REGISTRATIONS OF CULTIVARS

Registration of 'Ross' Meadowfoam

The meadowfoam (*Limnanthes alba* ssp. *alba* Benth.) cultivar Ross (Reg. no. CV-13, PI 634713) was developed and released in 2003 by the Oregon Agricultural Experiment Station. Ross was developed by three cycles of recurrent half-sib family selection for increased seed yield and lodging resistance from OMF58, a heterogenous, open-pollinated population. The first and second cycles of selection were performed between 1990 and 1997 (Crane and Knapp, 2000; 2002). Seed increases and field tests of Ross were performed at Corvallis, OR, between 1997 and 2003. Half-sib family seed for cycle three (C_3) was produced from open-pollinated plants in an isolated field in 1997–1998. Ross was developed by field testing 114 C_3 half-sib families in 1998–1999, selecting 10 families for seed yield, bulking nearly equal quantities of remnant seed of the selected families, and growing and intermating the selected families in an isolated field in 1999–2000. Breeder seed of Ross was produced in an isolated field in 2000–2001 from OMF58 C_4 seed produced by intermating selected C_3 families. Breeder seed was further increased in an isolated field in 2001–2002.

Ross was tested as OMF164 in replicated yield trials at Corvallis, OR, from 2000 to 2003, where single prophylatic sprays of the insecticide Capture (bifenthrin) were applied in January or February of each year to control meadowfoam fly (*Scaptomyza apicalis* Hardy) (Fisher et al., 2000). Ross was tested in unsprayed replicated yield trials at Corvallis from 2001 to 2003. Three check cultivars, Wheeler, Knowles, and Floral (Jolliff, 1994; Crane and Knapp, 2000, 2002) were grown in both sprayed and unsprayed yield trials. Seed yields were significantly greater for Ross than check cultivars in individual trials and across trials. The cultivar–trial interaction was nonsignificant and cultivar rankings for seed yield were identical in every trial. The seed yield for Ross across trials was 1681 kg ha^{-1}, compared with 1529 kg ha^{-1} for Wheeler, 1307 kg ha^{-1} for Knowles, and 1084 kg ha^{-1} for Floral (LSD 0.05 = 127 kg ha^{-1}). The last two cycles of selection in OMF58 increased seed yield by 374 kg ha^{-1}, and three cycles of selection in OMF58 produced a cultivar outyielding Floral by 597 kg ha^{-1}.

The seed oil concentration of Ross (292 g kg^{-1}) was significantly greater than Floral (277 g kg^{-1}) ($LSD_{0.05}$ = 10 kg ha^{-1}), whereas the seed oil concentrations of Ross, Wheeler (293 g kg^{-1}), and Knowles (290 g kg^{-1}) were not significantly different. Ross produced significantly more seed oil per hectare than the other cultivars tested. The mean seed oil yield for Ross across trials was 490 kg ha^{-1}, compared with 448 kg ha^{-1} for Wheeler, 378 kg ha^{-1} for Knowles, and 301 kg ha^{-1} for Floral (LSD0.05 = 42 kg ha^{-1}). The 100-seed weights for Ross (8.00 g), Knowles (7.96 g), and Floral (7.85 g) were not significantly different (LSD0.05 = 0.16 g). The 100-seed weight for Wheeler (7.77 g) was slightly lower than the other cultivars tested.

The fatty acid profile of Ross seed oil was assayed by gas chromatography and found to be similar to Wheeler and other *L. alba* ssp. *alba* seed oils (Knapp and Crane, 1995; Crane and Knapp, 2000, 2002). The *cis*-5-eicosenoic (20:1 Δ5), *cis*-5-docosenoic (22:1 Δ5), *cis*-13-docosenoic (22:1 Δ13), and *cis*-5 *cis*-13-eicosenoic (22:1 Δ5, Δ13) acid concentrations in Ross seed oil were 614, 43, 138, and 176 g kg^{-1}, respectively, compared with 631, 46, 137, and 160 g kg^{-1}, respectively, in Wheeler seed oil.

Ross is adapted for production as a winter annual in the Willamette Valley of Oregon and other mild maritime climates. There were no significant differences in days to flowering or days to physiological maturity among cultivars. The upright growth habit and lodging resistance of Ross was similar to Wheeler, while both were more resistant to lodging than the other cultivars. Wild meadowfoam populations have a prostrate growth habit.

Breeder seed of Ross is maintained by the Oregon Agricultural Experiment Station. Recognized seed classes of Ross are Breeder, Foundation, Registered, and Certified. Small quantities of seed may be obtained from the corresponding author for research purposes for a period of at least five years.

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Registration of 'S99-3181' Soybean

'S99-3181' soybean [*Glycine max* (L.) Merr.] (Reg. no. CV-469, PI 635039) was developed by the Missouri Agricultural Experiment Station at the University of Missouri–Delta Center, Portageville, MO, and released 6 June 2003 because of its potential use in the natto market. It has shatter resistance, broad resistance to soybean cyst nematode (SCN, *Heterodera glycines* Ichinohe), and resistance to southern root knot nematode [*Meloidogyne incognita* (Kofoid & White) Chitwood].

S99-3181 is an F_5 single plant selection composited in the F_6 generation from the cross S93-1344 × 'Camp' made in 1995. S93-1344 is from 'A6785' × 'Hartwig' (Shannon, 1989; Anand, 1992). Camp is a small-seeded natto cultivar released by the Virginia Agricultural Experiment Station, Virginia Polytechnic Institute and State University, Blacksburg, VA, from the cross of Essex × an unknown *Glycine soja* Siebold & Zucc. plant introduction (Glenn Buss, personal communication). The F_1 generation was grown in Puerto Rico. The F_2 through the F_5 generations were advanced by the bulk pod method in which seed from a single pod per plant is advanced with each generation of inbreeding. Only the smallest seed, selected by saving seed that would pass through a 3.6-mm round-holed sieve, were planted in the F_3, F_4, and F_5 generations. The F_2 and F_3 generations were advanced in an HG type 2- (formerly race 5) (Niblack et al., 2002) SCN-infested nursery at the University of Missouri Rhodes Farm, Clarkton, MO, and in Puerto Rico, respectively. The F_4 and F_5 generations were grown at Portageville. Single F_5 plants were harvested and individually screened in the greenhouse against a mixture of SCN HG types 2-, 0-, and 1.3- (formerly races 3, 5, and 14). The SCN resistant F_6 plant rows were grown in the field at Portageville in 1999. Row S99-3181 was uniform for agronomic traits and was bulked for yield tests. S99-3181 was screened in the greenhouse for resistance to individual SCN HG types (Niblack et al., 2002) 2-, 1.2-, 0-, 2- and 1.3- (races 1, 2, 3, 5, and 14) at Jackson, TN, Columbia, MO, and Portageville, MO.

S99-3181 is mid-group V maturity (relative maturity 5.6). In University of Missouri–Delta Center advanced research trials from 2001 to 2002 in 10 environments, yields were similar to 'Hutcheson' (Buss et al., 1988) on SCN-noninfested loam soils (four sites) and 20% more on SCN-infested soils (two sites) with a mean yield over six locations of 3113 kg ha^{-1} versus 2938 kg ha^{-1} for Hutcheson. However, in four sharkey clay (Vertic Haplaquept, very fine montmorillonitic, thermic) sites in the Portageville, MO region, yields of S99-3181 averaged 9% less than Hutcheson with a mean yield over four environments of 2787 kg ha^{-1} versus 3047 kg ha^{-1} for Hutcheson. It has been superior in yield to the shatter prone group V natto cultivar B3 from Blue Horizon, Inc., 851 Burlway Road, Burlingame, CA (2980 kg ha^{-1} versus 2060 kg ha^{-1} averaged over ten environments). S99-3181 is determinate in growth habit and has averaged 5 cm taller (S99-3181 averaged 81 cm) and 2 d earlier in maturity and has lodged (1.6 versus 1.2 on a scale of 1 = no lodging to 5 = severe lodging) slightly more than Hutcheson. Shatter resistance three weeks after maturity for S99-3181 was comparable to Hutcheson with a score of 1.0 (no shattering) and superior to B3 with a score of 5.0 (>50% seed shattered).

S99-3181 has white flowers, gray pubescence, and tan pods at maturity. Seed are shiny yellow with buff hila averaging 93 mg^{-1} seed versus 130 mg seed^{-1} for Hutcheson and 66 mg^{-1} seed for B3. Seed protein and oil content on a dry weight basis have averaged 405 g kg^{-1} and 200 g kg $^{-1}$, respectively, versus 425 g kg^{-1} and 192 g kg^{-1} for B3. S99-3181 is resistant to SCN HG types 2- (Race 1), 1.2- (Race 2), 0- (Race 3), 2- (Race 5) and 1.3- (Race 14). SCN female indices (Niblack et al., 2002) for each HG type (race) above were 3, 0, 0, 20, and 7, respectively, versus 100 for the susceptible 'Lee 74' (Caviness et al., 1975). It has moderate resistance to southern root knot nematode based on an average root knot gall score (1 = no galls to 5 = severe galling) over four infested fields during 2001 and 2002 of 2.2 versus 2.0 for the resistant check 'Manokin' (Kenworthy et al., 1996) and 4.5 for Hutcheson (susceptible). S99-3181 is susceptible to stem canker [caused by *Diaporthe phaseolorum* (Cooke and Ellis) Sacc. var. *meridionalis* F. A. Fernandez] and phytophthora root rot (caused by *Phytophthora sojae* M. J. Kaufmann & J. W. Gerdemann).

S99-3181 was licensed by the Missouri Agricultural Experiment Station to Missouri Premium Varieties, Concordia, MO, for use as a natto cultivar. Breeder seed of S99-3181 will be maintained by the University of Missouri Agricultural Experiment Station. Small quantities of seed may be obtained for research purposes, including hybridization and cultivar development, for at least 5 yr by writing to the corresponding author.

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Registration of 'Asmara' Vegetable Soybean

'Asmara' soybean [*Glycine max* (L.) Merr.] (Reg. no. CV-470, PI 633049), a maturity group (MG) VI cultivar, was developed jointly by the Virginia State University, Agricultural Research Station and the USDA-ARS and was released on 13 March 2003 as a vegetable soybean with resistance to seed shattering. This cultivar is named for the capital city of Eritrea, a newly independent country in east Africa. Asmara can be harvested at either the green pod or mature seed stages. Developing seeds harvested at the green pod stage are for direct human consumption while seeds harvested at maturity are useful for soyfood products such as tofu, soymilk, or roasted nuts (Mebrahtu et al., 1991; Carter and Shanmugasundaram, 1993; Konovsky et al., 1994; Rao et al., 2002a). Asmara was developed by conventional means compatible with the USDA guidelines for organic production (USDA-ARS, 2000; USDA-AMS, 2000).

Asmara is derived from the cross of the PI 417288 × BV-4. BV-4 is a selection from the hybridization of T135 × PI 83945-4. BV-4 was developed by USDA-ARS, Beltsville, MD, and has good pod set and resistance to lodging and shattering. The PI 417288 is a larger-seeded soybean MG V from Japan and is reported to have moderate resistance to Mexican bean beetle (*Epilachna varivestis* Mulsant) defoliation (Kraemer et al., 1994). PI 83945-4 is large-seeded fasciated MG IV line from South Korea (USDA-ARS, 1995). T135 is a chlorophyll mutant line found in Illinois and maintained by the USDA at Urbana, IL (Palmer and Kilen, 1987). PI 417288 and PI 83945-4 used in the development of Asmara have not appeared in the pedigree of North American soybean cultivars previously. Thus, Asmara is a unique cultivar that may be used to increase the genetic diversity of North American soybean breeding programs.

The F_2 through F_5 progenies from PI 417288 × BV-4 were advanced through single seed descent (Brim, 1966). At seed maturity, F_5 single plants were selected and threshed individually. Progenies of individual plants were grown in single rows at the Randolph Research Farm of Virginia State University, Petersburg, VA.

Asmara was evaluated under the experimental designation VS96-239. When planted in mid-May and harvested in mid-September (2001 and 2002) at the Randolph Research Farm, Virginia State University, the two-year average yield of green pods at R6-R7 (Fehr et al., 1971) was 22 082 kg ha^{-1} compared with a MG VII large-seeded PI from Japan 'Tambagura' (PI 187154) used as a standard (USDA-ARS, 1990; Rao et al., 2002b), with 16 598 kg ha^{-1} when harvested in early October. Asmara and Tambagura reached the green pod (R6-R7) at different times and were harvested at different times. The decision to harvest was made when the pods were green and plump and the seeds were green and nearly full size. Each genotype was harvested at about 35–40 d after 50% of the plants of each genotype flowered. Green bean composition of Asmara on a dry weight basis averaged 39.6 g kg^{-1} sucrose, 430 g kg^{-1} protein, and 92 g kg^{-1} oil, with 43.3% of the oil as oleic acid, as compared to Tambagura with 62.5 g kg^{-1} sucrose, 318 g kg^{-1} protein, and 109 g kg^{-1} oil, with 29.5% oleic acid. Oleic acid confers health benefits in reducing serum cholesterol levels (Wilson, 1991).

Asmara yielded 2467 kg ha^{-1} when mature seed was harvested on 10 October, compared to 2369 kg ha^{-1} for 'Twiggs' (Boerma et al., 1988), a grain-type used as a standard. Mature seed composition of Asmara on a 130 g kg^{-1} moisture basis averaged 431 g kg^{-1} protein, 120 g kg^{-1} oil with 22.9% of the oil as oleic acid. Tambagura had 359 g kg^{-1} protein, 123 g kg^{-1} oil, and 20.8% of the oil as oleic.

Asmara's performance was also evaluated at the Upper Marlboro Research Station of the University of Maryland, College Park in 2000 and 2001. When harvested in early November, the two-year average mature seed yield for Asmara was 2795 kg ha^{-1} compared to 3794 kg ha^{-1} for 'York' (Smith, 1968) which was used as a grain-type standard. The average seed size from both Maryland and Virginia locations was 22 g per 100 seeds while Twiggs seed weighed 14 g per 100 seeds. Asmara is resistant to seed shattering. Its two-year average shattering score was 1.0, which was the same as that for Twiggs and York. The shattering score was based on 1-to-5 scale (1 = no shattering and 5 = severe shattering).

Asmara has white flowers, tawny pubescence, and tan pod walls. Seeds have yellow seed coats and buff hila. Plants have determinate growth habit with an average height of 54 cm compared with 71 cm with Twiggs.

In tests at Jackson, TN, Asmara was susceptible to races 3 and 14 of the soybean cyst nematode (*Heterodera glycines* Ichinohe). In tests at West Lafayette, IN, Asmara was resistant to race 2, but was susceptible to race 33 of the Phytophthora root rot pathogen (*Phytophthora sojae* M. J. Kaufmann & J. W. Gerdemann). In southern Indiana, Asmara was susceptible to bacterial pustule [caused by *Pseudomonas syringae* pv. *glycine* (Coerper) Young, Dye & Wilkie] and mildly susceptible to sudden death syndrome (caused by *Fusarium virguliforme* O'Donnell & T. Aoki).

Breeder seed of Asmara will be maintained by the Agricultural Research Station of Virginia State University, P.O. Box 9061 Petersburg, VA 23806. Limited quantities of seeds are available for breeding and research purposes from the corresponding author for at least 5 yr. Seeds were deposited in the National Plant Germplasm System where they will be available for research purposes including development and commercialization of new cultivars. Rights for production and marketing of Asmara will be awarded by the USDA-ARS Office of Technology Transfer. The U.S. Plant Variety Protection Certificate no. 200300208 is granted for Asmara.

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Registration of 'LaMoure' Soybean

'LaMoure' soybean [*Glycine max* (L.) Merr.] (Reg. no. CV-471, PI 634813) was developed by the North Dakota Agricultural Experiment Station, North Dakota State University, and released on 12 Dec. 2003. LaMoure has high yield and is iron efficient and resistant to lodging.

LaMoure is an F_4–derived line, originally designated ND98-2252, with the pedigree SD92-1323M × M90-370. SD92-1323M is an experimental line that was jointly developed by South Dakota State University, Brookings, SD, and the University of Minnesota, St. Paul, MN. M90-370 is an experimental line that was developed by the University of Minnesota. SD92-1323M and M90-370 were never released as named cultivars. The pedigree of SD92-1323M is 'Kasota' × 'Kato' (Orf et al., 1991a; Orf et al., 1991b). The pedigree of M90-370 is M81-27 × M83-16. The pedigree of M81-27 is M68-49-26 × M70-294. The pedigree of M83-16 is A2 × 'Hodgson' (Fehr and Bahrenfus, 1980; Lambert and Kennedy, 1975). The pedigree of M68-49-26 is 'Evans' × M59-120 (Lambert and Kennedy, 1975). The pedigree of M70-294 is PI 358323 × M63-217Y. The pedigree of M63-217Y is 'Corsoy' × M53-117 (Weber and Fehr, 1970). The pedigree of M53-117 is M10 × PI 180501. The pedigree of M10 is 'Lincoln' (2) × 'Richland' (Bernard et al., 1995). The pedigree of M59-120 is M54-240 × M54-132. The pedigree of M54-240 is 'Korean' × M42-37. The pedigree of M54-132 is M10 × 'Capital' (Orf and Kennedy, 1992; Weiss and Stevenson, 1995). The pedigree of M42-37 is Lincoln (2) × Richland. The pedigree of M10 is Lincoln (2) × Richland (Orf and Kennedy, 1992).

