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Agricultural Research Service

April 2016

# Plant Releases

Forage and Range  
Research Laboratory  
Logan, UT



*Plants for the West*  
*Plant Materials Release Catalog*

*Featuring Rangeland, Irrigated Pasture, and Turfgrass Germplasm*



## ABSTRACT

Staub, Jack, Kevin Jensen, Thomas Jones, Douglas Johnson, Michael Peel, Joseph Robins, Shaun Bushman, Steve Larson, Ivan Mott, Richard Wang, and Blair Waldron. 2016. Plant Releases: Forage and Range Research Laboratory, Logan, Utah, ARS-176. U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C., 36 pp.

The Forage Range and Research Laboratory is a multidisciplinary team that has developed critically important plant materials presently used on western U.S. rangelands and pastures. In this volume, plant materials are categorized into three groups: rangeland, irrigated pasture, and turfgrass. Each group contains a plant overview that gives general information concerning germplasm origin, use, and optimal growing conditions; a list of beneficial plant material characteristics; and germplasm availability from local seed companies and seed ordering instructions from commercial seed growers. The audience for this publication includes agricultural researchers, seed companies, ecologists, extension agents, molecular geneticists, and plant breeders.

**Keywords:** forbs, germplasm, grass, legumes, plants, pre-variety germplasm, rangelands, seed, turfgrass, wheatgrass.

## AGRICULTURAL RESEARCH SERVICE

### ARS MISSION

ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provide information access and dissemination to:

- ensure high-quality, safe food and other agricultural products;
- assess the nutritional needs of Americans;
- sustain a competitive agricultural economy;
- enhance the natural resource base and the environment; and
- provide economic opportunities for rural citizens, communities, and society as a whole.

# ARS FORAGE AND RANGE RESEARCH LABORATORY

## LOGAN, UT

### MISSION

Provide improved plant materials and management alternatives for sustainable stewardship of rangelands, pastures, and turf in the Western United States.

### VISION

The Forage and Range Research Laboratory (FRRL) is composed of a multidisciplinary team that has developed critically important plant materials presently used on the Western United States rangelands and pastures. The FRRL is recognized as the international center of excellence for integrated research in breeding, genomics, and ecological applications of perennial plants for dry, temperate environments. Research is accomplished through the combined efforts of plant breeders, molecular geneticists, and ecologists to enhance plants and associated agronomic practices for rangelands, pasture, and turf. Such plant materials, combined with best management practices, will result in sustainable stewardship in these agricultural growing environments.

While supplies last, single copies of this publication can be obtained at no cost from Jack Staub, USDA-ARS-FRRL, Utah State University, Logan, UT 84322-6300; or by e-mail at [Jack.Staub@ars.usda.gov](mailto:Jack.Staub@ars.usda.gov).

Copies of this publication may be purchased in various formats (microfiche, photocopy, CD, print on demand) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (800) 553-6847, [www.ntis.gov](http://www.ntis.gov).

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\* *Pre-Variety Germplasm.*

# Online User Guide

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## Using the Table of Contents/Index

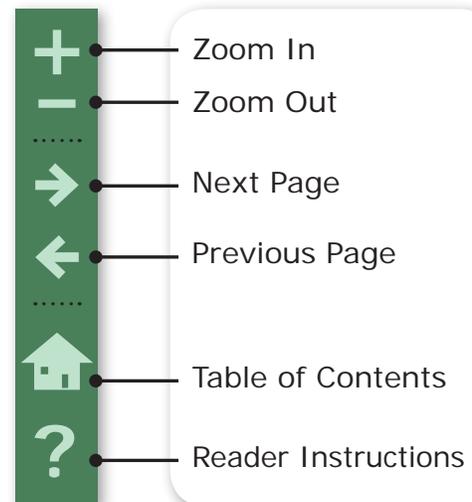
1. Click on the plant of your choice. →

## Using the Navigation Bar

The navigation bar is located at the bottom right of the document. →

Use the navigation bar to zoom, change the page, and return to the Table of Contents or Plant Index.

Press Ctrl + L to enter full screen mode. It may be easier to read the text in this mode. While viewing the document in full screen, only one page is visible at a time. To exit full screen mode, press Ctrl + L again.



## Using the Navigation Panel

Adobe Reader features a navigation panel. To activate the Navigation Panel, press F4. A menu will appear on the left of your screen.

Click the bookmark name or page image (depending on program preference) to navigate to the desired release documentation.

## Additional Resources

### Click here

The complete catalog can be downloaded as an electronic copy directly from the Forage and Range Research Laboratory website.

To download a standard .pdf of the catalog, see:

<http://www.ars.usda.gov/pwa/frr>

Information on individual historical releases is given on the website at:

<http://www.ars.usda.gov/Services/docs.htm?docid=17702>

Although the catalog provides important information on the origin and characteristics of the releases, more information about our laboratory and the plant materials releases it produces (for example, grasses, legumes, and forbs) for use on rangelands, pastures, and turf can be found by visiting the Forage and Range Research Laboratory website at:

<http://www.ars.usda.gov/pwa/frr>

## Product Release Classes

### 1. Variety Releases

The historical objective of plant germplasm development at the USDA, Agricultural Research Service, Forage and Range Research Laboratory (FRRL) is to produce varieties with documented adaptability and proven superior and/or unique characteristics that are distinct, uniform, and stable. A variety's distinctiveness is documented by evaluating its performance across multiple locations and years.

### 2. Pre-Variety Selected Class Germplasm

As an alternative to formal variety release (above), the Association of Official Seed Certifying Agencies (AOSCA) has defined specifications for the release of Pre-Variety Germplasm (PVG). Although there are several PVG release categories, the FRRL has only released "Selected" class germplasm (previously designated "Pre-Variety Germplasm-Selected Class"). Selected germplasms possess potentially desirable traits and may be the result of artificial selection within a population or by hybridization between populations (manipulated track), or by common-site comparisons among accessions or populations of the same species without artificial selection or hybridization (natural track).



# FRRL Plant Materials

Plant materials are categorized into three groups:

## Rangeland



## Irrigated Pasture



## Turfgrass



With each release documentation, you will find these sections:

### Plant Overview

General information concerning germplasm origin, use, and optimal growing conditions

### Plant Benefits

A list of beneficial plant material characteristics

### How To Order Seed

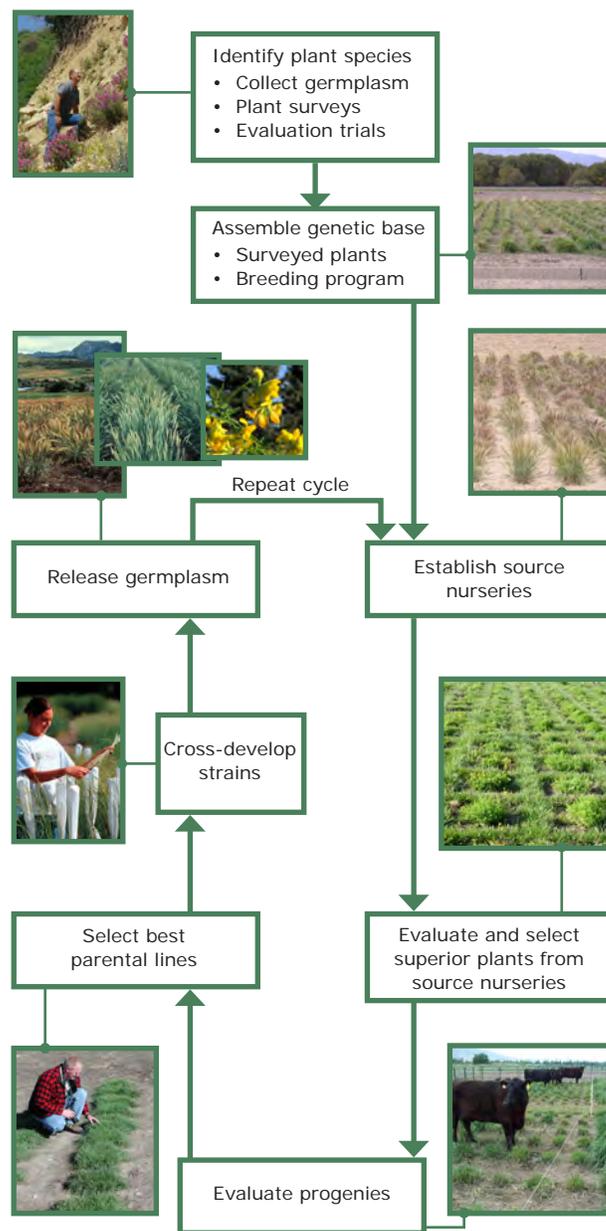
Germplasm availability and ordering instructions

# Plant Improvement

## The Story of Our Germplasm Breeding Strategies

The FRRL uses both simple and complex breeding strategies that facilitate germplasm release. These strategies range from evaluation of collected materials for Pre-Variety release without plant selection, to cultivar release strategies that involve intense evaluation, plant selection, and then recombination of the best plants in a cyclic fashion (below).

### Plant Breeding Scheme



## Foundation Seed Production

Foundation (early generation) seed is produced from "Breeder" seed that originates from seed increases of parental plant materials under controlled conditions.

## Seed Harvest

The production conditions of "Foundation" seed are strictly controlled such that uniform pollination occurs in a seed increase block.



## Seed Cleaning

Seed cleaning involves careful attention to each production field's seed purity, where only the highest quality seed is retained and extraneous materials are eliminated.



## Education and Delivery

FRRL clientele are regularly invited to see our experimental and released plant materials where critical management information is disseminated.

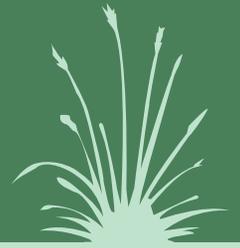




## Recovery

### Western Wheatgrass

*Pascopyrum smithii*



### Plant Overview



“Recovery” was released in 2009 by the USDA-ARS, the U.S. Army Corps of Engineers—Engineer Research and Development Center, and the USDA-Natural Resources Conservation Service. It was developed as a rapidly establishing grass for revegetation of semiarid rangelands in the Intermountain West, Great Basin, and Northern Great Plains regions of the Western United States. It is especially intended for revegetation of frequently disturbed rangelands, military training lands, and areas where repeated wildfires occur.

Rapid establishment is one of the keys to successful revegetation in the Western United States. Thus, western wheatgrasses’ inherently slow establishment limits its effectiveness in reducing erosion and controlling weeds in areas with frequent, severe disturbances. Selection emphasis during Recovery’s development focused on faster seedling establishment. During the establishment year, Recovery consistently demonstrated an increase in the frequency of seedlings (averaged across eight locations) when compared to ‘Arriba’, ‘Barton’, ‘Flintlock’, ‘Rodan’, and ‘Rosana’ western wheatgrasses. Recovery typically has superior stand until 4 to 6 years after planting, when due to their rhizomatous nature, the stand of all western wheatgrasses were equal.

On average, Recovery’s establishment is better than Bozoisky Russian wildrye, similar to Bozoisky II and Vavilov Siberian wheatgrass, and lower than Vavilov II, Hycrest, and Hycrest II crested wheatgrasses.

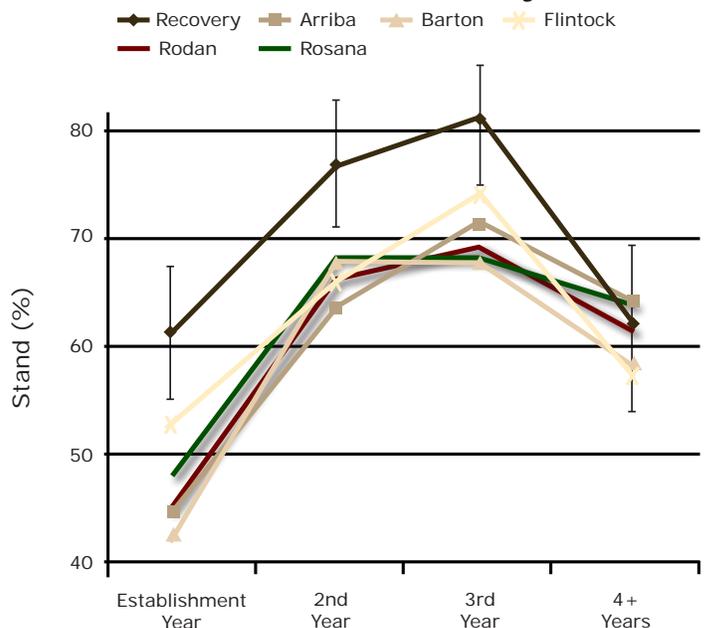
Morphological evaluations indicated that, in appearance, Recovery is most like Rosana and least like Barton western wheatgrasses. Two forage yield trials in Utah indicated that Recovery yielded comparably or slightly less than other western wheatgrasses.

The rapid establishment of Recovery, in comparison to other western wheatgrass cultivars, will allow land managers to use this native grass species to help limit weed infestation and soil erosion in areas where the regularity of disturbances normally prevents western wheatgrass from becoming fully established.

### Plant Benefits

- SUPERIOR SEEDLING ESTABLISHMENT
- MORE PERSISTENT
- HIGH DROUGHT TOLERANCE

#### Stand Persistence of ‘Recovery’



### To order seed:

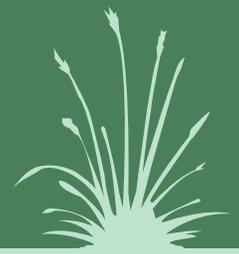
Check with local seed companies to determine availability, or call the Utah Crop Improvement Association (435-797-2082; [stanford.young@usu.edu](mailto:stanford.young@usu.edu)) or the Idaho Foundation Seed Program (208-423-6655; [Williams@kimberly.uidaho.edu](mailto:Williams@kimberly.uidaho.edu)) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the following contacts: the Utah Crop Improvement Association and the Idaho Foundation Seed Program.



# P-7 Germplasm

## Bluebunch Wheatgrass

*Pseudoroegneria spicata*



### Plant Overview



Bluebunch wheatgrass is a very important native bunchgrass found in the sagebrush-steppe ecosystem of the Intermountain Region, as well as the Rocky Mountains and western Great Plains of the United States. This grass is highly palatable to grazing animals, but is susceptible to overgrazing. For this reason, bluebunch wheatgrass is believed to be currently less common than before the introduction of live-stock in the latter half of the 19th century. Bluebunch wheatgrass may be awned or awnless, and is predominately cross-pollinated.



Collection Site.

P-7 was released in 2001 as a selected class Pre-Variety Germplasm (genetically manipulated track) on the basis of its high genetic diversity. Participating in the release were the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT.

P-7 is intended to provide genetic diversity within a single germplasm for semiarid to mesic sites where bluebunch wheatgrass was an original component of the vegetation. P-7 was constructed as a multiple-origin polycross and was developed by intermating 24 individual populations from Washington (13; WA), Idaho (3; ID), Oregon (3; OR), Utah (2), Nevada (1), Montana (1), and British Columbia (1) (Larson et al. 2000). The accessions from WA, ID, and OR represent a bluebunch wheatgrass center of genetic diversity, while the remaining accessions represent additional genetic variation from peripheral collection locations. P-7 is predominately awnless.

Larson, S.R., T.A. Jones, Z-M. Hu, A.J. Palazzo, and C.L. McCracken. 2000. Genetic diversity of bluebunch wheatgrass cultivars and a multiple-origin polycross. *Crop Science* 40:1142–1147.



