REGISTRATIONS OF CULTIVARS

Registration of 'Ok102' Wheat

'Ok102' (Reg. no. CV-941, PI 632635) is a hard red winter wheat (*Triticum aestivum* L.) developed cooperatively by the Oklahoma Agric. Exp. Stn. and the USDA-ARS. Ok102 was released in March 2002, primarily on the basis of its resistance to several foliar diseases, excellent milling quality, and desirable dough strength for leavened bread products.

Ok102 was derived from the cross '2174'/'Cimarron' (PI 536993), performed in 1991. 2174 has the pedigree IL71-5662/'PL145' (PI 600840)//'2165' and was released by the Oklahoma Agric. Exp. Stn. in 1997. Cimarron has the pedigree 'Payne' (CI*tr* 17717)*2/CO725052 and was released by the Oklahoma Agric. Exp. Stn. in 1990. Ok102 traces to the bulk progeny of a single $F_{3:4}$ head row harvested in 1995. The F_2 and F_3 generations were evaluated and harvested as bulk populations in Stillwater, OK. The head row progeny was selected in 1996 from a non-replicated nursery at Lahoma, OK, for its acceptable winterhardiness, plant and head type, heading and maturity date, leaf rust (caused by *Puccinia triticina* Eriks.) resistance, lodging resistance, grain yield, volume weight, kernel plumpness, and mixograph properties. Subsequent generations were advanced by bulk selfing in the field, with roguing of taller variants each year until 2002. Ok102 was evaluated as OK97508 in replicated Oklahoma performance trials from 1997 to 2001, and in the Southern Regional Performance Nursery (SRPN) in 2000 and 2001.

Ok102 is semidwarf but shorter than most HRW wheat cultivars currently in production. Its mature-plant height (77 cm) is 8 cm shorter than 2174 and 'Ok101' (Carver et al., 2003) and 7 cm shorter than 'Jagger' (Sears et al., 1997). Lodging resistance on a scale of 1 (highest) to 5 (lowest) is about 2 for Ok102, compared with values of 1 for 2174, 3 for Ok101, and 4 for Jagger. Ok102 shows an intermediate reaction to acidic, aluminum-toxic soil. With a tolerance rating of 3.2 on a scale of 1 (most tolerant) to 5 (most susceptible), Ok102 is more sensitive to Al toxicity than Ok101 (1.3) and Jagger (1.6), but similar to 2174 (3.0). Ok102 breaks winter dormancy relatively late, but its heading date (123 d) is intermediate among current cultivars. Comparative placement of cultivars for date of first-hollow-stem stage is Jagger < Ok101 < 2174 and Ok102. Precise differences are highly year-dependent. Heading date of Ok102 is 2 d later than Ok101 and Jagger, the same as 2174, and 2 d earlier than '2137'. This phenological pattern makes Ok102 well suited for winter grazing and grain production in a dual-purpose (graze-plus-grain) management system. Another characteristic that lends Ok102 to dual-purpose production is coleoptile elongation, or the ability to emerge from deeper seed placement. When measured at 15°C in a growth chamber, coleoptile length of Ok102 (8.7 cm) is 2.1 cm longer than Ok101 (short coleoptile), 0.4 cm longer than 2174 (moderately long), and 0.4 cm shorter than Jagger (moderately long). Ok102 has a relatively high seed dormancy rating based on germination tests conducted at 4 to 12 wk post-harvest for seed stored at ambient temperature and germinated at 24/35°C night/day temperature. Seed dormancy is not expressed at 13°C constant storage temperature. This rating is consistent with the high seed dormancy ratings for both parents of Ok102 (2174 and Cimarron).

Forage yield, grain yield, and grain volume weight were determined in replicated variety trials in Oklahoma in 2001 and 2002. Across seven environments, fall forage production (measured by hand clipping at the soil surface in December, Feekes stages 2–4) averaged 2610 kg ha^{-1} for Ok102, compared with 2710 kg ha^{-1} for Ok101, 2790 kg ha^{-1} for 2174, and 2770 kg ha^{-1} for Jagger. Across 40 site-years representing mostly grain-only trials, grain yield of these four cultivars were 3000 kg ha^{-1} (Ok102), 2990 kg ha^{-1} (Ok101), 2920 kg ha^{-1} (2174), and 3020 kg ha^{-1} (Jagger). From the same trials, grain volume weight averaged 763 kg m^{-3} (Ok102), 746 kg m^{-3} (Ok101), 768 kg m^{-3} (2174), and 748 kg m^{-3} (Jagger).

In greenhouse tests, juvenile plants of Ok102 exhibited a susceptible reaction to leaf rust comprised of bulk samples of urediniospores collected from wheat fields in Oklahoma in spring 1999 and 2000. From 1999 to 2002, Ok102 has consistently shown a resistant reaction to leaf rust in field trials conducted in Texas and Oklahoma, having an approximate rating of 1 (resistant) on a 1 (resistant)-to-9 (susceptible) scale. Hence, Ok102 has adult-plant resistance to wheat leaf rust races currently present in Oklahoma. On the basis of seedling tests conducted by the USDA-ARS Cereal Disease Laboratory, St. Paul, MN, Ok102 is postulated to have *Lr*3 and *Lr*24. Their tests also indicate that seedlings of Ok102 are susceptible or have an intermediate level of resistance to five (2001 tests) to seven (2000 tests) races of stem rust [caused by *Puccinia graminis* f. sp. *tritici* (Pers.:Pers.)], and are moderately susceptible or susceptible to stem rust in the field. Results from field trials in Oklahoma and Kansas indicate Ok102 is resistant to Wheat soilborne mosaic virus (1 on a 1-to-9 scale). Ok102 exhibits an intermediate reaction to Barley yellow dwarf virus in the field, similar to the reaction of one of its parents, 2174. On the basis of seedling responses in the greenhouse to populations prevalent in Oklahoma, Ok102 is moderately resistant to tan spot [caused by *Pyrenophera tritici-repentis* (Died.) Drechs.] and resistant to powdery mildew [caused by *Blumeria graminis* (DC.) E.O. Speer f. sp. *tritici* Em. Marchal]. Ok102 produces a heterogeneous response to the Great Plains biotype of Hessian fly (*Mayetiola destructor* Say) and is susceptible to Russian wheat aphid (*Diuraphia noxia* Mordvilko) and to greenbug (*Schizaphis graminum* Rondani).

The fall growth habit of Ok102 is semierect, which is similar to 2174 but more erect than Ok101 and Jagger. Flag leaves of Ok102 at the boot stage are blue-green, erect, and twisted. Spikes are white-chaffed, awned, tapering, middense, and inclined to nodding (in approximately horizontal position) at harvest-maturity. Kernels are red, hard textured, ovate to elliptical, and midlong, and they have a midwide, middeep crease, rounded cheeks, and midsized germ.

On the basis of single-kernel characterization system (SKCS) data recorded from 16 breeder trials from 1999 to 2001, means and standard deviations for Ok102 were 29.6 and 7.7 mg for kernel weight, 2.4 and 0.4 mm for kernel diameter, and 76 and 16 for kernel hardness. Values for 2174 were 29.6 and 7.4 mg for kernel weight, 2.4 and 0.4 mm for kernel diameter, and 75 and 16 for kernel hardness index. Hence, physical quality attributes of Ok102 and 2174 are indistinguishable on the basis of SKCS parameters. From 28 site-years in the 2001 and 2002 Oklahoma wheat variety trials, wheat protein content of Ok102 (135 g kg^{-1}) equaled that of 2174 and Jagger. Ok102 has greater dough strength than 2174 on the basis of mixograph properties. On the basis of mean performance in six breeder trials, Ok102 had a mixing time of 6.0 min, a mixing tolerance score of 5.1 on a 1-to-10 scale, and mixogram curve width at 2 min past peak development of 13.6 mm. Respective scores for 2174 were 4.5 min, 4.1, and 11.4 mm. Composite milling scores reported by the USDA-ARS from 2000 and 2001 SRPN sites carried ratings of good to very good in the southern Great Plains intraregional production zones. Ratings for baking scores varied from average to very good. Overall milling and baking quality was considered acceptable in the 2001 evaluation program of the Wheat Quality Council. On a 0-to-6 scale, mean scores were 3.83 for Ok102 and 3.23 for the check cultivar, 2174. Straight grade flour yield of Ok102 (with comparisons to 2174 as the check sample) was 557 g kg^{-1} (554 g kg^{-1}) with 4.8 g kg^{-1} flour ash (4.7 g kg^{-1}). Loaf volume averaged 1606 cc (1307 cc) among 11 cooperators.

Breeder seed of Ok102 will be maintained by the Dep. of Plant and Soil Sciences and the Oklahoma Agric. Exp. Stn., Oklahoma State University, Stillwater, OK 74078. Small quantities of seed may be obtained for breeding and research purposes from the corresponding author for 5 yr from the date of publication. Seed has also been deposited in the National Seed Storage Laboratory, Fort Collins, CO. Application for U.S. Plant Variety Protection is in progress as of the date of publication.

B.F. Carver,* E.G. Krenzer, R.M. Hunger, D.R. Porter, E.L. Smith, A.R. Klatt, J. Verchot-Lubicz, P. Rayas-Duarte, A.C. Guenzi, G. Bai, and B.C. Martin

References

Carver, B.F., E.L. Smith, E.G. Krenzer, R.M. Hunger, D.R. Porter, A.R. Klatt, J. Verchot-Lubicz, P. Rayas-Duarte, A.C. Guenzi, B.C. Martin, and G. Bai. 2003. Registration of 'Ok101' wheat. Crop Sci. 43:2298–2299.

Sears, R.G., J.M. Moffatt, T.J. Martin, T.S. Cox, R.K. Bequette, S.P. Curran, O.K. Chung, W.F. Heer, J.H. Long, and M.D. Witt. 1997. Registration of 'Jagger' wheat. Crop Sci. 37:1010.

B.F. Carver, E.G. Krenzer, E.L. Smith, A.R. Klatt, A.C. Guenzi, B.C. Martin, and G. Bai, Dep. of Plant and Soil Sciences, Oklahoma State Univ., Stillwater, OK 74078; R.M. Hunger and J. Verchot-Lubicz, Dep. of Entomology and Plant Pathology, Oklahoma State Univ., Stillwater, OK 74078; D.R. Porter, USDA-ARS Plant Science Res. Lab., Stillwater, OK 74075; P. Rayas-Duarte, Dep. of Biochemistry and Molecular Biology, Oklahoma State Univ., Stillwater, OK 74078. Ok102 was developed with partial financial support of the Oklahoma Wheat Res. Foundation and Oklahoma Wheat Commission. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (bfc@okstate.edu).

Published in Crop Sci. 44:1468–1469 (2004).

Registration of 'Hubbard' Wheat

'Hubbard' is a soft white winter wheat (*Triticum aestivum* L.) (Reg. no. CV-942, PI 632273) cultivar developed by the Idaho Agricultural Experiment Station and released in December 2000. It is an awned, tall semidwarf, soft white winter wheat with good to excellent yield potential in the intermediate to high rainfall areas of the Pacific Northwest. Hubbard is named after the late Verl Hubbard, an Idaho wheat producer from Bonners Ferry, ID, who was a strong supporter of cereal research at the University of Idaho.

Hubbard originated from a single F_4 headrow (designated ID86-10420A) selected for agronomic characteristics and resistance to stripe rust (caused by *Puccinia striiformis* Westend.) from the 1986 cross 'Hill 81'/'Augusta'. Hill 81('Yamhill'/'Hyslop') is a soft white winter wheat developed by the Oregon Agricultural Experiment Station in cooperation with the USDA-ARS (Kronstad et al., 1982). Augusta ('Genesee'/'Redcoat',B2747//'Yorkstar') is a soft white winter wheat developed by the Michigan Agricultural Experiment Station in cooperation with the USDA-ARS (Everson et al., 1986). ID86-10420A was evaluated from 1995 to 2001 in replicated yield trials. In 1994, ID86-10420A was entered in the Western Regional White Winter Wheat Nursery and evaluated for 3 yr. ID86-10420A was entered for evaluation in the Tri-State Extension cereal testing nursery in 1996 and evaluated for four years. In 1999, $F_{4:12}$ ID86-10420A was evaluated by the Pacific Northwest Wheat Quality Council for its end-use quality. Heads were collected in 1998 and grown during the 1998–1999 growing season at Moscow, ID, for evaluation for uniformity. Selected head rows were then bulked to produce breeder's seed.

Hubbard is a tall semidwarf wheat (99 cm) that averages 6 cm taller than 'Lambert' (Zemetra et al., 1995) and 15 cm taller than 'Stephens' (Kronstad et al., 1978) under rainfed conditions. Hubbard is blue-green in color with erect to semierect flag leaves that tend to lie perpendicular to the stem after full extension of the spike. It can have some height variation with 2 to 4% tall variants each year, similar to its parent Hill 81. Heading date for Hubbard is intermediate (166 DOY), similar to that observed with 'Madsen' (167 DOY) (Allan et al., 1989) and about 3 d later than Stephens (163 DOY). Hubbard has good to excellent straw strength showing little or no lodging under both rainfed and irrigated conditions. It has a moderate level of winter hardiness, similar to Hill 81. Glumes of Hubbard are awned and seed is intermediate in size, white, and soft.

Hubbard is high yielding under both rainfed and irrigated conditions equaling or exceeding the yield of Stephens, Madsen, and Lambert in advanced yield testing with a rainfed 7 yr (39 site-years) average of 6815 kg ha^{-1} and a 7-yr irrigated (20 site-years) average yield of 9877 kg ha^{-1}. This is in comparison to the rainfed and irrigated yields of Stephens (6421, 9905 kg ha^{-1}), Madsen (6700, 9339 kg ha^{-1}), and Lambert (6796, 9569 kg ha^{-1}), respectively. In the Western Regional White Winter Wheat Nursery, Hubbard (6965 kg ha^{-1}) was similar in yield to Madsen (6988 kg ha^{-1}) and had a slightly greater yield than Stephens (6697 kg ha^{-1}) over 3 yr of testing (28 site-years). In University of Idaho extension trials in northern Idaho, Hubbard was the highest yielding line during 4 yr (18 site-years) with a yield of 6249 kg ha^{-1} compared with 5778 kg ha^{-1} for Stephens, 5980 kg ha^{-1} for Madsen, and 6114 kg ha^{-1} for Lambert.

In 7 yr (38 site-years) of advanced testing, Hubbard's average grain volume weight (770 kg m^{-3}, rainfed and irrigated) equaled or exceeded the grain volume weight of Stephens (753, 751 kg m^{-3}), Madsen (764, 753 kg m^{-3}), and Lambert (762, 753 kg m^{-3}) under rainfed and irrigated conditions, respectively. In the Western Regional White Winter Wheat Nursery, Hubbard's grain volume weight (788 kg m^{-3}) equaled that of Madsen (786 kg m^{-3}) and exceeded that of Stephens (778 kg m^{-3}).

Hubbard has good to excellent soft white winter wheat end-use quality. The percent flour protein for Hubbard (8.1% rainfed, 9.2% irrigated) is similar to that found for Stephens (8.1% rainfed, 9.3% irrigated) for 31 site-years of rainfed, and 18 site-years for irrigated advanced line testing. For near infrared (NIR) kernel hardness, Hubbard (19.8) was most similar to Stephens (20.0) and lower than both Madsen (23.8) and Lambert (24.3) over 30 site-years of rainfed advanced line testing in Idaho. Under irrigated conditions in Idaho (14 site-years), similar differences for NIR hardness were observed with Hubbard (20.2) and Stephens (20.3) being lower than Madsen (25.2) and Lambert (26.2). Percent break flour yield for Hubbard is favorable under both rainfed and irrigated conditions averaging 42.4% rainfed and 39.2% irrigated compared to Stephens (38.0%, 36.3%), Madsen (38.7%, 37.3%), and Lambert (41.0%, 39.2%), respectively, in 3 yr (22 rainfed site-years and 11 irrigated site-years) of advanced line testing. In regional testing, percent break flour yield of Hubbard (24.4%) was slightly greater than both Stephens (22.8%) and Madsen (23.6%). Average percent flour ash was similar for Hubbard (0.37%), Stephens (0.37%), and Madsen (0.36%) over 3 yr of regional testing. For baking quality, Hubbard performs well in both the sugar snap cookie test and the sponge cake test. Hubbard was similar to Stephens and Lambert for cookie diameter (8.7, 8.8, and 8.6 cm, respectively) and exceeded Madsen (8.5 cm) in 29 site/years of advanced line testing under rainfed conditions. Under irrigated conditions (19 site-years), Hubbard had a greater average cookie diameter (8.9 cm) than Stephens (8.7 cm), Madsen (8.6 cm), or Lambert (8.4 cm). In regional testing, Hubbard had a greater cookie diameter (8.9 cm) and sponge cake volume (1258 cm^3) than both Stephens (8.7 cm, 1213 cm^3) and Madsen (8.6 cm, 1217 cm^3). In Pacific Northwest Wheat Quality Council testing, Hubbard was found to have favorable end-use quality for a soft white winter wheat.

Hubbard has a moderate level of resistance to stripe rust on the basis of 3 yr of regional testing (1995–1997). In the Western Regional Soft Winter Wheat Nursery disease trial grown at Mt. Vernon, WA, at growth stages 5 through 7 (depending on the year), Hubbard's percent stripe rust infection ranged from 0 to 2%, while Stephens' percent infection ranged from 5 to 20% and Madsen's percent infection ranged from 0 to 5%. Hubbard expresses an intermediate level of tolerance to cephalosporium stripe (caused by *Hymenula cerealis* Ellis & Everh.) and is susceptible to strawbreaker footrot [caused by *Pseudocercosporella herpotrichoides* (Fron) Deighton], Septoria tritici blotch (caused by *Septoria tritici* Roberge in Desmaz.), common bunt [caused by *Tilletia tritici* (Bjerk.) G. Wint. In Rabenh.], and dwarf bunt (caused by *Tilletia controversa* Kühn in Rabenh.). Hubbard shows little or no physiological leaf spot under cool, wet spring field conditions compared to symptom prone cultivars such as Madsen and Stephens.

Breeder and Foundation seed of Hubbard is maintained by the Idaho Foundation Seed Program under the direction of the Idaho Agricultural Experiment Station, University of Idaho, Moscow, ID 83844. U.S. Plant Variety Protection for Hubbard has been approved (PVP no. 200300007).

R.S. Zemetra,* S.O. Guy, M.A. Lauver, K. O'Brien, T. Koehler, L. Robertson, and B. Brown

References

Allan, R.E., C.J. Peterson, Jr., G.L. Rubenthaler, R.F. Line, and D.E. Roberts. 1989. Registration of 'Madsen' wheat. Crop Sci. 29:1575.

Everson, E.H., R.D. Freed, P.K. Zwer, L.W. Morrison, B.L. Marchetti, J.L. Clayton, and W.T. Yamazaki. 1986. Registration of 'Augusta' wheat. Crop Sci. 26:201–202.

Kronstad, W.E., C.R. Rhode, M.F. Kolding, and R.J. Metzger. 1978. Registration of 'Stephens' wheat. Crop Sci. 18:1097.

Kronstad, W.E., R.J. Metzger, W.L. McCuistion, N.H. Scott, C.R. Rohde, and M.F. Kolding. 1982. Registration of 'Hill 81' wheat. Crop Sci. 22:1266.

Zemetra, R.S., C.T. Liu, W.E. Kronstad, M. Lauver, and N. Haugerud. 1995. Registration of 'Lambert' wheat. Crop Sci. 35: 1222.

R.S. Zemetra, S.O. Guy, M.A. Lauver, and T. Koehler, Dep. of Plant, Soil and Entomological Sciences, Univ. of Idaho, Moscow, ID 83844-2339; K. O'Brien and L. Robertson, Dep. of Plant, Soil and Entomological Sciences, Univ. of Idaho, Aberdeen Res. & Ext. Ctr., Aberdeen, ID 83210-0530; B. Brown, Dep. of Plant, Soil and Entomological Sciences, Univ. of Idaho, Parma Res. & Ext. Ctr., Parma, ID 83660. Idaho Agric. Exp. Stn. Publ. no. 03701. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (rzemetra@uidaho.edu).

Published in Crop Sci. 44:1469–1470 (2004).

Registration of 'Expedition' Wheat

'Expedition' (Reg. no. CV-947, PI 629060) hard red winter wheat (*Triticum aestivum* L.) was developed by the South Dakota Agricultural Experiment Station and released to seed producers in August 2002. Expedition was released on the basis of its excellent winter survival and high grain yield potential in South Dakota and the northern Great Plains region.

Expedition was derived from the cross 'Tomahawk'/'Bennett' made during 1993. Tomahawk (PI 552814) is a hard red winter wheat developed by Agripro Biosciences, Inc. and released in 1991. Bennett (CI*tr* 17723) (Schmidt et al., 1981) is a hard red winter wheat developed cooperatively by the Nebraska Agric. Exp. Stn. and USDA-ARS. Expedition was developed by means of the bulk breeding method. The cross (coded X93184) was advanced to the F_3 generation as a bulk sample. Expedition was derived as an $F_{3:4}$ head row selected by S.D. Haley in 1997. Expedition was evaluated as SD97457 in the South Dakota Early Yield Trial nursery in 1998. It was advanced beyond the Preliminary Yield Trial to the South Dakota Advanced Yield Trial in 1999 because of superior performance. It was tested in the South Dakota Crop Performance Testing (CPT) Variety Trial between 2000 and 2002 and in the Northern Regional Performance Nursery during 2001 and 2002.

Expedition is an awned, white-glumed, early maturing, semidwarf hard red winter wheat. The flag leaf is recurved and twisted at the boot stage and the foliage is green at anthesis. The spike is tapered, inclined, and mid-dense. The glume size is medium, and the glume shoulder has a wanting shape. The beak is medium in length with an acuminate tip. Kernels are dark amber to light red, hard textured, and elliptical in shape with a collarless midsized brush, rounded cheeks, and a shallow crease.

Expedition is early maturing (147 d to heading from 1 January), being similar to 'Jagger' (PI 593688), 2 d earlier than 'Wesley' (PI 605742), and 5 d earlier than 'Harding' (PI 608049) (Haley et al., 2000) in South Dakota yield trials. Plant height (77.5 cm) of Expedition was similar to 'Alliance' (PI 573096) but averaged 7.5 cm less than Harding. The winter survival of Expedition is good to excellent (similar to Harding). It has a medium length coleoptile [68 mm; similar to Wesley; 106% of Alliance; 90% of 'Nekota' (PI 584997) (Haley et al., 1996); and 74% of Harding) and fair straw strength (similar to 'Arapahoe'—PI 518591].

In 23 site-years of testing in the South Dakota CPT, grain yield of Expedition, Wesley, Alliance, Nekota, Arapahoe, Harding, and 'Crimson' (PI 601818) was 3904, 3944, 3834, 3610, 3720, 3558, and 3363 kg ha^{-1}, respectively (LSD0.05, 183 kg ha^{-1}). Expedition had slightly greater volume weight (754 kg m^{-3}) than Wesley (743 kg m^{-3}), Alliance (737 kg m^{-3}), and Harding (747 kg m^{-3}) but was slightly lower than Nekota (758 kg m^{-3}) and Crimson (760 kg m^{-3}) (LSD0.05, 18 kg m^{-3}).

Expedition has moderate resistance to stem rust (caused by *Puccinia graminis* Pers.:Pers. = *graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn.) similar to Harding and has been postulated to carry *Sr6* and other unidentified genes based on tests conducted by the USDA-ARS Cereal Disease Laboratory, St. Paul, MN. It is moderately susceptible to leaf rust (caused by *Puccinia triticina* Eriks.) similar to Wesley. Field disease ratings of reaction to Fusarium head blight (caused by *Fusarium graminearum* Schwabe) between April 2000 and July 2002 indicated that Expedition is moderately susceptible to this disease, similar to Arapahoe. Expedition is susceptible to tan spot [caused by *Pyrenophora tritici-repentis* (Died.) Drechs.], *Wheat streak mosaic virus*, and the Great Plains biotype of Hessian fly [*Mayetiola destructor* (Say)]. Expedition has exhibited intermediate reaction to wheat soil-borne mosaic virus similar to 'Trego' (PI 612576).

Composite milling and bread baking properties of Expedition were determined by the USDA-ARS Hard Winter Wheat Quality Laboratory at Manhattan, KS, during 2000 and 2001. Relative to the check cultivars Alliance and Nekota, Expedition had larger kernels (32.6 versus 26.8 and 30.7 mg, respectively), which contributed to very high flour extraction (710 versus 673 and 675 g kg^{-1}, respectively) and low flour ash (3.6 versus 3.7 and 4.2 g kg^{-1}, respectively). Flour protein of Expedition (97 g kg^{-1}) was similar to Nekota and better than Alliance (90 g kg^{-1}). In bread baking tests, bake absorption of Expedition (592 g kg^{-1}) was similar to Alliance and better than Nekota (586 g kg^{-1}), while its loaf volume was comparable to Alliance and Nekota (0.74 versus 0.77 and 0.78 L, respectively). Expedition had better mixograph tolerance than both Alliance and Nekota (5.0 versus 3.0 and 2.5 scores, respectively; 0 = unacceptable to 6 = excellent scale). Expedition had strong mixing characteristics as determined by the mixograph mix time (6.3 min) compared with Alliance (3.1 min) and Nekota (3.6 min).

The South Dakota Foundation Seed Stocks Division (Plant Science Department, South Dakota State University, Brookings, SD) had Foundation seed of Expedition available to seed producers for planting during fall 2002. Seed classes will be Breeder, Foundation, Registered, and Certified. Expedition will be submitted for registration and U.S. Plant Variety Protection under P.L. 910577 with the certification option. Small quantities of seed for research purposes may be obtained from the corresponding author for at least 5 yr from the date of this publication.

A.M.H. Ibrahim,* S.D. Haley, Y. Jin, M.A.C. Langham, C. Stymiest, J. Rickertsen, S. Kalsbeck, R. Little, O.K. Chung, B.W. Seabourn, and D.V. McVey

References

Haley, S.D., J.L. Gellner, M.A.C. Langham, Y. Jin, S. Kalsbeck, C. Stymiest, J. Rickertsen, R. Little, B.E. Ruden, O.K. Chung, B.W. Seabourn, D.V. McVey, and J.H. Hatchett. 2000. Registration of Harding Wheat. Crop Sci. 40:1500–1501.

Haley, S.D., B. Moreno-Sevilla, P.S. Baenziger, C.J. Peterson, J.W. Schmidt, D.R. Shelton, D.D. Baltensperger, L.A. Nelson, D.V. McVey, J.E. Watkins, J.H. Hatchett, and R.A. Graybosch. 1996. Registration of Nekota Wheat. Crop Sci. 36:803.

Schmidt, J.W., V.A. Johnson, P.J. Mattern, A.F. Dreier, and D.V. McVey. 1981. Registration of Bennett wheat. Crop Sci. 21:988.

A.M.H. Ibrahim, Y. Jin, M.A.C. Langham, C. Stymiest, J. Rickertsen, S. Kalsbeck, R. Little, Plant Science Dep., South Dakota State Univ., Brookings, SD 57007; S.D. Haley, Soil and Crop Sciences Dep., Colorado State University, Fort Collins, CO 80523; O.K. Chung and B.W. Seabourn, USDA/ARS/Grain Marketing and Production Research Center/Hard Winter Wheat Quality Laboratory, 1515 College Ave., Manhattan, KS 66502; D.V. McVey, USDA-ARS and Dep. of Plant Pathology, Univ. of Minnesota, St. Paul, MN 55108. Expedition was developed with partial financial support from the South Dakota Wheat Commission and South Dakota Crop Improvement Association. Contribution no. 3355 from the South Dakota Agricultural Experiment Station. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (Amir_Ibrahim@sdstate.edu).

Published in Crop Sci. 44:1470–1471 (2004).

Registration of 'Caledonia' Wheat

'Caledonia' (Reg. no. CV-943, PI 610188) is a soft white winter wheat (*Triticum aestivum* L.) developed by the Cornell Agricultural Experiment Station and released in March 1998 for production in the northeastern USA. This cultivar was released because of its exceptionally high grain yield and wide-adaptation in the northeastern USA and southern Ontario, Canada.

Caledonia originated as one of six variants selected in 1987 from a Breeder seed lot of 'Geneva' (Sorrells and Jensen, 1987), a stable, commercial wheat cultivar with the pedigree Ross Selection/3/(NY5207aB-2B-34) 'Burt'//'Genesee'/CI 12658/4/Genesee. Geneva Variant #3 was grown in a 1988–1989 Screening nursery plot and was uniform for plant type. In the 1989–1990 and 1990–1991 Cornell Small Grains Winter Wheat Master Nursery, Geneva Variant #3 had good grain yield, grain volume weight, lodging resistance, and resistance to powdery mildew (caused by *Blumeria graminis* DC f. sp. *tritici* Em. Marchal). In addition, Geneva Variant #3 had heads with uniform white chaff color and was uniformly apically awnletted.

Geneva Variant #3 was designated Geneva Reselect and entered into the Cornell Soft White Winter Wheat Regional Trial where it was evaluated from 1992 to 1998. It was entered into the Uniform Eastern Soft White Winter Wheat Nursery in 1993. In 8 yr of regional testing at four locations in New York State, the grain yield of Caledonia averaged 4% higher than standard, widely grown cultivars, Harus (Teich, 1986) and Geneva. Over 8 yr, volume weight averaged 75.7 kg hL^{-1} which was 1 kg hL^{-1} below the mean of Harus and Geneva. Caledonia is shorter than most other commercially grown cultivars in the northeast and averaged 86 cm, approximately 11 cm shorter than Geneva and Harus. Lodging resistance of Caledonia averaged 1.6 versus 1.7 for Geneva on a 0-to-9 scale where 0 = erect and 9 = flat. Winter survival was 93% for Caledonia and 95% for Geneva over 8 yr of testing.

The mean heading date for Caledonia is similar to most soft white winter cultivars grown in New York except Geneva, which usually reaches heading 2 d earlier. Caledonia has yellow-green stems and leaves at booting and hollow white stems at maturity. At booting, the flag leaf is erect and the stems have a waxy bloom. Spikes are middense, fusiform, and apically awnletted. Glumes are white in color, long, medium wide, and have a rounded shoulder and an acute beak. The soft white kernels are ovate and have rounded cheeks, a medium brush, a narrow, middeep crease, and an average mass for 1000 kernels of 35 g.

Field observations in New York indicate that Caledonia is moderately resistant to the endemic populations of loose smut [caused by *Ustilago tritici* (Pers.) Rostr.]. The resistance of Caledonia to powdery mildew is somewhat better than Geneva as evidenced by a mean score of 0.6 for Caledonia, compared to a 1.7 for Geneva, when assessed on a 0-to-9 scale where 0 is no powdery mildew and 9 is 100% of the leaf area infected. Caledonia is susceptible to Fusarium head blight (caused by *Fusarium graminearum* Schwabe), having 7.9% incidence and 2.2% severity, compared to 6.1% incidence and 1.1% severity for the resistant cultivar 'Ernie' (McKendry et al., 1995) over 3 yr of testing. On the basis of field observations, Caledonia is resistant to *Wheatspindle streak mosaic virus* (score 3.3 on a 0-to-9 scale) and *Soil-borne wheat mosaic virus* (5% incidence).

Milling and baking quality was evaluated by the USDA Soft Wheat Quality Laboratory, Wooster, OH. Flour yield means over 3 yr (1993–1995) were 75.5% for Geneva, 74.1% for Harus, and 76.0% for Caledonia. Flour protein averaged 7.8% for Geneva, 8.3% for Harus, and 8.0% for Caledonia.

Percent alkaline water retention capacity was 55.0, 51.8, and 51.5 for Geneva, Harus, and Caledonia, respectively. Mean cookie diameter for Geneva was 18.7 cm, 18.1 cm for Harus, and 18.4 cm for Caledonia.

Seed derived from the 1993–1994 Cornell Soft White Winter Wheat Regional Trial was grown as Breeder seed in 1994–1995 and rogued for uniform plant type. The generation sequence of seed production will be Breeder, Foundation, and Certified. Cultivar protection has been approved under the U.S. Plant Variety Protection Act (PVPO no. 9500249). Caledonia was approved for release in 1995 and Certified seed was made available to farmers in the fall of 1998. Breeder and Foundation seed will be maintained by the New York Seed Improvement Cooperative, 103C Leland Fieldhouse, Cornell University, Ithaca, NY 14853. Small quantities of seed are available from the corresponding author for research purposes.

M.E. Sorrells,* D. Benscher, and W.J. Cox

References

McKendry, A.L., J.E. Berg, D.N. Tague, and K.D. Kephart. 1995. Ernie wheat. Crop Sci. 35:1513.

Sorrells, M.E., and N.F. Jensen. 1987. Registration of Geneva winter wheat. Crop Sci. 27:1314–1315.

Teich, A.H. 1986. Harus soft white winter wheat. Can. J. Plant Sci. 66:161–163.

M.E. Sorrells and D. Benscher, Dep. of Plant Breeding, 252 Emerson Hall, Cornell Univ., Ithaca, NY 14853; W. J. Cox, Dep. Of Crop and Soil Sciences, 233 Emerson Hall, Cornell Univ., Ithaca, NY 14853. Research supported by Hatch 149419. Registration by the CSSA. Accepted 31 Dec. 2003. *Corresponding author (mes12@cornell.edu).

Published in Crop Sci. 44:1471–1472 (2004).

Registration of 'Richland' Wheat

'Richland' (Reg. no. CV-944, PI 632399) is a soft white winter wheat (*Triticum aestivum* L.) developed by the Cornell Agricultural Experiment Station and released in March 2001 for production in the northeastern USA. This cultivar was released because of its exceptionally high grain yield and wide-adaptation in the northeastern USA and southern Ontario, Canada.

