Propagation & Introduction

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Presence of Soil Surface Depressions Increases Water Uptake by Native Grass Seeds

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Seeded characteristics often affect seedling emergence and
establishment (Chambers 2000). A crack or depression on the
soil surface may be a more hospitable environment for germination and emergence than a smooth soil surface because the depression captures moisture and organic matter (Evans and Young 1987, Smith and Capelle 1992).

During restoration, tools or implements such as lawn
sprayers are often used to improve soil-moisture retention and
firm the seedbed, thereby providing a more hospitable
environment for germination and seedling establishment
(Dixon 1988). Seedbed preparation is often the primary
concern for wildland restoration because it is the most
labor-intensive and environmentally disruptive, outcomes
large amounts of energy, and often determines success or
failure of a restoration effort (Whisenant 1999). Here, we
discuss the effects of soil surface-depressions on water
uptake by seeds of four native bunchgrasses commonly
used in restoration in the interior mountains region of the
western United States.

We conducted a greenhouse chamber study (constant tem-
perature of 15°C) to quantify water uptake by seeds of blue-
bunch wheatgrass (Pseudoroegneria spicata), Idaho fescue
( Festuca idahoensis), Sandberg bluegrass ( Poa secunda),
and squarreltail ( Bahiella emersdenii) subjected to four sizes
of soil surface depressions (4 mm x 4 mm, 6 x 12, 8 x 16,
and control (no depressions)). We collected field soil in 96
plastic trays, each assigned to a single depression size and
species, such that each treatment combination included
six replicates. Each tray contained forty 20-mm deep
depressions, and each received a single seed after the soil
was sufficiently watered. At 12, 24, 36, and 72 hours, we
randomly removed 10 seeds from each tray, blotted them
to remove soil particles and surface water, and weighed the
seeds to the nearest 0.1 mg. The water content of the seeds
was expressed as a percent dry weight basis (%DW) by
subtracting seed weight at sampling time from average dry
weight, soil dividing by average dry weight. We used an
ANOVA to test for treatments effects (depression size and
species) and interactions on cumulative water uptake at
each sampling time.

Depression size and species significantly influenced water
uptake both cumulatively and at 24, 36, and 72 hour
intervals (Table 1). Cumulative uptake averaged 231% ±
11% DW across all groups compared to the control uptake of
136% ± 10%. Cumulative uptake by Idaho fescue,

<table>
<thead>
<tr>
<th>Depression size</th>
<th>Control (means)</th>
<th>Large (8-mm x 10-mm)</th>
<th>Medium (6 x 12)</th>
<th>Small (4 x 8)</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (mean)</td>
<td>24.5 ± 0.5</td>
<td>25.0 ± 0.5</td>
<td>25.5 ± 0.5</td>
<td>26.0 ± 0.5</td>
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<tr>
<td>Large (8-mm x 10-mm)</td>
<td>25.5 ± 0.5</td>
<td>26.0 ± 0.5</td>
<td>26.5 ± 0.5</td>
<td>27.0 ± 0.5</td>
<td>27.5 ± 0.5</td>
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<tr>
<td>Medium (6 x 12)</td>
<td>26.5 ± 0.5</td>
<td>27.0 ± 0.5</td>
<td>27.5 ± 0.5</td>
<td>28.0 ± 0.5</td>
<td>28.5 ± 0.5</td>
</tr>
<tr>
<td>Small (4 x 8)</td>
<td>27.0 ± 0.5</td>
<td>28.0 ± 0.5</td>
<td>28.5 ± 0.5</td>
<td>29.0 ± 0.5</td>
<td>29.5 ± 0.5</td>
</tr>
<tr>
<td>Species</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Bluebunch wheatgrass</td>
<td>25.5 ± 0.5</td>
<td>26.0 ± 0.5</td>
<td>26.5 ± 0.5</td>
<td>27.0 ± 0.5</td>
<td>27.5 ± 0.5</td>
</tr>
<tr>
<td>Idaho fescue</td>
<td>26.5 ± 0.5</td>
<td>27.0 ± 0.5</td>
<td>27.5 ± 0.5</td>
<td>28.0 ± 0.5</td>
<td>28.5 ± 0.5</td>
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<tr>
<td>Sandberg bluegrass</td>
<td>27.0 ± 0.5</td>
<td>28.0 ± 0.5</td>
<td>28.5 ± 0.5</td>
<td>29.0 ± 0.5</td>
<td>29.5 ± 0.5</td>
</tr>
<tr>
<td>Squarreltail</td>
<td>27.5 ± 0.5</td>
<td>28.5 ± 0.5</td>
<td>29.0 ± 0.5</td>
<td>29.5 ± 0.5</td>
<td>30.0 ± 0.5</td>
</tr>
</tbody>
</table>

