. Number of viable Russian wildrye (Elju) seeds per foot of row and percent germination in samples excavated in the summer of 1969 from the Russian wildrye seeding made in the fall of 1968 and the spring of 1969 at Eureka, Utah.

Seeding rate	Viable seed/ft row Spring	Viable seed/ft row Fall	Germination[1] Spring	Germination[1] Fall
6 lb/acre	5.3	2.9	55.3	22.8
12 lb/acre	11.5	0.8	61.9	16.0
24 lb/acre	11.2	2.6	59.8	4.2

[1] Germination of stored seed from the same lot was 100% before planting and 100% at the time of testing of excavated samples.

Results

1966-1967 Tintic Valley Seeding

Seedling counts in both 1967 and 1968 showed that significantly more seedlings had become established from commercial seed than from Vinall seed (Table 1). Also, significantly more seedlings ($P < 0.05$) were established at the 9-lb/acre rate than at the 6-lb rate and significantly more were established at the 12-lb rate than at either the 6- or 9-lb rate. Drilling produced significantly more seedlings during the first two growing seasons, but these differences diminished by the third growing season. No differences in seedling establishment occurred between fall and spring planting. Density of plants decreased from 1.5 to 0.7/ft^2 from 1967 to 1969. In similar studies, Cook (1966) reported a reduction in seedling from 1.3 to 0.5/ft^2 after two growing seasons. For this area, 0.5 plants/ft^2 is considered adequate (Plummer et al., 1955).

In 1968, vigor measurements showed no significance between treatments in plant height, number of leaves per tiller, number of tillers per plant, or leaf length, but plants from commercial seed produced significantly more herbage than those from Vinall seed (Table 2). Production increased significantly with increased seeding rate and drilling produced significantly more herbage than broadcasting. Also fall planting produced significantly more herbage than spring planting.

Final vigor measurements made in 1969 indicated that differences in herbage production due to methods and rates of planting had been reduced (Table 3). However, fall planting and commercial seed still were producing significantly more herbage than spring planting or Vinall seed.

Weed competition apparently had little effect on establishment and production of Russian wildrye. There were significantly more weeds in the fall than in the spring planting, but there were no significant differences in numbers of Russian wildrye seedlings between spring and fall planting (Table 1). However, there was a trend toward less weed cover with increased rate of seeding.

1968-1969 Tintic Valley Seeding

Even though precipitation was above normal, a dry spring and sparce winter precipitation resulted in almost no emergence of Russian wildrye seedlings from fall 1968 and spring 1969 seedings, regardless of fertilizer treatment or rate of seeding. Moisture

in the upper one inch of soil was inadequate for germination and seedling growth during the spring.

Upon investigation it was found that the intensity of cheatgrass infestation perhaps may have influenced stand establishment not only by affecting soil moisture, but also through a fungus infestation. The 1966-1967 study area was freshly plowed and had no known history of cheatgrass infestation. The 1968-1969 study area was also freshly plowed, but had been moderately infested with cheatgrass. Seeds of Russian wildrye excavated from the 1968-1969 seeding had a moderate infestation of a fungus, *Podosporiella verticillata*, of which cheatgrass is an intermediate host (Krietlow and Bleak, 1964).

Germination tests conducted on seeds excavated in July, 1969, 2 months after spring 1969 planting and 7 months after fall 1968 planting, indicated 17.7% germination on fall palnted seeds and 59.0% germination on spring planted seeds. There was little difference in germination percentage between seeding rates (Table 4). Average number of viable seeds per foot of row was 9.3 from spring planting and 2.1 from fall planting. Part of the reduced seed viability may have been due to damage from fungus (*Podosporiella verticillata*) infection. This fungus infected 8.2% of the Russian wildrye seeds from the fall planting. Spring planted seeds were only 0.01% infected.

Conclusions

Both soil water deficiencies and fungus infestation could have caused lowered germination of fall-planted seed and failure of the 1968-1969 seeding. More study is needed into the effects of fungi on viability of seeds after planting.

Apparently, it is not necessary to plant high rates of seed for good stand establishment, as all three rates produced more than 0.5 plants per square foot after the third year.

Commercial sources of seed may be as effective as the improved Vinall variety for stand establishment where seed production is of no concern and the supply of Vinall seed is limited.

It is difficult to recommend for or against Russian wildrye as a species for seeding foothill ranges from these data. However, observations during the study did substantiate the longer growing period of Russian wildrye as compared to crested wheatgrass.

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