aspects of interplant competition in mixed-species swards, and especially to the importance of secondary growth to competitive ability under these conditions.

Literature Cited


Influence of Row Spacing on Crested Wheatgrass Seed Production

WILLIAM J. McGINNIES


Highlight

Crested wheatgrass was planted in rows spaced 6, 12, 18, and 24 inches apart. During 2 years of above-average precipitation, plants in all row spacings produced enough seed to justify harvesting, but during 2 years of average precipitation, only the plants in the 18- and 24-inch spacings produced sufficient seed. In a dry year, plants in none of the spacings produced enough seed to harvest. When a seeded field is to be used for forage in dry years and seed production in wet years, an 18-inch row spacing is suggested for northern Colorado.

Crested wheatgrass (Agropyron desertorum (Fisch. ex Link) Schult.) is frequently seeded for an early-season pasture on semiarid rangelands. Most range seedings are planted only for herbage production, but the possibility of harvesting seed from crested wheatgrass ranges should not be overlooked. Where a seeding is to be used primarily for seed production, wide row spacing (36 to 42 inches) is generally suggested (Rogler, 1960). Cultivation is usually necessary to keep the area between the rows clear of weeds and volunteer plants (Westover et al., 1932). Plants in wider row spacings produce less forage than 12- or 18-inch spacings (McGinnies, 1970). Cook et al. (1967) compared “thick” stands with “thin” stands and found that thick stands produced more seedheads per unit area, but that thin stands produced more spikelets per seedhead and more seeds per spikelet.

Because the row spacings usually suggested for forage production are too narrow for high seed yields and because the row spacings preferred for seed production are too wide for general grazing use, some compromise is needed. The following study evaluates narrow and intermediate width row spacings for seed production of crested wheatgrass.

Experimental Procedure

The study area was located immediately west of Fort Collins, Colorado. The soil is classified as Larian Loam. It contains numerous small patches of clay loam and sandy loam, and is of moderate to low fertility.

Average annual precipitation at Fort Collins is 14.7 inches, but yearly precipitation is variable in amount and distribution. During the period of this study (1960–1967), annual precipitation ranged from a high of 27.9 inches for 1961 down to 7.4 inches for 1966. Seasonal distribution is even more variable; but, on the average, half of the total annual precipitation comes during March through June.

The vegetation growing on the area before it was plowed for this seeding was dominated by blue grama (Bouteloua gracilis (HRK) Lag. ex Steud.), buffalograss (Buchloe dactyloides (Nutt.) Engelm.), sleepgrass (Stipa robusta (Vasey) Scribn.), and western wheatgrass (Agropyron smithii Rydb.).

The existing vegetation was plowed under in the fall. The following spring, the ground was smoothed and packed just before seeding. Planting dates were March 30, 1960; April 21, 1961; and April 10, 1962. Nordan crested wheatgrass was planted with a cone-type seeder at a depth of 3/4 inch and at a rate of 30 live seeds per ft of row in rows spaced 6, 12, 18, and 24 inches apart (equivalent to seeding rates of 15, 7½, 5, and 3 lb./acre, respectively). The plots were 25 ft long, 6 to 8 ft wide, and were adjacent to larger plots that were sampled for herbage yields (McGinnies, 1968, 1970). Three blocks were...
planted each year. Excellent stands were obtained from all plantings.

Each year, from 1962 to 1967, a 10-ft section of row which best represented the treatment in each plot was selected for harvest. Because of rabbit damage, no harvest was made in 1963. In the harvested section of row, all seedheads were clipped, placed in a paper bag, and allowed to dry. The seedheads were weighed and counted. The seedheads were then threshed and the weight of the cleaned seed determined. To determine weight per 100 seeds, 400 seeds were counted out and weighed.

A conventional analysis of variance was made of the data for each harvest year for each year of planting. Interpretation of the data was made on the basis of these analyses.

Results

Both row spacing and precipitation had a pronounced effect on seed yields; and furthermore, there was a strong interaction between row spacing and precipitation. The average precipitation at Fort Collins for the growing period (March through July) is 9.01 inches. For the years in which seed was harvested, the precipitation was:

- 1962 8.11 inches
- 1964 6.06 inches
- 1965 11.48 inches
- 1966 3.92 inches
- 1967 14.81 inches

Almost no seed was produced in the drouth year of 1966. Seed yields were as one can expect on this site at all row spacings in the above-average precipitation years of 1965 and 1967. In 1962 and 1964, years of average precipitation, seed yields from the 24-inch row spacings were much greater than from the 6-inch spacing (Table 1).

