

NATIVE WILDFLOWERS GROWN FOR SEED PRODUCTION SHOW TOLERANCE TO CONVENTIONAL POSTEMERGENCE HERBICIDES

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Introduction

Native forb seed is needed to restore rangelands of the Intermountain West. Commercial seed production is necessary to provide the quantity of seed needed for restoration efforts. A major limitation to economically viable commercial production of native forb seed is weed competition. Weeds are adapted to growing in disturbed soil, and native forbs are not competitive with these weeds. There is a considerable body of knowledge about the relative efficacy of different herbicides to control target weeds, but few trials have tested the tolerance of native forbs to commercial herbicides.

The trials reported here tested the tolerance of seven native forb species in successive years to conventional postemergence herbicides in the field. **This work seeks to discover products that could eventually be registered for use for native forb seed production.** The information in this report is for the purpose of informing cooperators and colleagues in other agencies, universities, and industry of the research results. Reference to products and companies in this publication is for the specific information only and does not endorse or recommend that product or company to the exclusion of others that may be suitable. Nor should any information and interpretation thereof be considered as recommendations for the application of any of these herbicides. **Pesticide labels should always be consulted before any pesticide use.** **Considerable efforts may be required to register these herbicides for use in native forb seed production.**

Materials and Methods

Plant Establishment

Seed of seven Great Basin forb species (Table 1) received in October 2005 was planted November 1, 2005. The field had been disked, ground hogged, and marked out in rows 30 inches apart. The seven forb species were planted in individual rows 435 ft long and 30 inches apart. Planting depths were similar to those used in the irrigation trial (Shock et al. 2007) and varied by species. The crop preceding forbs was wheat. Prior to planting, one drip tape was inserted 12 inches deep equidistant between pairs of rows to be planted. The drip tape was supplied with irrigation water using filtration and other common drip irrigation practices (Shock 2006).

2006 Postemergence Treatments

The field was staked out to make 5-ft-wide plots perpendicular to the forb rows, crossing all seven species using the lower 200 ft of the field. Eight treatments including the untreated check were replicated four times in a randomized complete block design (see Tables 2-8). Treatments were applied May 24, 2006 at 30 psi, 2.63 mph, in 20 gal/acre using 8002 nozzles with 3 nozzles spaced 20 inches apart. Plant injury in 2006 was rated visually on May 31, June 15, and June 30.

In 2006 the trial was irrigated very little with the drip irrigation system because of ample rainfall. Very few plants flowered and seed was not harvested in 2006.

Spring of 2007

By March 30, 2007 it was difficult if not impossible to distinguish any effects of the 2006 postemergence herbicide applications on any of the seven forb species. These observations suggest that some degree of phytotoxic damage may be acceptable in establishing native forb seed fields if effective weed control is achieved.

2007 Postemergence Treatments

The same treatments as 2006 were applied again to the same plots on April 24, 2007. The same application specifications as in 2006 were used in 2007. Plant injury was rated visually on May 1, May 11, May 25, and June 12.

Drip irrigations were applied every 2 weeks starting on April 5 and ending on June 24. Each irrigation applied 2 inches of water.

Seed of *Eriogonum umbellatum*, *Penstemon acuminatus*, *P. deustus*, and *P. speciosus* was harvested by hand as the seed reached maturity. The seed was cleaned and weighed. *Lomatium dissectum*, *L. triternatum*, and *L. grayi* did not flower in 2007.

General Considerations

The focus of the evaluations was forb tolerance of the herbicides, not weed control. Therefore, weeds were removed as needed.

The effects of herbicides for each species on plant stand and injury were evaluated independently from the effects on other species. Treatment differences were compared using ANOVA and protected least significant differences at the 95 percent confidence LSD (0.05) using NCSS Number Cruncher software (NCSS, Kaysville, UT).

Table 1. Forb species planted at the Malheur Experiment Station, Oregon State University, Ontario, OR, and their origins.

