DIRECT SURFACE SEEDING STRATEGIES FOR EMERGENCE OF NATIVE PLANTS IN 2014

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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, especially for certain species. Fall planting is important for many species, because their seed 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 factors that hinder emergence of fall-planted seed. Previous trials at the Malheur Experiment Station have examined seed pelleting, planting depth, and soil anti-crustants with a group of species that have problematic establishment (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 species tested due in part to soil crusting and bird damage.

In native rangelands and in established native perennial fields at the Malheur Experiment Station, we have observed prolific natural emergence from seed that falls on the soil surface and is covered by thin layers of organic debris. In 2011-2013, trials tested the effect of seven planting systems on surface-planted seed (Table 1; Shock et al. 2012, 2013, 2014). 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. Hydroseeding mulch could be a low-cost alternative for row cover. The treatments did not test all possible combinations of factors, but tested combinations that might be likely to result in adequate stand establishment based on previous observations. In 2014, the seven planting systems were tested for emergence of eight important species, most of which are difficult to establish. Seven of these species are native to Malheur County and surrounding rangelands and forests.

Materials and Methods

Seven species for which stand establishment has been problematic were chosen. An eighth species (*Penstemon speciosus*) was chosen as a check, because it has reliably produced good stands at Ontario. Seed weights for all species were determined. A portion of the seed was treated with a liquid mix of the fungicides Thiram and Captan (10 g Thiram, 10 g Captan in 0.5

L 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 seven treatments (Table 1). The trial was planted manually on November 26, 2013. The experimental design was a randomized complete block with six replicates. Plots were one 30-inch-wide by 5-ft-long bed. Two seed rows were planted on each bed.

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

After planting, 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 beds were covered with row cover. The row cover (N-sulate, DeWitt Co., Inc., Sikeston, MO) covered four rows (two beds) and was applied with a mechanical plastic mulch layer. For the hydroseeding mulch treatments, 12 lb of hydroseeding paper mulch (Premium Hydroseeding Mulch, Applegate Mulch, http://applegatemulch.com) was mixed in 50 gal of water in a jet-agitated 50-gal hydroseeder (Turbo Turf Technologies, Beaver Falls, PA). The mulch was applied with the hydroseeder in a 3-cm band over the seed row. On April 15, 2014 the row cover was removed and emergence counts were made in every plot.

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

Results and Discussion

Overall, emergence in the trial was poor. December 2013 and January 2014 precipitation was about 50% lower than normal and could have contributed to the poor emergence. Emergence and stand of *Phacelia linearis*, *Ligusticum porteri, and L. canbyi* were poor at 10% or less stand (Table 3). Emergence and stand of *Phacelia hastata*, *Heliomeris multiflora*, and *Penstemon speciosus* were fair at 20% or less. There was no significant difference in stand between treatments for *Phacelia linearis, P. hastata, Heliomeris multiflora, or Ligusticum canbyi.*

The row cover with sawdust plus seed treatment resulted in higher stands compared to no row cover (bare ground) with sawdust and seed treatment for *Machaeranthera canescens* and *Ligusticum porteri* (Table 3). Sawdust added to the row cover plus seed treatment only improved stands of *L. porteri.*

Adding seed treatment to sawdust plus row cover did not improve stands of any species. Adding sand to sawdust, seed treatment, plus row cover combination increased stand for *Penstemon speciosus.*

The hydroseed mulch applicator is designed to have the seed mixed in the tank with the mulch and then the mixture is sprayed on the soil surface. Because it was not practical to mix the seed with the mulch for small plot research, the application pressure had to be reduced to avoid displacing the seed, which had been previously planted on the soil surface. The resulting mulch application was too thick, resembling paper mache when dry, and likely presented an impenetrable barrier for seedling emergence. Future adjustments of the spray nozzle and density of the mulch mix might create mulch of the right consistency. Stand with hydroseed mulch and seed treatment was lower than with row cover and seed treatment for M*achaeranthera canescens.* For *Chaenactis douglasii*, stand with hydroseed mulch and seed treatment was not different from stand with row cover and seed treatment. Stand for the other species was too poor to draw conclusions.