Mature spikes of bluebunch wheatgrass.



P-7 in replicated trials (Beaver, UT).



Seed production field.

### Plant Benefits

- ABUNDANT SEED YIELDS
- HIGH GENETIC DIVERSITY
- BROAD ADAPTATION RANGE

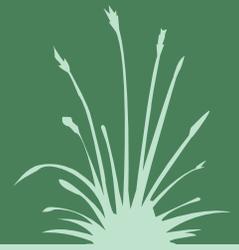
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.

# Columbia Germplasm

## Bluebunch Wheatgrass

*Pseudoroegneria spicata* [Pursh] Á. Löve



### Plant Overview

Columbia was released in 2015 as a selected class Pre-Variety Germplasm (genetically manipulated track) on the basis of its origin at a low-precipitation site and its excellent seed yield potential. Like ‘Whitmar,’ P-7 Germplasm, and Anatone Germplasm, but unlike ‘Goldar,’ Columbia is predominately awnless. Collaborators in the release were the USDA-NRCS and the Agricultural Experiment Station, Utah State University, Logan, UT.

Previous bluebunch wheatgrass plant materials have originated from sites that are much wetter than where they are typically used. The collection site of Columbia’s parent population in Adams County, WA, receives an average of about 10 inches of annual precipitation, while ‘Whitmar,’ ‘Goldar,’ and Anatone Germplasm originate from WA sites with an average annual precipitation of 22, 24, and 20 inches, respectively. While above-ground biomass of Columbia in the establishment year is relatively high, biomass in subsequent years is relatively low, perhaps reflecting the relatively low productivity of Columbia’s site of origin.

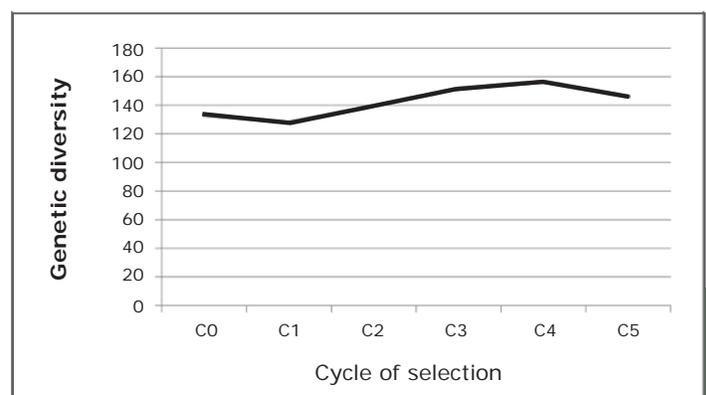
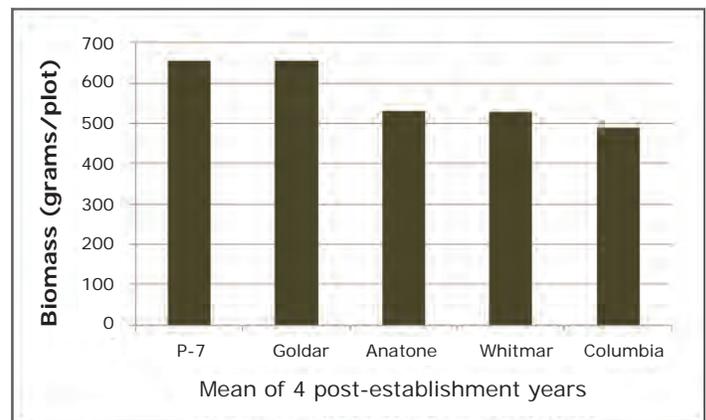
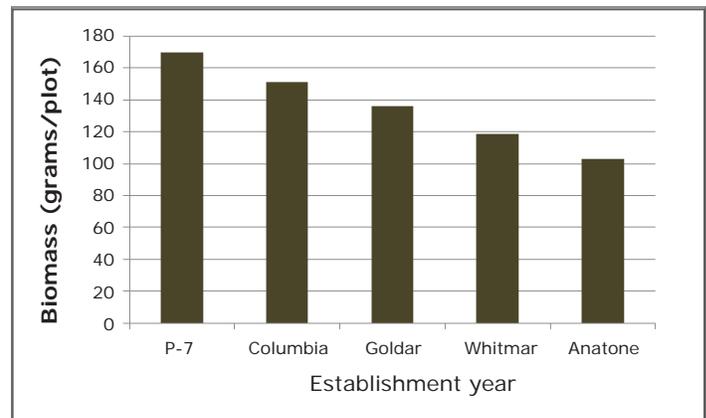
Columbia is the product of five cycles (C) of recurrent selection, mostly for high numbers of spikes. Despite this history of artificial selection, genetic diversity, as measured with DNA markers, did not decline with selection. This is because a deliberate effort was made to avoid inbreeding by maintaining a relatively large population size when generating each new cycle. For instance, the number of plants selected was 43 (C1), 78 (C2), 146 (C3), 60 (C4), and 62 (C5).

### Plant Benefits

- SUPERIOR SEEDLING ESTABLISHMENT
- MORE PERSISTENT
- GENETIC DIVERSITY



Seed increase field of Columbia bluebunch wheatgrass.



### To order seed:

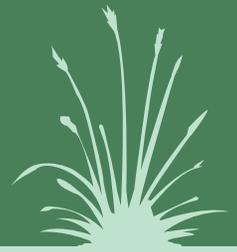
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# Discovery

## Snake River Wheatgrass

*Elymus wawawaiensis*



### Plant Overview



Snake River wheatgrass was officially described as a new species in 1997, although this species was first recognized in 1986. The first release of Snake River wheatgrass, 'Secar', was made in 1980. At the time, Secar was released as a bluebunch wheatgrass, and this confusion has persisted in the seed trade for many years.

The two species have a strikingly similar appearance, but they can easily be separated based on floral and seedling characters. Snake River wheatgrass is always awned, while bluebunch wheatgrass may be awned or awnless. The seedlings of Snake River wheatgrass are downy in appearance, while bluebunch wheatgrass seedlings have comparatively few hairs. Snake River



wheatgrass has a smaller seed and is generally more drought and grazing tolerant than bluebunch wheatgrass. Bluebunch wheatgrass is widespread throughout the Intermountain Region and the Rocky Mountains of the Western United States, but the natural distribution of Snake River

wheatgrass is limited to the drainages of the Columbia River and the lower portion of the Snake River in eastern Washington, northern and central Idaho, and northeastern Oregon. Snake River wheatgrass is always tetraploid ( $2n=28$ ), while bluebunch wheatgrass is usually diploid ( $2n=14$ ), but occasionally tetraploid ( $2n=28$ ).

Despite its limited natural distribution, Snake River wheatgrass has been widely used in restoration seed mixes throughout the Intermountain Region of the Western United States. Because of its drought and grazing tolerance, it may be regarded as a successful surrogate for bluebunch wheatgrass in environments where these traits are important. Like bluebunch wheatgrass, Snake River wheatgrass is cross-pollinating.

'Discovery' was released in 2007. Participating in the release were the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT. Discovery



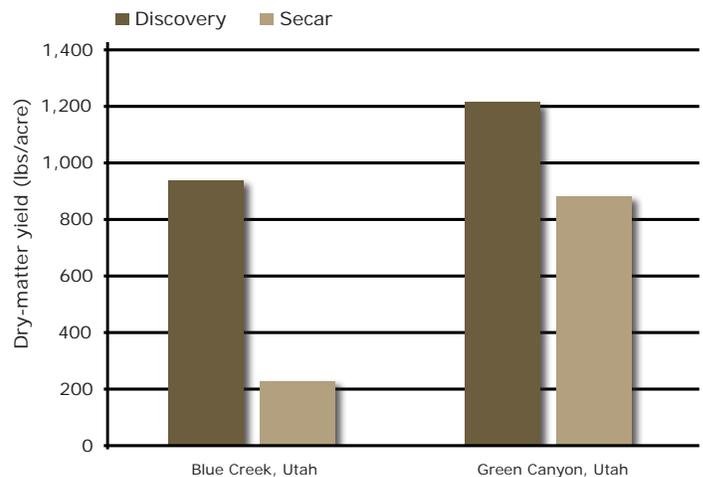
traces its origin to materials collected in Whitman and Asotin Counties in southeastern Washington and Idaho County in central Idaho. Discovery seedlings are more persistent during the summer drought than Secar seedlings, resulting in enhanced stand establishment. Thus, Discovery is

intended as an alternative to Secar.

### Plant Benefits

- ENHANCED SEED YIELDS
- IMPROVED STAND ESTABLISHMENT
- INCREASED DRY-MATTER YIELDS

**Dry-matter yield of Discovery and Secar Snake River wheatgrass (2001-2003)**



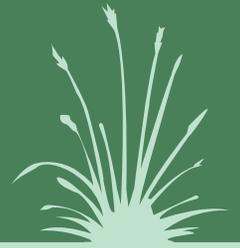
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# FirstStrike

## Slender Wheatgrass

*Elymus trachycaulus*



### Plant Overview



Slender wheatgrass is a short-lived, native bunchgrass with good seedling vigor and moderate palatability. Slender wheatgrass tolerates a wide range of conditions and is well adapted to high altitude ranges and more favorable sites on sagebrush and pine habitats and aspen and tall-mountain shrub regions. Due to its rapid seed germination and establishment, moderate salt tolerance, and compatibility with other species, slender wheatgrass is a valuable component in erosion-control and mine land-reclamation seed mixes.

Slender wheatgrass is widely adapted throughout the Western United States and Canada, where it grows at elevations from 4,500 to 10,000 feet along dry to moderately wet roadsides, streambanks, meadows, and woodlands from valley bottoms to subalpine and alpine elevations in aspen and open coniferous forests. It is, however, less drought tolerant than many of the wheatgrasses, including crested and bluebunch wheatgrass, and prefers loamy and sandy loamy soils in areas receiving at least 12 inches of annual precipitation.

'FirstStrike' was released in 2006 by the USDA-ARS and the U.S. Army—Engineer Research and Development Center for use on arid and semiarid rangelands as a rapidly establishing revegetation grass in the Intermountain Region and Northern Great Plains of the Western United States. FirstStrike was selected for persistence and overall plant vigor in response to drought.

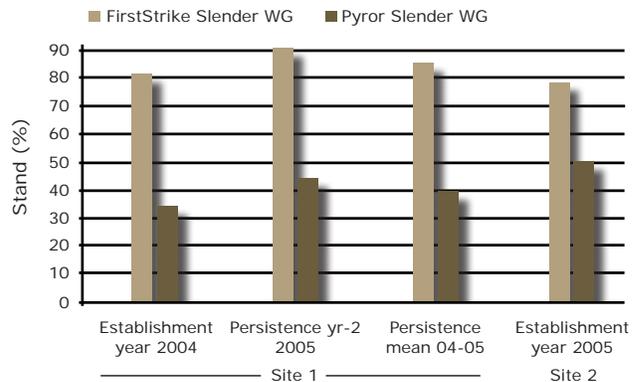
Rapid seedling establishment is the key to a successful revegetation planting in the Western United States. FirstStrike slender wheatgrass possesses enhanced germination and seedling establishment on dry rangelands. In seeded trials at Yakima Training Center (YTC), Yakima, WA; Camp Guernsey, Guernsey, WY; Fillmore, UT; and

Malta, ID, FirstStrike had significantly more seedlings per unit area than Pryor during the establishment year. At Guernsey, WY, forage production was 27 percent greater in FirstStrike than Pryor. FirstStrike also germinated 5 days earlier than Pryor on three different soil types (sandy loam, loam, and sandy).

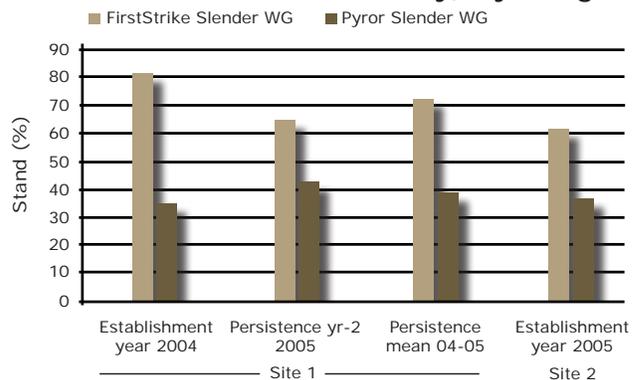
### Plant Benefits

- MORE PERSISTENT
- HIGH DROUGHT RESISTANCE
- HIGHER DRY-MATTER YIELDS
- SUPERIOR SEEDLING ESTABLISHMENT

#### Stand Persistence at Fillmore, Utah



#### Stand Persistence at Guernsey, Wyoming



### To order seed:

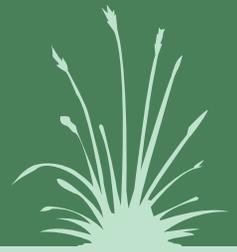
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.



# Bannock II

## Thickspike Wheatgrass

*Elymus lanceolatus* (Scribn. & J.G. Sm.) Gould



### Plant Overview



Bannock II thickspike wheatgrass evaluation nursery at Blue Creek, UT.

Thickspike wheatgrass is an important cool-season grass native to the Central and Western United States and Canada.

Because of its drought tolerance and soil stabilization characteristics owing to its aggressive rhizome development, thickspike wheatgrass is a common component of western North American revegetation seed mixes. Yet, there remains a need for thickspike wheatgrass with more rapid seedling establishment and increased seed production. For this reason, the USDA-ARS released the thickspike wheatgrass cultivar Bannock II in 2015, which possesses exceptional seedling establishment and seed production attributes.

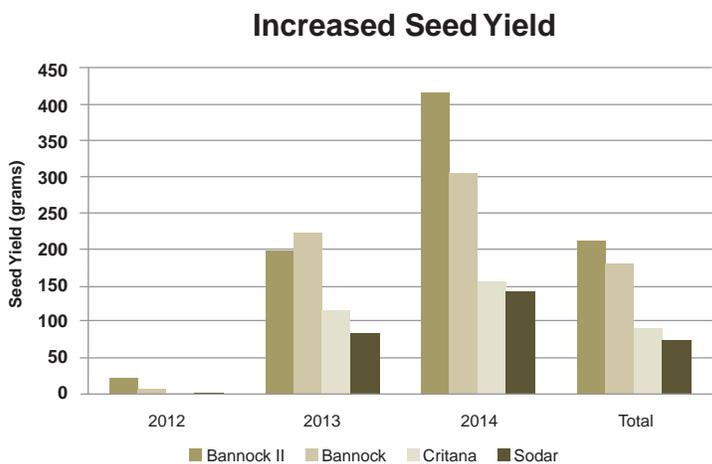
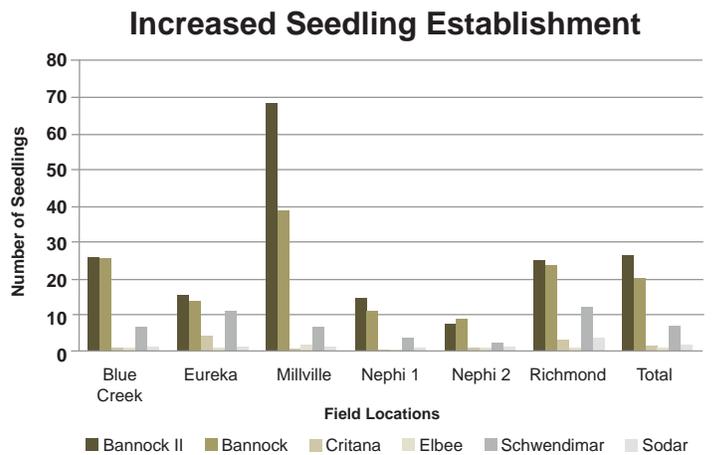
Bannock II resulted from two cycles of selection from an initial cross between cultivars Bannock and Schwendimar for increased seed production, seedling establishment, and biomass. Validation of Bannock II's seedling establishment, seed production, and ability to germinate and emerge from a deep planting depth occurred in multi-location field trials and greenhouse assays. The intended use of Bannock II is for revegetation projects on semiarid rangelands in the northern Great Basin, Snake River Plain, and Columbia Plateau.