Species	Common name	Origin	Year
<i>Eriogonum umbellatum</i>	Sulfur buckwheat	Shoofly Road (ID)	2004
<i>Penstemon acuminatus</i>	Sand penstemon	Bliss Dam (ID)	2004
<i>Penstemon deustus</i>	Hotrock penstemon	Blacks Cr. Rd. (ID)	2003
<i>Penstemon speciosus</i>	Royal or sagebrush penstemon	Leslie Gulch (OR)	2003
<i>Lomatium dissectum</i>	Fernleaf biscuitroot	Mann Creek (ID)	2003
<i>Lomatium triternatum</i>	Nineleaf desert parsley	Hwy 395 (OR)	2004
<i>Lomatium grayi</i>	Gray's lomatium	Weiser R. Rd. (ID)	2004

Results and Discussion

All observations made on the herbicides tested are strictly preliminary observations. Herbicides that were observed to be damaging to the forbs as reported here might be helpful if used at a lower rate or in a different environment. Herbicides that were relatively safe for the forbs in these trials might be harmful if used at higher rates or in a different environment. Nothing in this report should be construed as a recommendation.

Eriogonum umbellatum (Sulfur buckwheat)

Sulfur buckwheat showed herbicide injury on the May 1 evaluation with Goal[®] and Caparol[®] as postemergence treatments (Table 2). There were no significant differences in injury between herbicide treatments on the other evaluation dates. Select[®] and Prowl[®] had among the lowest injury symptoms on the May 11, May 25, and June 12 evaluations.

There were no significant differences in seed yield between herbicide treatments (Table 2). Prowl, the untreated check, and Outlook[®] had among the highest seed yields with no statistical differences between any of the treatments.

Table 2. Tolerance of *Eriogonum umbellatum* to postemergence herbicides applied on April 24, 2007. At the time of herbicide applications, plants were 50 percent dormant. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Visual estimates of foliar injury, %				Seed yield lb/acre
		May 1	May 11	May 25	June 12	
Untreated	--	0.0	0.0	0.0	0.0	91.7
Buctril 2.0 EC	0.125	12.5	22.5	20.0	15.0	38.1
Goal 2XC	0.125	45.0	27.5	17.5	13.8	42.6
Select 2.0 EC + Herbimax	0.094 + 1% v/v	11.7	6.7	3.3	1.7	57.6
Prowl H2O 3.8 C	1	10.0	6.3	3.8	3.8	115.0
Caparol FL 4.0	0.8	28.8	41.3	33.8	26.3	27.3
Outlook 6.0 EC	0.656	2.5	18.8	15.0	15.0	75.1
Lorox 50 DF	0.5	15.0	27.5	27.5	26.3	35.6
LSD (0.05)		19.4	NS	NS	NS	NS

***Penstemon acuminatus* (Sand penstemon)**

No injury symptoms were observed on the May 1 evaluation. On May 11, only Caparol resulted in significantly higher injury symptoms than the check (Table 3). On May 25, Caparol and Buctril® resulted in significantly higher injury symptoms than the check. On June 12, Caparol, Buctril, and Select resulted in significantly higher injury symptoms than the check.

Seed yields for Buctril, Select, Caparol, and Lorox® were significantly lower than the untreated check (Table 3). Plots treated with Prowl, Outlook, and the untreated check had among the highest seed yields.

Table 3. Tolerance of *Penstemon acuminatus* to postemergence herbicides applied on April 24, 2007. At the time of herbicide applications, plants were beginning to flower. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Visual estimates of foliar injury, %				Seed yield lb/acre
		May 1	May 11	May 25	June 12	
Untreated	--	0.0	0.0	0.0	0.0	520.4
Buctril 2.0 EC	0.125	0.0	11.3	16.3	17.5	305.7
Goal 2XC	0.125	0.0	2.5	2.5	7.5	417.8
Select 2.0 EC + Herbimax	0.094 + 1% v/v	0.0	2.5	5.0	17.5	304.6
Prowl H2O 3.8 C	1	0.0	0.0	0.0	0.0	509.4
Caparol FL 4.0	0.8	0.0	18.8	30.0	27.5	162.9
Outlook 6.0 EC	0.656	0.0	0.0	2.5	8.8	502.6
Lorox 50 DF	0.5	0.0	13.8	11.3	17.5	264.9
LSD (0.05)		NS	5.4	8.2	NS	183.4

