DIRECT SURFACE SEEDING SYSTEMS FOR SUCCESSFUL ESTABLISHMENT OF NATIVE WILDFLOWERS

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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 can be 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 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 Malheur Experiment Station have examined seed pelleting, planting depth, and soil anti-crustants (Shock et al. 2010). Planting wildflower seeds at a shallow depth with the addition of a soil anti-crustant increased seedling emergence compared to surface planting. Seed pelleting did not improve emergence. Despite these results, emergence was extremely poor for all treatments, due to soil crusting and bird damage.

In established native perennial fields at 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 seven planting systems on the establishment of 15 native wildflower species (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. Hydroseeding mulch could be a low-cost replacement for row cover. The treatments did not test all possible combinations of factors, but tested the combinations that could promote adequate stand establishment. In previous trials we demonstrated the importance of row cover for the establishment of native wildflower stands (Shock et al. 2012).

This trial tested seven plant systems that included combinations of seed cover, row cover, seed treatment, and hydroseeding mulch for stand establishment of 15 important wildflower species that are native to Malheur County and surrounding countryside.

Materials and Methods

Fourteen species for which stand establishment may be problematic were chosen. A fifteenth species (*Penstemon speciosus*) was chosen as a check, because it has reliably produced good

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hts for all species were determined. A portion of the seed was
. the fungicides Thiram and Captan (10 g Thiram, 10 g Captan in 0.5 l
reated seeds were determined after seed treatment. The seed
eed were used to make seed packets containing close to 300
ere assigned to one of seven treatments (Table 1). The trial was
er 15, 2012. The experimental design was a randomized complete
lots were 1 bed 30 inches wide and 5 ft long. Two seed rows were

e conducted to determine seed viability of each species (Table 2). The
were used to correct the plant stands to a percent of viable seed planted.

g, t. tments receiving sawdust had sawdust applied in a narrow band over the seed
.26 oz/ft of row (558 lb/acre). For the treatments receiving both sawdust and sand, the
as applied at 0.65 oz/ft of row (1,404 lb/acre) as a narrow band over the sawdust.
wing planting and sawdust and sand applications, some of the treatments had row cover
alled over the beds. The row cover (N-sulate, DeWitt Co., Inc., Sikeston, MO) covered four
ws (two beds) and was applied with a mechanical plastic mulch layer. For the simulated
hydroseeding mulch treatments, hydroseeding mulch (Hydrostraw LLC, Manteno, IL) was
applied dry at 7.5 g/ft of row in a 3-cm band over the seed row. The mulch was applied dry and
sprayed with water using a backpack sprayer to simulate hydroseeding.

On March 15, 2013, the row cover was removed and plant stand counts were made in each plot. Plant stands were counted again on April 2 and April 18.

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% probability level, LSD (0.05).

Results and Discussion

By the first plant count on March 15, 2013, all species were emerging. Between the second count on April 2 and the third count on April 18, most species showed no increase in stand and some species showed a decline. Even by April 18 the stands of *Phacelia linearis*, *Nicotiana attenuata*, and *Phacelia crenulata* were too poor to draw meaningful conclusions.

Direct planting of the seed without other aids was among the least successful plant system (Tables 3, 4, and 5). Row cover was beneficial to plant stand establishment. For the 12 species with statistical differences among planting systems, the planting systems with greatest plant establishment included row cover. The most effective system for plant establishment for each species varied somewhat by the date that the evaluations were made. Since plant stands later in the growing season are critical to seed yield, the discussion that follows is based on the last stand count on April 18 (Table 5).

Over all seedling plant stands were lower with simulated hydroseeding mulch plus seed treatment than with row cover plus seed treatment. Actual hydroseeding may result in better stand establishment than our simulated application.

Seedlings of *Ipomopsis aggregata* were best established using a system of row cover plus sawdust, and this system was among the most favorable for seven other species. Row cover plus

seed treatment was among the most favorable systems for eight of the species, while row cover plus seed treatment plus sawdust was among the most favorable system for six of the species. The system using row cover plus sawdust plus sand was among the best for 10 of the 12 species where significant differences between planting systems were found.

References

Shock, C.C., E.B.G. Feibert, C.A. Parris, L.D. Saunders, and N. Shaw. 2012. Direct surface seeding strategies for establishment of Intermountain West native plants for seed production. In Shock C.C. (Ed.) Oregon State University Agricultural Experiment Station, Malheur Experiment Station Annual Report 2011, Department of Crop and Soil Science Ext/CrS 141:130-135. (http://www.cropinfo.net/AnnualReports/2011/Forbemergence2011.php)

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 1. Seven planting systems were evaluated for the establishment of 15 native wildflower species. Mouse bait packs were scattered over the trial area. Malheur Experiment Station, Oregon State University, Ontario, OR, 2013.

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) for 15 native wildflower species submitted to 7 planting systems in the fall of 2012. Malheur Experiment Station, Oregon State University, Ontario, OR.