Across six field evaluations in Utah, Bannock II possessed higher seedling establishment than the thickspike wheatgrass cultivars Bannock, Critana, Elbee, Schwendimar, and Sodar. Similarly, across 3 years of seed production at two locations (Logan and Nephi, UT), Bannock II possessed higher seed production than the thickspike wheatgrass cultivars Bannock, Critana, and Sodar. Bannock II also emerged more rapidly from deep seeding depth and had greater total emergence than the cultivars Bannock, Critana, Schwendimar, and Sodar. Bannock II is morphologically similar to its parental cultivars Bannock and Schwendimar.

The ability of Bannock II to rapidly germinate and emerge following seeding provides an important tool for land managers faced with the need to rapidly revegetate disturbed rangeland in the Intermountain United States. Additionally, its high seed yield provides a good option to seed producers to maximize production.

### Plant Benefits

- DROUGHT TOLERANCE
- SUPERIOR SEEDLING ESTABLISHMENT
- SUPERIOR SEED PRODUCTION



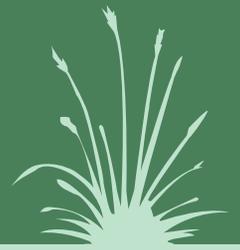
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# Continental

## Basin Wildrye

*Leymus cinereus*



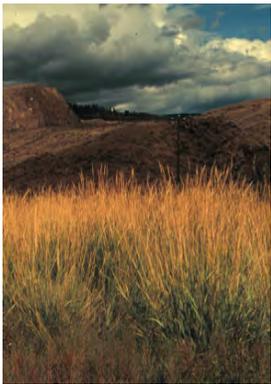
### Plant Overview



Basin wildrye is a statuesque late-maturing bunchgrass that is widespread throughout the Intermountain Region of the Western United States. It is highly drought tolerant once established, but in more arid regions, it tends to occupy ravines where water occasionally accumulates. The use of this species has been limited by its weak seedling vigor and poor seedling establishment.

Basin wildrye consists of two races

having distinct chromosome numbers. Tetraploids (2n=28) are found east of the Continental Divide and in Utah, southern Idaho, Montana, Wyoming, New Mexico, and Arizona, while octoploids (2n=56) are found in the northern Intermountain Region in Washington and British Columbia. Tetraploids and octoploids overlap in northeastern California, northern Nevada, and Oregon. Basin wildrye is predominately cross-pollinating.



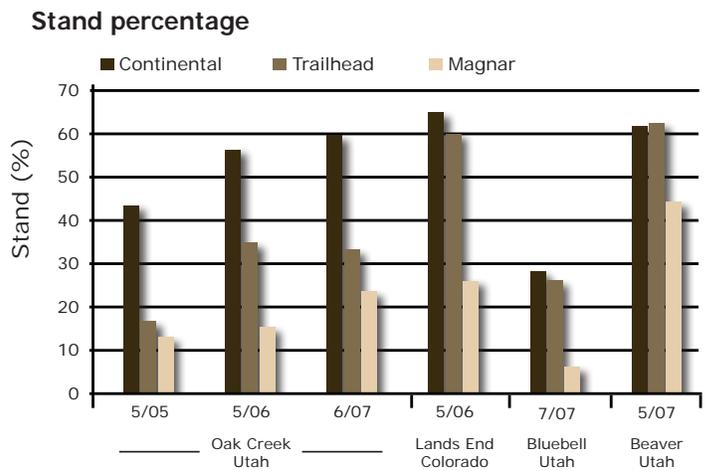
'Continental' was released in 2008 by the USDA-ARS, the Upper Colorado Environmental Plant Center, the USDA-NRCS, and the Agricultural Experiment Station, Utah State University, Logan, UT. Continental was developed by hybridizing 'Magnar' (2n=56) and a chromosome-doubled version (2n=56) of 'Trailhead' (2n=28) followed by selection for seedling and mature-plant vigor.

During the summer, Magnar develops a distinct bluish wax on its leaves and stems, while Trailhead remains green. In Continental, about three-fourths of the plants are bluish. Continental has displayed similar or superior stand establishment to Trailhead and Magnar in evaluation trials in west-central Utah, northeastern Utah, southwestern Wyoming, and northwestern Colorado. Continental is expected to be adapted in areas of the Intermountain Region where Trailhead and Magnar have been used successfully.

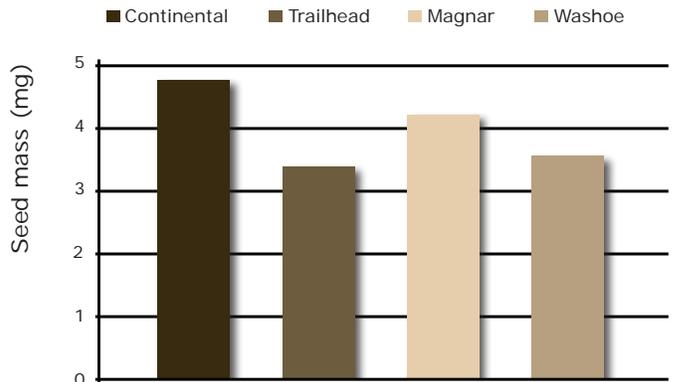
### Plant Benefits

- RAPID SEEDLING ESTABLISHMENT
- ABUNDANT SEED YIELD

#### Stand percentage and seed mass of basin wildrye



#### Seed mass at Millville, UT (2009)



### To order seed:

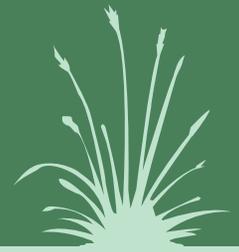
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.



# Sand Hollow Germplasm

## Big Squirreltail

*Elymus multisetus*



### Plant Overview



Big squirreltail is a native short-lived perennial bunchgrass that is noted for its ability to compete with invasive annual weeds such as cheatgrass and medusahead wildrye. This grass is most common in California, Nevada, Oregon, and Idaho. Because of its prominent awns, this grass is not considered to be an important forage species, but it is popular in restoration mixes.

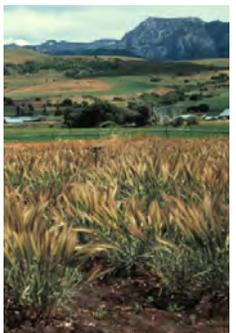
Sand Hollow was released in 1996 as a selected class Pre-Variety Germplasm (natural track) and is predominately self-pollinated. Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, and the USDA-Natural Resources Conservation Service.



Awns of Sand Hollow.

Sand Hollow was collected in Gem County, Idaho, near the town of Emmett. The collection site was a west-facing slope consisting of loamy coarse sand where the average annual precipitation is about 11 inches.

In general, big squirreltail is found in wetter habitats than bottlebrush squirreltail. However, Sand Hollow was collected from the driest portion of big squirreltail's distribution. Seed harvest of Sand Hollow requires close attention because of its tendency to shatter. Care must also be taken in debarding during threshing, so as not to damage the seed and reduce viability. Sand Hollow was the first squirreltail release and remains the only released big squirreltail.



Seed production of Sand Hollow.



Typical rangeland seeding.

### Plant Benefits

- ABUNDANT SEED YIELDS
- COMPETITIVE WITH INVASIVE ANNUAL GRASS

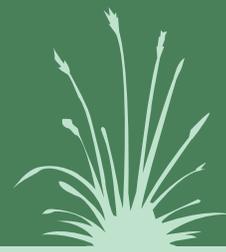
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.

# Toe Jam Creek Germplasm

## Bottlebrush Squirreltail

*Elymus elymoides* ssp. *californicus*



### Plant Overview



Bottlebrush squirreltail is an important early-seral grass that is utilized for rangeland restoration. The *californicus* subspecies can be found in montane habitats from British Columbia to California and east to Nevada, central Idaho, northern Utah, northwestern Wyoming, and southwestern Montana. Bottlebrush squirreltail is predominately self-pollinated, but when it coexists with bluebunch wheatgrass, sterile hybrid plants are not uncommon. The seed of ssp. *californicus* squirreltail is larger than the more common ssp. *elymoides* bottlebrush squirreltail, but the general appearance and stature of these two squirreltails is similar. Like the other squirreltails, ssp. *californicus* is susceptible to seed shattering.

Toe Jam Creek was released in 2003 as a selected class Pre-Variety Germplasm (natural track). Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, the USDA-NRCS, and the U.S. Department of Interior (USDI)-Bureau of Land Management. Toe Jam Creek was collected in northwestern Elko County, Nevada, about 8 miles west of the town of Tuscarora. Elevation at the collection site was 6,000 feet, and average annual precipitation at Tuscarora is 12 inches. Toe Jam Creek's intended area of use is the northern Great Basin and the lower Snake River Plain of the Western United States.

Toe Jam Creek was released in 2003 as a selected class Pre-Variety Germplasm (natural track). Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, the USDA-NRCS, and the U.S. Department of Interior (USDI)-Bureau of Land Management. Toe Jam Creek was collected in northwestern Elko County, Nevada, about 8 miles west of the town of Tuscarora. Elevation at the collection site was 6,000 feet, and average annual precipitation at Tuscarora is 12 inches. Toe Jam Creek's intended area of use is the northern Great Basin and the lower Snake River Plain of the Western United States.



Toe Jam Creek in replicated trial (Beaver, UT).



Seed production field.

### Plant Benefits

- HIGH SEED WEIGHT
- ENHANCED SEEDLING VIGOR
- ABUNDANT SEED YIELDS
- POPULAR IN RESTORATION SEED MIXES

### To order seed:

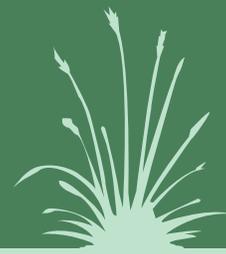
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.



# Pleasant Valley and Antelope Creek Germplasms

## Bottlebrush Squirreltail

*Elymus elymoides*



### Plant Overview

A new bottlebrush squirreltail subspecies has recently been recognized based on DNA data (Larson et al. 2003). Pending taxonomic revision, Pleasant Valley and Antelope Creek germplasms are provisionally referred to as *Elymus elymoides* ssp. "C". This subspecies is most common in central and eastern Oregon, but it also extends into north-eastern California, northern Nevada, and southern Idaho. This subspecies is taller, later in maturity, and more common at higher elevations than the *elymoides* or *californicus* subspecies of bottlebrush squirreltail.

Pleasant Valley was released in 2010 as a selected class Pre-Variety Germplasm (natural track). Participating in the release were the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT (UAES). Pleasant Valley was chosen for release based on its high seed yield relative to other accessions from the eastern Blue Mountains of Oregon. It was collected on a southwest-facing slope near Interstate-84, exit 315 in Baker County, Oregon, about 9 miles southeast of Baker City. Elevation at the site is 3,825 feet and average annual precipitation is 14 inches. Pleasant Valley is intended for use in the eastern Blue Mountains of Oregon, Washington, and Idaho.

Antelope Creek was released in 2009 as a selected Pre-Variety Germplasm (natural track). Participating in the release were the USDA-ARS and the UAES. Antelope Creek was chosen for release based on its high seed yield relative to other accessions collected at sites of similar precipitation level in the Western Blue Mountains and the eastern slopes and foothills of the Eastern Cascade Range in Oregon. Antelope Creek was collected in Wasco County, Oregon, about 7 miles east of the town of Antelope. Elevation at the site is 3,650 feet, and average annual precipitation is 14 inches. Antelope Creek is intended for use in the central region.



Typical collection site of bottlebrush squirreltail.

### Plant Benefits

#### Pleasant Valley

- ABUNDANT SEED YIELDS
- ADAPTED TO THE EASTERN BLUE MOUNTAINS OF OREGON

#### Antelope Creek

- ABUNDANT SEED YIELDS
- ADAPTED TO THE WESTERN BLUE MOUNTAINS AND EASTERN CASCADES OF OREGON

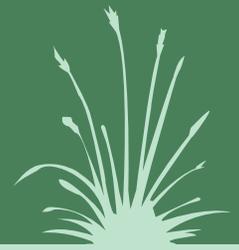
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.

# Fish Creek Germplasm

## Bottlebrush Squirreiltail

*Elymus elymoides* ssp. *elymoides*



### Plant Overview



The *elymoides* subspecies of bottlebrush squirreltail is the most common and widespread of all western U.S. squirrel-tails. It is common on valley floors throughout much of the Intermountain Region of the

Western United States. Like the other squirreltails, ssp. *elymoides* is short-lived, self-pollinating, and susceptible to shattering. Its primary use is in restoration seed mixes.

Fish Creek was released in 2003 as a selected class Pre-Variety Germplasm (natural track). Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, the USDI-Bureau of Land Management, and the USDA-NRCS. When compared with other ssp. *elymoides* populations, Fish Creek possessed high seedling emergence rates and the latest heading date. Fish Creek was collected



Typical heavily awned spike.

in Blaine County, Idaho, about 6 miles northeast of the town of Carey. Elevation at the site is approximately 4,750 feet, and average annual precipitation is about 12 inches.



Fish Creek in replicated trial (Beaver, UT).



Seed production field.

### Plant Benefits

- RAPID SEEDLING EMERGENCE
- ORIGINATES IN THE SNAKE RIVER PLAIN
- POPULAR FOR RESTORATION SEED MIXES

### To order seed:

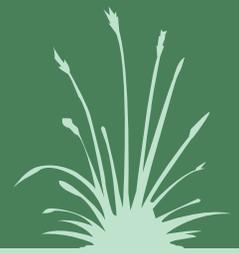
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.



# Rattlesnake Germplasm

## Bottlebrush Squirreiltail

*Elymus elymoides* ssp. *elymoides*



### Plant Overview



The most widespread of all the bottlebrush squirreltails is the subspecies *elymoides*. It frequently inhabits valley floors throughout much of the Intermountain Region of the Western United States. Like

the other squirreltails, ssp. *elymoides* is short-lived, self-pollinating, and susceptible to shattering. Its primary use is in restoration seed mixes.

Rattlesnake was released in 2007 as a selected class Pre-Variety Germplasm (genetically manipulated track). Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, and the USDI Bureau of Land Management.



Rattlesnake under replicated evaluation (Beaver, UT).

Rattlesnake was developed from accession T-1175, a population collected 4 miles northwest of the overpass of old Highway 30 over Interstate-84 near Mountain Home in Elmore County, Idaho. Elevation at the site is 3,835 feet, and estimated average annual precipitation is 12 inches. Rattlesnake is a bulk of eight lines selected from T-1175 for biomass, number of seedheads, and height. This material is intended to be used primarily in its area of origin, in the Lower Snake River Plain of Idaho.



Seed production field of Rattlesnake.



