

turf plots of DGR 91-4 from Adelphia. This nursery contained 3600 plants.

During the spring of 1993, 29 plants were selected from this nursery and moved into an isolated polycross block near Hubbard. Also included in this polycross were 12 early-maturing selections from a population designated PST-2MS, which was later developed into 'Manhattan 3'. These plants were selected for early maturity, high seed yield potential, an upright growth habit, and resistance to stem rust.

Seedlings from the 25 highest-yielding plants were transplanted to an isolated spaced-plant nursery during the fall of 1993, in alternating rows with plants taken from progeny turf plots of DGR 91-1, 2DGR, and DGR 91-3 that exhibited good summer performance at Adelphia. This nursery contained 4416 plants and was the third and final cycle of recurrent selection in Oregon. Plants were removed from this nursery prior to anthesis to increase population uniformity. Seed was harvested from 577 attractive, dark-green, healthy plants during the summer of 1994 as the Breeder seed of Citation III.

DGR 91-1 traces its maternal origin to Citation II. DGR 91-3 traces its maternal lineage to a plant related to Pinnacle. DGR 91-2 and DGR 91-4 were selected from the maternal progeny of a plant which traces its maternal origin to Pennant. Since the plant related to Pennant had been subjected to four cycles of crossing to other breeding populations prior to the selection of clones DGR 91-2 and DGR 91-4, it is estimated that only about one-sixteenth of the genes in each of these clones came from the Pennant breeding program. The selection from the Pinnacle breeding program should have contributed about one-fourth of the germplasm of clone DGR 91-3.

Citation III is a dark-green, fine-textured cultivar developed for turf uses. It has shown high resistance to stem rust and red thread [caused by *Laetisaria fuciformis* (McAlpine)] (Morris and Shearman, 1996). Citation III is recommended for the winter overseeding of bermudagrass (*Cynodon* spp.) lawns, sports fields, and golf course tees, greens, fairways, and roughs. Citation III is also recommended for permanent turf use in temperate regions, where it may be planted as a monostand; in blends with other turf-type perennial ryegrasses; or in mixtures with Kentucky bluegrass (*Poa pratensis* L.), fine-leaved fescues (*Festuca* spp.), or tall fescue (*F. arundinacea* Schreb.).

PST maintains Breeder seed of Citation III in Oregon. Seed increase is limited to three generations of increase from Breeder seed: one each of Foundation, Registered, and Certified. U.S. Plant Variety Protection of Citation III has been applied for (PVP Application No. 9700142).

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### References

- Bailey, R.H., B.L. Rose, C.R. Funk, and W.A. Meyer. 1978. Registration of 'Citation' perennial ryegrass. *Crop Sci.* 18:914.
- Funk, C.R., K.J. McVeigh, and G.W. Pepin. 1984a. Registration of 'Gator' perennial ryegrass. *Crop Sci.* 24:823.
- Funk, C.R., W.A. Meyer, and B.L. Rose. 1984b. Registration of 'Manhattan II' perennial ryegrass. *Crop Sci.* 24:823-824.
- Funk, C.R., C.J. Petersen, S. Ahmad, and J.P. Rutkai. 1983. Registration of 'Pennant' perennial ryegrass. *Crop Sci.* 23:183.
- Funk, C.R., R.H. White, R.F. Bara, G.W. Pepin, J.O. Jacob, and D.J. Herb. 1989. Registration of 'Pinnacle' perennial ryegrass. *Crop Sci.* 29:1569-1570.
- Meyer, W.A., C.A. Rose-Fricker, B.L. Rose, and C.R. Funk. 1987. Registration of 'Citation II' perennial ryegrass. *Crop Sci.* 27:815-816.
- Morris, K.N., and R. Sherman. 1996. National Perennial Ryegrass Test - 1994. Progress report 1995. NTEP No. 96-3. National Turfgrass Evaluation Program. USDA-ARS. Beltsville, MD 20705.

