# OPERATIONAL SUCCESS OF DIRECT SURFACE SEEDING STRATEGIES FOR ESTABLISHMENT OF INTERMOUNTAIN WEST NATIVE PLANTS

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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 make seed readily available. Direct seeding of native range plants has been generally problematic, but especially for certain species. Fall planting is important for many species, because seed of many species requires a period of cold to break dormancy (vernalization). Fall planting of native seed has resulted in poor stands in some years at the Malheur Experiment Station. Loss of soil moisture, soil crusting, and bird damage are some detrimental factors hindering emergence of fall planted seed. Previous trials at the Malheur Experiment Station have examined seed pelleting, planting depth, and soil anti-crustants (Shock et al. 2010). Planting at depth with soil anti-crustant improved emergence compared to surface planting. Seed pelleting did not improve emergence. Despite these positive results, emergence was extremely poor for all treatments, due to soil crusting and bird damage.

In established native perennial fields at the Malheur Experiment Station and in rangelands we have observed prolific natural emergence from seed that falls on the soil surface and is covered by thin layers of organic debris. This trial tested the effect of four factors on surface planted seed (Table 1). Row cover can be a protective barrier against soil desiccation and bird damage. Sawdust can mimic the protective effect of organic debris. Sand can help hold the seed in place. Seed treatment can protect the emerging seed from fungal pathogens that might cause seed decomposition or seedling damping off. The treatments did not test all possible combinations of factors, but tested the combinations that would theoretically be most likely to result in the best stand establishment.

This trial tested seed cover, row cover, and seed treatment for emergence of seven important species that are native to Malheur County and surrounding rangelands.

Table 1. Treatments evaluated for emergence of seven native plant species. Mouse bait packs were scattered over the trial area. Malheur Experiment Station, Oregon State University, Ontario, OR.

| Treatment | Row cover | Sawdust | Seed treatment* | Sand |
|---|---|---|---|---|
| 1 | yes | yes | yes | yes |
| 2 | yes | yes | yes | no |
| 3 | yes | yes | no | no |
| 4 | yes | no | yes | no |
| 5 | no | yes | yes | no |

*mixture of Captan and Ridomil fungicides for prevention of seed decomposition and seedling damping off.

## Materials and Methods

Six species for which stand establishment has been problematic were chosen. A seventh species (*Penstemon acuminatus*) was chosen as a check, because it has reliably produced good stands at Ontario. Seed of *Dalea ornata* was scarified by immersion for 5 min in 98 percent sulfuric acid. Seed weights for all species were determined. A portion of the seed was treated with a liquid mix of the fungicides Ridomil MZ58 and Captan (100 g Ridomil, 100 g Captan in 1 liter of water). Seed weights of the treated seeds were determined after treatment. The seed weights of untreated and treated seed were used to make seed packets containing approximately 300 seeds each. The seed packets were assigned to one of five treatments (Table 1). The trial was planted manually on November 12, 2009. The experimental design was a randomized complete block with six replicates. Plots were 1 30-inch wide bed by 5 ft long. Two seed rows were planted on each bed.

Table 2. Seed weights and tetrazolium test (seed viability) for native plants submitted to emergence treatments. Malheur Experiment Station, Oregon State University, Ontario, OR.

| Species | Common name | Untreated seed weight | Tetrazolium test |
|---|---|---|---|
| | | seeds/g | % |
| *Achnatherum thurberianum* | Thurber's needlegrass | 326.6 | 81 |
| *Dalea ornata* | blue mountain prairie clover | 328.0 | 89 |
| *Penstemon acuminatus* | sharpleaf penstemon | 922.1 | 84 |
| *Penstemon deustus* | hotrock or scabland penstemon | 5555.6 | 52 |
| *Heliomeris multiflora* | showy goldeneye | 1393.2 | 88 |
| *Crepis intermedia* | limestone hawksbeard | 186.3 | 39 |
| *Balsamorhiza sagittata* | arrowleaf balsamroot | 135.8 | 77 |

Tetrazolium tests were conducted to determine seed viability of each species (Table 2). The tetrazolium results were used to correct the emergence data to emergence of viable seed.

