

## EMERGENCE OF NATIVE PLANT SEEDS IN RESPONSE TO SEED PELLETING, PLANTING DEPTH, SCARIFICATION, AND SOIL ANTI-CRUSTING TREATMENT, 2009

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### Introduction

Seed of native plants is needed to restore rangelands of the Intermountain West. Reliable commercial seed production is desirable to provide the quantity of seed needed for restoration efforts. Establishment of native seed crops has been difficult, because fall-planted seed is susceptible to bird damage, soil crusting, and soil erosion. Fall planting is important for many species, because seed of many species requires a period of cold to break dormancy (vernalization). Planting of native seed has resulted in poor stands in some years at the Malheur Experiment Station. This trial tested seed pelleting, planting depth, and soil conditioner treatment for emergence of five important species that are native to Malheur County and surrounding areas.

### Materials and Methods

Seed of the five native species was either pelleted or used raw. Pelleting was done by Seed Dynamics Inc. (Salinas, CA). The pelleted and raw seed of each species (including the scarified and non-scarified *Lupinus argenteus*) was planted in single rows on 30-inch beds in a field of Owyhee silt loam on November 19, 2008. Each plot consisted of 1 row 5 ft long with 100 counted seeds planted in each plot. The pelleted and raw seed was planted at 3 depths: on the soil surface, 1/8-inch depth, and 1/4-inch depth. The pelleted and raw seed planted at each depth was further submitted to 3 soil anti-crusting treatments: untreated check, WaterMaxx II™ (Aquatrols, Inc., Salt Lake City, UT) at 2 quarts per acre, and Soil Binder™ (Simplot Soil Builders, Boise, ID) at 2 qt/acre. The anti-crusting treatments were applied to the soil surface after planting using a backpack sprayer with 8004 nozzles at 30 PSI and applying 30 gal of water/acre in a band 4 inches wide directly over the seed. One half of the *Lupinus argenteus* seed was scarified by immersion in concentrated sulfuric acid for 6 min and the other half was left without scarification, then both lots were subjected to all of the pelleting, planting depth, and anti-crusting treatments. Emerged seeds in each plot were counted four times: March 31, April 7, May 1, and May 10, 2009.

## Results and Discussion

Seed emergence was poor. The fall planting suffered from heavy soil crusting. Rapid drying of the soil surface or bird damage might also have reduced emergence and could be a factor in the poor emergence of seed planted on the soil surface. *Penstemon deustus* (hotrock or scabland penstemon) did not emerge so it was not considered in the statistical analyses.

### **Seed pelleting**

Seed pelleting did not result in a statistically significant improvement in the emergence of any of the species planted, but did decrease *Lupinus argenteus* (silvery lupine) establishment (Table 1).

### **Planting depth**

Planting the seed on the soil surface was detrimental to establishment (Tables 1 and 2).

### ***Lupinus argenteus***

Seed scarification resulted in decreased emergence compared to the non-scarified seed (Table 1). For the non-scarified seed, the highest emergence was obtained with the non-pelleted seed planted at either the 1/8-inch depth and treated with Soil Binder, or planted at the 1/4-inch depth with no soil treatment. Seed pelleting reduced emergence.

### ***Achnatherum thurberianum* (Thurber's needlegrass)**

The highest emergence was obtained with the combination of seed planted at 1/4-inch depth and the soil treated with Soil Binder (Fig. 1, Table 2). Seed pelleting did not affect emergence.

### ***Penstemon acuminatus* (sharpleaf or sandhill Penstemon)**

The 1/8-inch or the 1/4-inch planting depths with or without soil treatment were among the treatments with the highest emergence (Table 2). Seed pelleting did not affect emergence.

### ***Sphaeralcea grossulariifolia* (gooseberryleaf globemallow)**

Emergence was poor and there were no statistically significant differences between treatments.

Table 1. Seed emergence of *Lupinus argenteus* (silvery lupine) by May 10, 2009 in response to seed scarification, seed pelleting, planting depth, and soil treatment. Malheur Experiment Station, Ontario, OR.