Typical bottlebrush squirreltail habitats.

### Plant Benefits

- ADAPTED TO DROUGHT CONDITIONS
- ORIGINATES IN THE SNAKE RIVER PLAIN

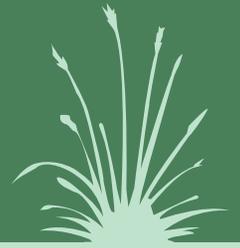
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.

# Star Lake Germplasm

## Indian Ricegrass

*Achnatherum hymenoides*



### Plant Overview



Indian ricegrass is an important bunchgrass that is found on light-textured soils throughout much of the Intermountain Region of the Western United States. Broad use of this highly variable species has been

hampered by poor seedling establishment due to very high levels of seed dormancy.

Star Lake was released in 2004 as a selected class Pre-Variety Germplasm (genetically manipulated track). Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, the USDA-NRCS, and the USDI-Bureau of Land Management. Star Lake was collected in northeastern McKinley County, New Mexico, about 14 miles northwest



Flowering habit.

of the town of Torreon. Elevation at the collection site is 6,750 feet, and average annual precipitation is about 10 inches. Star Lake was released on the basis of its high germinability, which is attributed to the thinness of the brown coverings that encapsulate the seed. Star Lake seed is relatively small and elongated in shape.

Star Lake is one of three seed morphs found at the Star Lake collection site (See image below).

### Comparison of Indian ricegrass seed morphs



Jumbo (JS)

Globose (GS)

Star Lake

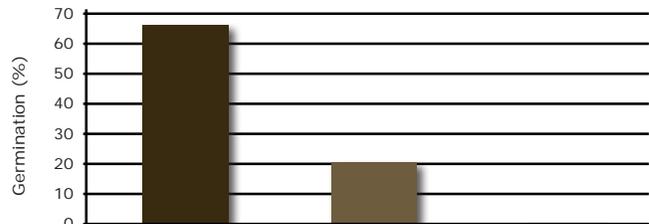


### Plant Benefits

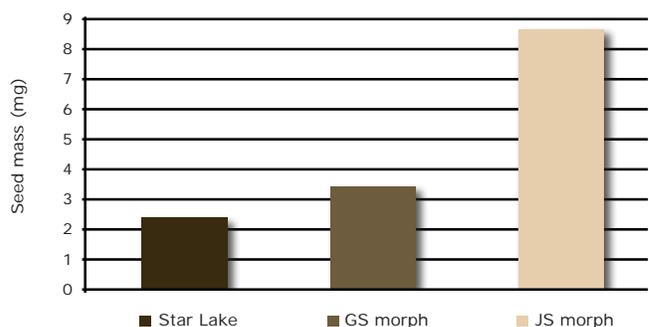
- EXCELLENT GERMINABILITY
- ADAPTED TO THE FOUR CORNERS REGION AND THE LOWER COLORADO PLATEAU

### Germination and seed mass of Indian ricegrass

#### Germination



#### Seed Mass



### To order seed:

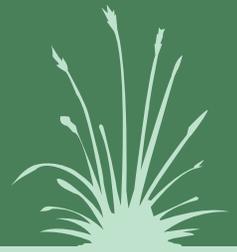
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; [stanford.young@usu.edu](mailto:stanford.young@usu.edu)) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.



# White River Germplasm

## Indian Ricegrass

*Achnatherum hymenoides*



### Plant Overview



Indian ricegrass is an important bunchgrass found on light-textured soils throughout much of the Intermountain Region of the Western United States. Broad use of this highly variable species has been hampered by poor seedling establishment due to very high levels of seed dormancy. Indian ricegrass is a highly self-pollinating species, but hybrids with several needlegrass species are known to occur.

Indian ricegrass is a highly self-pollinating species, but hybrids with several needlegrass species are known to occur.



White River was released in 2006 as a selected class Pre-Variety Germplasm (genetically manipulated track). Participating in the release were the USDA-ARS, the Agricultural Experiment Station, Utah State University, Logan, UT, and the USDI-Bureau of Land Management. The

Seed production.

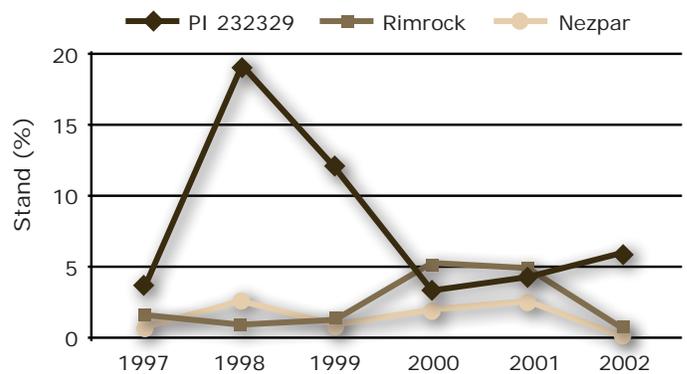
parental population of White River, PI 232329, was collected along route 64, about 24 miles east of the town of Rangely, CO. Average annual precipitation at the collection site is 10 to 12 inches, and elevation is about 5,400 feet. Thirty-two lines were selected from PI 232329 based on high germinability and seed yield, and these lines were bulked to form White River. It is anticipated that White River will be used in the Upper Colorado Plateau of eastern Utah, western Colorado, and the Basin Province of southern Wyoming.



### Plant Benefits

- VIGOROUS PLANT
- GOOD SEED YIELD
- HIGH GERMINABILITY

Stand percentage at Soda Lake, WY (1997-2002)



### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.

Indian ricegrass



Nezpar

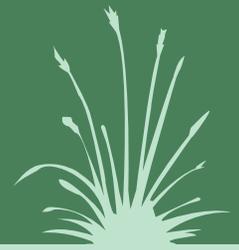
Rimrock

White River

# Reliable Germplasm

## Sandberg Bluegrass

*Poa secunda*



### Plant Overview



Reliable was released in 2004 by the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT, as a Selected Class (natural track) germplasm, which is eligible for seed certification under Association of Seed Certifying Agencies guidelines. Reliable was developed in cooperation with the U.S. Army Corps

of Engineers and the Strategic Environmental Research and Development Program (SERDP) project to identify resilient plant characteristics and develop wear-resistant plant cultivars for use on military training lands. Reliable Sandberg bluegrass is a multi-origin germplasm assembled to ensure adaptation across a broad range of ecological sites and provide a source of abundant seed. Reliable has been successfully established in rangeland trials in Utah, Idaho, and Washington where it has displayed better establishment and persistence than standard Sandberg check cultivars.

Sandberg bluegrass is an important understory grass in bluebunch wheatgrass-sagebrush ecological sites of the Intermountain and Northwest Regions of the Western United States. It is a medium-lived, perennial bunchgrass valuable for soil erosion control, spring livestock and wildlife grazing, and biodiversity.



Reliable was developed by compositing seed from plants originating from 28 locations, with each location potentially containing unique co-adapted gene complexes. Three-hundred fourteen Sandberg bluegrass plants were initially collected as live plants from 28 locations at the U.S. Army Yakima Training

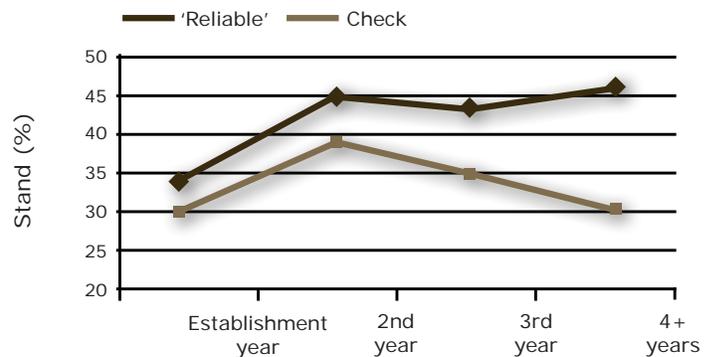
Center (YTC) in Yakima, WA. The collection locations had the following range of characteristics: annual precipitation (5 to 12 in.); surface soil texture (loam to sand); soil depth (6 to 72 in.); slope (0 to 45%); aspect (north, south, east, and west); and elevation (800 to 3,400 ft.). Collections were made in foothill, plain, canyon bottom, canyon summit, ridge top, canyon side, and bottom flat environments.

Sandberg bluegrass resists trampling and is often one of the first species to naturally reestablish on sites disturbed by fire, large equipment and vehicles, and animals. Thus, Reliable's intended use is for rehabilitation and restoration of western rangelands. It may be particularly useful as a pioneer plant species in severely disturbed environments, such as military training sites and after wildfires.

### Plant Benefits

- SUPERIOR PERSISTENCE
- BROAD GENETIC VARIATION
- HIGH DROUGHT TOLERANCE
- ORIGINATES FROM FREQUENTLY DISTURBED SITES
- RELIABLE SEEDLING ESTABLISHMENT IN DIVERSE ENVIRONMENTS

Stand persistence of 'Reliable' Sandberg Bluegrass



### To order seed:

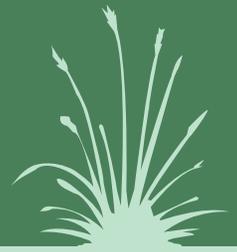
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.



# Cucharas Germplasm

## Green Needlegrass

*Nassella viridula*



### Plant Overview



Green needlegrass is an important native bunchgrass in the Western Great Plains and Rocky Mountains, ranging from New Mexico to Alberta, Canada. It is a useful forage species and is especially tolerant of grazing. Green needlegrass is an excellent seed producer, but stand establishment has been limited by high levels of seed dormancy. Although green needlegrass is predominately self-pollinated, it can

produce sterile progeny upon hybridization with Indian ricegrass.



Cucharas was released in 2003 as a selected class Pre-Variety Germplasm (natural track). Participating in the release were the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT. The original collection of Cucharas was made near Cucharas Junction, Huerfano County, Colorado, approximately 4 miles northeast of the town

of Walsenburg. Cucharas was chosen for release because of its high productivity and seed yield relative to 'Lodorm', which originated in North Dakota.



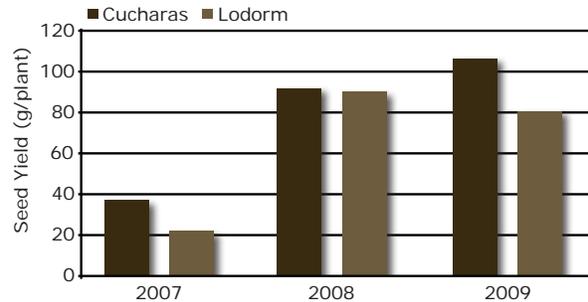
Lodorm

Cucharas

### Plant Benefits

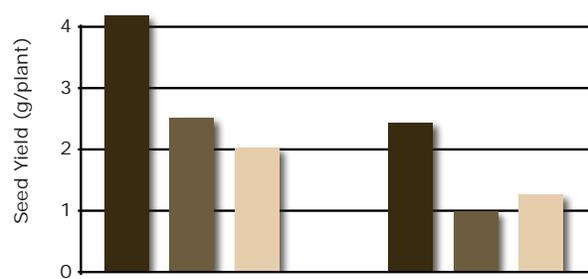
- ABUNDANT SEED YIELDS
- TOLERANT OF GRAZING

#### Dry-matter yield

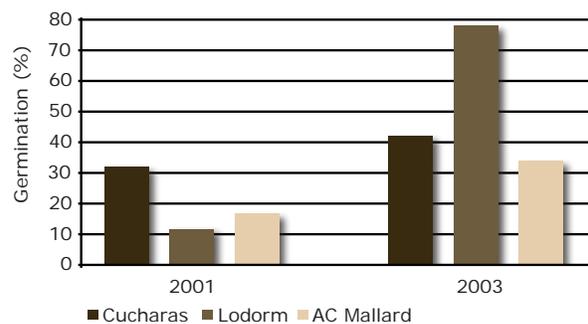


#### Seed yield and germination of green needlegrass germplasm (2001,2003)

##### Seed yield



##### Germination



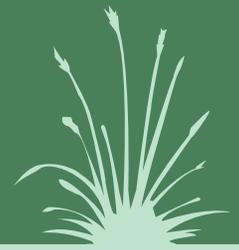
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.

# Yakima Germplasm

## Western Yarrow

*Achillea lanulosa*



### Plant Overview



Yakima was released in 2004 by the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT, as a Source Identified Class (natural track) germplasm, which is eligible for seed certification under Association of Seed

Certifying Agencies guidelines (AOSCA 2001). Yakima was developed in cooperation with the U.S. Army Corps of Engineers and the Strategic Environmental Research and Development Program (SERDP) project to identify resilient plant characteristics and develop wear-resistant plant cultivars for use on military training lands. Yakima western yarrow is a multi-origin germplasm assembled to ensure adaptation across a broad range of ecological sites and provide a source of readily available seed.

Yakima western yarrow demonstrated vigorous growth in field nurseries near Logan, UT, and has been successfully established in field trials in Utah, Idaho, and Washington where it established and persisted equal to or better than a common variety of western yarrow. A range of phenotypic (visual) differences has been observed in the seed production field indicating the broad range of phenotypic diversity within this germplasm.

Yakima was initially developed by combining germplasm from multiple environments, each possibly possessing a different co-adapted gene complex to enhance its establishment across a range of semiarid ecosystems. This wildland seed (generation G0) was collected from 27 locations representing seven different ecological sites at the U.S. Army Yakima Training Center (YTC) in Yakima, WA. The collection locations had the following range of characteristics: annual precipitation (6 to 11 in.); surface soil texture (loam to sand); soil depth (6 to 72 in.); slope (1 to 30%); aspect (north, south, east, and west); and elevation (1,600 to 2,800 ft.). The collections were made in foothill, plain, canyon bottom, canyon summit, ridge top, canyon side, and bottom flat environments.

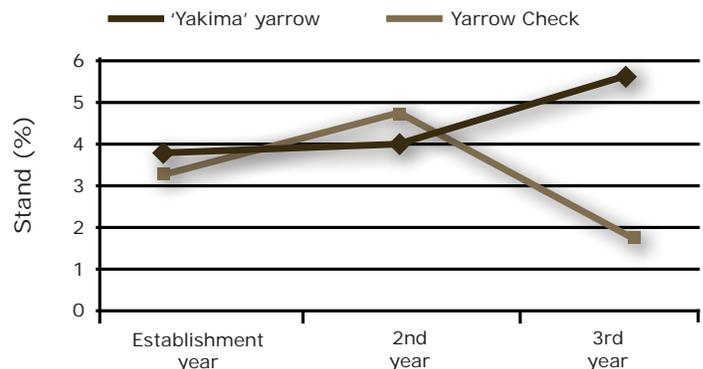
Western yarrow is an important, abundant forb in blue-bunch wheatgrass–sagebrush plant communities of the

Intermountain and Northwest Regions of the United States. It is rhizomatous and drought tolerant, enabling it to recruit into disturbed areas, and often competes well with invasive weedy plant species. Yakima western yarrow is intended for use in rehabilitation and restoration of western U.S. rangelands. It will be particularly useful in helping to stabilize and diversify severely disturbed sites, such as military training lands and burned areas.

### Plant Benefits

- ENHANCED PERSISTENCE
- BROAD GENETIC VARIATION
- HIGH DROUGHT TOLERANCE
- ORIGINATES FROM FREQUENTLY DISTURBED SITES

#### Stand Persistence of 'Yakima' in Washington



### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Early generation (G) seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association.