Two accessions of the German wheat 'Kleiber' (PI 345527 and PI 383394) were obtained from the National Small Grains Collection in Aberdeen, ID, and were used in a number of crosses because Kleiber had been reported to have resistance to preharvest sprouting (Derera et al., 1976). Richland originated as a selection from a composite population that was composed of the following F_1 hybrids: 79052-'Kleiber' (Poland)/'Houser'//Houser; 79053-Houser//Kleiber (Poland)/Houser; 79054-Houser//Houser/Kleiber (Germany); 79055-Houser/Kleiber (Germany)//Houser; 79056-Houser//Houser/Kleiber (Poland); 79057-Houser/Kleiber (Poland)//Houser; 59076-Kleiber (Poland)/Houser//'Geneva'; 59077-Houser/Kleiber (Poland)//Geneva. In 1988, F_1 seed from the crosses described above were bulked, designated NY88024, and fall planted. The F_2 through F_4 generations were bulk harvested and screened for large, plump seed with an air-screen cleaner. In 1992, 200 g were sampled from the harvested plot and space-planted in an F_5 selection plot. In 1993, 200 single spikes were harvested from plants selected for short stature and then examined for plump, white seed. Seventeen were selected for planting and in 1994, two of those headrows were selected for short stature, uniformity, and freedom from diseases and planted in our screening nursery where they were selected for winter survival, plant height, and freedom from diseases. One selection was advanced to the Cornell Small Grains Winter Wheat Master Nursery where it was evaluated for grain yield, test weight, lodging resistance, chaff color, absence of awns, and resistance to powdery mildew (caused by *Blumeria graminis* DC f. sp. *tritici* Em. Marchal) over the next 2 yr. In the fall of 1997, this line was designated NY88024-117 and seed from that plot was used for the Cornell Soft White Winter Wheat Regional Trial where it was evaluated from 1998 to 2002 and for the Uniform Eastern Soft White Winter Wheat Nursery in 2000.

In 5 yr (1998–2002) of regional testing at four locations in New York, the grain yield of Richland (5055 kg hL^{-1}) was similar to 'Caledonia' and averaged 6% higher than Geneva, both widely grown cultivars. Over 5 yr, volume weight of Richland was similar to Geneva and averaged 78.1 kg hL^{-1}, which was 1 kg hL^{-1} above Caledonia. Richland is similar in height (95 cm) to Geneva and averaged 11 cm taller than Caledonia. Lodging resistance (mean of 1.7 on a 0-to-9 score where 0 is erect and 9 is flat) and winter survival (98%) of Richland were similar to Geneva and slightly superior to Caledonia.

Mean heading date for Richland is similar to most soft white winter cultivars grown in New York except Geneva, which usually reaches heading 2 d earlier. Richland has yellow-green stems and leaves at booting and hollow white stems at maturity. At booting the flag leaf is erect and twisted and the stems have a waxy bloom. Spikes are dense, tapering, and awnletted. Glumes are tan in color, medium long, wide, and have a square shoulder and an obtuse beak. The soft white kernels are ovate and have rounded cheeks, a short brush, a narrow, shallow crease, and an average 1000-kernel weight of 35 g.

Field observations in New York indicate that Richland is moderately resistant to the endemic populations of loose smut [caused by *Ustilago tritici* (Pers.) Rostr.]. Powdery mildew means over 5 yr were 1.0 and 1.5 for Richland and Caledonia, respectively. Richland is moderately resistant to powdery mildew as evidenced by a mean score of 1.0 versus 1.5 for Caledonia when assessed on a 0 (no symptoms) to 9 (100% of leaf area covered) scale. Richland is moderately susceptible to Fusarium head blight (caused by *Fusarium graminearum* Schwabe). Richland was tested in the 2001 Uniform Northern Winter Wheat Scab Nursery where percent severity and percent incidence were 27.1 and 57.8 versus Ernie at 20.5 and 44.9 with LSDs of 10.4 and 16.8, respectively. On the basis of field observations Richland is classified as highly resistant to *Wheat spindle streak mosaic virus* (score 2.1 on a 0-to-9 scale) and *Soil-borne wheat mosaic virus* (0% incidence).

Milling and baking was evaluated by the USDA Soft Wheat Quality Laboratory, Wooster, OH. Flour yield means over 2 yr were 72.8% for Caledonia and 72.0% for Richland. Flour protein averaged 7.5% for Caledonia and 8.5% for Richland. Percent alkaline water retention capacity was 58.6 and 59.2 for Caledonia and Richland, respectively. Mean cookie diameter for Caledonia was 18.4 and 18.3 for Richland.

Seed from the 2000 regional trials was space-planted, rogued off-types and used directly for a Breeder seed increase in 2001. The generation sequence of seed production will be Breeder, Foundation, and Certified. Cultivar protection has been applied for under the U.S. Plant Variety Protection Act (Application no. 200300068). Certified seed was made available to farmers in the fall of 2002. Breeder and Foundation seed will be maintained by the New York Seed Improvement Cooperative, 103C Leland Fieldhouse, Cornell University, Ithaca, NY 14853.

M.E. Sorrells,* D. Benscher, and G.C. Bergstrom

References

Derera, N.F., G.J. McMaster, and L.N. Balaam. 1976. Pre-harvest sprouting resistance and associated components in 12 wheat cultivars. Cereal Res. Commun. 4:173–179.

M.E. Sorrells and D. Benscher, Dep. of Plant Breeding, 252 Emerson Hall, Cornell Univ., Ithaca, NY 14853; G.C. Bergstrom, Dep. of Plant Pathology, 334 Plant Science Building, Cornell Univ., Ithaca, NY 14853. Research supported by Hatch 149419. Registration by the CSSA. Accepted 31 Dec. 2003. *Corresponding author (mes12@cornell.edu).

Published in Crop Sci. 44:1472–1473 (2004).

Registration of 'Goodstreak' Wheat

'Goodstreak' (Reg. no. CV-945, PI 632434) is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in January 2002 by the developing institutions and the Wyoming Agricultural Experiment Station. Goodstreak was released primarily for its superior adaptation to rainfed wheat production systems in western Nebraska where conventional-height wheat cultivars with long coleoptiles are needed for good emergence and growth under in low moisture conditions. The name was chosen because the area in which it will most likely be grown is know as "Goodstreak" because the grasslands were better for grazing than the surrounding areas. In this area, drought is common and water-use efficient annual crops and cultivars, such as Goodstreak wheat are required for successful production.

Goodstreak was selected from the cross SD3055/KS88H164//NE89646 that was made in 1991. The pedigree of SD3055 is ND604/SD2971, where ND604 is 'Len' (CI 17990)//'Butte' (CI 17681)/ND526 and SD2971 is 'Agent' (CI 13523)/3/ND441//'Waldron' (CI 13958)/'Bluebird' (CI 17414)/4/Butte/5/Len. The pedigree of KS88H164 is 'Dular'(CI 13373)/'Eagle' (CI 15068)//2*'Cheney' (CI 17765)/'Larned' (CI 17650)/3/'TAM107' (PI 495594). The pedigree of NE89646 is 'Colt' (PI 476975) *2/'Patrizanka'. The F_1 to F_3 generations were advanced using the bulk breeding method. Goodstreak is an F_3–derived line that was selected in the F_4 generation.

Goodstreak was evaluated as NE97465 in Nebraska yield nurseries starting in 1997, in the Southern Regional Performance Nursery in 2000 and 2001, and in Nebraska cultivar performance trials in 2001 and 2002. The average Nebraska rainfed yield of Goodstreak of 3280 kg ha^{-1} (28 environments) was less than the grain yields of 'Millennium' (PI 613099; 3440 kg ha^{-1}), 'Wahoo' (PI 619098; 3430 kg ha^{-1}) and 'Alliance' (PI 573096; 3380 kg ha^{-1}), but greater than 'Culver' (PI 606726; 3230 kg ha^{-1}), 'Wesley' (PI 605742; 3160 kg ha^{-1}), and Arapahoe (PI 518591; 3180 kg ha^{-1}). In western NE and WY (12 environments), Goodstreak (2690 kg ha^{-1}) was similar in yield to 'Pronghorn' (PI 593047; 2710 kg ha^{-1}) and superior to Buckskin (CI 17263; 2500 kg ha^{-1}). Goodstreak, Pronghorn, and Buckskin are conventional-height wheat cultivars and the most widely grown cultivars in low moisture, rainfed wheat production. Though semidwarf cultivars may perform well in these environments, they are considered by producers as having inconsistent performance because of potentially poor emergence and difficult to harvest in fields that are not level. In the Southern Regional Performance Nursery, Goodstreak ranked 38th of 45 entries in 2000 (32 environments) and 15th of 43 entries in 2001 (32 environments) and averaged 40 kg ha^{-1} less grain yield than TAM 107. Goodstreak has not performed well under irrigation and is not recommended for use in irrigated productions systems.

Goodstreak is medium in maturity (142 d after 1 January, data from observations in Nebraska), about 1 d earlier flowering than Buckskin and 1.5 d later flowering than Pronghorn. Goodstreak has a long coleoptile (62 mm), as expected for a conventional-height wheat cultivar, and is similar in length to Pronghorn (64 mm) and slightly shorter than Buckskin (70 mm), but longer than semidwarf wheat cultivars such as Arapahoe (45 mm), and Millennium (44 mm). The mature plant height of Goodstreak (94 cm) is 7 cm taller than Millennium and 21 cm taller than Wesley. Goodstreak has good straw strength (9% lodged), which is better than Arapahoe (25% lodged), but lower than Wesley (2% lodged). Though Pronghorn and Buckskin were not in the same trials where lodging was measured, Goodstreak would be slightly superior to Pronghorn and Buckskin. The winter hardiness of Goodstreak is good to very good, and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

Goodstreak is moderately resistant to stem rust (caused by *Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks & E. Henn; most likely containing *Sr6* and an unknown gene; data provided by D. McVey at the USDA Cereal Disease Laboratory, St. Paul, MN), and Hessian fly (*Mayetiola destructor* Say, superior to Arapahoe, data provided by J. Hatchett and Ming-Shun Chen, USDA and Kansas State University). Goodstreak is susceptible to leaf rust (caused by *P. triticina* Eriks.; may contain an unknown ineffective gene; data provided by D. McVey at the USDA Cereal Disease Laboratory), *Soil-borne wheat mosaic virus*, *Wheat streak mosaic virus*, and Barley yellow dwarf virus (data obtained from the Uniform Winter Wheat Southern Regional Performance Nursery, 2000–2001 and field observations in NE).

Goodstreak has good grain volume weight (76.7 kg hL^{-1}), which is similar to Pronghorn and Millennium, and is superior to Arapahoe (75.0 kg hL^{-1}) and Wesley (74.8 kg hL^{-1}). The milling and baking properties of Goodstreak were determined for 5 yr by the Nebraska Wheat Quality Laboratory. In these tests, Arapahoe was used as a check cultivar. The average protein content of the grain and flour of Goodstreak (137 and 118 g kg^{-1}) was lower than Arapahoe (143 and 131 g kg^{-1}). In the low rainfed environments of western Nebraska and Wyoming, the average grain protein content of Goodstreak (135 g kg^{-1}) was higher than Pronghorn (130 g kg^{-1}) and Buckskin (130 g kg^{-1}). The average flour extraction on the Buhler Laboratory Mill for Goodstreak (708 g kg^{-1}) was similar to Arapahoe (712 g kg^{-1}). The flour ash content (43 g kg^{-1}) was similar to Arapahoe (43 g kg^{-1}). Dough mixing properties of Goodstreak are acceptable, but weaker than Arapahoe. Average bake water absorption was slightly better than Arapahoe. The average loaf volume of Goodstreak (912 cm^3) was less than Arapahoe (937 cm^3). The scores for internal crumb grain and texture were good and similar to those of Arapahoe. The overall end-use quality characteristics for Goodstreak should be acceptable to the milling and baking industries.

Goodstreak is an awned, white-glumed cultivar. Its field appearance is most similar to Buckskin. After heading, the canopy is moderately closed and upright. The flag leaf is erect and twisted at the boot stage. The foliage is light green to yellow-green with a light waxy bloom at anthesis. The leaves are glaborous. The spike is tapering in shape, narrow, and midlong. The glume is glabrous, midlong and narrow, and the glume shoulder is midwide to wide and square to oblique. The beak is medium in length with an acuminate to acute tip. The spike is usually inclined to nodding at maturity. Kernels are red colored, hard textured, short to midlong, and elliptical in shape. The kernel has no collar, a large brush of medium length, rounded cheeks, large germ, and a narrow and shallow crease.

In positioning Goodstreak, it has performed well throughout most of Nebraska but is best adapted to low rainfed wheat production systems where conventional height wheat cultivars are grown. Goodstreak should be a good replacement for Buckskin. Both are conventional-height cultivars, but Goodstreak has a higher yield potential, slightly better straw strength, and superior disease and insect resistances. Buckskin is susceptible to *P. graminis* f. sp. *tritici* and less resistant than Goodstreak to *M. destructor*. Goodstreak is genetically complementary to '2137' (PI 532107), Alliance, Buckskin, Culver, 'Jagger' (PI 593688), Millennium, 'Niobrara' (PI 584996), Pronghorn, 'Vista' (PI 562653), and 'Windstar' (PI 587379).

Goodstreak has been uniform and stable in type and composition since 2000. Less than 0.5% of the plants were rogued from the Breeder seed increase in 2000. The rogued variant plants were taller in height (7–15 cm) or were awnless with red chaff. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association and Mr. Roger Hammons provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln NE 68583 provided Foundation seed to qualified certified seed enterprises in 2002. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. The Registered seed class will be a non-salable seed class. A research and development fee will be assessed on all certified seed sales. Goodstreak will be submitted for registration and U.S. Plant Variety Protection under P. L. 10577 with the certification option. Small quantities of seed for research purposes may be obtained from the corresponding author and the Department of Agronomy and Horticulture, University of Nebraska-Lincoln for at least 5 yr from the date of this publication.

P.S. Baenziger,* B. Beecher, R.A. Graybosch, D.D. Baltensperger, L.A. Nelson, J.M. Krall, D.V. Mcvey, J.E. Watkins, J.H. Hatchett, and Ming-Shun Chen

P. S. Baenziger, B. Beecher, D. D. Baltensperger, and L. A. Nelson, Dep. of Agronomy and Horticulture; R. A. Graybosch, USDA-ARS and Dep. of Agronomy and Horticulture; J. E. Watkins, Dep. of Plant Pathology; Univ. of Nebraska, Lincoln, NE 68583; J. M. Krall, Torrington Res. And Ext. Center, University of Wyoming, Torrington, WY 88240; D. V. McVey, USDA-ARS and Dep. of Plant Pathology, Univ. of Minnesota, St. Paul, MN 55108; J. H. Hatchett and Ming-Shun Chen, USDA-ARS and Dep. of Entomology, Kansas State Univ., Manhattan, KS 66506. Goodstreak was developed with partial financial support from the Nebraska Wheat Development, Utilization, and Marketing Board. Cooperative investigations of the Nebraska Agric. Res. Div., Univ. of Nebraska, and USDA-ARS. Contribution no. 14024 from the Nebraska Agric. Res. Div. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (Pbaenziger1@unl.edu).

Published in Crop Sci. 44:1473–1474 (2004).

Registration of 'Harry' Wheat

'Harry' (Reg. no. CV-946, PI 632435) is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in January 2002 by the developing institutions. Harry was released primarily for its superior adaptation to rainfed wheat production systems in western Nebraska. The name Harry was chosen to honor Mr. Harry Cullan, deceased, who was a proponent of well-adapted cultivars and certified seed production in western Nebraska.

Harry was selected from the cross NE90614/NE87612 which was made in 1991. The pedigree of NE90614 is 'Brule'/4/'Parker' *4/'Agent'//'Beloterkovskaia 198'/'Lancer'/3/'Newton'/Brule. The pedigree of NE87612 is Newton//'Warrior' *5/Agent/3/'Agate' sib. The F_1 to F_3 generations were advanced using the bulk breeding method. Harry is an F_3–derived line that was selected in the F_4 generation.

Harry was evaluated as NE97689 in Nebraska yield nurseries starting in 1998, in the Northern Regional Performance Nursery in 2000 and 2001, and in Nebraska cultivar performance trials in 2000 to 2002. The average Nebraska rainfed yield of Harry of 3310 kg ha^{-1} (28 environments from 2001 to 2002) was greater than the yields of 'Wesley' (PI 605742; 3160 kg ha^{-1}), and 'Culver' (PI 606726; 3230 kg ha^{-1}), but was lower than 'Millennium' (PI 613099; 3440 kg ha^{-1}), 'Wahoo' (PI 619098; 3430 kg ha^{-1}), and 'Alliance' (PI 573096; 3380 kg ha^{-1}). In its primary area of adaptation (western Nebraska), Harry (17 environments from 2000 to 2002) has yielded 3000 kg ha^{-1}, which was greater than Wesley (2650 kg ha^{-1}), Culver (2770 kg ha^{-1}), Millennium (2890 kg ha^{-1}), Wahoo (2910 kg ha^{-1}), and Alliance (2880 kg ha^{-1}). In the Northern Regional Performance Nursery, Harry ranked first of 33 entries in 2000 (12 environments) and 4th of 30 entries in 2001 (12 environments) and averaged 520 kg ha^{-1} more grain yield than 'Abilene' (PI511307) and 750 kg ha^{-1} more grain yield than 'Nekota' (PI 584997). Harry has acceptable performance under irrigation, but other wheat cultivars with superior performance, especially with better straw strength (described below), would be recommended.

Harry is late in maturity (147 d after 1 January, data from observations in Nebraska), about 2.2 and 3.6 d later flowering than 'Arapahoe' (PI 518591) and Wesley, respectively. Harry is a semidwarf wheat cultivar and has a short coleoptile (41 mm) similar to Arapahoe (45 mm), Millennium (44 mm), and Wahoo (47 mm); but shorter than 'Cougar' (PI 613098; 67 mm), a semidwarf line with a different semidwarfing gene that does not affect coleoptile length, and Pronghorn (PI 593047; 64 mm), a conventional-height wheat cultivar. The mature plant height of Harry (79 cm) is 6 cm shorter than Arapahoe and 6 cm taller than Wesley. Harry has moderate straw strength (25% lodged), similar to Arapahoe (25% lodged), but weaker than Wesley (2% lodged). The winter hardiness of Harry is good to very good, similar to Abilene and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

Harry is moderately resistant to stem rust [caused by *Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks & E. Henn; most likely containing *Sr6, Sr17* (which alone is no longer effective), and *Sr24*; data provided by D. McVey at the USDA Cereal Disease Laboratory, St. Paul, MN]. It is also moderately resistant to leaf rust (caused by *P. triticina* Eriks.; most likely contains *Lr24,* and possibly other leaf rust resistance genes; data provided by D. McVey at the USDA Cereal Disease Laboratory), and Hessian fly (*Mayetiola destructor* Say, similar to Arapahoe, and most likely contains the Marquillo-Kawvale genes for resistance; data provided by J. Hatchett and Ming-Shun Chen, USDA and Kansas State University). It is susceptible to *Soil-borne wheat mosaic virus* and *Wheat streak mosaic virus*, but may possess a low level of tolerance to Barley yellow dwarf virus (data obtained from the Uniform Winter Wheat Northern Regional Performance Nursery, 2000–2001 and field observations in NE).

Harry is a genetically lower in grain volume weight (72.0 kg hL^{-1}), which is lower than Arapahoe (75.0 kg hL^{-1}) and Wesley (74.7 kg hL^{-1}), Culver (74.3 kg hL^{-1}), Millennium (76.3 kg hL^{-1}), and Alliance (74.5 kg hL^{-1}). The milling and baking properties of Harry were determined for 6 yr by the

Nebraska Wheat Quality Laboratory. In these tests, Arapahoe was used as a check cultivar. The average protein content of grain and flour of Harry (130 and 119 g kg^{-1}) was lower than Arapahoe (143 and 131 g kg^{-1}). The average flour extraction on the Buhler Laboratory Mill for Harry (687 g kg^{-1}) was lower than Arapahoe (712 g kg^{-1}). The flour ash content (42 g kg^{-1}) was lower than Arapahoe (43 g kg^{-1}). Dough mixing properties of Harry were acceptable, but slightly weaker than Arapahoe. Average bake water absorption was slightly less than Arapahoe. The average loaf volume of Harry (885 cm^3) was less than Arapahoe (937 cm^3). The scores for internal crumb grain and texture were good and slightly better than those for Arapahoe. The overall end-use quality characteristics for Harry should be acceptable to the milling and baking industries.

Harry is an awned, white-glumed cultivar. Its field appearance is most similar to Alliance. After heading, the canopy is moderately open and upright. The flag leaf is erect and twisted at the boot stage. The foliage is green to yellow-green with a waxy bloom on the flag leaf, leaf sheath, and a light waxy bloom on the spike at anthesis. The leaves are pubescent. The spike is tapering to oblong in shape, narrow, midlong, and mid-dense. The glume is midlong and midwide, and the glume shoulder is midwide and square to rounded. The beak is medium long to long in length with an acuminate tip. The spike is erect to inclined at maturity. Kernels are red colored, hard textured, midlong, and elliptical in shape. The kernel has no collar, a large brush of short length, rounded cheeks, large germ, and a midwide and middeep crease.

In Nebraska cultivar performance trials, Harry is well adapted to most rainfed wheat production systems in western Nebraska and in adjacent states with similar growing seasons where its later maturity and full season grain filling capabilities are favored except in times of drought. Being a later maturity wheat may explain its exceptional performance in the Northern Regional Performance Nursery where later wheat genotypes (by Nebraska standards) are favored. Where it is adapted, Harry should be a good replacement for Arapahoe, 'Windstar' (PI 587379), and '2137' (PI 532107) as it has a higher yield potential and similar or superior disease and insect resistances. Harry is genetically complementary to 2137, Alliance, 'Buckskin' (CI 17263), 'Jagger'(PI 593688), Pronghorn, Windstar. It is noncomplementary to Arapahoe, Culver, Millennium, 'Niobrara' (PI 584996), and 'Vista' (PI 562653).

Harry has been uniform and stable in composition since 2000. Less than 0.5% of the plants were rogued from the Breeder seed increase in 2000. The rogued variant plants were taller in height (10–15 cm) or were awnless with red chaff. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association and Mr. Roger Hammons provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE 68583 provided Foundation seed to qualified certified seed enterprises in 2002. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. The Registered seed class will be a non-salable seed class. Harry will be submitted for registration and trade marking. A research and development fee will be assessed on all certified seed sales. Small quantities of seed for research purposes may be obtained from the corresponding author and the Department of Agronomy and Horticulture, University of Nebraska-Lincoln for at least 5 yr from the date of this publication.

P.S. Baenziger,* B. Beecher, R.A. Graybosch,
D.D. Baltensperger, L.A. Nelson, D.V. Mcvey,
J.E. Watkins, J.H. Hatchett, and Ming-Shun Chen

P.S. Baenziger, B. Beecher, D.D. Baltensperger, and L.A. Nelson, Dep. of Agronomy and Horticulture; R.A. Graybosch, USDA-ARS and Dep. of Agronomy and Horticulture; J.E. Watkins, Dep. of Plant Pathology; Univ. of Nebraska, Lincoln, NE 68583; D.V. McVey, USDA-ARS and Dep. of Plant Pathology, Univ. of Minnesota, St. Paul, MN 55108; J.H. Hatchett and Ming-Shun Chen, USDA-ARS and Dep. of Entomology, Kansas State Univ., Manhattan, KS 66506.
Harry was developed with partial financial support from the Nebraska Wheat Development, Utilization, and Marketing Board. Cooperative investigations of the Nebraska Agric. Res. Div., Univ. of Nebraska, and USDA-ARS. Contribution no. 14025 from the Nebraska Agric. Res. Div. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (Pbaenziger1@unl.edu).

Published in Crop Sci. 44:1474–1475 (2004).

Registration of 'DW' Wheat

'DW' hard red winter wheat (*Triticum aestivum* L.) (Reg. no. CV-948, PI 620629) was released in 2001 by the Idaho Agricultural Experiment Station. DW is a semidwarf wheat adapted to rain-fed production zones of the Pacific Northwest area of the USA. It was released on the basis of its high grain yield and superior bread baking quality. DW is named for D.W. Sunderman, a wheat breeder at the Aberdeen location with both the USDA-ARS (1963–1986) and University of Idaho (1986–1988).

DW is a selection from the 1985 cross A8616W with the pedigree A81710WSW-54/'Blizzard' (Sunderman et al., 1991). The selection A81710SW-54 (pedigree 'WAID'/2*'Borah'// 'Neeley') was intended to transfer strong gliadin characteristics from WAID (CI*tr* 17806) durum (*T. turgidum* L. subsp. *durum*) into a bread wheat background (Sunderman and Bruinsma 1975; Sunderman and O'Connell 1983). Harvested seed was bulked and advanced in the F_1 through F_4 generations at Aberdeen. In 1989, heads from the F_4 bulk of A8616W were individually harvested and planted to $F_{4:5}$ headrows at Aberdeen in fall of 1990. One of the headrow selections, A8616W--4S, was yield tested in an unreplicated trial at Aberdeen in the fall of 1991 and in replicated testing at rain-fed locations in Idaho (Teton, Franklin, Oneida, and Power counties) beginning in the fall of 1992. After 4 yr of replicated testing, A8616W-4S was entered into the Western Regional Nursery as IDO513 from 1997 to 1999. Pure line $F_{4:9}$ heads of IDO513 were selected in 1999 and evaluated for uniformity and trueness-to-type in 2000. Approximately 100 head row $F_{4:9}$ selections harvested in 2000 were composited to form breeder seed of DW.

DW has a prostrate juvenile growth habit with blue-green foliage and no waxy bloom. The flag leaves of DW are erect with auricles that are glabrous and blue-green in color. The heads of DW are lax and awned. Glumes of DW are long, medium wide, with a squared shoulder shape, and an acute beak. At maturity, DW has bronze chaff color. Seed of DW is medium sized, approximately 31 mg per kernel, similar to 'Manning' (CI*tr* 17846) and 'Utah 100' (PI 594920), yet smaller than Bonneville (37 mg kernel^{-1}) and 'Weston' (CI*tr* 17727, 40 mg kernel^{-1}). Seed is elliptical in shape, with angular cheeks, and a short, uncollared brush. The seed crease is wide and shallow in depth.

DW has a medium maturity, heading approximately 158 d after 1 January, 3 d earlier than 'Bonneville' (PI 557015) and 1 d later than Manning. In southeastern Idaho rain-fed production, the mature height of DW is approximately 77 cm, similar to 'Boundary' (PI 603039) and 14 cm shorter than Bonneville. On the basis of 5 yr of field evaluations at the USDA-ARS

Green Canyon field trial near Logan, UT, DW is highly resistant to dwarf bunt (caused by *T. controversa* Kühn in Rabenh.), similar to the cultivars Blizzard and Bonneville, with average number of bunted kernels below 2% and highest ratings below 8% when 'Cheyenne' (CI*tr* 8885), the susceptible check cultivar, exceeded 75% bunted kernels. In 3 yr of Western Regional Testing in Idaho and Washington, DW had adult plant resistance (Type 4 or no reaction in 6 site-years) to stripe rust (causal organism *Puccinia striiformis* Westend), and seedling resistance to races CDL37 and CDL45 (Roelfs et al., 1992, p. 32). DW is susceptible in the seedling stage to race CDL43. In 4 yr of moderate to severe snow mold disease pressure in Oneida County, ID, yield trials, DW had an average spring survival rate of 73% compared with 68% for the resistant cultivar Bonneville and 62% for the moderately resistant cultivars Weston and 'Eltan' (PI 536994).

In southeastern Idaho rain-fed yield trials, 1994 to 2000 (23 site-years), DW had an average yield of 4.1 Mg ha^{-1} compared with 3.6 Mg ha^{-1} for Bonneville, 3.7 Mg ha^{-1} for Weston, and 4.1 Mg ha^{-1} for Manning. DW is similar in grain volume weight to Bonneville and Weston (789, 797, and 795 kg m^{-3}, respectively), yet greater than Manning (780 kg m^{-3}). On the basis of milling and baking evaluations by University of Idaho Wheat Quality Laboratory, DW has good quality characteristics. In 16 site-years of southeastern Idaho trials with a Braebender Quadrumat Senior Mill, DW had similar flour extraction to Manning and Utah 100, yet lower than Bonneville, with flour extractions of 678 g kg^{-1} for DW, 679 g kg^{-1} for Manning, 672 g kg^{-1} for Utah 100, and 699 g kg^{-1} for Bonneville (LSD $p < 0.05 = 6$ g kg^{-1}). DW has strong mixing characteristics with a mixograph mixing time of 3.7 min to peak dough development compared with 3.0 min for Bonneville and 3.1 min for Manning and Utah 100. Loaf volumes for bread baked from DW flour is similar to Bonneville and larger than Manning and Utah 100 (Loaf volumes: 986, 991, 948, and 952 mL, respectively; LSD $p < 0.05 = 32$ mL).

Seed of DW will be maintained by the University of Idaho, Foundation Seed Program and may be obtained by contacting the corresponding author. U.S. Plant Variety Protection has been applied for with the recognized classes of Foundation, Registered, and Certified seed.

E.J. Souza,* M.J. Guttieri, and K. O'Brien

References

Roelfs, A.P., R.P. Singh, and E.E. Saari. 1992. Rust diseases of wheat: Concepts and methods of disease management. CIMMYT, Mexico, D.F.

Sunderman, D.W. Ed Souza, and Diane Birzer. 1991. Registration of 'Blizzard' wheat. Crop Sci. 31:409–410.

Sunderman, D.W., and B. O'Connell. 1983. Registration of Neeley wheat. Crop Sci. 23:187.

Sunderman, D.W., and B. Bruinsma. 1975. Registration of four wheat cultivars. Crop Sci. 15:104.

E.J. Souza, Plant Breeding and Genetics, M.J. Guttieri, and K. O'Brien, Idaho Wheat Quality Laboratory, respectively; Aberdeen Research and Extension Center, P.O. Box 870, University of Idaho, Aberdeen, ID 83210. Manuscript no. 03718 of research funded in part by the Idaho Wheat Commission and the Idaho Agric. Exper. Stn. Hatch Project IDA 1222. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (esouza@uidaho.edu).

Published in Crop Sci. 44:1475–1476 (2004).

Registration of 'Gary' Wheat

'Gary' hard white winter wheat (*Triticum aestivum* L. Reg. no. CV-951, PI 620632) was released in 2001 by the Idaho Agricultural Experiment Station. Gary is a semidwarf wheat adapted to rain-fed production zones of the Pacific Northwest area of the USA. It has end-use quality suited to both domestic bread use and Asian noodle products.

Gary is a selection from a first backcross made in 1987, A879W, with the parentage 'Manning'*2/'Survivor' (Dewey, 1981; Souza et al., 1992). Plants of the BC_1 generation were harvested in bulk in fall 1988 from a field plot at Aberdeen and planted again as BC_1F_2 in the field at Aberdeen, fall 1988. The BC_1F_3 seed was harvested in bulk in 1989 and portion of the seed was planted at Aberdeen in 1991. Heads from the population were harvested in 1992 and planted to $BC_1F_{3:4}$ head rows in the fall of 1993. One of the head rows, designated A879W-5, was advanced to yield testing and evaluated in replicated testing at rain-fed locations in southern Idaho (Teton, Franklin, Oneida, and Power counties) from 1994 to 1998. A879W-5 was advanced to the Western Regional Nursery in 1998 with the line number IDO550. Pure line $BC_1F_{3:9}$ heads of IDO550 were selected in 1999 and evaluated for uniformity and trueness-to-type in 2000. Approximately 100 head row $BC_1F_{3:9}$ selections harvested in 2000 were composited to form Breeder seed of Gary.

Gary has a prostrate juvenile growth habit with blue-green foliage and no waxy bloom. The flag leaves of Gary are erect with auricles that are glabrous and green to yellow-green in color. The heads of Gary are lax and awned. Gary's glumes are long, mediumwide, with a squared shoulder shape, and an acute beak. At maturity, Gary has white chaff color. Seed of Gary is medium sized, approximately 35 mg per kernel compared with 31 mg for Manning and 'Utah 100' (PI 594920), 37 mg for Bonneville, and 40 mg per kernel for 'Weston' (CI*tr* 17727). Seed is elliptical in shape, with angular cheeks, and a short, uncollared brush. The seed crease is wide and shallow in depth.

Gary has a medium maturity, flowering approximately 158 d after 1 January, 3 d earlier than 'Bonneville' (PI 557015) and 1 d later than Manning. In southeastern Idaho rain-fed production, Gary's mature height is approximately 89 cm, 5 cm taller than Manning and 8 cm shorter than Bonneville. On the basis of 5 yr of field evaluations at the USDA-ARS Green Canyon field trial near Logan, UT, Gary is resistant to dwarf bunt (caused by *T. controversa* Kühn in Rabenh.), similar to the cultivars 'Blizzard' (PI 512302) and Bonneville, with average number of bunted kernels below 2% and highest ratings below 8% when 'Cheyenne' (CI*tr* 8885), the susceptible check cultivar, exceeded 75% bunted kernels. In 3 yr of Western Regional Testing in Idaho and Washington, Gary had moderate adult plant resistance to stripe rust (Type 5 reaction, causal organism *Puccinia striiformis* Westend), when inoculated with races CDL37, CDL43, and CDL45 similar to Bonneville (Roelfs et al., 1992, p. 32). Gary is tolerant to snow mold. In six site-years of southeastern Idaho testing where *Typhula* snowmolds reduced spring stands, Gary had an average spring stand of 92% compared with 89% for the tolerant winter wheat Bonneville, 87% for Manning and 85% for the moderately susceptible cultivar 'Promontory' (PI 555458, Gary and Promontory different at the 95% confidence interval).

In southeastern Idaho rain-fed yield trials, 1997 to 2000 (14 site-years), Gary had an average yield of 4.2 Mg ha^{-1} compared with 3.8 Mg ha^{-1} for Bonneville, 3.9 Mg ha^{-1} for 'Weston', 4.1 Mg ha^{-1} for Manning, and 4.2 Mg ha^{-1} for Utah 100. Gary is similar in grain volume-weight to Utah 100 (773 and 780 kg m^{-3}, respectively), yet lower than Manning and Bonneville (782 and 798 kg m^{-3}, respectively).