In 2013 (Shock et al. 2014), the same establishment systems were tested with 15 species, including all of the species in the 2014 trial. In 2013, systems including row cover improved stand of six of the species including *Chaenactis douglasii*, *Machaeranthera canescens*, and *Penstemon speciosus*. Seed treatment only improved stand of *Penstemon speciosus* and reduced stand of *Phacelia hastata.* Sand improved stand of *Chaenactis douglasii* and *Heliomeris multiflora*.

Systems including row cover have most consistently improved stand establishment over the years of trials at the Malheur Experiment Station (Shock et al. 2011, 2012, and 2013). Seed treatment, sawdust, and sand are factors that for some species in some trials have shown value in improving stand, but their performance has not been consistent.

Acknowledgements

This project was funded by the U.S. Forest Service Rocky Mountain Research Station, Oregon State University, Malheur County Education Service District, and supported by Formula Grant no. 2014-31100-06041 and Formula Grant no. 2014-31200-06041 from the USDA National Institute of Food and Agriculture.

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Table 1. Planting systems evaluated for emergence of eight native plant species. Mouse bait packs were scattered over the trial area. Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

No.	Row cover	Seed treatment*	Sawdust	Sand	Mulch
1	yes	yes	yes	no	no
2	yes	yes	no	no	no
3	yes	no	yes	no	no
4	no	yes	yes	no	no
5	yes	yes	yes	yes	no
6	no	yes	no	no	yes
7	no	no	no	no	no

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

Table 2. Seed weights and tetrazolium test (seed viability) results for seed subjected to emergence treatments in the fall of 2013 and evaluated in the spring of 2014, Malheur Experiment Station, Oregon State University, Ontario, OR.

Species	Common name	Untreated seed weight	Tetrazolium test
		seeds/g	%
Chaenactis douglasii	Douglas' dustymaiden	787	71.0
Machaeranthera canescens	hoary tansyaster	2,321	84.0
Phacelia hastata	silverleaf phacelia	1,471	98.0
Phacelia linearis	threadleaf phacelia	2,843	98.0
Heliomeris multiflora	showy goldeneye	1,700	83.0
Ligusticum porteri	Porter's licorice-root	158	77.0
Ligusticum canbyi	Canby's licorice-root	238	54.0
Penstemon speciosus	royal penstemon	710	89.0

Table 3. Plant stands of eight native plant species on April 18, 2014 in response to seven planting systems used in the fall of 2013. Emergence for each species was corrected to the percent emergence of viable seed. Malheur Experiment Station, Oregon State University, Ontario, OR.

Species	Row cover, seed treatment, sawdust	Row cover, seed treatment	Row cover, sawdust	Seed treatment, sawdust	Row cover, seed treatment, sawdust, sand	Seed treatment, mulch	Untreated check	LSD (0.05)
	---------- % stand ----------							
Chaenactis douglasii	36.0	34.7	49.9	15.8	57.0	33.1	11.3	26.8
Machaeranthera canescens	67.3	63.0	76.4	28.4	70.2	8.6	26.4	31.6
Phacelia hastata	11.5	15.0	11.3	4.1	7.7	15.0	3.9	NS
Phacelia linearis	2.6	2.7	9.0	0.5	0.6	1.2	1.6	NS
Heliomeris multiflora	13.5	16.4	19.9	4.2	13.7	0.5	8.8	NS
Ligusticum porteri	1.1	0.4	0.9	0.0	0.9	0.2	0.0	0.7
Ligusticum canbyi	1.3	0.5	2.7	1.5	1.9	0.0	0.0	NS
Penstemon speciosus	5.4	1.7	1.9	1.9	12.2	1.9	0.7	6.1