Interseeding Russian Wildrye into Native Shortgrass Rangeland

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AUGUST 1963
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Bermage production from shortgrass rangeland is relatively low, both because of the dominance and growth characteristics of warm-season species, and the limited rainfall.

Introduction of a cool-season species into native shortgrass rangeland not only increases herbage production but also lengthens the green-feed grazing season.

During the past several years, range interseeders have been developed to seed directly into native sod or into tilled strips on rangeland and abandoned fields. In areas of limited rainfall seeding into tilled strips appears more promising for plant establishment than seeding directly into native sod, since competition for moisture from existing vegetation is reduced. Desert wheatgrass (Agropyron desertorum) and Ladak alfalfa (Medicago sativa) have been successfully interseeded into native rangeland. Treated pastures have produced more lamb gain per head per acre than the nontreated native range.

To determine (1) the effect of competition removal and (2) the effect of phosphate fertilizer on Russian wildrye seeding establishment, a study was begun in the spring of 1960 at the Archer Substation, situated approximately 10 miles east of Cheyenne, Wyoming.

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1 Contribution from Northern Plains Branch, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, and the Wyoming Agricultural Experiment Station.
2 Soil Scientist, USDA; Head of Plant Science Division and Professor of Agricultural Engineering, University of Wyoming, Laramie, Wyoming, respectively.
GENERAL DESCRIPTION OF AREA

The major soil type on the experimental area is Altvan fine sandy loam. The slope on the experimental plots varies from nearly level to one percent.

Native vegetation is characteristic of the shortgrass plains. The principal warm-season species are blue grama (Bouteloua gracilis) and buffalograss (Buchloe dactyloides). Western wheatgrass (Agropyron smithii) is the principal cool-season grass. Other cool-season grasses and forbs characteristic of the area are present but constitute a minor part of the composition.

The average annual and seasonal (April 1 to September 30) precipitation for the past 49 years are 14.86 and 11.67 in. respectively.

EXPERIMENTAL PROCEDURE

The Wyoming range seeder was adapted to till strips 6, 12, 18, or 24 in. wide while leaving 24 in. of undisturbed soil between the strips (Fig. 1). Depth of tillage was between 4 and 5 in. In the center of each tilled row, 8 lbs. per acre of Russian wildrye was seeded to a depth of approximately one-half inch. Two of the four rows of each treatment (an inner and an outer row) received 60 lbs. per acre of treble superphosphate.

The mechanical treatments were applied between late April and late May, depending on climatic conditions. Four tilled rows were made by the Wyoming range seeder for each tillage width studied. The tilled strips were 50 ft. long and data were collected only from the two center rows. One of the two center rows was randomly selected to phosphate fertilizers.

A stand count to determine the number of seedlings established was made each year in mid-July. Leaf-height measurements of the seedlings were also taken to determine vigor.

RESULTS AND DISCUSSION

The first set of tillage and seeding treatments was applied on May 4, 1960 (Fig. 2). Good soil-moisture conditions were present at the time the tillage treatments were applied, but drought conditions prevailed for the remainder of the growing season. Only 6.96 in. of precipitation were recorded from April 1 to September 30. After the treatments had been applied it was found that there was a calibration error in the seeding rate. This rate was less than desired. The Russian wildrye seed used tested 89 percent germination based on pure live seed.

The stand counts made in July of 1960 and for the following two years (1961, 1962) are presented in Table I. There was no significant difference in the number of Russian wildrye seedlings
FIG. 1—Rear view of the Wyoming range seeder tilling native rangeland.

FIG. 2—Native shortgrass treated with Wyoming range seeder showing seedling establishment.
TABLE 1—Average Number of Russian Wildrye Seedlings per 20 ft. of Row for the Four Tillage Treatments, July 1960, 1961 and 1962, Archer.

<table>
<thead>
<tr>
<th>Year</th>
<th>Treatment</th>
<th>Tillage Width (inches)</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>Rows with seed only</td>
<td>6.3</td>
<td>14.3</td>
<td>20.3</td>
<td>11.7</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rows with seed and P₂O₅</td>
<td>5.3</td>
<td>13.7</td>
<td>21.0</td>
<td>9.0</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>Rows with seed only</td>
<td>6.0</td>
<td>11.3</td>
<td>52.0</td>
<td>43.7</td>
<td>28.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rows with seed and P₂O₅</td>
<td>19.7</td>
<td>40.3</td>
<td>49.7</td>
<td>44.0</td>
<td>38.4</td>
<td></td>
</tr>
<tr>
<td>1962</td>
<td>Rows with seed only</td>
<td>20.7</td>
<td>7.3</td>
<td>54.0</td>
<td>22.7</td>
<td>26.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rows with seed and P₂O₅ (Faulty seeder)</td>
<td>22.7</td>
<td>2.0</td>
<td>1.7</td>
<td>16.0</td>
<td>10.6</td>
<td></td>
</tr>
</tbody>
</table>

established in the rows with or without phosphate. The relatively low number of seedlings established resulted from the low seeding rate and from drought conditions. The best seedling establishment in 1960 was in the rows tilled in 18-in. widths followed by the 12-in. wide row. In order to utilize the full width of the 24-in. sweep, it had to be operated with less pitch than the 12 or 18-in. sweeps and because of this the soil was not thrown clear of the tilled row.