The cross of LaMoure was made in the summer of 1995 at Fargo, ND. The F_1 plants were grown in the 1995–1996 Chile winter nursery. The F_2 population was grown in the summer of 1996 and advanced to the F_3 generation by the single pod bulk method (Fehr, 1991). The F_3 population was grown in the 1996–1997 Chile winter nursery and advanced to the F_4 generation by the single pod bulk method. Individual F_4 plants were grown in the Fargo, ND nursery in 1997. $F_{4:5}$ plant-rows were evaluated in 1998 at the Casselton, ND nursery. LaMoure was first tested as ND98-2252 in replicated yield trials in North Dakota in 1999.

LaMoure was tested in the USDA Uniform Regional Trials: Northern States in 2001–2003 (Abney, 2003). In three years of USDA Uniform Regional Tests, LaMoure yielded 3% less than Lambert and was 2 d later in maturity. Protein content was 401 g kg^{-1} for LaMoure and 414 g kg^{-1} for Lambert. Oil content was 199 g kg^{-1} for LaMoure and 207 g kg^{-1} for Lambert. Seeds of LaMoure are 11 mg $seed^{-1}$ smaller than Lambert.

LaMoure was evaluated by the North Dakota State University soybean breeding project for a total of 24 location-years that included 2000–2003 data. LaMoure yielded 3% more than 'Sargent' (Helms et al., 2002) and 8% more than 'Barnes' (Helms et al., 2001) in North Dakota trials, averaged across years from 2000 to 2003. LaMoure matured 23 September which was 3 d earlier than Sargent and 5 d later than Barnes. Lodging was rated on a 1–5 scale with 1 = best and 5 = worst. LaMoure had a lodging score of 2.3, compared to Sargent with a score of 3.3 and Barnes with a score of 2.6. Plant height of LaMoure was 0.94 m, the same as Sargent compared to the plant height of Barnes, which was 0.97 m. Iron deficiency chlorosis was rated on a 1-to-5 scale with 1 = best and 5 = worst. When LaMoure was evaluated for iron deficiency chlorosis in 2002 at four sites in North Dakota, LaMoure was classified as moderately resistant to iron deficiency chlorosis with a score of 2.5 versus a score of 3.3 for Sargent.

LaMoure has white flower color, tawny pubescence, brown pods at maturity, brown hila, dull seed coat luster, and indeterminate growth habit. It is a Maturity Group 0 cultivar (relative maturity 0.7) and is generally adapted as a full-season cultivar from 45 to 48° N. lat. LaMoure was resistant to race 3 but susceptible to race 4 of *Phytophthora sojae* (M.J. Kaufmann & J.W. Gerdemann), the cause of Phytophthora root rot. Breeder seed of LaMoure will be maintained by North Dakota State University. A small sample of seed for research purposes can be obtained from the corresponding author for at least 5 yr. Protection for LaMoure under the U.S. Plant Variety Protection Act Title V is pending.

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Registration of 'NE2701' Soybean

'NE2701' soybean [*Glycine max* (L.) Merr.] (Reg. no. CV-472, PI 634827) was developed by the Nebraska Agricultural Experiment Station. It was released in 2001 because of its superior yield compared with cultivars of similar maturity.

NE2701 is derived from the cross 'Colfax' × A91-701035. Colfax is a cultivar developed from a male-sterile facilitated breeding program at the University of Nebraska (Graef et al., 1994). The line A91-701035 is an experimental breeding line from Iowa State University, derived from the cross A86-301024 × 'Dekalb 226'. The line A86-301024 is from the cross A81-356022 × 'Hack' (Nickell et al., 1985). The line A81-356022 is from the cross 'Century' × A76-304020 (Wilcox et al., 1980). The line A76-304020 is from the cross ('Beeson' × AP68-1016) × (L15 × 'Calland') (Probst et al., 1969a, 1969b). The line AP68-1016 is from the cross 'Clark' (5) × PI 84.946-2, and L15 is from the cross 'Wayne' (6) × 'Clark 63' (Johnson, 1958; Williams and Bernard, 1964; Bernard, 1966). The population was inbred using a modified single-seed descent procedure

(Brim, 1966) through the USDA Tropical Agriculture Research Station in Isabela, Puerto Rico, and at the University of Nebraska-Lincoln Agronomy Farm, Lincoln, NE. The F_3–derived lines were evaluated in single-row plots at two locations during 1995 in Nebraska. Plots were 1 m long and spaced 0.76 m apart, with a 1.2-m alley between plots. Selections among lines were made based on phenotypic scores and yield. NE2701 was evaluated in replicated tests in Nebraska during 1996 to 2000, and in the USDA Uniform Soybean Tests, Northern States, from 1997 through 2000 under the designation U96-2233.

NE2701 is a late Maturity Group II cultivar (2.7 relative maturity) with determinate growth habit, purple flowers, gray pubescence, and tan pods at maturity. The seeds have a yellow cotyledon, yellow seed coat with intermediate luster, and imperfect black hilum. NE2701 is heterogeneous for seed coat peroxidase activity. Over two years of USDA Uniform Regional Group II Tests (1998–1999), NE2701 had an average yield of 3810 kg ha^{-1}, compared with 3796 kg ha^{-1} for the check cultivar IA2021. It matured 1.7 d later than IA2021, with better lodging score, 13 cm shorter plant height, 3 mg seed^{-1} greater seed weight, 15 g kg^{-1} higher seed protein, and 11 g kg^{-1} lower oil content (Wilcox, 1999, 2000). In Nebraska breeding program tests conducted at four locations each year during 1999–2001, NE2701 matured 2 d later than IA2021 and yielded 3984 kg ha^{-1}, compared with 3850 kg ha^{-1} for IA2021. While NE2701 has shown good broad adaptation, as evidenced by the multiple-year averages in the USDA Uniform Regional Tests, its shorter stature and high yield response make it well suited for irrigated and high-productivity environments where higher populations and/or narrow row culture may be used to increase productivity. NE2701 is susceptible to Phytophthora root rot (caused by *Phytophthora sojae* J.J. Kaufmann & J.W. Gerdemann).

Foundation seed of NE2701 was produced by the Nebraska Foundation Seed Division, and is available for non-exclusive licensing from the University of Nebraska Agricultural Research Division and the Technology Transfer Office. U.S. Plant Variety Protection will not be applied for.

Seeds of this release will be deposited in the National Plant Germplasm System where it will be available for research purposes. Small quantities of seed for research purposes can be obtained for five years from the date of this release from the corresponding author. The Nebraska Agricultural Experiment Station will maintain Breeder seed.

G.L. Graef,* D.M. White, and L.L. Korte

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Registration of 'Frio' Buffelgrass

'Frio' buffelgrass [*Pennisetum ciliare* (L.) Link syn. *Cenchrus ciliaris* L.] (Reg. no. CV-239, PI 634535) was jointly released in January 1999 by the Texas Agricultural Experiment Station and USDA-ARS and was tested under the experimental designations T-704, T-409704, and 409704. This cultivar has more winter hardiness than any commercially available buffelgrass cultivar, including 'Llano' and 'Nueces' which were released because of their increased cold tolerance (Bashaw, 1980). Frio is intended to be used primarily for grazing and conservation purposes in regions where currently available cultivars experience winter damage.

Frio was discovered growing as an off-type plant in a row of open-pollinated progeny from PI 409704, a facultative apomictic buffelgrass accession that was collected by Dr. E.C. Bashaw in 1976 near Beaufort West, Union of South Africa. Open-pollinated seed from this off-type plant were used to increase Frio for subsequent testing. Both Frio and PI 409704 are pentaploids with 45 chromosomes that associate essentially as 18 bivalents and 9 univalents during metaphase I of meiosis. Frio is an aposporous apomict, and its mode of reproduction was determined by (i) cytologically observing megasporogenesis and embryo sac development and (ii) progeny testing. Cytological observations revealed that the female gametophyte development in the ovule is such that the plant has the potential of reproducing as a facultative apomict with the level of sexuality depending on environmental conditions under which the plant is grown. At College Station, TX, field-grown plants of Frio have the highest potential for sexual reproduction in May and lowest in August (Hussey et al., 1992). Even though cytological findings indicate that Frio has the potential for sexual reproduction, less than 0.1% off-type plants have been observed in field plantings. Based on these findings, Frio should be considered a facultative apomict with a very low level of sexual reproduction. Some of these rare off-type plants may originate from the fertilization of unreduced gametes ($2n + n$). Several $2n + n$ hybrids have been recovered when Frio was used as a female parent in controlled hybridization studies (Bashaw and Hignight, 1990; Hussey et al., 1993; Burson et al., 2002).

Frio was evaluated in field plantings in north, central, and south Texas as well as in the states of Nuevo Leon and Tamaulipas in northern Mexico. In field trials conducted from 1986 to 1988 at three locations in north Texas [Stephenville (32°20′ N), Knox City (33°25′ N), and Vernon (34°10′ N)], Frio exhibited better winter survival than Common, Llano, and Nueces buffelgrasses and significantly higher forage production than the other three cultivars. Frio had significantly better winter survival than Common at College Station (30°36′ N) in south-central Texas (Hussey and Bashaw, 1996). However, Frio produced less forage (8.2 Mg ha^{-1}) than Common (11.3 Mg ha^{-1}) during the establishment year at College Station. In subsequent years, Frio (18.3 Mg ha^{-1}) produced more forage than Common (9.3 Mg ha^{-1}), even when winter survival was not an issue (19.2 vs. 10.2 Mg ha^{-1}) (Hussey and Bashaw, 1996). At Beeville (28°24′ N) in south Texas, Frio produced 23% less forage than Common in a 2-yr study conducted in 1991 and 1992. Frio is similar to Common in crude protein and fiber concentration (NDF and ADF).

Even though Frio produces similar quantities of seed material (kg involucres ha^{-1}) as Common, its seed set is lower. Seed set was evaluated for both Frio and Common at multiple locations throughout south Texas and northern Mexico and ranged from less than 10% to more than 70% for Frio and from less than 10% to more than 150% for Common. Seed set is influenced by the environmental conditions under which the plants are grown and the number of spikelets per involucre. Common buffelgrass produces an average of two spikelets (seed) per involucre, whereas Frio produces one spikelet (seed) per involucre. The low and sometimes erratic seed set could be a potential limitation in the use of this cultivar; however, when seed is produced under ideal conditions, yields are high enough that sufficient seed will be available for propagation purposes (Shafer et al., 2000).

Breeder seed of Frio is maintained by the Texas Agricultural Experiment Station. Foundation and Certified seed classes will be allowed. Foundation seed may be produced for three consecutive years, and Certified seed may be produced for five years. Foundation seed will be distributed by the Texas Foundation Seed Service, 11914 Highway 70, Vernon, TX 76384. U.S. Plant Variety Protection will be requested for Frio.

M.A. Hussey* and B.L. Burson

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M.A. Hussey, Dep. of Soil & Crop Sciences, Texas A&M Univ., College Station, TX 77843-2474; B.L. Burson, USDA-ARS, Crop Germplasm Research Unit, 430 Heep Center, Texas A&M Univ., College Station, TX 77843-2474. Registration by CSSA. Accepted 31 July 2004. 2004. *Corresponding author (mhussey@tamu.edu).

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Registration of 'Highlander' Eastern Gamagrass

'Highlander' eastern gamagrass [*Tripsacum dactyloides* (L.) L.] (Reg. no. CV-238, PI 634941) is a perennial, native warm-season grass selected at the USDA Natural Resources Conservation Service (NRCS) Jamie L. Whitten Plant Materials Center (PMC), Coffeeville, MS, and released in 2003 in cooperation with the Mississippi Agricultural and Forestry Experiment Station (MAFES) and the NRCS Jimmy Carter PMC, Americus, GA. Highlander was tested under the experimental designation NRCS accession no. 9062680.

This cultivar is an increase of a single seed collection made by Gregg Brann (NRCS Grazing Lands Specialist, Nashville, TN) in Montgomery County, Tennessee in 1990. Highlander was initially evaluated at the Jamie L. Whitten PMC from 1992 to 1994. When compared to 72 other eastern gamagrass accessions collected from nine states in the southeastern USA and southern Great Plains, it exhibited superior vigor, growth form, and disease resistance. It was advanced to a regional trial at six locations and compared to 13 superior eastern gamagrass accessions from southern and western seed sources for forage production. Highlander was the highest yielding accession in the trial (16.1 Mg ha^{-1}) when averaged over all years (1996–1998) at Coffeeville, Americus, GA, Booneville, AR, and Nacogdoches, TX. Yields were lower at Knox City, TX, and Brooksville, FL, where they averaged 9.3 Mg ha^{-1}. At two locations in Mississippi, Highlander produced 19 and 30% more forage than 'Pete' (Fine et al., 1990). When harvested at its recommended 45-d cutting frequency, Highlander yielded approximately 10% more forage than 'Tifton 44' (Burton and Monson, 1978) bermudagrass [*Cynodon dactylon* (L.) Pers.] harvested at its recommended 30-d cutting frequency. Crude protein averaged 110 g kg^{-1}, acid detergent fiber 420 g kg^{-1}, neutral detergent fiber 790 g kg^{-1}, and in vitro true digestibility, determined by procedures of Goering and Van Soest (1970), was 740 g kg^{-1} for the 45-d harvests. It is more susceptible to damage from overgrazing than bermudagrass and requires careful grazing management. Highlander has also demonstrated potential as a perennial silage and biomass crop for energy production and as a nutrient sink for water quality improvement. It is also useable in buffer plantings to provide soil stabilization and wildlife cover.

The range of adaptation for Highlander includes all but the southernmost portions of the southeastern USA, the lower Midwest, and the southeastern portion of the Great Plains. Highlander has grown well on soils ranging from acidic to moderately alkaline and will tolerate wet, poorly drained sites, yet also has fairly good drought tolerance. It is a tetraploid ($2n = 4x = 72$) and reproduces by facultative apomixis. In north central Mississippi, Highlander flowers from May to July, and the optimum seed harvest period is generally in mid-July. Highlander is not an abundant seed producer (approximately 160 kg ha^{-1}), and seeds require specialized cleaning and stratification to overcome mechanical dormancy created by hard fruit coverings.

Breeder seed will be maintained at the USDA-NRCS Jamie L. Whitten Plant Materials Center, Coffeeville, MS. Foundation seed will be maintained at the MAFES Foundation Seed Stock, Mississippi State, MS, and will be sold to producers of registered and certified seed. U.S. Plant Variety Protection will be sought for Highlander.

J.M. Grabowski,* J.L. Douglas,
D.J. Lang, and S.D. Edwards

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Registration of 'Grand Mesa' Pinto Bean

'Grand Mesa' pinto bean (*Phaseolus vulgaris* L.) (Reg. no. CV-231, PI 631163) was developed by the Colorado Agricultural Experiment Station and released in May 2001. Grand Mesa was developed to provide bean growers in the High Plains with a high yielding pinto cultivar that combines resistance to rust [caused by *Uromyces appendiculatus* (Pers.) Unger var. *appendiculatus*], *Bean common mosaic virus* (BCMV), and semi-upright plant architecture (indeterminate Type IIb growth habit according to the CIAT scale) which conditions field avoidance to white mold [caused by *Sclerotinia sclerotiorum* (Lib.) de Bary].

Grand Mesa, tested as CO75511, was derived from the cross, CO56249/83b235//RNK 178, made in 1994. CO56249 is an experimental pinto line from the Colorado State University Dry Bean Breeding Project that combines high yield potential, pinto seed color, and adaptation to local growing environments. However, it is susceptible to strains of bean rust prevalent in the High Plains. Line 83b235 (pedigree unknown) is an experimental line developed by Jim Myers and John Kolar at the University of Idaho that has high yield potential and determinate Type I growth habit, and is susceptible to strains of bean rust prevalent in the High Plains. RNK 178 (pedigree unknown) is an experimental line developed by Rogers/Syngenta Seed Company, Nampa, ID, that has semi-upright growth habit, high yield potential, and resistance to the prevalent strains of rust in the High Plains conferred by the *Ur-3* allele.

Grand Mesa was developed by pedigree selection. The initial selection was an F_2 plant that was resistant to rust in a field nursery at Fort Collins, CO. Resistance was confirmed in the $F_{2:3}$ family and no susceptible segregants were observed. Several plants were selected from the $F_{2:3}$ family and advanced by the pedigree method to the F_5. In 1997, one $F_{4:5}$ line was selected and bulked for testing in 1998 and 1999 at Fort Collins, CO. During the winter 1997, seed from 24 $F_{4:5}$ plants were planted in the greenhouse at Fort Collins, CO, to produce 24 plant rows at Fruita, CO in 1998. Eighteen of the 24 plant rows were selected based on uniformity for growth habit and maturity, and good commercial pinto seed color and size. The seed produced on all 18 rows was bulked as the source for an initial seed increase and regional cultivar testing. This seed was planted at Fruita, CO, in 1998 to produce Breeder seed. This Breeder seed was subsequently used for production of Foundation seed in 2000.