# Majestic and Spectrum Germplasms

## Western Prairie Clover

*Dalea ornata*



### Plant Overview



Use of a diversity of species in rangeland revegetation can help minimize weed invasion. Diverse species occupy available ecosystem niches that could otherwise be colonized by invasive weeds. Legumes are of particular interest because they biologically fix nitrogen, which can increase the productivity of associated species in plant communities. Legumes also typically contain more protein

and less fiber than many other plants at similar stages of maturity. Few North American legumes, however, are commercially available for revegetation of arid and semiarid western rangelands.



Western prairie clover is a perennial North American legume that is non-toxic to livestock and wildlife. It is found in Idaho, Nevada, Washington, Oregon, and California. Western prairie clover develops a taproot

that reaches a length of 1 to 2 feet. The species is primarily insect-pollinated. A cluster of stems arises from the crown, and stems die back during late fall and early winter. Flowers are typically pinkish to purple in color and occur in dense, cylinder-shaped spikes. The flowers of Western prairie clover bloom upward from the base of the spike to its tip during a 3-week period in June and July, depending on location and year.

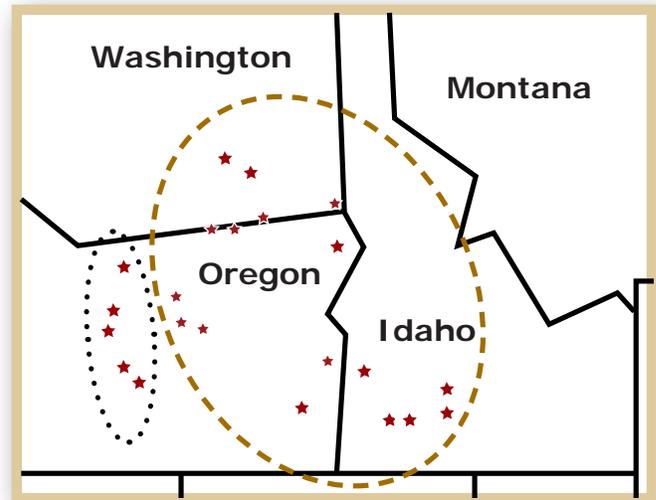


Majestic and Spectrum Germplasm were released in 2011 and are intended for use in revegetation of arid and semiarid rangelands. They are useful in increasing biodiversity, enhancing forage quality, providing a food source for birds and wildlife, and biologically fixing nitrogen. They

also can be used in habitat enhancement programs for native pollinators and in the beautification of roadsides, rest

areas, and parks. Similarly, their beautiful, showy flowers make them ideal for use in home xeriscaping applications.

Majestic Germplasm was selected for use in western Columbia Plateau (Washington) and western Blue Mountains (Oregon). Spectrum Germplasm was selected for use in the central and eastern Columbia Plateau, central and eastern Blue Mountains, northern Great Basin, and Snake River Plain of the Western United States (see image below).



- Majestic Germplasm
- Spectrum Germplasm
- ★ Collection Site

### Plant Benefits

- NITROGEN FIXER
- DROUGHT TOLERANT
- SHOWY FLOWERS

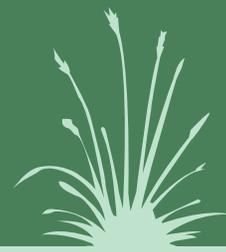
### To order seed:

Early generation (G), G0 (original generation), and G1 seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu).

# Fanny, Carmel, and Bonneville Germplasms

## Searls' Prairie Clover

*Dalea searlsiae*



### Plant Overview

Forb species enhance rangeland biodiversity and provide food and habitat resources for grazing animals, native pollinators, and wildlife (including sage-grouse) in the Western United States. Leguminous forbs biologically fix nitrogen, improve forage quality, and increase plant production in rangelands.

Searls' prairie clover is a perennial North American legume that is insect pollinated and occurs naturally in Nevada, northwestern and southern Utah, southeastern California, and northern Arizona. It is non-toxic to grazing animals, has an upright growth habit (1 to 2 ft. tall), and produces multiple stems that arise from a shallow, woody base. Flower spikes on terminal branches bear dense cylindrical clusters of showy, small pink- to purple-colored flowers. The flower spike consists of many individual flowers that bloom from the base to the tip of the spike.

Twenty collections of Searls' prairie clover were characterized for their phenotypic and genotypic variation in common gardens and with DNA-marker analysis, respectively. Two distinct genetic groups are apparent: one group comprising collections from Nevada and southern Utah (Group A) and another from northwestern Utah (Group B). Fanny and Bonneville Germplasms were released in 2015 as natural-track selected class Pre-Variety Germplasms to represent Group A and Group B, respectively. Fanny Germplasm originated from a site south of Ely, NV (12 in. annual precipitation, 6,680 ft. elevation), whereas Bonneville Germplasm originated from relatively saline soils on the shores of historic Lake Bonneville, south of Wendover, UT (7 in. annual precipitation, 4,656 ft. elevation). Carmel Germplasm was released for use on the Colorado Plateau and regions near Mt. Carmel, UT, its site of origin (14 in. annual precipitation, 5,561 ft. elevation).

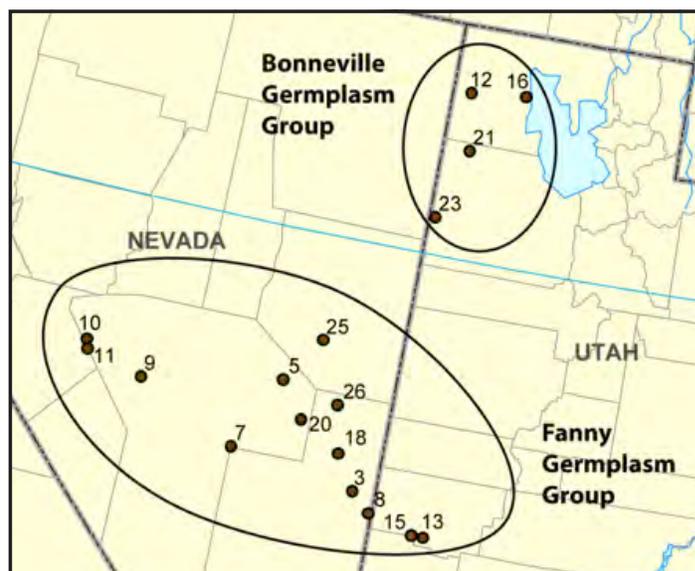
Typically in northern Utah, Fanny Germplasm flowers earlier and produces greater dry-matter yield (DMY) and number and weight of inflorescences than Bonneville Germplasm. Bonneville Germplasm should be considered for harsh sites with low annual precipitation and relatively high salinity levels. These two germplasms are intended for rangeland revegetation, biodiversity enhancement, and wildlife and pollinator habitat improvement for Great Basin rangelands. These are the first releases of this species into the commercial seed trade.



Bonneville germplasm



Fanny germplasm



Bonneville and Fanny germplasm groups as defined by molecular genotyping.

### Plant Benefits

- BIODIVERSITY ENHANCEMENT
- NITROGEN FIXATION
- DROUGHT TOLERANT
- STRIKING FLOWERS FOR POLLINATORS

### To order seed:

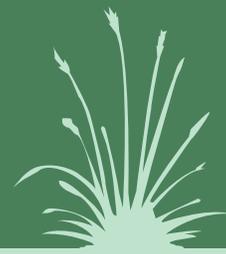
Early generation (G), G0 (original generation), and G1 seed is maintained by the USDA-ARS Forage and Range Research Laboratory at Logan, UT. Stock seed is available through the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu), and the Upper Colorado Environmental Plant Center (970-878-5003; ucepc@wreawildblue.org) for Fanny and Bonneville, and Carmel, respectively.



# NBR-1 Germplasm

## Basalt Milkvetch

*Astragalus filipes*



### Plant Overview



Arid and semiarid rangelands are usually nitrogen-limited, and only a few native legumes are commercially available for revegetation of arid and semiarid western U.S. rangelands. Legumes in rangelands and pastures fix atmospheric nitrogen (N) in association with rhizobia bacteria, enhance plant diversity, and increase the quantity and quality of forage for

livestock and wildlife. They also increase the productivity of associated species in plant communities by releasing symbiotically fixed N through root exudates and decaying plant litter. Legumes also generally contain more protein and less fiber than grasses at similar stages of maturity.

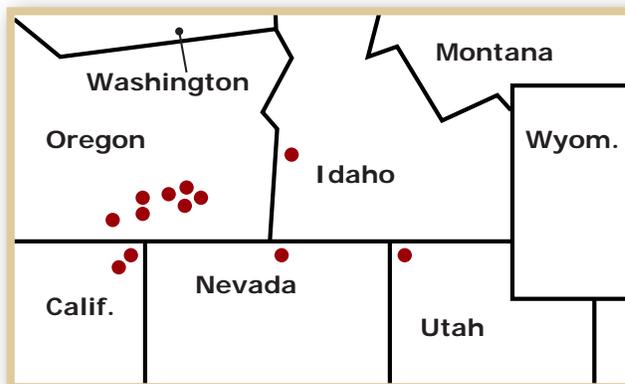


Basalt milkvetch, also known as threadstalk milkvetch, is a perennial North American legume that is found in California, Idaho, Nevada, Oregon, Utah, Washington, northern Mexico, and British Columbia, Canada. It is a relatively tall (up to 3 ft.), sparsely leafed plant with creamy white to pale-yellow flowers. Basalt milkvetch has

a thick, woody taproot with clumped stems arising from the crown. Its long, thin seedpods (which dry to a papery texture) are attached to the stem with a characteristic thread-like attachment. Basalt milkvetch occurs commonly on basalt-derived, sandy, loamy or gravelly soils in sagebrush-steppe, pinyon-juniper woodland, ponderosa pine forest, or chaparral ecosystems.

Its upright growth habit and prominence in recently burned areas makes basalt milkvetch a promising species for rangeland revegetation. Its prevalence after fire may be especially important considering the increasing fire frequency on western U.S. rangelands and the importance of fire as a management tool. Although many species of *Astragalus* are toxic to livestock, basalt milkvetch has non-detectable or extremely low levels of toxic compounds.

NBR-1 basalt milkvetch selected class Pre-Variety Germplasm was derived from 12 collections that originated from the northern Great Basin in Utah, Idaho, Oregon, and California. Elevations of these collection sites ranged from (4,049 to 6,148 ft.), and precipitation varied from 8 to 18 inches. NBR-1 Germplasm was released in 2008 and is intended for rangeland revegetation, rangeland diversity enhancement, and wildlife and pollinator habitat improvement. Its showy flowers and drought-resistant characteristics make it of interest for xeriscaping applications in home gardens.



● Collection Site

### Plant Benefits

- NITROGEN FIXER
- DROUGHT RESISTANT
- AESTHETIC FLOWERS

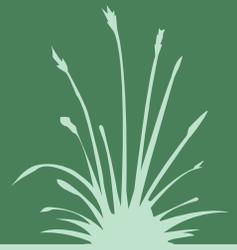
### To order seed:

Early generation (G), G0 (original generation), and G1 seed is maintained by the USDA-ARS-FRRL at Logan, UT. Stock seed is available through the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu).

## Vavilov II

### Siberian Wheatgrass

*Agropyron fragile*



#### Plant Overview



Vast areas of semiarid rangeland in the Western United States are severely disturbed, frequently burned, increasingly eroded, and infested with troublesome weeds. Reseeding disturbed rangelands with genetically improved plant materials that are competitive enough to replace existing undesirable vegetation

is often the most plausible and economically feasible way to reclaim such sites.

One such cultivar is the newly released Siberian wheatgrass Vavilov II, which was developed by the USDA-ARS and released in 2008 in cooperation with the U.S. Army Engineer Research and Development Center and the USDA-NRCS.

Vavilov II is an improved cultivar of Siberian wheatgrass that was derived from collections originating from the steppes of Kazakhstan and selected clones of the cultivar Vavilov. This new cultivar was selected for increased seedling establishment and stand persistence in response to drought. Vavilov II expands the genetic base of the cultivar Vavilov and has been evaluated extensively on ecological sites in the Western United States. It has superior seedling establishment and stand persistence when compared to Vavilov.

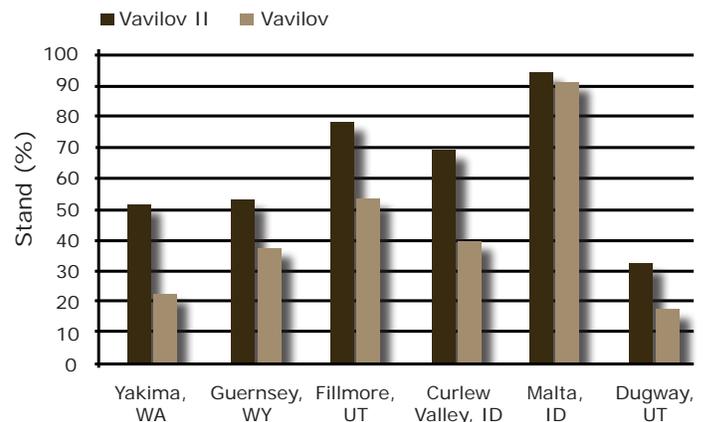
In North America, Vavilov II is well-adapted to a wide range of ecological sites and zones that receive as little as 7 to 8 inches of precipitation in regions of the northern and central Great Plains, and in the Intermountain Region, where it is a long-lived, drought-tolerant, bunch-type grass.

Vavilov II is noted for its ability to establish quickly on sandy soils. It is adapted to foothills, sagebrush, ponderosa pine, mountain brush, and pinyon-juniper ecological zones. Vavilov II is one of the few grasses that can compete with difficult-to-control weeds such as cheatgrass, halogeton, and medusahead wildrye in arid environments. Vavilov II is recommended primarily for soil conservation on dry sandy soils, where it is tolerant to grazing by wildlife and livestock.

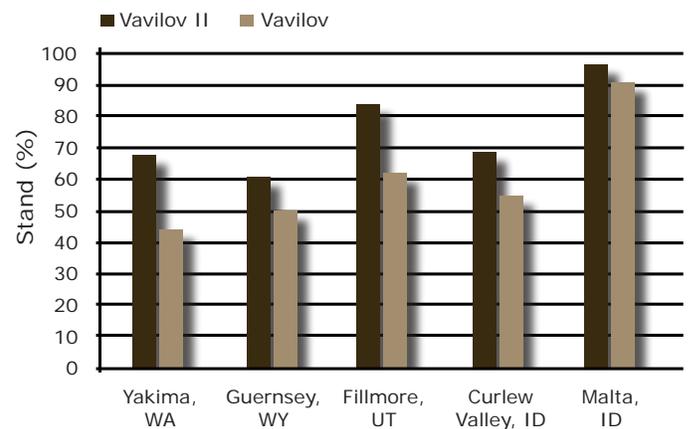
#### Plant Benefits

- HIGH STAND PERSISTENCE
- IMPROVED DROUGHT TOLERANCE
- SUPERIOR SEEDLING ESTABLISHMENT

#### Stand Establishment



#### Stand Persistence



#### To order seed:

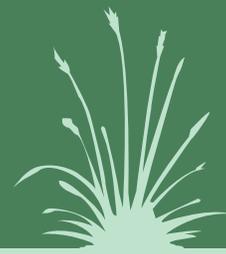
Check with local seed companies to determine availability, or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) or the Idaho Foundation Seed Program (208-423-6655; Williams@kimberly.uidaho.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the following contacts: the Utah Crop Improvement Association and the Idaho Foundation Seed Program.