Species	Common name	Untreated seed weight	Tetrazolium test
		seeds/g	%
Chaenactis douglasii	Douglas' dustymaiden	787	72
Machaeranthera canescens	hoary tansyaster	2,321	84
Phacelia hastata	silverleaf phacelia	1,471	100
Phacelia linearis	threadleaf phacelia	2,843	100
Eriophyllum lanatum	common woolly sunflower	1,634	88
Enceliopsis nudicaulis	nakedstem sunray	127	92
Heliomeris multiflora	showy goldeneye	1,700	85
Ipomopsis aggregata	scarlet gilia	656	76
Mentzelia albicaulis	whitestem blazingstar	1,130	84
Nicotiana attenuata	coyote tobacco	13,000	25
Phacelia crenulata	cleftleaf wildheliotrope	942	94
Thelypodium milleflorum	manyflower thelypody	3,650	96
Ligusticum porteri	Porter's licorice-root	158	93
Ligusticum canbyi	Canby's licorice-root	238	63
Penstemon speciosus	royal penstemon	710	88

Table 3. Plant stands of 15 native plant species on March 15, 2013 in response to 7 planting systems used in the fall of 2012. Plant stand for each species was corrected to percent based on the number of viable seed planted. Oregon State University, Malheur Experiment Station, 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	22.2	21.9	17.8	1.6	45.6	9.2	0.3	13.6
Machaeranthera canescens	69.6	54.5	53.0	20.7	61.6	18.1	21.7	23.1
Phacelia hastata	7.4	10.2	18.5	0.3	12.2	0.2	1.3	9.2
Phacelia linearis	2.8	0.1	0.2	0.0	2.4	0.1	0.1	NS
Eriophyllum lanatum	47.9	55.1	31.8	1.6	45.8	14.5	2.0	21.9
Enceliopsis nudicaulis	12.1	12.6	5.5	0.1	5.5	0.3	4.0	NS
Heliomeris multiflora	5.8	15.0	9.5	0.4	15.9	0.5	0.3	6.7
Ipomopsis aggregata	0.3	0.3	9.4	0.3	0.1	0.1	0.5	3.8
Mentzelia albicaulis	18.9	22.5	16.7	3.1	22.2	5.6	3.4	10.8
Nicotiana attenuata	1.6	0.2	0.2	0.9	6.9	7.8	0.0	NS
Phacelia crenulata	0.1	1.1	4.1	0.0	1.1	0.0	0.0	NS
Thelypodium milleflorum	29.7	41.0	31.5	4.6	21.2	2.7	3.1	20.4
Ligusticum porteri	0.1	0.8	1.7	0.0	5.8	0.0	1.3	NS
Ligusticum canbyi	0.4	9.3	0.4	0.1	0.3	0.7	0.0	NS
Penstemon speciosus	25.7	25.1	7.8	0.1	34.0	0.4	0.1	13.9

Table 4. Plant stands of 15 native plant species on April 2, 2013 in response to 7 planting systems used in the fall of 2012. Plant stand for each species was corrected to percent based on the number of viable seed planted. Oregon State University, Malheur Experiment Station, 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	21.5	28.6	18.7	4.2	46.5	13.1	2.5	11.8
Machaeranthera canescens	70.5	46.2	61.6	18.5	61.4	21.3	21.4	28.8
Phacelia hastata	12.1	26.4	20.9	1.1	15.8	0.4	3.2	14.9
Phacelia linearis	2.8	0.1	0.2	0.1	2.8	0.1	0.2	NS
Eriophyllum lanatum	44.8	52.1	29.2	4.2	47.5	14.6	3.9	23.4
Enceliopsis nudicaulis	13.8	12.5	7.1	0.2	8.9	0.6	4.1	NS
Heliomeris multiflora	7.5	19.0	12.3	1.0	17.6	0.1	0.3	7.5
Ipomopsis aggregata	0.5	0.4	13.5	0.4	0.9	0.0	0.3	3.0
Mentzelia albicaulis	19.3	21.4	17.2	3.4	19.9	6.5	3.3	11.3
Nicotiana attenuata	0.4	10.4	1.6	0.4	4.2	16.4	6.0	NS
Phacelia crenulata	0.4	5.6	4.4	0.0	2.1	0.0	0.1	NS
Thelypodium milleflorum	28.0	40.5	34.8	3.9	23.1	3.6	3.9	20.7
Ligusticum porteri	3.6	7.6	11.8	0.0	12.5	0.0	2.5	7.2
Ligusticum canbyi	4.1	20.2	6.4	0.2	10.1	0.0	0.0	8.8
Penstemon speciosus	31.4	27.3	11.2	0.1	43.0	0.6	0.4	15.5

Table 5. Plant stands of 15 native plant species on April 18, 2013 in response to 7 planting systems used in the fall of 2012. Plant stand for each species was corrected to percent based on the number of viable seed planted. Oregon State University, Malheur Experiment Station, 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	18.8	26.5	17.5	4.2	39.1	12.2	5.4	12.2
Machaeranthera canescens	67.3	47.4	48.8	18.7	57.7	19.1	22.1	26.3
Phacelia hastata	10.6	23.6	19.9	1.0	14.2	0.7	1.9	13.9
Phacelia linearis	2.6	0.1	0.1	0.0	2.7	0.0	0.1	NS
Eriophyllum lanatum	38.8	46.6	25.6	4.7	44.0	14.6	3.9	22.9
Enceliopsis nudicaulis	10.9	11.5	6.4	0.1	7.8	0.0	3.7	8.6
Heliomeris multiflora	8.0	14.2	11.2	0.3	17.4	0.1	0.3	8.2
Ipomopsis aggregata	0.3	1.1	14.3	0.0	1.0	0.0	0.7	3.2
Mentzelia albicaulis	18.7	20.3	15.7	3.3	17.5	7.1	2.9	10.5
Nicotiana attenuata	4.4	11.8	1.8	0.0	4.2	12.2	0.0	NS
Phacelia crenulata	0.6	3.4	4.3	0.1	2.0	0.0	0.1	NS
Thelypodium milleflorum	23.2	37.0	28.5	1.7	19.7	2.4	2.0	17.5
Ligusticum porteri	3.4	7.7	10.6	0.0	12.1	0.1	2.5	7.1
Ligusticum canbyi	5.3	16.1	6.3	0.0	8.8	0.8	0.1	7.6
Penstemon speciosus	27.0	27.0	7.6	0.0	33.1	0.7	0.1	14.6