On the basis of milling and baking evaluations by the University of Idaho Wheat Quality Laboratory, Gary has good quality characteristics. In 10 site-years of southeastern Idaho trials with a Braebender Quadrumat Senior Mill, Gary had similar flour extraction to Manning and Utah 100, yet lower than Bonneville, with flour extractions of 656 g kg^{-1} for Gary, 663 g kg^{-1} for Manning, 654 g kg^{-1} for Utah 100, and 687 g kg^{-1} for Bonneville (LSD $p < 0.05 = 8$ g kg^{-1}). Gary has strong mixing characteristics with a mixograph mixing time of 3.3 min to peak dough development compared with 3.1 min for Bonneville and 3.1 min for Manning and 3.2 min for Utah 100. Loaf volumes for bread baked from Gary flour is similar to Bonneville when corrected for protein content, yet smaller than Manning and Utah 100 (Average loaf volume at 110 g kg^{-1} grain protein: 1001, 959, 1036, and 1052 mL, respectively; LSD $p < 0.05 = 42$ mL). On the basis of standard protocols for measuring alkali noodle color (Souza et al., 2004), the brightness and brightness stability of Gary is excellent, similar to 'Eltan' (PI 536994), soft white winter wheat. In seven environments in southeastern Idaho, Gary had an average alkali noodle brightness of 86.9 CIE L* units with a decline in brightness over 24 h of 5.8 CIE L* units. In the Pacific Northwest Wheat Quality Council evaluations, Gary's Chinese noodle hardness texture, as measured by Tx-TA2 texture analysis was favorable compared with 'Idaho 377s' (PI 591045) and Manning. After cooking using standard Chinese noodle procedures (Souza et al., 2004), the hardness of Chinese noodles made from flour of Gary was 1436 g, with noodle hardnesses of 1366 g for Manning, and 1299 g for Idaho 377s.

Seed of Gary will be maintained by the University of Idaho and may be obtained by contacting the corresponding author. U.S. Plant Variety Protection has been applied for with Foundation, Registered, and Certified classes of seed recognized.

E.J. Souza,* M.J. Guttieri, and R. McLean

References

Dewey, W.G. 1981. Registration of Manning wheat. Crop Sci. 21:636.

Roelfs, A.P., R.P. Singh, and E.E. Saari. 1992. Rust diseases of wheat: Concepts and methods of disease management. CIMMYT, Mexico, D.F.

Souza, E., D.W. Sunderman, J. Whitmore, and K.M. O'Brien. 1992. Registration of 'Survivor' wheat. Crop Sci. 32:833.

Souza, E.J., J.M. Martin, M.J. Guttieri, K.M. O'Brien, D.K. Habernicht, S. P. Lanning, G.R. Carlson, and L.E. Talbert. 2004. Influence of genotype, environment, and nitrogen management on spring wheat quality. Crop Sci. 44:425–432.

E.J. Souza and M.J Guttieri, Aberdeen Research and Extension Center, P.O. Box 870, University of Idaho, Aberdeen, ID 83210. R. McLean, Pendelton Flour Mills, 463 W. Hwy 26, Blackfoot, ID 83221. Manuscript No. 03719 of research funded in part by the USDA Fund for Rural America, the Idaho Wheat Commission, and the Idaho Agric. Exp. Stn. Hatch Project IDA 1222. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (esouza@uidaho.edu).

Published in Crop Sci. 44:1476–1477 (2004).

Registration of 'Alturas' Wheat

'Alturas' soft white spring wheat (*Triticum aestivum* L., Reg. no. CV-950, PI 620631) was released by the Idaho Agricultural Experiment Station in 2002 for use by grain producers in the Pacific Northwest of the United States. Alturas is a semidwarf wheat with excellent yield and milling quality, adapted to rainfed and irrigated production.

Alturas was derived from the cross 'Whitebird' (PI 592982)/'Centennial' (PI 537303) made at the University of Idaho, Aberdeen Research and Extension Center in 1989 (Souza et al., 1991, 1997). The cross, designated A89078S, was advanced by the bulk method without intentional selection in the F_2 generation. In the F_3 generation, heads were selected from short plants and planted as $F_{3:4}$ headrows in 1993. From these headrows, the selection A89078S-10 was advanced to yield trials in southeastern Idaho in 1994. In 1997, A89078S-10 was designated IDO526 and entered into the Tri-State Spring Wheat Nursery. IDO526 was advanced the next year into the Western Regional Spring Wheat Nursery for two years of testing (1998–1999). In 1999, IDO526 was evaluated in the Pacific Northwest Wheat Quality Council. In 1999, 200 head selections were grown at Aberdeen, ID, and selected for uniform plant type. Seed from headrows that were true-to-type were harvested and planted at Tetonia in 2001 to form breeder seed.

Alturas is most similar in appearance to Centennial soft white spring wheat. Alturas has an unpigmented coleoptile and erect juvenile growth. Alturas has a twisted flag leaf and an awned, erect, lax head, which is white-chaffed at maturity. Seed of Alturas is soft, white, ovate, and plump, with a kernel type similar to Centennial, but approximately 1.8 mg per kernel larger.

Alturas is 85 cm tall, similar to 'Penawawa' and Centennial, yet 3 cm shorter than 'Alpowa' and Whitebird. Alturas is similar in heading date to 'Jubilee', (PI 614839) on average in southern Idaho, 185 d after 1 January. Alturas heads 1 d later than Centennial and 1 d earlier than Penawawa, Alpowa, and Whitebird and 4 d earlier than 'Treasure'. On the basis of field evaluations in Mount Vernon, WA, Pullman, WA, and Moscow, ID, from 1999 to 2002, Alturas has adult plant resistance to stripe rust similar to Centennial [both cultivars have Type 0 reactions (caused by *Puccinia striiformis* Westend.) primary Idaho races CDL37, CDL43, and CDL45 (Roelfs et al., 1992, p. 32)], but susceptibility to the Hessian fly [*Mayetiola destructor* (Say)], similar to Whitebird and Centennial. Alturas has the high-molecular weight glutenin profile of *Glu-A1a*, *Glu-B1f*, and *Glu-D1d* (Guttieri et al., 2001).

In 40 site-years of southeastern Idaho replicated trials from 1995 to 2001, Alturas had a grain yield of 6416 kg ha^{-1} compared with 6388 kg ha^{-1} for Penawawa, 6326 kg ha^{-1} for Jubilee, 6188 kg ha^{-1} for Treasure, and 6119 kg ha^{-1} for Whitebird. In the same trials, Alturas, Penawawa, Jubilee, Treasure, and Whitebird had grain volume weights of 779, 772, 786, 764, and 786 kg m^{-3}, respectively. In irrigated trials, Alturas lodged less than Treasure (10 and 28% average lodging, respectively), but similar to Penawawa and Whitebird (10 and 6%, respectively). In southwestern Idaho on-farm, irrigated yield trials 1999 to 2001 (8 site-years), Alturas, Jubilee, and Penawawa had grain yields of 7962, 7752, and 7551 kg ha^{-1}, respectively.

Alturas has a high milling yield. In 9 site-years of test milling with a Quadrumat Senior Mill by the University of Idaho Wheat Quality Laboratory, Alturas had a total flour yield of 652 g kg^{-1}, similar to Treasure (648 g kg^{-1}) and Whitebird (649 g kg^{-1}), greater than Penawawa (603 g kg^{-1}), yet less than Jubilee (661 g kg^{-1}). In the same quality evaluations, Alturas had a cookie diameter of 8.7 cm, similar to Treasure and Whitebird, greater than Penawawa, yet less than Jubilee (8.8, 8.8, 8.4, and 8.9 cm, respectively). The soft wheat quality of Alturas is unusual among soft white cultivars, due in part to the combination of low levels in the flour of damaged starch and pentosans as measured by the Solvent Retention Capacity, yet relatively strong gluten (Guttieri et al., 2001). In 9 site-years of irrigated, southern Idaho trials, the sodium carbonate flour-solvent absorptions (correlated to damaged starch in flour) for Alturas, Jubilee, Treasure, Whitebird, and Penawawa, were 599, 594, 610, 607, and 637 g kg^{-1}, respectively (LSD 0.05, 12 g kg^{-1}). In the same evaluations, Alturas, Jubilee, Treasure, Whitebird, and Penawawa had lactic acid flour-solvent absorptions (correlated to gluten strength) of 986, 848, 869, 856, 961 g kg^{-1}, respectively (LSD 0.05, 30 g kg^{-1}). Alturas has an elevated flour hot-paste viscosity relative to wheat cultivars with functional alleles at all three loci of the Granule Bound Starch Synthase enzyme such as Whitebird, Treasure, and Jubilee (Guttieri et al., 2001). Alturas has peak Rapid Visco-Analyzer flour viscosity similar to partial waxy genotypes Centennial and Penawawa and likely carries the null mutation for *Wx-B1* derived from its parent Centennial (Guttieri et al., 2001). Alturas has excellent Asian noodle color. On the basis of standard alkaline noodle protocols (Souza et al., 2004), Alturas had a decline in alkali noodle brightness 24 h after sheeting of 6.3 CIE L* units when averaged across five southern Idaho yield trials, in comparison to 6.2, 6.4, 8.0, and 15.5 CIE L* units, respectively, for Whitebird, Treasure, Jubilee, and Penawawa.

Seed of Alturas will be maintained by the Idaho Agricultural Experiment Station. Seed for research purposes may be obtained by contacting the corresponding author. U.S. Plant Variety Protection has been requested for with Foundation, Registered, and Certified classes of seed recognized.

E.J. Souza,* M.J. Guttieri,
K.M. O'Brien, and B. Brown

References

Guttieri, M.J., D. Bowen, D. Gannon, K. O'Brien, and E. Souza. 2001. Solvent retention capacities of irrigated soft white spring wheat flours. Crop Sci. 41:1054–1061.

Roelfs, A.P., R.P. Singh, and E.E. Saari. 1992. Rust diseases of wheat: Concepts and methods of disease management. CIMMYT, Mexico, D.F.

Souza, E.J., J.M. Martin, M.J. Guttieri, K.M. O'Brien, D.K. Habernicht, S.P. Lanning, G.R. Carlson, and L.E. Talbert. 2004. Influence of genotype, environment, and nitrogen management on spring wheat quality. Crop Sci. 44:425–432.

Souza, E., D.W. Sunderman, J. Whitmore, and K. O'Brien. 1991. Registration of "Centennial" wheat. Crop Sci. 31:1095–1096.

Souza, E., J.M. Windes, D.W. Sunderman, and K. O'Brien. 1997. Registration of Whitebird wheat. Crop Sci. 37:1009.

E.J. Souza, M.J. Guttieri, and K.M. O'Brien, Univ. of Idaho, Aberdeen Research and Extension Ctr., P.O. Box 870, Aberdeen, ID 83210. B.D. Brown, University of Idaho, Parma Research and Experiment Station 29603 U of I Lane, Parma, ID 83660. Manuscript No. 03720 of research funded in part by the USDA Fund for Rural American, the Idaho Wheat Commission and the Idaho Agric. Exper. Stn. Hatch Project IDA 1222. . Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (esouza@uidaho.edu).

Published in Crop Sci. 44:1477–1478 (2004).

Registration of 'Moreland' Wheat

'Moreland' hard red winter wheat (*Triticum aestivum* L. Reg. no. CV-949, PI 620630) was released by the Idaho Agricultural Experiment Stations in 2002 for use by grain producers in the Pacific Northwest of the USA. Moreland is a semidwarf wheat adapted to irrigated production at elevations above 1000 m with excellent grain yield and bread baking quality.

Moreland was derived from a cross of A791060W-2/A81666SW-45 made at the University of Idaho, Aberdeen Research and Extension Center in 1986 and designated A86327W. A791060W-2 was an USDA-ARS, Aberdeen breeding line with the pedigree 'Sonora 65'/II-60-155//'Heglar' (CI*tr* 17269)/3/'Warrior' (CI*tr* 13190)//'Kiowa'/PI 178383/6/'Frocor'//'Frontana'/'Yaqui'/3/'Wanser' (CI*tr* 13844)/4/'McCall' (CI*tr* 13842)/5/Heglar. The selection A81710SW-45 (pedigree 'WAID'/2*'Borah'//'Neeley') was intended to transfer strong gliadin characteristics from WAID (CI*tr* 17806) durum (*T. turgidum* subsp. *durum*) into a bread wheat background (Sunderman and Bruinsma 1975; Sunderman and O'Connell 1983). A86327W was advanced by the bulk method without intentional selection in the F_2 generation. In the F_3 generation, heads were selected from short plants and planted as $F_{3:4}$ headrows in 1989. Heads from short plants were selected and advance by pedigree selection in 1990 and 1991 to form $F_{6:7}$ headrows that were harvested in 1992. From these headrows, the short plant selection A86327W-3-2-2 was advanced to trials in southeastern Idaho (Bingham and Minidoka counties) in 1993. In 1996, A86327W-3-2-2 was designated IDO517 and entered into the Tri-State Irrigated Winter Wheat Nursery for two years. IDO517 was advanced into the Western Regional Winter Wheat Nursery for 2 yr of testing (2000 and 2001). In 2001, IDO517 was evaluated in the Pacific Northwest Wheat Quality Council. IDO517 was also evaluated in on-farm extension trials from 1999 to 2001 in Idaho and in 2001 in Oregon and Washington. In fall 2000, 200 head selections were planted at Aberdeen, ID, and in summer 2001 the headrows that were true-to-type were composited to form Moreland breeder seed. Moreland is uniform for plant type without obvious phenotypic variants and has remained true-to-type during testing and seed increase, from 1992 to 2001.

Moreland has an unpigmented coleoptile and semierect juvenile growth. Moreland has recurved, twisted flag leaf and an awned, erect, lax head, which is bronze-chaffed at maturity. Seed of Moreland is hard, red, ovate, and plump, with a kernel type similar to Neeley.

On the basis of field evaluations in Washington and Idaho, Moreland has moderate adult plant resistance to stripe rust (caused by *Puccinia striiformis* Westend.). Moreland had less than a type 5 reaction in 6 site-years of field inoculation with *P. striiformis* races CDL37, CDL45, and CDL43 at Aberdeen (Roelfs et al., 1992, p. 32). Under severe stripe rust pressure at Pullman, WA, spring 2002, Moreland had a type 5 reaction covering 30% of the flag leaf during grain fill. By comparison the resistant cultivar, Boundary, had a type 5 reaction covering 10% of the flag leaf, and the moderately susceptible cultivar Brundage had a type 8 reaction covering 90% of the flag leaf.

Moreland is 85 cm tall, similar to 'Brundage' (PI 599193) soft white winter wheat, yet 10 cm shorter than 'Boundary' hard red winter wheat and 18 cm taller than 'Garland'. The average heading date for Moreland is 156 d after 1 January, which is similar to that for Brundage. Moreland heads 4 d earlier than Boundary and 5 d earlier than Garland. In 5 yr of irrigated yield trials in southern Idaho, Moreland was more ($p < 0.05$) winter hardy than Boundary, Garland, and Stephens, with average spring stands of 99, 96, 96, and 96%, respectively. In 16 site-years of southeastern Idaho irrigated replicated trials from 1994 to 2001, Moreland had a grain yield of 9161 kg ha^{-1} compared with 9115 kg ha^{-1} for Stephens, and 8907 kg ha^{-1} for Garland. In a set of 10 irrigated trials from southern Idaho, 1997 to 2001, Moreland had a grain yield of 9205 kg ha^{-1} compared with 9739 kg ha^{-1} for Boundary, and 9062 kg ha^{-1} for Garland. In the same trials from 1997 to 2001, Moreland, Boundary, and Garland had average flour protein concentrations of 113, 107, and 110 g kg^{-1}, respectively. Moreland is similar to Garland for lodging resistance, both of which are less prone to lodging than Boundary, which averaged 0, 0, and 4% lodging in southern Idaho irrigated trials from 1997 to 2001.

Moreland has moderate milling yield. In 10 irrigated trial site-years of test milling from with a Quadrumat Senior Mill by the University of Idaho Wheat Quality Laboratory, Moreland had a total flour yield of 672 g kg^{-1}, greater ($p < 0.05$) than Garland (642 g kg^{-1}), yet less ($p < 0.05$) than Boundary (692 g kg^{-1}). In the same quality evaluations, Moreland had a dough mixing development time of 3.8 min, longer ($p <$

0.01) than that for Boundary and Garland, which were 3.0 min and 2.1 min, respectively. In 10 site-years of irrigated southern Idaho trials, Moreland had a loaf volume of 1009 mL compared with 892 mL for Boundary and 935 mL for Garland.

Seed of Moreland will be maintained by the University of Idaho, Foundation Seed Program and may be obtained by contacting the corresponding author. U.S. Plant Variety Protection has been applied for with the recognized classes of Foundation, Registered, and Certified seed.

E.J. Souza,* M.J. Guttieri, and R. Mclean

References

Roelfs, A.P., R.P. Singh, and E.E. Saari. 1992. Rust diseases of wheat: Concepts and methods of disease management. CIMMYT, Mexico, D.F.

Sunderman, D.W., and B. Bruinsma. 1975. Registration of four wheat cultivars. Crop Sci. 15:104.

Sunderman, D.W., and B. O'Connell. 1983. Registration of Neeley wheat. Crop Sci. 23:187.

E.J. Souza and M.J. Guttieri, Aberdeen Research and Extension Center, P.O. Box 870, University of Idaho, Aberdeen, ID 83210. R. McLean, Pendelton Flour Mills, 463 W. Hwy 26, Blackfoot, ID 83221. Manuscript No. 03716 of research funded in part by the Idaho Wheat Commission and the Idaho Agric. Exper. Stn. Hatch Project IDA 1222. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (esouza@uidaho.edu).

Published in Crop Sci. 44:1478–1479 (2004).

Registration of 'NC-Neuse' Wheat

'NC-Neuse' soft red winter wheat (*Triticum aestivum* L.) (Reg. no. CV-952, PI 633037) was released in spring 2003 by the North Carolina Agricultural Research Service. NC-Neuse is a high yielding, full-season maturity cultivar with good volume weight, biotic stress resistance, and end-use quality. It is adapted to wheat-producing regions of North Carolina, South Carolina, and northern Georgia.

NC-Neuse has the pedigree Coker 86-29//'Stella'/CHD 756-80/3/'Coker 9907'. Stella (PI 286525) is a soft red winter wheat germplasm line containing the *H9* and *H10* genes for resistance to Hessian Fly [*Mayetiola destructor* (Say)] (Patterson et al., 1982). CHD 756-80 is a Polish winter wheat of unknown pedigree that expressed resistance to powdery mildew (caused by *Blumeria graminis* DC. f. sp. *tritici* Em. Marchal) in field evaluations in North Carolina. The pedigree of Coker 86-29 is VA75-57-53//'H-McNair 2003'/'Coker 68-15'/3/Coker 79-14. The pedigree of Coker 9907 is 'Coker 762'/4/'Abe'/3/Coker 68-15*3//CItr 13836/8*'Chancellor'. CI*tr* 13868 is a source of the *Pm*1 gene for resistance to powdery mildew.

NC-Neuse was developed by a combination of the mass selection and pedigree breeding methods. The final cross was made in the greenhouse in 1989. Bulk F_2 seed was harvested from F_1 plants in June 1991 at the Central Crops Research Station, Clayton, NC. The F_2 and F_3 generations underwent mass selection at the Tidewater Research Station, Plymouth, NC, during the 1991–1992 and 1992–1993 seasons. Each season a single 11.1-m^2 plot was sown with a bulk of approximately 1700 seeds. One hundred heads were selected at maturity on the basis of desired plant height, large head size, and white color. Selected heads were threshed in bulk and a sample of seed was planted the following season. Procedures were similar in the F_4 generation grown at Clayton during the 1993–1994 season except selected heads were threshed separately and $F_{4:5}$ head-rows were planted at Plymouth in the 1994–1995 season. Selection in head-rows was based on winter survival, time of head emergence, plant height, straw strength, overall plant vigor, and reaction to natural inoculum of powdery mildew and leaf rust [caused by *Puccinia triticina* Eriks. = *P. recondita* Roberge ex Desmaz. f. sp. *tritici* (Eriks. & E. Henn.) D.M. Henderson]. This protocol was repeated during the 1995–1996 season on $F_{5:6}$ head-rows. A single $F_{5:6}$ head-row selection, designated NC96-13156, was harvested. Fifty $F_{8:9}$ head selections were grown during the 1998–1999 season and a single uniform head-row that was true-to-type was harvested to produce Breeder seed. This material underwent seed increase during the 1999–2000 and 2000–2001 seasons. In fall 2001, 82 kg of $F_{8:12}$ seed was transferred to the North Carolina Foundation Seed Producers, Inc.

Eight location-years of data from the North Carolina Official Wheat Variety Test grown in the 1999–2000, 2000–2001, and 2001–2002 seasons indicated NC-Neuse had a yield of 4568 kg ha^{-1} in comparison with 4703 kg ha^{-1} for 'USG 3209' (PI 617055), 4435 kg ha^{-1} for 'Pioneer 26R61', and 4367 kg ha^{-1} for 'Roane' (PI 612958). NC-Neuse had a significantly greater volume weight (755 kg m^{-3}) than USG 3209 (731 kg m^{-3}) and a similar volume weight to Pioneer 26R61 (759 kg m^{-3}) and Roane (759 kg m^{-3}). Heading date of NC-Neuse (16 April) was 6 d later than USG 3209, 5 d later than Pioneer 26R61, and 1 d earlier than Roane. NC-Neuse (85 cm) was 2.5 cm taller than Roane, 5 cm taller than USG 3209, and 10 cm shorter than Pioneer 26R61. NC-Neuse had a mean lodging score of 11% compared to 19% for USG 3209, 11% for Roane, and 8% for Pioneer 26R61. Two-year means (2000–2001 and 2001–2002 seasons) from the Pee Dee Research and Education Center, Florence, SC, indicated that NC-Neuse did not differ significantly in yield from 'Pioneer 26R38', the highest yielding cultivar. Four location-years of data (2000–2001 and 2001–2002 seasons) from north Georgia indicated that NC-Neuse did not differ significantly in yield from USG 3209, the highest yielding cultivar.

NC-Neuse was entered in the USDA-ARS Uniform Southern Soft Red Winter Wheat Nursery (USSRWWN) in 2000–2001. NC-Neuse (mean rating of 1.5) was less susceptible to *Soil-borne wheat mosaic virus* than the mean for all entries (rating of 2.9) and NC-Neuse (mean rating of 5.7) was more susceptible to *Wheat spindle streak mosaic virus* than the mean for all entries (rating of 3.6). NC-Neuse does not contain the 1B1R translocation.

NC-Neuse exhibited a high level of resistance to the naturally occurring powdery mildew population in North Carolina through 2003. At the Lower Coastal Plain Research Center, Kinston, NC during the 2001–2002 and 2002–2003 seasons the major resistance genes *Pm*2, *Pm*3a, *Pm*3b, *Pm*3c, *Pm*3f, *Pm*4, *Pm*5, *Pm*6, *Pm*7, and *Pm*8 exhibited ratings between 6.7 and 8.0 on a scale of 0-9, where 0 indicated immunity and 9 indicated full susceptibility. *Pm*1 exhibited partial resistance (3.8) and NC-Neuse had a mean rating of 0.5 during the same period. NC-Neuse has exhibited moderate to high levels of resistance to the naturally occurring leaf rust population in North Carolina through 2002. NC-Neuse was postulated to contain the major seedling resistance genes *Lr*9, *Lr*10, and *Lr*11 in controlled environment tests at the Cereal Disease Laboratory, St. Paul, MN.

NC-Neuse exhibited low levels of infestation by Hessian fly in Beaufort County, NC, in 2000–2001 and Lenoir County, NC, in 2000–2001 and 2001–2002. Mean tiller infestation (8%) was significantly lower than the susceptible 'Coker 9663' (PI 596345) (30%) and similar to the resistant 'Pioneer 26R61' (3%). Examination of the biotype composition in North Carolina during this time by Dr. Roger Ratcliffe, USDA-ARS, Purdue University found Biotype L (66%) and Biotype D (19%) were predominant. Nevertheless, four controlled environment tests at Purdue University were inconclusive with respect to the identification of major genes with resistance to Biotype L in NC-Neuse. NC-Neuse was identified as resistant to Biotype C and susceptible to Biotype D.

NC-Neuse has exhibited a moderate level of resistance to Fusarium Head blight (FHB) [caused by *Fusarium graminearum* Schwabe, Group II (anamorph)]. Mean head severity over seven locations for NC-Neuse (20%) was significantly better than the susceptible 'Coker 9835' (PI 548846) (47%), and not significantly different than the moderately resistant 'Ernie' (PI 584525) (13%) in the Uniform Southern FHB Nursery in 2000–2001. Similar results were observed for scabby seed percentage. Vomitoxin (deoxynivalenol) levels in NC-Neuse (7.9 μg g^{-1}) and Ernie (6.6 μg g^{-1}) were not significantly different.

Milling and baking evaluations were conducted on entries in the 2000–2001 USSRWWN at the USDA-ARS Soft Wheat Quality Laboratory, Wooster, OH. On the basis of grain samples from seven locations, NC-Neuse (73.7%) had a flour yield similar to 'AGS 2000' (PI 612956) (73.2%), significantly lower Alkaline Water Retention Capacity (52.4 versus 55.5%), and significantly lower Softness Equivalent (52.9 versus 61.1%). NC-Neuse received an overall Milling Quality score of 101 compared to 103.8 for AGS 2000. NC-Neuse received an overall Baking Quality score of 98.6 in comparison to 99.6 for AGS 2000. MidState Mills, Inc., Newton, NC, conducted milling and baking evaluations on 3000-g samples of entries in the North Carolina Official Wheat Variety Test in 2001 and 2002. NC-Neuse (28.2 mm) had a significantly lower alveograph overpressure than 'Tribute' (PI 632689) (64.3 mm) and Pioneer 26R61 (39.3 mm). The dough extensibility of NC-Neuse (132 mm) was similar to Pioneer 26R61 (151 mm), and significantly greater than Tribute (72.5 mm). The alveograph work for NC-Neuse (105 J) was significantly less than that of Tribute (165 J) or Pioneer 26R61 (178 J). NC-Neuse is not a strong gluten cultivar. Cookie spread for NC-Neuse (86.3 cm) was similar to Pioneer 26R61 (79.4 cm) but significantly greater than Tribute (75.4 cm).

The juvenile growth habit of NC-Neuse is semierect. The head is awnletted, middense, tapering, and inclined at harvest. Glumes are white, long, and of medium width at harvest. They have an oblique shoulder and obtuse beak. Seeds are red in color, soft in texture, ovate in shape with a rounded cheek, and a long non-collared brush. The crease is narrow and deep.

Classes of seed of NC-Neuse will be limited to Breeder, Foundation, and Certified. Breeder seed will be maintained by NCARS. Application for U.S. Plant Variety Protection is being filed for this cultivar. Foundation seed will be maintained by the N.C. Foundation Seed Producers, Inc., 8220 Riley Hill Road, Zebulon, NC 27597 (919 269-5592). Certified seed will be produced by seed growers licensed by the N.C. Foundation Seed Producers. Small samples (500 seeds) of NC-Neuse can be obtained from the corresponding author for at least 5 yr. Appropriate recognition of the source of NC-Neuse is requested if it is used in the development of a new cultivar, germplasm, parental line, or genetic stock.

J.P. Murphy,* R.A. Navarro, S. Leath, D.T. Bowman, P.R. Weisz, L.G. Ambrose, M.H. Pate, and M.O. Fountain

References

Patterson, F.L., R.G. Gallun, N.B. Stebbins, and S.K. Carlson. 1982. Registration of Stella and Ella common wheat germplasm lines. Crop Sci. 22:902–903.

J.P. Murphy, R.A. Navarro, D.T. Bowman, P.R. Weisz, and M.O. Fountain, Dep. of Crop Science; S. Leath, Dep. of Plant Pathology, North Carolina State Univ., Raleigh, NC 27695-7629; L.G. Ambrose, Beaufort Co. CES, 155 Airport Rd., Washington, NC 27889; M.H. Pate, MidState Mills, Inc., P.O. Box 350, Newton, NC 28658. Research supported in part by grants from the North Carolina Small Grains Growers Association, the North Carolina Foundation Seed Producers, Inc., and the North Carolina Crop Improvement Association. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (njpm@unity.ncsu.edu).

Published in Crop Sci. 44:1479–1480 (2004).

Registration of 'Cabernet' Kentucky Bluegrass

'Cabernet' Kentucky bluegrass (*Poa pratensis* L.) (Reg. no. CV-76, PI 631179) is a turf-type cultivar released in September 2001 by Lebanon Seaboard, Lebanon, PA. Cabernet was developed from germplasm obtained from the New Jersey Agricultural Experiment Station (NJAES). The experimental designations of Cabernet were H94-329 and LTP-329.

Cabernet Kentucky bluegrass originated as a single, 95% apomictic plant selected from the polycross progeny of RSP. RSP is a vigorous, facultatively apomictic plant collected from an old turf in Riverside Park, Baltimore, MD. RSP is a mid-Atlantic ecotype with excellent summer stress tolerance but moderate susceptibility to leaf spot disease [caused by *Drechslera poae* (Baudys) Shoemaker] in cloudy wet spring weather (Murphy et al., 1997).

A plant of RSP was pollinated by plants of 'Princeton P-105' (Hurley et al., 2000), 'Rita', a component of 'Unique' (Rose-Fricker et al., 1999) designated as C-74, and plants collected from old turfs of the eastern USA. Four plants each of *Poa ampla* L. and *P. ampla* × *P. pratensis* were also included in a greenhouse pot polycross (Funk and Duell, 1976) consisting of 153 plants. Daily repositioning of each plant during the 7- to 10-d pollination period is equivalent to 7 to 10 replications of a field polycross for each replication of potted plants. The cross was made during the late winter of 1991 to 1992 in a greenhouse located on the Cook College campus of Rutgers University, New Brunswick, NJ. Environmental conditions before and during pollination were modified to increase sexual reproduction of facultatively apomictic Kentucky bluegrasses (Bashaw and Funk, 1987; Hintzen and van Wijk, 1985; Pepin and Funk, 1971). Seed from the RSP female parent was harvested in the spring of 1992. Seedlings were grown in the greenhouse in the winter of 1992 to 1993 under cool, short daylength conditions. Promising hybrids were phenotypically identified. Selected hybrid plants were established in a spaced-plant nursery at the Rutgers University Plant Biology and Pathology Research and Extension Farm at Adelphia, NJ, during the spring of 1993. In June 1994, an attractive F_1 hybrid plant designated as 93-1002-11 was harvested from this nursery. Seed from this plant was planted in a turf trial at North Brunswick, NJ, in September 1994 and designated H94-329. This turf trial was located in a field with severely restricted air movement resulting in conditions of excess summer heat stress. This turf trial was evaluated over 36 times during the 4 yr following establishment. The trial was evaluated for characteristics such as seedling vigor, establishment, turf quality, density, leaf spot disease [caused by *Drechslera poae* (Baudys) Shoemaker], drought tolerance, and heat tolerance. H94-329 was selected on the basis of these evaluations. Tillers were taken from this turf plot and used to establish a spaced-plant nursery containing 24 plants. Seed harvested from these plants was evaluated for apomixis, used to establish replicated turf trials, and sent to Lebanon Seaboard in Oregon for further evaluation of seed yield and commercial potential. A 0.4-ha Breeder seed nursery was established near Imbler, OR, in

1998. An experimental Foundation seed field was established in 1999. The first Certified seed was harvested in 2001.

Cabernet has a medium-low growth habit, medium-fine leaf width, bright, medium-dark-green color, medium shoot density, and acceptable turf quality (Morris, 2003). Cabernet performed well in most areas where Kentucky bluegrass is used in the USA. Cabernet exhibited moderate leaf spot resistance (Morris, 2003), which was a meaningful improvement compared to its maternal parent, RSP (Bonos et al., 2001). Cabernet exhibited very good resistance to necrotic ring spot [caused by *Ophiosphaerella korrae* (J.C. Walker & A.M. Smith) R.A. Shoemaker (=*Leptosphaeria korrae* J.C. Walker & A.M. Smith)] (Morris, 2003). Cabernet also showed good tolerance to drought stress in Wyoming (Morris, 2003).

Cabernet was developed for turf uses including lawns, athletic fields, and recreation areas. It should perform well in regions where Kentucky bluegrass is adapted, as a monostand or in blends with other Kentucky bluegrass cultivars. Cabernet performed well under simulated fairway conditions in New Jersey, which included a cutting height of 1.74 cm, traffic stress, and *Poa annua* L. competition (Morris, 2003). This suggests potential successful use of Cabernet on athletic fields. Monthly quality ratings during the 2002 growing season, under simulated fairway conditions in New Jersey, revealed that Cabernet exhibited improved relative performance during high temperature stress (Morris, 2003). This indicates that Cabernet has good summer stress performance similar to its maternal parent RSP. Cabernet Kentucky bluegrass may also be used in mixtures with improved turf-type perennial ryegrass (*Lolium perenne* L.), fine-leafed fescues (*Festuca* spp.), and improved turf-type tall fescues (*Festuca arundinacea* Schreb.).

Lebanon Seaboard maintains Breeder seed of Cabernet. Seed production is limited to two generations of increase from Breeder seed: one each of Foundation and Certified. Application has been made for U.S. Plant Variety Protection (Application no. 200200155).

S.A. Bonos,* T.M. Ford, R.F. Bara, W.A. Meyer, and C.R. Funk

Acknowledgments

Appreciation is expressed to William K. Dickson, Joseph Clark, Raymond Schaaf, George Ziemienski, Michael Reynolds, Dirk Smith, Melissa Mohr, Barbara Smith and participants in the National Turfgrass Evaluation Program for their assistance.

References

Bashaw, E.C., and C.R. Funk. 1987. Apomictic grasses. p. 40–82. *In* W.E. Fehr (ed.) Principles of cultivar development. Vol. 2 Crop Species. Macmillan Publ. Co., New York.

