IDENTIFICATION OF HERBICIDES FOR USE IN NATIVE FORB SEED PRODUCTION

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Introduction

Native forb seed is needed to restore the rangelands of the Intermountain West. Commercial seed production is necessary to provide the quantity of seed needed for restoration efforts. A major limitation to commercial production of native forb seed is the ability to control weeds within the seed crop. Weeds compete with crop plants, reducing establishment, vigor, and seed production. In addition, some weed seeds can contaminate the seed crop, reducing its value or introducing weeds to reclamation areas.

Selective weed control products are needed for reliable native forb seed production at reasonable cost. A three-phase approach will be used to develop herbicide options for the production of native forb seed. Herbicides will be screened for plant tolerance, product rates will be tested, and field performance will be evaluated. The results from each phase will shape the design of the successive phases.

Phase I, Initial Plant Tolerance to Herbicides

In the greenhouse, each forb species will be screened for tolerance to herbicides. Herbicides for screening will be selected based on their potential for selectivity determined through literature reviews and our understanding of different modes of action and principles of selectivity. Forbs will be evaluated for their tolerance to herbicides applied either preemergence or postemergence.

Phase II, Herbicide Rate Response Screen

Once herbicides have been identified that have selectivity on the different forb species, a more detailed experiment in the greenhouse will examine the level of tolerance by testing the herbicides at rates of 0, ½, 1, 2, and 4 times the standard use rate. This "dose response" is critical to identify the level of safety that a herbicide has on the species it is being used on.

Phase III, Field Testing

Herbicides identified in greenhouse tests will be evaluated in the field to verify their safety on the forbs and their efficacy in controlling weeds under field conditions. Herbicides will be evaluated alone and when possible in combinations with each other to determine if weed control can be increased and crop safety maintained. The scale of field trials will depend on the number of candidate herbicides identified in the previous research phases and the availability of seed.

Materials and Methods

Two initial screening trials were initiated in 2005 at the Malheur Experiment Station, one in the greenhouse and one in the field.

Greenhouse Herbicide Screening Trial

Sunshine® all-purpose potting soil was mixed with silt loam from field A-1 at the Malheur Experiment Station and was used to fill 224 half trays (0.28 m by 0.28 m). On October 13 and 14, seven native species were planted in 32 half trays at 50 seeds per tray with planting depth dependent upon the species (Table 1). Seeds were equally spaced at 5 by 5 locations with 2 seeds per location.

Table 1. Forb species planted in the greenhouse herbicide screening trial at the Malheur Experiment Station, Ontario, OR, 2005.

Species	Common name	Depth, mm, (inches)
Eriogonum umbellatum	Sulfur buckwheat	3, (1/8)
Penstemon acuminatus	Sand penstemon	3, (1/8)
Penstemon deustus	Hotrock penstemon	3, (1/8)
Penstemon speciosus	Royal or Sagebrush penstemon	3, (1/8)
Lomatium dissectum	Fernleaf biscuitroot	12, (½)
Lomatium triternatum	Nineleaf desert parsley	12, (½)
Lomatium grayi	Gray's lomatium	12, (½)

The trays were saturated October 17 and drained. The next day the trays were moved into a cooler set at 1°C (34°F). The room was also humidified to reduce the need for frequent irrigation. The trays were saturated November 4 and returned to the cooler.

On November 15 all trays were moved to the greenhouse head house for spraying. Four replicate trays of each of species received eight herbicide treatments (Table 2). Products were applied in a spray chamber at 19.2 gal/acre of water with an 8002E nozzle at 30 psi moving at 2 mph. The air temperature was 53°F with 50 percent relative humidity. On November 16 each tray received 1/8 inch of water to incorporate the herbicide and the trays were returned to the cooler at 34°F.

On November 21 *Lomatium triternatum, L. grayi,* and *Eriogonum umbellatum* were moved to the greenhouse. On November 28, supplemental light was added to the greenhouse for 10 hours per day. On December 12 the other forbs were moved to the greenhouse. Forbs were irrigated as needed and plant stands were counted twice a week.

Field Herbicide Screening Trial

The field was prepared in October 2005 and bedded into 76-cm (30-inch) rows. On October 23, drip tape (T-Tape TSX 515-16-340) was buried at 0.3-m (1-ft) depth and spaced 1.52 m (5 ft) apart. Two rows of forbs were planted 0.38 m (15 inches) to each side of the drip tape. Each species (Table 1) was planted in a single row for a length of

over 122 m (400 ft). The drip tape was buried on alternating inter-row spaces. The flow rate for the drip tape was 0.34 gal/min/100 ft at 8 PSI with emitters spaced 0.4 m (16 inches) apart, resulting in a water application rate of 0.066 inch/hour. The drip tape will be supplied with water filtered through sand media filters. Application durations can be controlled automatically and soil water content and water applied can be measured.