Grand Mesa was tested in the national Cooperative Dry Bean Nursery (CDBN) that included observations and measurements from 20 locations throughout the US and Canada during 2001. In the CDBN, mean seed yields across locations for Grand Mesa and the check variety 'Bill Z' were 2668 and 3013 kg ha^{-1}, respectively. Mean seed size was somewhat smaller than other pinto cultivars at 33 g 100 seed^{-1} for Grand Mesa and 34 g 100 seed^{-1} for Bill Z. Days to first flower and days to maturity were intermediate for Grand Mesa at 51 and 92 d, respectively, compared to the shortest maturing cultivar at 47 and 85 d for 'CDC Pintium' and 50 and 92 d for the check Bill Z. The growth habit of Grand Mesa varied across locations. Grand Mesa was rated a Type II (semi-erect CIAT scale) at two locations and a Type III (indeterminate, prostrate) at three locations. A sixth location did not use the CIAT scale; however, Grand Mesa was rated more erect than prostrate. Reactions to common bacterial blight [caused by *Xanthomonas campestris* pv. *phaseoli* (Smith) Dye], soil zinc deficiency, and root rot (causal organisms not distinguished) were intermediate for Grand Mesa compared to other pinto cultivars. Among pinto entries, Grand Mesa ranked among the most resistant for field reaction to white mold at four locations, with the exception that CDC Pintium was lower at one location. Grand Mesa has also been widely tested in Colorado from 2000 to 2004. Grand Mesa had better field tolerance to white mold with 22% infection versus 72 and 61% infection for 'Montrose' and Bill Z, respectively (Johnson et al., 2001). Field tolerance to white mold is due to the semi-upright growth habit, because Grand Mesa does not possess physiological resistance to white mold based on the straw test developed by Petzoldt and Dickson (1996) that measures physiological resistance. Reaction to white mold based on the straw test was 7, on a scale of 1–9, where a rating of 9 is considered highly susceptible.

The gene that confers resistance to rust in Grand Mesa is *Ur-3*, derived from the parent RNK 178. Grand Mesa also carries the recessive allele $bc\ 2^2$ which confers resistance to pathogroups I, II, III, and V of BCMV based on tests conducted at the University of Idaho. Seed of Grand Mesa has traditional pinto shape and bright cream background coloration.

Grand Mesa pinto bean has been released as a public, nonexclusive cultivar. Plant Variety Protection has been granted (No. 200200156) under the U.S. Plant Variety Protection Act, Public Law 91-577, with the option that Grand Mesa may be sold for seed by name only as a class of Foundation, Registered, or Certified seed. Breeder and Foundation seed will be maintained by the Colorado State University Dry Bean Foundation Seed Project at Fruita, CO. A technology fee will be assessed on all Registered and Certified Seed produced in the US. Consult the Dry Bean Foundation Seed Project at Fruita, CO for fee structure and details. Small amounts of seed for research purposes are available for five years from the date of publication from the corresponding author.

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J.J. Johnson, and F. Judson

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Registration of 'Yacine' Cowpea

'Yacine' cowpea [*Vigna unguiculata* (L.) Walp.] (Reg. no. CV-232, PI 634767) was developed by the Institut Senegalais de Recherches Agricoles (ISRA) as part of a collaborative project with the University of California, Riverside, CA, and was released by ISRA in Senegal in 2003. Yacine has resistance to cowpea aphid (*Aphis craccivora* Koch), major strains of

Cowpea aphid-borne mosaic virus (CABMV), and bacterial blight [caused by *Xanthomonas campestris* pv. *vignicola* (Burkholder) Dye], and has early maturity. Yacine is adapted for dry grain production under rainfed conditions in the Sahelian Zone of northern Senegal where the annual monomodal rainfall provides 200–400 mm per growing season. Yacine is not recommended for zones where flower thrips (*Megalurothrips sjostedti* Trybom) are prevalent, such as those zones with higher rainfall, since it is more susceptible to flower thrips than 'Melakh'.

Yacine was derived from the cross 86-5-2/Melakh which was made in 1989. The line 86-5-2 is a selection from the landrace 'Mame Penda' (Sène, 1966; Cissé and Hall, 2003) which is widely grown in northern Senegal. Farm families prefer Mame Penda for its desirable grain qualities (color, taste, and size), and it has resistance to bacterial blight. Mame Penda is, however, susceptible to cowpea aphids and CABMV. Melakh (Cissé et al., 1997) is also grown in northern Senegal and flowers and matures earlier than Mame Penda. Melakh has resistance to cowpea aphid, CABMV, and bacterial blight. Single plant selections for resistance to mosaic virus and bacterial blight were made in 1990–1991 at the F_2, F_3, and F_4 under artificial inoculation. The F_5 was included in a preliminary yield trial under the designation ISRA-819 during the 1991 growing season and was bulk harvested. A single F_6 plant that had no infestation of cowpea aphid and no symptoms of mosaic virus or bacterial blight under field conditions was selected based on various seed qualities and earliness from an observational nursery in 1998. Reselection for resistance to cowpea aphid was made under artificial infestation at F_7. F_8 seeds of resistant plants were bulked and introduced in yield trials in Senegal from 1999 through 2003. Tests were conducted at two sites (Bambey and Thilmakha) per year and at 50 on-farm sites from 2001 to 2003. Selection for uniform seed color was made at F_{10}. The resulting lines were bulked as Breeder seed of Yacine.

Yacine is erect and belongs to the same maturity group as Melakh, whereas Mame Penda has an indeterminate growth habit and a greater biomass production. Under well-watered conditions Yacine reaches physiological maturity 62 d after sowing, whereas Mame Penda reaches maturity at 75 d. Yacine produced 40% more grain (1434 kg ha^{-1}) than Mame Penda (1020 kg ha^{-1}) and had similar grain yield as Melakh. Yacine produced less hay (dry shoot biomass minus pods) than either Mame Penda or Melakh. Seeds of Yacine are brown with a small, white eye and are larger (23 g 100 seed^{-1}) than those of Mame Penda (18 g 100 seed^{-1}) and Melakh (19 g 100 seed^{-1}). On-farm yields of Yacine in pure culture were similar to those of Melakh (750 kg ha^{-1}) and 30% greater than those of Mame Penda (580 kg ha^{-1}). Grain taste of Yacine has been rated superior to that of Melakh and Mame Penda by farm families.

Breeder seed will be maintained by ISRA at the Center National de Recherches Agronomiques, BP53 Bambey, Senegal.

N. Cissé,* M. Ndiaye, and A. Sène

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Registration of 'Beefmaker' Intermediate Wheatgrass

'Beefmaker' intermediate wheatgrass [*Elytrigia intermedia* (Host) Nevski subsp. *intermedia* = *Thinopyrum intermedium* subsp. *intermedium* (Host) Barkw. & D.R. Dewey] (Reg. no. CV-26, PI 634505) is a broadly adapted cultivar that produces forage with high in vitro dry matter digestibility (IVDMD) and high protein concentration in the tall, mid-grass, and shortgrass ecoregions of the central Great Plains, USA. It was released in January 2003 by the USDA, Agricultural Research Service and the Agricultural Research Division, Institute of Agricultural and Natural Resources, University of Nebraska. Beefmaker was tested as NE TI1 C1.

Beefmaker intermediate wheatgrass was developed from six plant introductions (PI 345586, PI 273733, PI 273732, PI 315353, PI 315067, and PI 3155355) that were identified as having superior agronomic performance in the central Great Plains in a germplasm evaluation (Vogel, 1980). Approximately 40 plants from each PI strain were subdivided into ramets and were transplanted into separate, isolated polycross nurseries in 1978 at the University of Nebraska's Agricultural Research and Development Center near Ithaca, NE, where all subsequent selection and polycross research was conducted. Seed was harvested in bulk in 1979 from each of the polycross nurseries. This seed was used to establish space-transplanted selection nurseries in 1980 for each strain using greenhouse grown seedlings. Each selection nursery contained approximately 1000 plants. In 1981, approximately 100 plants were visually selected in each nursery for forage yield, leafiness, erectness, and absence of diseases by using a modified form of restricted recurrent phenotypic selection (RRPS) (Burton, 1974). The visually selected plants were harvested for forage yield and sampled for IVDMD analysis. A selection index that equally weighted forage yield and IVDMD was used to select 20 plants from each population (total of 120 plants). Two ramets of each of the 120 plants were transplanted into an isolated polycross nursery in 1983. Seed was harvested from individual plants in 1984 and equally bulked to form experimental strain NE TI1. This Syn 1 seed was used to establish a seeded nursery in 1985 for the production of Syn 2 seed which was used to initiate the first cycle of selection for the synthesized population.

A space-transplanted selection nursery containing 1100 plants was established in 1987 using greenhouse grown seedlings started with Syn 2 seed. A modified form of RRPS was used on this selection nursery. Three hundred plants were visually selected for harvest in 1988. These plants were harvested on an individual plant basis after spike emergence and were analyzed for IVDMD. A selection index was again used to identify plants with both superior yield and IVDMD. Sixty-five plants were selected for polycrossing and were subdivided into two ramets each and transplanted into an isolated polycross nursery in 1991. Seed harvested from this nursery was designated NE TI1 C1 Syn 1, and it was used to establish regional tests and a 400 m^2 increase nursery in 1999 which produced 18.6 kg of Breeder seed in 2000.

Beefmaker was tested across several ecoregions (Bailey, 1995) in the central Great Plains, specifically at the following sites: Prairie (Ithaca, NE), Steppe (Hays, KS), and Dry Steppe (Sidney, NE, and Cheyenne, WY) during the period 1993–1995. Beefmaker had the highest IVDMD and protein concentration averaged over ecoregions. Beefmaker forage averaged 7–20 g kg^{-1} greater IVDMD than forage of other released cultivars of intermediate wheatgrass in these trials. Beefmaker forage yields were lower than the yields of 'Haymaker' but were similar to yields of other released cultivars of intermediate wheatgrass. The improved forage quality of Beefmaker was stable across a wide array of ecoregions. In a previous grazing trial with intermediate wheatgrass at Ithaca in which Beefmaker's parent strain, NE TI1, was included, a one percentile or 10 g kg^{-1} increase in IVDMD resulted in a 25 kg ha^{-1} improvement in total gains of beef yearling stockers (Moore et al., 1995; Casler and Vogel, 1999). Beefmaker will be recommended for use in pastures in the central Great Plains for growing beef cattle.

Beefmaker has an erect growth habit and has rhizomes typical of intermediate wheatgrass. Its culms and leaves are glabrous and non-glacuous and leaf margins are smooth. Leaves are green-yellow or Munsell 5GY 5/4 (Munsell Color, 1977). Sheaths have ligules, very small auricles, and smooth sheath margins. Spikes are oblong, erect, and have green, lanceolate glumes. Spike density is lax. Anthers are yellow. At 41° N lat. in the central Great Plains, Beefmaker is at anthesis during the last week of June. In swards at Ithaca, its spike and flag leaf height are about 5 and 3 cm, respectively, shorter in height than the intermediate wheatgrass cultivars Luna, Manska, Reliant, and Oahe. Beefmaker is adapted to USDA Plant Hardiness Zones 3, 4, and 5.

Breeder seed will be jointly maintained and produced as needed by USDA-ARS and the University of Nebraska-Lincoln with random-mated isolations based on the Syn 2 Breeder seed produced in 2000. Foundation seed production of Beefmaker will be managed by the Nebraska Foundation Seed Division, University of Nebraska–Lincoln, Lincoln, NE 68583. Foundation seed will be made available for Certified seed production on a non-exclusive basis to seed producers who contractually agree to produce and market the seed only as Certified seed using the cultivar name Beefmaker. A technology development and transfer fee will be assessed by the University of Nebraska. Seed of this release will be deposited in the National Plant Germplasm System (USDA-ARS, 2004) where it will be available for research purposes. Limited amounts of seed for research purposes will be provided on written request to the corresponding author. Recipients are asked to recognize the source if it contributes to the development of a cultivar or germplasm or is used for other research purposes. Application for U.S. Plant Variety Protection is pending.

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Registration of 'Haymaker' Intermediate Wheatgrass

'Haymaker' intermediate wheatgrass [*Elytrigia intermedia* (Host) Nevski subsp. *intermedia* = *Thinopyrum intermedium* subsp. *intermedium* (Host) Barkw. & D.R. Dewey] (Reg. no. CV-27, PI 634506) is a broadly adapted cultivar that produces high, stable forage yields when used for cool-season grass hay production or for pastures in the tall, mid-grass, and shortgrass ecoregions of the central and northern Great Plains. It was released in April 2003 by USDA-ARS; Agricultural Research Division, Institute of Agricultural and Natural Resources, University of Nebraska-Lincoln; and USDA-NRCS. Haymaker was tested under the experimental designation NE TI3.

Haymaker is a synthetic cultivar or population produced by intermating selected plants from intermediate wheatgrass germplasm accessions and an adapted cultivar, Slate (Newell, 1974). The accessions originated from collections made by Douglas Dewey, USDA-ARS Plant Geneticist, in the former USSR in 1977. Three accessions with high forage yields, in vitro dry matter digestibility (IVDMD), and overall forage evaluation scores were identified. Superior plants in these accessions and from 'Slate' were identified prior to flowering in 1985 in an evaluation nursery at Mead, NE. All other plants were mowed and seed was harvested from the selected plants. The evaluation nursery had 20 plants of each accession. The accessions and the number of plants (in parentheses) selected from each accession were as follows: PI 440015 (15), PI 440008 (10), PI 440011 (17), and Slate (12). The harvested seed was used to establish an increase nursery of the strain designated NE TI3 in the fall of 1985. The increase nursery contained 1100 spaced plants which produced the Syn 2 seed of NE TI3 used to establish evaluation trials in the Great Plains.

Haymaker was tested across several ecoregions (Bailey, 1995) of the central and northern Great Plains at the following sites: Prairie (Mead, NE), Steppe (Hays, KS; Ft. Pierre, SD), Dry Steppe (Sidney, NE; Cheyenne, WY; Hettinger, ND) during the period 1990–1997. Haymaker had the greatest average forage yields at both the central and northern Great Plains sites when compared with released cultivars and other experimental strains of intermediate wheatgrass. The forage quality of Haymaker as measured by IVDMD and protein concentration is less than that of 'Beefmaker' (Vogel et al., 2005), but is similar to that of other released cultivars of intermediate wheatgrass. Haymaker is recommended for dryland hay production in the central and northern Great Plains, USA in USDA Plant Hardiness Zones 3, 4, and 5 (Cathey, 1990).

Haymaker has an erect growth habit and has rhizomes typical of intermediate wheatgrass. Its culms and leaves are glabrous and non-glacuous, and leaf margins are smooth. Leaves are green-yellow or Munsell 5GY 5/4 (Munsell Color, 1977). Sheaths have ligules, auricles are usually absent, and sheath margins are smooth. Spikes are oblong, erect, and have green, lanceolate glumes. Spike density is lax. Anthers are yellow. At 41° N lat. in the central Great Plains, Haymaker has anthesis the last week of June. The spike height of Haymaker varies with environment but is typically taller than other intermediate wheatgrasses and has a wider flag leaf.

Breeder seed will be jointly maintained and produced as needed by USDA-ARS and the University of Nebraska-Lincoln with random-mated isolations based on the Syn 2 seed used in evaluation trials. Foundation seed production of Haymaker will be managed by the Nebraska Foundation Seed Division, University of Nebraska-Lincoln, Lincoln, NE 68583. Foundation seed will be made available for Certified seed production on a non-exclusive basis to seed producers who contractually agree to produce and market the seed only as Certified seed using the cultivar name Haymaker. A technology development and transfer fee will be assessed by the University of Nebraska.

Limited amounts of seed for research purposes will be provided upon written request to the corresponding author. Recipients are asked to recognize the source if it contributes to the development of a cultivar or germplasm or is used for other research purposes. U.S. Plant Variety Protection will be sought for Haymaker.

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Registration of 'NU-ARS AC2' Crested Wheatgrass

'NU-ARS AC2' crested wheatgrass [*Agropyron cristatum* (L.) Gaertn.–*A. cristatum* var. *pectinatum* (M. Bieb.) Tzvelev] (Reg. no. CV-28, PI 634507) is a broadly adapted, complex composite population produced by allowing selected plants from fairway-type germplasm accessions to randomly intermate. It originates from collections made by Douglas Dewey, USDA-ARS Plant Geneticist, in the former USSR in 1977. It was released in September 2002 by USDA-ARS; Agricultural Research Division, Institute of Agricultural and Natural Resources, University of Nebraska-Lincoln; and the USDA-NRCS. NU-ARS AC2 was tested under the experimental designation NE AC2.