***Penstemon deustus* (Hotrock penstemon)**

On the first three evaluation dates, Buctril, Goal, Caparol, and Lorox resulted in significantly higher injury symptoms than the check (Table 4). On the last evaluation (June 12), plants treated with Caparol and Lorox still showed injury symptoms.

Seed yields for the Buctril, Goal, Caparol, and Lorox treatments were significantly lower than the untreated check (Table 4). Plots treated with Select, Outlook, Prowl, and the untreated check had among the highest seed yields.

Table 4. Tolerance of *Penstemon deustus* to postemergence herbicides applied on April 24, 2007. At the time of herbicide applications, plants were growing vegetatively. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Visual estimates of foliar injury, %				Seed yield lb/acre
		May 1	May 11	May 25	June 12	
Untreated	--	0.0	0.0	0.0	0.0	903.1
Buctril 2.0 EC	0.125	18.3	26.3	18.8	10.0	348.5
Goal 2XC	0.125	18.0	23.8	18.8	17.5	333.0
Select 2.0 EC + Herbimax	0.094 + 1% v/v	1.3	2.5	0.0	2.5	927.3
Prowl H2O 3.8 C	1	0.0	2.5	1.3	2.5	747.6
Caparol FL 4.0	0.8	21.3	48.3	50.0	47.5	86.8
Outlook 6.0 EC	0.656	0.0	1.3	7.5	10.0	835.1
Lorox 50 DF	0.5	21.3	52.5	50.0	38.8	108.5
LSD (0.05)		8.7	14.9	16.4	18.4	334.8

***Penstemon speciosus* (Royal or sagebrush penstemon)**

There were no significant injury symptoms for any of the treatments on the first evaluation (Table 5). Only Caparol and Lorox treatments showed significant injury symptoms, with Caparol having the most severe injury symptoms.

Seed yields for the Buctril, Goal, Caparol, and Lorox treatments were significantly lower than the check (Table 5). Plots treated with Select, Outlook, Prowl, and the untreated check had among the highest seed yields.

Table 5. Tolerance of *Penstemon speciosus* to postemergence herbicides applied on April 24, 2007. At time of herbicide applications, plants were beginning to flower. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Visual estimates of foliar injury, %				Seed yield lb/acre
		May 1	May 11	May 25	June 12	
Untreated	--	0.0	0.0	0.0	0.0	55.3
Buctril 2.0 EC	0.125	1.3	2.5	2.5	1.3	24.6
Goal 2XC	0.125	0.0	0.0	0.0	2.5	20.9
Select 2.0 EC + Herbimax	0.094 + 1% v/v	0.0	0.0	0.0	0.0	51.2
Prowl H2O 3.8 C	1	0.0	0.0	0.0	0.0	52.9
Caparol FL 4.0	0.8	0.0	26.3	37.5	42.5	15.7
Outlook 6.0 EC	0.656	0.0	0.0	0.0	0.0	56.6
Lorox 50 DF	0.5	0.0	10.0	6.3	11.3	20.0
LSD (0.10)		NS	4.2	4.1	6.2	29.7

***Lomatium dissectum* (Fernleaf biscuitroot)**

Only plants treated with Buctril showed significant injury symptoms on the first evaluation (Table 6). There were no significant differences in injury between treatments on the last three evaluations.

Lomatium dissectum had a very short growing period before going dormant and did not flower in 2007.