None of the species had emerged by January 5, 2006. The same herbicide products used in the greenhouse screening trial were applied at the same rates in the field on January 5. Five-ft-wide plots were assigned to the eight treatments in Table 2, perpendicular to the direction of the plant rows, with four replicates. A spray boom with three 8002 E nozzles 20 inches apart covered the 5-ft plot width. Applications were based on 20 gal/acre, 30 psi, at 2.63 mph. The conditions were air temperature of 42°F, soil surface temperature 43°F, 10 percent cloud cover, and wind at 2 mph from the east.

Because the field was infested with blue mustard, common mallow, and wheat the field was sprayed with Roundup Ultra Max® at 1.01 lb ai/acre on January 6.

Table 2. Herbicides screened for forb tolerance at the Malheur Experiment Station, Ontario, OR, 2005-2006.

Treatment	Product rate	Rate	Plant stands, %		
		lb ai/acre	*Lomatium grayi* Dec 12	*Eriogonum umbellatum* Jan 10	*Lomatium dissectum* Dec 30
Check	none	none	39.0	16.5	2.0
Prefar 4.0 EC	5 qt/acre	5	41.0	13.5	6.0
Kerb 50 WP	2 lb/acre	1	28.0	0.5	5.0
Treflan HFP	0.75 pt/acre	3/8	31.5	14.5	3.5
Prowl 3.8 SC	1.58 pt/acre	3/4	36.5	19.0	2.0
Balan 60 DF	2 lb/acre	1.2	42.5	14.0	1.0
Outlook 6.0 EC	14 fl oz/acre	2/3	27.5	10.5	4.0
Lorox 50 DF	1 lb/acre	1	41.0	0.0	8.0
	LSD (0.05)		10.8	8.5	3.8

Results and Discussion

By late January reliable plant stands had been established for three species, *Lomatium dissectum, L. grayi*, and *Eriogonum umbellatum,* from the greenhouse screening trial. These plant stands showed significant differences between herbicide treatments (Table 2). *L. triternatum* emerged slowly.

In this preliminary screening trial, the forb species are tolerating different herbicides (Fig. 1). Prefar, Balan, and Lorox look promising for *L. grayi.* Prowl has potential for *Eriogonum umbellatum.* Lorox, Prefar, and Kerb look promising for *L. dissectum.* These preliminary results should not be used as a basis for field treatments.

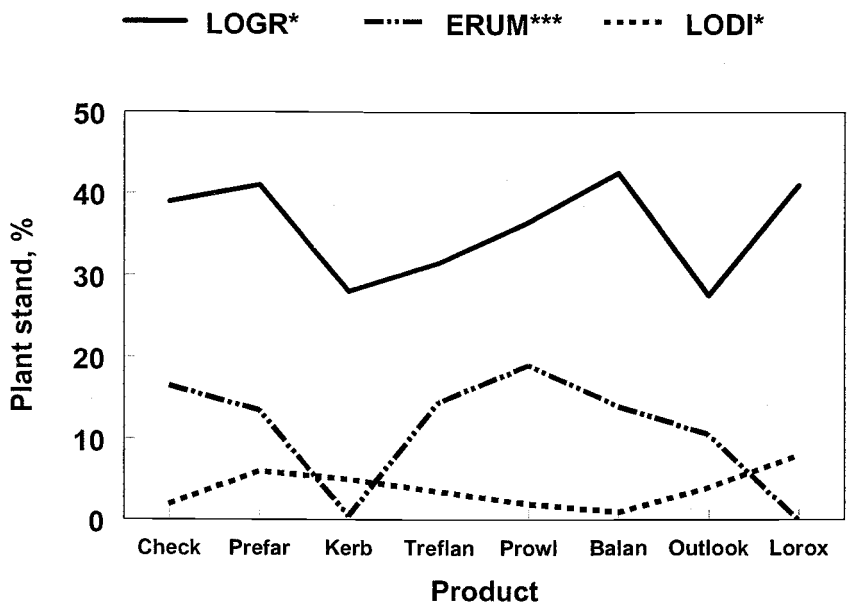

Figure 1. Plant stand of three forb species treated with seven herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR. LOGR is *Lomatium grayi*, ERUM is *Eriogonum umbellatum*, and LODI is *Lomatium dissectum*.

* Treatment differences are significant at $P = 0.05$,
*** Treatment differences are significant at $P = 0.001$.