| Seed<br>pelleting                         | Planting<br>depth | Soil treatment | Scarified               | Non-<br>scarified | Average |
|-------------------------------------------|-------------------|----------------|-------------------------|-------------------|---------|
|                                           | inches            |                | ----- % emergence ----- |                   |         |
| none                                      | 0                 | none           | 0.00                    | 2.33              | 1.17    |
|                                           |                   | WaterMaxx      | 1.00                    | 1.33              | 1.17    |
|                                           |                   | Soil Binder    | 0.00                    | 0.00              | 0.00    |
|                                           |                   | average        | 0.33                    | 1.22              | 0.78    |
|                                           | 1/8               | none           | 1.67                    | 3.00              | 2.34    |
|                                           |                   | WaterMaxx      | 3.00                    | 5.00              | 4.00    |
|                                           |                   | Soil Binder    | 3.00                    | 15.33             | 9.17    |
|                                           |                   | average        | 2.56                    | 7.78              | 5.17    |
|                                           | 1/4               | none           | 1.67                    | 13.00             | 7.34    |
|                                           |                   | WaterMaxx      | 4.33                    | 11.67             | 8.00    |
|                                           |                   | Soil Binder    | 9.33                    | 2.00              | 5.67    |
|                                           |                   | average        | 5.11                    | 8.89              | 7.00    |
| average                                   |                   | 6.26           | 7.52                    | 6.89              |         |
| pelleted                                  | 0                 | none           | 0.00                    | 0.00              | 0.00    |
|                                           |                   | WaterMaxx      | 0.00                    | 0.00              | 0.00    |
|                                           |                   | Soil Binder    | 0.00                    | 0.33              | 0.17    |
|                                           |                   | average        | 0.00                    | 0.11              | 0.06    |
|                                           | 1/8               | none           | 0.00                    | 1.67              | 0.84    |
|                                           |                   | WaterMaxx      | 0.33                    | 2.67              | 1.50    |
|                                           |                   | Soil Binder    | 0.33                    | 2.67              | 1.50    |
|                                           |                   | average        | 0.22                    | 2.34              | 1.28    |
|                                           | 1/4               | none           | 0.67                    | 1.33              | 1.00    |
|                                           |                   | WaterMaxx      | 2.00                    | 2.67              | 2.34    |
|                                           |                   | Soil Binder    | 0.00                    | 2.33              | 1.17    |
|                                           |                   | average        | 0.89                    | 2.11              | 1.50    |
| average                                   |                   | 0.37           | 1.52                    | 0.94              |         |
| average                                   | average           | none           | 0.67                    | 3.56              | 2.11    |
|                                           |                   | WaterMaxx      | 1.78                    | 3.89              | 2.83    |
|                                           |                   | Soil Binder    | 2.11                    | 3.78              | 2.94    |
|                                           |                   | average        | 1.52                    | 3.74              | 2.63    |
| average                                   | 0                 |                | 0.17                    | 0.67              | 0.42    |
|                                           | 1/8               |                | 1.39                    | 5.06              | 3.22    |
|                                           | 1/4               |                | 3.00                    | 5.50              | 4.25    |
|                                           | average           |                | 1.52                    | 3.74              | 2.63    |
| LSD (0.05)                                |                   |                |                         |                   |         |
| Planting depth                            |                   |                |                         | 2.47              |         |
| Seed scarification                        |                   |                |                         | 0.94              |         |
| Scar. X depth                             |                   |                |                         | NS                |         |
| Scar. X anti-crusting soil trt.           |                   |                |                         | NS                |         |
| Scar. X pelleting                         |                   |                |                         | 1.09              |         |
| Scar. X depth X anti-crusting             |                   |                |                         | 2.31              |         |
| Scar. X depth X anti-crusting X pelleting |                   |                |                         | 3.26              |         |

Table 2. Seedling emergence by May 10, 2009 for four native plant species in response to seed pelleting, planting depth, and anti-crusting soil treatment. Malheur Experiment Station, Ontario, OR.