# Stabilizer

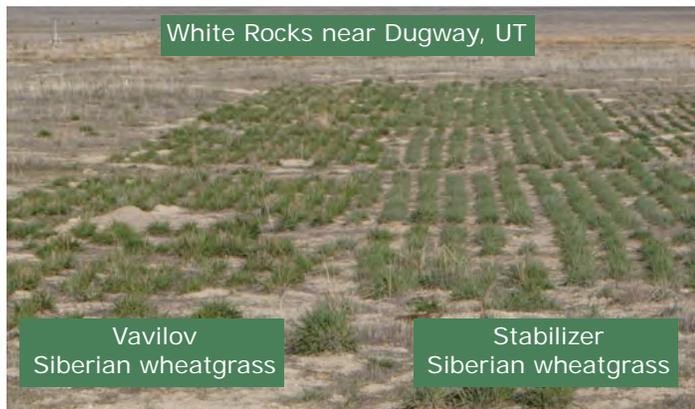
## Siberian Wheatgrass

*Agropyron fragile*



### Plant Overview

Vast areas of semiarid rangelands in the Western United States are currently classified as severely disturbed. In addition, based on predicted climate-change models for semiarid rangelands, trends toward hotter and drier conditions will increase, increasing the already high rate of rangeland degradation, particularly on semiarid ecosystems. With these changes, the frequency and intensity of wildfires will expand. There is a need to develop a drought-tolerant grass that is low-growing, can establish and compete with invasive species such as cheatgrass and medusahead, and maintain its green color throughout the growing season.



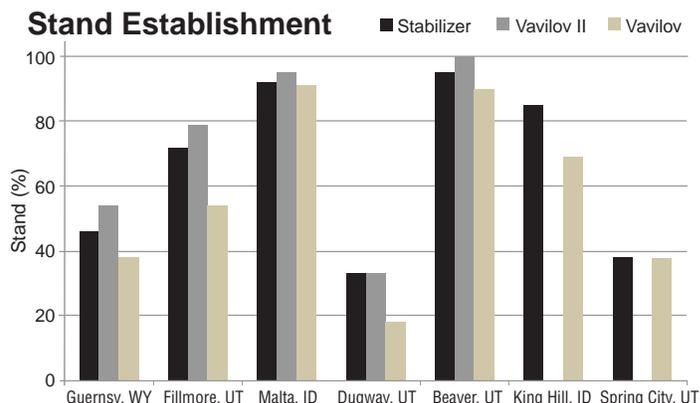
The USDA-ARS-FRRL released a new Siberian wheatgrass cultivar ‘Stabilizer’ in 2011. Stabilizer was selected for seedling establishment, persistence, seed production, pubescence, and reduced forage yield. It has been extensively evaluated at semiarid sites representative of different ecological regions in the northern plains and Western United States. Overall, it has maintained its short growth habit and color with seedling establishment and persistence similar to Vavilov and Vavilov II in these environments. This unique cultivar is lower growing, maintains its blue-green color throughout the growing season, but produces less forage than Siberian wheatgrass cultivars Vavilov and Vavilov II. It was developed for use on arid and semiarid rangelands as a low growing, rapid establishing revegetation grass for use on rangelands and roadsides, and as a grass component in fire strip plantings in the Intermountain West, Great Basin, and Northern Great Plains Regions of the Western United States. Due to its rapid establishment and persistence, Stabilizer can successfully compete against troublesome weeds such as cheatgrass, medusahead rye, and others, which frequently occupy the targeted sites.

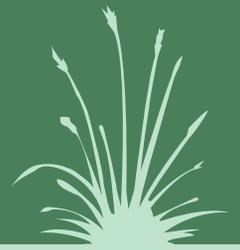


Stabilizer is the only true Siberian wheatgrass to be released, since recent reports suggest that P-27, Vavilov, and Vavilov II have some introgression with *Agropyron desertorum*. Stabilizer has a narrower genetic base than cultivars of Siberian wheatgrass and has been evaluated extensively on rangeland sites in the Western United States with seedling establishment and persistence similar to Vavilov II.

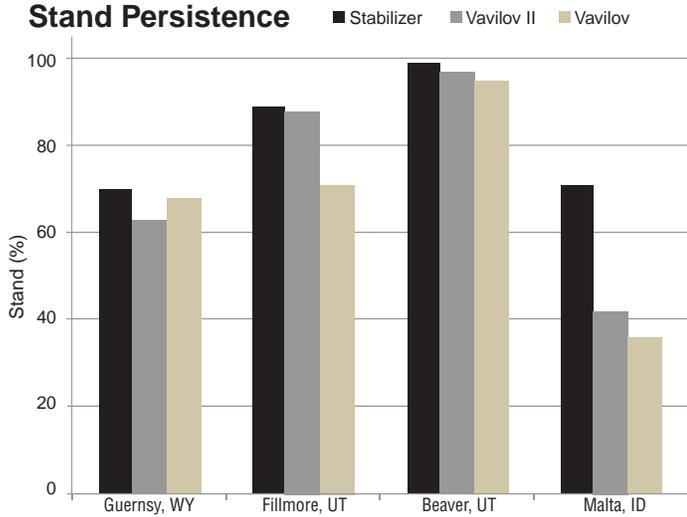
### Plant Benefits

- LOW GROWTH HABIT
- DROUGHT TOLERANT
- ENHANCED SEEDLING VIGOR
- PERSISTENCE UNDER HARSH GROWING CONDITIONS
- USED FOR RANGELANDS, ROADSIDES, AND SOIL CONSERVATION





## Stand Persistence



## To order seed:

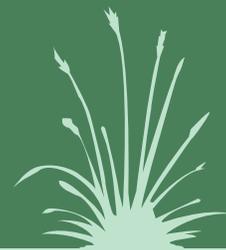
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; [stanford.young@usu.edu](mailto:stanford.young@usu.edu)) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.



# Hycrest II

## Crested Wheatgrass

*Agropyron cristatum*



### Plant Overview

It has been estimated that cheatgrass (*Bromus tectorum*) has displaced approximately 10 million hectare of perennial vegetation in the Great Basin. During the past 20 years, the frequency and size of cheatgrass infestations have continued to increase, which enhances fire frequency, destroys soil structure, and reduces the economic profitability of western U.S. rangelands. The control of cheatgrass without replacement by desirable perennial species frequently results in the reestablishment of cheatgrass or other noxious weeds on disturbed rangeland. Rapid seedling growth and the ability to compete against cheatgrass are two characteristics that perennial grasses must have for successful establishment on semiarid western rangelands.

Crested wheatgrass is one of only a few grasses that have the ability to compete with difficult-to-control weedy annuals such as cheatgrass, halogeton, and medusahead on semiarid rangelands that receive between 10 to 15 inches of annual precipitation. Crested wheatgrass is a long-lived, drought-tolerant, bunch to moderately rhizomatous range grass that is adapted to a wide range of ecological sites including foothills, sagebrush, ponderosa pine, mountain brush, and pinyon-juniper habitats.

#### Competitiveness of crested wheatgrass



1st Year

2nd Year

3rd Year

Hycrest II crested wheatgrass was released by the USDA-ARS and the Utah Agricultural Experiment Station, Utah State University, Logan, UT, in 2008, and is intended for use on arid and semiarid rangelands as a rapidly establishing revegetation grass in the Intermountain Region and Northern Great Plains of the Western United States. Hycrest II was selected for improved seedling establishment under dryland conditions.

Hycrest II produces more seedlings per unit area during the establishment year than Hycrest at Bluecreek, UT; Green

Canyon, UT; Mandan, ND; Miles City, MT; Dugway, UT; and Curlew Valley, ID. Due to Hycrest II's increased seedling establishment potential



Hycrest II

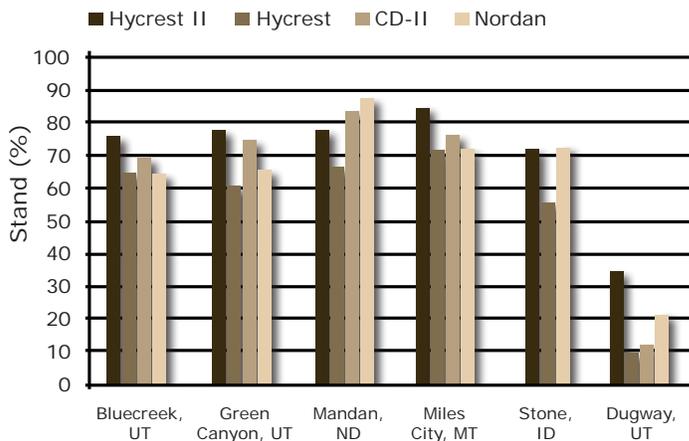
(particularly under harsh dry environments), it is intended to replace Hycrest for reseeding of severely disturbed range sites on heavier soils receiving less than 15 inches of annual

precipitation. It is recommended that Hycrest II be planted as a component in seed mixes and not as a monoculture.

### Plant Benefits

- RAPID SEEDLING ESTABLISHMENT
- INCREASED DROUGHT TOLERANCE
- INCREASED STAND PERSISTENCE UNDER DROUGHT

#### Stand Establishment



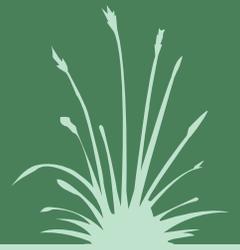
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.

# Bozoisky – II

## Russian Wildrye

*Psathyrostachys juncea*



### Plant Overview



Russian wildrye is a long-lived bunchgrass. Most of the forage of this species is produced in the basal leaves that grow rapidly in spring and remain palatable throughout the summer and fall, as long as soil moisture is available. In

North America, this species has been successfully seeded most often on arid and semiarid rangelands of the Northern Great Plains and Intermountain Regions in areas that receive above 8 inches of annual precipitation. It is adapted to heavy grazing, and once established, Russian wildrye competes effectively with undesirable plants (for example, weeds and annuals).

Russian wildrye is best adapted to the highly fertile loam and clay soils of the Intermountain Region of the Western United States, although acceptable stands can be obtained on a wide range of soil types. Forage production and stand persistence decline on low fertility soils. Nevertheless, Russian wildrye is exceptionally tolerant of cold and drought. Although its resistance to drought exceeds that of crested wheatgrass, it is more difficult to establish. Within the Intermountain Region, Russian wildrye is adapted to sagebrush, mountain-brush, and pinyon-juniper environments. It is moderately tolerant of saline and alkaline soils, and is particularly productive on soils too alkaline for crested wheatgrass and too dry for tall wheatgrass.



Bozoisky

Bozoisky II

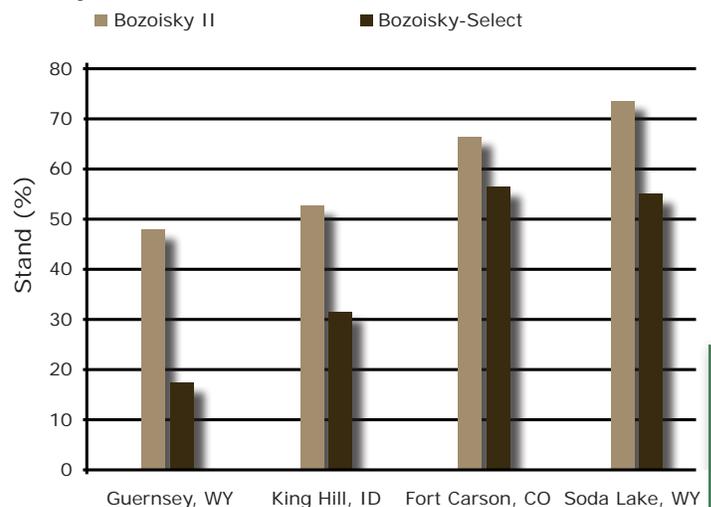
Bozoisky II Russian wildrye was released in 2006 for use on arid and semiarid rangelands as a revegetation and

winter forage grass in the Intermountain Region and Northern Great Plains of the Western United States. Bozoisky II was selected for seedling establishment, seed mass, seed yield, plant vigor, forage production, and response to drought. It has been extensively evaluated on rangeland sites in the Western United States, where it has been shown to have equal or greater seedling establishment than commercially available cultivars. In seeded trials at Guernsey, WY, King Hill, ID, and Soda Lake, WY, Bozoisky II had significantly more seedlings per unit area than did Bozoisky-Select.

### Plant Benefits

- RAPID SEEDLING ESTABLISHMENT
- INCREASED DROUGHT TOLERANCE
- INCREASED STAND PERSISTENCE AND FORAGE PRODUCTION UNDER DROUGHT

#### Superior Stand Establishment



### To order seed:

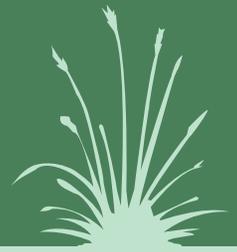
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.



# Mustang

## Altai Wildrye

*Leymus angustus*



### Plant Overview



Altai wildrye is a long-lived perennial bunchgrass with short creeping rhizomes that has excellent winter hardiness and drought resistance. Altai wildrye is native to western Siberia, in the Altai Mountain Region between Siberia and Mongolia, and is widely distributed throughout Kazakhstan.

It is most often found on semi-desert, alkaline meadows, steppes, on sandy or rocky river edges, and in lake valleys. It is well adapted to loam and clay soils. Altai wildrye is almost as productive as tall wheatgrass on saline soils.

Forage of Altai wildrye cures well and maintains its nutritional value better during the late summer and early fall than many cool-season grasses. Erect culms and moderate forage quality make Altai wildrye a valuable species for extending the grazing season into the fall and winter.

In the past, the major limitation for the use of Altai wildrye was its poor seedling establishment and low seed yields. In 2004, the USDA-ARS and the Agricultural Experiment Station, Utah State University, Logan, UT, released 'Mustang' Altai wildrye with increased seedling establishment and forage yield.



Mustang

Prairieland

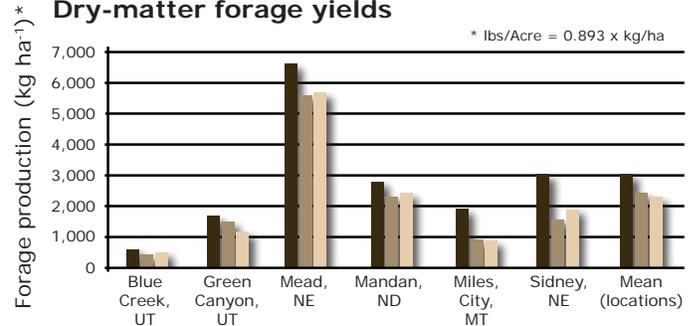
Mustang Altai wildrye has been evaluated at Blue Creek, UT; Green Canyon, UT; Mead, NE; Sidney, NE; Mandan, ND; and Miles City, MT, for forage production, stand establishment, and persistence.

Mustang produced significantly more forage than cultivars Prairieland and Pearl Altai wildrye, and Magnar and Trailhead basin wildrye. Except at Mead, NE, Mustang had superior initial stands over the other Altai and basin wildrye cultivars examined. After 4 years, Mustang was more persistent than Prairieland and Pearl.