Seed of fairway-type crested wheatgrass accessions obtained from Dewey's collections were used to establish evaluation trials at Mead and Alliance, NE. Accessions were evaluated during the period 1979–1983 in space-transplanted evaluation trials. Four accessions with high forage yields, high in vitro dry matter digestibility (IVDMD), and overall superior forage evaluation ratings were identified. Superior plants of these accessions were visually selected in the evaluation nursery at Mead, NE, in 1985 prior to anthesis. All non-selected plants in the evaluation nursery were mowed prior to anthesis and seed was harvested and bulked from the selected plants. The Dewey accessions and the numbers of plants selected from each accession to form NU-ARS AC-2 were as follows: D-1458 (18), D-1462 (6), D-1610 (13), and D-1654 (9). The Dewey accessions have been entered into the USDA Plant Germplasm System. D-1458 was a single plant collection (D.R. Dewey, personal communication, 1980) which was combined with D-1457 to form PI 440062. D-1462 was a bulk collection and assigned PI 439922. Both PI 440062 and PI 439922 are fairway-like in appearance and were collected from a site 52 km southeast of Stavropol, Russia. PI 440062 has subsequently been classified as *A. cristatum* var. *pectinatum* and is a tetraploid. D-1610 was assigned PI 439926 and D-1654 was assigned PI 439929. PI 439926 and PI 439929 were classified as *A. cristatum*. PI 439926 was collected on a seeded site near Stavropol, Russia and believed to be the cultivar Krasnokovskii 305 (D.R. Dewey, personal communication, 1980). PI 439929, a diploid, was collected about 50 km southeast of Svetlograd, Russia. Bulked seed from selected plants was used to establish an increase nursery in the fall of 1985 at Mead, NE. Seed harvested from the increase nursery (Syn 2 generation) produced the synthesized population, NE AC2, which was used to plant evaluation trials.

NU-ARS AC2 was tested across several eco-regions (Bailey, 1995) in the Central and Northern Great Plains at the following sites; Prairie (Mead, NE), Steppe (Hays, KS; Ft. Pierre, SD), Dry Steppe (Sidney, NE; Cheyenne, WY; Hettinger, ND) during the period 1990–1997. In both the Central and Northern Plains locations, NU-ARS AC2 had greater average forage yields than the other fairway-type crested wheatgrass entries and was equivalent to the best standard crested wheatgrass cultivars. The in vitro dry matter digestibility (IVDMD) and protein content of NU-ARS AC2 was similar to that of the other strains and cultivars evaluated. Seed yields were 200 and 260 kg ha^{-1} in 2000 and 2001, respectively, under rainfed conditions at Mead, NE.

NU-ARS AC2 has an erect, caespitose growth habit typical of crested wheatgrasses. Its culms and leaves are glabrous and non-glacuous, and leaf margins are smooth. Leaves are green-yellow or Munsell 5GY 4/4 (Munsell Color, 1977). Sheaths have ligules, sheath margins are smooth, and auricles are absent. Spikes are dense, tapering, erect, and have green, lanceolate, awned glumes. At 41° N lat. in the central Great Plains, NU-ARS AC2 heads the last 10 d of May. Approximately 95% of the plants in a population of NU-ARS AC2 are diploids, the remainder are tetraploids. No triploids were identified in almost 100 seedlings produced from Breeder seed. Although NU-ARS AC2 is genetically heterogeneous, it is similar in phenotypic uniformity to other fairway-type crested wheatgrasses. It is typically about 3–5 cm taller in height than *A. cristatum* cultivars such as Fairway or Parkway and 10 to 12 cm in height shorter than *A. desertorum* or standard crested wheatgrass cultivars such as HyCrest and Nordan. Spike length is shorter and spike width is greater than standard crested wheatgrass cultivars. NU-ARS AC-2 is adapted to USDA Plant Hardiness Zones 3, 4, and 5 (Cathey, 1990).

Breeder seed will be jointly maintained and produced as needed by USDA-ARS and the University of Nebraska-Lincoln with random mated isolations based on the Syn 2 Breeder seed. Foundation seed production of NU-ARS AC2 will be managed by the Nebraska Foundation Seed Division, University of Nebraska-Lincoln, Lincoln, NE 68583. Foundation seed will be made available for Certified seed production on a nonexclusive basis to seed producers who contractually agree to produce and market the seed only as Certified seed using cultivar name NU-ARS AC2. A fee for technology development and transfer will be assessed by the University of Nebraska. Limited amounts of seed for research purposes will be provided upon written request to the corresponding author. Recipients are asked to recognize the source if it contributes to the development of a cultivar or germplasm or is used for other research purposes. U.S. Plant Variety Protection will be sought for NU-ARS AC2.

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Registration of 'McCormick' Wheat

'McCormick' (Reg. no. CV-959, PI 632691) is a soft red winter wheat (*Triticum aestivum* L.) developed and released May 2002 by the Virginia Agricultural Experiment Station. McCormick wheat was named in tribute of Robert Hall of Walnut Grove in Rockbridge County, VA, and his sons, including Cyrus Hall McCormick, William Sanderson McCormick, and Leander James McCormick. Their inventing, perfecting, manufacturing, and marketing of the mechanical grain reaper ushered in the era of modern agriculture and wrought one of the greatest advancements in agricultural history. McCormick wheat is broadly adapted and has performed well over most of the soft red winter wheat production region. In addition to high grain yield and volume weight, McCormick provides the wheat industry with a good pastry-quality cultivar that has resistance to most disease and insect pests prevalent in the region.

McCormick was derived from the cross VA92-51-39/AL870365. The parentage of VA92-51-39 is IN71761A4-31-5-48//VA71-54-147 (CItr 17449)/'McNair 1813' (CItr 15289). Wheat line IN71761A4-31-5-48 was developed by Purdue University and has the pedigree 'Benhur' (CItr 14054)/3/'Arthur' (CItr 14425)/'Knox' (CItr12798) type line/4/'Beau' (CItr17420)*2/3/Arthur*2//'Riley' (CItr 13702)/'Bulgaria 88' (PI 94407). The Knox type line has gene *H5* for Hessian fly [*Mayetiola destructor* (Say)] resistance. The parental line AL870365 was derived from the cross 'Coker 747' (CItr 17923)*2/'Amigo' (PI 578213) by the Coker Breeding Program now a part of Syngenta and was selected as a parent from the 1990–1991 USDA-ARS Uniform Eastern Soft Red Winter Wheat Nursery. McCormick possesses the 1AL.1RS translocation derived from AL870365, which inherited it from Amigo (Sebesta et al., 1995). The cross from which McCormick originated was made in spring 1992, and the F_1 generation was grown in the field at Warsaw, VA, as a single 1.2-m headrow in 1993 to produce F_2 seed. The population was advanced from the F_2 to F_4 generation using a modified bulk breeding method. Wheat spikes were selected from the population in each segregating generation (F_2–F_3) on the basis of disease resistance, early maturity, short straw, and desirable head shape and size. Selected spikes were threshed in bulk, and the seed was planted in a 20.8-m^2 block in the fall of each year. Spikes selected from the F_4 bulk were threshed individually and planted in separate 1.2-m headrows at Warsaw, VA. McCormick was derived as a bulk of one of these $F_{5:6}$ headrows selected in 1997 on the basis of earliness of head emergence, short plant height, and resistance to powdery mildew [caused by *Erisyphe graminis* DC. f. sp. *tritici* Ém. Marchal; syn. *Blumeria graminis* (DC) E.O. Speer] and leaf rust (caused by *Puccinia triticina* Eriks.). Before its release, McCormick was evaluated as VA98W-591 in Virginia's official variety trials and throughout the soft red winter wheat region in the USDA-ARS Uniform Southern and Uniform Eastern Soft Red Winter Wheat Nurseries in 2001 and 2002.

Coleoptiles of McCormick are red. Juvenile plants exhibit a prostrate growth habit. Plant color at boot stage is green and a waxy bloom is present on the stem and flag leaf sheath. Plants grown in greenhouse have yellow anther color, while those grown under field conditions often have reddish-purple anther color. Straw color is reddish purple at physiological maturity. Spikes are tapering, middense, and awnleted. Glumes are short and midwide, and have rounded shoulders with acute beaks. Kernels are red, soft, and ovate with a narrow and shallow crease, rounded cheeks, and a short non-collared brush. The phenol reaction is brown.

Head emergence of McCormick is 1 to 3 d later than 'AGS 2000' and 1 to 2 d earlier than 'Roane'. Average plant height of McCormick (79 cm) is similar to that of 'Coker 9835' and

5–8 cm shorter than AGS 2000. On the basis of Belgian lodging (Szoke et al., 1979) scale (0.2–10), average straw strength of McCormick is good (0.9) and better than that of 'Coker 9663' (2.2). On the basis of data (9 yr-locations) from 2001 and 2002 Uniform Eastern Soft Red Winter Wheat Nurseries, average winter survival of McCormick (73%) is similar to that of 'Agri-Pro Foster' (72%) and Roane (72%).

In Virginia's State Variety Trials conducted under a conventional tillage regime from 2000 through 2002 (15–18 yr-locations), average grain yield of McCormick (5690 kg ha^{-1}) was similar ($P \geq 0.05$) to those of the highest yielding commercial cultivars Pioneer Brand 26R24, Sisson, Tribute, and USG 3209. In Virginia's No-till Variety Trial, conducted at Warsaw, VA, to evaluate performance of wheat genotypes drilled into shredded maize stubble, McCormick had a 3-yr average grain yield (6335 kg ha^{-1}) similar ($P \geq 0.05$) to those of the top-yielding cultivars Pioneer Brand 26R24, Sisson, SS 520, and Tribute. McCormick has high grain volume weight (768 kg m^{-3}), which is similar to that of Tribute (772 kg m^{-3}) and significantly ($P \leq 0.05$) higher than those of Pioneer Brand 26R24, Sisson, SS 520, and USG 3209 (737–746 kg m^{-3}).

McCormick was evaluated for 2 yr (20–22 locations per year) in the Uniform Southern Soft Red Winter Wheat Nursery. McCormick (5125 kg ha^{-1}) ranked first among 43 entries for grain yield in the 2001 nursery compared with the highest yielding check cultivar AGS 2000 (4905 kg ha^{-1}) which ranked fourth. In the 2002 nursery, McCormick (4145 kg ha^{-1}) ranked third among 40 entries for grain yield compared with AGS 2000 (4085 kg ha^{-1}) which ranked fourth. McCormick ranked sixth for grain volume weight (761 kg m^{-3}) in 2001 and fifth (750 kg m^{-3}) in 2002. During the same period, McCormick was evaluated (19–24 locations per year) in the Uniform Eastern Soft Red Winter Wheat Nursery. McCormick (5595 kg ha^{-1}) ranked second among 44 entries for grain yield in 2001 compared with the highest yielding check cultivar Roane (5570 kg ha^{-1}) which ranked third. In the 2002 nursery, McCormick (5155 kg ha^{-1}) ranked seventh among 44 entries for grain yield compared with Roane (4930 kg ha^{-1}) which ranked 16th. McCormick ranked fifth for grain volume weight (773 kg m^{-3}) in 2001 and third (765 kg m^{-3}) in 2002.

McCormick has been evaluated for reaction (0 = no visible symptoms to 9 = severe infection) to most disease and insect pests prevalent in the soft red winter wheat production regions in the 2001 and 2002 Uniform Southern and Uniform Eastern Soft Red Winter Wheat Nurseries. McCormick is resistant (score = 0.4, n = 28 environments) to powdery mildew. McCormick possesses the *Pm*17 gene from Amigo in addition to other non-identified genes on the basis of seedling tests conducted in 2001 by USDA-ARS Plant Science Research Unit in Raleigh, NC, in which McCormick expressed resistance to 24 of 30 isolates of *Erisyphe graminis* DC. f. sp. tritici. Reaction of McCormick to leaf rust has varied from resistant (score = 0) to moderately susceptible (score = 6) with an average score of 1.3 over 37 environments. McCormick is resistant (score = 0.5) to stem rust (cause by *Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn.). Assessments of seedling reaction of McCormick to differential races of *Puccinia triticina* and *Puccinia graminis*, conducted by the USDA-ARS Cereal Disease Laboratory in St. Paul, MN, indicate that McCormick possesses gene *Lr*24 conferring resistance to leaf rust and genes *Sr*6, *Sr*17, and *Sr*24 conferring resistance to stem rust. McCormick has been resistant (score = 1.1, n = 8) to predominant races of *Puccinia striiformis* Westend., prevalent in the Mississippi Delta and Great Plains regions, but is susceptible (score = 8) to stripe rust in the Pacific Northwest. McCormick is resistant to *Wheat soil borne mosaic virus* (score = 1.7, n = 6) and *Wheat spindle streak mosaic virus* (score = 1.6, n = 4). It is moderately resistant (score = 3.7, n = 14) to *Barley yellow dwarf virus*. McCormick is moderately resistant to leaf blotch caused by *Septoria tritici* Roberge in Desmaz. (score = 2.5, n = 15) and glume blotch caused by *Stagonospora nodorum* (Berk.) Castellani & E.G. Germano (score = 3.4, n = 5). It is moderately susceptible (score = 5.5, n = 2) to tan spot caused by *Pyrenophora tritici-repentis* (Died.) Drechs. McCormick is moderately resistant to Fusarium head blight (FHB) caused by *Fusarium graminearum* Schwabe on the basis of disease assessments made in the 2001 Uniform Southern and Uniform Northern Soft Red Winter Wheat FHB Screening Nurseries at 13 locations. In the Uniform Southern FHB Nursery, FHB Index (1–100), Scabby Seed (%), and Deoxynivalenol (DON, in micrograms per gram) values for McCormick (12, 23%, and 6.0 μg g^{-1}) were similar to those of the resistant check cultivar Ernie (7, 18%, 6.6 μg g^{-1}). In the Northern Uniform Scab Nursery, McCormick (17, 9.7%, and 7.4 μg g^{-1}) and Ernie (19, 17%, 7.9 μg g^{-1}) also had similar values for these three FHB assessment parameters. Seedlings of McCormick are susceptible to Hessian fly biotypes GP, B, C, D, E, and L on the basis of tests conducted in a growth chamber by USDA-ARS at West Lafayette, IN.

On the basis of Allis-Chalmers milling and quality evaluations conducted in 2002 by the USDA-ARS Soft Wheat Quality Laboratory in Wooster, OH, milling and baking quality of McCormick is most similar to that of Sisson. Grain of McCormick had values of 775 g kg^{-1} for straight grade flour yield, 8.9% for endosperm separation index, 59% for alkaline water retention capacity, 30.3% for break flour recovery, and 17.8 cm for cookie spread diameter. In comparison, grain of Sisson had values of 777 g kg^{-1} for straight grade flour yield, 9.9% for endosperm separation index, 58.1% for alkaline water retention capacity, 29.7% for break flour recovery, and 17.8 cm for cookie spread diameter. Flour protein concentration of McCormick (8.29%) is higher than that of Sisson (7.9%), and on the basis of Lactic Acid Retention Capacity, glutenin strength of McCormick (120%) is stronger than that of Sisson (94%). Milling and baking quality of McCormick also was evaluated in tests coordinated by the Wheat Quality Council in 2001.

Initial Breeder seed of McCormick was developed in 2000 via removal of visual variants from a 0.05-ha F_8 purification block and provided to the Foundation Seed Farm of Virginia Crop Improvement Association (VCIA). In fall 2001 grain from 136 F_9 headrows, selected on the basis of homogeneity and trueness of type and harvested individually, was planted in 10.6 m^2 plots. Grain from 97 of these plots was harvested in bulk to form a purer source of McCormick Breeder seed and was provided to the VCIA Foundation Seed Farm during fall 2002. Authorized seed classes of McCormick are Breeder, Foundation, and Certified. McCormick is protected under the amended U.S. Plant Variety Protection Act of 1994 (Certificate no. 200300115). The Department of Crop and Soil Environmental Sciences and the Virginia Agricultural Experiment Station, Blacksburg, VA, will maintain Breeder seed. Requests for availability of Foundation seed should be directed to Bruce Beahm, Manager, Foundation Seed Farm, Mt. Holly, VA 22524.

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Registration of 'Tribute' Wheat

'Tribute' (Reg. no. CV-958, PI 632689) is a soft red winter wheat (*Triticum aestivum* L.) developed and released May 2002 by the Virginia Agricultural Experiment Station. Tribute is broadly adapted and has performed well over most of the soft red winter wheat production regions in the U.S.A. and Canada. Tribute was granted a three year interim registration (Reg. no. I-303) in Canada for Ontario, Quebec, and the Atlantic Provinces of Newfoundland, Prince Edward Island, New Brunswick, and Nova Scotia in October 2003. In addition to high grain yield and volume weight, Tribute provides the wheat industry with a strong gluten cracker-quality cultivar that has resistance to most disease and insect pests prevalent in the region.

