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Registration of 6NDRFG-1 Six-Rowed Barley Germplasm Line with Partial Fusarium Head Blight Resistance

The six-rowed spring barley (*Hordeum vulgare* L.) germplasm line 6NDRFG-1 (Reg. no. GP-136, PI 615583) was developed by the North Dakota Agricultural Experiment Station and tested as C95-167-250-9. 6NDRFG-1 has partial resistance to Fusarium head blight (FHB) (incited by *Fusarium graminearum* Schw.) that is expressed as reduced numbers of FHB infected kernels and more significantly as reduced concentrations of the mycotoxin deoxynivalenol (DON). 6NDRFG-1 is an $F_{3:7}$ selection from the cross 'Foster'/CIho 4196. Foster (PI 592758) (Horsley et al., 1997) is a six-rowed malting barley susceptible to FHB and adapted for growth in the upper Midwest USA. CIho 4196 is an FHB resistant two-rowed accession received from China in 1925 and held in the USDA National Small Grains Collection.

6NDRFG-1 has a sessile six-rowed spike (*vvII*), semi-smooth lemma awns, and glume awn length equal to the length of the glume. Its covered kernels have long rachilla hairs and a white aleurone. Unlike many of the six-rowed genotypes with good FHB resistance, 6NDRFG-1 does not derive its resistance from 'Chevron' (PI 38061) or Chevron-derived lines (Prom et al., 1996). This may be advantageous because Chevron and resistant Chevron-derived progeny generally have fewer plump kernels and lower malt extract (Gebhardt et al., 1992). Thus, 6NDRFG-1 represents a six-rowed source of FHB resistance that may have alleles for acceptable malt quality not found in Chevron.

The F_2 population that 6NDRFG-1 was derived from was designated C95-167 and was grown at Fargo and Langdon, ND, in 1996. At maturity, 250 six-rowed plants were individually harvested from the population. Seed from these plants was sown as $F_{2:3}$ families in FHB screening nurseries during the 1996-1997 winter at Shanghai, China, and the 1997 growing season at Langdon, ND. Plants in these and subsequent nurseries were inoculated with *F. graminearum* by the methods described by Xia (Xia, 1956) and modified by Prom et al. (1996). Fusarium head blight severity reported as percent infection was assessed at the soft dough stage (Zadoks 85) by counting the number of infected kernels on 10 to 15 random spikes in each $F_{2:3}$ family. At both locations, the $F_{2:3}$ family C95-167-250 was observed to have FHB severity similar to that of the resistant check Chevron. At Shanghai, FBH severity was 9.0% for C95-167-250, 6.5% for Chevron, and 24.0% for Foster. At Langdon, the FHB severity was 1.6% for C95-167-250, 3.7% for Chevron, and 34.8% for Foster.

Eleven F_3 plants were individually harvested from C95-167-250 grown at Langdon, ND, in 1997 and were designated C95-167-250-1 through C95-167-250-11. These $F_{3:4}$ families were grown in FHB screening nurseries at Fargo, Langdon, and Osnabrock, ND, in 1998, where C95-167-250-9 was observed to have the lowest FHB severity and DON accumulation. Averaged across the three locations, FHB severity and DON concentration were 16.6% and 5.8 $\mu g\ g^{-1}$ for C95-167-250-9, 4.7% and 8.4 $\mu g\ g^{-1}$ for Chevron, and 52.8% and 27 $\mu g\ g^{-1}$ for Foster, respectively. At Hangzhou, China, during winter 1997-1998, FHB severity was 10.0% for C95-167-250-9, 5.3% for Chevron, and 19.8% for Foster.

In greenhouse screening at Fargo ND, by the method of Prom et al. (1996) during spring 1999, FHB severity was 16.3% for C95-167-250-9, 9.2% for Chevron, and 41.2% for Foster. In 1999 screening nurseries at Langdon and Osnabrock, ND, FHB severity averaged 16.3% for C95-167-250-9, 18.9% for Chevron, and 50.5% for Foster.

In 1999 at Langdon and Osnabrock, mean days to heading for C95-167-250-9 was similar to Chevron and about 10 d later than Foster. Mean plant height of C95-167-250-9 was similar to Chevron (130 cm) and much taller than Foster (100 cm).

