'Recovery' Western Wheatgrass

The United States Department of Agriculture - Agricultural Research Service, the United States Department of Army Corps of Engineers - Engineer Research and Development Center, and the United States Department of Agriculture - Natural Resources Conservation Service announce the release of the cultivar 'Recovery' western. 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 with repeated wildfires. Recovery was evaluated in field trials as TC3, TC-Rich, Army WWG, SERDP WWG, and 9076517 (NRCS designation). Recovery was developed as part of the Strategic Environmental Research and Development Program project CS-1103 to identify resilient plant characteristics and develop wear-resistant plant cultivars for use on military training lands. Recovery was selected for seedling establishment under rangeland conditions and has been extensively evaluated at semiarid sites representative of different ecological regions in northern plains and western U.S. Overall, it has shown superior and faster seedling establishment compared to commercially available cultivars Arriba, Barton, Flintlock, Rodan, and Rosana.

The development of Recovery western wheatgrass was initiated to breed a western wheatgrass cultivar with rapid establishment for use in areas that are frequently disturbed such as military training lands. Recovery traces it parentage to three maternal sources and was selected for superior vegetative vigor, seed yield, and seedling establishment. The parentage consists of Rosana (28%), D2945 (50%), and WW117FC (22%). Rosana traces to USDA-NRCS, Bridger Plant Materials Center collections from a native meadow near Forsyth, MT and was released in 1972 having improved seedling establishment, sod-forming ability, and forage and seed production (U.S. Department of Agriculture, 1995). Accession D2945, evaluated as Mandan456 or T05659, is a different seed lot of the same population that gave rise to Rodan western wheatgrass. WW117FC is a native western wheatgrass collection made by the USDA-ARS Forage and Range Research Lab from the Fort Carson Army base near the site of the initial evaluations.

The breeding of Recovery was initiated in 1996 with an evaluation trial of 14 germplasm sources at the Fort Carson, Turkey Creek Recreation area approximately 20 km south of Colorado Springs, CO. After two years of evaluation, five entries were identified with the desired phenotype. Open-pollinated seed was harvested in August 1998 from all plants within the five entries and 17 plants with the highest seed yield were identified. The seed from the 17 plants was screened for seedling vigor by determining rate of emergence from 6.35 cm, and 4 of the 17 plants were determined to have superior seedling vigor (one from Rosana, two from D2945, and one from WW117FC). A total of 196 seedlings (49 from each of the four parents) were intermated in a randomized crossing block. Of the 196 plants, 155 were identified with high seed production and used in the next cycle. Twenty-eight seeds from each of the 155 plants were planted at a 5 cm depth in cones. Those seedlings that emerged on or before 14 DAP were saved and pooled together by maternal source (559 plants from Rosana, 490 plants from D2945-1, 537 plants from D2945-2, and 446 plants from WW117FC). Seedlings were randomized and transplanted to an isolation block in Richmond, Utah, May 2001. Seed was harvested from the isolated block and designated as breeder seed. This seed was used for testing and morphological evaluation.

Rapid establishment is one of the keys to successful revegetation in the western U.S. Thus, western wheatgrasses' inherent slow establishment limits its effectiveness in reducing erosion and controlling weeds in areas with frequent, severe disturbances. During the spring of the establishment year, Recovery had significantly higher ($P \leq 0.05$) frequency of seedlings (0.60) than parental/closely-related cultivars Rosana (0.48) and Rodan (0.45), and the western wheatgrass cultivars of Arriba (0.45), Barton (0.42), and Flintlock (0.53) when analyzed across eight locations in Utah, Idaho, and Wyoming (Supporting Data, Table 1). Within locations, Recovery had significantly better establishment than Rodan in three of five test locations, and more than Rosana in three of eight test locations (Supporting Data, Table 1). On average, Recovery's establishment was better than Bozoisky Russian wildrye, similar to Bozoisky II Russian wildrye and Vavilov Siberian wheatgrass, and lower than Vavilov II Siberian wheatgrass and Hycrest and Hycrest II crested wheatgrasses (Supporting Data, Table 1).

The ability of seedlings to survive the first year after planting can be difficult due to competition from invasive annual and biennial grasses and forbs that benefit from the disturbed, open environment. Across locations, Recovery had significantly ($P \leq 0.05$) more surviving plants (frequency of 0.77) the year after establishment than parental/closely-related cultivars Rosana (0.68) and Rodan (0.66), and the western wheatgrass cultivars of Arriba

(0.63), Barton (0.68), and Flintlock (0.66) (Supporting Data, Fig. 1). In fact, Recovery had higher frequency ($P \leq 0.05$) of plants than any other western wheatgrass cultivar until the fourth to sixth year after planting (Supporting Data, Fig. 1). The equilibrating of stand frequency after this period of time is in part due to western wheatgrasses' extensive rhizomes that fill in blank areas of the plot, and in part because of the limited resources available on rangelands, thus restraining the number of plants that can be supported in a given area. 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.