Tribute was derived from the cross VA92-51-39/AL870365. The parentage of VA92-51-39 is IN71761A4-31-5-48//VA71-54-147 (CItr 17449)/'McNair 1813' (CItr 15289). Wheat line IN71761A4-31-5-48 was developed by Purdue University and has the pedigree 'Benhur' (CItr 14054)/3/'Arthur' (CItr 14425)/'Knox' (CItr12798) type line/4/'Beau' (CItr17420)*2/3/Arthur*2//'Riley' (CItr13702)/'Bulgaria 88' (PI 94407). The Knox type line has gene *H5* for Hessian fly [*Mayetiola destructor* (Say)] resistance. The parental line AL870365 was derived from the cross 'Coker 747' (CItr17923)*2/'Amigo' (PI 578213) by the Coker Breeding Program now a part of Syngenta and was selected as a parent from the 1990–1991 USDA-ARS Uniform Eastern Soft Red Winter Wheat Nursery. Tribute possesses the 1AL.1RS translocation derived from AL870365, which inherited it from Amigo (Sebesta et al., 1995). The cross from which Tribute originated was made in spring 1992, and the F_1 generation was grown in the field at Warsaw, VA, as a single 1.2-m headrow in 1993 to produce F_2 seed. The population was advanced from the F_2 to F_4 generation using a modified bulk breeding method. Wheat spikes were selected from the population in each segregating generation (F_2–F_3) on the basis of disease resistance, early maturity, short straw, and desirable head shape and size. Selected spikes were threshed in bulk, and the seed was planted in a 20.8-m^2 block in the fall of each year. Spikes selected from the F_4 bulk were threshed individually and planted in separate 1.2-m headrows at Warsaw, VA. Tribute was derived as a bulk of one of these $F_{5:6}$ headrows selected in 1997 on the basis of earliness of head emergence, short plant height, and resistance to powdery mildew [caused by *Erisyphe graminis* DC f. sp. *tritici* Ém. Marchal; syn. *Blumeria graminis* (DC) E.O. Speer] and leaf rust (caused by *Puccinia triticina* Eriks.). Prior to its release, Tribute was evaluated as VA98W-593 in Virginia's official variety trials and throughout the soft red winter wheat region in the USDA-ARS Uniform Southern and Uniform Eastern Soft Red Winter Wheat Nurseries from 2000 to 2002.

Coleoptiles of Tribute are white. Juvenile plants exhibit a prostrate growth habit. Plant color at boot stage is green and a waxy bloom is present on the stem and flag leaf sheath. Anther color is yellow and straw color is yellow at physiological maturity. Spikes are tapering, middense, and awnleted. Glumes are short and midwide, and have rounded shoulders with obtuse beaks. Kernels are red, soft, and ovate with a narrow and deep crease, rounded cheeks, and a medium non-collared brush. The phenol reaction is brown.

Head emergence of Tribute is 2 days later than 'AGS 2000' and 2 days earlier than 'Roane'. Average plant height of Tribute (84 cm) is 3 cm taller than 'Coker 9835' and 5 cm shorter than AGS 2000. Average straw strength (score = 1.5) of Tribute is good on the basis of Belgian lodging (Szoke et al., 1979) scale (0.2–10). On the basis of data (9 yr-locations) from 2001 and 2002 Uniform Eastern Soft Red Winter Wheat Nurseries, average winter survival of Tribute (73%) is similar to that of 'AgriPro Foster' (72%) and Roane (72%).

In Virginia's State Variety Trials conducted under a conventional tillage regime from 2000 through 2003 (15–18 yr-locations), average grain yield of Tribute (5780 kg ha^{-1}) was similar ($P \geq 0.05$) to those of the highest yielding commercial cultivars McCormick, SS 520, SS 550, Sisson, and USG 3209. In Virginia's No-till Variety Trial, conducted at Warsaw, VA, to evaluate performance of wheat genotypes drilled into shredded maize stubble, Tribute had a 3-yr average grain yield (6360 kg ha^{-1}) similar ($P \geq 0.05$) to those of the top yielding cultivars McCormick, Pioneer Brand 26R24, Sisson, SS 520, SS 550, and SS 560. Tribute has high grain volume weight (772 kg m^{-3}), which is similar to that of McCormick (768 kg m^{-3}) and significantly ($P \leq 0.05$) higher than those of Pioneer Brand 26R24, Sisson, SS 520, SS 550, SS 560, and USG 3209 (737–746 kg m^{-3}).

Tribute was evaluated for three years (20–22 locations per yr) in the Uniform Southern Soft Red Winter Wheat Nursery. Tribute (5240 kg ha^{-1}) ranked second among 33 entries for grain yield in the 2000 nursery compared to the highest yielding check cultivar AGS 2000 (5530 kg ha^{-1}) which ranked first. In 2001, Tribute (4890 kg ha^{-1}) ranked sixth among 43 entries for grain yield compared to AGS 2000 (4905 kg ha^{-1}) which ranked fourth. In 2002, Tribute (4200 kg ha^{-1}) ranked first among 40 entries for grain yield compared to AGS 2000 (4085 kg ha^{-1}) which ranked fourth. Tribute had the highest grain volume weight (762–786 kg m^{-3}) among entries in all three years. During the same period, Tribute was evaluated (19–24 locations per year) in the Uniform Eastern Soft Red Winter Wheat Nursery. Tribute (5625 kg ha^{-1}) ranked third among 40 entries for grain yield in the 2000 nursery compared to the highest yielding check cultivar Roane (5740 kg ha^{-1}) which ranked first. In 2001, Tribute (5460 kg ha^{-1}) ranked tenth among 44 entries for grain yield compared to Roane (5570 kg ha^{-1}) which ranked third. In 2002, Tribute (5220 kg ha^{-1}) ranked fourth among 44 entries for grain yield compared to Roane (4930 kg ha^{-1}) which ranked 16th. Tribute had the highest grain volume weight (771–784 kg m^{-3}) among entries in all three years.

Tribute was evaluated for reaction (0 = no visible symptoms to 9 = severe infection) to most disease and insect pests prevalent in the soft red winter wheat production regions in the 2001 and 2002 Uniform Southern and Uniform Eastern Soft Red Winter Wheat Nurseries. Tribute is resistant (score = 0.4, n = 28 environments) to powdery mildew. Tribute possesses the *Pm*17 gene from Amigo in addition to other nonidentified genes on the basis of seedling tests conducted by USDA-ARS Plant Science Research Unit in Raleigh, NC, in which Tribute expressed resistance to 9 of 10 isolates of *Erisyphe graminis* f. sp. *tritici*. Reaction of Tribute to leaf rust has varied from resistant (score = 0) to moderately susceptible (score = 6) with an average score of 1.2 over 58 environments. Tribute is resistant to moderately resistant (score = 0−2) to stem rust (cause by *Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn.). Assessments of seedling reaction of Tribute to differential races of *Puccinia triticina* and *Puccinia graminis*, conducted by the USDA-ARS Cereal Disease Laboratory in St. Paul, MN indicate that Tribute possesses genes *Lr*9 and *Lr*24 conferring resistance to leaf rust and gene *Sr*24 conferring resistance to stem rust. Tribute has expressed moderate resistance (score = 2.8, n = 13) to predominant races of stripe rust (caused by *Puccinia striiformis* Westend.), prevalent in the Mississippi Delta and Great Plains regions, but is susceptible (score = 8) to stripe rust in the Pacific Northwest. Tribute is moderately resistant (score = 2.5, n = 6) to *Wheat spindle streak mosaic virus*, but susceptible (score = 6.3, n = 6) to *Wheat soil borne mosaic virus*. It is moderately resistant (score = 4.3, n = 21) to *Barley yellow dwarf virus*. Tribute is moderately resistant (score = 2.6, n = 29) to leaf blotch (caused by *Septoria tritici* Roberge in Desmaz.) and glume blotch [caused by *Stagonospora nodorum* (Berk.) Castellani & E.G. Germano] (score = 3.3, n = 6). It is moderately resistant (score = 4.5, n = 2) to tan spot [caused by *Pyrenophora tritici-repentis* (Died.) Drechs]. Tribute is moderately resistant to fusarium head blight (FHB) [caused by *Fusarium graminearum* (Schwabe)] on the basis of disease assessments made in the 2001 Uniform Southern and Uniform Northern Soft Red Winter Wheat FHB Screening Nurseries at 13 locations. In the Uniform Southern FHB Nursery, FHB Index (1–100), Scabby Seed (%), and Deoxynivalenol (DON, micrograms per gram) values for Tribute (15, 21%, and 4.3 $\mu g\ g^{-1}$) were similar to those of the resistant check cultivar Ernie (7, 18%, 6.6 $\mu g\ g^{-1}$). In the Northern Uniform Scab Nursery, Tribute (22, 7.2%, and 5.3 $\mu g\ g^{-1}$) and Ernie (19, 17%, 7.9 $\mu g\ g^{-1}$) also had similar values for these three FHB assessment parameters. Seedlings of Tribute are susceptible to Hessian fly biotypes GP, B, C, D, E, and L on the basis of tests conducted in a growth chamber by USDA-ARS at West Lafayette, IN.

Quadrumat milling and pastry baking quality of Tribute is most similar to that of 'Coker 9663' on the basis of analyses conducted by the USDA-ARS Soft Wheat Quality Laboratory in Wooster, OH using grain samples from Virginia's 2000 and 2001 State Variety Trials. On the basis of softness equivalent score, Tribute (48.8%) and Coker 9663 (48.7%) both produced flours that were slightly harder in texture than that of Sisson (50%). Flour yields of Tribute (708 $g\ kg^{-1}$) were similar to those of Coker 9663 (711 $g\ kg^{-1}$) but slightly lower than those of Sisson (717 $g\ kg^{-1}$). While flour Alkaline Water Retention Capacity of Tribute (62.5%) was higher than that of Coker 9663 (58%) and Sisson (59.2%), all three cultivars produced cookies of similar diameter (17.5–17.6 cm). Average flour protein concentration of Tribute (8.3%) was lower than those of Coker 9663 (8.8%) and (8.5%). Protein gluten strength of Tribute (126%) and Coker 9663 (124%); however, are significantly higher than that of Sisson (94%) on the basis of Lactic Acid Retention Capacity. Tribute possesses the 5 + 10 glutenin protein subunit on the basis of milling and baking quality tests coordinated by the Wheat Quality Council in 2000.

Initial Breeder seed of Tribute was developed in 2000 via removal of visual variants from a 0.05-ha F_8 purification block and provided to the Foundation Seed Farm of Virginia Crop Improvement Association (VCIA). In fall 2000, grain from 103 F_9 headrows, selected on the basis of homogeneity and trueness of type and harvested individually, was planted in 10.6-m^2 plots. Grain from 77 of these plots was harvested in bulk to form a purer source of Tribute Breeder seed and was provided to the VCIA Foundation Seed Farm during fall 2001. Authorized seed classes of Tribute in the U.S.A. are Breeder, Foundation, Registered, and Certified. Tribute is protected under the amended U.S. Plant Variety Protection Act of 1994 (Certificate no. 200300113). The Department of Crop and Soil Environmental Sciences and the Virginia Agricultural Experiment Station, Blacksburg, VA, will maintain Breeder seed. Requests for availability of seed in the U.S.A. should be directed to Greg St. Clair, Royster-Clark, 70 North Market St., Mt. Sterling, OH 43143. Authorized seed classes of Tribute in Canada are Breeder, Select, Foundation, Registered, and Certified. The Ridgetown College–University of Guelph, Ridgetown, ON, will maintain Breeder seed in Canada. Requests concerning availability of Tribute seed in Canada should be directed to C & M Seeds, 6180 5th Line Minto, Palmerston, ON, N0G 2P0, Canada.

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Registration of 'Dapps' Wheat

'Dapps' (Reg. no. CV-956, PI 633862), is a hard red spring wheat (*Triticum aestivum* L.) developed at North Dakota State University (NDSU) and released by the North Dakota Agricultural Experiment Station (NDAES) in July 2003. Dapps was released because it combines good yield and high quality end-use value for the domestic and export wheat markets.

Dapps was derived from the cross 'Kitt'/'Amidon'//'Grandin'/'Stoa' sib. Kitt (Heiner et al., 1976) (PI 518818) is a hard red spring wheat (HRSW) developed by the University of Minnesota in 1975; Amidon (PI 527682), Grandin (PI 531005), and Stoa (PI 520297) are HRSW developed at NDSU and released by NDAES in 1988, 1989, and 1987, respectively. The original cross of Dapps was made in the greenhouse in the spring of 1991 by Dr. R. Frohberg. Subsequently, F_1 and F_2 plants were grown in the greenhouse in fall 1991 and spring 1992, respectively. Seed from selected F_2 plants were grown as F_3 at the Prosper, ND, experimental station in summer of 1992. Ten selected spikes from each F_3 row were bulked and grown for observation at the Agronomy Seed Farm at Casselton, ND, as F_4 bulk in 1993. Similarly, ten selected spikes from the F_4 bulk were threshed individually and sown as $F_{4:5}$ lines in 1.2-m head rows at the Agronomy Seed Farm at Casselton, ND. Spikes selected at each generation were based on agronomic traits and prevalent disease reactions. Dapps was produced from a bulk of one $F_{4:5}$ head row selected in 1994 at Casselton. Dapps was entered into a preliminary yield trial as an $F_{4:6}$ line at Casselton and Prosper, ND, in 1995 and subsequently was tested in advanced and elite yield trials in four locations in North Dakota from 1996 to 1998. Dapps was then tested as ND724 in ND State Trials from 1999 to 2002 and in the Uniform Regional Nursery (URN) conducted from 1999 to 2000 in the states of North Dakota, Minnesota, South Dakota, Nebraska, Montana, Wyoming, Washington, and Manitoba, Canada. Dapps was tested for agronomic and quality traits over 55 location-years from 1996 to 2000.

Dapps is an awned cultivar with mid-dense, erect, and tapering spikes. The culms are white and the peduncle is slightly recurved. The awns are white and 10–12 cm in length. The glumes are medium, white, elevated, and acuminate; the shoulder and beak are medium width. The kernels are rounded, hard, red, and oval; the germ is midsized; and the brush is medium. Plant height of Dapps (93 cm) is similar to 'Keene' (PI 598224), an NDSU HRSW cultivar released in 1996, and 12 cm taller than Alsen (PI 615543). Dapps is similar to Grandin in heading date (61 d after planting), 1 d later than Alsen and 1 d earlier than Keene. Dapps is resistant to grain shattering and has straw strength that is similar to Alsen.

Mean grain yield of Dapps over 32 locations/years in ND State trials and advanced yield nurseries was 3110 kg ha^{-1}, similar to 'Parshall' (PI 613587) (2934 kg ha^{-1}) and Alsen (3005 kg ha^{-1}), but less than 'Reeder' (PI 613586) (3454 kg ha^{-1}). Parshall and Reeder are HRSW cultivars developed at NDSU and released by NDAES in 1999. While Parshall is a high quality cultivar used as the standard quality check, Alsen is the first HRSW cultivar released with resistance Fusarium head scab (FHB) [caused by *Fusarium graminearum* Schwabe; teleomorph *Gibberella zeae* (Schweinitz) Petch]. However, Reeder is adapted to drought-prone regions of western North Dakota. In 33 location-years tests in the 1999–2000 URN (Busch, 1999; 2000), Dapps yielded 3447 kg ha^{-1} compared to 3575, 3655, and 2681 kg ha^{-1} for Keene, Verde (PI 592561), and Chris (CItr 13751), respectively.

Mean grain volume of Dapps (770 kg m^{-3}) over 19 location-years was lower than Alsen (788 kg m^{-3}) and Parshall (801 kg m^{-3}), but slightly higher than 'McNeal' (PI 574642) (757 kg m^{-3}). However, grain protein of Dapps was high (166 g kg^{-1}) compared to Alsen (155 g kg^{-1}), Reeder (153 g kg^{-1}), and Parshall (155 g kg^{-1}). Similarly, flour yield for Dapps averaged 695 g kg^{-1} compared to 681, 687, and 676 g kg^{-1} for Alsen, Parshall, and Reeder, respectively. Water absorption was 66.4%, more than Reeder (64.7%), Parshall (65.1%), and Alsen (65.8%). Mixogram mix time (after 3 h fermentation) was 2.20 min, similar to Alsen and Parshall, but greater than Reeder (1.95 min). The mixing tolerance scored (21.0 min) higher than Alsen (18.4 min), Parshall (19.4 min), and Reeder (14.9 min). Loaf volume was 1130 mL, comparable to Parshall (1130 mL), but greater than Alsen (1075 mL) and Reeder (1032 mL).

On the basis of reactions at 12 sites in 2001–2003 and seedling screening under greenhouse conditions, Dapps exhibited a resistant reaction to pathotype THBL, the predominant race of leaf rust (caused by *Puccinia triticina* Eriks.) in the region. Dapps was evaluated at the USDA-ARS, Cereal Crop Research Unit, Fargo, ND, for resistance to stem rust (caused by *Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn) and was found to be highly resistant to pathotypes Pgt-QCCJ, -QTHJ,-RTQQ,-TMLK,-TPMK, and-HPHJ. On a scale of 1–5 where 1 is resistant and 5 susceptible, Dapps had an average scores of 3 and 2 in reaction to Septoria nodorum [caused by *Stagonospora nodorum* (Berk.) Castellani & E.G. Germano] and tan spot [caused by *Pyrenophora tritici-repentis* (Died.) Drechs] compared to 5 and 5 for the susceptible cultivar Alsen and 2 and 1 for the resistant check 'Erik' (PI 476849), respectively. Dapps was also more susceptible to FHB based on 6 location-years of the URN conducted between 1999 and 2002 (Busch, 1999, 2000); and field observations at three locations of scab nurseries conducted from 1999 to 2002 under mist irrigation and artificial inoculation.

