

Basin wildrye (*Leymus cinereus*) pooled tetraploid accessions for U.S. Intermountain West rangeland reclamation

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Introduction

Basin wildrye (*Leymus cinereus* [Scribn. & Merr.] Á. Löve) is an important perennial, hardy, long-lived, cool season C3 native grass of rangeland plant communities throughout much of western United States and Canada. All classes of livestock and wildlife, including large and small birds and mammals, utilise the grass year round for food and protection due to its 2-3 m tall, stiff stature which provides standing winter cover. Though occurring in precipitation areas of 150-500 mm and elevations of 600 to 3,000 m, it is usually found in deep, well-drained soils of high water holding capacity along drainage areas. Seedling vigour is only fair, and stands may take 2 to 5 years to fully establish. While tolerant of low to moderate levels (<10 mmhos/cm³) of saline and sodic soils and short-term winter or spring flooding, it does not tolerate extended periods of inundation (Ogle *et al.* 2012). It also does not tolerate heavy grazing or haying in the spring and summer due to its high growing point and minimal regrowth capability, and misuse has caused diminished population density through much of its original range (Anonymous, Utah Farmer-Stockman 1983).

In response to losses of basin wildrye, due to wildfires and invasive species as well as historical overgrazing, it is desired to bolster the populations of basin wildrye in the Great Basin and other parts of the U.S. Intermountain area. However, the only seed supplies with reasonable commercial availability have been sourced from sites distant to this geographic area and establishment and survival has been inconsistent. These include the varieties Magnar, an octoploid (2n=56) originally collected in south-eastern British Columbia (released 1979) and Trailhead, a tetraploid (2n=28) originally collected in south-central Montana (released 1991). Washoe germplasm (2002; tetraploid) was released for use on harsh mining sites in Montana, and the variety Continental (2009) an octoploid developed from the hybridisation of Magnar and Trailhead (Ogle *et al.* 2012).

Materials and Methods

In order to provide a source of Basin wildrye indigenous and locally adapted to the Intermountain area, the Utah Division of Wildlife Resources (UDWR) collected 59 accessions of Basin wildrye from eastern Oregon, southern Idaho, Nevada, and Utah. The collection protocol included

harvesting seed from natural stands; areas that did not appear to have been replanted as part of reclamation projects (many of which have included Magnar and/or Trailhead as components). In 2003 they were planted in an evaluation orchard in central Utah.

Results

Thirty-one of these accessions were determined by DNA analysis to be tetraploid and the balance octoploid. The octoploid race was reported as indigenous to only the western part of British Columbia, Washington, Oregon (outside of the Great Basin) and north-eastern California (Jones *et al.* 2009). The octoploid representation in the UDWR collections was puzzling, particularly since the foliage of these accessions was green in color vs. the bluish cast exhibited by the octoploid cultivar Magnar. More recent DNA analysis of basin wildrye plants from 224 locations (which included the 59 UDWR accessions) in the western U.S. and Canada showed evidence of an indigenous phylogeographic race of octoploids in north-central Nevada and eastern Oregon (Culumber *et al.* 2013). These octoploids appear to be coexisting with indigenous tetraploids present in the same area, though additional mapping will be necessary to clarify their specific geographic distribution.

Basin wildrye is an outcrossing species, but the immediate product of octoploid vs. tetraploid hybridisation includes unstable hexaploids and sterility. Therefore, a decision was made to increase only the 31 UDWR tetraploids for more efficient seed production and reclamation site establishment. The octoploids were initially cut down before heading in the evaluation orchard and subsequently removed from the field, preventing cross pollination with the tetraploids. Seed was harvested from the intercrossed tetraploid accessions, pooled as Generation 1 stock seed, and commercial seed increase fields were established in 2009. Generation 2 certified seed is becoming commercially available and has been seeded on reclamation projects in Utah. These are scheduled for evaluation in 2013-2014.

Discussion

Maintenance of genetic identity in development, production, and marketing of this pooled basin wildrye germplasm entity has been verified by member agencies of the Asso-

ciation of Official Seed Certifying Agencies (AOSCA). Formal release as a Natural-Track, Selected category of AOSCA Pre-Variety Germplasm is pending (2013) and it will be identified as UDWR Intermountain Tetra Germplasm basin wildrye (“UDWR Tetra”). According to AOSCA definitions, Selected refers to germplasm for which the source is known, having been chosen for the expected presence of specific traits. It can be used for immediate application on sites where local provenance is desired. In contrast, plant varieties are released only after many years of development and testing have proven them to be distinct, uniform, and stable in their defined area of adaptation (Young *et al.* 2003).

Original collections and subsequent evaluation and seed increase of UDWR Tetra was supported in part by the Great Basin Native Plant Selection and Increase Project (GBNPSIP) funded by the U.S. Bureau of Land Management and administered by the U.S. Forest Service. GBNPSIP scientists established a research study on a rangeland area at Saylor Creek (south west Idaho, precipitation 200-250 mm) which included replicated seeded plots of Magnar, Trailhead, and UDWR Tetra. Preliminary data show that Trailhead had initial establishment superior to the others in the unusually wet spring of 2011. Subsequent observations after the very dry 2012 summer indicates that plant attrition was more rapid in Trailhead plots, so that

the surviving stands of the three entries became similar in density. These results show that UDWR Tetra is competitive with the two varieties, but several years of observation and additional study locations will be required to determine long-term survival and productivity. Utilising UDWR Tetra in Intermountain West reclamation projects allows a conservative approach, which can avoid potential situations of outbreeding depression or lack of fitness of non-local germplasm sources.

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