SUBSURFACE DRIP IRRIGATION FOR NATIVE FORB SEED PRODUCTION

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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 stable and consistent seed productivity over years. Variations in spring rainfall and soil moisture result in highly unpredictable water stress at seed set and development. Excessive water stress during seed set and development is known to compromise yield and quality of other seed crops.

Native forbs are not competitive with crop weeds. Both sprinkler and furrow irrigation promote seed production, but risk the encouragement of weeds. Furthermore, sprinkler and furrow irrigation can lead to the loss of plant stand and seed production to fungal pathogens. This project tests buried drip tapes for timely irrigation to supply only limited amounts of water. By burying drip tapes at 30-cm (1-ft) depth, and avoiding wetting of the soil surface, we hope to assure flowering and seed set without encouraging weeds or opportunistic diseases.

Materials and Methods

Seed of the seven forb species (Table 1) was received in late November 2004 from the Rocky Mountain Research Station (Boise, ID). The plan was to plant the seed in the fall of 2004, but due to excessive rainfall in October, the completion of ground preparation and planting was postponed to 2005. To ensure germination in the spring of 2005, the seed was submitted to a cold stratification treatment. The seed was soaked overnight in distilled water on January 26, 2004. After soaking, the water was drained and the seed soaked for 20 minutes in a 10 percent by volume solution of 13 percent bleach in distilled water. The water was drained and the seed placed in a thin layer in plastic containers. The plastic containers had lids with holes drilled to allow air movement. The seed containers were placed in a cooler set at approximately 34°F. Every few days the seed was stirred and, if necessary, distilled water added to maintain moisture. In late February, seed of *Lomatium grayi* and *L. triternatum* had started sprouting.

The field was bedded into 76-cm (30-inch) rows. In late February 2005, drip tape (T-Tape TSX 515-16-340) was buried at 30-cm (1-ft) depth and spaced 1.52 m (5 ft) apart. 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 41 cm (16 inches) apart,

resulting in a water application rate of 0.066 inch/hour. Water was filtered through sand media filters and application duration was controlled automatically. Water applied was measured.

On March 3, seed of all species (Table 1) was planted in 76-cm (30-inch) rows using a custom-made plot grain drill with disk openers. Two rows of forbs were planted 38 cm (15 inches) to each side of the drip tape. All seed was planted at 20-30 seeds/ft of row. The *Eriogonum umbellatum* and *Penstemon* spp. were planted at 0.64-cm (0.25 inch) depth and the *Lomatium* spp. at 0.5 inch depth. The trial was irrigated with a minisprinkler system (R10 Turbo Rotator, Nelson Irrigation Corp., Walla Walla, WA) for even stand establishment from March 4 to April 29. The trial was irrigated on March 4 (5 hours), March 8 (3 hours), March 11 (2 hours), March 14 (2 hours), April 12 (4 hours), April 15 (3 hours), April 26 (4 hours), and April 29 (3 hours). Risers were spaced 7.6 m (25 ft) apart along the flexible polyethylene hose laterals that were spaced 9 m (30 ft) apart and the water application rate was 0.10 inch/hour. The drip irrigation system was used in June and July.

Results and Discussion

Eriogonum umbellatum, *Lomatium triternatum*, and *L. grayi* started emerging on March 29. All other species except *L. dissectum* emerged by late April. Very few *L. dissectum* ever emerged.

Heavy weed populations emerged with the sprinkler irrigation and spring rains. Weeds were controlled by cultivation and hand weeding. Appropriate herbicides for weed control are urgently needed to reduce production costs.

A total of 4.4 cm (1.72 inches) of water was applied with the minisprinkler system. Starting June 24, the field was irrigated using the drip system. A total of 9.5 cm (3.73 inches) of water was applied with the drip system from June 24 to July 7. Thereafter the field was not irrigated. Preliminary results indicate that relatively little irrigation water will be needed to sustain native forbs.

Plant stands for *Eriogonum umbellatum*, *Penstemon acuminatus, P. deustus*, *Lomatium triternatum*, and *L. grayi* were acceptable but not perfect. In early October 2005, more seed was received from the Rocky Mountain Research Station for replanting. The *E. umbellatum* and *Penstemon* spp. plots had the blank lengths of row replanted by hand. The *Lomatium* spp. plots had the entire row lengths replanted using the planter. The seed was replanted on October 26, 2005 for germination in the spring of 2006.

Forbs established in 2005 will receive three irrigation treatments: 0 mm/yr; low (up to 10 cm/yr, 4 inches/yr); or modest (up to 20 cm/yr, 8 inches/yr) supplemental irrigation in 2006. Water will be applied so that the soil surface is not appreciably moistened. Water will be applied in small increments during flowering and seed formation. Four replicates of each forb and each irrigation rate will be established. The first

measurements of seed yield will occur in 2006. This research effort is expected to require at least two seed harvest years. The current work is funded through 2006.

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

Species	Common name	Origin	Collection Year
Eriogonum umbellatum	Sulfur buckwheat	Shoofly Road	2004
Penstemon acuminatus	Sand penstemon	Bliss Dam	2004
Penstemon deustus	Hotrock penstemon	Black Cr. Rd.	2003
Penstemon speciosus	Sagebrush penstemon	Leslie Gulch	2003
Lomatium dissectum	Fernleaf biscuitroot	Mann Creek	2003
Lomatium triternatum	Nineleaf desert parsley	Hwy 395	2004
Lomatium grayi	Gray's lomatium	Weiser R. Road	2004

Technology Transfer

The concept of producing native forb seed as a crop and the initial planting described above was presented to growers and fieldmen at the Malheur Experiment Station Field Day, July 13, 2005.