Breeder seed of Dapps will be maintained by the Seed Stocks Project, Agricultural Experiment Station, North Dakota State Univ., Fargo ND 58105-5051. Dapps is protected under the U.S. Plant Variety Protection Act for Foundation, Registered, and Certified seed (PVP Certificate no. 200300316).

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Registration of 'Truman' Wheat

'Truman' soft red winter wheat (*Triticum aestivum* L.) (Reg. no. CV-957, PI 634824) was developed by the Missouri Agricultural Experiment Station and released in July 2003. Truman originated from the cross MO 11769/'Madison' which was made in 1990. MO 11769 was from the cross 'Kawvale'/'Vigo'//'Directeur Journee'/3/W7510/4/'NS 314'/'Stoddard'. W7510 is a full sib of 'Hart'. The F_1 through F_3 generations were advanced in the field at the Agronomy Research Center near Columbia, MO, using the bulk method with no selection. In 1993, F_3–derived F_4 selections were made on the basis of maturity, height, general disease resistance, and over-all plant architecture. Selections were advanced using the pedigree method in 1-m head-rows in 1994 and 1995. During the summer of 1995, head-row 11 010 was bulked and entered into preliminary yield testing in 1996 as the F_5–derived F_7 line MO 960304. MO 960304 was variable for height and maturity and was reselected in 1996. Truman was an F_7–derived F_8 re-selection from MO 960304. It was grown in an individual head row in 1997, hand harvested, and re-entered as an F_9 line in preliminary yield testing in 1998. Truman (tested as MO 980525) was released for its high grain yield, good test weight, and broad-based resistance to Fusarium head blight [caused by *Fusarium graminearum* Schwabe; telomorph: *Gibberella zeae* Schweinitz (Petch)]. The name Truman was chosen to recognize Harry S. Truman, a farmer from Lamar, Missouri who became the 33rd President of the USA.

Truman is a white-chaffed, apically awnletted, soft red winter wheat with mid-long, mid-dense tapered spikes. The coleoptiles are white and anthers are yellow. Glumes are white, mid-long and mid-wide with an oblique, mid-wide shoulder. The beak is mid-wide, acute, and averages 0.75 mm in length. Kernels of Truman are red, ovate, short to midlong (ranging from 5.5–6.5 mm) with rounded cheeks and a narrow, middeep crease. The brush is midsized, with mid-long hairs and has no collar. The germ is midsized.

Truman is a full-season variety. It heads approximately 4, 5, and 8 d later than 'Agripro Foster', 'Roane', and 'Ernie', respectively. Although Truman heads later than most varieties, this difference is reduced by 2–3 d at harvest maturity (Shawn Conley, Agronomy Dep., Univ. of Missouri, personal communication). Harvest maturity is comparable to 'Cardinal'. Truman was tested in the Missouri Winter Wheat Performance Trials from 2001 through 2003 (McKendry et al., 2003). Across 21 location-years of Missouri testing, the average yield of Truman was 4589 kg ha^{-1} compared with 4730 kg ha^{-1} for the top yielding variety, 'Pioneer Variety 25R37'. During the same period, Roane had a mean yield of 4354 kg ha^{-1} and Ernie had a mean yield of 3931 kg ha^{-1}. The average grain volume weight of Truman was 749 kg m^{-3}, 21 kg m^{-3} and 2 kg m^{-3} higher than Ernie and Pioneer Variety 25R37, respectively, and 13 kg m^{-3} lower than Roane. Truman was evaluated in the USDA-ARS Uniform Eastern Soft Red Winter Wheat Nursery (UESRWWN) in 2001 and 2002 (harvest years). Across 26 locations in 2001, Truman had a mean yield of 5266 kg ha^{-1}, compared with a mean yield of 5160 kg ha^{-1} for Roane and 5221 kg ha^{-1} for 'Agripro Patton', the check varieties in this nursery. Across 31 locations of the UESRWWN in 2002, Truman had a mean yield of 4515 kg ha^{-1} compared with mean yields of 4663 kg ha^{-1} and 4744 kg ha^{-1} for Roane and Agripro Patton, respectively. The average grain volume weight for Truman in the 2001 UESRWWN was 759 kg m^{-3}, 9 kg m^{-3} higher than Agripro Patton and 18 kg m^{-3} lower than Roane while in the 2002 nursery, it averaged 743 kg m^{-3}, 2 kg m^{-3} higher than Agripro Patton and 27 kg m^{-3} lower than Roane.

Truman is a moderately tall variety, approximately 1 cm taller than Agripro Patton and 12 cm taller than Roane and Ernie. It has good straw strength and stands well in most environments. When scored on a scale of 1 (erect) to 9 (flat) under conditions of heavy lodging pressure, lodging of Truman (score = 4) was similar to Roane (score = 4) and better than Ernie (score = 6). Over locations of the 2001 and 2002 UESRWWN, winterhardiness of Truman was equal to Roane; however, tolerance to spring freeze injury was better than Roane. Truman is moderately tolerant of acid soil conditions.

Based on 2001 Northern Uniform Winter Wheat Scab Nursery data, Truman has excellent resistance to Fusarium head blight (scab). Assessments made in from 3 to 9 locations under artificial field inoculation indicated that Truman has broad-based resistance including low disease severity (11.8%), low disease incidence (34.6%), a low disease index determined as (incidence × severity)/100 (7.5%), low deoxynivalenol (DON) (5.3 mg kg^{-1}), and a low percentage of scabby seed (5.4%) in diseased heads compared with the susceptible nursery check, 'Pioneer Variety 2545' which had high disease severity (39.8%), high disease incidence (71.4%), a high disease index (40.7%), higher DON (16.2 mg kg^{-1}), and a high percentage of scabby seed (26.8%). Under greenhouse inoculation, Truman has low disease severity (14.3%) compared with the susceptible nursery check Pioneer Variety 2545 (55.8%). Of 49 entries tested, Truman was one of only 2 entries with low scores for all measures of disease assessment.

Seedling tests conducted at the USDA-ARS Cereal Disease Laboratory at St. Paul, MN, indicated that Truman possesses *Lr11* and other unidentified genes governing resistance to leaf rust (caused by *Puccinia triticina* Eriks.) and *Sr24* governing resistance to stem rust (caused by *P. graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn.), however, in most environments, Truman is moderately susceptible to both leaf rust and stem rust. Truman is moderately resistant to stripe rust (score = 0–2% of the flag leaf) caused by *P. striiformis* Westend. On the basis of disease assessment scores reported in the 2001 and 2002 UESRWWN on a scale ranging from 0 to 9 (where 0 = no visible disease symptoms and 9 = severe infection), Truman is moderately resistant (score = 2–4) to Septoria leaf blotch [caused by the fungus *Mycosphaerella graminicola* (Fückel) Schroeter (anamorph: *Septoria tritici* Roberge in Desmaz)]; however, disease infection may be underestimated because of Truman's later maturity. Truman is moderately resistant to *Wheat soilborne mosaic virus* (score = 1–3), moderately susceptible to *Wheat spindle streak mosaic virus* (score = 5–6.5), moderately susceptible to *Barley yellow dwarf virus* (score = 4–6), and susceptible to powdery mildew [caused by *Blumeria graminis* (DC) E.O. Speer f. sp. *tritici* Em. Marchal]. Seedling tests conducted by the USDA-ARS at West Lafayette, IN indicate that Truman is susceptible to Hessian fly [caused by *Mayetiola destructor* (Say)] biotypes B, C, D, E, and L.

End-use quality was evaluated in 2001 and 2002 by the USDA-ARS Soft Wheat Quality Laboratory at Wooster, OH. In 2001, softness equivalent (52.9 g kg^{-1}), alkaline water retention capacity (59.61 g kg^{-1}), flour protein (8.42 g kg^{-1}), cookie diameter (18.21 cm) and top grain score (3), gave Truman an overall baking quality score of 100.6% of the quality standard, Agripro Patton. Milling quality was somewhat lower. Flour yield was 70.9 g kg^{-1} and the overall milling quality score was 94.0% of the standard. In 2002, the overall baking quality score was 97.8% of the standard, Ernie, while the overall milling quality score was 91.4% of the standard. Micro-test data for baking quality traits including softness equivalent (52.8 g kg^{-1}), alkaline water retention capacity (55.3 g kg^{-1}), and flour protein (8.74 g kg^{-1}) agreed closely with those of 2001 while adjusted flour yield (67.9 g kg^{-1}) was somewhat lower. Over years, the end-use quality of Truman was approximately equal to Ernie.

Breeder seed was developed from seven F_9–derived F_{12} increase strips approximately 1 m wide and 20 m long. Each was rogued approximately five times for purity. Off-types removed were primarily height variants. Authorized seed classes are Breeder, Foundation, and Certified. Breeder and Foundation seed will be maintained by the Foundation Seed Organization, of the Missouri Agricultural Experiment Station, College of Agriculture Food and Natural Resources, University of Missouri, Columbia. Application for U.S. Plant Variety Protection is underway under the Title V option.

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Dep. of Agronomy, Plant Sciences Unit, Univ. of Missouri, Columbia, MO. 65211. Research funded in part by the U.S. Wheat and Barley Scab Initiative. Registration by CSSA. Accepted 30 June 2004. *Corresponding author (mckendrya@missouri.edu).

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Registration of 'CP 96-1252' Sugarcane

'CP 96-1252' (Reg. no. CV-120, PI 634935) sugarcane (a complex hybrid of *Saccharum officinarum* L., *S. barberi* Jeswiet, *S. spontaneum* L., and *S. sinense* Roxb. amend. Jeswiet) was selected from progeny of the cross, CP 90-1533 × 'CP 84-1198' (Glaz et al., 1994) made at Canal Point, FL, in December 1991. The female parent was derived from a polycross made to broaden the germplasm base in which a *S. officinarum* clone, NG 77-252, was used as the female parent. CP 96-1252 was developed through cooperative research conducted by the USDA-ARS, the University of Florida, and the Florida Sugar Cane League, Inc. and was released to growers in the autumn of 2003.

Stalk weight of CP 96-1252, averaged across three crops (plant-cane, first- and second-ratoon), was 93% on sand and 88% on organic soils of that of the commercial check, 'CP 70-1133' (Rice et al., 1978). CP 96-1252 is pubescent along the entire length of the leaf sheath and has short auricles (<1.0 cm). It has a tan growth ring, heavy wax bloom, clasping leaf sheath, and a green stalk under the leaf sheath.

CP 96-1252 was evaluated at nine locations over a three-crop cycle (seven plant-cane, nine first- and eight second-ratoon crops) on organic soils where its cane yield (Mg cane ha^{-1}) was 8.5% higher than that of CP 70-1133. Theoretical recoverable sugar (kg sucrose Mg^{-1} cane) of CP 96-1252 was 4.5% higher than that of CP 70-1133. Its sucrose yield (Mg sucrose ha^{-1}) was 13.5% higher than that of CP 70-1133. The theoretical economic index, which integrates the costs of harvesting, hauling, and milling the cane produced with sucrose content (Deren et al., 1995) on organic soils for CP 96-1252, was 17.4% higher than that of CP 70-1133.

CP 96-1252 was also evaluated at two locations across a three-crop cycle (two plant-cane, two first- and two second-ratoon crops) on sand soils. The cane yield of CP 96-1252 in these tests was 26.5% higher than that of CP 70-1133. Sucrose content for CP 96-1252 was 2.7% higher and its sucrose yield was 30.2% higher than that of CP 70-1133. The theoretical economic index on sand soils for CP 96-1252 was 38.1% higher than that of CP 70-1133. CP 96-1252 has a fiber content of 9.4% compared with 10.4% for CP 70-1133.

CP 96-1252 has shown field resistance in Florida to eye spot [caused by *Bipolaris sacchari* (E.J. Butler) Shoemaker], rust (caused by *Puccinia melanocephala* Syd. & P. Syd.), smut (caused by *Ustilago scitaminea* Syd. & P. Syd.), leaf scald [caused by *Xanthomonas albilineans* (Ashby) Dowson], sugarcane mosaic virus strain E, and ratoon stunting disease (caused by *Leifsonia xyli* subsp. *xyli* Evtushenko et al.). Resistance to ratoon stunting disease was based on the presence of colonized vascular bundles in inoculated tests. CP 96-1252 is susceptible to sugarcane yellow leaf virus.

CP 96-1252 was released because of its high cane and sugar yields and its disease resistance to the major and minor sugarcane diseases in Florida except sugarcane yellow leaf virus.

Seedcane will be maintained by USDA-ARS at the Sugarcane Field Station, Canal Point, FL, for five years and is available through the National Plant Germplasm System.

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Registration of 'Juchi F2000' Wheat

'Juchi F2000' hard red spring wheat (*Triticum aestivum* L.) (Reg. no. CV-962, PI 619635) was developed by the National Institute of Forestry, Agriculture and Animal Research (INIFAP) for rainfed areas of Mexico. Juchi F2000 was released in September 2000 on the basis of its high grain yield and stable performance under a wide range of environments.

Juchi F2000 has the pedigree 'Kite' (PI 442902)/'Bobwhite' (PI 519665)//'Romoga F96' (Moncho/Siskin//Canario). The final cross was made in Chapingo, Mexico in 1992 and given the cross designation TC920338-S. The F_1 was bulk harvested in Roque, Guanajuato in May and the F_2 population was evaluated for height and maturity in Chapingo during the summer of 1993 where an individual plant (designated 9C) was selected. The F_3–9C family was evaluated under drought stress and four plants were bulk harvested and designated 04R. From the F_4 to F_6, individual plants and families were selected on the basis of desired height, maturity, and resistance to leaf rust (caused by *Puccinia triticina* Eriks.). Juchi F2000 was derived as a $F_{6:7}$ line on the basis of visual uniformity for the selected characteristics and tested under the designation TC920338-S-9C-04R-1C-0R-1C-0R.

Coleoptiles of Juchi F2000 are predominantly green. Juvenile plants exhibited semierect growth habit. Plant color at booting is green with a slight blue cast and a waxy bloom at booting. The spike is awned, middense, fusiform, and tapering. Kernels are hard, red, midlong, and elliptical in shape. The kernel has no collar, a midsize brush of medium length, and a midwide and shallow crease. The phenol reaction is fawn. Juchi F2000 is a semidwarf wheat, averaging 85 cm in height, similar to 'Pavon F96' (PI 519847) and taller than Romoga F96. Juchi F2000 is a medium maturing cultivar with 63 d to heading and 113 d to physiological maturity, similar to Romoga F96 and four days earlier than Pavon F76.

From 1996 to 1999, Juchi F2000 was tested in 57 environments across 12 Mexican states in the National Bread Wheat Yield Trial for rainfed areas, where the environments varied in precipitation from 350 mm (dryland) to 900 mm (high rainfall). Over all environments, Juchi F2000 produced a mean grain yield of 2.7 Mg ha^{-1}, which was higher than Romoga F96 and Pavon F76 by 5.5 and 21.9%, respectively. In environments with less than 450 mm rainfall, Juchi F2000 yielded 1.5 Mg ha^{-1}, outyielding Romoga F96 and Pavon F76 by 11.2 and 16.4%, respectively. In high rainfall environments (over 650 mm), Juchi F2000 yielded 4.3 Mg ha^{-1}, which is 10.9 and 20.1% superior to the yield of standard cultivars Romoga F96 and Pavon F76, respectively. As shown by the regression coefficient ($b_i = 1.2$), the yield of Juchi F2000 is responsive to environmental (rainfall) conditions (Eberhart and Russell, 1966).

On the basis of evaluation in 38 environments under natural infection in Mexico, Juchi F2000 has shown immunity to stem rust (caused by *P. graminis* Pers.:Pers. f. sp. *tritici*. Eriks. and Henn.), moderate resistance to leaf rust (similar to Romoga F96), and moderate resistance to stripe rust (caused by *P. striiformis* Westend.), [similar to 'Arandas F90' (Hermosillo 77/Sapsucker//Veery)]. It is moderately resistant to foliar diseases caused by *Bipolaris sorokiniana* (Sacc.) Shoemaker, *Septoria tritici* Roberge in Desmaz., and *Fusarium* spp. On the basis of seedling studies conducted at CIMMYT, Juchi F2000 carries the leaf rust resistance genes *Lr*1, *Lr*13, and *Lr*17 (which are ineffective for most common leaf rust races present in Mexico). It is susceptible to *P. triticina* race MCJ/SP as a seedling (Singh, 1991) but moderately resistant as an adult plant to the same race. Juchi F2000 also carries the leaf rust resistance gene *Lr*34. Juchi F2000 contains *Yr*18 and 2 to 3 genes of minor effects for resistance to stripe rust (Singh et al., 1999).