After planting, the sawdust was applied in a narrow band over the seed row at 0.26 oz/ft of row (558 lb/acre). For the treatments receiving both sawdust and sand, the sand was applied at 0.65 oz/ft of row (1,404 lb/acre) as a narrow band over the sawdust. Following planting and sawdust and sand applications, some of the beds were covered with row cover. The row cover (N-sulate, DeWitt Co., Inc., Sikeston, MO 63801) covered four rows (two beds) and was applied with a mechanical plastic mulch layer. The field was drip irrigated for 24 hours on November 20 to ensure adequate moisture for germination.

On March 10, 2011, the row cover was removed and emergence counts were made in each plot. Emergence counts were again taken on April 9. Seed of *Dalea ornata*, *Penstemon acuminatus*, and *Heliomeris multiflora* was harvested by hand in August. *Heliomeris multiflora* continued to flower and seed was again harvested in November.

Data were analyzed using analysis of variance (General Linear Models Procedure, NCSS, Kaysville, UT). Means separation was determined using Fisher's least significant difference test at the 5 percent probability level, LSD (0.05).

## Results and Discussion

By the first emergence count on March 10, 2010, all species had started emerging. By March 10, 2010, row cover with sawdust and seed treatment resulted in higher emergence than no row cover (bare ground) with sawdust and seed treatment for *Achnatherum thurberianum*, *Penstemon*

*deustus, Heliomeris multiflora, Crepis intermedia,* and *Balsamorhiza sagittata* (Table 3). By April 9, row cover with sawdust and seed treatment had resulted in higher emergence than no row cover with sawdust and seed treatment for *Penstemon deustus, Heliomeris multiflora, Crepis intermedia,* and *Balsamorhiza sagittata* (Table 4). On both dates, adding sawdust to row cover and seed treatment did not improve emergence of any species, but reduced emergence of *P. deustus.*

On either date, adding seed treatment to sawdust and row cover did not improve emergence of any species. Adding seed treatment to sawdust and row cover reduced emergence of *Penstemon deustus, Heliomeris multiflora, Crepis intermedia,* and *Balsamorhiza sagittata* on March 10 and reduced emergence of *Penstemon deustus, Heliomeris multiflora,* and *Crepis intermedia* on April 9. Adding sand to sawdust, seed treatment, and row cover increased emergence only for *Crepis intermedia* on March 10. There was no difference in emergence between treatments for *Dalea ornata* on either date. Averaged over species, row cover with sawdust resulted in the highest emergence. In conclusion, row cover was the important factor in improving emergence.

Plant establishment and growth were excellent in 2010. *Dalea ornata, Penstemon acuminatus,* and *Heliomeris multiflora* produced seed in 2010 (Table 5). Seed yields of *Penstemon acuminatus* and *Heliomeris multiflora* were substantial (based on two hand harvests in 2010). Seed yields of *H. multiflora* were not realistic on a commercial scale because there were no border rows and the plants grew beyond the plot boundaries. For *Dalea ornata,* row cover with sawdust and seed treatment resulted in higher first year seed yield than when either row cover or seed treatment was omitted. For *D. ornata,* adding sand to row cover, sawdust, and seed treatment significantly reduced yields. Adding seed treatment to row cover and sawdust increased yields of *D. ornata*.

## Conclusions

The above results describe practices that can be immediately implemented by seed growers.

-Row cover improved emergence for all species except *Penstemon acuminatus*.

-Sawdust did not improve emergence with the probable exception of *Balsamorhiza sagittata*.

-Seed treatment reduced emergence of six species. Seed treatment might be beneficial for *Dalea ornata*.

-Sand improved the early emergence of *Penstemon acuminatus* and *Crepis intermedia.*

## References

Shock, C.C., E.B.G. Feibert, L.D. Saunders, and N. Shaw. 2010. Emergence of native plant seeds in response to seed pelleting, planting depth, scarification, and soil anti-crusting treatment. Oregon State University Malheur Experiment Station Annual Report 2009:218-222.

Table 3. Emergence of seven native plant species on March 10, 2010 in response to five treatments applied at planting in the fall of 2009. Emergence for each species was corrected to the percent emergence of viable seed. Means within columns followed by the same letter are not significantly different at $P = 0.05$ according to Fisher's protected LSD. Oregon State University, Malheur Experiment Station, Ontario, OR.