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### Registration of 'Drummond' Barley

'Drummond' six-rowed spring barley (*Hordeum vulgare* L.) (Reg. no. CV-291, PI 615584) was developed by the North Dakota Agricultural Experiment Station and released 23 June 2000. Drummond was named for William "Bill" Drummond who served North Dakota barley growers and the barley industry throughout his working career. Drummond, whose experimental designation was ND15477, has the pedigree ND-9712//'Stander'/ND12200. ND9712 has the pedigree 'Hazen'/WPG821-22-13. WPG821-22-13 is a net blotch (caused by *Pyrrenophora teres* Drechs.) resistant line obtained from Dick Metcalf, former Agriculture Canada barley breeder at Winnipeg, Manitoba. The pedigree of WPG821-22-13 is unknown. ND12200 has the pedigree 'Bumper'//Hazen/'Azure'.

The cross that led to Drummond was made in 1992. Drummond originated from a single spike taken at random from a selected  $F_{3,4}$  line. Selection of the  $F_4$  line was based on maturity, plant height, straw strength, kernel color, and awn type. Replicated agronomic and disease testing began in North Dakota in 1994 and regional testing began in 1997. Malt quality evaluation began in 1994 and industry malting and brewing evaluation began in 1996.

Drummond has semi-smooth awns and its covered kernels have long rachilla hairs and a white aleurone. The spike is medium-lax, medium-long, and semierect. On the basis of spike and kernel morphology, it is very difficult to distinguish among Drummond, 'Foster' (Horsley et al., 1997), Hazen (Foster et al., 1984), and 'Excel' (Rasmusson et al., 1991). DNA analysis using PCR-SSR (polymerase chain reaction-simple sequence repeat) techniques (Ramsay et al., 2000) can easily differentiate Drummond from Foster, Hazen, and Excel. By use of the Scottish Crop Research Institute (Dundee, Scotland) SSR primer pair Bmag0125, a 134-bp band is produced in Drummond, but not Foster, Hazen, or Excel.

In 31 trials grown in North Dakota (1994-2000), Drummond had an average grain yield of 3933 kg ha<sup>-1</sup>. This yield was greater than 'Robust' (Rasmusson and Wilcoxson, 1983) (3857 kg ha<sup>-1</sup>) and similar to Foster (3922 kg ha<sup>-1</sup>) and Stander (Rasmusson et al., 1993) (3986 kg ha<sup>-1</sup>). On the basis of data from North Dakota and regional trials, Drummond is similar in height to Stander (78 cm) and is 5 cm shorter than Robust. Drummond has a heading date similar to Robust. Straw strength of Drummond is superior to that of Robust, Stander, and Foster. In 11 trials (1997-1999) of the Mississippi Valley Barley Nursery (MVBN) where lodging occurred, percent lodging of Drummond, Robust, Stander, and Foster was 18, 32, 26, and 30%, respectively. In seven MVBN trials in the same years, on the basis of kernels retained on a sieve with 0.24- by 1.9-cm slotted openings, Drummond had a slightly lower amount of plump kernels (780 g kg<sup>-1</sup>) than Robust (800 g kg<sup>-1</sup>), Stander (820 g kg<sup>-1</sup>), and Foster (810 g kg<sup>-1</sup>).

Like most Midwest barley cultivars, Drummond possesses the NDB112 resistance to spot blotch [caused by *Cochliobolus sativus* (Ito and Kuribayashi) Drechs. Ex Dastur.] and the *Rpg1* (T) gene for resistance to the prevalent Midwest pathotypes of barley stem rust, caused by *Puccinia graminis* Pers f. sp. *tritici* Eriks. & Henn, except Pgt-QCC. Drummond is

moderately susceptible to pathotype Pgt-QCC, net blotch, and *Barley yellow dwarf virus*. Drummond has slightly better resistance to net blotch than Robust, Stander, and Foster. Drummond is susceptible to loose smut [caused by *Ustilago nuda* (C.N. Jensen) Rostr.], leaf scald (caused by *Rhynchosporium secalis* (Oudem) J.J. Davis] and several *Septoria* spp. and *Fusarium* spp. that attack barley in the Midwest USA.