Milling and baking quality of Juchi F2000 is very good on the basis of CIMMYT Wheat Quality Laboratory tests using grain from 11 evaluation sites in 1999. Juchi F2000 had a volume weight of 792 kg m^{-3}, which was higher than 'Batan F96' [PI603213 (752 kg m^{-3})] and Romoga F96 (771 kg m^{-3}). Protein content was 127 g kg^{-1} in the grain and 115 g kg^{-1} in the flour, which was similar to Romoga F96. The average loaf volume of Juchi F2000 (904 cm^3) was higher than that of Pavon F76 (839 cm^3) and Batan F96 (820 cm^3).

Juchi F2000 was registered (no. 1242-TRI-025-081099/C) by the Mexican Seeds Inspection and Certification Service (SNICS), adhering to the requirements established by the International Union for the Protection of New Varieties of Plants (UPOV). Breeder seed of Juchi F2000 will be maintained by the INIFAP wheat breeding program. Limited quantities of seed for research are available on request.

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Registration of 'Nahuatl F2000' Wheat

'Nahuatl F2000' hard white spring wheat (*Triticum aestivum* L.) (Reg. no. CV-960, PI 619633) was developed cooperatively by the National Institute of Forestry Agriculture and Animal Research (INIFAP) and the International Maize and Wheat Improvement Center (CIMMYT) in Mexico. Nahuatl F2000 is recommended for rainfed areas of Mexico that receive 350–600 mm of rain during the growing season.

Nahuatl F2000 has the pedigree 'E7408'/'Pamir'//'Hork' (PI 519726)/PF73226 (PI 520130)/3/'Ures T81' (PI 471923)/4/'Opata M85' (PI 519776)/5/Opata M85/'Bobwhite' (PI 519665). The final cross (designated CMBW89Y00814) was made by the CIMMYT Bread Wheat Program in March 1989 in the Yaqui Valley, Sonora. The segregating population was distributed by CIMMYT and selected by the INIFAP Rainfed Wheat Breeding Program at Chapingo, Mexico and Roque, Guanajuato. The F_1 was designated 0TOPM and the F_2 was evaluated under two irrigation conditions during the 1991–1992 growing season. Plant 9R was selected on the basis of apparent drought tolerance, giving origin to the F_3–9R family, which was then bulk harvested and designated 0C. In the F_4, the 2R plant was selected for height, maturity, and white seed color. In the F_5, the 3C plant was selected for resistance to leaf rust (caused by *Puccinia triticina* Eriks.) and the F_6 was derived as a visually uniform line for plant type and was identified as CMBW89Y00814-0TOPM-9R-0C-2R-3C-0R.

Coleoptiles of Nahuatl F2000 are predominantly green. Juvenile plants exhibit erect growth habit. Plant color at booting is green, and a waxy bloom is present on the stem and flag leaf sheath. Spikes of Nahuatl F2000 are middense, erect, but distinctly compacted at the tip. Kernels are hard, white, midlong with a midwide and shallow crease, with a thousand kernel weight of 36 g. Nahuatl F2000 is a semidwarf wheat moderately resistant to lodging. It is 83 cm tall, similar to 'Pavon F76' (PI 519847) and 'Romoga F96'(Moncho/Siskin//Canario). Nahuatl F2000 is an early maturing cultivar with 57 d to flowering and 107 d to physiological maturity, five days earlier than Romoga F96.

From the summer of 1994 to 1999, Nahuatl F2000 was evaluated across 80 environments in 13 Mexican states through the National Bread Wheat Yield Trial for Rainfed Areas. In the rainfed sites, which were characterized by an annual average of 350 mm of rain, Nahuatl F2000 yield 1.6 Mg ha^{-1} outyielding 'Batan F96'(PI603213) and Romoga F96 by 8 to 13%, respectively. Under rainfed conditions, Nahuatl F2000 tends to be a stable variety ($b_i = 1.04$) as defined by Eberhart and Russell (1966) with a mean grain yield of 2.6 Mg ha^{-1}. At intermediate rainfall conditions (450 mm rain) Nahuatl F2000 yielded 2.7 Mg ha^{-1}, the same as Romoga F96.

On the basis of tests at 38 environments under natural infection in Mexico, Nahuatl F2000 exhibited immunity to stem rust (caused by *P. graminis* Pers.:Pers. f. sp. *tritici*. Eriks. and Henn.); moderate resistance to leaf rust, similar to Romoga F96, and resistance to stripe rust (caused by *P. striiformis* Westend.). Nahuatl F2000 is moderately susceptible to foliar diseases caused by *Bipolaris sorokiniana* (Sacc.) Shoemaker, *Septoria tritici* Roberge in Desmaz., and *Fusarium* spp. Therefore, Nahuatl F2000 is not recommended for planting in those areas where diseases caused by these pathogens are common. On the basis of genetic studies at the CIMMYT Wheat Pathology Laboratory, Nahuatl F2000 carries leaf rust resistance gene *Lr*16 as detected in seedling tests. In the adult plant stage, leaf tip necrosis is clearly distinguished, suggesting the presence of *Lr*34. Nahuatl F2000 bases its stripe rust resistance on the *Yr*18 gene and at least 3 other slow rusting genes with additive effects (Singh et al., 1999).

Milling and baking quality of Nahuatl F2000 is good on the basis of CIMMYT Wheat Quality Laboratory tests using grain from 11 evaluation sites in 1999. Nahuatl F2000 showed a volume weight (752 kg m^{-3}) similar to Batan F96 (752 kg m^{-3}), but lower than Romoga F96 (771 kg m^{-3}). Protein content was 130 g kg^{-1} in the grain and 118 g kg^{-1} in the flour, which was greater than Batan F96 and Romoga F96. The average loaf volume of Nahuatl F2000 (893 cm^3) was higher than that from Pavon F76 (839 cm^3) and Batan F96 (820 cm^3). According to Finlay and Wilkinson (1963), Nahuatl F2000 can be characterized as having a stable loaf volume ($b_i = 0.21$).

Nahuatl F2000 was registered (no. 1242-TRI-025-081099/C) by the Mexican Seeds Inspection and Certification Service (SNICS), adhering to the requirements established by the International Union for the Protection of New Varieties of Plants (UPOV). Breeder seed of Nahuatl F2000 will be maintained by the INIFAP Wheat Breeding Program. Limited quantities of seed for research are available on request.

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Registration of 'Tlaxcala F2000' Wheat

'Tlaxcala F2000' hard red spring bread wheat (*Triticum aestivum* L.) (Reg. no. CV-961, PI 619634) was developed by the National Institute for Forestry, Agriculture and Animal Research (INIFAP) in Mexico. Tlaxcala F2000 was named for Tlaxcala, one of the 16 states of Mexico where the variety has good adaptation. It was released in September 2000 on the basis of its high grain yield, resistance to leaf rust (caused by *Puccinia triticina* Eriks.), and stable performance under a wide range of environments in Mexico.

Tlaxcala F2000 originated from a cross between 'Zacatecas VT74' (PI 282050) and 'Romoga F96' (Moncho/Siskin//Canario), made during the summer of 1992 in the Valle de Mexico Agricultural Experimental Station of INIFAP (CEVAMEX) and designated as cross number TC920248-S. The F_1 was bulk harvested in Roque, Guanajuato in May 1992. An F_2 plant (designated 34C) was selected for desired height, maturity, and leaf rust resistance during the summer of 1993 in Chapingo, Mexico, which originated the F_3–34C family. Six F_3 plants were selected for drought tolerance at Roque, bulk harvested and designated 06R. Individual plants were selected from F_4 to F_6 on the basis of height and maturity. Tlaxcala F2000 was derived as a $F_{6:7}$ line on the basis of visual uniformity for the selected traits and tested under the designation TC920248-S-34C-06R-1C-0R-1C-0R.

Juvenile plants of Tlaxcala F2000 exhibit erect growth habit. Plant color at booting is green with a slight blue cast and a waxy bloom at anthesis. Tlaxcala F2000 shows early and late heads, and spikes are awned, middense, fusiform, and tapering. Kernels are hard, red, and midlong with a midwide and shallow crease, and have a thousand kernel weight of 38 g. The phenol reaction is fawn. Tlaxcala F2000 is a semidwarf wheat 83 cm tall, similar to 'Pavon F96' (PI 519847) and Romoga F96. Tlaxcala F2000 is a medium maturing cultivar with 60 d to heading and 110 d to physiological maturity, similar to Romoga F96 and five days earlier than Pavon F96.

From the summer of 1996 to 1999, Tlaxcala F2000 was tested in 57 environments across 12 Mexican states through the National Bread Wheat Yield Trial for rainfed areas. In those environments, precipitation varied from 350 mm (dryland) to 900 mm (high rainfall). Tlaxcala F2000 produced a mean grain yield of 2.8 Mg ha^{-1}, which was superior to Romoga F96 and Pavon F76 by 5.5 and 21.9%, respectively. In the lower rainfall environments (rainfall below 450 mm), Tlaxcala F2000 yielded 1.6 Mg ha^{-1}, outyielding Romoga F96 and Pavon F76 by 14.2 and 22.5%, respectively. In the high rainfall environments (rainfall over 650 mm), Tlaxcala F2000 yielded 4.1 Mg ha^{-1}, which is 7.2 and 16.8% superior to the yields of standard cultivars Romoga F96 and Pavon F76, respectively. Tlaxcala F2000 tends to be a stable variety as defined by Eberhart and Russell (1966) with a high mean grain yield and a regression coefficient of 1.05.

On the basis of evaluation in 38 environments under natural infection in Mexico, Tlaxcala F2000 is immune to stem rust (caused by *P. graminis* Pers.:Pers. f. sp. *tritici*. Eriks. and Henn.), moderately resistant to leaf rust, similar to Romoga F96, and moderately resistant to stripe rust (caused by *P. striiformis* Westend.), similar to 'Arandas F90'. It is moderately resistant to foliar diseases caused by *Bipolaris sorokiniana* (Sacc.) Shoemaker, *Septoria tritici* Roberge in Desmaz., and *Fusarium* spp. On the basis of seedling genetic studies at the CIMMYT Wheat Pathology Laboratory, Tlaxcala F2000 carries genes *Lr*1 and *Lr*13, which are ineffective for most common leaf rust races present in Mexico. It is susceptible to *P. triticina* race MCJ/SP as a seedling plant (Singh, 1991), but highly resistant (5MR) to the same race as an adult plant. Tlaxcala F2000 adult plant stripe rust resistance is based on *Yr*18 and 2 to 3 slow-rusting genes of minor effects (Singh et al., 1999).

Milling and baking quality of Tlaxcala F2000 is good on the basis of CIMMYT Wheat Quality Laboratory tests using grain from 11 evaluation sites in 1999. Tlaxcala F2000 showed a volume weight (784 kg m^{-3}) higher than 'Batan F96' [PI603213 (752 kg m^{-3})] and Romoga F96 (771 kg m^{-3}). Protein content was 125 g kg^{-1} in the grain and 112 g kg^{-1} in the flour, which are similar to check cultivars. Dough mixing properties of Tlaxcala F2000 were stronger than those of check varieties. The average loaf volume of Tlaxcala F2000 (846 cm^3) was higher than that from Pavon F76 (839 cm^3) and Batan F96 (820 cm^3). According to Finlay and Wilkinson (1963), Tlaxcala

F2000 can be characterized as having a stable loaf volume ($b_i = 0.5$).

Tlaxcala F2000 was registered (no. 1245-TRI-028-081099/C) by the Mexican Seeds Inspection and Certification Service (SNICS), adhering to the requirements established by the International Union for the Protection of New Varieties of Plants (UPOV). Breeder seed of Tlaxcala F2000 will be maintained by the INIFAP Wheat Breeding Program. Limited quantities of seed for research are available on request.

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REGISTRATIONS OF GERMPLASMS

Registration of Mo48 and Mo49 Maize Germplasm Lines with Resistance to European Corn Borer

Maize (*Zea mays* L.) germplasm lines Mo48 (Reg. no. GP-377, PI 634206) and Mo49 (Reg. no. GP-378, PI 634207) are yellow endosperm, dent inbred lines in the maturity group AES 800 developed for European corn borer (ECB, *Ostrinia nubilalis* Hübner) resistance by the Plant Genetics Research Unit of the USDA-ARS in cooperation with the Missouri Agricultural Experiment Station, University of Missouri-Columbia. Development of both releases began in the winter of 1978–1979 with crosses made in Hawaii by Cargill, Inc. and they were released in November 2003.

Mo48 was derived from the cross NC33 × B52. NC33 (PI 608538) is a selection from 'Cokes Prolific' (GRIN, 2003) and is moderately susceptible to second-generation ECB stalk tunneling damage (ECB2). B52 (PI 550454) (Russell et al., 1971) was derived by USDA-ARS and Iowa State University from an unknown private seed source and is highly resistant to ECB2. Selections from NC33 × B52 were manually infested in the leaf whorl with approximately 160 ECB neonate larvae per plant to evaluate resistance to first-generation feeding (ECB1) (Guthrie et al., 1960). At least three pollinations were made in each S_1 family using approximately 20 tassels from a balanced bulk of the other selections. Sixty neonate larvae were infested twice within four days into or near the ear leaf axel at anthesis to assess ECB2 resistance to sheath feeding and stalk tunneling damage by splitting stalks at maturity and selecting for minimal tunneling. The best three ears of the most resistant rows were recombined in the winter nursery without ECB infestation to complete one cycle of selection per year for six cycles. This was followed by ear-to-row pedigree selection through the S_6 generation with ECB pressure on the odd-numbered generations. The best of three self-pollinated selections from the best rows were continued each generation. Mo48 has been observed to be stable for resistance to ECB since bulking seed at the S_6.

Mo49 was derived from a broadly based synthetic comprised of 'Mo ECB selection 1' through 'Mo ECB selection 6' crossed in all combinations to three exotic Cargill populations acquired from E.E. Gerrish (1980): Cargill 4 (adapted Caribbean material), Mexico 2, and Mexico 3. S_1 selections from these crosses were planted ear-to-row, infested with ECB, and three plants pollinated by a bulk of the other selections. Half-sib recurrent selection was performed, as described above, for six cycles. The improved population was then crossed with MpSWCB#4, acquired from Frank Davis, USDA-ARS, Starkville, MS. MpSWCB#4 was selected for resistance to the southwestern corn borer, *Diatraea grandiosella* (Dyer) (SWCB). Recurrent selection then resumed at Columbia, MO, for four cycles based on SWCB resistance and ear type. In 1984, 2000 plants were screened for ECB2 resistance and 70 bulked for random mating in the winter nursery. This was continued five additional cycles. Finally, pedigree selection was followed through the S_6 generation. Mo49 has been observed to be stable for ECB resistance and type since bulking.

Mo48 has dark green, medium-wide leaf blades angled open at about 60 degrees from the vertical. The cob is white, anthers are yellow, trace color on the glumes, and no glume bar. It has 19 to 21 tassel branches with a 23-cm spike. It has few tillers and floral synchrony is good.

Mo49 has medium green leaves possibly with lesion mimic syndrome. Leaves are medium in width and angled upright at about 30 degrees from the vertical. The cob is white, anthers are purple, glumes are striped, and there is a glume bar. Mo49 has 5–11 tassel branches with a 30.5-cm spike. It sometimes produces a few tillers and silking is slightly delayed.

In 1999, Mo48 and Mo49 were at least as resistant as the resistant checks Mo47 (Barry et al., 1995) and CI31A in replicated trials in MO, NE, IA, and MS. In 2001, for ECB2 stalk tunneling length, the most important measure of resistance, Mo48 and Mo49 were not significantly different ($P < 0.05$) from the best check, Mo47 (2.5, 4.7, and 3.8 cm, respectively). In 2002, the inbreds were part of multi-state, three replication tests in MO, MS, NE, IA, IL, OH, and DE for a total of 11 ECB1 locations evaluated and 10 for ECB2 with Mo47 used as a resistant check. Mo48, Mo49, Mo47, and B73 had ECB2 stalk tunneling lengths of 10.6, 7.0, 8.3, and 29.1 cm, respectively, which were all significantly different at $P < 0.05$. In 2001 and 2002, testcrosses were evaluated in five Missouri environments. Both Mo48 and Mo49 yielded more on a Mo17 tester than on B98, which has BS11 background (Lamkey and Hallauer, 1997). Therefore, these releases should be useful to improve highly ECB-susceptible Stiff Stalk Synthetic–derived inbreds. Mo48 × Mo17 and Mo49 × Mo17 averaged 4857 and 4101 kg ha^{-1} vs. 5603 kg ha^{-1} for the check B73 × Mo17. The

Mo49 testcross was significantly lower in yield ($P < 0.05$) while the Mo48 testcross was not lower than the check. Stalk tunneling length for these three crosses averaged 5.7, 4.1, and 8.4 cm, respectively with the check being significantly more damaged ($P < 0.05$). For plant and ear height means in Missouri in 2001 and 2002, Mo48 averaged 175 and 83 cm tall; Mo49 averaged 143 and 62 cm vs. Mo17 at 187 and 98 cm, respectively. In some environments, Mo49 had slightly more lodging than the other entries due to its thin stalk. Among the lines tested for possible release, Mo48 had the best combination of yield (especially with the Mo17 tester) and ECB2 tunneling resistance. Mo49 had the highest level of resistance—equal to or better than that of Mo47.