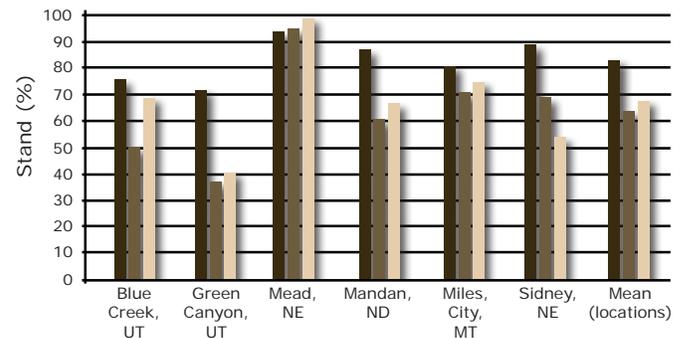
### Plant Benefits

- HIGHER DRY-MATTER YIELDS
- SUPERIOR PERSISTENCE
- SUPERIOR INITIAL STANDS

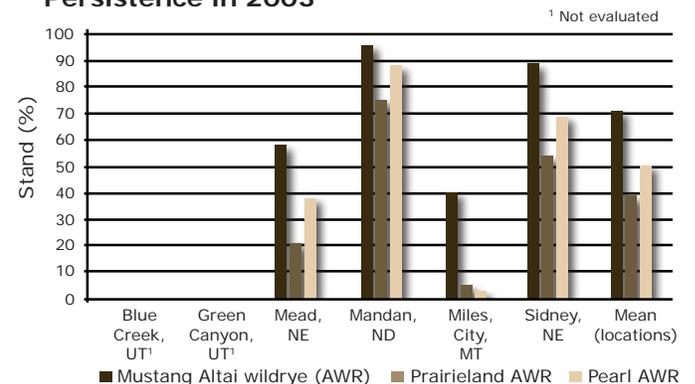
#### Northern Plains Area Regional Trials Dry-matter forage yields



#### Initial Stand Establishment in 2001



#### Persistence in 2003



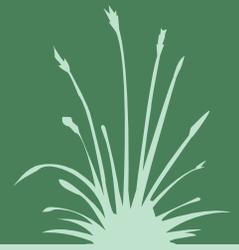
### To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.

# NewHy

## RS Hybrid

*Elymus hoffmannii*



### Plant Overview



NewHy RS hybrid wheatgrass is a cross between quackgrass and bluebunch wheatgrass. This cross combines the vigor, productivity, salinity tolerance, and persistence of quackgrass with the drought resistance, bunch growth habit, and seed and forage quality of bluebunch wheatgrass. The rhizome development in NewHy is comparable to intermediate wheatgrass.

This new hybrid cultivar is recommended for range sites and pastures with moderate salinity problems and that receive at least 14 to 16 inches of effective annual precipitation. The forage quality of NewHy is excellent. NewHy begins growth early in the spring and retains a more succulent and palatable forage for livestock and wildlife later in the growing season than all other wheatgrass germplasm evaluated on semiarid sites. Under high soil fertility and adequate irrigation, forage yields of NewHy are lower than other pasture grasses (that is, orchardgrass, meadow brome, and tall fescue). However, on saline soils where irrigation is limited or absent, NewHy will persist and provide high-quality forage when other pasture grasses are short-lived and lack productivity. Salinity tolerance of NewHy approaches tall wheatgrass.



Meadow brome, NewHy, Meadow brome, Tall fescue.

Under hay management, NewHy should be cut at the pre-heading stage to maximize forage quality. When harvested later, forage quality declines as plant maturity increases. Under proper management, one can expect two crops of hay from a NewHy field per year. Another management

option is to harvest a hay crop in early summer and graze the regrowth in late fall and early winter as winter forage.



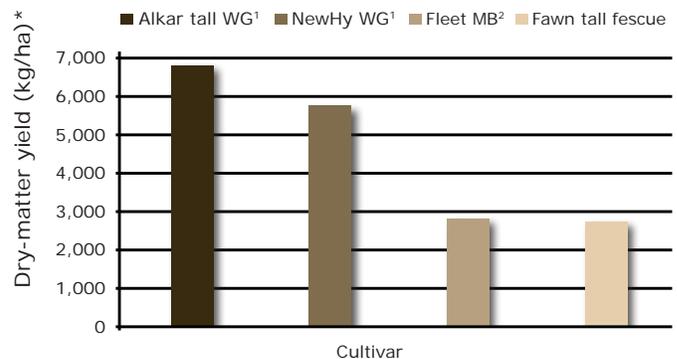
NewHy Alkar tall wheatgrass

On saline soils, as either a hay or pasture crop, the forage quality (palatability and nutritional value) of NewHy is better than that of tall wheatgrass.

### Plant Benefits

- EXCELLENT QUALITY FORAGE
- HIGH DROUGHT RESISTANCE
- HIGH SALT TOLERANCE

#### Evaluation in Utah County for dry-matter yield (2004-2006)



\* lbs/Acre = 0.893 x kg/ha

<sup>1</sup> WG=wheatgrass

<sup>2</sup> MB=meadow brome

### To order seed:

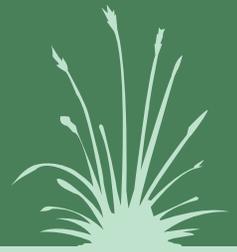
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# Arsenal

## Meadow Bromegrass

*Bromus biebersteinii* Roem. & Schult. (excluded)



### Plant Overview



Arsenal meadow bromegrass (Eureka, UT).

Meadow bromegrass is a long-lived perennial with moderately creeping rhizomes, early season forage production, and rapid regrowth after defoliation typically grown under irrigation. However, with the interest in utilizing less productive agricultural land often associated

with periods of reduced irrigation or increased drought, soil salinity, and low fertility, there is a need to develop an improved pasture grass under non-irrigated environments. Arsenal meadow bromegrass, which was selected for plant vigor, rapid seedling establishment, increased forage and seed yield, and seed mass under dryland environments ranging between 10 to 18 inches of annual precipitation, fills that need. Arsenal's intended use is on semiarid rangelands and non-irrigated pastures as a rapid establishing forage grass with early spring growth, good fall nutritional quality, and exceptional winter hardiness. Arsenal meadow bromegrass resulted from five cycles of intercrossing plants tracing back to meadow bromegrass cultivars Fleet, Regar, Paddock, and Cache.



Arsenal meadow bromegrass (Panguitch, UT).

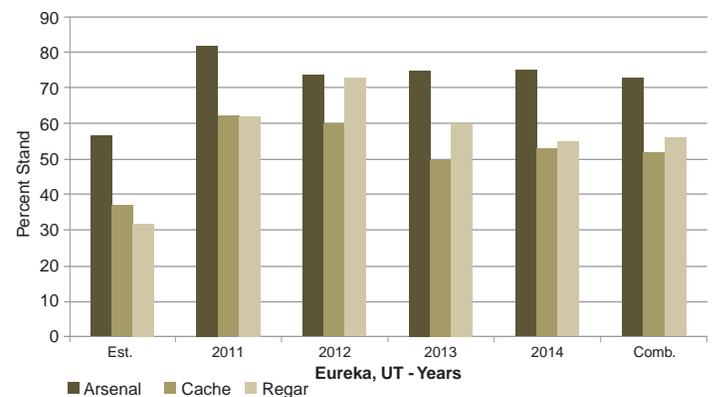
On dryland sites, Arsenal had significantly better seedling establishment and overall stand persistence combined from 2011-2013 than meadow bromegrass cultivars Cache and Regar. Arsenal has been evaluated in New York, Kentucky, Wyoming, and Utah for forage yield and is superior or equal to the cultivar Cache. It has demonstrated its ability to produce DMY comparable to or better than smooth bromegrass and meadow bromegrass cultivars under higher precipitation environments in New York and Kentucky.

Fall nutritional characteristics of Arsenal were better than Cache in crude protein and *in vitro* true digestibility. Arsenal expands the use of meadow bromegrass from irrigated pastures to non-irrigated pastures and rangelands with 13 inches or more annual precipitation, providing livestock producers with high-yielding nutritious forage, which is winter hardy and drought tolerant.

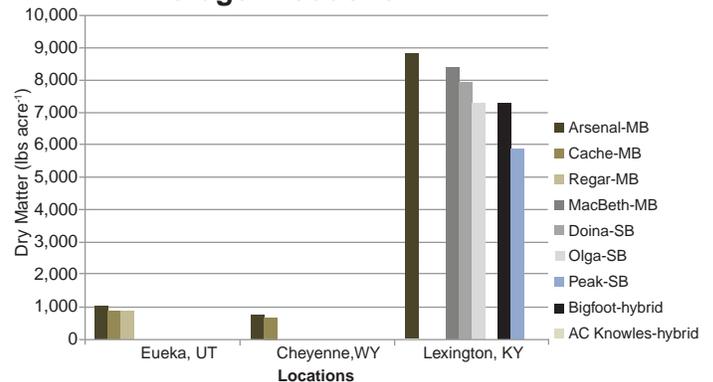
### Plant Benefits

- HIGH YIELDING – DROUGHT TOLERANT
- SUPERIOR SEEDLING ESTABLISHMENT
- SUPERIOR WINTER HARDINESS

#### Plant Establishment and Persistence



#### Forage Production



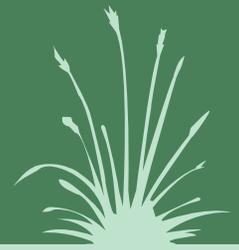
### To order seed:

Arsenal is licensed through Barenbrug USA, and seed can be obtained by contacting this company. Breeder, Foundation, Registered, and Certified seed classes are recognized.

# Don

## Falcata Alfalfa

*Medicago sativa* ssp. *falcata*



### Plant Overview



Don was developed for use exclusively in mixed plantings and is meant for use on semiarid rangelands and irrigated pastures. Don is a persistent and non-aggressive legume that can be used in land reclamation. When

grown in mixtures with grasses, alfalfa cultivars Ladak, Spredor3, Amerigaze, and P53V08 showed long-term mortality ranging from 25 to 50 percent. In contrast, there was no measurable mortality in Don when grown in these grass mixtures. Over a 4-year period at Nephi, UT, which has a long-term annual precipitation of 13 inches, Don showed 9 percent mortality compared to Ladak (46%) and Vernal (38%).

Don has small, fine leaves and stems that bear bright yellow flowers. Don has a semi-decumbent growth habit that does not deter grazing but makes mechanical harvesting difficult. It also has moderately fibrous roots with a crown typically 1 to 2 inches below the soil surface. The top part of the crown can be removed, and plants will initiate growth from well below the soil surface.



Don mixed with kochia and alтай wildrye.

When Don was used in mixtures with tall fescue and meadow brome, the production increased from 10 to 32 percent. Similar production advantages are expected when Don is grown with

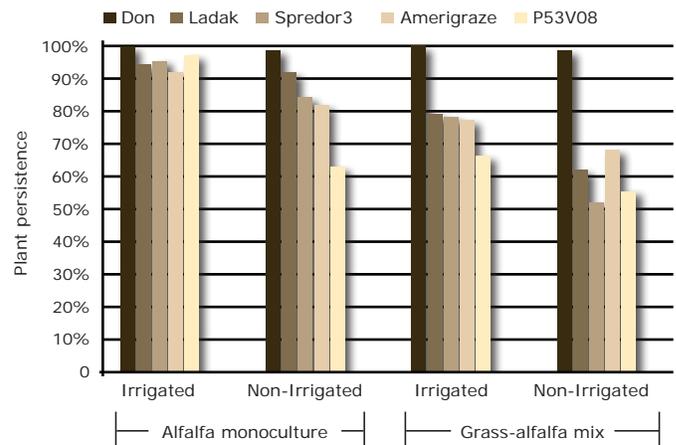
crested wheatgrass on dry rangelands. It has a low-growth habit and stays well below the canopy of most cool-season grasses. Thus, it will not dominate when grown in mixtures with grasses. When grown in monocultures, however, forage yield of Don is less than sativa-type alfalfas. Consequently, Don is only recommended for growing in mixtures with grass.

When moisture is limiting, Don will go dormant. Seeds of Don are smaller when compared to typical alfalfa. Don's seeding rate is 1 lb/acre. Don also has a high percentage of hard seed that should prove to be an advantage when it is used in dormant seedings with grasses.

### Plant Benefits

- INCREASED FORAGE PRODUCTION UNDER DROUGHT CONDITIONS

#### Persistence of Don is greater than standard commercial alfalfa varieties



#### Using Don in mixtures increases yield potential

	Irrigated				Seasonal production
	Harvest 1	Harvest 2	Harvest 3	Harvest 4	
Don	2.40	2.31	1.25	0.47	6.42
Meadowbrome	2.59	2.20	1.25	0.83	6.88
<b>MB/Don</b>	<b>3.06</b>	<b>2.42</b>	<b>1.63</b>	<b>0.82</b>	<b>7.93</b>
Tall fescue	2.07	1.84	0.84	0.58	5.33
<b>TF/Don</b>	<b>2.92</b>	<b>2.59</b>	<b>1.36</b>	<b>0.99</b>	<b>7.86</b>
Non-irrigated					
Don	2.31	0.83	0.32	0.03	3.47
Meadowbrome	3.64	1.35	0.22	0.07	5.28
<b>MB/Don</b>	<b>3.84</b>	<b>1.68</b>	<b>0.27</b>	<b>0.08</b>	<b>5.87</b>
Tall fescue	3.40	1.43	0.17	0.03	5.03
<b>TF/Don</b>	<b>4.02</b>	<b>1.65</b>	<b>0.32</b>	<b>0.05</b>	<b>6.03</b>

### To order seed:

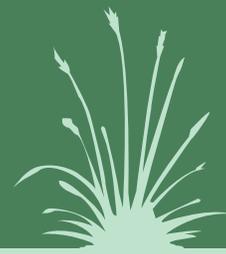
Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.



# Snowstorm

## Forage Kochia

(*Bassia prostrata* [L.] A.J. Scott)  
(synonym = *Kochia prostrata* [L.] Schrad.)



## Plant Overview



Snowstorm (left) versus Immigrant (right).  
Blue Creek, UT.

Snowstorm forage kochia was released on March 22, 2012, by the USDA-ARS Forage and Range Research Laboratory and the Utah Agricultural Experiment Station. Forage kochia is an important winter forage for sheep, cattle, and wildlife. ARS research has shown that the cultivar 'Immigrant' increases rangeland carrying capacity by up to six-fold, improves cattle body condition during winter grazing, and reduces winter feed costs by 25 percent. However, Immigrant's short stature has limited its use for fall and winter grazing due to the snow cover associated with many rangelands.



Snowstorm. Dubois, ID.

Snowstorm is named for its ability to extend the grazing season and is recommended to ranchers and land managers as a taller, more productive, more nutritious forage kochia for fall and winter grazing by livestock and wildlife.

Descriptively, Snowstorm is subspecies *grisea*, with increased pubescence and grayish-green stems as compared to the more glabrous, reddish stems of subspecies *virescens*-types, including Immigrant.



Cattle grazing on Immigrant forage kochia.

Successful establishment is dependent upon understanding forage kochia seed biology. Forage kochia does not emerge from depths, has rapid loss of seed viability when stored, and has delayed, asynchronous germination of fresh seed. Therefore, the best establishment comes from broadcast plantings done during the months of December through February using freshly harvested seed. Seed bed should be prepped by tillage, fire, or other disturbance.