| Seed<br>pelleting                      | Planting<br>depth | Soil treatment | <i>Lupinus<br/>argenteus</i><br>non-<br>scarified | <i>Achnatherum<br/>thurberianum</i> | <i>Sphaeralcea<br/>grossulariifolia</i> | <i>Penstemon<br/>acuminatus</i> | Avg. |      |
|----------------------------------------|-------------------|----------------|---------------------------------------------------|-------------------------------------|-----------------------------------------|---------------------------------|------|------|
|                                        | inches            |                | ----- % emergence -----                           |                                     |                                         |                                 |      |      |
| none                                   | 0                 | none           | 2.33                                              | 0.00                                | 0.00                                    | 1.67                            | 1.00 |      |
|                                        |                   | WaterMaxx      | 1.33                                              | 0.00                                | 0.00                                    | 0.00                            | 0.33 |      |
|                                        |                   | Soil Binder    | 0.00                                              | 0.00                                | 0.00                                    | 0.00                            | 0.00 |      |
|                                        |                   | average        | 1.22                                              | 0.00                                | 0.00                                    | 0.56                            | 0.44 |      |
|                                        | 1/8               | none           | 3.00                                              | 3.00                                | 0.00                                    | 3.67                            | 2.42 |      |
|                                        |                   | WaterMaxx      | 5.00                                              | 7.00                                | 0.00                                    | 5.67                            | 4.42 |      |
|                                        |                   | Soil Binder    | 15.33                                             | 6.67                                | 0.00                                    | 8.33                            | 7.58 |      |
|                                        |                   | average        | 7.78                                              | 5.56                                | 0.00                                    | 5.89                            | 4.81 |      |
|                                        | 1/4               | none           | 13.00                                             | 1.00                                | 0.00                                    | 3.67                            | 4.42 |      |
|                                        |                   | WaterMaxx      | 11.67                                             | 0.00                                | 2.33                                    | 8.00                            | 5.50 |      |
|                                        |                   | Soil Binder    | 2.00                                              | 12.33                               | 0.00                                    | 0.33                            | 3.67 |      |
|                                        |                   | average        | 8.89                                              | 4.44                                | 0.78                                    | 4.00                            | 4.53 |      |
|                                        | average           |                | 5.96                                              | 3.33                                | 0.26                                    | 3.48                            |      |      |
|                                        | pelleted          | 0              | none                                              | 0.00                                | 0.33                                    | 0.00                            | 0.67 | 0.25 |
|                                        |                   |                | WaterMaxx                                         | 0.00                                | 0.00                                    | 0.33                            | 1.00 | 0.33 |
|                                        |                   |                | Soil Binder                                       | 0.33                                | 5.33                                    | 0.00                            | 0.67 | 1.58 |
| average                                |                   |                | 0.11                                              | 1.89                                | 0.11                                    | 0.78                            | 0.72 |      |
| 1/8                                    |                   | none           | 1.67                                              | 3.33                                | 0.33                                    | 8.00                            | 3.33 |      |
|                                        |                   | WaterMaxx      | 2.67                                              | 4.67                                | 0.00                                    | 6.33                            | 3.42 |      |
|                                        |                   | Soil Binder    | 2.67                                              | 6.67                                | 0.33                                    | 4.33                            | 3.50 |      |
|                                        |                   | average        | 2.34                                              | 4.89                                | 0.22                                    | 6.22                            | 3.42 |      |
| 1/4                                    |                   | none           | 1.33                                              | 0.67                                | 2.00                                    | 4.00                            | 2.00 |      |
|                                        |                   | WaterMaxx      | 2.67                                              | 0.00                                | 0.00                                    | 8.33                            | 2.75 |      |
|                                        |                   | Soil Binder    | 2.33                                              | 9.33                                | 0.00                                    | 8.00                            | 4.92 |      |
|                                        |                   | average        | 2.11                                              | 3.33                                | 0.67                                    | 6.78                            | 3.22 |      |
| average                                |                   | 1.52           | 3.37                                              | 0.33                                | 4.59                                    | 2.45                            |      |      |
| average                                |                   | none           | 3.56                                              | 1.39                                | 0.39                                    | 3.61                            | 2.24 |      |
|                                        |                   | WaterMaxx      | 3.89                                              | 1.94                                | 0.44                                    | 4.89                            | 2.79 |      |
|                                        |                   | Soil Binder    | 3.78                                              | 6.72                                | 0.06                                    | 3.61                            | 3.54 |      |
|                                        | average           | 3.74           | 3.35                                              | 0.30                                | 4.04                                    | 2.86                            |      |      |
| average                                | 0                 |                | 0.67                                              | 0.94                                | 0.06                                    | 0.67                            | 0.58 |      |
|                                        | 1/8               |                | 5.06                                              | 5.22                                | 0.11                                    | 6.06                            | 4.11 |      |
|                                        | 1/4               |                | 5.50                                              | 3.89                                | 0.72                                    | 5.39                            | 3.88 |      |
|                                        | average           |                | 3.74                                              | 3.35                                | 0.30                                    | 4.04                            | 2.86 |      |
| LSD (0.05)                             |                   |                |                                                   |                                     |                                         |                                 |      |      |
| Depth                                  |                   |                |                                                   |                                     | NS                                      |                                 |      |      |
| Species                                |                   |                |                                                   |                                     | 1.20                                    |                                 |      |      |
| Species X depth                        |                   |                |                                                   |                                     | 2.08                                    |                                 |      |      |
| Species X soil treatment               |                   |                |                                                   |                                     | 2.08                                    |                                 |      |      |
| Species X pelleting                    |                   |                |                                                   |                                     | 1.70                                    |                                 |      |      |
| Species X depth X soil treatment       |                   |                |                                                   |                                     | 3.61                                    |                                 |      |      |
| Species X depth X soil treat. X pellet |                   |                |                                                   |                                     | 5.10                                    |                                 |      |      |

