Reseeding by Eight Alfalfa Populations in a Semiarid Pasture

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Abstract

Eight alfalfa populations were seeded in a dryland pasture in northern Utah. Densities of mature plants, seeds, seedlings, and 1-year-old plants were measured in each of 3 years. The populations did not differ for mature plant stands or seed production. There was a higher rate of seedling survival for populations that primarily originated from *Medicago sativa* rather than *M. falcata*. All populations had some one-year-old plants persisting to replace mature plants killed by disease or rodents.

Alfalfa (*Medicago sativa* and *M. falcata*) is a valued component of pastures in subhumid environments. Its contribution to livestock production in dryland pastures and modified rangelands of semiarid areas is less well documented, although Townsend et al. (1975) regarded alfalfa as one of the most promising forage legumes for dryland seedings in the Great Plains. Hervey (1960) reported that lamb gains increased after alfalfa and crested wheatgrass (*Agropyron desertorum*) were interseeded into native sod in Wyoming. The introduction of the dryland alfalfa cultivar ‘Nomad’ was one of the most successful techniques used to improve antelope (*Antilocapra americana*) ranges in southeastern Oregon (Yoakum 1979). After 36 separate aerial seedings on more than 26,000 ha, alfalfa constituted 10% of the vegetation present for 6 years or longer. Lee and Rothwell (1966) and Norman (1968) successfully used alfalfa pasture to supplement native pasture for sheep and cattle in Australia. Vallentine et al. (1963) recommended the use of alfalfa in sagebrush range sites in Utah where annual precipitation averaged 30 cm or more. The merit of using alfalfa for supplementing native pasture or for interseeding will depend on the longevity of plants and the ability of the species to reseed in a droughty environment while subjected to grazing.

Kilcher and Heinrichs (1965), Pearse (1965), and Rumbaugh and Pedersen (1979) presented evidence that alfalfa lived up to 23 years in environments that received 20 to 30 cm average annual precipitation. Gomm (1964) did find that ‘Ladak’ alfalfa and ‘Madrid’ sweetclover (*Melilotus officinalis*) established equally well in a dryland experiment where the seedbed was prepared with a moldboard plow.

Nichols and Johnson (1969) concluded that biennial sweetclover was well adapted as a legume for rangelands with heavy clay soils in western South Dakota where annual precipitation averaged 39 cm. Natural reseeding was successful every 2 years and sufficient hard seed remained in the soil to safeguard against elimination of the species in a season when drought killed the seedlings. They believed that periodic seedset would provide sweetclover stands whenever growing conditions were suitable. Similar data and observations with alfalfa have not been reported. A mature stand of alfalfa in northern Utah was available as a study site to provide such information.

Methods

Eight populations of alfalfa were seeded at the rate of 2.8 kg/ha on May 20, 1954, in a one-replicate planting with plots 12.2 m wide and 76.2 m long on the contour of a slightly sloping field. The site, located 2 km southeast of Snowville, Utah, previously had been used for dryland wheat (*Triticum aestivum*) production. Precipitation at Snowville averages 28 cm annually and the elevation is 1,420 m. Soils are of the Xerollic Haplargids-Xerollic Calcioptorthids Association. The eight alfalfa populations seeded were 1) *M. falcata* from Coal Springs, South Dakota, 2) ‘Grimm’, 3) ‘Ladak’, 4) ‘Nomad’ 5) ‘Ranger’, 6) ‘Rhizoma’, 7) ‘Sevelra’, and 8) ‘Utah Common’. After alfalfa establishment, the field was used as early spring pasture for cattle. The animals were removed before June each year.

Seed production and seedling stand counts were estimated in 3 years from ten randomly placed 30.5 × 61.0-cm (12 × 24-in) sampling frames in each population. The frames were repositioned on each date on which data were recorded. Sampling dates were July 5 and September 20, 1977; May 30 and September 25, 1978; and June 26 and September 17, 1979. The counts on the first sampling date of each year were considered to represent maximum seedling density in the spring of that year. Seed production was estimated from the number of plump seeds hand threshed from each sample in September. All counts were transformed to numbers/m² prior to statistical analysis. Every mature plant in the experiment was counted in 1977 as described by Rumbaugh and Pedersen (1979). Numbers were estimated in the spring of 1978 and

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1979 at the same time and in the same way that seedling counts were made. Plants with single stems and no visible evidence of massive crown development were considered to be 1-year-old plants and counted separate from the mature plant category in the spring of 1978 and the fall of 1978 and 1979.

Results and Discussion

Average densities of mature plants, seeds, and seedlings, and seedling survival are listed in Table 1. An average of 3.5 plants/m² was observed for 1977 through 1979. This supported the evidence of Kilcher and Heinrichs (1965), Pearse (1965), and Rumbaugh and Pedersen (1979) that alfalfa can be a long-lived and productive species in semiarid pastures. Differences in numbers of mature plants among the eight populations were not statistically significant (P > 0.05) despite the range from 2.3 for Rhizoma to 4.7 for Ladak. Number of seeds/m² also did not differ significantly among the alfalfas. For these reasons, seedling counts were not adjusted for unequal stands or amount of seed produced by the parental populations.

