NATIVE PERENNIAL FORB TOLERANCE TO REPEATED ANNUAL APPLICATIONS OF 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 in 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 a recommendation 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 for 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 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 lower 200 ft of the field was staked out to make 5-ft-wide plots perpendicular to the forb rows, crossing all seven species. Eight treatments including the untreated check were replicated four times in a randomized complete block design (Table 2). 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 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 in 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 10 and ending on May 29 (total of 4 irrigations). Each irrigation applied 1 inch 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.

2008 Postemergence Treatments

The same treatments as in 2006 were applied again to the same plots on March 12, 2008. The same application specifications as in 2006 were used in 2008.

Drip irrigations were applied every 2 weeks starting on April 5 and ending on June 24 (total of 4 irrigations). Each irrigation applied 1 inch of water.

Seed of *Eriogonum umbellatum, Penstemon acuminatus, P. deustus, P. speciosus,* and *Lomatium triternatum was* harvested by hand as the seed reached maturity from the 5 ft of row across the plot width. The seed was cleaned and weighed. *Lomatium dissectum* and *L. grayi* had only a few flowers in 2008.

General Considerations

The focus of the evaluations was forb tolerance to the herbicides, not weed control. Therefore, weeds were removed as needed in 2006 and 2007. In 2008 the weeds of each species were counted in each plot (data not shown).

For each species the effects of herbicides 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).

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. The herbicides were relatively safe for the forbs in these trials but they might be harmful if used at higher rates or in a different environment. Nothing in this report should be construed as a recommendation.

2008 Postemergence Treatments

Symptoms of herbicide injury were not observed on any of the plants in 2008. All treatments were applied earlier in 2008 (March 12) than in 2007 (April 24). The earlier application in 2008 occurred before all the forb species broke dormancy, except the Lomatiums. The Lomatiums were observed breaking dormancy around February 29. In 2007, the treatments were applied when all the forbs were actively growing and herbicide damage was associated with the foliar-active herbicides. The timing of future applications should be based on the mode of action of each herbicide: early applications for the soil-active herbicides (before weeds emerge) and later applications for the foliar-active herbicides (after weeds emerge). Later applications of the foliar-active herbicides might have resulted in foliar damage as in 2007.

Although the seed yields were based on very small harvest areas, seed yields were substantial for the five species with prolific flowering in 2008. There was no significant difference in seed yield between the reapplied herbicide treatments and the check for *Eriogonum umbellatum, Penstemon acuminatus, P. deustus,* and *P. speciosus* in 2008 (Table 2). For *Lomatium triternatum,* seed yield was reduced for the Buctril® treatment, despite the early application. The *Lomatium* spp. break dormancy early in the growing season, and *L. triternatum* could have been susceptible at the early application date. Buctril, applied later in 2007 also reduced seed yield of *L. triternatum.*

Lomatium dissectum and *L. grayi* plants need further plant development prior to seed production. Seed productivity may begin in 2009.

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 native forb 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 1075:21-32.

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

Species	Common name	Origin	Year
Eriogonum umbellatum	Sulfur-flower buckwheat	Shoofly Road, Owyhee Co., ID	2004
Penstemon acuminatus	Sharpleaf or sand-dune penstemon	Bliss Dam, Elmore Co., ID	2004
Penstemon deustus	Scabland or hot-rock penstemon	Blacks Cr. Rd., Elmore Co., ID	2003
Penstemon speciosus	Royal or sagebrush penstemon	Leslie Gulch, Malheur Co., OR	2003
Lomatium dissectum	Fernleaf biscuitroot	Mann Creek, Washington Co., ID	2003
Lomatium triternatum	Nineleaf biscuitroot or nineleaf desert parsley	Hwy 395, Lake Co., OR	2004
Lomatium grayi	Gray's biscuitroot or Gray's lomatium	Weiser R. Rd., Washington Co, ID	2004

Table 2. Yield of five native forbs in response to postemergence herbicides applied on March 12, 2008, Malheur Experiment Station, Oregon State University, Ontario, OR. This was the third consecutive year these forbs received the same herbicide treatments.

Treatment	Rate	Mode of action	*Eriogonum umbellatum*	*Penstemon deustus*	*Penstemon acuminatus*	*Penstemon speciosus*	*Lomatium triternatum*
	lb ai/acre		lb/acre				
Untreated	--		365.1	330.2	93.9	487.5	981.5
Buctril 2.0 EC	0.125	foliar	285.5	309.1	195.6	781.7	187.9
Goal 2XC	0.125	foliar	279.7	427.0	173.3	728.1	820.8
Select 2.0 EC[a]	0.094	foliar	263.0	421.3	107.8	814.7	1,062.1
Prowl H_2O 3.8 C	1.000	soil	385.0	345.4	112.6	608.4	922.7
Caparol FL 4.0	0.800	foliar	298.5	267.2	184.6	785.3	1,069.8
Outlook 6.0 EC	0.656	soil	354.8	420.1	110.3	569.0	987.0
Lorox 50 DF	0.500	soil	368.4	360.4	140.0	672.2	888.1
LSD (0.05)			NS	NS	NS	NS	388.7

[a]applied with Herbimax adjuvant at 1 percent v/v.