Bonos, S.A., J.A. Murphy, W.A. Meyer, C.R. Funk, W.K. Dickson, E. Watkins, R.F. Bara, D.A. Smith, and M.M. Mohr. 2001. Performance of Kentucky bluegrass cultivars and selections in New Jersey turf trials. Rutgers Turfgrass Proc. 2000. 32:55–112.

Funk, C.R., and R.W. Duell. 1976. The pot polycross– a method for expediting the development of synthetic cultivars. Rutgers Turfgrass Proc. 1976. 7:108–109.

Hintzen, J.J., and A.J.P. van Wijk. 1985. Ecotype breeding and hybridization in Kentucky bluegrass (*Poa pratensis* L.). p. 213–219. *In* F. Lemaire (ed.) Proc. Int. Turfgrass Res. Conf., 5th, Avignon, France. INRA Publ., Versailles, France.

Hurley, R.H., V.G. Lehman, R.F. Bara, and C.R. Funk. 2000. Registration of Princeton P-105 Kentucky bluegrass. Crop Sci. 40:1494.

Morris, K.N. 2003. National Kentucky Bluegrass Test–2000. Progress Report 2003. NTEP No. 03–02. National Turfgrass Evaluation Program. USDA-ARS, Beltsville, MD.

Murphy, J.A., S.A. Bonos, and P. Perdomo. 1997. Classification of Kentucky bluegrass genotypes. Int. Turf. Soc. Res. J. 8:1176–1183.

Pepin, G.W., and C.R. Funk. 1971. Intraspecific hybridization as a method of breeding Kentucky bluegrass for turf. Crop Sci. 11: 445–448.

Rose-Fricker, C.A., M.L. Fraser, W.A. Meyer, and C.R. Skogley. 1999. Registration of 'Unique' Kentucky bluegrass. Crop Sci. 39:290.

S.A. Bonos, R.F. Bara, W.A. Meyer, and C.R. Funk, Dep. of Plant Biology and Pathology, New Jersey Agric. Exp. Stn. Cook College, Rutgers Univ. 59 Dudley Rd., Foran Hall, New Brunswick, NJ 08901; T. Ford. Lebanon Seaboard, P.O. Box 10, Huntsville, UT 84317. Publication no. D–12180-10-03. Some of this work was conducted as part of the NJAES Project no. 12180, supported by NJAES funds, other grants and gifts. Additional support was received from the U.S. Golf Association-Golf Course Superintendents Association of America Research Fund, and New Jersey Turfgrass Association. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (bonos@aesop.rutgers.edu).

Published in Crop Sci. 44:1480–1481 (2004).

Registration of 'Lakeshore' Kentucky Bluegrass

'Lakeshore' Kentucky bluegrass (*Poa pratensis* L.) (Reg. no. CV-75, PI 631170) is a turf- type cultivar released in July 2001 by LESCO Inc., Rock River, OH. Lakeshore was developed from germplasm obtained from the New Jersey Agricultural Experiment Station (NJAES). The experimental designations of Lakeshore were A93-200 and NJ-GD.

Lakeshore Kentucky bluegrass originated as a single, highly apomictic (>95%) plant selected from the open-pollinated progeny of A80-336. A80-336 is an exceptionally vigorous, moderately apomictic F_1 hybrid selected from the progeny of the cross Warren's A-25 (Dale et al., 1975)/'Touchdown' (Rewinski et al., 1978).

A80-336 was pollinated by typical plants of 'Sydsport', 'Baron' (Hurley and Ghysen, 1980), and 'Julia' during late winter of 1985 in a greenhouse located on the Cook College campus of Rutgers University, New Brunswick, NJ. Environmental conditions before and during pollination were modified to increase sexual reproduction of facultatively apomictic Kentucky bluegrasses (Bashaw and Funk, 1987; Hintzen and van Wijk, 1985; Pepin and Funk, 1971). Seedlings from these crosses were established in a spaced-plant nursery at the Rutgers University Plant Biology and Pathology Research and Extension Farm at Adelphia, NJ, during late summer of 1985. Attractive F_1 hybrid plants from the progeny of A80-336 were selected in June 1986 and used to establish turf evaluation plots at North Brunswick, NJ, in August 1986. Remnant seed of the best performing progenies of A80-336 were used to establish a spaced-plant nursery at the Adelphia Research Farm during spring of 1992. Plant A92-446-7 was selected in June 1993. Seed harvested from this plant was used to establish plot A93-200 in a turf trial at Adelphia in October 1993. A spaced-plant progeny test was established in 1997 to evaluate the level of apomictic reproduction and to produce Breeder seed. Breeder seed was sent to St. Paul, OR, in August 1998 to establish an experimental Foundation seed increase field. The first Certified seed was harvested in July 2001.

Lakeshore is a turf-type Kentucky bluegrass with an attractive, bright, medium-dark-green color and medium-low growth habit. It has performed well in the National Turfgrass Evaluation Program in most areas where Kentucky bluegrass is adapted in North America (Bonos et al., 2001; Morris, 2003). Lakeshore produces turf with medium-fine leaves, medium shoot density, early spring green-up, and good winter color. It has shown good resistance to leaf spot and melting out [caused by *Dreshclera poae* (Baudys) Shoem.] (Morris, 2003) and stripe smut [caused by *Ustilago striiformis* (Westend.) Niessl] (Bonos et al., 2001). Lakeshore has large seed with excellent processing characteristics and has the potential of producing high seed yields under proper management. It produces extensive rhizomes, giving it good spreading and recuperative ability. It has also performed well under simulated fairway conditions in New Jersey, which included a cutting height of 1.74 cm, traffic stress, and *Poa annua* L. competition (Morris, 2003)

Lakeshore is compatible in blends with most other Kentucky bluegrass cultivars and in mixtures with turf-type perennial ryegrasses (*Lolium perenne* L.), strong creeping red fescues (*Festuca rubra* L. subsp. *rubra*), and turf-type tall fescues (*F. arundinacea* Schreb.). It is recommended for lawn-type turfs in regions where Kentucky bluegrass is well adapted.

Breeder seed is maintained by LESCO, Inc in cooperation with the NJAES. Seed propagation is restricted to three generations of increase: Breeder, Foundation, and Certified. Application (no. 200200142) has been made for U.S. Plant Variety Protection.

S.A. Bonos,* T. Brentano, T.J. Molnar,
W.A. Meyer, and C. Reed Funk

Acknowledgments

Appreciation is expressed to Raymond Schaaf, George Ziemienski, Mike Reynolds, Ronald F. Bara, Dirk Smith, Melissa Mohr and all participants involved in the National Turfgrass Evaluation Program for their assistance.

References

Bashaw, E.C., and C.R. Funk. 1987. Apomictic grasses. p. 40–82. *In* W.E. Fehr (ed.) Principles of Cultivar Development. Vol. 2 Crop Species. Macmillan Publ. Co., New York.

Bonos, S.A., J.A Murphy, W.A Meyer, C.R. Funk, W.K. Dickson, E. Watkins, R.F. Bara, D.A. Smith, and M.M. Mohr. 2001. Performance of Kentucky bluegrass cultivars and selections in New Jersey turf trials. Rutgers Turfgrass Proc. 2000. 32:55–112.

Dale, M.R., M.K. Ahmed, G. Jelenkovic, and C.R. Funk. 1975. Characteristics and performance of interspecific hybrids between Kentucky bluegrass and Canada bluegrass. Crop Sci. 15:797–799.

Hintzen, J.J., and A.J.P. van Wijk. 1985. Ecotype breeding and hybridization in Kentucky bluegrass (*Poa pratensis* L.). p. 213–219. *In* F. Lemaire (ed.) Proc. Int. Turfgrass Res. Conf., 5th, Avignon, France. INRA Publ., Paris.

Hurley, R.H., and H. Ghysen. 1980. Registration of Baron Kentucky bluegrass. Crop Sci. 20:549–550.

Morris, K.N. 2003. National Kentucky Bluegrass Test–2000. Progress Report 2003. NTEP No. 03–02. National Turfgrass Evaluation Program. USDA-ARS, Beltsville, MD.

Pepin, G.W., and C.R. Funk. 1971. Intraspecific hybridization as a method of breeding Kentucky bluegrass for turf. Crop Sci. 11: 445–448.

Rewinski, T.F., A.M. Radko, W.K. Wiley, M.C. Pick, and C.R. Funk. 1978. Registration of Touchdown Kentucky bluegrass. Crop Sci. 18:163.

S.A. Bonos, T.J. Molnar, W.A. Meyer, and C.R. Funk, Dep of Plant Biology and Pathology, New Jersey Agric. Exp. Stn., Cook College, Rutgers Univ., 59 Dudley Rd., Foran Hall, New Brunswick, NJ 08901; T. Brentano, 19664 Bernards Lane NE, St. Paul, OR 97137. Publication no. D–12180-11-03. Some of this work was conducted as part of the NJAES Project no. 12180, supported by NJAES funds, other grants and gifts. Additional support was received from the U.S. Golf Assoc.–Golf Course Superintendents Assoc. of America Research Fund, and the New Jersey Turfgrass Assoc. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (bonos@aesop.rutgers.edu).

Published in Crop Sci. 44:1481–1482 (2004).

Registration of 'LS94-3207' Soybean

'LS94-3207' soybean [*Glycine max* (L.) Merr.] (Reg. no. CV-467, PI 634335) was developed by Southern Illinois University Carbondale and released as a maturity group IV cultivar with resistance to multiple races of soybean cyst nematode (SCN) (*Heterodera glycines* Ichinohe) (Riggs and Schmitt, 1988) and a high level of resistance to soybean sudden death syndrome (SDS) [caused by *Fusarium solani* (Mart.) Sacc. f. sp. *glycines*]. LS94-3207 is a nonexclusive release for nonspecific brand labeling.

LS94-3207 originated from an individual F_5 plant selection from the cross 'Pharaoh' × 'Hartwig' (Schmidt et al., 1993; Anand, 1992). The F_2 and subsequent generations were advanced by the single-pod bulk method (Brim, 1966). A single F_5 plant was selected on an SCN Race 3 infested field near Ridgway, IL. The $F_{5:6}$ row was selected on a field near Villaridge, IL. This field had a known history of SDS and was infested with SCN Race 14.

LS94-3207 was field-evaluated in Southern Illinois University SDS variety tests from 1996 through 2001. These trials were scored for SDS as described earlier (Njiti et al., 1998). It consistently scored a very low SDS disease index (DX), with a DX of 2.3 (on a scale of 0–100, where 0 indicates maximum resistance) compared with a score of 2.7 for 'LS90-1920' a cultivar previously released as resistant to SDS (Schmidt et al., 1999). Soybean cyst nematode resistance was determined by greenhouse evaluation utilizing an SCN Race 3 infested soil collected from a field near Elkville, IL, and an SCN Race 14 infested soil collected from a field near Sandridge, IL. Resistance to Races 1, 2, 3, 5, and 14 was confirmed at the University of Missouri by greenhouse evaluation. The Race 3 culture was maintained on 'Hutcheson' and the other race cultures were maintained on 'Forrest' (Buss et al., 1988; Hartwig and Epps, 1973).

LS94-3207 was evaluated in the Regional SCN Tests and the USDA Uniform Soybean Tests—Southern Region (Cary and Diers, 1999; Tyler et al., 2000) from 1997 to 1999. As tested in the Uniform Test, the seed yield of LS94-3207 was 4.2% lower than 'KS4694' (Schapaugh and Dille, 1998). Plant height averages 65 cm, compared with 74 cm for KS4694. Lodging score averages 2.0 (where, 1 = all plants upright to 5 = all plants prostrate), compared with 1.3 for KS4694. Seed quality scores average 2.0 (where, 1 = excellent to 5 = poor) for LS94-3207 compared with 1.7 for KS4694. Seed size is approximately 122 mg seed^{-1}, compared with 152 mg seed^{-1} for KS4694. Seed composition averages 411 g kg^{-1} protein and 201 g kg^{-1} oil on a dry weight basis.

LS94-3207 is determinate in growth habit. It has white flowers, tawny pubescence, and brown pod walls. Seed coats are shiny yellow with black hila. It has a relative maturity of 4.7 and matures at the same date as KS4694 in a full season planting. Its range of adaptation is from approximately 35 to 39° N lat.

LS94-3207 is resistant to frogeye leaf spot (caused by *Cercospora sojina* K. Hara), stem canker [caused by *Diaporthe phaseolorum* (Cook & Ellis) Sacc. var. *caulivora* K.L. Athow & R.M. Caldwell] and is moderately resistant to southern root knot nematode [*Meloidogyne incognita* (Kofoid and White) Chitwood].

LS94-3207 is released for nonexclusive licensing to seedsmen for brand labeling. Parent seed maintenance and distribution will be handled by Gateway Seed Company, 5517 Van Buren Road, Nashville, IL. Breeders seed will be maintained by Southern Illinois University–Carbondale. Small quantities of seed for breeding and research purposes may be obtained for a minimum of 5 yr from the date of this publication by writing the corresponding author. U.S. Plant Variety Protection will not be applied for.

M.E. Schmidt* and J.H. Klein

Acknowledgments

Appreciation is extended to A.P. Rao-Arelli and co-workers, while employed at the University of Missouri, for SCN evaluation. Appreciation is also extended to Karen Gallo of Syngenta at Bay, AR for stem canker and frogeye evaluation. Research supported in part by the Illinois Soybean Program Operating Board and the North Central Soybean Research Program.

References

Anand, S.C. 1992. Registration of 'Hartwig' soybean. Crop Sci. 32: 1069–1070.
Brim, C.A. 1966. A modified pedigree method of selection in soybeans. Crop Sci. 6:220–225.
Buss, G.R., H.M. Camper, Jr., and C.W. Roane. 1988. Registration of 'Hutcheson' soybean. Crop Sci. 28:1024–1025.
Cary, T., and B. Diers. (ed.) 1999. Northern regional soybean cyst nematode test report I–IV. Univ. of Illinois, Urbana, IL.
Hartwig, E.E., and J.M. Epps. 1973. Registration of 'Forrest' soybeans. Crop Sci. 13:287.
Njiti, V.N., M.A. Shenaut, R.J. Suttner, M.E. Schmidt, and P.T. Gibson. 1998. Relationship between soybean sudden death syndrome disease measures and yield components in F_6 derived lines. Crop Sci. 38:673–678.
Riggs, R.D., and D.P. Schmitt. 1988. Complete characterization of the race scheme for *Heterodera glycines.* J. Nematol. 20:392–395.
Schapaugh, W.T., Jr., and R.E. Dille. 1998. Registration of 'KS4694' Soybean. Crop Sci. 38:891.
Schmidt, M.E., O. Myers, and P.T. Gibson. 1993. Registration of 'Pharaoh' Soybean. Crop Sci. 33:210–211.
Schmidt, M.E., J.H. Klein, R.J. Suttner, and O. Myers. 1999. Registration of 'LS90–1920' Soybean. Crop Sci. 39:295.
Tyler, J., G.W. Shelton, and P.P. Bell. 2000. Uniform Soybean Tests, Southern States: 1999. USDA-ARS, Stoneville, MS.

Department of Plant, Soil and General Agriculture, Mailcode 4415, Southern Illinois University–Carbondale, Carbondale, IL 62901. A Center of Excellence for Soybean Research, Teaching, and Outreach publication. Registration by CSSA. Accepted 31 Jan. 2004. 2001. Corresponding author (mesch@siu.edu).

Published in Crop Sci. 44:1482–1483 (2004).

Registration of 'LN97-15076' Soybean

LN97-15076 soybean [*Glycine max* (L.) Merr.] (Reg. no. CV-465, PI 633983) was developed by the Illinois Agricultural Experiment Station at the University of Illinois. It was released in 2003 for use by breeders as a parent because of its higher yield when compared with cultivars of similar maturity.

LN97-15076 originated as an F_4 plant selection from the cross 'Macon' × 'Stressland' made at the Illinois Agricultural Experiment Station (Nickell et al., 1996; Cooper et al., 1999). The cross was made in the field in the summer of 1994, and the F_1 generation was grown in the field in 1995. The F_2 and F_3 generations were advanced by the single-pod bulk method (Brim, 1966), in Puerto Rico during the winter of 1995–1996, and the F_4 population was grown at Urbana during the summer of 1996. LN97-15076 was selected as an $F_{4:5}$ plant row in 1997. The row was selected, composited, and the line was evaluated in replicated yield trials in Illinois during 1998 through 2003. LN97-15076 was evaluated in the Uniform Soybean Tests Northern Region Preliminary Group IV Test in 2000, and Uniform Group IV Test from 2001 through 2002 (Nowling, 2000; Crochet, 2002).

LN97-15076 is an indeterminate line classified as having a mid group IV maturity (relative maturity 4.3). In the uniform test, LN97-15076 had 7% greater seed yield (3474 kg ha^{-1} vs. 3245 kg ha^{-1}) and was 3 d later in maturity than Macon across 30 environments. Compared to Macon, LN97-15076 was 13 cm taller with a similar lodging score across 32 environments, and was 10 g kg^{-1} greater in seed protein (412 vs. 402 g kg^{-1}) and 5 g kg^{-1} less in seed oil (206 vs. 211 g kg^{-1}) concentration across nine locations. Compared with HS93-4118 (St. Martin et al., 2001) at the same locations, LN97-15076 was 1% greater in seed yield, 13 cm taller, similar in lodging score, 2 days later in maturity, 11 g kg^{-1} greater in seed protein, and 4 g kg^{-1} greater in seed oil concentration.

LN97-15076 has white flowers, tawny pubescence, brown pod color at maturity, and dull yellow seeds with black hila. LN97-15076 is susceptible to Phytophthora rot (Races 4 and 7) (caused by *Phytophthora sojae* M.L. Kaufmann & J.W. Gerdemann), sudden death syndrome [caused by *Fusarium solani* (Mart.) Sacc.], and soybean cyst nematode (*Heterodera glycines* Ichinohe).

Seed of LN97-15076 will be maintained by the Illinois Agricultural Experiment Station at the University of Illinois, Urbana, IL 61801. A small sample of LN97-15076 may be obtained from the experiment station for research purposes, including development and commercialization of new cultivars, for at least 5 yr. It is requested that appropriate recognition be made if LN97-15076 contributes to the development of new cultivars, germplasm, parental lines, or genetic stocks. No application will be made for U.S. Plant Variety Protection for LN97-15076.

B.W. Diers,* T.R. Cary,
D.J. Thomas, and C.D. Nickell

References

Brim, C.A. 1966. A modified pedigree method of selection in soybeans. Crop Sci. 6:220–225.
Cooper, R.L., R.J. Martin, S.K. St. Martin, A. Calip-DuBois, R.J. Fioritto, and A.F. Schmitthenner. 1999. Registration of 'Stressland' soybean. Crop Sci. 39:590–591.
Crochet, W.D. (ed.) 2002. The uniform soybean tests, northern region: 2002. USDA-ARS, West Lafayette, IN.
Nickell, C.D., D.J. Thomas, T.R. Cary, and D. Heavner. 1996. Registration of 'Macon' soybean. Crop Sci. 36:1410.
Nowling, G.L. (ed.) 2000. The uniform soybean tests, northern region: 2000. USDA-ARS, West Lafayette, IN.
St. Martin, S.K., G.R. Mills, R.J. Fioritto, A.F. Schmitthenner, and R.L. Cooper. 2001. Registration of HS93-4118 soybean. Crop Sci. 41:591.

Dep. of Crop Sciences, Univ. of Illinois, 1101 W. Peabody Dr., Urbana, IL 61801. Contribution from the Illinois Agric. Exp. Stn., Urbana. Research supported in part by the Illinois Soybean Checkoff Board. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (bdiers@uiuc.edu).

Published in Crop Sci. 44:1483 (2004).

Registration of '5002T' Soybean

'5002T' (Reg. no. CV-466, PI 634193) soybean [*Glycine max* (L.) Merr.] was developed by the Tennessee Agricultural Experiment Station and was released in 2002. It is a high yielding maturity group V cultivar adapted to the southern USA.

5002T is an F_6–derived line from the cross 'Holladay' (Burton et al., 1996) × 'Manokin' (Kenworthy et al., 1996). The F_1 plants were grown at Knoxville, TN, in 1991. Harvested F_2 seeds were sent to Costa Rica and grown for generation advancement, without selection, via single-pod descent (using all seeds from pods, rather than single seeds) to the F_5 stage (Fehr, 1991). F_6 plants were grown in Knoxville, TN, in 1993, and single plants were harvested. The $F_{6:7}$ plant-rows were grown at Knoxville in 1994, and those rows that were visually desirable were individually bulk harvested. In 1996, seed from one of those bulks was designated TN96-68. TN96-68 was selected on the basis of superior yield and other agronomic traits and was tested in yield trials at multiple locations each year in Tennessee from 1996 to the present.

5002T is most similar in its characteristics to the variety Manokin. Averaged over 46 Tennessee environments from 1996 to 2002, 5002T (3391 kg ha^{-1}) significantly exceeded Manokin (3089 kg ha^{-1}) in seed yield. 5002T was entered in the Tennessee State Variety Test in 2001 and 2002 where its 2-yr average seed yield (3225 kg ha^{-1}) was significantly higher than that of Manokin (2889 kg ha^{-1}) (Allen et al., 2003).

5002T was entered in the Uniform Soybean Tests Southern Region preliminary group V test in 1998 and uniform group V test in 1999, 2000, 2001, and 2002 (Tyler et al., 2000; Paris et al., 2001, 2002; Paris and Bell, 2003). In these tests, averaged across 4 yr (1999–2002), 5002T produced 3119 kg ha^{-1} seed yield, with 204 g kg^{-1} seed oil, 410 g kg^{-1} seed protein, and 0.14 g seed^{-1}, compared with Manokin at 2794 kg ha^{-1} seed yield, 203 g kg^{-1} seed oil, 406 g kg^{-1} seed protein, and 0.125 g seed^{-1}. Maturity of 5002T was 1.2 d later than Manokin, and 5002T was 5.8 cm shorter in height than Manokin. Lodging resistance in 5002T (1.8 score) was better than that of Manokin (2.2 score). 5002T has white flowers, tawny pubescence, tan podwall, and a determinate growth habit. Seeds are yellow with imperfect black hila.

5002T is resistant to sudden death syndrome [caused by *Fusarium solani* (Mart.) Sacc.] and resistant to stem canker [caused by *Diaporthe phaseolorum* (Cooke & Ellis) Sacc. var. *caulivora* K.L. Athow & R.M. Caldwell]. 5002T is susceptible to *Soybean mosaic virus*, susceptible to southern root-knot nematode [*Meloidogyne incognita* (Kofoid and White) Chitwood], susceptible to peanut root-knot nematode [*Meloidogyne arenaria* (Neal) Chitwood], and susceptible to soybean cyst nematode (*Heterodera glycines* Ichinohe).

The Tennessee Agricultural Experiment Station will maintain Breeder seed. An application for U.S. Plant Variety Protection is being filed for 5002T. Small samples (200 seeds) of 5002T can be obtained from the corresponding author for at least 5 yr.

V.R. Pantalone,* F.L. Allen, and D. Landau-Ellis

References

Allen, F.L., R. Johnson, R.C. Williams, M.A. Newman, and G.L. Lentz. 2003. Performance of soybean varieties in Tennesse 2002. Univ. of Tennessee Agric. Exp. Stn. Res. Rep. 03–03. http://www.taes.utk.edu/researchprograms/Variety_trials/index.htm (verified 12 February 2004).

Burton, J.W., T.E. Carter, Jr., and E.B. Huie. 1996. Registration of 'Holladay' soybean. Crop Sci. 36:467.

Fehr, W.R. 1991. Principles of cultivar development. 1st ed. Iowa State University, Ames, IA.

Kenworthy, W.J., J.G. Kantzes, L.R. Krusberg, and S. Sardanelli. 1996. Registration of 'Manokin' soybean. Crop Sci. 36:1079.

Paris, R.L., and P.P. Bell. (ed.) 2003. Uniform Soybean Tests, Southern States: 2002. USDA-ARS, Stoneville, MS.

Paris, R.L., G.W. Shelton, and P.P. Bell. (ed.) 2002. Uniform Soybean Tests, Southern States: 2001. USDA-ARS, Stoneville, MS.

Paris, R.L., G.W. Shelton, and P.P. Bell. (ed.) 2001. Uniform Soybean Tests, Southern States: 2000. USDA-ARS, Stoneville, MS.

Tyler, J.M., G.W. Shelton, and P.P. Bell. (ed.) 2000. Uniform Soybean Tests, Southern States: 1999. USDA-ARS, Stoneville, MS.

Dep. of Plant Sciences, 2431 Joe Johnson Dr., University of Tennessee, Knoxville, TN 37996-4561. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (vpantalo@utk.edu)

Published in Crop Sci. 44:1483–1484 (2004).

Registration of 'Oneida Ultra' Alfalfa

'Oneida Ultra' alfalfa (*Medicago sativa* L.) (Reg. no. CV-201, PI 634339) was developed by the Cornell University Agricultural Experiment Station, New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, NY. This cultivar was released in 1995. Experimental designation was NY 9144.

Oneida Ultra is a 34-clone synthetic originating from Oneida VR (Viands et al., 1990) (75%) and multiple germplasm sources of Flemish types in the Cornell breeding program that were selected for multiple disease resistances {bacterial wilt [caused by *Clavibacter michiganense* subsp. *insidiosum* (McCull) Davis et al., 1984]; Fusarium wilt [caused by *Fusarium oxysporum* Schlecht. f. sp. *medicaginis* (Weimer) Snyd. & Hans.]; Verticillium wilt (caused by *Verticillium albo-atrum* Reinke & Berth.); anthracnose (Race 1) (caused by *Colletotrichum trifolii* Bain & Essary); and Phytophthora root rot (caused by *Phytophthora megasperma* Drechs. f. sp. *medicaginis* Kuan & Erwin)}. Selection for resistance to diseases was followed by one cycle of phenotypic selection in the field for plant vigor, freedom of disease symptoms, resistance to lodging, and lower forage neutral detergent fiber concentration in the second production year. This cultivar is made up of about 46% Flemish, 43% *M. varia* Martyn, 8% *M. falcata* L., 2% Ladak, <1% Turkestan, and <1% Chilean germplasm sources. Seed of the Syn. 1 generation was bulked in equal weight per clone. The Syn. 2 generation (Breeder seed) was produced in 1992.

Oneida Ultra is a moderately dormant cultivar with fall dormancy similar to the FD4 check. It has high resistance to bacterial wilt, Fusarium wilt, and Verticillium wilt. It also has resistance to anthracnose (Race 1), and Phytophthora root rot. It is susceptible to Aphanomyces root rot (Race 1) (caused by *Aphanomyces euteiches* Drechs). Across several locations in New York and Ontario, Canada, Oneida Ultra averaged 0.45 Mg ha^{-1} per year more dry forage than 'Oneida VR', 1.50 Mg ha^{-1} more than 'Vernal', and 0.69 Mg ha^{-1} more than 'Arrow' in two to four production years. Neutral detergent fiber, acid detergent fiber, and relative feed value of the forage is equivalent to those of 'Arrow.' Flower color of the Syn. 2 generation is 100% purple and trace cream, yellow, variegated, and white.

In 1992, breeder seed (Syn. 2) was produced under cage isolation at Caldwell, ID, in sufficient quantity to last the lifetime of the cultivar. This seed is maintained under controlled environmental conditions by the Department of Plant Breeding at Cornell University. Foundation seed (Syn. 3) may be produced from Breeder seed in northern USA on stands no more than 3 yr old unless by consent of the breeder. Certified seed (Syn. 3 or 4) may be produced from Breeder or Foundation seed on stands no more than 6 yr old. Seed shall be sold by cultivar name only as a class of certified seed. Oneida Ultra was reviewed favorably by the National Alfalfa and Miscellaneous Legumes Variety Review Board in 2003.

D.R. Viands,* J.L. Hansen,
E.M. Thomas, and J.L. Neally

Acknowledgments

Development of this cultivar was partially supported by Hatch 149416 and Multistate Research Project NE-144.

References

Viands, D.R., C.C. Lowe, R.P. Murphy, and R.L. Millar. 1990. Registration of 'Oneida VR' alfalfa. Crop Sci. 30:955.

Department of Plant Breeding, Cornell University, Ithaca, NY 14853. Registration by CSSA. Accepted 31 Jan. 2004. * Corresponding author (drv3@cornell.edu).

Published in Crop Sci. 44:1484–1485 (2004).

Registration of 'Seedway 9558' Alfalfa

'Seedway 9558' alfalfa (*Medicago sativa* L.) (Reg. no. CV-202, PI 634340) was developed by the Cornell University Agricultural Experiment Station, New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, NY. This cultivar was released in 1999. Experimental designation was NY 9558.

Seedway 9558 is a cross of two plant populations: (i) Iroquois-type of germplasm sources crossed onto Oneida VR (Viands et al., 1990); the resulting population was selected for multiple disease resistances {bacterial wilt [caused by *Clavibacter michiganense* subsp. *insidiosum* (McCull) Davis et. al. 1984]; Fusarium wilt [caused by *Fusarium oxysporum* Schlecht. f. sp. *medicaginis* (Weimer) Snyd. & Hans.]; Verticillium wilt (caused by *Verticillium albo-atrum* Reinke & Berth.); anthracnose (Race 1) (caused by *Colletotrichum trifolii* Bain & Essary); and Phytophthora root rot (caused by *Phytophthora megasperma* Drechs. f. sp. *medicaginis* Kuan & Erwin)}; followed by one cycle of phenotypic selection for root regeneration capability for one growing season in the field at Ithaca, NY, according to procedures described by Viands (1987), and (ii) a population from multiple sources, mostly derived from Oneida VR, that also went through selection for the same disease resistances; followed by one cycle of phenotypic selection in the field for plant vigor, freedom of disease symptoms, resistance to lodging, and lower forage neutral detergent fiber and acid detergent fiber concentrations (determined by near infrared spectroscopy calibrated to forage samples analyzed by wet-lab procedures), and one cycle of phenotypic selection for root regeneration capability. The population cross was done by hand, with a mixture of pollen from one population to cross onto each clone of the other population (95 clones per population). Seed of the Syn. 1 generation was a bulk of equal weight of seed per clone from each of the two populations. The Syn. 2 generation (Breeder seed) was produced in 1995.

Seedway 9558 is a dormant cultivar with fall dormancy similar to the FD3 check. It has high resistance to bacterial wilt, Fusarium wilt, Verticillium wilt, and anthracnose (Race 1). It is resistant to Phytophthora root rot, and is susceptible to Aphanomyces root rot (Race 1) (caused by *Aphanomyces euteiches* Drechs); and spotted alfalfa aphid (*Therioaphis maculata* Buckton). In NY, Seedway 9558 averaged 0.65 Mg ha^{-1} per year more dry forage than 'Oneida VR' and 0.99 Mg ha^{-1} more than 'Vernal' in three production years. Forage quality (acid detergent fiber, neutral detergent fiber, and relative feed value) is between that of the high- and low-quality check cultivars 'WL 322 HQ' and 'Vernal,' respectively (Sheaffer et al., 1995). Flower color of the Syn. 2 generation is 80% purple, 19% variegated, 1% cream, and a trace of yellow and white.

In 1995, Breeder seed (Syn. 2) was produced under cage isolation at Caldwell, ID, in sufficient quantity to last the lifetime of the cultivar. This seed is maintained under controlled environmental conditions by the Department of Plant Breeding at Cornell University. Foundation seed (Syn. 3) may be produced from Breeder seed in northern USA on stands no more than 3 yr old unless by consent of the breeder. Certified seed (Syn. 3 or 4) may be produced from Breeder or Foundation seed on stands no more than 6 yr old. Seed shall be sold by cultivar name only as a class of certified seed. Seedway 9558 was reviewed favorably by the National Alfalfa and Miscellaneous Legumes Variety Review Board in 2003.

D.R. Viands,* J.L. Hansen,
E.M. Thomas, and J.L. Neally

Acknowledgments

Development of this cultivar was partially supported by Hatch 149416 and Multistate Research Project NE-144.

References

Sheaffer, C.C., M.A. Peterson, M. McCaslin, J.J. Volenec, J.H. Cherney, K.D. Johnson, W.T. Woodward, and D.R. Viands. 1995. Acid detergent fiber, neutral detergent fiber concentration, and relative feed value. *In* Standard tests to characterize alfalfa cultivars—third edition. http://www.naaic.org/stdtests/acidfiber.htm; verified 12 February 2004

Viands, D.R. 1987. Variability and selection for characters associated with root regeneration capability in alfalfa. Crop Sci. 28:232–236.

Viands, D.R., C.C. Lowe, R.P. Murphy, and R.L. Millar. 1990. Registration of 'Oneida VR' alfalfa. Crop Sci. 30:955.

Department of Plant Breeding, Cornell University, Ithaca, NY 14853. Registration by CSSA. Accepted 31 Jan. 2004. * Corresponding author (drv3@cornell.edu).

Published in Crop Sci. 44:1485 (2004).

Registration of 'Georgia-03L' Peanut

'Georgia-03L' (Reg. no. CV-79, PI 634333) is a new large-podded runner-type peanut (*Arachis hypogaea* L. subsp. *hypogaea* var. *hypogaea*) cultivar that was released by the Georgia Agricultural Experiment Stations in 2003. It was developed at the University of Georgia, Coastal Plain Experiment Station, Tifton, GA.

Georgia-03L originated from a cross made in 1991 between 'Georgia Browne' (Branch, 1994) and 'VA-C 92R' (Mozingo et al., 1994). Pedigree selection was practiced within the F_2, F_3, and F_4 segregating populations, and performance testing began in the $F_{4:6}$ generation with the advanced pure breeding line GA 962533.

Georgia-03L has a high level of resistance to spotted wilt disease caused by *Tomato spotted wilt virus* (TSWV) comparable to 'Georgia Green' (Branch, 1996). Georgia-03L is unique from other runner-type peanut cultivars in having a distinctively higher percentage of fancy pods (riding a 1.35-cm spacing set on pod presizer). It has pod size similar to virginia-types (>40% fancy pods), however it has seed weight similar to runner-types (65–70 g 100^{-1}). Georgia-03L combines TSWV-resistance with large smooth pods and excellent yielding ability.