Results from pilot malt quality evaluations, conducted by the USDA-ARS Cereal Crops Research Unit at Madison, WI, and the American Malting Barley Association (AMBA), show that Drummond has more plump kernels and higher malt extract than the six-rowed industry standard 'Morex' (Rasmusson and Wilcoxson, 1979). Grain protein, wort protein, and the ratio of wort protein to total protein of Drummond are slightly lower than that of Morex. Enzymatic activity of Drummond and Morex are similar. Drummond was found satisfactory as compared with the check in its first year of plant scale malting and brewing quality tests conducted by members of the AMBA.

Breeder seed is maintained by the Seedstocks Project, Agricultural Experiment Station, North Dakota State Univ., Fargo, ND 58105-5051. U.S. Plant Variety Protection of Drummond (PVP Certificate no. 200100098) has been applied for Foundation, Registered, and Certified seed.

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### References

- Foster, A.E., J.D. Franckowiak, V.D. Pederson, and R.E. Pyler. 1984. Registration of 'Hazen' barley. *Crop Sci.* 24:1210.
- Horsley, R.D., J.D. Franckowiak, P.B. Schwarz, and B.J. Steffenson. 1997. Registration of 'Foster' barley. *Crop Sci.* 37:1018.
- Ramsay, L., M. Macaulay, S. degli Ivanisovich, K. MacLean, L. Cardle, J. Fuller, K.J. Edwards, S. Tuveison, M. Morgante, A. Massari, E. Maestri, N. Marmiroli, T. Sjakste, M. Ganai, W. Powell, and R. Waug. 2000. A simple sequence repeat-based linkage map of barley. *Genetics* 156:1997-2005.
- Rasmusson, D.C., and R.W. Wilcoxson. 1979. Registration of 'Morex' barley. *Crop Sci.* 19:293.
- Rasmusson, D.C., and R.W. Wilcoxson. 1983. Registration of 'Robust' barley. *Crop Sci.* 23:1216.
- Rasmusson, D.C., R.D. Wilcoxson, and J.V. Wiersma. 1991. Registration of 'Excel' barley. *Crop Sci.* 31:227.
- Rasmusson, D.C., R.D. Wilcoxson, and J.V. Wiersma. 1993. Registration of 'Stander' barley. *Crop Sci.* 33:1403.

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### Registration of 'Millennium' Barley

'Millennium' spring barley (*Hordeum vulgare* L.) (Reg. no. CV-292, PI 614659) was developed by the Utah Agricultural Experiment Station (UAES) and released in 2000. It was initially selected at Logan, UT, in 1994 as an  $F_6$  line derived from a single  $F_5$  spike selected in 1993 from a cross of UT87B603-1266/UT Short #2 made in 1989. UT87B603-1266 is a six-rowed breeding line from the cross WA6415-66 /UT Short #2. WA6415-66 (a sib to 'Steptoe') is a six-rowed breeding line derived from the cross WA Sel. 3564/'Unitan'. UT Short #2 is a six-rowed, semidwarf breeding line selected at Logan, UT, from the cross S.D.S.S. (a South Dakota breeding line)/'Primus', made by Dr. Phil B. Price at South Dakota State University.  $F_1$  plants were grown in the greenhouse during the

winter of 1989-1990. Segregating generations ( $F_2$ - $F_5$ ) were space-planted at Logan, UT, and advanced by a modified bulk method wherein agronomically desirable plants were selected each year from 1990 through 1993. Individual spikes from 265  $F_5$  plants were selected in 1993 on the basis of agronomic appearance, and were evaluated as  $F_6$  head rows in 1994. The  $F_5$ -derived line from which Millennium originated was yield-tested under irrigation at Logan, UT, in 1995, and annually thereafter at four irrigated sites and two non-irrigated sites in Utah, where it was identified as UT94B1058-4603. It was evaluated in the Western Regional Spring Barley Nursery and the Western Regional Dryland Spring Barley Nursery (1997 and 1998) as UT004603. Breeder seed was produced at Logan, UT, in 1998 from 400  $F_6$ -derived head rows selected in 1997. Rows questionable for trueness to type were rogued, and remaining rows were harvested in bulk. Foundation seed was produced at Logan, UT, in 1999.