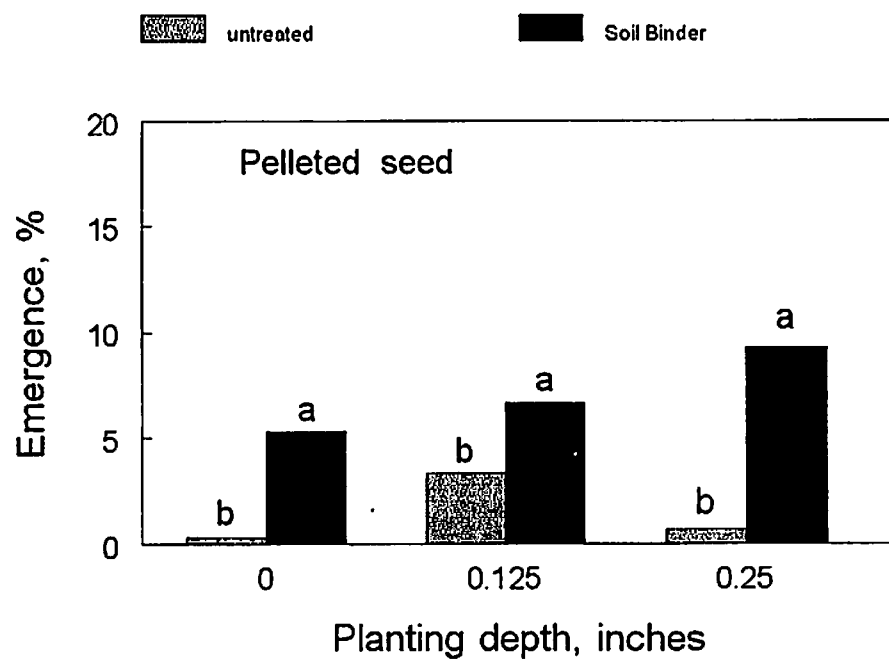
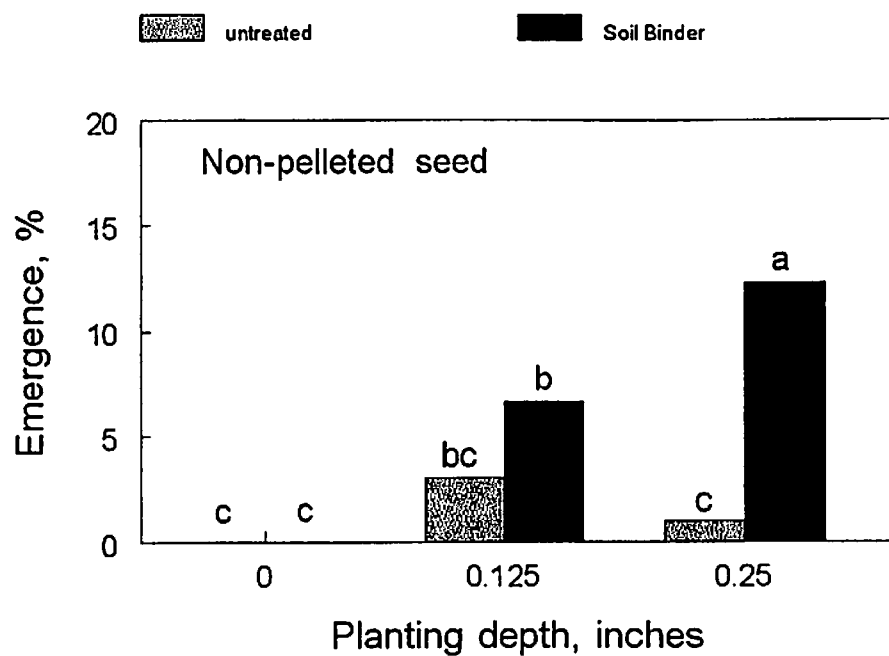


Figure 1. The emergence of *Achnatherum thurberianum* responded to planting depth and treatment with Soil Binder as an anti-crusting agent for non-pelleted and pelleted seed. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.