In 15 tests conducted at multiple locations in Georgia from 1998 to 2002, Georgia-03L was found to be significantly higher in yield than Georgia Green with the same high dollar value return per hectare. Georgia-03L also produced about twice the percentage (37 vs. 19%) of jumbo runner seed (riding a 8.33 by 19.05 mm slotted screen) as compared to Georgia Green, but had fewer medium and No. 1 seed.

Georgia-03L has similar maturity, pink testa color, protein content, oil content, O/L ratio, and roasted flavor as Georgia Green and 'Florunner' (Norden et al., 1969). Georgia-03L also has very good stability and a wide range of adaptability throughout the U.S. peanut production areas (Branch et al., 2001, 2002, 2003).

U.S. Plant Variety Protection is pending for Georgia-03L.

Breeder seed of Georgia-03L will be maintained by the University of Georgia, Coastal Plain Experiment Station at Tifton. Foundation seed stock will be available from the Georgia Seed Development Commission, 2420 S. Milledge Avenue, Athens, GA 30605.

W.D. Branch*

References

Branch, W.D. 1994. Registration of 'Georgia Browne' peanut. Crop Sci. 34:1125–1126.
Branch, W.D. 1996. Registration of 'Georgia Green' peanut. Crop Sci. 36:806.
Branch, W.D., R.W. Mozingo, T.G. Isleib, J.P. Bostick, D.W. Gorbet, C.E. Simpson, M.D. Burow, M. Baring, K.R. Keim, and T. Stevens. 2001. Uniform peanut performance tests-2000. Res. Prog. Rept. No. 4–01, Univ. of Georgia, Coastal Plain Exp. Sta. Tifton, GA.
Branch, W.D., R.W. Mozingo, T.G. Isleib, J.P. Bostick, D.W. Gorbet, C.E. Simpson, M.D. Burow, M. Baring, and K.E. Dashiell. 2002. Uniform peanut performance tests-2001. Res. Prog. Rept. No. 4–02, Univ. of Georgia, Coastal Plain Exp. Sta., Tifton, GA.
Branch, W.D., R.W. Mozingo, T.G. Isleib, J.P. Bostick, D.W. Gorbet, C.E. Simpson, M.D. Burow, M. Baring, and K.E. Dashiell. 2003. Uniform peanut performance tests-2002. Res. Prog. Rept. No. 4–03, Univ. of Georgia, Coastal Plain Exp. Sta., Tifton, GA.
Mozingo, R.W., J.C. Wynne, D.M. Porter, T.A. Coffelt, and T.G. Isleib. 1994. Registration of 'VA-C 92R' peanut. Crop Sci. 34: 539–540.
Norden, A.J., R.W. Lipscomb, and W.A. Carver. 1969. Registration of Florunner peanuts (Reg. No. 2). Crop Sci. 9:850.

Dep. of Crop and Soil Sciences, Univ. of Georgia, Coastal Plain Exp. Stn., Tifton, GA 31793-0748. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (wdbranch@tifton.uga.edu).

Published in Crop Sci. 44:1485–1486 (2004).

Registration of 'Apagbaala' Cowpea

'Apagbaala' cowpea [*Vigna unguiculata* (L.) Walp.] (Reg. no. CV-219, PI 633739) was developed by the Savanna Agricultural Research Institute (SARI) of the Council for Scientific and Industrial Research (CSIR), Tamale, Ghana, and released on 9 May 2003 by the National Varietal Release Committee of Ghana. Apagbaala has high grain yields, is resistant to *Striga gesnerioides* (Willd.) Vatke, and heat tolerant during reproductive development.

Apagbaala was selected from a three-way cross between IT82E-16, 'Prima', and 148-1. IT82E-16 is a red-seeded cultivar developed by the International Institute of Tropical Agriculture (IITA), Nigeria and released for general cultivation in Ghana as 'Vallenga'. Prima is a heat-tolerant cultivar from Nigeria (Marfo and Hall, 1992). 148-1 is a heat-tolerant line developed by the University of California, Riverside, USA, and has the pedigree Prima/TVu 4552//'California Blackeye No.5'/7977. IT82E-16 was crossed to Prima and the F_1 was then crossed to 148-1. Single seeds of the progeny were advanced in a glasshouse, and in June 1987 the F_2 was evaluated at the Imperial Valley Agricultural Field Station (IVAFS), California, USA, which has a average daily minimum and maximum air temperatures during flowering of 24 and 42°C, respectively. Criteria for selection were the number of pods per peduncle, earliness to flower, and white seed coat. Desirable F_3 families were evaluated in single row plots in the field at IVAFS in June 1988 under similar temperatures as in 1987. On the basis of number of pods per peduncle, a pedigree row was selected. The F_4 to F_7 were evaluated under field conditions in Northern Ghana at the SARI main station from 1990 to 1992.

In 1993, Apagbaala was evaluated in replicated yield trials at the SARI main station, Nyankpala as ITxP-148-1, and was included in advanced performance trials from 1994 to 2000 at four sites representative of the various agro-ecologies within Northern Ghana. In these trials, the mean grain yield of Apagbaala was 968 kg ha^{-1}, which was 41% higher than that of the local check, 'Bengpla'. Apagbaala was about 6 days later in maturing than Bengpla. Nodulation (in terms of nodule dry weight) was 40% higher in Apagbaala than Bengpla under either sole cropping or intercropping with cereals. Apagbaala was less infested by *Maruca vitrata* Fabricius compared with Bengpla, probably because the pods are held at wide angles from each other on a peduncle in Apagbaala. Reactions of Apagbaala and Bengpla to *S. gesnerioides* infection were compared by means of *Striga* seeds collected from farmers' fields across the Sudan savannah zone of Ghana. Apagbaala showed high levels of resistance to the parasite compared with Bengpla.

Farmer-managed comparative agronomic trials were conducted from 1996 to 1999 in 66 farm sites across Northern Ghana. Apagbaala recorded higher grain yields than Bengpla in 74% of the test sites. The average yield of Apagbaala in these trials ranged between 533 and 1200 kg ha^{-1} and that of Bengpla between 400 and 950 kg ha^{-1}. Results from both researcher-managed and farmer-managed evaluations suggested that the agronomic potential of Apagbaala was mainly attributed to its ability to set a high number of pods under the low soil fertility and high temperature conditions that characterize the predominant cowpea growing regions in Northern Ghana. Apagbaala is recommended for cultivation in the Guinea and Sudan savannah zones of Ghana. Apagbaala has small-sized, dark green leaves that are fairly ovate in shape. It is erect with a determinate growth habit. It is classified as an early maturing cultivar flowering at 39 to 42 d after sowing (DAS) and maturing at 60 to 65 DAS. The flowers are white. The pods are carried well above the canopy and they number an average of 3.5 per peduncle. The dry seeds have a bright very white coat with a small light brown pigment around the hilum. Dry seeds are kidney shaped and have a 100-seed weight of 13 g.

In consumer preference tests, Apagbaala was preferred to Bengpla in cowpea flour-based staple dishes in Northern Ghana. Bengpla was preferred to Apagbaala for whole-grain cowpea dishes within Northern Ghana. Breeder seed of Apagbaala is maintained by SARI, Tamale, Ghana. Small quantities of seed may be obtained from the corresponding author. Plant Variety Protection will not be sought for Apagbaala.

F.K. Padi,* N.N. Denwar, F.Z. Kaleem, A.B. Salifu, V.A. Clottey, J. Kombiok, M. Haruna, A.E. Hall, and K.O. Marfo

References

Marfo, K.O., and A.E. Hall. 1992. Inheritance of heat tolerance during pod set in cowpea. Crop Sci. 32:912–918.

F.K. Padi, N.N. Denwar, F.Z. Kaleem, A.B. Salifu, V.A. Clottey, J. Kombiok, M. Haruna, and K.O. Marfo, CSIR, Savanna Agricultural Research Institute, Box 52, Tamale, Ghana; A.E Hall, Dep. of Botany and Plant Sciences, Univ. of California, Riverside, CA 92521, USA. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author: (padifrancis@yahoo.co.uk).

Published in Crop Sci. 44:1486 (2004).

Registration of 'Marfo-Tuya' Cowpea

'Marfo-Tuya' cowpea [*Vigna unguiculata* (L.) Walp.] (Reg. no. CV-220, PI 633740) was developed by the Savanna Agricultural Research Institute (SARI) Tamale, of the Council for Scientific and Industrial Research (CSIR), Ghana, and released on 9 May 2003 by the National Varietal Release Committee of Ghana. Marfo-Tuya was released for cultivation in the Guinea and Sudan savannah zones of Ghana because of its high grain yield in soils of low fertility, tolerance to heat during reproductive development, and resistance to *Striga gesnerioides* (Willd.) Vatke.

Marfo-Tuya was developed from a cross between 'Sumbrisogla' and 518-2 made in April 1987. Sumbrisogla is a landrace from the Upper West Region of Ghana, with resistance to *S. gesnerioides* (NAES, 1991). 518-2 is a blackeye breeding line of the University of California, Riverside, USA and was developed from a cross of 'California Blackeye No. 5' and 'TVu 4552'. TVu 4552 is a Nigerian landrace tolerant to heat stress during reproductive development (Marfo and Hall, 1992). The F_1 was advanced in a screen house facility in 1987. In June 1988, F_2 plants were evaluated under field conditions at the Imperial Valley Agricultural Field Station (IVAFS) California, USA, with average daily minimum and maximum air temperatures during flowering of 24 and 42°C, respectively. Criteria for selection were the number of pods per peduncle, erect plant habit, and white seed coat. Desirable F_3 families were evaluated in single-row plots under field conditions in Northern Ghana at the SARI main station and on the basis of the above selection criteria a pedigree row was selected and selfed to the F_6 from 1990 to 1992.

Marfo-Tuya was evaluated as Sul 518-2 in replicated preliminary yield trials at the SARI main station, Nyankpala in 1993, and in advanced agronomic performance trials at four locations in Northern Ghana from 1994 to 2000. In the multilocational trials, the average grain yield was 1159 kg ha^{-1}, which was 52% higher than that of the check variety, 'Bengpla'. In addition, post-harvest biomass yield was significantly higher in Marfo-Tuya compared with Bengpla. Marfo-Tuya was 10 d later in maturing than Bengpla. Marfo-Tuya has similar levels of tolerance to *Megalurothrips sjostedti* Trybom and *Maruca vitrata* Fabricius, as Bengpla. Marfo-Tuya exhibited higher levels of resistance to the predominant races of *S. gesnerioides* in the Sudan savannah zone of Ghana than Bengpla.

In farmer-managed comparative yield trials conducted from 1997 to 1999 in 52 farm sites across Northern Ghana, Marfo-Tuya produced grain yield significantly higher than the local checks and Bengpla in 72% of test sites. Results of the farmer-managed agronomic evaluations indicated that Marfo-Tuya is very tolerant to low soil fertility.

Marfo-Tuya is erect with a semideterminate growth habit. It is classified as a medium maturing cultivar flowering at 41 to 42 d after sowing (DAS) and maturing at 66 to 70 DAS. Flowers are white with a tinge of purple in the standard petal. The majority of the pods are carried within the canopy, and the mean number of pods per peduncle is two. The dry seeds have a dull cream luster with brown pigmentation around the hilum. Dry seeds are fairly round and have a 100-seed weight of 17 g.

In consumer preference tests, Marfo-Tuya was preferred to Bengpla in whole-grain cowpea dishes in Northern Ghana. Bengpla was however preferred to Marfo-Tuya for flour-based staple dishes in Northern Ghana.

Breeder seed of Marfo-Tuya is maintained by the Savanna Agricultural Research Institute, Tamale, Ghana. Small quantities of seed may be obtained from the corresponding author. Plant Variety Protection will not be sought for Marfo-Tuya.

F.K. Padi,* N.N. Denwar, F.Z. Kaleem, A.B. Salifu, V.A. Clottey, J. Kombiok, M. Haruna, A.E. Hall, and K.O. Marfo

References

Marfo, K.O., and A.E. Hall. 1992. Inheritance of heat tolerance during pod set in cowpea. Crop Sci. 32:912–918.

NAES. 1991. Annual Report. Nyankpala Agricultural Experiment Station, Crops Research Institute, Tamale, Ghana.

F.K. Padi, N.N. Denwar, F.Z. Kaleem, A.B. Salifu, V.A. Clottey, J. Kombiok, M. Haruna, and K.O. Marfo, CSIR, Savanna Agricultural Research Institute, Box 52, Tamale, Ghana. A.E. Hall, Dep. of Botany and Plant Sciences, Univ. of California Riverside, CA 92521, USA. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author: (padifrancis@yahoo.co.uk).

Published in Crop Sci. 44:1486–1487 (2004).

Registration of 'Merrit' Lentil

'Merrit' (Reg. no. CV-18, PI 634208) is a large-seeded yellow-cotyledon lentil (*Lens culinaris* Medik.) developed by the USDA-ARS in cooperation with the Washington Agricultural Research Center, Pullman, WA, the Idaho Agricultural Experiment Station, Moscow, ID, and the North Dakota Agricultural Experiment Station, Fargo, ND, and released in 2003. Merrit has large seed size, slight seed coat mottling an upright plant habit, and high yield.

Merrit originated as an F_5 selection from the cross Brewer*2/LC760336/'Palouse' made in 1990. Brewer (PI 508090) was developed and released in 1984 as a large-seeded, slightly mottled, yellow-cotyledon, high-yielding cultivar (Muehlbauer, 1987). Palouse has larger seeds when compared with Brewer and has an absence of seed coat mottling (Muehlbauer, 1992). LC760336 is a selection from a bulk population from the cross (XH79006) between two breeding lines (GH107 and GH101) of unknown pedigrees made by V.E. Wilson. The cross that led to the selection of Merrit was advanced by the bulk method to the F_5 and single plant selections were made in 1993. The F_5 selection was grown in a single plant row (LC460266) in 1994. Preliminary screening for yield and plant traits were conducted in 1995 and Merrit (LC460266) was entered in the preliminary yield trial at Pullman in 1996. Merrit was tested in advanced yield trials at three locations each year from 1997 to 2000. Merrit was entered in Western Regional Yield Trials from 1998 to 2000. Thus in 25 site-years from 1997 to 2000, Merrit averaged 5% higher yield when compared with Brewer. In the Palouse region of eastern Washington and northern Idaho, the yield advantage was 6%.

Compared with Brewer, Merrit averaged 2 cm taller, flowered an average of 1 d later, and matured 1 d later. Merrit has an upright plant habit with basal branches that imparts a bushy structure and enables the canopy to remain somewhat erect during the growing season. Seed size of Merrit is larger and averages 6.4 g per 100 seeds compared with 5.7 g for Brewer. The large slightly mottled seeds of Merrit have yellow cotyledons. The large seed size and the presence of seed coat mottling are traits that should permit the replacement of Brewer by Merrit as a predominant lentil type in the U.S. Pacific Northwest. Both Merrit and Brewer required 21 min for cooking. Merrit had lower scores for virus infection, mainly pea enation mosaic, when compared with Brewer. Scores for resistance to Aphanomyces root rot (caused by *Aphanomyces eutieches* Drechs.) were the same as for Brewer.

Plant variety protection will not be sought for Merrit. Breeder and Foundation seed of Merrit will be maintained by the Washington State Crop Improvement Association under the supervision of the Department of Crop and Soil Sciences, College of Agriculture Research Center, Washington State University; and the USDA-ARS, Pullman, WA 99164-6434. Small quantities of seed of Merrit for research purposes may be obtained from the corresponding author for at least 5 yr. Recipients of seed are asked to make appropriate recognition of the source of Merrit if it is used in the development of a new cultivar, germplasm, parental line, or genetic stock.

F.J. Muehlbauer* and K.E. McPhee

References

Muehlbauer, F.J. 1992. Palouse lentil. Crop Sci 32:1070.

Muehlbauer, F.J. 1987. Registration of 'Brewer' and 'Emerald' lentil. Crop Sci. 27:1088–1099.

USDA-ARS, Washington State University, Pullman, WA 99164-6434. Contribution from USDA-ARS in cooperation with the College of Agriculture and Home Economics, Agric. Res. Ctr., Washington State University, Pullman, WA 99164. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (muehlbau@wsu.edu).

Published in Crop Sci. 44:1487–1488 (2004).

Registration of 'Pennell' Lentil

'Pennell' (Reg. no. CV-19, PI 634209) is a large-seeded yellow-cotyledon lentil (*Lens culinaris* Medik.) developed by the USDA-ARS in cooperation with the Washington Agricultural Research Center, Pullman, WA, the Idaho Agricultural Experiment Station, Moscow, ID, the North Dakota Agricultural Experiment Station, Fargo, ND, and released in 2003. Pennell has absence of seed coat mottling, upright plant habit and high yield.

Pennell, selection LC460197, originated as an F_6 selection from the cross of LC660194/'Brewer' made in 1990 to combine large seed size with upright plant habit. LC6600194 is a selection from PI 299321 made in 1986 for large seed size and upright plant habit. Brewer (PI 508090) was released in 1984 as a large-seeded, yellow-cotyledon, high-yielding cultivar (Muehlbauer, 1987). The cross was advanced to the F_6 by the bulk method, single plant selections were made in 1993, and grown in progeny rows in 1994. The F_7 progeny-row that led to the development of Pennell was selected in 1994. Preliminary screening tests for yield and plant traits were conducted in 1995 and Pennell was entered in the preliminary yield trial at Pullman in 1996. Pennell was evaluated in advanced yield trials at 15 site-years from 1997 to 2000. The average yield of Pennell was comparable to Brewer; however, Pennell yielded 9.1% higher than 'Mason' (PI 619099) (Muehlbauer, 2002), the comparable cultivar for seed size.

Compared with Brewer, Pennell was 1cm taller, flowered an average of 2 d later, and matured 1 d later. Plants of Pennell are strongly branched at the base, which imparts a bushy structure that enables the canopy to remain somewhat erect during the growing season. Pennell has uniform large seeds (100 seeds weigh an average of 6.6 g compared with 6.0 g for Brewer and 6.5 g for Mason). Pennell seeds have yellow cotyledons and its light green seed coats lack mottling. These seed features should appeal to markets in the USA and internationally. Cooking time tests in 2000 and 2001 indicated that both Pennell and Brewer required 21 min for cooking.

Pennell had lower scores for virus infection, mainly pea enation mosaic, when compared with Mason. Scores for resistance to Aphanomyces root rot (caused by *Aphanomyces euteiches* Drechs.) were similar to those for Mason and Brewer.

Plant variety protection will not be sought for Pennell. Breeder and Foundation seed of Pennell will be maintained by the Washington State Crop Improvement Association under the supervision of the Department of Crop and Soil Sciences, College of Agriculture Research Center, Washington State University; and the USDA-ARS, Pullman, WA 99164-6434. Small quantities of seed of Pennell for research purposes may be obtained from the corresponding author for at least 5 yr. Recipients of seed are asked to make appropriate recognition of the source of Pennell if it is used in the development of a new cultivar, germplasm, parental line, or genetic stock.

F.J. Muehlbauer* and K.E. McPhee

References

Muehlbauer, F.J. 1987. Registration of 'Brewer' and 'Emerald' lentil. Crop Sci. 27:1088–1099.

Muehlbauer, F.J. 2002. Registration of 'Mason' Lentil. Crop Sci. 42: 301–302.

F.J. Muehlbauer and K.E. McPhee, USDA-ARS, Washington State University, Pullman, WA 99164-6434. Contribution from USDA-ARS in cooperation with the College of Agriculture and Home Economics, Agric. Res. Ctr., Washington State University, Pullman, WA 99164-6434. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (muehlbau@wsu.edu).

Published in Crop Sci. 44:1488 (2004).

Registration of 'Pardee' Birdsfoot Trefoil

'Pardee' birdsfoot trefoil (*Lotus corniculatus* L.) (Reg. no. CV-11, PI 634338) was developed by the Cornell University Agricultural Experiment Station, New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, NY. This cultivar was released in 1999.

Pardee, experimental designation NY 9754, was derived from several birdsfoot trefoil cultivars and plant introductions available in the 1970s. This material was selected by C. Lowe and K. Zeiders (personal communication) for two cycles of recurrent phenotypic selection for resistance to Fusarium wilt (caused by *Fusarium oxysporum* f. sp. *loti* Bergstrom and Kalb) in a northern New York field with a history of the disease. Number of plants selected is unknown. This selection was followed by one cycle of phenotypic selection for forage vigor after 1 yr in a spaced planted field nursery in Ithaca, NY, followed by two cycles of recurrent phenotypic selection for resistance to Fusarium wilt after inoculating plants in a greenhouse. In the greenhouse selection, 120 to 150 plants were selected each cycle of selection.

Pardee birdsfoot trefoil is an upright, hay-type cultivar, like 'Viking' (PI 310483), but with earlier maturity than both 'Norcen' (PI 570670) and Viking. Pardee has about 50% plants resistant to Fusarium wilt, whereas other cultivars are susceptible. In most location-years in New York, Pardee has higher forage yield than Norcen, and higher or equal yield to Viking. In fields with or without noticeable disease, plant stand after 2 yr is higher for Pardee than for either Viking or Norcen. Pardee also has a darker orange-yellow colored flower compared with the yellow flowers of other cultivars.

Prebreeder seed was produced from 107 plants selected for resistance to Fusarium wilt in a greenhouse after being inoculated with *F. oxysporum* f. sp. *loti*. Selected plants were cross-pollinated by bumblebees in isolated indoor cages to produce the Syn. 1 generation. Breeder seed (Syn. 2) anticipated to last the life of the cultivar was produced in 1998 at Rosemount, MN, by Dr. Nancy Ehlke (University of Minnesota). This seed is stored under controlled environmental conditions in Ithaca, NY, to preserve seed viability. Foundation seed (Syn. 3) may be produced from Breeder seed in northern USA on stands no more than 3 yr old unless by consent of the breeder. Certified seed (Syn. 3 or 4) may be produced from Breeder or Foundation seed on stands no more than 6 yr old. Seed shall be sold by cultivar name only as a class of certified seed. Pardee was reviewed favorably by the National Alfalfa and Miscellaneous Legumes Variety Review Board in 2003. Plant Variety Protection will not be sought for Pardee.

D.R. Viands,* J.E. Miller-Garvin, J.L. Hansen, G.C. Bergstrom, B.P. Tillapaugh, C.C. Lowe, E.M. Thomas, J.L. Neally

Acknowledgments

Development of this cultivar was partially supported by Multistate Research Project NE-144.

D.R. Viands, J.L. Hansen, E.M. Thomas, and J.L. Neally, Department of Plant Breeding, and G.C. Bergstrom, Department of Plant Pathology, Cornell University, Ithaca, NY 14853; J.E. Miller-Garvin, Department of Agronomy and Plant Genetics, University of Minnesota, St. Paul, MN 55108; B.P. Tillapaugh, Wyoming Co. Cooperative Extension, 401 N. Main Street, Warsaw, NY 14569; C.C. Lowe, deceased. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (drv3@cornell.edu).

Published in Crop Sci. 44:1488–1489 (2004).

Registration of 'BUmug-1' Mungbean

'BUmug-1' mungbean [*Vigna radiata* (L.) Wilczek] (Reg. no. CV-217, PI 633419) was developed jointly by Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh and Lentil Blackgram Mungbean Development Pilot Project (LBMDPP) of the Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh. BUmug-1 was released in Bangladesh in 2000 for stable and high yield with combined resistance to *Mungbeanyellow mosaic virus* (MYMV) and Cercospora leaf spot (CLS) (caused by *Cercospora cruenta* Sac. *or Cercospora canescens* Ellis & Martin). BUmug-1 is an early maturing, bold-seeded material with synchronous pod maturity.

BUmug-1 originated as line, VC 6372 (45-8-1), from the Asian Vegetable Research and Development Center (AVRDC), Taiwan. In 1994, 18 advanced mungbean lines together with VC 6372 (45-8-1) were received from AVRDC. In the first year, the material was tested in the research field of BSMRAU, Salna, Gazipur, Bangladesh, along with local released cultivars. Subsequently, a series of field trials were conducted across locations and years. Among the lines–cultivars, VC 6372 (45-8-1) consistently performed better in terms of yield, with synchronous maturity. Days to maturity, reaction to disease, growth habit, podding intensity, and seed yield were given priority during selection. VC 6372 (45-8-1) was evaluated in preliminary, advanced and regional yield trials during the Kharif-I, Kharif-II, and late Rabi seasons of 1996-1997, 1997-1998, and 1998-1999 at four different agroecological locations of the country (LBMDPP, 1999).

Yield trials across 3 yr in different mungbean growing areas in three cropping seasons in Bangladesh showed that BUmug-1 averaged 1400 kg ha^{-1} compared with 1200 kg ha^{-1} for the check Barimung-2 (LBMDPP, 1999). BUmug-1 had a 30% yield advantage over Barimung-2 and 60% advantage over the local check 'Barisal Local' and gave consistently higher yields throughout the trials (LBMDPP, 1999). Because of its wide adaptability, the cultivar is recommended for three different mungbean growing seasons [Kharif-I (February–May), Kharif-II (August–October), and late Rabi (January–April)] and for cultivation in all mungbean growing areas of Bangladesh.

BUmug-1 has an erect growth habit and attains a height of 40 to 60 cm. It flowers in 30 to 35 d after emergence and reaches physiological maturity 50 to 60 d after emergence. Leaves are trifoliolate, alternate, and green. Leaf pubescence is absent or very sparse. Petioles are short and purple-green. The corolla is yellow-green. The raceme position is above the canopy. Mature pods are black. Seeds are drum-shaped, dull and greenish. BUmug-1 has a 100-seed weight of 5.2 g (LBMDPP, 1999). The hypocotyl color is purple. Cotyledon color is yellow.

BUmug-1 is resistant to MYMV and CLS. During initial evaluation, the cultivars or lines were screened for combined resistance with the spreader row technique (Bakr, 1994). A cultivar highly susceptible to MYMV and CLS ('KPS 2') was planted after every five families or lines to create artificial disease pressure. BUmug-1 was rated as 0 on a 0-to-5 rating scale (where 0 is no disease symptoms and 5 is severe disease symptoms) for both the diseases throughout its evaluation across locations (LBMDPP, 1999).

Cotyledons of BUmug-1 seeds contain 72% of the seed producing 77.2% of head dahl (intact cotyledon after splitting) with the traditional method of dehulling. It takes 22 min to cook and shows solid dispersion of 27.4%. BUmug-1 seed contains 205 mg g^{-1} protein and 476 mg g^{-1} carbohydrate (Haque et al., 2001).

Breeder seed of BUmug-1 was distributed to the Bangladesh Agricultural Development Corporation (BADC) to produce Foundation and Certified seed. Breeder seed will be maintained jointly by the Pulses Research Centre, BARI, Joydebpur, Gazipur-1701, Bangladesh and Bangabadhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur-1703, Bangladesh. U.S Plant Variety Protection for BUmug-1 will not be applied for. Small quantities of seed for research purposes may be obtained from the corresponding author or from AVRDC for at least 5 years from the date of this publication.

A. Hamid, M.A. Afzal,* M. Moynul Haque, and S. Shanmugasundaram

References

Bakr, M.A. 1994. Checklist of pulses diseases in Bangladesh. Bangladesh J. Plant Pathol.10 (1&2):13–16

LBMDPP. 1999. Lentil Blackgram and Mungbean Development Pilot Project, Annual Report for1999. Bangladesh Agricultural Research Institute, Gazipur-1701, Bangladesh.

Haque, M.M., M.A. Afzal, A. Hamid, M. Abu Bakr, Q.A. Khaliq, and M.A. Hossain. 2001. Improved Mungbean Variety, BUmug-1 [Bangla Folder]. Lentil Blackgram and Mungbean Development Pilot Project, Publication no. 20. Bangabadhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1703, Bangladesh.

Hamid, M. Moynul Haque, Bangabadhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Department of Agronomy, Gazipur-1703, Bangladesh; M.A. Afzal, Pulses Research Centre, Bangladesh Agricultural Research Institute (BARI), Gazipur-1701, Bangladesh; S. Shanmugasundaram, Asian Vegetable Research and Development Center P.O. Box 42, Shanhua, Tainan, Taiwan 741, R. O. C. Registration by CSSA. Accepted 30 Sep. 2003. *Corresponding author (aafzal@bdcom.com).

Published in Crop Sci. 44:1489 (2004).

REGISTRATIONS OF GERMPLASMS

Registration of N95L11881 and 97L9521 Strong Gluten 1BL.1RS Wheat Germplasm Lines

N95L11881 (Reg. no. GP-745, PI 617064) and 97L9521 (Reg. no. GP-746, PI 617066) hard red winter wheat (*Triticum aestivum* L.) germplasm lines were released by the ARS, USDA, and the Nebraska Agricultural Experiment Station, in June 2002. These lines carry the 1BL.1RS wheat-rye (*Secale cereale* L.) chromosomal translocation inherited from the hard red winter wheat 'Siouxland' (Schmidt et al., 1985), but they possess improved gluten strength relative to this parent. The 1BL.1RS translocation in Siouxland originally was derived from the Russian wheat 'Kavkaz' (PI 367723). While this translocation confers a number of advantageous traits, including resistance to several fungal diseases and improved grain yield and grain yield stability, it has a detrimental effect on the processing quality of hard winter wheat (reviewed by Graybosch, 2001). The most noticeable effect, a lack of dough strength, is overcome in these two germplasm lines.

N95L11881 (Siouxland/2*N86L177) and 97L9521 (Siouxland/4*N86L177) were derived from intermatings and backcrosses between Siouxland and N86L177 (PI 559717). N86L177 is a high protein, strong gluten, non-1RS wheat derived from NapHal/'Lancer'//'Karlik1'/3/NS622/4/'Centurk'/'GK-Tiszataj'//'PlainsmanV. The pedigree of Siouxland is 'Warrior' *5/'Agent' *2//'Kavkaz'. To develop N95L11881, Siouxland was crossed to N86L177 in 1990. In 1991, resultant F_1 plants were backcrossed to N86L177. Single-seed analysis was used to identify BC_1F_1 seed carrying the 1BL.1RS translocation. The brush end of each kernel was removed and the embryo end saved with identity maintained. Seventy-percent ethanol soluble grain storage proteins (prolamins) were extracted, separated by SDS-PAGE, and visualized by silver-staining (Graybosch and Morris, 1990). The presence of 1BL.1RS is inferred in such separations by the presence of secalin proteins (prolamins of rye arising from the *Sec-1* locus on 1RS). Since 1RS arms do not recombine with wheat 1BS arms, the presence of secalins in grain protein extracts provides a consistent marker for this rye chromosome arm. Secalin positive seed were then transplanted to the greenhouse, and self-pollinated until the F_3 generation. Single plant selections were made from F_3 populations, and sown as F_4 single-plant progeny rows at Lincoln, NE, in 1994. After harvest of 1995, secalin proteins were identified in extracts of bulked F_5 seed, via separation of prolamins by high-performance liquid chromatography (HPLC) (Lookhart et al., 1990). HPLC facilitated the identification of homogeneous lines with 1BL.1RS. N95L11881 was identified as one of these homogeneous, homozygous lines. Homogeneity of 1BL.1RS was again confirmed by a third technique, capillary electrophoretic separation of prolamins (Lookhart et al., 1996).

97L9521 was developed in an identical fashion to N95L11881, except two additional cycles of backcrossing to the recurrent parent (N86L177) were conducted. F_1 seed from each backcross was tested for secalins, as described above. BC_4F_1 secalin positive plants were greenhouse grown in 1994. In 1995, BC_4F_2 plants again were greenhouse grown, threshed individually, and screened for homogeneity of secalins from *Sec-1*. Seed from homogeneous individuals was used to seed BC_4F_3 single plant progeny rows at Yuma, AZ, in 1996, and BC_4F_4 lines were grown as single 4-row plots at Lincoln, NE, in 1997. One of these $BC_4F_{2:4}$ plots was selected as 97L9521, on the basis of phenotypic uniformity, homogeneity for secalins, and similarity in field phenotypic appearance to the recurrent parent.

Grain yield (five Nebraska locations) and quality (three Nebraska locations) characteristics of N95L11881 and 97L9521 were tested in 1997 and 1998 (Table 1). Grain yield of N95L11881 was significantly ($p = 0.05$) greater than both parental lines, while that of 97L9521 did not differ significantly from either Siouxland or N86L177. Bake mix time, flour protein content, and Mixograph tolerance of 97L9521 were all significantly higher than Siouxland and did not differ significantly from N86L177. N95L11881 was significantly higher than Siouxland in flour protein content, bake mix time, Mixograph mix time, and Mixograph tolerance. Bake mix times, an indicator of gluten strength, of both lines exceeded that of Siouxland by at least two minutes and did not differ from that of N86L177. Mixograph tolerance of N95L11881 was intermediate between that of its two parents. The development and performance of these lines demonstrates that the dough weakening effect of 1BL.1RS may be overcome by introgression of the chromosome into suitable genetic backgrounds.

Both N95L11881 and 97L9521 are susceptible to prevalent races of leaf rust (caused by *Puccinia triticina* Eriks.) but are resistant to current North American races of stem rust (caused by *Puccinia graminis* Pers.: Pers.). Both carry the stem rust resistance gene *Sr31*, found on the Kavkaz 1BL.1RS chromosome (Schmidt et al., 1985). In addition, N95L11881 carries *Sr24*, and is postulated to also carry *Lr24* and *Lr26*. Plant heights and lodging resistance of N95L11881 are similar to Siouxland. 97L9521 is nearly identical to its recurrent parent N86L177 in both plant height and lodging resistance.