Forage yield of Recovery was not significantly different than other western wheatgrass cultivars at Blue Creek, UT and Curlew Valley, ID with the exception of a higher yield than Rosana at Curlew Valley. However, at Nephi, UT, Recovery forage yield was significantly lower than all other western wheatgrass cultivars except Arriba. Overall, these results suggest that Recovery will yield comparable or slightly less than other western wheatgrasses.

Overall, Recovery is similar in height as other western wheatgrasses, but has a longer spike than Arriba, Barton, and Rodan, and a wider spike than Barton, Flintlock, and Rodan. Recovery's flag leaf is oriented lower on the culm than Arriba and Barton, and at a similar position as Flintlock, Rodan, and Rosana. Recovery has a shorter flag leaf than Barton, but is similar to other western wheatgrass cultivars. On average, the flag leaf width of Recovery is similar to other cultivars; however, at the Nephi, UT location it was narrower than that for Arriba, Barton, Flintlock, and Rosana. These results indicate that in appearance, Recovery is most like Rosana and the least like Barton.

The USDA-NRCS conducts an environmental evaluation of all plant material releases. From this evaluation and the USDA-NRCS Plant Guide the following has been determined. Western wheatgrass is a long-lived perennial species that spreads primarily via rhizomes. It establishes only in areas where major disturbance has occurred, and has no perceivable negative impacts on native plant populations. It has no known allelopathic effects on other plants, and no negative impact on wildlife habitat. Western wheatgrass is not regarded as having any adverse negative characteristics that would preclude its use. (See Appendix A - Environmental Evaluation of Plant Materials Releases).

A Foundation seed production field was established at the USDA-NRCS Aberdeen Plant Materials Center in August 2005 and again in 2008. Foundation seed has been harvested each year beginning in 2007. The first Registered/Certified seed will be produced in 2009 in North Dakota and in 2010 in Idaho. Breeder, Foundation, Registered, and Certified seed classes will be recognized. Breeder seed will be maintained by the USDA-ARS Forage and Range Research Laboratory at Logan, UT, and Foundation seed will be maintained by the USDA-ARS Forage and Range Research Laboratory and the USDA-NRCS Plant Materials Center at Aberdeen, ID. Plant Variety Protection (PVP) will not be sought for this cultivar. Foundation seed is available through the following contacts: Foundation seed is available through the following contacts: Utah Crop Improvement Association (435-797-2082; sayoung@mendel.usu.edu) and University of Idaho Foundation Seed Program (208-423-6655; Williams@kimberly.uidaho.edu).

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RELEASE DATE FOR PUBLICITY PURPOSES SHALL BE EFFECTIVE ON THE DATE OF THE FINAL SIGNATURE ON THE RELEASE NOTICE.

APPROVAL SIGNATURES:

11/18/09
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Supporting Data

Table 1. Establishment year stand of 'Recovery' western wheatgrass compared with standard western wheatgrass and other rangeland grass checks at eight locations. Stand establishment measured as seedling frequency during the first May or June following a late-fall-dormant or early-spring planting.

Cultivar†	Beaver, UT	Guernsey, WY – site 1	Guernsey, WY – site 2	Malta, ID	Fillmore, UT – site 1	Fillmore, UT – site 2	Curlew Valley, ID	Yakima, WA	Across loc. Mean
Recovery	**0.54**	**0.61**	**0.51**	**0.68**	**0.66**	**0.63**	**0.46**	**0.73**	**0.60**
WWG checks									
Arriba	0.21*	.	.	0.41*	0.54	0.82	0.44	.	0.45*
Barton	0.36*	.	.	0.55*	0.38*	0.64	0.37	.	0.42*
Flintlock	.	0.57	0.22*	.	.	0.84	.	.	0.53*
Rodan	0.25*	.	.	0.55*	0.48*	0.78	0.39	.	0.45*
Rosana	0.51	0.55	0.39	0.45*	0.35*	0.73	0.49	0.40*	0.48*
SB3	0.40*	0.54	0.49	0.69	0.45*	0.88	0.34*	.	0.53*
Other checks									
Bannock	0.73	0.50	0.51	.	.	.	.	.	0.61
Bozoisky	0.72	0.17	0.65	0.61	0.21	0.63	0.56	.	0.50
Bozoisky_II	0.70	0.48	0.50	0.67	0.23	.	0.60	0.54	0.55
Firststrike	0.84	0.81	0.62	0.86	0.56	0.81	.	0.82	0.75
Hycrest	0.86	.	.	0.92	0.65	.	0.56	.	0.74
Hycrest_II	0.90	.	.	0.94	0.64	0.63	0.72	.	0.73
Vavilov	0.82	0.38	0.65	0.92	0.54	.	0.40	0.23	0.58
Vavilov_II	0.94	0.54	0.67	0.95	0.79	.	0.70	0.52	0.76
WWG mean	0.38	0.57	0.40	0.56	0.48	0.76	0.41	0.56	0.50
Entry Mean	0.62	0.52	0.52	0.71	0.50	0.74	0.50	0.54	0.58
LSD (0.05)	0.13	0.23	0.18	0.12	0.18	0.18	0.12	0.17	0.06

†Designations in this column include: WWG=western wheatgrass; SB3 is a WWG breeding population closely related to Recovery; Bannock is a thickspike wheatgrass; Bozoisky and Bozoisky II are Russian wildryes; Firststrike is a slender wheatgrass; Hycrest and Hycrest II are crested wheatgrasses; and Vavilov and Vavilov II are Siberian wheatgrasses.

