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Cultivation and Irrigation of Fernleaf Biscuitroot *(Lomatium dissectum)* for Seed Production

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Abstract. **Native grass, forb, and shrub seed is needed to restore rangelands of the U.S. Intermountain West. Fernleaf biscuitroot [*Lomatium dissectum* (Nutt.) Mathias & Constance] is a desirable component of rangelands. Commercial seed production is necessary to provide the quantity and quality of seed needed for rangeland restoration and reclamation efforts. Fernleaf biscuitroot has been used for hundreds if not thousands of years in the western United States as a source of food and medicine. Knowledge about fernleaf biscuitroot is confined to ethnobotanical reports, evaluation of some of its chemical constituents, and its role in rangelands. Products derived from fernleaf biscuitroot are sourced from wild plant populations. Little is known about fernleaf biscuitroot cultivation or its seed production. Variations in spring rainfall and soil moisture result in highly unpredictable water stress at flowering, seed set, and seed development of fernleaf biscuitroot. Water stress is known to compromise seed yield and quality for other seed crops. Irrigation trials were conducted at the Oregon State University Malheur Experiment Station at Ontario, OR, a location within the natural environmental range of fernleaf biscuitroot. It was anticipated that supplemental irrigation would be required to produce a seed crop in all years. Fernleaf biscuitroot was established through mechanical planting and cultivation on 26 Oct. 2005 in a randomized complete block design with four replicates; plot size was 9.1 m × 3.04 m wide. Irrigation treatments were 0 mm, 100 mm, and 200 mm/year applied in four equal treatments 2 weeks apart, timed to begin with flowering and continue through seed formation. First flowering occurred in the third year after planting. Seed production increased from the fourth through the sixth year. Optimal irrigation for seed production was calculated as 140 mm/year.**

Fernleaf biscuitroot or desert parsley [*Lomatium dissectum* (Nutt.) Mathias & Constance] is a long-lived forb (non-woody perennial wildflower) with yellow, purple, or green/brown flowers native to the western United States. The shoot develops from the crown of a large taproot in early spring using the natural moisture from snow melt and spring rain. Fernleaf biscuitroot can start flowering before the last frosts, but floral development may suffer from hard freezes. Flowers are in compound umbels atop stalks that range from 60 to 150 cm (2 to 5 ft) in height. The highly dissected leaves have a fern-like appearance and are often over 40 cm (15 in) in length (Thompson, 1998). Plants initiate growth in early spring and complete vegetative growth, flowering, and seed set by early to midsummer. After seed set, the leaves die back during midsummer. Plants are dormant during summer and do not resume growth with fall rains.

L. dissectum is self-fertile and protogynous and bee pollination is necessary for fernleaf biscuitroot seed production. *Halictus* sweat bees and *Apis* honeybees have been observed in production stands of fernleaf biscuitroot in Ontario, OR. In nature, there are other bees that specialize in pollinating fernleaf biscuitroot (Jim Cane, USDA-ARS Pollinating Insects–Biology, Management, and Systematics Research Unit, personal communication).

L. dissectum grows at elevations from sea level to 2500 m in western North America from southern California to British Columbia to the Rocky Mountains, mostly on rocky soils and in meadows (Meilleur et al., 1990; Soltis et al., 1997). Highly fertile, well-drained, and rocky soils are preferred environments where *L. dissectum* grows into large clumps 1.0 to 1.2 m (3 to 4 ft) wide. It can grow in a range of precipitation regimes, including semiarid conditions. Three varieties, *L. dissectum* var. *dissectum*, *L. dissectum* var. *eatonii*, and *L. dissectum* var. *multifidum*, have been recognized indicating a considerable range of variation in the species; however, the varieties intergrade and there is disagreement as to whether varietal separation is warranted (Cronquist et al., 1997; Soltis et al., 1997).

Current State of Knowledge

Lomatium dissectum was used by Native American populations as food, medicine, and a piscicide. Specific uses described in historic, ethnobotanical records cannot be verifiably linked to *L. dissectum* as a result of the morphological similarities, especially in leaf morphology, among some *Lomatium* spp. and revisions of taxonomic classifications after the ethnobotanical studies (Ebeling, 1986; Jones, 1941; Meilleur et al., 1990). More than half of the *Lomatium* spp. are relatively rare with geographically restricted ranges (Soltis et al., 1997) making proper identification by a generally trained ethnobotanist less likely and perpetuating possible cases of folk underdifferentiation, the use of one folk name for two closely associated Linnaean species (Hunn and Brown, 2011). Of the 70 to 80 *Lomatium* species from western North America, only 20 occur in the ethnobotanical literature (Moerman, 2012).

Recent pharmacological research has demonstrated antiviral and antibacterial effects of *L. dissectum*. In laboratory studies, root extracts have inhibited rotavirus (a cause of severe childhood diarrhea), *Mycobacterium tuberculosis* (one cause of tuberculosis), and *Mycobacterium avium* (McCutcheon et al., 1995, 1997). *Lomatium dissectum* has shown no activity against a variety of other viruses and bacteria: bovine coronavirus (BCV, Coronaviridae), bovine herpesvirus type 1 (BHVl, Herpesviridae), bovine parainfluenza virus type 3 (BP13, Paramyxoviridae), bovine respiratory syncytial virus (BRSV, Paramyxoviriaize), vaccinia virus (Poxviridae), and

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