Due to its greater yield potential, N95L11881 was entered in the 1999 and 2000 USDA-ARS Western Plains Regional Performance Nursery (WPRPN). In eight locations in 1999, average grain yield of N95L11881 was 3554 kg ha^{-1}. In the same tested environments, the check cultivars Trego (PI 612576), Arapahoe (PI 518591), and Prowers (PI 605389) averaged 3555, 3633, and 3418 kg ha^{-1} respectively (LSD 0.05 = 356 kg ha^{-1}). In seven locations in 2000, average yields for N95L11881, Trego, Arapahoe, and Prowers were 2360, 2911, 2497, and 2126 kg ha^{-1}, respectively (LSD = 323 kg ha^{-1}). In the 1999 WPRPN, N95L11881 displayed a mean volume weight of 77.6 kg hL^{-1}, a mean plant height of 87 cm and averaged 144 d after 1 January to heading. Respective means for Trego, Arapahoe, and Prowers were volume weights of 79.5, 75.4, and 79.6 kg hL^{-1}, plant heights of 77, 84, and 88 cm, and days to heading of 144, 145, and 145. In the 2000 WPRPN, respective means of N95L11881, Trego, Arapahoe, and Prowers were volume weights, 71.9, 75.8, 74.6, and 71.9 kg hL^{-1}; plant heights of 66, 59, 63, and 68 cm; days to heading of 135, 134, 134, and 133. Quality characteristics from composite samples over locations in each year (Table 2) of N965L11881 were similar or superior to these three non-1RS check cultivars.

Seed of N95L11881 and 97L9521 has been deposited in the USDA National Small Grains Collection, Aberdeen, ID. Small quantities of seed may be obtained from R. Graybosch, USDA-ARS, University of Nebraska, Lincoln, NE 68583. It is requested that the source of this material be acknowledged in future usage by wheat breeding and genetics programs.

R.A. Graybosch,* C.J. Peterson, and O.K. Chung

References

Graybosch, R.A., and M.R. Morris. 1990. An improved SDS-PAGE methods for the analysis of wheat endosperm storage proteins. J. Cereal Sci. 11:201–212.

Table 1. Mean grain yield and quality attributes of 1BL.1RS germplasm lines relative to parents.

	Grain yield	Flour protein	Loaf volume	Bake mix time	Mixograph mix time	Mixograph tolerance
	kg ha^{-1}	g kg^{-1}	mL	min		0–7
N95L11881	3049	141	868	7.6	5.6	3.3
97L9521	2740	138	902	6.7	4.4	3.7
Siouxland	2734	127	913	4.8	3.8	2.4
N86L177	2614	132	926	7.3	5.3	4.5
LSD (0.05)	285	5	38	0.9	0.9	0.9

Table 2. Quality characteristics of N95L9511 relative to check cultivars in the 1999 and 2000 WPRPN.

Line	Flour protein	Loaf volume	Bake mix time	Mixograph mix time	Mixograph tolerance
	g kg^{-1}	mL	min		0–5
			1999		
N95L11881	107	805	5.5	5.8	4
Arapahoe	105	795	5.6	5	3
Trego	102	860	4.1	4.4	4
Prowers	106	825	6.8	4.8	4
Std. dev.	6	39	1	0.8	1
			2000		
N95L11881	143	970	5.1	4.6	5
Arapahoe	138	865	4.9	3.8	3
Trego	128	900	3.3	2.9	2
Prowers	141	940	6.5	5.3	5
Std. dev.	6	48	0.9	0.9	1

Graybosch, R.A. 2001. Uneasy unions: Quality effects of rye chromatin transfers to wheat. J. Cereal Sci. 33:3–16.

Lookhart, G.L., R.A. Graybosch, C.J. Peterson, and A. Lukaszewski. 1990. Identification of wheat lines containing the 1BL/1RS translocation by HPLC. Cereal Chem. 68:312–316.

Lookhart, G.L., S.R. Bean, R. Graybosch, O.K. Chung, B. Morena-Sevilla, and S. Baenziger. Identification by high-performance capillary electrophoresis of wheat lines containing the 1AL.1RS and the 1BL.1RS translocation. Cereal Chem. 73:547–550.

Schmidt, J.W., V.A. Johnson, P.J. Mattern, A.F. Dreier, D.V. McVey, and J.H. Hatchett. 1985. Registration of Siouxland wheat. Crop Sci. 25:1130.

R.A. Graybosch, USDA-ARS, 344 Keim, University of Nebraska, Lincoln, NE 68583; C.J. Peterson, Department of Crop and Soil Science, Oregon State University; and O.K. Chung, USDA-ARS, Manhattan, KS. Joint contribution of the United States Department of Agriculture, Agriculture Research Service and the University of Nebraska Agriculture Research Division as Journal Series Paper No. 13912. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (rag@unlserve.unl.edu).

Published in Crop Sci. 44:1490–1491 (2004).

Registration of Nineteen Waxy Spring Wheats

Nineteen spring waxy (amylose-free) wheat (*Triticum aestivum* L.) germplasm lines (Reg. no. GP-748 to GP-766, PI 619354–619357, 619359–619363, 619365–619369, 619371–619375) were developed and released by the ARS, USDA, and the Nebraska Agricultural Experiment Station in cooperation with the Agricultural Experiment Stations of North Dakota and Idaho in September 2002. Waxy wheats carry three nonfunctional (null) alleles (*Wx-A1b*, *Wx-B1b*, and *Wx-D1b*) at the genetic loci encoding the enzyme granule-bound starch synthase (GBSS, EC 2.4.1.21) (Nakamura et al., 1995). GBSS also is known as the “waxy” protein. Waxy wheats produce endosperm starch that is nearly devoid of amylose. Such starch confers unique functional properties to derived wheat flour. Suggested uses for waxy wheats include the production of modified food starches, a blending agent to create flours with optimal amylose concentration for the production of a variety of sheeted and baked food products, and as an animal feed (reviewed by Graybosch, 1998). Waxy wheats also are useful as donors of the *Wx* null alleles, which may be used to develop partial waxy or reduced-amylose wheats. The presence of one or two such alleles can result in wheat flours with superior performance in certain food applications including white salted noodles (Epstein et al., 2002). Few waxy wheats have been publicly available to date, and those released (Morris and Konzak, 2001) are ill-adapted to North American spring wheat production zones. The release of this set of 19 waxy lines greatly expands the number of available genetic backgrounds carrying the waxy trait in wheat. Pedigrees and Plant Introduction (PI) numbers of the lines are listed in Table 1.

Lines were developed from matings between Asian and North American sources of the *Wx* null alleles. After the last cross in each pedigree, the brush end of F_2 plants was stained with a dilute solution of I_2KI and the germ end was saved for planting. Under these staining conditions, waxy seed were identified by their red-brown color, as opposed to the dark purple-black color typical of wild-type or partial waxy lines (Nakamura et al., 1995). F_2 plants were grown, without vernalization, in greenhouses in the fall of 1998, and maintained and harvested individually. Only true spring growth habit types (e.g., those that flowered and set seed under nonvernalizing conditions) were harvested. F_2–derived F_3 single-plant progeny rows were grown at Aberdeen, ID, USA in the spring of 1999. At harvest the 19 $F_{2:4}$ waxy lines were selected from these progeny rows, on the basis of uniformity of phenotype under field conditions and uniformity of the waxy trait.

Grain yields of the 19 waxy lines, based on replicated tests in three locations (Fargo, ND and Aberdeen, ID, 2000; Mead, NE, 2001), are given in Table 2. Grain yields ranged from a high of 3606 kg/ha in PI 619362 to a low of 2076 kg/ha in PI 619360. In the same testing environments, the spring wheat cultivars ‘Express’ (PI 573003), ‘Westbred 926’ and ‘Klasic’ (PI 486139) averaged 3441, 3703, and 2799 kg/ha, respectively. On the basis of assessment by a Perten Single Kernel Hardness Characterization System, mean hardness scores (Table 2) identified three soft endosperm textured wheats, while the remaining 16 waxy wheats were classified as hard wheats. Fifteen of the lines breed true for red grain color, while four are heterogeneous for red and white grain (Table 2).

Table 2 also lists postulated resistance genes to foliar diseases. On the basis of reactions to current races of leaf rust

Table 1. Plant Introduction (PI) numbers, experimental line designations, and pedigrees of 19 spring waxy wheats.

PI no.	Experimental line designation	Pedigree
619354	99ID388	Kanto107/MN2540/3/BaiHuo5/K94H115//IDO469
619355	99ID389	Kanto107/MN2540/3/BaiHuo5/K94H115//IDO469
619356	99ID435	BaiHuo/L910097//Kanto107/3/Kanto107/Yanshi9
619357	99ID450	BaiHuo3/Cimarron//MN91227/3/Kanto107
619359	99ID477	BaiHuo/Chris//Kanto107
619360	99ID484	BaiHuo/L910097//Kanto107/3/BaiHuo3/Cimarron//MN91227
619361	99ID490	BaiHuo/Kanto107//Express
619362	99ID496	BaiHuo/Kanto107//Express
619363	99ID498	BaiHuo/Kanto107//Express
619365	99ID516	KY87C-42-8-5/Collin//ACMajestic/3/Kanto107/BaiHuo
619366	99ID520	KY87C-42-8-5/Collin//ACMajestic/3/Kanto107/BaiHuo
619367	99ID524	KY87C-42-8-5/Collin//ACMajestic/3/Kanto107/BaiHuo
619368	99ID529	KY87C-42-8-5/Collin//ACMajestic/3/Kanto107/BaiHuo
619369	99ID536	KY87C-42-8-5/Collin//ACMajestic/3/Kanto107/BaiHuo
619371	99ID548	Penawawa/NE92608//BaiHuo/3/BaiHuo4/Kanto107/A92-3327/Kanto107
619372	99ID554	Kanto107/BaiHuo//BaiHuo/Russ
619373	99ID569	BaiHuo/Kanto107//ACMajestic
619374	99ID590	BaiHuo/ACMajestic//Kanto107/MN2540
619375	99ID594	BaiHuo/Gunnar//Kanto107/Penawawa

Table 2. Mean grain yield, grain hardness class, and grain color characteristics of 19 waxy spring wheats.

				Postulated resistance genes†	
Line	Grain yield	Grain hardness class	Grain color	leaf rust	stem rust
	kg/ha				
619354	2257	hard	red	+	none
619355	2984	hard	red	none	none
619356	2660	hard	red	14a, +	10 or 17
619357	2352	soft	red	+	none
619359	2611	hard	red	16, +	none
619360	2076	hard	red	none	none
619361	3228	soft	red/white	1, +	none
619362	3606	hard	red	+	none
619363	2828	hard	red	none	none
619365	2829	hard	red	9, +	10 or 17
619366	3104	hard	red/white	+	36
619367	2633	hard	red/white	+	10 or 17
619368	3443	hard	red/white	9, +	10 or 17
619369	2955	hard	red	+	none
619371	2960	hard	red	none	none
619372	2588	hard	red	16, +	none
619373	2682	hard	red	+	none
619374	2897	hard	red	+	10 or 17
619375	3299	soft	red	+	none

† + designates presence of unknown gene postulated.

(caused by *Puccinia recondita* Roberge ex Desmaz.), the following resistance genes are postulated as being present in the respective waxy lines: *Lr1*, PI 619361; *Lr16*, PI 619372, PI 619359; *Lr14a*, PI 619356; *Lr9*. PI 619368, PI 619365. Unidentified additional leaf rust resistance genes are speculated to occur in all lines with the exception of PI 619363, PI 619360, PI 619371, and PI 619355. These last four lines are susceptible to current leaf rust races. Resistance genes to current races of stem rust (caused by *Puccinia graminis* Pers.: Pers.) occur in PI 619356, PI 619367, PI 619388, PI 619374, and PI 619365 (*SR10* or *Sr17*). Resistance gene *Sr36* was found in PI 619366. The remaining lines are susceptible to current races of stem rust.

Seed of all lines has been deposited in the USDA National Small Grains Collection, Aberdeen, ID. Small quantities of seed may be obtained from R. Graybosch, USDA-ARS, University of Nebraska, Lincoln, NE 68583. It is requested that the source of this material be acknowledged in future usage by wheat breeding and genetics programs.

R.A. Graybosch,* E.J. Souza, W.A. Berzonsky,
P.S. Baenziger, D.J. McVey, and O.K. Chung

References

Epstein, J., C.F. Morris, and K.C. Huber. 2002. Instrumental texture of white salted noodles prepared from recombinant inbred lines of wheat differing in the three granule bound starch synthase (Waxy) genes. J. Cereal Sci. 35:39–50.

Graybosch, R.A. 1998. Waxy wheats: Origin, properties and prospects. Trends Food Sci. Technol. 9:135–142.

Morris, C.F., and C.F. Konzak. 2001. Registration of hard and soft homozygous waxy wheat germplasm. Crop Sci. 41:934–935.

Nakamura, T., M. Yamamori, H. Hirano, S. Hidaka, and T. Nagamine. 1995. Production of waxy (amylose-free) wheats. Mol. Gen. Genet. 248:253–259.

R.A. Graybosch, USDA-ARS, 344 Keim, University of Nebraska, Lincoln, NE, 68583; E.J. Souza, University of Idaho, Aberdeen, ID; W.A. Berzonsky, North Dakota State University, Fargo, ND; P.S. Baenziger, University of Nebraska, Lincoln, NE; D.J. McVey, USDA-ARS, St. Paul, MN; O.K. Chung, USDA-ARS, Manhattan, KS. Joint contribution of the United States Department of Agriculture, Agriculture Research Service and the University of Nebraska Agriculture Research Division as Journal Series Paper No. 13913. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (rag@unlserve.unl.edu).

Published in Crop Sci. 44:1491–1492 (2004).

Registration of N96L9970 Greenbug Resistant Wheat

'N96L9970' (Reg. no. GP-747, PI 619231) is a hard red winter wheat (*Triticum aestivum* L.) germplasm line developed cooperatively by the USDA, ARS, and the Nebraska Agricultural Experiment Station, and was released in June 2002. The pedigree of N96L9970 is GRS1201/'TAM 202'. GRS1201 carries resistance to multiple races of greenbug (*Schizaphis graminum* Rondani) along with a 1AL.1RS wheat-rye (*Secale cereale* L.) chromosomal translocation originally produced from an irradiated alien chromosome substitution plant derived from a wheat × rye hybrid (short wheat selection/'Scout' [TX69A345-2]//'Insave' rye/3/'TAM W-101') (Porter et al., 1993). TAM 202 (described as an outcross between an unknown parent and 'Siouxland' (PI 483469) carries a different 1AL.1RS translocation (Worrall et al., 1995; Graybosch et al., 1999). The greenbug resistance (*Gb6*) of N96L9970 is located on the 1AL.1RS translocation inherited from GRS1201.

N96L9970 was derived as follows. The cross GRS1201/TAM 202 was made in the greenhouse at the University of Nebraska in the spring of 1992; F_1 seed was fall-sown at Yuma, AZ, in 1992. In 1993, an F_2 population was grown in the greenhouse at Lincoln. F_3 seed was harvested from each F_2 plant separately. For greenbug resistance screening, rows of 25 to 32 F_3 seed, plus resistant and susceptible check rows, were planted in flats. The flats were watered and placed in a growth chamber having a photoperiod of 13 h of light at 22°C and 11 h of dark at 18°C. When plants reached a height of approximately 1 cm, flats were infested so that each plant received approximately 10 to 20 greenbugs. Seven days after infestation, the plants were clipped to a height of 10 to 13 cm, and rated when susceptible check plants were damaged enough to distinguish them easily from resistant check plants (13–14 d after infestation). Susceptible plants were chlorotic and stunted in height. Greenbug biotype G was used to verify the presence of *Gb6*, and to differentiate *Gb6* from the 'Amigo' (PI 578213) derived (*Gb2*) greenbug resistance. *Gb6* conditions resistance to greenbug biotypes B, C, E, G, I, and K (Porter et al., 1993). F_3 seed of the all lines was planted at Yuma, in the fall of 1994; the F_4 generation was seeded at Lincoln in 1995. N96L9970 was selected as an $F_{2:4}$ line, scored as resistant to greenbug biotype G in the F_3 generation. In 1998, N96L9970 was entered in the USDA-ARS Hard Winter Wheat Regional Germplasm Observation Nursery (http://www.ianr.unl.edu/arslincoln/wheat/98RGON.pdf; verified 13 February 2004). N96L9970 again was scored as resistant after all lines in this nursery were tested against greenbug biotype E.

N96L9970 primarily was released because of significantly better agronomic performance than GRS1201, the only previously released source of resistance to greenbug biotypes B, C, E, G, I, and K. In six (five in Nebraska, one in Texas) Great Plains production environments over the 1997 and 1998 harvest years, N96L9970 averaged 3364 kg ha^{-1}, significantly higher than GRS1201 (2550 kg ha^{-1}). In the same environments, the check cultivars Arapahoe (PI 518591), TAM 202 and Siouxland averaged 3743, 3790, and 3425 kg ha^{-1}, respectively. N96L9970 was entered in the USDA-ARS Western Plains Regional Performance Nursery (WPRPN) in 1999 and 2000. In eight production environments in 1999, N96L9970 averaged 3817 kg ha^{-1}. In the same environments, check cultivars 'Trego' (PI 612576), Arapahoe, and 'Prowers' (PI 605389) averaged 3555, 3633, and 3418 kg ha^{-1} respectively. In the 2000 WPRPN (seven locations), N96L9970 averaged 2714 kg ha^{-1}, as opposed to 2911, 2497, and 2126 kg ha^{-1} for Trego, Arapahoe, and Prowers, respectively. Grain volume weight of N96L9970 averaged 69.3 kg hL^{-1}; Trego, Arapahoe, and Prowers averaged 75.8, 73.2, and 71.9 kg hL^{-1}, respectively.

Bread making properties of N96L9970 have similarities to those of both GRS1201 and TAM202. Respective mean (from three 1997 locations) quality traits of the GRS1201, N96L9970, and TAM202 were: grain hardness, 62.3, 62.7, and 66.0 hardness units; grain protein content, 134, 127, and 124 g kg^{-1}; Mixograph time, 3.0, 4.2, and 5.1 min; Mixograph tolerance 9.4, 11.4, and 12.1 mm (width of mixogram at 2 min past peak time); and loaf volume, 942, 923, and 938 mL.

N96L9970 is susceptible to prevalent races of leaf and stem rust (caused by *Puccinia triticina* Eriks. and by *Puccinia graminis* Pers.: Pers., respectively) but shows some resistance to *Soil-borne wheat mosaic virus* (SBWMV). N96L9970 is moderately tolerant of acid soils and has winter-hardiness similar to that of 'TAM 107' (PI 495594). It is susceptible to Russian wheat aphid (*Diuraphis noxia* Mordvilko). Plant height is similar to Trego, and N96L9970 arrives at heading approximately 1 d earlier.

Seed of N96L9970 has been deposited in the USDA National Small Grains Collection, Aberdeen, ID. Small quantities of seed may be obtained from R. Graybosch, USDA-ARS, University of Nebraska, Lincoln, NE 68583. It is requested that the source of this material be acknowledged in future usage by wheat breeding and genetics programs.

R.A. Graybosch,* C.J. Peterson,
D.R. Porter, and O.K. Chung

References

Graybosch, R.A., J-H. Lee, C.J. Peterson, D.R. Porter, and O.K. Chung.. 1999. Peterson, D.R. Porter, and O.K. Chung. 1999. Genetic, agronomic and quality comparisons of two 1AL.1RS. wheat-rye chromosomal translocations. Plant Breed. 118:125–130.

Porter, D.R., J.A. Webster, R.L. Burton, and E.L. Smith. 1993. Registration of GRS1201 greenbug multi-biotype-resistant wheat germplasm. Crop Sci. 33:1115.

Worrall, W.D., S.P. Caldwell, D.S. Marshall, M.E. McDaniel, S. Serna-Saldivar, and M.D. Lazar. 1995. TAM-202 wheat. Crop Sci. 35:1224.

R.A. Graybosch, USDA-ARS, 344 Keim, University of Nebraska, Lincoln, NE 68583; C.J. Peterson, USDA-ARS, Lincoln, NE (present address, Department of Crop and Soil Science, Oregon State University); D.R. Porter, USDA-ARS, Stillwater, OK; O.K. Chung, USDA-ARS, Manhattan, KS. Joint contribution of the USDA-ARS and the University of Nebraska Agriculture Research Division as Journal Series Paper No. 13911. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (rag@unlserve.unl.edu).

Published in Crop Sci. 44:1492–1493 (2004).

Registration of NE-1 Proso Millet Germplasm

NE-1 (Reg. no. GP-88, PI 583348) is a white-seeded proso millet (*Panicum miliaceum* L.) developed by the Nebraska Agricultural Experiment Station. It was released for seed production in February 1995.

NE-1 was selected from the cross NE830141/NE83019. The expanded pedigree is Minn 402/2*'Dawn'//'Panhandle'/2*Dawn/3/Minn 402//Dawn/Panhandle. The cross was made, and F_2 seed was produced in the greenhouse during the winter of 1985–1986. NE-1 is an increase of an F_4 line selected in 1988 and tested as NE860203. NE-1 was not released as a cultivar because of its small seed size. It has potential as a germplasm because of high yield potential, lodging tolerance, high grain volume weight, and mid-season maturity.

NE-1 has a white seed coat (lemma and palea) and a compactum (closed) type panicle. The foliage is green in color and is similar to 'Sunup' (Nelson, 1990).

NE-1 has been tested in Nebraska yield nurseries since 1988 and in regional trials from 1991 to 1998. In regional trials, average grain yields were similar to Sunup, 'Sunrise' (Baltensperger et al., 1997), 'Huntsman' (Baltensperger et al., 1995b), 'Earlybird' (Baltensperger et al., 1995a) and 'Rise' (Nelson, 1984), and it yielded 24 and 18% greater than Panhandle

(Wietgrefe, 1990, p.184) and Minco (Robinson, 1976), respectively.

NE-1 is similar in maturity to Rise, Earlybird, and Sunup and earlier than Huntsman. Heading date varies with planting date and heat unit accumulation, but is generally around the first week in August. Seed size of NE-1 (159 seeds g^{-1}) is similar to Rise and Sunup and 9% smaller than Earlybird. NE-1 had the lowest general combining ability for seed size as determined on the basis of a diallel analysis of the cultivars Earlybird, Huntsman, Dawn (Nelson, 1976), Rise, and Sunrise (Yu, 1996). Grain volume weight of NE-1 (726 g l^{-1}) is not significantly different from Sunup (721 g l^{-1}). The straw strength of NE-1 is similar to Sunup. It has been less susceptible to lodging than Panhandle, 'Cope' (Hinze et al., 1978), or Minco. NE-1 is similar to Rise, Huntsman, Sunrise, and Earlybird in plant height and averages 6 cm shorter than Cope.

NE-1 has shown no susceptibility to Russian wheat aphid [*Diuraphis noxia* (Mordvilko)]. No observations have been made of relative resistance to other insects or diseases in the 7 yr it has been tested.

Breeder seed of NE-1 will be maintained by the Nebraska Agricultural Experiment Station. Seed can be obtained for research and breeding purposes from the senior author. NE-1 will not be submitted for U.S. Plant Variety Protection.

D.D. Baltensperger,* L.A. Nelson,
G.E. Frickel, R.F. Heyduck, and T.T. Yu

References

Baltensperger, D.D., L.A. Nelson, and G.E. Frickel. 1995a. Registration of 'Earlybird' Proso Millet. Crop Sci. 35:1204–1205.

Baltensperger, D.D., L.A. Nelson, G.E. Frickel, and R.L. Anderson. 1995b. Registration of 'Huntsman' Proso Millet. Crop Sci. 35:941.

Baltensperger, D.D., L.A. Nelson, G.E. Frickel, and R.L. Anderson. 1997. Registration of 'Sunrise' Proso Millet. Crop Sci. 37:1380.

Hinze, G., H.O. Mann, E.J. Langin, and A. Fisher. 1978. Registration of 'Cope' Proso Millet. Crop Sci. 18:1093.

Nelson, L.A. 1976. Registration of 'Dawn' Proso Millet. Crop Sci. 16: 739.

Nelson, L.A. 1984. Registration of 'Rise' Proso Millet. Crop Sci. 24: 383.

Nelson, L.A. 1990. Registration of 'Sunup' Proso Millet. Crop Sci. 30:746–747.

Robinson, R.G. 1976. Registration of 'Minco' Proso Millet. Crop Sci. 16:884.

Wietgrefe, G.W. 1990. How to Produce Proso Millet: A Farmer's Guide. Box 45, Pierre, SD.

Yu, T.T. 1996. Inheritance study of seed size in proso millet. Masters thesis. University of Nebraska–Lincoln.

D.D. Baltensperger and G.E. Frickel, Panhandle Res. and Ext. Ctr., Univ. of Nebraska, Scottsbluff, NE 69361; L.A. Nelson and R.F. Heyduck, Dep. of Agronomy, Univ. of Nebraska, Lincoln, NE 68583; T.T. Yu, former graduate student Dep. of Agronomy, Univ. of Nebraska, Lincoln. NE-1 was developed with partial financial support from the Anna Elliott Foundation. Contribution no. 14128 from the Nebraska Agric. Res. Div., Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (dbaltensperger1@unl.edu).

Published in Crop Sci. 44:1493–1494 (2004).

Registration of Eight Multiadversity Resistant (MAR-7B) Germplasm Lines of Upland Cotton

Eight multiadversity resistant (MAR) germplasm lines of upland cotton (*Gossypium hirsutum* L.) (Reg. no. GP-777 through GP-784, PI 634320 through PI 634327) from the MAR-7B germplasm pool were released by the Texas Agricultural Experiment Station (TAES) in 2003. These lines were developed by the TAES-MAR cotton genetic improvement program utilizing techniques and procedures for the simultaneous genetic improvement of resistance to biotic and abiotic stresses in addition to yield, and fiber and seed quality (Bird, 1982; El-Zik and Thaxton, 1989).

These lines were derived by means of a short-cycle recurrent selection method combining field, greenhouse, and laboratory screening at College Station, TX. Single cross F_1s were planted in the greenhouse and self-pollinated to produce F_2 populations, followed by visual selection for yield potential in the field. Bolls were bulked within the best F_2 populations and submitted to the MAR laboratory procedures for seed quality evaluations. F_3 plants that survived the MAR seed quality challenge were selected based on boll set in the greenhouse for subsequent F_4 progeny row field evaluation (El-Zik and Thaxton, 1989). The resulting $F_{3:4}$ progeny rows were selected on the basis of overall seed and plant performance, and apparent yield potential, followed by hand harvest, and then further selected for high volume instrument (HVI) fiber properties.

Field evaluations were conducted over 2 to 3 yr at eight locations in Texas (Weslaco, Corpus Christi, College Station, Temple, McGregor, Munday, Chillicothe, and Halfway) for yield, boll size, lint fraction, and fiber properties (unpublished data, 1996–1998). F_4 progeny row selections were tested in the F_5 in the Early Field Planting Test (EFP) at Weslaco, Corpus Christi, and College Station. Selections based on yield and fiber quality from the EFP were planted for the next 2 yr in the Uniform MAR Test at eight locations. Seed increases of the germplasm lines and checks were rogued for off-types and hand harvested in College Station for further testing so as not to confound seed quality with production environment.

The germplasm designations and their pedigrees are given in Table 1. CABCSV506S-1-94, SPNXHQBPIS-1-94, and PD22CUBQWS-1-95 have glabrous plant parts, while the other lines have pubescent stems and leaves. All lines possess normal leaves and bract types, and are glanded and nectaried. The glabrous lines were compared with 'Tamcot CAB-CS' (Bird et al., 1986) and 'Tamcot Sphinx' (El-Zik and Thaxton, 1996), and the pubescent lines with Tamcot Sphinx and 'Deltapine 50' (Calhoun et al., 1997), the latter a popular cultivar in Southern and Central Texas.

Resistance to bacterial blight [caused by *Xanthomonas campestris* pv. *malvacearum* (Smith 1901) Dye 1978b] was evaluated with greenhouse and field inoculations at College Station. These new MAR-7B lines are resistant to all U.S. races of bacterial blight known to be pathogenic to cotton. On the basis of stand establishment in soils naturally infested with the seedling diseases Pythium and Rhizoctonia (caused by *Pythium ultimum* Trow and *Rhizoctonia solani* Kühn, respectively), the MAR-7B lines have stand establishment and seedling vigor similar to the resistant check, Tamcot Sphinx, and 20% better stand establishment than the susceptible check Deltapine 50. Resistance to Fusarium wilt [caused by *Fusarium oxysporum* Schlechtend.:Fr. f. sp. *vasinfectum* (Atk.) W.C. Snyd. & H.N. Hans.] was determined at the Regional Cotton Fusarium Wilt Nursery, Tallassee, AL (Glass and Gazaway, 1996, 1997, 1999). The MAR-7B line HQCULHQPIH-1-95 has an intermediate level of resistance to Fusarium wilt. Averaged over 3 yr (1996, 1997, and 1999), HQCULHQPIH-1-95 had 24% wilted plants compared with 14% for the resistant check M-315 and 68% for the susceptible check Rowden. The other seven MAR germplasm lines are susceptible to Fusarium wilt.

Averaged over 2 yr (1997–1998) at eight Texas locations, CABCSV506S-1-94 and SPNXHQBPIS-1-94 had lint yield 15% less than Tamcot Sphinx and similar to Tamcot CAB-CS, but both have improved HVI fiber qualities. CABCSV506S-1-94 and SPNXHQBPIS-1-94 have 4% longer upper half mean

Table 1. Designations and pedigrees of MAR-7B cotton germplasm lines.

Designation	Pedigree	Reference
CABCSV506S-1-94	Tamcot CAB-CS/Stoneville 506	Bird et al. (1986); Calhoun et al. (1997)
SPNXHQBPIS-1-94	Tamcot Sphinx/CBD3CUBPIH-91	El-Zik and Thaxton (1996), unreleased breeding line
PD22CUBQWS-1-95	MAR5PD208S-2-92/HQWIHGCUBS-2-92	El-Zik and Thaxton (1998), unreleased breeding line
HGPICG14QH-1-94	CAHUGARPIH-88/CHG14CBD3H-91	El-Zik and Thaxton (1998), unreleased breeding line
PD24HQBPIH-1-94	MAR5PD208S-4-90/CBD3CUBPIH-3-91	Unreleased breeding lines
SPNXCHGLBH-1-94	Tamcot Sphinx/CBUHGLBPIS-1-91	El-Zik and Thaxton (1996), unreleased breeding line
SPNXCBGP6H-1-95	Tamcot Sphinx/CUBC4HGP6S-1-91	El-Zik and Thaxton (1996), unreleased breeding line
HQCULHQPIH-1-95	CBD3CDULBH-2-91/CBD3CUBPIH-3-91	Unreleased breeding lines

length (UHM) fiber, and 14 and 8% stronger fiber, respectively, than Tamcot CAB-CS. PD22CUBQWS-1-95 averaged 24% higher lint yield than Tamcot CAB-CS with fiber bundle strength similar to that of Tamcot Sphinx but 10% higher than that of Tamcot CAB-CS.

Averaged over eight Texas locations and 3 yr, lint yields of SPNXCHGLBH-1-94, SPNXCBGP6H-1-95, HGPICG14QH-1-94, and PD24HQBPIH-1-94 were similar to Tamcot Sphinx and Deltapine 50. SPNXCBGP6H-1-95 averaged 7.6% lower lint fraction and 9% lower micronaire reading than those of Tamcot Sphinx and Deltapine 50. HGPICG14QH-1-94 had improved fiber bundle strength averaging 6.6% higher than Tamcot Sphinx and 12.6% more than Deltapine 50. PD24HQBPIH-1-94 had 10% larger bolls and 5% longer UHM than Tamcot Sphinx. HQCULQPIH-1-95 expressed 10% higher yield than Tamcot Sphinx and Deltapine 50. It is similar to Tamcot Sphinx and Deltapine 50 for UHM length, fiber length uniformity index, fiber strength, and micronaire reading.

These germplasm lines should be useful to cotton breeders in the development of cultivars that are glabrous or pubescent, and with broad and higher levels of resistance to bacterial blight, and improved yield, and/or fiber quality. Small quantities of seed of these germplasm lines are available for distribution upon written request to the corresponding author.

P.M. Thaxton* and K.M. El-Zik

Acknowledgments

This research was supported in part by the Texas Food and Fibers Commission and Cotton Incorporated's Texas State Support program.

References

Bird, L.S. 1982. The MAR (multi-adversity resistance) system for genetic improvement of cotton. Plant Dis. 66:172–176.

Bird, L.S., K.M. El-Zik, and P.M. Thaxton. 1986. Registration of 'Tamcot CAB-CS' upland cotton. Crop Sci. 26:384–385.

Calhoun, D.S., D.T. Bowman, and O.L. May. 1997. Pedigrees of upland and pima cotton cultivars released between 1970 and 1995. Miss. Agron. & For. Exp. Stn. Bull. 1069.

El-Zik, K.M., and P.M. Thaxton. 1989. Genetic improvement for resistance to pests and stresses in cotton. p. 191–224. *In* R. Frisbie et al. (ed.) Integrated Pest Management Systems and Cotton Production. John Wiley & Sons, New York.

El-Zik, K.M., and P.M. Thaxton. 1996. Registration of 'Tamcot Sphinx' cotton. Crop Sci. 36:1074.

El-Zik, K.M., and P.M. Thaxton. 1998. Registration of five glabrous multi-adversity resistant (MAR-6) germplasm lines of upland cotton. Crop Sci. 38:1730.

Glass, K.M., and W.S. Gazaway. 1996. Regional cotton fusarium wilt report. Alabama and Soils Departmental Series 199. Auburn Agric. Exp. Stn., Auburn, AL.

Glass, K.M., and W.S. Gazaway. 1997. Regional cotton fusarium wilt report. Alabama and Soils Departmental Series 208. Auburn Agric. Exp. Stn., Auburn, AL.

Glass, K.M., and W.S. Gazaway. 1999. Regional cotton fusarium wilt report. Alabama and Soils Departmental Series 221. Auburn Agric. Exp. Stn., Auburn, AL.

Dep. of Soil and Crop Sciences, Texas Agric. Exp. Stn., Texas A&M Univ. System, College Station, TX 77843-2474. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (pthaxton@ag.tamu.edu).

Published in Crop Sci. 44:1494–1495 (2004).