Millennium is a six-rowed, midseason, erect-growing, semi-dwarf spring feed barley. It has a tapering, erect (lax-to-dense) spike, with some overlap of lateral kernels at the tip of the head, and rachis edges covered with hairs. Leaves and spikes are waxy. It has long glumes, with extremely long, rough glume awns. The glumes are completely covered with long hairs. It has erect (non-flaring), long, rough lemma awns. Stigmas are heavily feathered. The seed is covered, midlong, semi-wrinkled, with long rachilla hairs, and a depression at the base. Aleurone color is white and 1000-kernel weight averages 39 g. Most stems have a straight neck and most spikes are marked by a closed collar at the base.

Millennium is recommended for growing primarily under irrigation or where annual precipitation is 400 mm or more. Its relatively short, stiff straw makes it well suited for production under sprinkler or surface irrigation. In Utah irrigated tests (44 site years), average yield of Millennium (7567 kg ha<sup>-1</sup>) exceeded ( $P < 0.05$ ) that of Steptoe (6680 kg ha<sup>-1</sup>), 'Brigham' (7104 kg ha<sup>-1</sup>), 'Century' (7287 kg ha<sup>-1</sup>), 'Statehood' (7225 kg ha<sup>-1</sup>), 'Rollo' (6948 kg ha<sup>-1</sup>), 'Walker' (6749 kg ha<sup>-1</sup>), and 'Bracken' (6288 kg ha<sup>-1</sup>). In two years (1997,  $n = 12$  and 1998,  $n = 11$ ) of Western Regional Spring Barley tests, Millennium ranked second in grain yield in 1997, and first in 1998. Yield of Millennium exceeded ( $P < 0.05$ ) that of Steptoe by 11.5% (5502 kg ha<sup>-1</sup> vs. 4935 kg ha<sup>-1</sup>) in 1997, and by 15.4% (6424 kg ha<sup>-1</sup> vs. 5568 kg ha<sup>-1</sup>) in 1998 and was not significantly different from that of Brigham (5522 kg ha<sup>-1</sup>) in 1997. Millennium headed the same time as Steptoe (169 d after 1 January in Utah tests, and 175 d in Western Regional tests); it headed 3 d earlier ( $P < 0.05$ ) than Rollo (169 vs. 172 d) in Utah tests and its heading date was not significantly different from Brigham, Century, Statehood, Walker, or Bracken in these tests. In Utah irrigated tests (44 site years), Millennium (88 cm) was shorter ( $P < 0.05$ ) than Steptoe (93 cm), Century (94 cm), Rollo (91 cm), Walker (99 cm), and Bracken (92 cm); it was taller than Brigham (86 cm), and was not significantly different from Statehood (88 cm). In the same tests, Millennium's lodging percentage (2%) was lower ( $P < 0.05$ ) than Steptoe (54%), Century (19%), Statehood (15%), Rollo (35%), Walker (14%), and Bracken (34%) and was not significantly different from Brigham (4%). In Utah tests (12 site years), average test weight for Millennium (667 kg m<sup>-3</sup>) was significantly ( $P < 0.05$ ) higher than that of Rollo (642 kg m<sup>-3</sup>), but was not significantly different from that of Steptoe, Brigham, Century, Statehood, Walker, or Bracken. The test weight of Millennium was significantly ( $P < 0.05$ ) higher than that of Steptoe (630 vs. 605 kg m<sup>-3</sup>) in Regional Barley tests (21 site years). In Utah tests (12 site years), average percent protein for Millennium (132 g kg<sup>-1</sup>) was lower ( $P < 0.05$ ) than that of Century (140 g kg<sup>-1</sup>), Statehood (138 g kg<sup>-1</sup>),