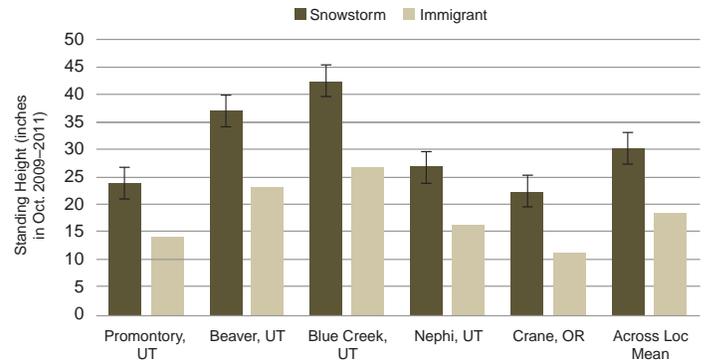
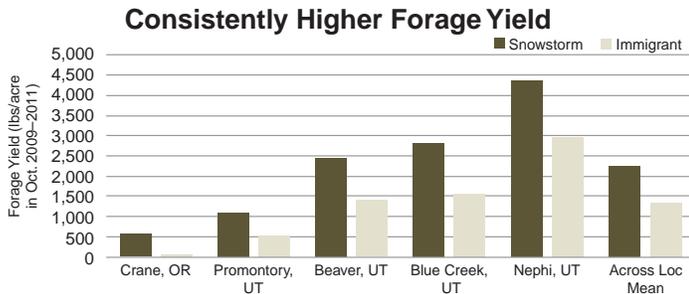
Snowstorm seed is 1.6 times larger (280,000 seeds per pound), and is mature 2 to 3 weeks earlier (mid-November), than Immigrant. To maximize quality and production of fall and winter grazinglands, it is recommended to plant Snowstorm at a rate of 2 to 4 lbs pure live seeds per acre in combination with adapted, grazing tolerant grasses.

## Plant Benefits

- TALL STATURE FOR ENHANCED WINTER GRAZING
- HIGHER PRODUCTION FOR ENHANCED WINTER GRAZING
- INCREASED PROTEIN AND DIGESTIBILITY TO IMPROVE LIVESTOCK PERFORMANCE
- DROUGHT AND SALT TOLERANT TO IMPROVE RANGELAND PRODUCTIVITY
- STAY GREEN TO STOP WILDFIRES



## Snowstorm Forage Kochia

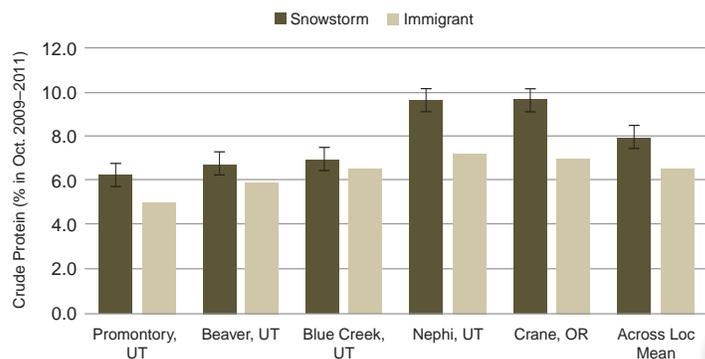
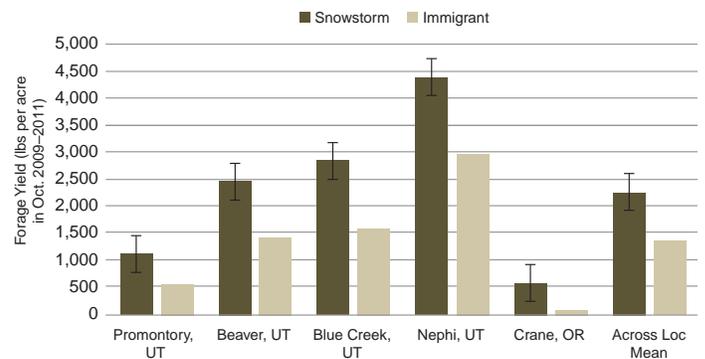


**Table 1. Snowstorm performance compared to Immigrant forage kochia.**

Data from 5 locations in UT, ID, WY, OR, and WA (Snowstorm numbers followed by different letters than Immigrant are statistically different).

Entry	Snowstorm	Immigrant
Height (in)	30 a	18 b
Forage (lb/acre)	2,256 a	1,343 b
Protein (%)*	7.9 a	6.5 b
NDF (%)	48.2 a	47.0 a
ADF (%)	34.4 b	33.0 a
IVTD (%)	67.4 a	64.8 b
Mature seed	Mid-Nov	Early-Dec
Seed yield (lb/acre)	119 a	166 a
Seeds (per pound)	280,000 a	530,000 b

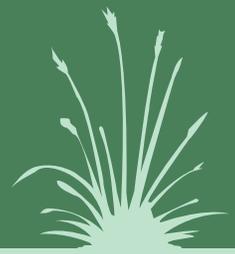
\* It is recommended that forage kochia utilization not exceed 65% in order to ensure that plant nutritional content continues to meet livestock needs. Waldron, B., et al. 2006. Stockpiled forage kochia to maintain beef cows during winter. Rangeland Ecology and Management 59:275-284.



## To order seed:

Check with local seed companies to determine availability. Call the Utah Crop Improvement Association (435-797-2082; sayoung@mendel.usu.edu) to obtain stock seed. Breeder, Foundation, Registered, and Certified seed classes are recognized.





## Plant Overview



Meadow brome is a long-lived perennial grass that offers promise on non-irrigated or irrigated pastures. It “greens up” 2 to 3 weeks earlier in the spring than other pasture grasses, increasing the grazing

season as well as forage production under reduced irrigation. It is adapted to slightly acidic to mildly alkaline soils on dryland pastures where annual precipitation exceeds 15 inches. It is extremely winter hardy (see image below) and recovers quickly after grazing. Meadow brome is adapted to the mountain brush, aspen, conifer forests, and subalpine environments. It is less dormant under high summer temperatures than smooth brome.

Cache meadow bromegrass was released in 2004 by the USDA-ARS, Forage and Range Research Laboratory in cooperation with the Agricultural Experiment Station, Utah State University, Logan, UT. Cache meadow bromegrass possesses enhanced seedling establishment and increased forage yields on irrigated and semi-irrigated pastures in the Intermountain and Northern Great Plains Regions of the Western United States.

Stand Establishment



Cache

Fleet

At different irrigation rates ranging from 0.5 inches to 1.5 inches per week, Cache produced significantly more forage than the cultivar Fleet at all irrigation rates and significantly more forage than the cultivar Regar at the two lowest irrigation rates. In forage trials at Powell, WY, Cache produced more forage (5.52 t/ac) than Paddock (4.90), Montana (4.71), Regar (4.39), meadow brome and Lincoln (5.07), and Big Foot (4.76) smooth bromegrass. Likewise, under multiple harvests (6 harvests per year), Cache produced more forage than orchardgrass cultivars Ambassador and Latar under irrigation in northern Utah.

Winter Kill



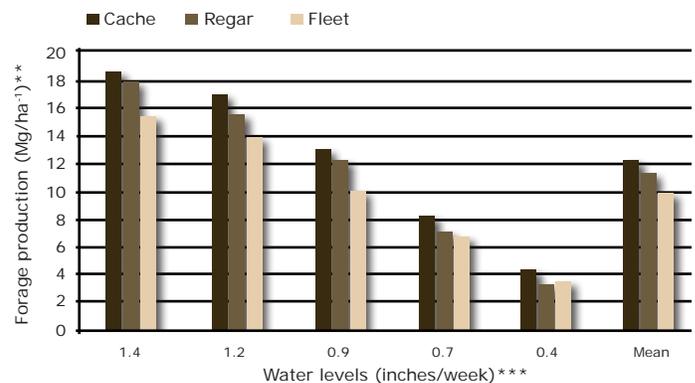
Orchard grass

Meadow brome

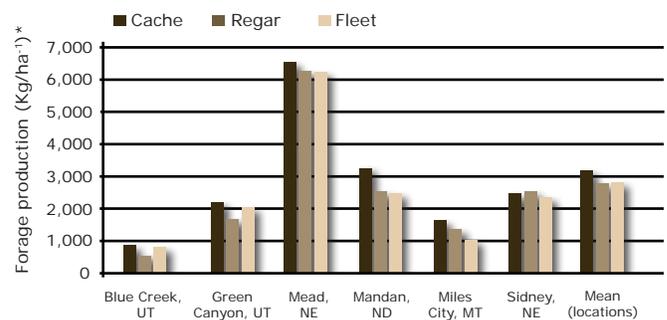
## Plant Benefits

- EXCELLENT EARLY SPRING FORAGE
- RAPID SEEDLING ESTABLISHMENT
- INCREASED FORAGE PRODUCTION UNDER DROUGHT

### Meadow brome forage production under five irrigation levels - Dry-matter yield (2001-2002)



### Dry-matter forage yield from the Northern Plains Area Regional Trials



\* lbs/Acre = 0.893 x kg/ha \*\* lbs/Acre = 893 x mg/ha \*\*\* 1 inch = 25.4 mm

## To order seed:

Check with local seed companies to determine availability or call the Utah Crop Improvement Association (435-797-2082; stanford.young@usu.edu) to find commercial seed growers. Breeder, Foundation, Registered, and Certified seed classes are recognized. Foundation seed is available through the Utah Crop Improvement Association.

## RoadCrest

Crested Wheatgrass

*Agropyron cristatum*



### Plant Overview



RoadCrest is an improved cultivar of crested wheatgrass that was released by the USDA-ARS Forage and Range Research Laboratory in cooperation with the Agricultural Experiment Station, Utah State University, Logan, UT, in 1998. The parental plant materials were collected in Turkey, but

in contrast to typical bunch-type crested wheatgrass, the original breeding population displayed varying degrees of rhizome development. RoadCrest is named such because of its rhizomatous nature, and the ease of establishment in harsh environments, which make it a leading choice for reducing soil erosion along roadsides and highways in the Western United States. RoadCrest was released after three cycles of selection for rhizomatous growth habit, short stature, and fine leaves under low-maintenance conditions.

RoadCrest is a long-lived perennial that is significantly more rhizomatous than any other crested wheatgrass. RoadCrest has finer leaves, produces less biomass, and is 15 to 25 percent shorter in stature than forage-type crested wheatgrass cultivars. Although it is adapted to areas that receive from 10 to 20 inches of annual precipitation, seedling diseases may be a problem if precipitation and irrigation exceeds 25 inches.



Sod-forming characteristics typical of RoadCrest.

Germination and seedling vigor compare favorably with other crested wheatgrasses, which makes it easier to establish than other low-maintenance turf grasses, including Kentucky bluegrass, ‘Sodar’ thickspike wheatgrass, and hard fescue.

Turf quality and color are not as good as Kentucky bluegrass, tall fescue, and perennial ryegrass under optimum

environmental conditions. Nevertheless, RoadCrest “greens up” in early spring and remains green until mid-summer in climates similar to Logan, UT. Like other crested wheatgrasses, RoadCrest turf goes and remains dormant during the summer until temperatures decline in the fall. However, summer dormancy is not as pronounced at higher elevations of 5,000 to 7,000 feet.



RoadCrest used as low-maintenance turf along highways.

RoadCrest is recommended for use along roadsides and other disturbed sites including mining, wildfire, and construction, and in traditional low-maintenance turf settings such as summer cabins and golf course roughs in the Northern Plains and Western United States.

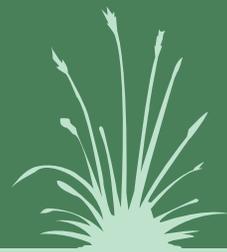
### Plant Benefits

- DROUGHT TOLERANT
- ENHANCED SEEDLING VIGOR
- MODERATELY RHIZOMATOUS SOD-FORMER
- SHORTER STATURED AND FINER LEAVED THAN TYPICAL CRESTED WHEATGRASSES
- USED FOR ROADSIDES, LOW-MAINTENANCE TURF, AND SOIL CONSERVATION

### To order seed:

RoadCrest was released as a protected variety, and three western seed companies are licensed to sell it. Check with these companies for seed availability (Utah Seed, Tremonton, UT, 435-854-3720; Bruce Seed Farm Inc., Townsend, MT, 406-266-3103; and Round Butte Seed Growers Inc., Culver, OR, 866-358-7001).



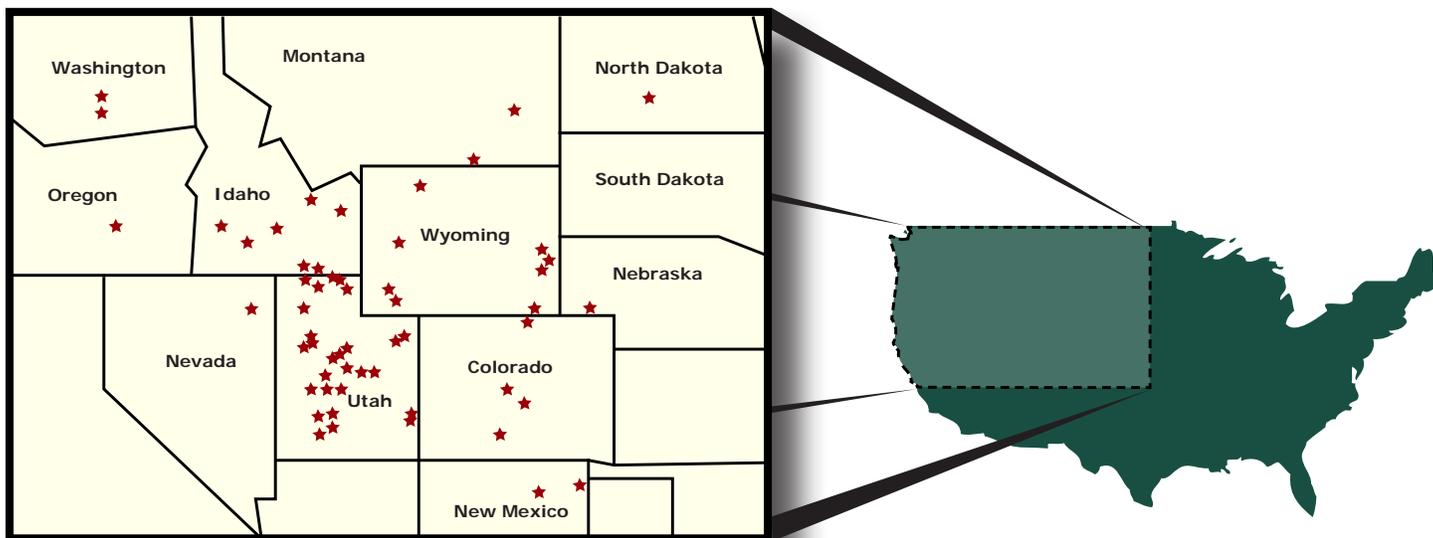


Nezpar

White River  
(Replicated Trial Beaver, UT 2008)

Rimrock

Each year, the Forage and Range Research Laboratory conducts numerous trials at sites throughout the Western United States to thoroughly evaluate its varieties under production and natural conditions for factors such as yield, persistence, forage quality, drought tolerance, and disease resistance. Only the very highest performing germplasm is commercialized as a result of stringent trialing of breeding populations.



★ - FRRR Range Evaluation Site





**USDA-ARS Forage and Range Research Laboratory**  
**[www.ars.usda.gov/npa/logan](http://www.ars.usda.gov/npa/logan)**  
**Logan, UT**  
**435-797-2249**