| Treatment | Row cover | Sawdust | Seed treatment | Sand | *Achnatherum thurberianum* | *Dalea ornata* | *Penstemon acuminatus* | *Penstemon deustus* | *Heliomeris multiflora* | *Crepis intermedia* | *Balsamorhiza sagittata* | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ---------- % emergence ---------- | | | | | | | |
| 1 | yes | yes | yes | yes | 48.6ab | 6.74a | 26.8a | 23.2b | 21.4b | 76.6a | 53.0ab | 36.6b |
| 2 | yes | yes | yes | no | 47.7ab | 8.7a | 15.3ab | 23.5b | 21.6b | 64.5b | 47.3b | 32.7b |
| 3 | yes | yes | no | no | 55.8a | 3.6a | 24.6a | 39.1a | 37.1a | 86.2a | 62.9a | 44.2a |
| 4 | yes | no | yes | no | 44.5b | 11.9a | 19.7ab | 42.8a | 24.2b | 57.6b | 40.1b | 34.4b |
| 5 | no | yes | yes | no | 33.3c | 4.1a | 10.5b | 9.8c | 8.3c | 38.6c | 19.5c | 17.7c |
| | | | Average | | 46.0 | 6.2 | 19.4 | 27.7 | 19.8 | 64.7 | 34.3 | 25.5 |
| | LSD (0.05) | | Treatment | | | | | | | | | 6.9 |
| | LSD (0.05) | | Species | | | | | | | | | 5.2 |
| | LSD (0.05) | | Treat. X Species | | | | | | | | | 11.6 |

Table 4. Plant stands of seven native plant species on April 9, 2010 in response to five treatments applied at planting in the fall of 2009. Plant stands for each species was corrected to the percent of viable seed. Means within columns followed by the same letter are not significantly different at *P* = 0.05 according to Fisher's protected LSD. Oregon State University, Malheur Experiment Station, Ontario, OR.

| Treatment | Row cover | Sawdust | Seed treatment | Sand | *Achnatherum thurberianum* | *Dalea ornata* | *Penstemon acuminatus* | *Penstemon deustus* | *Heliomeris multiflora* | *Crepis intermedia* | *Balsamorhiza sagittata* | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ---------- % emergence ---------- | | | | | | | |
| 1 | yes | yes | yes | yes | 47.2ab | 13.9a | 22.5a | 29.8b | 22.4b | 66.5ab | 59.3ab | 37.4b |
| 2 | yes | yes | yes | no | 44.3ab | 9.6a | 19.6a | 32.3b | 26.0b | 57.0b | 60.0ab | 35.6b |
| 3 | yes | yes | no | no | 54.3a | 3.2a | 26.4a | 43.8a | 39.2a | 77.2a | 66.7a | 44.4a |
| 4 | yes | no | yes | no | 41.9b | 9.8a | 18.9a | 49.1a | 23.4b | 50.7b | 49.6b | 34.8b |
| 5 | no | yes | yes | no | 41.2b | 5.0a | 18.1a | 17.1c | 10.9c | 27.1c | 25.5c | 20.7c |
| | | | Average | | 45.8 | 7.4 | 21.1 | 34.4 | 21.4 | 55.7 | 40.2 | 27.4 |
| | | LSD (0.05) | Treatment | | | | | | | | | 6.0 |
| | | LSD (0.05) | Species | | | | | | | | | 5.0 |
| | | LSD (0.05) | Treat. X Species | | | | | | | | | 11.2 |

Table 5. Seed yield in 2010 of three native plant species planted on November 12, 2009. Yields are based on very small plots without border rows. The seed yields of *H. multiflora* are not realistic in terms of commercial production, because the plants grew beyond the plot boundaries. Oregon State University, Malheur Experiment Station, Ontario, OR.

| Treatment | Row cover | Sawdust | Seed treatment | Sand | *Dalea ornata* | *Penstemon acuminatus* | *Heliomeris multiflora* | Average |
|---|---|---|---|---|---|---|---|---|
| | | | | | ---------- lb/acre ---------- | | | |
| 1 | yes | yes | yes | yes | 40.5b | 848.7 | 891.0 | 593.4 |
| 2 | yes | yes | yes | no | 77.0a | 632.4 | 966.2 | 558.6 |
| 3 | yes | yes | no | no | 35.9b | 783.6 | 885.5 | 568.3 |
| 4 | yes | no | yes | no | 41.2ab | 524.4 | 863.0 | 476.2 |
| 5 | no | yes | yes | no | 11.2b | 861.0 | 768.7 | 547.0 |
| | | | Average | | 41.2 | 730.0 | 874.9 | 548.7 |
| LSD (0.10) | Treatment | | | | 35.9 | NS | NS | |