On April 26, 1961, another set of tillage treatments was applied. Favorable soil-moisture conditions prevailed at the time the tillage treatments were applied. A total of 14.80 in. of precipitation was recorded for the growing season. This is three inches above the long-time average seasonal precipitation at Archer. A hailstorm occurring in late May damaged the Russian wildrye seedlings, but many of the seedlings recovered in a few days.

The stand count in July showed that the rows receiving phosphate had more seedlings established than did the non-phosphated rows. This difference was not statistically significant. The 18-in. tillage width had more seedlings established than did the 6, 12, or 24-in. tillage widths.

The third set of tillage treatments was applied on May 26, 1962. This was later than desired. Tillage treatments were attempted on April 26, but the soil was too dry for the sweeps to enter the soil. The soil-moisture content at tillage time was high, and in many of the tilled strips the sweep did not throw sod clear of the tilled row, and it became re-established. The planter unit seeding into the tilled rows receiving phosphate was not operating properly; some of the rows received no seed and other rows less than the specified amount. When the seeder is working properly, 20 seeds per foot of row are metered out.
The stand count of established Russian wildrye seedlings was made in mid-July. The seedling establishment in the 12 and 18-inch tilled rows was very low, and may have resulted from the faulty planter unit. An increase in the number of seedlings established in the 6-in. tillage width compared with previous years was noted. Again the 18-in. tillage width had the greatest number of Russian wildrye seedlings established.

Leaf-height measurements were to evaluate vigor at the time the stand counts were made. No significant differences were obtained between tillage treatments or between the rows that received phosphate.

During the spring of 1962, the draft and energy requirements of the various methods of tillage were determined with strain-gage-draft transducers built into the hitch of the tractor-pulling unit. The energy requirements for the four tillage widths were 9.1, 10.4, 9.6 and 9.4 horsepower hours per acre for the 6, 12, 18, and 24-in. sweeps, respectively.

The three years of seedling-establishment data were analyzed by a split-plot analysis. It was realized that the first and third years' data were not entirely reliable, but use of all the data has given some clues.

The variables from the split-plot analysis that were significant at the 0.05 level were treated with Duncan's Multiple range test. The analysis showed that years, treatments, and phosphate times years were significant. The number of seedlings established in 1961 were significantly greater than the number established in 1960 and 1962. There was no significant difference in the number of seedlings established in 1960 as compared with 1962. The number of seedlings established in the 18-in. wide row was significantly greater than the number of seedlings established in either the 6 or 12-in. row, but there was no significant difference in the number of seedlings established in 18 and 24-in. rows. The number of seedlings established in the 6 and 12-in. rows was not significantly different from that in the 24-in. width.

The interaction of phosphate times years for seedling establishment showed that the rows receiving phosphate in 1961 had significantly more seedlings established than where no phosphate was applied. This was not true in 1960 or 1962.

The use of phosphate for seedling establishment was not clearly understood. It appears that under high-moisture conditions, phosphate addition may aid in seedling establishment. The phosphate level on the unfertilized plots was determined to be 47 lbs. of available P₂O₅ per acre, using the Olson sodium bicarbonate method. This amount is believed to be sufficient for good grass growth under dryland conditions.

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The tillage and seeding treatments were applied from late April to late May during the three-year period. The time of year is also a factor because, generally, the cool-season grass species should be seeded early in the spring or in late fall for best results.

The number of seedlings established by mid-July no doubt will be greater than those counted at a later date because of competition for soil moisture. In 1963 a stand count will be made on all treatments for the three-year period to determine survival and vigor of the Russian wildrye.

**SUMMARY**

A study to determine the feasibility of using the Wyoming range seeder to introduce Russian wildrye into native shortgrass rangeland was begun in the spring of 1960.

A set of four tillage treatments (6-, 12-, 18-, and 24-in. widths) was applied each year for 3 years. Each tillage treatment consisted of four rows 50 ft. long. Two of the four rows (an inner and an outer row) received treble superphosphate at a rate equivalent to 60 lbs. per acre. All rows received Russian wildrye at the rate of 8 lbs. per acre except for the first year, 1960.

The significant results obtained were:

1. There were significantly more seedlings of Russian wildrye established in the 18- and 24-in. tillage widths than either the 6- or 12-in. tillage width.
2. The effect of phosphate alone was significant only in 1961, which was a wet year.
3. The draft requirements for establishing the various tillage widths used were not significantly different.