Small quantities of seed (5 g) of 6NDRFG-1 are available upon written request from the corresponding author. Appropriate recognition of source should be given if this germplasm contributes to research or development of new cultivars.

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References

Gebhardt, D.J., D.C. Rasmusson, and R.D. Wilcoxson. 1992. Cyclic breeding used to incorporate kernel discoloration resistance into malting barley. Crop Sci. 32:352–356.

Horsley, R.D., J.D. Franckowiak, P.B. Schwarz, and B.J. Steffenson. 1997. Registration of 'Foster' barley. Crop Sci. 37:1018.

Prom, L.K., B.J. Steffenson, B. Salas, T.G. Fetch, Jr., and H.H. Casper. 1996. Evaluation of selected barley accessions for resistance to *Fusarium* head blight and deoxynivalenol conentration. p. 764–766. *In* Scoles and Rossnagel (ed.) Proc. of the V international oat conference & VII international barley genetics symposium. Univ. of Saskatchewan, Saskatoon, Canada. 30 July–6 Aug. 1996. University Extension Press, Saskatoon, Saskatchewan.

Xia, Y.-T. 1956. The resistance to scab of wheat. (In Chinese.) Agri. Academy in East China. Bull. No. 11:597–600.

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Registration of *Leymus* Hybrid-1 Wildrye Germplasm

Leymus hybrid-1 wildrye germplasm (Reg. no. GP-82, PI 618816) was developed by the USDA-ARS, Forage and Range Research Laboratory in cooperation with the Utah Agricultural Experiment Station at Utah State University and released in January 2001. It was derived from a segmental alloautoploid population that originated from intercrossing three hybrids: (i) mammoth wildrye [*Leymus racemosus* (Lam.) Tzvelev ($2n = 4x = 28$)]/Altai wildrye [*L. angustus* (Trin.) Pilger ($2n = 12x = 84$)], (ii) Great Basin wildrye [*L. cinereus* (Scribner & Merr.) A. Löve ($2n = 8x = 56$)]/Altai wildrye, and (iii) a backcross hybrid, mammoth wildrye//Altai wildrye.

In 1982, seed of the above *Leymus* hybrid populations was acquired from Dr. Douglas Dewey at Logan, UT (Dewey, 1972, 1978). Population I was a cross between *L. racemosus* (PI313965)/*L. angustus* (PI314682) which produced a 70-chromosome hybrid that resulted from an unreduced *L. racemosus* egg ($n = 28$), fertilized by a reduced *L. angustus* gamete ($n = 42$). Population II was a 98-chromosome hybrid that originated from a cross that involved an unreduced *L. cinereus* (PI286809) gamete ($n = 56$) and reduced *L. angustus* (PI 314672 and 314682) pollen ($n = 42$). Population III was a backcross of *L. racemosus*//*L. angustus*. Chromosome numbers in the backcross population ranged from 76 to 78. In 1983, F_2 seedlings from the three *Leymus* hybrids were established at the Evans farm near Logan, UT, in spaced-plant nurseries.

In 1984, cycle-1 open pollinated (OP) seed across hybrids

from vegetatively superior plants were harvested from 20 F_2 hybrids of *L. racemosus*/*L. angustus*, 17 F_2 hybrids of *L. cinereus*/*L. angustus*, and 13 backcross (BC_1) hybrids from *L. racemosus*//*L. angustus*. Cycle-1 seed was screened for seed yield, individual seed weight, and seedling emergence from deep (7.6 cm) planting in the greenhouse. In 1986, 50 half-sib families of the cycle-1 population were established at Logan, UT (mean annual precipitation 425 mm). Recurrent phenotypic selection for vegetative vigor and seed and seedling characteristics evaluated in cycle-1 was practiced for cycles 2 (1985) and 3 (1987).