blubunch wheatgrass, and Sandberg bluegrass was similar at
200% ± 16% DW, 223% ± 14% DW, and 232% ±
10% DW, respectively. Squarreltail cumulative uptake was
lower than the other three species at 169% ± 10% DW. An
interaction between depression size and species influenced
uptake at 12 hours (p = 0.0050) Idaho fescue seeds in
large and small depressions, and bluebunch wheatgrass in
the medium depression experienced significantly higher
take than the control (Figure 1).

Water uptake by seeds was generally greater where soil
surface depressions were present compared to a smooth soil
surface, but the size of the depression did not matter. The
majority of studies evaluating soil surface characteristics
indicate any level of heterogeneity improves water uptake by
seeds and subsequent seedling emergence compared to a
smooth soil surface (Oomes and Jaffe 1976, Evans and

Table 1. Least square mean water uptake by seeds (% dry weight) as affected by depression size (ANOVA, DB-1, p ≤ 0.0001) and species (df = 3, p ≤ 0.00001 to
0.0001) at each sampling period. Letters indicate
cumulatively significant (α = 0.05) differences across
depression size and species.

depression size and species.
Conclude that direct seeding can establish a wide range of native plants. However, using newly harvested seed from wild populations will result in a range of emergence times. Cool-season grasses showed little seed dormancy, while legumes were slow to germinate. While seed sizes of species with a range of emergence times can simulate successional processes and eliminate the need for subsequent plantings, they also increase the risk of weeds becoming densely established in the seeded bare areas of the prepared seeded, especially at low seeding rates. Of the 33 species that established and reproduced in field trials, 30 expanded beyond the study area, and 12 of these had effective dispersal mechanisms for long-distance colonization. The authors propose direct seeding as a cost-effective means to restore native vegetation at larger scales and recommend developing regional seed production systems to increase seed production and storage. This would provide a greater supply of materials in advance of restoration needs and increase the likelihood of success.


Using expertise gained from her work at the Wehr Nature Center in Milwaukee, Nowak provides advice on salvaging plants from construction sites, including creating a notification network to find sites and obtain permission, planting and operating salvage activities, transplanting procedures, and caring for plants and people involved in the process. Nowak notes that plant rescue opportunities are less common as undeveloped parcels become increasingly rare and that new construction occurs on already developed sites. She also notes that individual species differ in their needs, and that public education is necessary to help people understand that native landscaping is not just fine because "those plants should be there anyway".

Control of Pest Species

Adding Nitrogen Controls Yellow Sweetclover in Common Garden Study (Minnesota)

James O. Fickberg (Biology Dept. Gustavus Adolphus College, 800 University Ave, St. Peter, MN 56082) and Ida Helmersson (Email: ehs@cc Gustavus.edu). J. Entomol. Entomol. 82(2):114-122, 132-133.

After conducting laboratory and field experiments with newly harvested seeds of 64 native Australian grassland species, the authors conclude that direct seeding can establish a wide range of native plants. However, using newly harvested seed from wild populations will result in a range of emergence times. Cool-season grasses showed little seed dormancy, while legumes were slow to germinate. While seed sizes of species with a range of emergence times can simulate successional processes and eliminate the need for subsequent plantings, they also increase the risk of weeds becoming densely established in the seeded bare areas of the prepared seeded, especially at low seeding rates. Of the 33 species that established and reproduced in field trials, 30 expanded beyond the study area, and 12 of these had effective dispersal mechanisms for long-distance colonization. The authors propose direct seeding as a cost-effective means to restore native vegetation at larger scales and recommend developing regional seed production systems to increase seed production and storage. This would provide a greater supply of materials in advance of restoration needs and increase the likelihood of success.

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