Registration of D95-6271 Soybean Germplasm Line Resistant to Velvetbean Caterpillar

Soybean [*Glycine max* (L.) Merr.] germplasm line D95-6271 (Reg. no. GP-301, PI 633735) was developed by the USDA-ARS, Stoneville, MS, in cooperation with the Mississippi Agricultural and Forestry Experiment Station, Stoneville, MS, and released in June 2003. This line has value as germplasm because of its resistance to velvetbean caterpillar (VBC), *Anticarsia gemmatalis* Hübner.

D95-6271 was selected in the F_5 generation from the cross 'Davis' × PI 417061 (Caviness and Walters, 1966). PI 417061 ('Kosa Mame') is a Maturity Group VIII germplasm accession. It is a very poor agronomic type, but was found by Kraemer et al. (1988) to be highly resistant to Mexican bean beetle, *Epilachna varivestis* Mulsant. Kilen (1990) reported that PI 417061 was also resistant to soybean looper (SBL), *Pseudoplusia includens* Walker, and VBC. Davis is very susceptible to all known lepidopterous defoliators. Seed from individual F_2 plants were planted in single plant progeny rows both in a field cage (Lambert, 1984) to screen for resistance to defoliation by SBL, and in the field to select for agronomic traits. Four plants were harvested from each $F_{2:3}$ line grown in the field cage that had the least defoliation by SBL, the least lodging and shattering in the field, and were earliest in maturity. The following season, seed from these F_3 plants were planted in the same manner and four plants were harvested from selected $F_{3:4}$ rows, using the same selection criteria as in the previous generation. Several $F_{4:5}$ lines were grown the following year, from which D95-6271 was selected and harvested in bulk as an F_5 row. In 1999, the F_8 generation of D95-6271, along with parents, were evaluated for resistance to defoliation by VBC in a field cage. Results showed that Davis had significantly more defoliation (85.0%) than D95-6271 (37.5%) and PI 417061 (32.5%), and that percent defoliation for D95-6271 and PI 417061 were not significantly different.

In replicated tests on Sharkey clay soil (very-fine, smectitic, thermic Chromic Epiaquerts) at Stoneville, MS, the 3-yr mean seed yield was 2993 kg ha^{-1} for Davis and 2637 kg ha^{-1} for D95-6271 (about 88%). The insect resistant parent, PI 417061, was included in yield tests only the first year because it yielded only 56% as much as D95-6271 and was 20 d later in maturity. D95-6271 has a relative maturity of 6.2, averaging 6 d earlier than Davis, and has a determinate growth habit, white flowers, gray pubescence, tan pod walls, and yellow seeds with light buff hila.

Small quantities of seed will be available for at least 5 yr for research purposes by writing to the corresponding author. Seed of this release will be deposited in the National Plant

Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. It is requested that appropriate recognition be made if this germplasm contributes to the development of new germplasm or cultivars.

C.A. ABEL* AND T.C. KILEN

References

Caviness, C.E., and H.J. Walters. 1966. Registration of Davis soybeans. Crop Sci. 6:502.

Kilen, T.C. 1990. Multiple insect resistance in a soybean germplasm line. Soybean Genet. Newsl. 17:103–105.

Kraemer, M.E., M. Rangappa, P.S. Benepal, and T. Mebrahtu. 1988. Field evaluation of soybeans for Mexican bean beetle resistance. I. Maturity Groups VI, VII, and VIII. Crop Sci. 28:497–499.

Lambert, L. 1984. An improved screen cage design for use in plant and insect research. Agron. J. 76:168–170.

C.A. Abel, USDA-ARS, P.O. Box 346, Stoneville, MS 38776; T.C. Kilen, USDA-ARS, P.O. Box 345, Stoneville, MS, 38776. Cooperative investigation of the USDA-ARS and Mississippi Agric. and For. Exp. Sta. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (cabel@ars.usda.gov).

Published in Crop Sci. 44:1495–1496 (2004).

Registration of Five Induced Semidwarf Mutants of Rice

The ARS, USDA, and the Arkansas Agricultural Experiment Station released five induced semidwarf mutants of rice (*Oryza sativa* L.), KBNT 11 (Reg. no. GP-90, PI 632953), LGRU 2 (Reg. no. GP-91, PI 632955), LGRU 14 (Reg. no. GP-92, PI 632956), ADAR 22 (Reg. no. GP-88, PI 632951), and KATY 1 (Reg. no. GP-89, PI 632952) in April 2002. The mutants were induced in four tall Arkansas rice cultivars, Kaybonnet (KBNT) (Gravois et al., 1995), LaGrue (LGRU) (Moldenhauer et al., 1994), Adair (ADAR) (Gravois et al., 1994), and Katy (KATY) (Moldenhauer et al., 1990), to obtain quickly semidwarfism in adapted germplasm. These mutants, which have height reductions from 18 to 24% of their tall parents, provide breeding sources of semidwarfism, nonallelic to the worldwide semidwarfing gene *sd*1, in tropical japonica germplasm adapted to the southern USA and similar climatic areas. Such mutants provide alternative semidwarfing sources should genetic vulnerability problems arise from widespread use of *sd*1.

Approximately 4000 dry seeds of each parent cultivar were treated with 200 Gy of γ rays in 1994 or 1995. In the M_1 generation of each cultivar, 1000 or more random panicles were harvested to establish a panicle-to-row M_2 generation. In the M_2 generation semidwarf selections were made in rows segregating for more than one semidwarf plant per row. Usually about one-fourth of the plants in M_2 rows thus chosen were semidwarf, which virtually assured that recessive mutants were being selected. Allelism tests to *sd*1, the worldwide semidwarf source, were conducted by crossing the M_3 or M_4 semidwarf generation mutants as females to 'Calmochi-101' (C101) (Carnahan et al., 1986) or 'S-101' (S101) (Johnson et al., 1989), both of which are known to carry *sd*1 from 'Calrose 76' (Rutger et al., 1977). Calrose 76 is itself an induced semidwarf mutant. Height of the two known *sd*1 sources was 80 to 90 cm, which was similar to or slightly taller than the new mutants. Both *sd*1 sources derived from Calrose 76 have pubescent leaves and hulls, while the new mutants and their parents carry the recessive gene for glabrous leaves and hulls. The F_1 generations were grown in the greenhouse and checked for pubescence to assure true crosses, but height data were inconclusive under these conditions. The F_2 and F_3 generations were grown in the field. Allelism tests among the five mutants were not conducted.

In an eight-replication characterization test at Stuttgart, AR, in 1997, KBNT 11 was 84 cm, or 19 cm shorter, and 2 d later than its parent. In the cross KBNT 11/C101, subjective scoring of 1997 F_2 plant segregation was 79 tall:43 semidwarf:4 double dwarf, a satisfactory fit ($0.10 < P < 0.25$) to a 9:6:1 ratio for nonallelism. The nonallelism of this semidwarf source was confirmed in 2002 F_3 progeny tests of an additional set of F_2 plants from the same cross. In this second set it was deduced that the F_2 plant phenotypes had been 194 tall:126 semidwarf:13 double dwarf, a satisfactory fit ($0.10 < P < 0.25$) to a 9:6:1 ratio.

In the 1997 characterization test, LGRU 2 was 84 cm, or 21 cm shorter, and the same maturity as its parent. In the cross LGRU 2/S101, subjective scoring of 1997 F_2 plant segregation was 58 tall:54 semidwarf:8 double dwarf, a satisfactory fit ($0.10 < P < 0.25$) to a 9:6:1 ratio for nonallelism. The nonallelism of this source also was confirmed in 2002 F_3 progeny tests of a new F_2 population. In this second set it was deduced that the F_2 plant phenotypes had been 193 tall:122 semidwarf:21 double dwarf, a satisfactory fit ($0.75 < P < 0.90$) to a 9:6:1 ratio. Averaged over the 1998 Stuttgart Initial Test No. 6 (SIT 6) and the 1999 Short Season Arkansas Rice Performance Trial, LGRU 2 yielded 8560 compared with 8880 kg ha^{-1} for its parent, and was one day later and 20 cm shorter. In the 1998 SIT Pathology Greenhouse test, LGRU 2 showed essentially the same susceptibility as its parent to six blast {caused by *Pyricularia grisea* Sacc. = *P. oryzae* Cavara [teleomorph: *Magnaporthe grisea* (Hebert) Barr]} isolates, IB1, IB33, IB49, IC17, IE1K, and IG1.

In the 1997 characterization test, LGRU 14 was 85 cm, or 20 cm shorter and 3 d later than its parent. In the cross LGRU 14/C101, subjective scoring of 1997, F_2 plant segregation was 83 tall:55 semidwarf:1 double dwarf, a marginal fit ($0.025 < P < 0.050$) to a 9:6:1 ratio for nonallelism. However, the nonallelism was confirmed in 2002 F_3 progeny tests of a new F_2 population. In this second set it was deduced that the F_2 plant phenotypes had been 177 tall:129 semidwarf: 14 double dwarf, a satisfactory fit ($0.25 < P < 0.50$) to a 9:6:1 ratio.

In the 1997 characterization test, ADAR 22 was 86 cm, or 18 cm shorter, and 3 d later than its parent. In the cross ADAR 22/S101, segregation data were deferred until the F_3 generation, in which the F_2 plant segregation was deduced to have been 98 tall:79 semidwarf:10 double dwarf, a satisfactory fit ($0.25 < P < 0.50$) to a 9:6:1 ratio for nonallelism. The nonallelism was confirmed in 2002 F_3 progeny tests of a new F_2 population. In this second set it was deduced that the F_2 plant phenotypes had been 159 tall: 76 semidwarf: 16 double dwarf, a satisfactory fit ($0.05 < P < 0.10$) to a 9:6:1 ratio. In the 1996 SIT 2, ADAR 22 yielded 6380 compared with 5630 kg ha^{-1} for the parent in the Rohwer location, but lodged so severely in the Stuttgart location that it could not be harvested. ADAR 22 was one day earlier and 22 cm shorter than its parent in this test. In the 1998 SIT 7, ADAR 22 yielded 5940 compared with 7810 kg ha^{-1} for the tall check cultivar 'Drew' (Moldenhauer et al., 1998) (the ADAR parent was not included). In the 1998 SIT Pathology Greenhouse test, ADAR 22 was relatively susceptible to all six blast isolates, a reaction similar to what had been previously observed of its parent.

In the 1997 characterization test, KATY 1 was 80 cm, or 24 cm shorter, and 2 d earlier than its parent. In the cross KATY 1/C101, segregation data were deferred until the F_3 generation, in which the F_2 plant segregation was deduced to have been 72 tall:78 semidwarf:15 double dwarf. This did not provide a satisfactory fit ($P < 0.005$) to a 9:6:1 ratio for nonallelism. However, the nonallelism was confirmed in 2002 F_3 progeny tests of a new F_2 population. In this second set, it was deduced that the F_2 plant phenotypes had been 190 tall: 129 semidwarf: 10 double dwarf, a satisfactory fit ($0.05 < P < 0.10$) to a 9:6:1 ratio. Averaged over a 1997 nitrogen response test, the 1997 SIT 6, and the 1998 SIT 7, KATY 1 yielded 5580 compared with 6600 kg ha^{-1} for its parent, was the same maturity, and 19 cm shorter. In the 1998 SIT Pathology Greenhouse test, KATY 1 and KATY had similar blast reactions: both were susceptible to isolates IB33 and IE1K and resistant to the other four isolates, IB1, IB49, IC17, and IG1.

Brown rice grain dimensions were similar to their respective long grain parents. Apparent amylose contents of the five mutants were similar to the intermediate amylose (210–230 g kg^{-1}) of the parent cultivars, as were the intermediate alkali spreading values.

Germplasm amounts of seed (5 g) of the above lines may be obtained by writing to J. Neil Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160. Seed also will be placed in the National Small Grains Collection, USDA-ARS, 1691 South 2700 West, Aberdeen, ID 83210, where it is available for research purposes, including development and commercialization of new cultivars. If this germplasm contributes to the development of new cultivars, it is requested that appropriate recognition be given to the source.

J.N. Rutger,* K.A.K. Moldenhauer, K.A. Gravois, F.N. Lee, R.J. Norman, and R.J. Bryant

References

Carnahan, H.L., C.W. Johnson, S.T. Tseng, J.J. Oster, and J.E. Hill. 1986. Registration of 'Calmochi-101' rice. Crop Sci. 26:197.

Gravois, K.A., K.A.K. Moldenhauer, F.N. Lee, R.J. Norman, R.S. Helms, B.R. Wells, R.H. Dilday, P.C. Rohman, and M.M. Blocker. 1994. Registration of 'Adair' rice. Crop Sci. 34:1123.

Gravois, K.A., K.A.K. Moldenhauer, F.N. Lee, R.J. Norman, R.S. Helms, J.L. Bernhardt, B.R. Wells, R.H. Dilday, P.C. Rohman, and M.M. Blocker. 1995. Registration of 'Kaybonnet' rice. Crop Sci. 35:587–588.

Johnson, C.W., H.L. Carnahan, S.T. Tseng, J.J. Oster, J.E. Hill, J.N. Rutger, and D.M. Brandon. 1989. Registration of 'S-101' rice. Crop Sci. 29:1090–1091.

Moldenhauer, K.A.K., K.A. Gravois, F.N. Lee, R.J. Norman, J.L. Bernhardt, B.R. Wells, R.H. Dilday, M.M. Blocker, P.C. Rohman, and T.A. McMinn. 1998. Registration of 'Drew' rice. Crop Sci. 38:896–897.

Moldenhauer, K.A.K., K.A. Gravois, F.N. Lee, R.J. Norman, J.L. Bernhardt, B.R. Wells, R.S. Helms, R.H. Dilday, P.C. Rohman, and M.M. Blocker. 1994. Registration of 'LaGrue' rice. Crop Sci. 34:1123–1124.

Moldenhauer, K.A.K., F.N. Lee, R.J. Norman, R.S. Helms, B.R. Wells, R.H. Dilday, P.C. Rohman, and M.A. Marchetti. 1990. Registration of 'Katy' rice. Crop Sci. 30:747–748.

Rutger, J.N., M.L. Peterson, and C.H. Hu. 1977. Registration of 'Calrose 76' rice. Crop Sci. 17:978.

J.N. Rutger and R.J. Bryant, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160; K.A.K. Moldenhauer and F.N. Lee, University of Arkansas, Rice Research and Extension Center, P.O. Box 351, Stuttgart, AR 72160; K.A. Gravois, Sugar Research Station, P.O. Box 604, St. Gabriel, LA 70776; and R.J. Norman, University of Arkansas, Department of Agronomy, Fayetteville, AR 72701. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (jnrutger@spa.ars.usda.gov).

Published in Crop Sci. 44:1496–1497 (2004).

Registration of Goldhull Low Phytic Acid (GLPA) Germplasm of Rice

The ARS, USDA, and the Arkansas Agricultural Experiment Station released goldhull low phytic acid (GLPA) (Reg. no. GP-93, PI 632954) germplasm of rice (*Oryza sativa* L.) in February 2003. GLPA was produced by hybridizing the low phytic acid mutant (KBNT *lpa*1-1) (Rutger et al., 2004) of 'Kaybonnet' (Gravois et al., 1995) with the goldhull color cultivar 'Bluebelle' (Bollich et al., 1968), followed by selection for recombinants possessing the recessive gene *lpa*1-1 from the first parent and the recessive gene for goldhull (*gh*) color from the second parent. While the original low phytic acid mutant KBNT *lpa*1-1 was phenotypically indistinguishable from the original parent, GLPA germplasm is marked by goldhull color, enabling identity preservation of the line in the field, in the farm truck, and in the elevator.

The *lpa*1-1 gene reduces the phytic acid portion of seed phosphorus from 71 to 39%, with a concomitant increase in inorganic phosphorus of 5 to 32%, with little effect on total seed P (Larson et al., 2000). This is considered important because phytic acid P is poorly digested by humans and nonruminant livestock, and also may interfere with nutritional uptake of iron, calcium, and zinc. The *gh* gene was used in several U.S. cultivars through the 1960s, but eventually was phased out as parboiling became popular, because some of the goldhull cover penetrated into and discolored the parboiled white rice. Since most of the phytic acid is in the bran portion of the rice grain, the most likely use of low phytic acid rice will be for the brown rice market. It is not anticipated that any goldhull color diffusion from parboiling will be of concern in brown rice.

GLPA was constituted by bulking eight F_8 generation lines that were uniform for goldhull color, low phytic acid, maturity, and height. Like both parents, GLPA is long grain, has glabrous hulls, and tall plant type.

In a preliminary small-plot test at Stuttgart AR, in 2002, GLPA, KBNT *lpa*1-1, and KBNT averaged 6800, 6600, and 6900 kg ha^{-1}, respectively. All three were similar in height, approximately 118 cm, and maturity, flowering 105 to 107 d after planting. Brown rice grain dimensions of all three were similar. Amylose contents of all three also were similar, 229 to 235 g kg^{-1}, as were the intermediate alkali spreading values.

Germplasm amounts of seed (5 g) of GLPA may be obtained by writing to J. Neil Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160. Seed also will be placed in the National Small Grains Collection, USDA-ARS, 1691 South 2700 West, Aberdeen, ID 83210, where it is available for research purposes, including development and commercialization of new cultivars. If this germplasm contributes to the development of new cultivars, it is requested that appropriate recognition be given to the source.

J.N. Rutger,* R.J. Bryant, K.A.K. Moldenhauer, and J.W. Gibbons

References

Bollich, C.N., J.E. Scott, B.D. Webb, and J.G. Atkins. 1968. Registration of Bluebelle rice. Crop Sci. 8:399–400.

Gravois, K.A., K.A.K. Moldenhauer, F.N. Lee, R.J. Norman, R.S. Helms, J.L. Bernhardt, B.R. Wells, R.H. Dilday, P.C. Rohman, and M.M. Blocker. 1995. Registration of 'Kaybonnet' rice. Crop Sci. 34:587–588.

Larson, S.R., J.N. Rutger, K.A. Young, and V. Raboy. 2000. Isolation and genetic mapping a non-lethal rice (*Oryza sativa* L.) low phytic acid 1 mutation. Crop Sci. 40:1397–1405.

Rutger, J.N., V. Raboy, K.A.K. Moldenhauer, R.J. Bryant, F.N. Lee, and J.W. Gibbons. 2004. Registration of KBNT *lpa*1–1 low phytic acid germplasm of rice. Crop Sci. 44:363.

J.N. Rutger and R.J. Bryant, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160; K.A.K. Moldenhauer and J.W. Gibbons, University of Arkansas, Rice Research and Extension Center, P.O. Box 351, Stuttgart, AR 72160. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (jnrutger@spa.ars.usda.gov).

Published in Crop Sci. 44:1497–1498 (2004).

Registration of LGRU *ef* Early Flowering Mutant of Rice

The ARS, USDA, and the Arkansas Agricultural Experiment Station released LGRU *ef* (Reg. no. GP-94, PI 632957), an induced early flowering mutant of rice (*Oryza sativa* L.), in February 2003. The mutant was induced at Stuttgart, AR, in the Arkansas long-grain rice cultivar LaGrue (LGRU) (Moldenhauer et al., 1994). The mutant flowers 16 d earlier but is otherwise phenotypically similar to its parent. Early flowering in this mutant is controlled by a single recessive gene. LGRU *ef* may be useful as a tropical japonica genetic stock or breeding source for early maturity.

Approximately 4000 seeds of the parent cultivar LaGrue were treated with 200 Gy of γ radiation in 1994. The M_1 generation was grown at Stuttgart, Arkansas, and over 1000 random panicles were harvested for a panicle-to-row M_2 generation, which was grown in a 1994–1995 winter nursery. In the winter nursery M_2 generation, LGRU *ef* initially was selected as a putative semidwarf, but when progeny tested at Stuttgart in 1995, it turned out to be a tall line which was segregating for early flowering. No flowering data had been taken in the winter nursery, but it was postulated that the early flowering gene that the mutant carried caused reduced plant height resulting in its selection as a putative semidwarf. Subsequent progeny tests of M_3 generation early flowering plants showed this mutant to be stable for tall plant height and early maturity.

In an eight-replication characterization test at Stuttgart in 1997, LGRU *ef* was 16 d earlier and 3 cm shorter than its parent. The cross LGRU *ef*/LGRU was made in early 1997 and the F_1 was grown in the field the same year, with the F_1 being similar in flowering time as the LGRU parent. An F_2 generation was grown in the winter greenhouse in early 2002, where flowering times were inconclusive. Panicle-to-row progeny tests of 342 F_2 plants, planted at the rate of 21 seeds per row, spaced 30 cm apart within and between rows, were conducted in summer 2002. An average of about 14 plants survived per F_3 row resulting in segregation of 86 rows homozygous early: 165 segregating for flowering with a majority of plants being late: 91 homozygous late. This provided a satisfactory fit ($0.75 < P < 0.90$) to a 1:2:1 segregation ratio characteristic of a single recessive gene for early flowering. Further evidence of the complete recessiveness of this gene was obtained from counting numbers of early flowering and late plants within 64 of the segregating rows. Summed over those 64 rows, there were 237 early flowering: 624 late plants, a satisfactory fit ($0.05 < P < 0.10$) to a 1:3 ratio. Recessiveness of mutations is the general case in plant genetics, although McKenzie et al. (1978) reported an early maturing rice mutant in which early heading was weakly dominant.

In 11 tests between 1999 and 2002, LGRU *ef* yielded 5400 kg ha^{-1}, flowered in 75 d, was 109 cm tall, and showed 29% lodging. In the same tests an early cultivar of similar maturity, 'Maybelle' (MBLE) (Bollich et al., 1991) yielded 5850 kg ha^{-1}, flowered in 78 d, was 100 cm tall, and showed 6% lodging. In a direct comparison with its parent in four tests in 2002, LGRU *ef* yielded 6860 compared with 9580 kg ha^{-1} for LGRU. In a 1999 short-duration screening trial, LGRU *ef* yielded 6860 compared with 6510 kg ha^{-1} for the average of seven Arkansas experimental lines of similar maturity. In a 2000 cropping systems study, LGRU *ef* yielded 6810 compared with 8980 kg ha^{-1} for the average of nine Arkansas experimental lines of similar maturity, and showed 65% lodging while lodging was observed in only two of the nine experimental lines.

The breeding value of LGRU *ef* may be limited by the yield penalties observed in most tests although the mutant should be tested in different genetic backgrounds by crossing with other materials (MacKay, 1984). This process, which sometimes is called "cleaning up" will help eliminate any detrimental factors linked with the original mutation.

Brown rice grain dimensions were similar to the long grain parent. Apparent amylose content of LGRU *ef* was similar to the parent cultivar LGRU (210–230 g kg^{-1}), as was the intermediate alkali spreading value.

Germplasm amounts of seed (5 g) of LGRU *ef* may be obtained by writing to: J. Neil Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160. Seed also will be placed in the National Small Grains Collection, USDA-ARS, 1691 South 2700 West, Aberdeen, ID 83210, where it is available for research purposes, including development and commercialization of new cultivars. If this germplasm contributes to the development of new cultivars it is requested that appropriate recognition be given to the source.

J.N. Rutger,* K.A.K. Moldenhauer, J.W. Gibbons,
M.M. Anders, and R.J. Bryant

References

Bollich, C.N., B.D. Webb, M.A. Marchetti, and J.S. Scott. 1991. Registration of 'Maybelle' rice. Crop Sci. 31:1090.

MacKay, J. 1984. Selection problems and objectives in mutation breeding. p. 34–48. *In* Selection in mutation breeding. International Atomic Energy Agency, Vienna.

McKenzie, K.S., J.E. Board, K.W. Foster, and J.N. Rutger. 1978. Inheritance of heading date of an induced mutant for early maturity in rice (*Oryza sativa* L.). SABRAO J. 10:96–102.

Moldenhauer, K.A.K., K.A. Gravois, F.N. Lee, R.J. Norman, J.L. Bernhardt, B.R. Wells, R.S. Helms, R.H. Dilday, P.C. Rohman, and M.M. Blocker. 1994. Registration of 'LaGrue' rice. Crop Sci. 34:1123–1124.

J.N. Rutger and R.J. Bryant, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160; K.A.K. Moldenhauer, J.W. Gibbons, and M.M. Anders, University of Arkansas, Rice Research and Extension Center, P.O. Box 351, Stuttgart, AR 72160. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (jnrutger@spa.ars.usda.gov).

Published in Crop Sci. 44:1498 (2004).

Registration of Spring Wheat Germplasm ND2710 Resistant to Fusarium Head Blight

ND2710 (Reg. no. GP-771, PI 633976), a Fusarium head blight (FHB) {caused by *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch]} resistant spring wheat (*Triticum aestivum* L.) was developed at North Dakota State University NDSU), Fargo, ND. It was released by the North Dakota Agricultural Experiment Station (NDAES) in June 1998 on the basis of its high level of resistance to FHB among adapted wheats to the northern spring wheat region of the USA.

ND2710 was selected from the progeny of the cross ND2603/'Grandin' made in 1991. Grandin (PI 531005) is a HRSW cultivar released by NDAES in 1989 and ND2603 is one of the advanced HRSW lines developed by NDAES breeding program from the cross 'Sumai3' (PI 481542)/'Wheaton' (PI 469271) made in 1987. ND2603 was previously selected as the least susceptible to FHB evaluated in 1989 to 1991 and the earliest maturing line among the progenies of the Sumai3/Wheaton cross (Mitchell-Fetch et al., 1998). ND2710 was developed by a modified pedigree selection method. While F_3 and F_5 generations of ND2710 were grown and evaluated for FHB in the greenhouse, F_2 and F_4 generations were advanced and screened under artificial inoculation for FHB disease under field conditions at Proper, ND, in summer 1992 and 1993, respectively. ND2710 was developed from a single F_6 row showing a high level of resistance to FHB in a greenhouse test in spring 1994, derived from a single F_5 plant which also showed high resistance to FHB in a greenhouse test in fall 1993. The F_5 seed for that test was obtained from an F_4 progeny row selected in 1993 as one of 14 resistant lines during the severe FHB epidemic of 1993 in North Dakota. Twenty spikes selected from a single F_6 row were planted in the greenhouse as F_7 head rows. The agronomically desirable and homogenous rows were bulked to produce the seed of ND2710. Further seed purification of ND2710 was conducted in subsequent generations by planting 20 head rows selected from previous generations, discarding the off-types and bulking the similar and homogenous rows.

Among 3600 lines derived from various crosses that were evaluated in a 1997 disease nursery inoculated for FHB, Lines with ND2710 in their background predominated (65%) among those rated as having high level of FHB resistance. ND2710 was tested as an experimental line from 1996 to 1999 (Busch, 1996, 1997, 1998, 1999) and as the resistant check from 2000 to 2002 (Busch, 2000; Garvin, 2001, 2002) in the HRSW Uniform Regional Scab Nursery (URSN). URSN is conducted in six locations across North Dakota, Minnesota, South Dakota, and Canada by the support of the United States Wheat and Barley Scab Initiative (USWBSI). During the period of 1996 to 1999, FHB disease incidence and severity recorded on ND2710 were 49 and 22% compared to 82 and 71% and 62 and 33% scores recorded on the susceptible check Wheaton and the moderately resistant check 'BucUp' (PI 596533) (Busch, 1996, 1997, 1998, 1999). Visual Scabby Kernels (VSK) of ND2710 (16%) was significantly lower than Wheaton (58%) and similar to BucUp (19%).

During the same period, average grain yield showed that ND2710 had similar yield than the Pioneer cultivar '2375' but significantly superior than Wheaton. Similarly, during the 2000 to 2002 period, FHB incidence, severity and VSK scores of ND2710 were 58, 17, and 15%, significantly lower than 90, 55, and 52%; and slightly less than 69, 26, and 19% recorded on Wheaton and BucUp, respectively. Grain yield of ND2710 were also significantly higher than Wheaton and equal to BucUp (Busch, 2000; Garvin, 2001, 2002).

Since 1994, ND2710 has been used as the main source of resistance to FHB in the NDSU spring wheat breeding program (Munkvold et al., 2000; Stack and Frohberg, 2000; del Blanco et al., 2003). This has resulted in the release by NDAES in 2000 the first HRSW cultivar Alsen (PVP no. 200100066), a derivative of ND2710 with medium resistance to FHB disease. For more than a decade, ND 2710 has consistently been rated as having a high level of FHB resistance (Stack and Frohberg, 1997). This was confirmed in nine replicated greenhouse trials and in a regional field trial over 4 yr at five locations (Garvin and Anderson, 2002). In addition to its resistance to *F. graminearum*, ND2710 is resistant to other *Fusarium* species (Stack et al., 1997). It also has reduced levels of deoxynivalenol (DON) in grain (Munkvold et al., 2000; Stack et al., 1997) compared with Wheaton and 'Oslo' (Cltr 17901) (Busch, 1996, 1997, 1998, 1999).

ND2710 is an awned, conventional height hard red spring wheat. It is an early maturing line, similar to Grandin, and is day-length insensitive. It has a lax head type with shattering similar to 2375 but less shattering than Sumai3. ND2710 is moderate susceptible to lodging. Grain yield of ND2710 in field trials (2439 kg ha^{-1}) is lower than Grandin (3292 kg ha^{-1}) and 'Butte 86' (3433 kg ha^{-1}), a reselection from 'Butte' (CItr 17681). Grain quality is slightly lower in protein than Grandin, the standard quality check (14.9% protein) in the NDSU breeding program. ND2710 is resistant to the prevalent races of stem rust (caused by *Puccinia graminis* Pers:Pers. f. sp.*tritici* Eriks. & E. Henn) in the region, and moderately resistant to leaf rust (caused by *Puccinia triticina* Eriks.).

ND2710 was the first North Dakota HRSW experimental line that combines a high level of FHB resistance with relatively acceptable agronomic traits. Upon submission of written request to the corresponding author, a 5-g sample seed of ND2710 can be obtained for research purposes and for use in transferring FHB resistance to adapted cultivars. Appropriate recognition of the source should be noted if ND2710 contributes to research on FHB or to the development of new genetic stocks, molecular tools, germplasm, or cultivars.

R.C. Frohberg, R.W. Stack, and M. Mergoum*

References

del Blanco, I.A., R.C. Frohberg, and R.W. Stack. 2003. Detection of QTL linked to Fusarium head blight resistance in Sumai-3 derived North Dakota bread wheat lines. Theor. Appl. Genet. 106:1027–1031.

Busch R. 1996, 1997, 1998, 1999, 2000. Uniform Regional Scab Nursery For Spring Wheat Parents. (Distributed reports).

Garvin D.F. 2001, 2002. Uniform Regional Scab Nursery For Spring Wheat Parents. (Distributed reports).

Garvin, D.F., and J.A. Anderson. 2002. A historical analysis of the uniform regional scab nursery for spring wheat parents. p. 235–238. *In* 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. 7–9 Dec. 2002. see http://www.scabusa.org/forum02.html; verified 16 February 2004.

Mitchell-Fetch, J.W., R.W. Stack, and R.C. Frohberg. 1998. Reaction to Fusarium Head Blight in recombinant inbred lines derived from the spring wheat cross ND2603/Butte86. vol. 3, p. 294–296. *In* A.E. Slinkard ed. Proceedings of the 9th International Wheat Genetics Symposium, Saskatoon, SK. 2–7 Aug. 1998. University Extension Press, Saskatoon, SK.

Munkvold, G.P., J.M. Shriver, R.W. Stack, and R.C. Frohberg. 2000. Evaluation of hard red spring wheat for resistance to Fusarium head blight in Iowa 1999. Biol. Cult. Tests Control Plant Dis. 15:131.

Stack, R.W., and R.C. Frohberg. 1997. Fusarium head blight of spring wheat in an inoculated and irrigated nursery 1996. Biol. Cult. Tests Control Plant Dis. 12:111.

Stack, R.W., and R.C. Frohberg. 2000. Inheritance of resistance to Fusarium head blight in spring wheat F-1 hybrids. p. 94–97. *In* Proc. Int. Symposium on Wheat Improvement for scab resistance, Suzhou and Nanjing, China.

Stack, R.W., R.C. Frohberg, and H.H. Casper. 1997. Reaction of spring wheats incorporating Sumai-3 derived resistance to inoculation with seven Fusarium species. Cereal Res. Comm. 25:667–671.

R.C. Frohberg (retired) and M. Mergoum, Dep. of Plant Sciences, North Dakota State Univ., Fargo, ND 58105; R.W. Stack, Dep. of Plant Pathology, North Dakota State Univ., Fargo, ND 58105. Research supported in part by the U.S. Wheat and Barley Scab Initiative. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (mohamed.mergoum@ndsu.nodak.edu).

Published in Crop Sci. 44:1498–1499 (2004).

Registration of Four Synthetic Hexaploid Wheat Germplasm Lines with Resistance to Fusarium Head Blight

Four synthetic hexaploid spring wheat (× *Aegilotriticum* sp.) lines designated 01NDSWG-2, 01NDSWG-5, 01NDSWG-4-1, and 01NDSWG-4-2 (Reg. nos. GP-767–GP-770, PI 634196–PI 634199) were developed and evaluated at North Dakota State University in 2002. The release of these synthetics is intended to broaden the genetic base of resistance to Fusarium head blight (FHB) (caused by *Fusarium graminearum* Schwabe). The FHB resistance expressed by the synthetics originates from *Triticum turgidum* L. var. *dicoccoides* (genome constitution AABB). In two separate greenhouse evaluation seasons, the synthetics exhibited a Type II resistance to FHB (Mesterhazy, 1995) comparable or superior to their resistant parent, and in at least one season, 01NDSWG-5, 01NDSWG-4-1, and 01NDSWG-4-2 exhibited resistance comparable to 'Alsen' (PI 615543), a North Dakota hard red spring wheat cultivar with Type II resistance originating from the Chinese cultivar Sumai 3 (PI 481542) (Ban and Suenaga, 2000).