*Western wheatgrass check cultivars with stand frequency significantly ($P < 0.05$) lower than Recovery western wheatgrass.

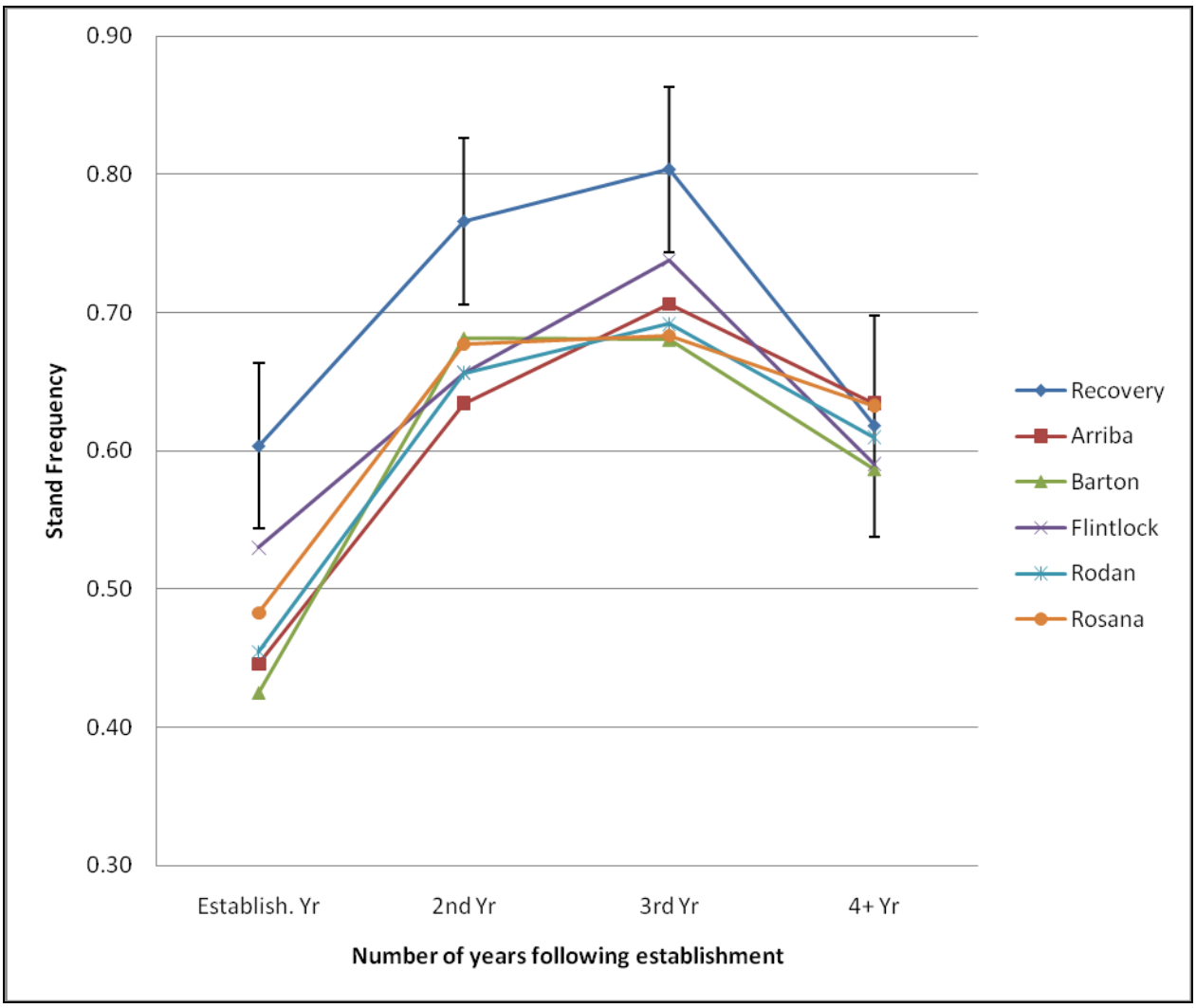

Figure 1. Stand of Recovery western wheatgrass as compared to standard western wheatgrass checks when evaluated at eight locations throughout the western U.S. Error bars are the LSD value at the P=0.05 probability level. The "4+ Yr" category is the latest evaluation taken at a given site and ranges from four to six years after planting.