A spaced-plant nursery of 700 cycle-3 plants was established at the Evans farm in 1988. In 1989, 15 additional paired crosses between superior F_1 hybrids of *L. angustus* (PI314682) and *L. cinereus* (PI236820) and 17 cycle-3 plants selected for vegetative vigor, broadened the genetic base of the initial breeding population. Seed from the paired crosses and OP selected cycle-3 plants were harvested to constitute cycle-4. This breeding population was advanced through four more cycles of recurrent phenotypic selection conducted respectively at the Evans farm (1990–1992), Blue Creek, UT (1993-1994; mean annual precipitation 350 mm), Nephi, UT (1995-1996; mean annual precipitation 350 mm), and Evans farm (1997–1999). Plants with reduced plant vigor were removed prior to anthesis during cycles 5, 6, 7, and 8. In 1998 and 1999, equal amounts of seed from 10 selected half-sib families at Logan, UT, were combined to generate the *Leymus* hybrid-1 germplasm by means of a selection index that included forage yield, crude protein (CP) concentration, neutral detergent fiber (NDF) concentration, acid detergent fiber (ADF) concentration, total seed yield, and 100-seed weight.

Leymus hybrid-1 germplasm is highly cross-pollinated and behaves meiotically as a segmental autoallopolyploid that contains multiple copies of the **Ns** genome from the genus *Psathyrostachys* (wildryes) and the **Xm** genome whose diploid progenitor is not known. *Leymus* hybrid-1 germplasm flowers 2 to 3 wk later than Altai wildrye. Morphologically, *Leymus* hybrid-1 germplasm is 23% ($P < 0.05$) taller and has leaves 12% wider with improved vegetative vigor than currently available Altai wildrye cultivars Prairieland, Eejay, and Pearl. Spike characteristics and rhizome development are intermediate to the parental species.

In the Intermountain west, where annual precipitation ranges from 400 to 450 mm, dry matter (DM) production in the *Leymus* hybrid-1 germplasm exceeded the mean of the current Altai wildrye cultivars at mid-August by 36% and at late-November by 42% (Jensen et al., 2001). Under these environments, CP concentrations were lower ($P < 0.05$) in the *Leymus* hybrid-1 germplasm which averaged 61.5 and 28.6 g kg^{-1} compared to 80.5 and 34.1 g kg^{-1} in the check cultivars for summer and fall harvests, respectively (Jensen et al., 2002). Increased DM yields in the *Leymus* hybrid-1 germplasm more than compensated for the reduced CP levels. Fiber concentrations of ADF and NDF in the *Leymus* hybrid-1 germplasm were similar to the check cultivars of Altai wildrye. When evaluated on harsher sites where annual precipitation averaged 240 mm, DM yields, CP, and NDF were similar ($P > 0.05$) to the check cultivar Prairieland. Because of its increased DM yield in the fall, *Leymus* hybrid-1 germplasm should be utilized as a standing forage during the winter.

Seed yield, individual seed weight, and rate of seedling emergence from a 7.6-cm planting depth of *Leymus* hybrid-1 germplasm were lower ($P < 0.05$) than the mean of the check cultivars. Improving seed quality continues to be an emphasis of the breeding program. However, until it is improved, the seeding rates of *Leymus* hybrid-1 germplasm should be increased to 10 kg ha^{-1} in areas of adaptation. After emergence, seedlings are vigorous and persistent under semiarid conditions.

Seed stocks of *Leymus* hybrid germplasm are maintained by the USDA-ARS, Forage and Range Research Laboratory, Utah State University, Logan, UT 84322-6300 and are available in 20-g quantities upon written request. It is requested that appropriate recognition be made if this germplasm contributes to the development of a new breeding population or cultivar.

K.B. Jensen,* K.H. Asay, N.J. Chatterton, and D.R. Dewey (deceased)

References

Dewey, D.R. 1972. Cytogenetics of *Elymus angustus* and its hybrids with *Elymus giganteus*, *Elymus cinereus*, and *Agropyron repens*. Bot. Gaz. (Chicago) 133:57–64.

Dewey, D.R. 1978. Advanced-generation hybrids between *Elymus giganteus* and *E. angustus*. Bot. Gaz. (Chicago) 139:369–376.

Jensen, K.B., D.A. Johnson, K.H. Asay, and K.C. Olson. 2002. Forage production and quality of 14 grasses for fall and winter grazing. Canadian J. Plant Sci. 82(2), in press.

USDA-ARS, Forage and Range Res. Lab., Utah State Univ., Logan, UT 84322-6300. Utah Agric. Exp. Stn. Journal Article No. 7378. Registration by CSSA. Accepted 30 Sept. 2001. *Corresponding author (kevin@cc.usu.edu).

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