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Recommended Seeding Rates for Reduced-maintenance, Turf-type Wheatgrasses

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Abstract
Crested wheatgrass [Agropyron cristatum (L.) Gaertn.] has potential as a reduced-maintenance turfgrass, but seeding rates that assure rapid, uniform establishment are critical for success. 'Roadcrest,' CWG-R, and Chelkar breeding populations of crested wheatgrass, 'Sodar' streambank wheatgrass [Elymus lanceolatus (Scribn. & J.G. Sm.) Gould], and 'Gazelle' tall fescue (Festuca arundinacea Schreb.) were seeded at 0.5, 2.0, and 6.0 lb/1000 ft$^2$ in 1999. Plots were irrigated 50 to 60% ET$_o$ replacement, with 2 lb of N per 1000 ft$^2$ per year, and mowed at 3 inches. Higher seeding rates consistently had higher percent cover ratings than did lower seeding rates in 1999. By July of 2000 no differences existed between the 2.0 and 6.0 lb/1000 ft$^2$ seeding rates for turf quality, and percent cover, but both had higher ratings than the 0.5 lb/1000 ft$^2$ rates. Sodar, Chelkar, and tall fescue established faster, retained a denser stand, and better turf quality than Roadcrest and CWG-R. A seeding rate of 6.0 lb/1000 ft$^2$ is recommended for fastest establishment of wheatgrass cultivars in a low maintenance turf. A 2.0 lb/1000 ft$^2$ seeding rate could be used, but would likely need somewhat more maintenance and time to achieve a comparable stand.

Introduction
Low maintenance turfgrass species could replace a significant amount of high maintenance turfgrass to reduce inputs of water, fertilizer, pesticides, and mowing, but maintain aesthetic and functional requirements and expectations (8,12,15,17). Acceptable turf quality is defined as meeting the expectations for the use and appearance of a particular area, but includes traits such as green color, fine leaf texture, high tiller density, and overall aesthetic appeal. Many native and adapted species are being evaluated to meet these needs, but often these species do not tolerate the very low summer rainfall environment of the Intermountain West. These turf areas can reduce labor costs, conserve management resources, and potentially reduce pollutants, but appropriate management for those grasses is needed in many turfgrass sites. Reduced-maintenance areas include highway medians, cemeteries, low-use sections of parks and schools, some home lawns, and golf course roughs. Crested wheatgrass [Agropyron cristatum (L.) Gaertn.] is a species being evaluated for these types of situations.

Crested wheatgrass is well adapted to the cool or cold, semiarid climate of the Northern Great Plains and the Intermountain West. It withstands weed competition, tolerates insect depredation, produces long-lived stands (> 20 years), is easily established, and is adapted to a wide variety of soils (2,3). Early turf-type cultivars of crested wheatgrass include Fairway, Ruff, and Ephraim. Roadcrest is a recent cultivar release with some adaptation to turfgrass situations (3). All of these cultivars are currently recommended for use on roadsides and other very low-maintenance areas where soil stabilization is important and appearance is of less importance (3). Other wheatgrasses being evaluated for turf are CWG-R, Chelkar, and Sodar. CWG-R is a rhizomatous crested wheatgrass from Iran, which has exhibited many turfgrass
characteristics that can be improved (10); Chelkar is a non-rhizomatous, fine-leaved crested wheatgrass from Kazakhstan, and ‘Sodar’ streambank wheatgrass [Elymus lanceolatus (Scribn. & J.G. Sm.) Gould] is a native species that has been used for naturalized grass stands, reclamation, and low-maintenance turf (4).

Collecting and developing the germplasm for these reduced-maintenance cultivars is only part of the process. Management of the grasses, such as irrigation, fertilization, mowing, and herbicide use are just as important to the success of a reduced-maintenance turf (7). Establishment is also greatly affected by seeding rates and an optimum seeding rate can be defined as one that assures rapid, uniform turfgrass establishment (11). Insufficient seeding rates take longer to form acceptable, dense, uniform stands (5) and a longer establishment period increases the probability of competition from weeds and wind and water erosion (7). A thin stand is also subjected to more extreme temperatures due to the exposure of the soil surface, causing high drying rates (5). However, excessive seeding rates can result in intense seedling competition, resulting in a weak, disease-susceptible stand (5), in addition to higher costs for excess seed.