During dry periods in the growing season, moisture stress (indicated by incipient wilting and darkening of the leaves) was observed in the 6-inch and 12-inch spacings much before it was seen in the 18- and 24-inch spacings (McGinnies, 1970). The dry periods occurred during both average-precipitation years, and the moisture stress was doubtless partly responsible for the lower yields in the narrower spacings. No periods of stress were observed during the "wet" years, 1965 and 1967.

Seedhead weight and number of seedheads per ft² were the two most important components of seed yield. Seedhead weight (expressed as weight/100 seedheads) and number of seedheads/ft² of row increased with increasing row spacing in all years. However, the number of seedheads/ft² increased with row spacing only in years of average or low rainfall (the differences were not significant in 1964). In wet years, there was a consistent tendency for a higher number of seedheads in the narrower row spacings, but the relationship was statistically significant in only one-third of the sets of data.

The low seed yields in the narrower row spacings in average years result from a combination of fewer seedheads per ft² and smaller seedheads. In wet years, the greater number of seedheads in the narrower row spacings compensated for the larger seedhead size in the wider row spacings to such a degree that none of the differences in seed yield could be attributed to row spacing.

The correlation coefficients were .83 between seedhead weight and seed yield, and .90 between number of seedheads per ft² and seed yield. The coefficient of correlation between an index (computed by multiplying weight/100 seedheads × number of seedheads/ft²) and seed yield was .97.

Seed size (weight/100 seeds) generally increased slightly with increasing row width. However, the differences were statistically significant in only half of the sets of data.

<table>
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<tr>
<th>Year</th>
<th>1962</th>
<th>1964</th>
<th>1965</th>
<th>1966</th>
<th>1967</th>
<th>Mean</th>
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<td>36</td>
<td>198</td>
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<td>184</td>
<td>266</td>
<td>11</td>
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<td>Weight (g)/100 seedheads 6 inches</td>
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<td>5.3</td>
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<td>9.0</td>
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Discussion

This study does not lend itself to detailed economic analysis of crested wheatgrass seed production on rangeland, but some general conclusions can be made. Mr. L. W. Engstrom, Longmont Seed Company, (personal communication) estimated that for the period covered by this study, a field would have to produce at least 100 lbs. of clean seed per acre, in order to pay the cost of harvesting and to make a minimum return to the landowner. Following this rule-of-thumb, harvesting of seed would have been economically feasible for all row spacings in the years of above-average precipitation (1965 and 1967). In average years, only the 18- and 24-inch spacings produced enough seed to warrant harvesting.

If the field is to be used solely for seed production, the 24-inch spacing would be the best choice of those spacings tested. However, if the field is to be seeded for optional use for pasture or seed production, the 18-inch spacing should be a good choice. At Fort Collins, the 18-inch spacing produced good seed yields in years of average and above-average precipitation, and, at the same time, in the dry years, it produced slightly more herbage than the 24-inch spacing (McGinnies, 1970).

One problem of the 24-inch spacing is invasion by perennial weeds and volunteer crested wheatgrass plants between the seeded rows. Some weeds also became established in the 18-inch spaced rows, but the 12- and 6-inch spacings remained almost clear of weeds.

For optimum use of crested wheatgrass range, one or more seeded fields could be held for seed harvest in average or wet years, but these would be grazed in dry years. Under this management scheme, the precipitation would dictate the decision. In the dry years, seed production would be inadequate for profitable harvesting and, at the same time, there would probably be a shortage of feed. In wet years, it might be desirable to hold back even more acreage for seed production.

Obviously, an extensive system of fences would be a necessity for a combined forage and seed production system of management. At the same time, if a large seeded area is well-subdivided with fences, the seeding can be better managed. That part of the overall area that is grazed in a particular year can be fully utilized, because the size of the grazed area can be readily adjusted to the amount of forage produced. The remaining ungrazed area can then either be harvested for hay or be held until the seed matures and harvested for seed.

Literature Cited