Table 6. Tolerance of *Lomatium dissectum* to postemergence herbicides applied on April 24, 2007. At the time of herbicide applications, plants were growing vegetatively. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Visual estimates of foliar injury, %			
		May 1	May 11	May 25	June 12
Untreated	--	0	0	0	0
Buctril 2.0 EC	0.125	5	2.5	3.75	5
Goal 2XC	0.125	1.25	1.25	1.25	0
Select 2.0 EC + Herbimax	0.094 + 1% v/v	0	0	0	0
Prowl H2O 3.8 C	1	0	0	0	5
Caparol FL 4.0	0.8	1.25	1.25	3.75	7.5
Outlook 6.0 EC	0.656	1.25	1.25	1.25	2.5
Lorox 50 DF	0.5	0	0	1.25	0
LSD (0.05)		2.2	NS	NS	NS

Lomatium triternatum (Nineleaf desert parsley)

Only plants treated with Buctril showed injury symptoms (Table 7).

No seed was produced by *Lomatium triternatum* in 2007.

Table 7. Tolerance of *Lomatium triternatum* to postemergence herbicides applied on April 24, 2007. At the time of herbicide applications, plants were growing vegetatively. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Visual estimates of foliar injury, %			
		May 1	May 11	May 25	June 12
Untreated	--	0	0	0	2.5
Buctril 2.0 EC	0.125	20	63.75	88.75	92.5
Goal 2XC	0.125	0	0	0	0
Select 2.0 EC + Herbimax	0.094 + 1% v/v	0	0	0	0
Prowl H2O 3.8 C	1	0	0	0	0
Caparol FL 4.0	0.8	0	0	0	0
Outlook 6.0 EC	0.656	0	0	0	0
Lorox 50 DF	0.5	0	0	0	0
LSD (0.05)		2.1	2.5	1.3	2.9

Lomatium grayi (Gray's lomatium)

On the May 1, May 25, and June 12 evaluations, only Buctril resulted in injury symptoms significantly higher than the check (Table 8). On the May 11 evaluation, Buctril and Caparol resulted in injury symptoms significantly higher than the check.

No seed was produced by *Lomatium grayi* in 2007.

Table 8. Tolerance of *Lomatium grayi* to postemergence herbicides applied on April 24, 2007. At the time of herbicide applications, plants were growing vegetatively. Malheur Experiment Station, Oregon State University, Ontario, OR, 2007.

Treatment	Rate lb ai/acre	Injury %			
		May 1	May 11	May 25	June 12
Untreated	--	0	0	0	0
Buctril 2.0 EC	0.125	15	37.5	41.25	28.75
Goal 2XC	0.125	2.5	6.25	1.25	3.75
Select 2.0 EC + Herbimax	0.094 + 1% v/v	0	0	0	0
Prowl H2O 3.8 C	1	0	0	0	0
Caparol FL 4.0	0.8	2.5	11.25	7.5	6.25
Outlook 6.0 EC	0.656	0	0	0	0
Lorox 50 DF	0.5	0	0	0	0
LSD (0.05)		2.7	8.8	8.8	6.7

Summary

All seven species tested were tolerant to Prowl and Outlook applied as postemergence treatments at the rate, timing, and soils used in these trials. *Penstemon deustus*, *P. speciosus*, and the *Lomatium* species were also tolerant to postemergence applications of Select at the rate, timing, and soils used in these trials. Prowl and Outlook are broad spectrum, soil-active herbicides that will prevent weed emergence during the season. Select is a foliar-contact, grass herbicide. The use of these three herbicides may provide the basis for an effective weed control program for seed production of these five species. Further tests are warranted to describe the range of safety for these herbicides and whether or not they have any undesirable interactions.

References

- Shock, C.C. 2006. Drip irrigation: an introduction. Sustainable Agriculture Techniques, Oregon State University Extension Service. EM8782-E Revised October 2006.
- Shock, C.C., E.B.G. Feibert, L.D. Saunders, N. Shaw, and A. DeBolt. 2007. Seed production of native forbs shows little response to irrigation in a wet year. Oregon State University Agricultural Experiment Station Special Report 1075:13-20.