To determine an optimal seeding rate of a given species, its intended use, management, and expectations must be considered. A seeding rate of 1.0 lb/1000 ft² was recommended for crested wheatgrass in no-maintenance situations, such as roadside and slope stabilization on non-irrigated land in Idaho, eastern Washington, and eastern Oregon (9). Other recommendations for seeding rates of crested wheatgrass have been in the range of 0.11 to 0.25 lb/1000 ft² (14). This is very low in comparison to rates of 3.0 to 9.0 lb/1000 ft² typically recommended for turfgrass species with a similar seed size (5). No studies have been conducted for wheatgrass seeding rate recommendations where aesthetics was a high priority. Therefore, our objective was to determine the most appropriate seeding rates of wheatgrass when used for reduced-maintenance turf in the Intermountain West region, with turf quality as a major consideration.

**Experimental Design**

The five entries evaluated were ‘Sodar’ streambank wheatgrass, ‘Roadcrest’ crested wheatgrass, and two crested wheatgrass breeding populations: CWG-R and Chelkar. We also included ‘Gazelle’ tall fescue as a check or a typical species used in low maintenance turfgrass applications. These entries were each evaluated at seeding rates of approximately 0.5, 2.0, and 6.0 lb/1000 ft² in 5- × 5-ft plots. There were three replications of each treatment in a randomized complete block design at each of two locations (Greenville Research and Evans Experimental Farms). Evans Experimental Farm, located approximately 2 miles south of Logan, UT, at 4500 ft in elevation with a Nibley silt clay loam soil (fine, mixed, mesic Argivstoll). The Greenville Research Farm is located in North Logan at 4500 ft in elevation with a Millville silt loam soil (coarse-silty mesic Typic Haploxeroll). The plots were seeded on 11 June 1999 and irrigated at 100% ET₀ for the first month, and then 80% ET₀ for the remainder of the 1999 growing season. ET₀ is a reference evapotranspiration calculated by the Penman-Monteith equation using measurements over grass (1). Plots were mowed at a height of 3 inches, removing approximately one third of the growth at each mowing and leaving the clippings on site. This translated to a mowing frequency of approximately every 5 to 10 days, depending on growth rate. Urea was applied in September 1999, June 2000, and September 2000 at the rate of 1.0 lb/1000 ft² at each application.

Irrigation during the 2000 growing season at the Evans location was approximately 50% of ET₀ replacement, while the Greenville location received approximately 60% ET₀ replacement. ET₀ data was compiled from a local weather station (at Greenville Research Farm) and was used to determine weekly irrigation needs. The plots at Greenville had an automatic irrigation system while the Evans plots were irrigated by a manual system. Both systems were equally uniform and accurate in output. An herbicide mixture of 2,4-D (2,4-dichlorophenoxyacetic acid), MCPP [(+)-R-2-(2-methyl-4-chlorophenoxy)
propionic acid], and dicamba (3,6-dicloro-o-anisic acid) (2,4-D [(2,4-dichlorophenoxy) acetic acid] + dicamba [(3,6-dichloro-2-methoxy) benzoic acid]+ mecoprop [(±)-2-(4-chloro-2-methylphenoxy) propanoic acid]), and 2,4-D [(2,4-dichlorophenoxy) acetic acid] was used sparingly to control broadleaf weeds, and only as needed. No other pesticides were used.

**Traits Evaluated**

Evaluations for percent cover, turf quality, and color were taken monthly from June 1999 to October 2000. Turfgrass quality is a composite visual rating of characteristics including color, texture, density, growth habit, and overall turf appeal. Turf quality was visually rated with a scale from 1 to 9, with a score of 9 representing an ideal turfgrass, a score of 5 indicating the minimal acceptable rating, and a score of 1 indicating a very poor turf quality, caused by dormancy, low tiller density, or mortality (13,16). Color was also visually rated on a scale from 1 to 9, with a score of 9 being the darkest green cultivar, and a score of 1 being brown. Percent cover was a visual rating that estimated the percentage of plot coverage attributed to the turfgrass.

**Statistical Analysis**

The experiment was analyzed using the repeated measures analysis of PROC MIXED (SAS Institute Inc., Cary, NC). Entry, seeding rate, and observation date were fixed variables. Replication and location were random variables. The analysis was repeated on observation date. Means were compared using Fisher’s protected Least Significant Difference (LSD) at the 0.05 level of probability.