Table 1. Number (No./m²) of mature plants, seeds, and seedlings/m² and percent seedling survival in eight alfalfa populations. Data are means for the three years, 1977-1979, near Snowville, Utah.

<table>
<thead>
<tr>
<th>Population</th>
<th>Mature plants</th>
<th>Seeds</th>
<th>Spring</th>
<th>Fall</th>
<th>Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. falcata L.</td>
<td>3.6</td>
<td>206</td>
<td>8.0</td>
<td>0.3</td>
<td>4</td>
</tr>
<tr>
<td>Grimm</td>
<td>3.1</td>
<td>118</td>
<td>10.2</td>
<td>2.0</td>
<td>21</td>
</tr>
<tr>
<td>Ladak</td>
<td>4.7</td>
<td>152</td>
<td>14.0</td>
<td>0.4</td>
<td>6</td>
</tr>
<tr>
<td>Nomad</td>
<td>4.6</td>
<td>53</td>
<td>2.5</td>
<td>0.3</td>
<td>4</td>
</tr>
<tr>
<td>Ranger</td>
<td>2.7</td>
<td>102</td>
<td>8.7</td>
<td>0.6</td>
<td>7</td>
</tr>
<tr>
<td>Rhizoma</td>
<td>2.3</td>
<td>197</td>
<td>7.3</td>
<td>1.4</td>
<td>9</td>
</tr>
<tr>
<td>Severa</td>
<td>4.3</td>
<td>153</td>
<td>14.3</td>
<td>0.9</td>
<td>4</td>
</tr>
<tr>
<td>Utah Common</td>
<td>2.9</td>
<td>152</td>
<td>17.8</td>
<td>9.4</td>
<td>43</td>
</tr>
<tr>
<td>Mean</td>
<td>3.5</td>
<td>141</td>
<td>10.3</td>
<td>1.9</td>
<td>12</td>
</tr>
</tbody>
</table>

LSD (0.05) N.S. 1

1 N.S. = not significant at P = 0.05.

Plants of Utah Common were M. sativa in phenotype because they were erect, blue flowered, and bore legumes with two to four tight coils. This population had more seedlings in both the spring and fall of 1977 and 1978 and in the fall of 1979 than any other population. The plants of Grimm, Nomad, and Ranger also were typically of M. sativa phenotype although both Grimm and Ranger are known to have M. falcata in their parentage. The Ladak and Rhizoma cultivars displayed characteristics of both M. sativa and M. falcata. The M. falcata population contained more yellow and variegated flowering plants than any of the other cultivars. Cultivars bred for pasture and range use, such as Nomad, Rhizoma and Severa, varied in seedling emergence. Nomad was inferior to the other seven populations in this attribute, but Severa exceeded all others except Utah Common. Seedling survival from spring to fall averaged 12% for 3 years. Figure 1 shows a vigorous seedling in the Grimm plot typical of those observed in all 3 years. Plants and seedlings showed symptoms of drought stress each summer. April to September precipitation at Snowville was 19.5, 11.6, and 13.3 cm for 1977, 1978, and 1979, respectively. The number of days with temperatures above 32°C was 49, 34, and 30 for those time periods. The highest temperature of 39°C occurred on July 28, 1978.

The population-by-year interaction used as the error mean square in the analysis of variance was sufficiently large to preclude the detection of significant differences in number of mature plants among the populations. However, the survival of seedlings of Grimm and Utah Common was substantially higher than that of the other six alfalfas. Although Grimm originated as a hybrid between M. sativa and M. falcata, the plants at Snowville consist-

Fig. 1. A Grimm alfalfa seeding in the 1954 Snowville, Utah, planting. Photographed July 8, 1977.

Fig. 2. Average numbers of seedlings and young alfalfa plants per m² in 3 years.
1978, and again in September 1979. Mortality was moderately high. Figure 2 illustrates the changes in the numbers of seedlings and young plants observed in the two time sequences. Within each sequence, the count in the first year was of seedlings and the count in the second year was of young plants. The first sequence showed a decline in average density from 19.1 to 2.2 seedlings/m² from spring to fall 1977. However, 2.6 young plants/m² were counted in the spring of 1978 and 1.7/m² in the fall of that year. The density of young plants in 1979 for the second sequence was 1.5 per m² or about half that of seedlings in the fall of 1978. No attempt was made to distinguish 2-year-old plants from older ones. Alfalfa plants were noted for having deep and extensive root systems capable of extracting moisture from rather dry soils. I believe that any plant surviving two summer drought periods would continue to survive until it was killed by disease or rodents.

Conclusions

Alfalfa persisted and maintained satisfactory plant stands for 25 years in a semiarid environment. Apparently, plants may be heavily grazed in the spring and still produce sufficient seeds and seedlings to replace mature plants dying from disease, rodent damage, or environmental stress. The eight populations evaluated did not differ in stand density or in the amount of seed produced. There was some evidence that *M. sativa* populations had more seedlings and possibly higher seedling survival than did populations of *M. falcata* or their hybrids.

**Literature Cited**


