#585

# Propagation & Introduction

## 202

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

*Jane M. Mangold (USDA-Agricultural Research Service, 67826-A Hwy 205, Burns, OR 97720, 541/573-4073, jane.mangold@oregonstate.edu), Jeremy J. James (USDA-Agricultural Research Service) and Roger L. Sheley (USDA-Agricultural Research Service)*

Seedbed 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 land imprinters 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 wild land restoration because it is the most labor intensive and environmentally disruptive, consumes 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 intermountain region of the western United States.

We conducted a growth chamber study (constant temperature of 15°C) to quantify water uptake by seeds of bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*), and squirreltail (*Elymus elymoides*) subjected to four sizes of soil surface depressions (4 mm × 8 mm, 6 × 12, 8 × 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 them to the nearest 0.1 mg. The water content of the seeds was expressed on a percent dry weight basis (%DW) by subtracting seed weight at sampling time from average dry weight and dividing by average dry weight. We used an ANOVA to test for treatment effects (depression size and species) and interactions on cumulative water uptake and water uptake at each sampling time.

**Table 1. Least-square mean water uptake by seeds (% dry weight) as affected by depression size (ANOVA, df = 3, $p \le 0.0001$) and species (df = 3, $p \le 0.0001$ to 0.0181) at each sampling period. Letters indicate statistically significant ($\alpha = 0.05$) differences across depression size and species.**

| | 24 h | 36 h | 72 h | Cumulative |
|---|---|---|---|---|
| **Depression size** | | | | |
| Control (none) | 36 a | 32 a | 35 a | 136 a |
| Large (8-mm × 16-mm) | 60 b | 62 b | 57 b | 223 b |
| Medium (6 × 12) | 54 b | 62 b | 65 b | 227 b |
| Small (4 × 8) | 59 b | 66 b | 67 b | 243 b |
| **Species** | | | | |
| Bluebunch wheatgrass | 55 b | 61 b | 63 b | 223 b |
| Idaho fescue | 52 b | 55 ab | 57 ab | 206 b |
| Sandberg's bluegrass | 59 b | 60 b | 56 ab | 232 b |
| Squirreltail | 42 a | 46 a | 48 a | 169 a |

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, bluebunch wheatgrass, and Sandberg bluegrass was similar at 206% ± 16% DW, 223% ± 14% DW, and 232% ± 10% DW, respectively. Squirreltail 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 depressions experienced significantly higher uptake 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 Elberse 1976, Evans and Young 1987, Winkel et al. 1991, Smith and Capelle 1992). However, many of these studies also found a difference in emergence or water uptake by seeds when compared across a gradient of soil surface topography.

Restoration practitioners often spend a majority of their resources attempting to create safe sites for seeded species (Whisenant 1999). Our study suggests that while seedbed preparation is important, the details of the process may not be critical. Providing soil surface depressions may improve water uptake by the seed, presumably through retention of available water (Smith and Capelle 1992), but the size of those depressions may be less important. Using a diverse seed mix in restoration projects is often recommended (Monsen et al. 2004). Because our test species generally did not differ in their responses to depression size, we believe using a diverse seed mix may not mandate additional complications for seedbed preparation. The presence of a seedbed that offers variable microtopography should suffice.

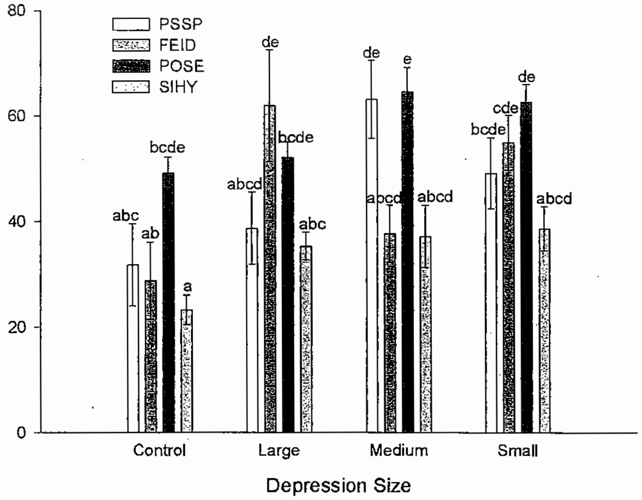

**Figure 1. Mean imbibition (± SE) at 12 hours as affected by depression size x species interaction. Tukey's critical value is used to separate statistically different means (α = 0.05).**

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## 203

**Restoring the Victorian Western (Basalt) Plains Grassland. 1. Laboratory Trials of Viability and Germination, and the Implications for Direct Seeding** and **2. Field Emergence, Establishment and Recruitment Following Direct Seeding.** 2007. Gibson-Roy, P. (Grassy Groundcover Research Project, 500 Yarra Blvd, Richmond, Victoria 3121, Australia, +03 92506946, roypg@unimelb.edu.au), J. Delpratt and G. Moore. **Ecological Management & Restoration** 8(2):114–122, 123–132.

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 mixes 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 resulting bare areas of the prepared seedbed, especially at low seeding rates. Of the 32 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 a regional seed production system 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.

## 204

**To the Rescue: Tips for a Successful Plant Dig.** 2007. Nowak, M. **The Blazing Star** 8(2):5.

Using experience 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, planning 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 new construction occurs on already developed sites. She also explains that native species can be difficult to propagate, and that public education is necessary to help people understand that native landscaping is not free just because "those plants should be there anyway."

# Control of Pest Species

## 205

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

*James O. Eckberg (Biology Dept, Gustavus Adolphus College, 800 W College Ave, St Peter, MN 56082, jeckberg@unlserve.unl.edu), Elizabeth A. Bockman and Pamela M. Kittelson*

Yellow sweetclover (*Melilotus officinalis*) is a widespread exotic legume in the tallgrass prairie of the northern Great Plains. Sweetclover can fix large quantities of nitrogen (40–84 kg N/ha/yr), of which about 12 kg N/ha/yr is released into the soil as inorganic nitrogen (Lesica and DeLuca 2000). By contrast, symbiotic nitrogen fixation in undisturbed tallgrass prairies contributes only about 0.3 kg N/ha/yr (Woodmansee 1978). Nitrogen enrichment has the potential to reduce native prairie plant diversity (Lesica and DeLuca 2000). Mowing, annual burning, and herbicide application to reduce yellow sweetclover are costly and can have non-target effects (for example, Tyser et al. 1998). Nitrogen application may provide an alternative management technique, since it can reduce productivity of some legumes and favor competitive dominance of non-nitrogen-fixing species (Chapman et al. 1996, Hebeisen et