**Influence of Seeding Rates on Turf Cover and Quality**

Overall, seeding rates, entries, and observation dates had effects on cover and turf quality (Table 1), but interactions occurred for date × entry and date × seeding rate. In 1999, the seeding rates differed for percent cover on nearly all observation dates, but in 2000, turfgrass cover of the two higher seeding rates (2.0 and 6.0 lb/1000 ft²) converged beginning in July (Fig. 1). The 0.5 lb seeding rate produced a lower cover than the other seeding rates throughout the experiment. Turfgrass quality showed a similar pattern among seeding rate during 2000 (Fig. 2). Cultivars and seeding rates with thinner stands may have been subjected to more extreme temperatures as a result of soil exposure and weed competition which affected all evaluation ratings.

Table 1. Analysis of entries, seeding rates, and observation date fixed effects for turfgrass cover and turfgrass quality.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Turfgrass Quality</th>
<th>Turfgrass Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Num. df</td>
<td>Den. df</td>
</tr>
<tr>
<td>Entry</td>
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<td>74</td>
</tr>
<tr>
<td>Seeding Rate (SR)</td>
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<td>74</td>
</tr>
<tr>
<td>SR*Entry</td>
<td>8</td>
<td>74</td>
</tr>
<tr>
<td>Date</td>
<td>6</td>
<td>450</td>
</tr>
<tr>
<td>Date*Entry</td>
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<td>450</td>
</tr>
<tr>
<td>Date*SR</td>
<td>12</td>
<td>450</td>
</tr>
<tr>
<td>Date<em>SR</em>Entry</td>
<td>48</td>
<td>450</td>
</tr>
</tbody>
</table>

Abbreviations: Num. = numerator; Den. = denominator.
Influence of Entries on Turf Cover and Quality

We also observed differences among the entries for turf cover and quality. Chelkar established faster than the other entries in 1999, but in 2000, Chelkar was similar to Sodar and tall fescue in cover ratings (Fig. 3). Cover of CWG-R and Roadcrest decreased during the summer of 2000 (Fig. 3), which was reflected in lower quality ratings (Fig. 4). However, cover of CWG-R and RoadCrest again nearly equaled the quality of Chelkar, Sodar, and tall fescue by September 2000 (Fig. 3). Thinning during June, July, and August 2000 was due to the strong summer dormancy responses of the entries. Chelkar and tall fescue decreased slightly in cover and quality during summer 2000, while Sodar increased in cover and maintained quality throughout this summer stress period. Sodar however, had a whitish appearance during summer, caused by leaf tip shredding after mowing which tended to decrease its overall quality. Quality
of tall fescue was consistently highest throughout 2000, except for the later summer period, while CWG-R and Roadcrest generally exhibited the poorest quality (Fig. 4). As a result, tall fescue would be favored in areas with sufficient irrigation, but Sodar, CWG-R, and Roadcrest are best choices in areas with less than adequate or no irrigation because of their ability to survive without supplemental irrigation in the Intermountain West.

The seeding rate responses described were similar to those of Kentucky bluegrass (*Poa pratensis* L.), where turf quality and percent cover of various seeding rates also converged over time (6,11). Lower seeding rates may be acceptable if an extended amount of time is allowed for an acceptable turf, and
weed pressure and soil erosion are manageable (5). However, the extra maintenance and time required to achieve an acceptable stand with a lower seeding rate is often undesirable in turf situations.

Growth habit did not seem to impact the seeding rate responses in our study. Roadcrest, CWG-R, and Sodar are rhizomatous, and Chelkar and tall fescue are bunch-types, however, the cultivars responded similar to seeding rates as indicated by marginal or non-significant entry × seeding rate interactions (Table 1).

Conclusion

In conclusion, a 6.0 lb/1000 ft² seeding rate is recommended for quickest establishment of wheatgrass cultivars, under a reduced-maintenance regimen. The 2.0 lb/1000 ft² seeding rate is recommended if a quick establishment rate is not needed and cost of seed is an issue. Seeding rates of 0.5 lb/1000, which are commonly used for rangeland or pasture situations, are not acceptable for low maintenance landscapes.

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Literature Cited