Development of the synthetics was initiated by hybridizing a 'Langdon' (CI*tr* 13165) durum wheat (*Triticum turgidum* spp. *durum*) with a *T. dicoccoides* 3A chromosome substitution [LDN(Dic-3A)-32 recombinant inbred chromosome line, RICL (Joppa, 1993)] as the female to accessions TA 2452 and TA 2473 of *Triticum tauschii* spp. *squarrosa* (genome constitution DD). After hybridizations, embryos were rescued on artificial media, and the regenerated hybrid plants (genome constitution ABD) were treated with a colchicine solution (Berzonsky and Kimber, 1989) to produce fertile, hexaploid plants (genome constitution AABBDD). The pedigree for 01NDSWG-2 and 01NDSWG-5 is LDN(Dic-3A)-32/TA 2452, while the pedigree for 01NDSWG-4-1 and 01NDSWG-4-2 is LDN(Dic-3A)-32/TA 2473. Seed of TA 2452 and TA 2473, the *T. tauschii* parents, was obtained from the Wheat Genetics Resource Center, Kansas State University, Manhattan, KS, USA. These two accessions were chosen to possibly incorporate resistance to leaf rust (caused by *Puccinia triticina* Eriks.), greenbug [*Schizaphis graminum* (Rondani)], and Hessian fly [*Mayetiola destructor* (Say)] from the D-genome into the four synthetics. Accession TA 2452 was collected from the Caspian region of Iran (Lubbers et al., 1991), and Gill et al. (1986) demonstrated in greenhouse evaluations that TA 2452 exhibited an immune reaction to leaf rust culture PRTUS6, an intermediate resistant reaction to greenbug Biotype E, and a resistant reaction to Hessian fly Biotype D. Accession TA 2473 carries the *H26* gene on chromosome 4D for resistance to Biotype L of the Hessian fly (Cox and Hatchett, 1994), and it was previously used to produce the Hessian fly resistant germplasm line KS92WGRC26 (GP-397, PI 572542) (Cox et al., 1994). The substituted 3A chromosome originated from *T. dicoccoides* accession FA-15-3 ("Israel A"), and the 3A substitution line was selected because it had previously exhibited a high level of Type II resistance to FHB (Stack et al., 2002). In addition, a QTL accounting for 55% of the genetic variation for FHB resistance had been identified on the 3A chromosome substitution originating from the 3A RICL (Otto et al., 2002).

In 2002, a minimum of 90 spikes from 30 progeny of each of the four synthetic hexaploids, the RICL parent, 'McNeal' (PI 574642) (Lanning et al., 1994) and Alsen, FHB susceptible and resistant hard red spring wheat cultivars, respectively, were evaluated for Type II resistance to FHB in separate spring and summer greenhouse evaluations. Plants were screened for resistance by a single spikelet inoculation procedure (Stack, 1989), and according to standard protocol, spikelets were inoculated at midanthesis (Feekes growth stage 10.52) with a single Fusarium isolate obtained from a regional field environment. A percent FHB severity rating for spikes (Stack and McMullen, 1998) was made 21 d after inoculation. The mean FHB spike severity ratings during the 2002 spring and summer evaluations were; 44 and 47% for 01NDSWG-2, 54, and 29% for 01NDSWG-4-1, and 53 and 33% for 01NDSWG-4-2, which were comparable to or significantly lower ($p \leq 0.05$) than the 56 and 99% ratings for LDN(3A)-32, the RICL parent. The ratings for 01NDSWG-5 were 36 and 32% for the spring and summer seasons, respectively, compared with ratings of 9 and 30% for 'Alsen' and ratings of 70 and 96% for McNeal.

In 2002, we had insufficient seed quantities to grow the synthetics at different field locations, and the few plots, which were planted, had poor stands such that we did not obtain data on agronomic field performance and response to natural FHB infection. In addition, the synthetics have not been evaluated for resistance to any other pathogens; however, observations were made on their agronomic performance under greenhouse conditions, which consisted of day and night temperatures maintained in the range of 16 to 21°C and an artificially extended 16-h daylength with high-pressure sodium lamps (Agro Model Lamps, PL Light Systems, Inc., Grimsby, ON, Canada). The synthetics are not free-threshing, they exhibited a spring growth habit, and they tillered extensively under these greenhouse conditions. The synthetics also matured somewhat later under these conditions, flowering on average 84 to 92 d from germination compared with 54 d for Alsen, 63 d for McNeal, and 75 d for Langdon. Synthetics were comparable to Langdon durum in height, ranging from 115 to 133 cm tall under these greenhouse conditions.

Upon submitting a written request to the corresponding author, small quantities of seed (2 g) of each synthetic can be obtained for research purposes and for use in transferring resistance to cultivars. If this germplasm is used as a source of FHB resistance and contributes to research on FHB or to the development of new genetic stocks, germplasm, or cultivars, we request that North Dakota State University be recognized as developer of the synthetics.

W.A. Berzonsky,* K.D. Hartel, S.F. Kianian, and G.D. Leach

References

Ban, T., and K. Suenaga. 2000. Genetic analysis of resistance to Fusarium head blight caused by *Fusarium graminearum* in Chinese wheat cultivar Sumai 3 and the Japanese cultivar Saikai 165. Euphytica 113:87–99.

Berzonsky, W.A., and G. Kimber. 1989. The tolerance to aluminum of *Triticum* N-genome amphiploids. Plant Breed. 103:37–42.

Cox, T.S., and J.H. Hatchett. 1994. Hessian fly-resistant gene H26 transferred from Triticum tauschii to common wheat. Crop Sci. 34:958–960.

Cox, T.S., J.H. Hatchett, R.G. Sears, and B.S. Gill. 1994. Registration of KS92WGRC26, Hessian fly-resistant hard red winter wheat germplasm. Crop Sci. 34:1138.

Gill, B.S., W.J. Raupp, H.C. Sharma, L.E. Browder, J.H. Hatchett, T.L. Harvey, J.G. Moseman, and J.G. Waines. 1986. Resistance in *Aegilops squarrosa* to wheat leaf rust, wheat powdery mildew, greenbug, and Hessian fly. Plant Dis. 70:553–556.

Joppa, L.R. 1993. Chromosome engineering in tetraploid wheat. Crop Sci. 33:908–913.

Lanning, S.P., L.E. Talbert, C.F. McGuire, H.F. Bowman, G.R. Carlson, G.D. Jackson, J.L. Eckhoff, G.D. Kushnak, R.N. Stougaard, and G.F. Stallknecht. 1994. Registration of 'McNeal' wheat. Crop Sci. 34:1126–1127.

Lubbers, E.L., K.S. Gill, T.S. Cox, and B.S. Gill. 1991. Variation

of molecular markers among geographically diverse accessions of *Triticum tauschii.* Genome 34:354–361.
Mesterhazy, A. 1995. Types and components of resistance to Fusarium head blight in wheat. Plant Breed. 114:377–386.
Otto, C.D., S.F. Kianian, E.M. Elias, R.W. Stack, and L.R. Joppa. 2002. Genetic dissection of a major Fusarium head blight QTL in tetraploid wheat. Plant Mol. Biol. 48:625–632.
Stack, R.W. 1989. A comparison of inoculum potential of ascospores and conidia of *Gibberella zeae.* Can. J. Plant Pathol. 11:137–142.
Stack, R.W., E.M. Elias, J.M. Fetch, J.D. Miller, and L.R. Joppa. 2002. Fusarium head blight reaction of Langdon durum-*Triticum dicoccoides* chromosome substitution lines. Crop Sci. 42:637–642.
Stack, R.W., and M.P. McMullen. 1998. A visual scale to estimate the severity of Fusarium head blight. Bull. PP-1095. North Dakota State Univ. Ext. Ser., Fargo.

Dep. of Plant Sciences, North Dakota State Univ., Fargo, ND 58105. Research supported in part by the U.S. Wheat and Barley Scab Initiative. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (bill.berzonsky@ndsu.nodak.edu).

Published in Crop Sci. 44:1500–1501 (2004).

Registration of LG92-4208, LG94-1128, LG94-1906, and LG94-4667 Soybean Germplasm

The soybean [*Glycine max* (L.) Merr.] germplasm lines LG92-4208 (Reg. no. GP-302, PI 633729), LG94-1128 (Reg. no. GP- 303, PI 633730), LG94-1906 (Reg. no. GP-304, PI 633731), and LG94-4667 (Reg. no. GP-305, PI 633732) were cooperatively developed and released in 1999 by the USDA-ARS and the Illinois Agricultural Experiment Station for use as parental lines in yield improvement programs. These lines combine high yield with unique genetic diversity not currently present in the commercially used gene pool in the USA. All four lines were developed through an early generation testing procedure. The progenitor populations were yield tested as F_2 families in the F_3 and F_4 generations. The released lines were derived from single-plant selections made in the F_5 generation.

LG92-4208 is a selection from LG84-1269 × ‘Chamberlain’ (Nickell et al., 1987). LG84-1269 is an F_5 selection from PI 227333 × PI 91730-1 (Bernard et al., 1987b, 1987a). LG92-4208 has indeterminate stem termination and is classified as late group III maturity. It has white flowers, tawny pubescence, brown pods, and yellow seed coat. LG92-4208 has predominately black hilum color but some brown and yellow hilum colors do occur. In testing at six locations in central Illinois in 1996 and 1997, LG92-4208 was equivalent in yield to Chamberlain. In 1998, LG92-4208 was tested at 9 locations in the Uniform Preliminary Test IIIA. LG92-4208 was 2 d earlier than ‘Macon’ and yielded 4% less (Wilcox, 1998). LG92-4208 lodged more (3.2 vs. 2.1 on a 1-to-5 scale), was 5 cm taller, had smaller seeds (14.6 vs. 16.6 g 100 seeds^{-1}), was similar in protein (412 vs. 415 g kg^{-1}), and lower in oil (196 vs. 205 g kg^{-1}) when compared with Macon (Wilcox, 1998). LG92-4208 was challenged with race 7 of *Phytophthora sojae* M.J. Kaufmann & J.W. Gerdemann and was susceptible. No other data on disease reactions are available.

LG94-1128 is a selection from LG85-3343 × LG87-1991. LG85-3343 is an F_5 selection from PI 361064 × PI 407710 (Bernard et al., 1987b). LG87-1991 is an F_6 selection from PI 189930 × PI 68600 (Bernard et al., 1987b, 1987a). This is the first soybean germplasm release for high yield that is derived solely from exotic germplasm not in the pedigrees of U.S. soybean cultivars. LG94-1128 has indeterminate stem termination and is classified as mid group II maturity. It has purple flowers, gray pubescence, brown pods, yellow seed coat, and imperfect black hilum. LG94-1128 is resistant to race 7 of *P. sojae* but has not been tested with any other races. In the Uniform Preliminary Test IIA in 1998, LG94-1128 was 1 d later and yielded 5% less than IA2021 (Wilcox, 1998). LG94-1128 lodged more (2.5 vs. 1.9 on a 1-to-5 scale), was taller (91 vs. 74 cm), had smaller seeds (13.4 vs. 16.5 g 100 seeds^{-1}), was substantially higher in protein (428 vs. 403 g kg^{-1}), and lower in oil (197 vs. 213 g kg^{-1}) when compared with IA2021 (Wilcox, 1998).

LG94-1906 is a selection from PI 468377 × ‘A3205’ (Bernard et al., 1987b). A3205 was used as a parent with permission of the Asgrow Seed Company and is from ‘S1474’ × ‘A3127’. S1474 was developed by Northrup King Company from ‘Hark’ × ‘Wayne’ (Weber, 1967; Bernard, 1966). A3127 is from ‘Williams’ × ‘Essex’ (Bernard and Lindahl, 1972; Smith and Camper, 1973.) LG94-1906 has indeterminate stem termination and is classified as late group II maturity. It has white flowers, gray pubescence, brown pods, yellow seed coat, and buff hilum. LG94-1906 was challenged with race 7 of *P. sojae* and was susceptible. LG94-1906 was tested in the Uniform Preliminary Test IIA in 1998 and was 3 d later and yielded 7% less than IA2021 (Wilcox, 1998). LG94-1906 was similar in lodging (2.0 vs. 1.9 on a 1-to-5 scale), was taller (94 vs. 74 cm), had smaller seeds (14.8 vs. 16.5 g 100 seeds^{-1}), was substantially higher in protein (435 vs. 403 g kg^{-1}), and lower in oil (194 vs. 213 g kg^{-1}) when compared with IA2021 (Wilcox, 1998).

LG94-4667 is a selection from PI 458511 × ‘Flyer’ (Bernard et al., 1987b; McBlain et al., 1990). LG94-4667 has indeterminate stem termination and is classified as early group IV maturity. LG94-4667 has white flowers, tawny pubescence, tan pods, yellow seed coat, and black hilum. It is resistant to race 7 of *P. sojae* but has not been tested with any other races. LG94-4667 was tested in the Uniform Preliminary Test IVA in 1998 and was 2 d earlier and yielded 15% less than HS93-4118 (Wilcox, 1998). LG94-4667 lodged more (2.7 vs. 1.4 on a 1-to-5 scale), was taller (97 vs. 84 cm), had larger seeds (14.4 vs. 13.7 g 100 seeds^{-1}), was higher in protein (428 vs. 412 g kg^{-1}), and similar in oil (197 vs. 195 g kg^{-1}) when compared with HS93-4118 (Wilcox, 1998).

The eight exotic parental lines (PI 68600, PI 91730-1, PI 189930, PI 227333, PI 361064, PI 407710, PI 458511, and PI 468377) are all yellow-seeded, grain-type soybean that have been introduced into the USA over the past 75 yr. PI 68600 [maturity group (MG) II] and PI 91730-1 (MG III) were brought from northeast China in 1926 and 1931, respectively (Bernard et al., 1987a). PI 189930 (MG II) was imported from France in 1950 but very likely originated in northeast China (Bernard et al., 1987b). PI 227333 (MG II) came from an agricultural experiment station in Sapporo, Japan, in 1955 (Bernard et al., 1987b) and is one of the few Japanese lines successfully used in our breeding program. PI 361064 (MG II) is an experimental line developed in Yugoslavia and was brought to the USA in 1971 (Bernard et al., 1987b). PI 407710 (MG I) is a primitive Chinese cultivar that was introduced in 1974 (Bernard et al., 1987b). PI 458511 (MG II) and PI 468377 (MG 00) are Chinese cultivars developed in provincial research programs. PI 458511 is Kai yu No. 8 released in Liaoning province in 1980 (Cui et al., 1999). Because of a translation mistake, the correct name for PI 468377 is uncertain but it is likely that it is Hong feng No. 3 that was released in Heilongjiang province in 1981 (Cui et al., 1999). None of these accessions are in the pedigrees of any released cultivar in the USA, and only two are in the pedigree of released germplasm. PI 361064 and PI 407710 are in the pedigree of LG93-7054 previously released from our program (Brown-Guedira et al., 2004).

All of the exotic parents in these releases have been characterized by means of RAPD fragments and SSR alleles and compared with the major ancestral lines of current U.S. cultivars (Brown-Guedira et al., 2000). On the basis of analysis of these DNA marker data these eight introductions were classified into four genetic groups but two could not be consistently assigned to any group. PIs 189930, 227333, and 407710 were placed in the same group. This group contained the U.S. ancestral line Korean, which contributed less than 1% to the currently used gene pool (Gizlice et al., 1994). PI 468377 clustered with only one major U.S. ancestral line, Mandarin (Ottawa), that contributed over 12% of the current U.S. gene pool (Gizlice et al., 1994). PI 91730-1 was in the same cluster as Richland and Haberlandt, which combined contributed 9% of the genes to current U.S. cultivars on the basis of pedigree analysis (Gizlice et al., 1994). PI 68600 and PI 458511 did not cluster with any U.S. ancestral lines. PI 361064 was grouped with major U.S. ancestral lines including S-100 and Lincoln when the clustering was based on 109 RAPD fragments and 3 SSR loci (Brown-Guedira et al., 2000) but did not cluster with any U.S. ancestral lines or exotic accessions and was classified as an outlier when the clustering was based on 281 RAPD fragments (Thompson et al., 1998). PI 458511 clustered with one other Chinese introduction. PI 68600 could not be consistently grouped with any other lines and was classified as an outlier.

Seeds of LG92-4208, LG94-1128, LG94-1906, and LG94-4667 will be deposited in the USDA Soybean Germplasm Collection and may be requested from the corresponding author for research purposes, including development and commercialization of new cultivars. It is requested that appropriate recognition be made if this germplasm contributes to the development of a new breeding line or cultivar.

M.L. Warburton, G.L. Brown-Guedira, and R.L. Nelson*

References

Bernard, R.L. 1966. Registration of Wayne soybeans. Crop Sci. 6:305.

Bernard, R.L., G.A. Juvik, and R.L. Nelson. 1987a. USDA soybean germplasm collection inventory. Vol. 1. International Agricultural Publications. INTSOY Series Number 30. International Agriculture Publications, University of Illinois.

Bernard, R.L., G.A. Juvik, and R.L. Nelson. 1987b. USDA soybean germplasm collection inventory. Vol. 2. International Agricultural Publications. INTSOY Series Number 31. International Agriculture Publications, University of Illinois.

Bernard, R.L., and D.A. Lindahl. 1972. Registration of Williams soybean. Crop Sci. 12:716.

Brown-Guedira, G.L., M.L. Warburton, and R.L. Nelson. 2004. Registration of LG92–1255, LG93–7054, LG93–7654, and LG93–7792 Soybean Germplasm. Crop Sci. 44:356–357.

Brown-Guedira, G.L., J.A. Thompson, R.L. Nelson, and M.L. Warburton. 2000. Evaluation of genetic diversity of soybean introductions and North American ancestors using RAPD and SSR markers. Crop Sci. 40:815–823.

Cui, Z., T.E. Carter, Jr., J. Gai, J. Qiu, and R.L. Nelson. 1999. Origin, description, and pedigree of Chinese soybean cultivars released from 1923 to 1995. USDA Tech. Bull. 1871. U.S. Gov. Print. Office, Washington, DC.

Gizlice, Z., T.E. Carter, Jr., and J.W. Burton. 1994. Genetic base for North American public soybean cultivars released between 1947 and 1988. Crop Sci. 34:1143–1151.

McBlain, B.A., R.J. Fioritto, S.K. St. Martin, A. Calip-DuBois, A.F. Schmitthenner, R.L. Cooper, and R.J. Martin. 1990. Registration of 'Flyer' soybean. Crop Sci. 30:425.

Nickell, C.D., S.A. Sebastian, P. Hanson, D.J. Thomas, and L. Gray. 1987. Registration of 'Chamberlain' soybean. Crop Sci. 27:611.

Smith, T.J., and H.M. Camper. 1973. Registration of Essex soybean. Crop Sci. 13:495.

Thompson, J.A., R.L. Nelson, and L.O. Vodkin. 1998. Identification of diverse soybean germplasm using RAPD markers. Crop Sci. 38:1348–1355.

Weber, C.R. 1967. Registration of Hark soybeans. Crop Sci. 7:403.

Wilcox, J.R. (ed.) 1998. The uniform soybean tests, northern states: 1998. USDA-ARS, West Lafayette, IN.

M.L. Warburton, CIMMYT, Int., Apdo Postal 6-641 06600 Mexico DF, Mexico; G.L. Brown-Guedira, USDA-ARS, Plant Science and Entomology Research Unit, Dep. of Agronomy, 2001 Throckmorton Plant Science Center, Kansas State Univ., Manhattan, KS, 66506; and R.L. Nelson, USDA-ARS, Soybean/Maize Germplasm, Pathology, and Genetics Research Unit, Dep. Of Crop Sciences, 1101 W. Peabody Dr., Univ. of Illinois, Urbana, IL 61801. Registration by CSSA. Accepted 31 Jan. 2004. *Corresponding author (rlnelson@uiuc.edu).

Published in Crop Sci. 44:1501–1502 (2004).

Registration of Root-Knot Nematode-Resistant Sugarbeet Germplasm M6-2

Sugarbeet (*Beta vulgaris* L.) germplasm M6-2 (Reg. no. GP-237, PI 632234) was developed by the USDA-ARS, Salinas, CA, in cooperation with the California Beet Growers Association, Ltd., Stockton, CA, and released in December 2002. M6-2 is highly resistant, if not immune, to root-knot nematode (*Meloidogyne* spp.).

M6-2 was produced by interpollinating selected F_2 plants from the fifth backcross generation of hybrids between M66 (PI 586688; Yu, 1996) as the donor parent and cultivated sugarbeet lines C37 (PI 590715; Lewellen et al., 1985) and C78 (PI 593671; Lewellen, 1997). F_1BC_5 plants with root-knot resistance were intercrossed. Nematode resistant F_2BC_5 plants were individually test crossed to a susceptible line. Thirty-six F_2 plants that produced resistant test cross progeny and appeared to be homozygous were identified and subsequently intercrossed to produce M6-2. M6-2 is a multigerm, biennial, self-incompatible germplasm that is heterogeneous for plant type and hypocotyl color. Approximately 25% of the seedlings have green hypocotyls. Root size and root conformation are not as uniform as the recurrent parents. Due to its wild beet ancestry, roots of M6-2 are often sprangled.

The M6-2 germplasm is resistant to multiple species of root-knot nematode, including *M. incognita* (Kofoid and White) Chitwood, *M. javanica* (Treub) Chitwood, *M. arenaria* (Neal) Chitwood, *M. hapla* Chitwood, *M. chitwoodi* Golden et al., and *M. fallax* Karssen, based on J2 larval inoculation studies in the greenhouse and monoxenic *M. incognita* and *M. javanica* infested field trials (Yu et al., 1999; Yu and Roberts, 2002). The level of resistance to root-knot nematode in M6-2 and M6-1 (PI 613165; Yu, 2001), a first generation backcross progeny of M66, appear to be similar. However, M6-1 is a self-compatible line with green hypocotyls, and taproots tend to be more sprangled than roots of M6-2.

Breeder seed will be maintained by the USDA-ARS and provided to sugarbeet breeders and researchers in small quantities upon written request. Recipients of seed are requested to make appropriate recognition of the source if M6-2 contributes to the development of a new population, parental line, cultivar, or hybrid. U.S. Plant Variety Protection for M6-2 will not be applied for.

M.H. Yu and R.T. Lewellen*

Acknowledgments

The technical assistance of Linda Pakish is gratefully acknowledged.

References

Lewellen, R.T. 1997. Registration of sugarbeet germplasm lines C78, C80, and C82. Crop Sci. 37:1037.

Lewellen, R.T., E.D. Whitney, and I.O. Skoyen. 1985. Registration of C37 sugarbeet parental line. Crop Sci. 25:375.

Yu, M.H. 1996. Registration of root-knot nematode resistant beet germplasm M66. Crop Sci. 36:469.

Yu, M.H. 2001. Registration of M6–1 root-knot nematode resistant sugarbeet germplasm. Crop Sci. 41:278–279.

Yu, M.H., W. Heijbroek, and L.M. Pakish. 1999. The sea beet source of resistance to multiple species of root-knot nematode. Euphytica 108:151–155.

Yu, M.H., and P.A. Roberts. 2002. Selection of root-knot nematode resistant sugar beet from field plantings. Nematology 4:240.

USDA-ARS, U. S. Agric. Res. Sta., Crop Improvement and Protection Research Unit, 1636 East Alisal St., Salinas, CA 93905-3018. Cooperative investigation by the USDA-ARS and the California Beet Growers Association, Ltd., 2 West Swain Rd, Stockton, CA 95207. Registration by CSSA. Accepted 30 Sep. 2003. *Corresponding author (rlewellen@pw.ars.usda.gov).

Published in Crop Sci. 44:1502–1503 (2004).

Registration of Eight Pairs of Oat Near Isogenic Lines, Naked vs. Covered

Eight pairs of near-isogenic lines of oat (*Avena sativa* L.) (Reg. no. GP-71 to GP-86, PI 633779 to PI 633794) were developed by Agriculture and Agri-Food Canada (AAFC), Lacombe Research Centre, Lacombe, AB, Canada, and released in 2002. The near-isogenic lines were released as germplasm for research purposes since they may offer unique specimens for quantifying the agronomic values of the genes conditioning nakedness in oat. The materials could also be used to determine the genetic, physiological, and biochemical basis for the expression of the naked seed trait in oats. In addition, they may be useful in genomics and proteomics studies, and for molecular characterization and mapping of the alleles controlling the naked seed trait at the *N-1, N-2, N-3*, and *N-x* loci. The symbol *N-x* is used here tentatively to denote the fourth gene that was described by Jenkins and Hanson (1976), but which was not assigned a gene symbol by Simons et al. (1978).

The eight pairs of near isogenic lines originated from an OT253/'Marion' cross made in 1988. OT253 is an experimental naked oat developed by AAFC, Cereal Research Centre, Winnipeg, MB, from a cross involving two experimental lines, W81224 and OT224. Marion is a covered oat with high β-glucan content that was developed from a Q.O. 130.4/Q.O. 51.27 cross made at the AAFC Research Centre at Sainte Foy, QB, and registered in 1985 (Q.O. is the plant breeder's accession code and stands for Quebec Oat). The experimental line, Q.O. 130.4, was derived from a cross of two experimental lines and has the pedigree 'Siberian'/1952//'Clintafe'/3/'Rodney', and Q.O. 51.27 was developed from a biparental cross of two other experimental lines and its pedigree is 'Roxton'/RL1276//'Ajax'/RL1276/3/'Gary'/'Klein' (Tinker, 2002).

The F_1 generation of the OT253/Marion cross was grown in a growth chamber. The F_2 through F_6 generations were advanced in a greenhouse by single-seed descent. In the F_6 generation, a single panicle was harvested from each of 108 F_6 plants and was planted in a head-row nursery established at the Lacombe Research Centre in 1993. Each head-row, hereafter referred to as an F_6 derived F_7 ($F_{6:7}$) family, consisted of approximately 20 to 30 plants. At heading, the $F_{6:7}$ families were classified as covered, naked, or segregating on the basis of inflorescence characteristics. The accuracy of this phenotypic classification was later confirmed by examination of the kernel characteristics. From the initial population of 108 $F_{6:7}$ families, eight families segregating for the covered and naked seed traits were identified. These eight families originated from eight heterozygous F_6 plants, which in turn traced back to eight F_2 plants.

From each of the eight $F_{6:7}$ families, 10 panicles were collected at random. These panicles were threshed separately and planted in the greenhouse to produce eight groups of $F_{6:8}$ families. Each group consisted of 10 families, and each family consisted of 20 individuals. Families within each group were scored for kernel characteristics in an effort to advance the families to succeeding generations while maintaining heterozygosity at the locus or loci conditioning nakedness. This procedure was repeated until the $F_{6:10}$ generation was attained. The $F_{6:10}$ generation was grown in a head-row nursery at the Lacombe Research Centre in 1995. The nursery was established on a Ponoka clay-loam (Black Orthic Chernozome) soil at the Lacombe Research Centre. Throughout the growing season the $F_{6:10}$ families were scored for uniformity. From each of the eight groups of $F_{6:10}$ families, one homogenous naked and one homogenous covered family were selected. Seed from each selected family was bulked (within family) to produce the eight pairs of nearly-isogenic lines.

All eight pairs of near-isogenic lines have spring growth habit and do not require vernalization. The seedlings of all 16 genotypes have green coleoptiles and medium long hypocotyls. Juvenile plants are erect and have medium green to dark green leaves. Adult plants average 117 cm (range 110–131 cm) in height, and have medium thick culms. The flag leaf is medium green to dark green, medium wide, medium long, and slightly drooping. A ligule is present at the base of the flag leaf. The upper culm nodes and internodes are glabrous. Penultimate leaves are medium green to dark green, and glossy. The sheath, blade, and margins of the penultimate leaves are glabrous.

The panicles of each of the eight covered lines are ovate, medium wide, medium long, and equilateral. The panicle branches are medium long, semierect, and intermediate in density. There are four or five whorls of branches per panicle. The rachis is straight, and the rachilla is medium long and glabrous. The glumes are glabrous, medium wide, medium long, pointed, and boat-shaped. The spikelets are nodding and have three or four florets. Spikelet separation is by fracture, and floret separation is by heterofracture. The lemma is glabrous, medium wide, medium long, and pointed. The palea is about the same size as the lemma. The kernels are medium wide, medium long, and cream colored; they have very few basal hairs and fluoresce light blue under UV light.

The panicles of each of the eight naked lines are medium wide, medium long, equilateral, and multiflorous. The rachis is straight and there are about five whorls of panicle branches. The panicle branches are medium long, semi-erect, and intermediate in density. The caryopsis is pubescent, with a pointed scutellum and long brush hairs.

The eight pairs of near-isogenic lines were evaluated in nine trials at three central Alberta locations from 1996 to 1998. The naked lines emerged about a day earlier than the covered lines, but were similar in height, and took the same number of days to flower and to ripen as the covered lines. The naked lines differed significantly from their covered counterparts in stand count at 5 weeks after emergence (lower on average by 61.2 plants m^{-2}), grain yield (lower on average by about 43.7%), percentage of lodged plants (lower on average by 9.2% points), test weight (higher on average by about 6.1 kg hL^{-1}) and kernel weight (lower on average by 8.8 mg/kernel). The large yield differences between the covered and naked lines were presumably due to the lower stand establishment and the absence of hull in the naked lines. The lower kernel weight and higher test weight of the naked lines were exclusively due to the absence of hull. The covered lines showed a higher propensity to lodge than the naked lines. The reason for this tendency was not readily discernible from the data on hand, but may be related to the higher grain yield of the covered lines compared to the naked lines. Isozyme analyses have shown that the naked and covered lines have different esterase banding patterns; a band that is consistently present in all eight naked lines is absent in the covered lines.

The eight pairs of near-isogenic lines were developed for comparative research of naked and covered seed genotypes and have not been screened for disease resistance. All 16 genotypes have shown disease reactions similar to cultivars commonly grown in the disease-free areas of western Canada (primarily Alberta and western Saskatchewan). They are resistant to Victoria blight [caused by *Bipolaris victoriae* (F. Meehan & Murphy) Shoemaker], and moderately susceptible to smut [caused by *Ustilago avenae* (Pers.) Rostr., and *U. kolleri* Wille.] and Barley yellow dwarf virus. They are also susceptible to oat crown rust (caused by *Puccinia coronata* Corda var. *avenea* W.P. Fraser & Ledingham), and oat stem rust (caused by *P. graminis* Pers.: Pers. f. sp. *avenae* Eriks & E. Henn.).

Seed of the eight pairs of near-isogenic lines are stored at the Plant Gene Resources of Canada, Agriculture and Agri-Food Canada, Saskatoon Research Centre, 107 Science Place, Saskatoon, SK S7N 0X2, and at the USDA-ARS National Center for Genetic Resources Preservation, Fort Collins, CO 80521-4500. Small quantities (about 5 g) of seed of each line may be obtained from the author for at least 5 yr. from the date of this publication. Seeds will be sent upon a written request and agreement to make appropriate recognition of the seed source when these near-isogenic lines are used in research or publications, or in the development of new cultivars, germplasm lines, parental lines or genetic stocks.

S. Kibite and G. Clayton*

Acknowledgments

The technical assistance of Don Beauchesne, Bruce Wendel, and Patty Reid is gratefully acknowledged.

References

Jenkins, G., and P.R. Hanson. 1976. The genetics of naked oats (*Avena nuda* L.). Euphytica 25:167–174.

Simons, M.D., J.W. Martens, R.I.H. McKenzie, I. Nishiyama, K. Sadanaga, J. Sebesta, and H. Thomas. 1978. Oats: A standardized system of nomenclature for genes and chromosomes and catalog of genes governing characters. USDA-SEA Agric. Handb. 509. U.S.Gov. Print. Office, Washington, DC.

Tinker, N. 2002. Pedigree of oat lines (POOL) [Online] Available: http://gnomad.agr.ca/ICIS/ogis/index.php; verified 10 December 2003.

S. Kibite (deceased), Agriculture and Agri-Food Canada, Research Centre, 6000 C&E Trail, Lacombe, AB, Canada T4L 1W1. Contribution no. 1015. Registration by CSSA. Accepted 31 Oct. 2003. *Corresponding author (claytong@agr.gc.ca).

Published in Crop Sci. 44:1503–1504 (2004).

REGISTRATION OF GENETIC STOCK

Registration of Short Internode Red Clover Genetic Stock

Red clover *(Trifolium pratense* L.) genetic marker stock (L38-1810) (Reg. no. GS-13, PI 633760) was released by the Kentucky Agricultural Experiment Station in 2003. It was discovered in 1995 in an inbred multiple-cotyledon genetic stock (L38-1485) in which a single plant expressed shortened internodes but normal-sized leaflets (Taylor and Mundell, 1999). Some leaves have only a single leaflet and others have three leaflets with an elongated central leaflet stalk. Short internode plants usually present a rosetted appearance but flower sparingly under long daylengths.

The progeny of short internode plants crossed with normal plants in 1996 were all normal, suggesting the character was inherited in a recessive manner. Selfs and intercrosses of short internode plants bred true. In further crosses made in 1999, intercrossed heterozygous normal plants produced progeny segregating a close fit to a 3:1 ratio (124:42). Twenty-four test crosses of heterozygous normal produced progeny segregating to a reasonable fit to a 1:1 ratio (145:120). Based on these data, we conclude that a single recessive gene is responsible for the short-internode condition. We suggest that the symbol *(ab)* be assigned for this gene. Accordingly, the normal condition would be *AbAb* or *Abab*, and short internode, *abab*. This gene symbol has not been used for a genetic marker in red clover (Quesenberry et al., 1991).

In the summer of 2003, short internode plants were hand crossed in a greenhouse to produce seed. Up to 10 seeds of this genetic marker stock may be obtained upon written request and agreement to return increased seed to the corresponding author.

N.L. Taylor* and G.L. Olson

References

Taylor, N.L., and R.E. Mundell. 1999. Registration of multiple-cotyledon red clover genetic marker stock: L38–1485. Crop Sci. 39:1259.

Quesenberry, K.H., R.R. Smith, N.L. Taylor, D.D. Baltensberger, and W.A. Parrott. 1991. Genetic nomenclature in clovers and special purpose legumes: Red and white clover. Crop Sci. 31:861–867.

Dep. of Agronomy, Univ. of Kentucky, Lexington, KY 40546-0091. The investigation reported in this paper (97-06-6) was in connection with a project of the Kentucky Agric. Exp. Stn., Lexington and is published with approval of the Director. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (nltaylor@uky.edu).

Published in Crop Sci. 44:1504 (2004).