Seed from the S_6 generation of Mo48 and Mo49 is available in lots of 50 kernels and may be obtained from the Plant Genetics Research Unit, USDA-ARS, 204 Curtis Hall, University of Missouri, Columbia, MO 65211. They are on deposit in the National Plant Germplasm System. We ask that appropriate recognition be given when this germplasm contributes to research or to a new cultivar.

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Registration of D98-1218 Soybean Germplasm Line Resistant To Phytophthora Rot (*Rps2*) And Soybean Cyst Nematode Races 3 (HG Type 0) And 14 (HG Type 1.3.6.7)

Soybean [*Glycine max* (L.) Merr.] germplasm line D98-1218 (Reg. no. GP-306, PI 635053) was developed by the USDA-ARS, Stoneville, MS, in cooperation with the Mississippi Agricultural and Forestry Experiment Station, Stoneville, MS, and released in October 2003. D98-1218 is a product of a backcrossing program to transfer the *Rps2* gene into 'Bedford' (Hartwig and Epps, 1978) background. This line has value as a parent because of its resistance to Phytophthora rot (caused by *Phytophthora sojae* M. J. Kaufmann & J. W. Gerdemann) and races 3 with HG type 0 and 14 with HG Type 1.3.6.7 of the soybean cyst nematode (*Heterodera glycines* Ichinohe). The HG Type 1.3.6.7 had a female index of 28.9, 19.6, 12.4, and 16.5 on differentials 1, 3, 6, and 7, respectively.

This line will be useful to the research community because it will expand the set of previous releases of Phytophthora rot–resistant lines which are near-isogenic to the cultivar Bedford. The previously released lines, each with a single different allele are: D92-6487, *Rps1-k*; D93-8664, *Rps5*; D94-6041, *Rps4*; D95-5246, *Rps3-a*; D96-1217, *Rps1-c*; and D98-1216, *Rps3-b* (Kilen and Young, 1994, 1996, 1998, 2000, 2003a, 2003b). These lines have the same level of resistance to SCN races 3 and 14 as their recurrent parent Bedford. All these releases, and the one currently proposed, have a unique gene–allele combination in the same genetic background (Bedford) which makes them very useful as diagnostic tools and as parents in breeding. All the releases are very similar phenotypically to the current parent, Bedford.

Currently, at least 55 races of *P. sojae* have been identified (Leitz et al., 2000). Early studies showed that *Rps2* provided resistance to races 1 and 2 of *P. sojae* (Kilen et al., 1974). Additional studies indicated that *Rps2* is susceptible to race 7, but highly resistant to races 10 and 12 (T. C. Kilen, unpublished data). Recently, Dorrance and Schmitthenner (2000) published results showing that *Rps2* provides resistance to races 25, 33, and 38 but was susceptible to races 7, 17, 30, and 31 of *P. sojae*.

D98-1218 is an F_5 selection from Bedford (5) × [Forrest (6) × D51-4863]. D51-4863 is derived from Roanoke × N45-745. N45-745 is obtained from Ogden × CNS. Forrest (Hartwig and Epps, 1973) was first used as the adapted SCN-resistant recurrent parent. Forrest is highly resistant to SCN race 3 but is susceptible to race 14. Because Bedford has a moderate level of resistance to race 14 and is highly resistant to race 3, Bedford was used, instead of Forrest, as the recurrent parent. The original donor of *Rps2* was 'CNS' (PI 548445), which was introduced from China in 1927. A breeding line, D51-4863, was used as the intermediate donor of *Rps2* because of its more desirable agronomic traits.

Before screening segregating progenies from a Bedford backcross, we used a standard set of soybean differentials with known genes for resistance to *P. sojae* and an array of *P. sojae* races. This procedure verifies that the races are reacting to the known genes in the way they were originally described. The reaction of 12 plants was used to identify lines uniformly resistant to Phytophthora rot at each cycle. $F_{2:3}$ lines from Bedford (5) × [Forrest (6) × D51-4863] that were uniformly resistant to Phytophthora rot were selected as pollen parents between each of the five crossing cycles. Seedlings were inoculated in a greenhouse in 2002 and 2003 by the hypocotyl puncture method (Morgan and Hartwig, 1965), using race 2 of the pathogen. After the fourth backcross to Bedford, F_3 lines uniformly resistant to race 2 were advanced for two generations by the pedigree method. A sample of 100 F_5 plants were inoculated with race 2 to verify the reaction of the $F_{3,}$ before replicated yield testing.

D98-1218 was evaluated in the F_8 generation for reaction to races 3 and 14 of the soybean cyst nematode at Jackson, TN, using a modification of the method described by Young (1990). The modification was in removal of the cysts from the roots. The cysts were forcefully washed from the roots and captured on a 250-μm mesh sieve. D98-1218 has a similar level of resistance to races 3 and 14 as the recurrent parent, Bedford.

D98-1218 was evaluated for yield in comparison with Bedford in 1999 through 2002 at Stoneville MS in replicated trials. Yield of D98-1218 and Bedford were 3968 vs. 3805 (1999), 1786 vs. 1282 (2000), 2386 vs. 1016 (2001), and 3921 vs. 3312 kg ha^{-1} (2002), respectively. The differences in 2001 and 2002 were significant at the $P \leq 0.01$ level. Supplemental irrigation was provided all three years. A breeding line susceptible to Phytophthora rot was planted in the same field, and it showed symptoms of the disease all three years. Comparative yields on soils not prone to Phytophthora rot, however, was not measured. D98-1218 had similar agronomic characteristics to the recurrent parent, and no observable differences in plant height, lodging, maturity date, flower color, and pubescence.

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 acknowledgment and recognition be made if this germplasm contributes to the development of new cultivars. Initially, small amounts of seed may be obtained from the Crop Genetics and Production Research Unit, P.O. Box 345, Stoneville, MS 38776-0345.

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Registration of IDO602 Spring Wheat Germplasm

IDO602 (Reg. no. GP-776, PI 620628) hard red spring wheat (*Triticum aestivum* L.) was developed by the Idaho Agricultural Experiment Stations and released in February 2003 for use in research and crop improvement programs. IDO602 is a semidwarf wheat with resistance to Karnal bunt, causal organism *Tilletia indica* (Mitra).

IDO602 was derived from a first backcross of the hard white spring wheat 'Borlaug M95' (IWIS 2004) onto the hard red spring wheat 'Westbred 926', with the pedigree Borlaug M95*2/Westbred 926. Borlaug M95 has intermediate resistance to Karnal bunt, based on evaluations by CIMMYT and was grown in Sonora, Mexico as a cultivar resistant to Karnal bunt (Fuentes-Davila, unpublished data, 2002). Borlaug M95 was developed from a cross of CIMMYT derived breeding lines ('Hahn'*2/'Parula'), but the source of Borlaug M95 Karnal bunt resistance is unclear. However, its milling and baking quality does not meet North American milling and pan bread standards. Borlaug M95 also matures too late for many northern latitude production environments. The backcross population, designated A93324S, was made at University of Idaho, Aberdeen Research and Extension Center in 1993 and BC_1 plants were grown in the greenhouse. The BC_1F_2 seed of A93324S was composited and planted in a field near Aberdeen in 1994. The BC_1F_3 seed was harvested in bulk and space planted in Aberdeen in 1996. Individual BC_1F_3 plants were harvested and the $BC_1F_{3:4}$ seed was sent to CIMMYT for Karnal bunt resistance evaluation in 1997, using previously published protocols (Fuentes-Davila and Rajaram, 1994). Plants were inoculated at boot stage using suspensions of allantoid secondary sporidia (10 000 mL^{-1}). Plant selections with low levels of infection in spring 1997 were replanted in fall 1997 and 1998 for reevaluation of Karnal bunt resistance. One of the selections, A93324S-76kbr, was found to have resistance to Karnal bunt similar to 'Yavaros 79' (see details below) and also was uniform for agronomic characters and seed color. A93324S-76kbr was placed into yield trials at Aberdeen in 1998 and in multisite testing across southern Idaho in 2000 and 2001. A93324S-76kbr was designated IDO602 for release as germplasm in 2002.

IDO602 is a short stature, medium maturity hard red spring wheat. IDO602 has a non-pigmented coleoptile and erect juvenile growth. IDO602 has an awned, erect, mid-dense head, which is white-chaffed at maturity. In irrigated trials, IDO602 has a plant height of 59 cm, shorter than standard semi-dwarf cultivars produced in the Pacific Northwest, such as 'Westbred 936' (PVP No. 9500095; 75 cm) and 'Jefferson' (82 cm, Souza et al., 1999). IDO602 is similar in heading date to Westbred 936, on average in southern Idaho, approximately 71 d after planting. IDO602 heads 2 d earlier than Jefferson and 3 d earlier than 'Iona' (Souza et al., 2002) hard red spring wheat. Seed of IDO602 is hard, red, ovate, and plump, with a kernel type similar to 'Yecora Rojo' (CI*tr* 17414). Based on field evaluations in Idaho and Washington in 2000 and 2001, IDO602 has resistance to stripe rust [caused by *Puccinia striiformis* (Westend.)]. The race spectrum of the stripe rust pathogen during this time period was complex (see Chen et al. [2002] for a partial description of races). Both Borlaug M95 and Westbred 926, parents of IDO602, have complex, multigenic stripe rust resistance, making the stripe rust resistance gene designations in IDO602 uncertain.

In three years of replicated testing (1997, 1998, and 1999) by CIMMYT at Ciudad Obregon, Mexico, using two dates of inoculation [see Fuentes-Davila and Rajaram (1994) for description of methods], IDO602 had 5% of kernels bunted in inoculated heads, which did not significantly differ from the resistant check, the durum cultivar 'Yavaros 79' (PI 520300), which had 4% of kernels bunted. IDO602 had significantly fewer bunted kernels than the susceptible check, 'Yecora Rojo', which had 23% of kernels bunted ($P < 0.01$). In two years of evaluation (1997 and 1998), IDO602 had 3% bunted kernels in inoculated heads compared with 22% in the donor line for milling and baking quality, Westbred 926.

In 9 site-years of southeastern Idaho irrigated and rain-fed trials from 2000 to 2001, IDO602 had a grain yield of 5972 kg ha^{-1} similar to Jefferson (5842 kg ha^{-1}) and Westbred 936 (6000 kg ha^{-1}). In the same trials, IDO602, Jefferson, and Westbred 936 had test weights of 778, 798, and 787 kg m^{-3}, respectively. In irrigated trials in 2000 and 2001, IDO602 had 8% lodging compared with 37% lodging in Jefferson and 18% lodging in Westbred 936 ($LSD_{0.05}$ = 9%). IDO602 is a hard endosperm genotype with milling quality similar to Westbred 936. Nine separate mill and bake evaluations were conducted on the grain produced in the 9 site-years of trials (4 in 2000 and 5 in 2001). IDO602 had a milling yield (Quadrumat Senior mill) of 656 g kg^{-1} compared with 658 g kg^{-1} for Westbred 936, and 680 g kg^{-1} for Jefferson. IDO602 has relatively long dough mixing times, similar to Jefferson. In mixograph evaluations by the Idaho Wheat Quality Laboratory at Aberdeen, IDO602 had a 3.1 min time to peak dough development, compared with 3.1 min for Jefferson and 2.5 min for Westbred 936. Water absorption for IDO602 was 559 g kg^{-1} in the 9 bake evaluations, compared with 599 g kg^{-1} for Jefferson and 598 for Westbred 936. IDO602, Jefferson, and Westbred 936 had loaf volumes of 1000, 1118, and 1168 mL, respectively. The relatively low water absorption and small loaf volume for IDO602 may be due in part to its low flour protein in these trials, 110 g kg^{-1}, compared with 119 g kg^{-1} for Jefferson and 126 g kg^{-1} for Westbred 936.

Seed of IDO602 will be maintained by the Idaho Agricultural Experiment Station. Small quantities of IDO602 for research and crop improvement may be obtained by contacting the corresponding author.

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Registration of 'IDO580' Spring Wheat Germplasm

'IDO580' (Reg. no. GP-777, PI 620638) hard white spring wheat (*Triticum aestivum* L.) was developed by the Idaho Agricultural Experiment Stations and released in February 2003 for use in research and crop improvement programs. IDO580 is a semi-dwarf wheat with near null levels of seed polyphenol oxidase activity (PPO), an enzyme that causes browning reactions prior to cooking in high moisture food products.

IDO580 was derived from the three-way cross, 'Cadoux' (PI 591905)//'Maya 74'/M2 made at the University of Idaho, Aberdeen Research and Extension Center in 1996. Cadoux is a soft white semi-dwarf wheat from Australia. Maya 74 is a hard white spring wheat developed by CIMMYT (IWIS, 2004). M2 is a synthetic hexaploid wheat developed at CIMMYT by crossing 'Ruff' [*T. turgidum* subsp. *durum* (Desf.)] with the CIMMYT *Aegilops tauschii* (Coss.) germplasm #112. M2, a soft red spring wheat, had been found in previous evaluations to have very low levels of seed PPO activity. Twelve seeds (F_1) of the three-way cross, designated A96203S, were grown in the greenhouse. Plants (F_1) with white (F_2) kernels were evaluated for PPO activity using tyrosine salt solution as a substrate (Mahoney and Ramsey, 1992). Two F_2 families from two F_1 plants of A96203S with white grain and low PPO reaction were planted in the field at Aberdeen in 1997. One $F_{2:3}$ seed from each of approximately 200 plants was evaluated for PPO reaction after 24 h in the reaction buffer rather than standard reaction times of 3–4 hr. Seeds without discoloration were removed from the buffer and planted into the greenhouse. The $F_{3:4}$ grain from each plant (approximately 80 plants) was evaluated (3–5 seeds) at harvest to confirm the low PPO reaction. Grain from 73 confirmed plants were planted in the field in 1998 at Aberdeen in single rows, one $F_{3:4}$ plant per row. Nineteen headrows were selected for good agronomic type, resistance to stripe rust [caused by *Puccinia striiformis* (Westend.)], sodium dodecyl sulfate-sedimentation (a measure of gluten), NIR hardness, and PPO reaction. The hard white spring $F_{3:5}$ selection A96203S-D-11 was advanced to non-replicated plot testing in 1999 and replicated yield trials in 2000. In 2001, A96203S-D-11 was designated as experimental number IDO580 and entered into the Tri-State Spring Wheat Nursery (Idaho, Oregon, and Washington).

IDO580 has a non-pigmented coleoptile with erect juvenile growth and an awned, erect, lax head, which is white-chaffed at maturity. IDO580 has an average plant height of 83 cm, similar to 'Idaho 377s' (Souza et al., 1997) and 'Lolo' (Souza et al., 2003) hard white wheats, 3 cm shorter than 'Iona' (Souza et al., 2002) hard red spring and 3 cm taller than 'Pristine' (PVP No. 200000180) hard white spring wheat. On average, IDO580 heads 104 days after planting, which is similar to Idaho 377s and Lolo. IDO580 heads 3 d later than Pristine. Seed of IDO580 is hard, white, oval, and plump, with a kernel type similar to Idaho 377s, yet approximately 6 mg per kernel smaller than Idaho 377s. Based on field evaluations in Washington (2002) and Idaho (1999 and 2000), IDO580 has resistance to stripe rust. The source of resistance is uncertain as Cadoux, Maya 74, and M2 have genes conditioning resistance to stripe rust, based on field evaluations in the Pacific Northwest during the 1990s. The race spectrum of the stripe rust pathogen during this time period was complex (see Chen et al. [2002] for a partial description of races). Other disease and insect resistances were not recorded for IDO580.

In 9 site-years of southeastern Idaho irrigated and rain-fed trials conducted in 2000–2001, IDO580 had an average grain yield of 5552 kg ha^{-1} similar to Pristine hard white (5730 kg ha^{-1}) and 'Jefferson' (Souza et al. 1999) hard red spring (5842 kg ha^{-1}), yet less than Idaho 377s (6297 kg ha^{-1}) and Lolo (6354 kg ha^{-1}). In the same trials, IDO580, Pristine, Jefferson, Idaho 377s, and Lolo had test weights of 772, 817, 798, 805, and 812 kg m^{-3}, respectively. In irrigated trials, IDO580 had 35% lodging, similar to Jefferson (32%), Idaho 377s (26%), and Pristine (21%), yet more than Lolo (11%). Nine separate mill and bake evaluations were conducted on the grain produced in the 9 site-years of trials (4 in 2000 and 5 in 2001). IDO580 has relatively poor milling yield (Quadrumat Senior mill) with an average flour yield of 606 g kg^{-1} compared with 632 g kg^{-1} for Idaho 377s, 647 g kg^{-1} for Lolo, 667 g kg^{-1} for Pristine, and 680 g kg^{-1} for Jefferson. IDO580, Lolo, Idaho 377s, Pristine, and Jefferson had average loaf volumes of 970, 975, 985, 1071, and 1118 ml, respectively.

The unique characteristic of IDO580 is its low kernel PPO activity. In evaluations of IDO580 across six environments using L-DOPA as a substrate for the PPO enzyme (Anderson and Morris, 2001), IDO580 had a PPO activity measured in optical density (OD) of the reaction buffer at 490 nm of 0.114, significantly ($P < 0.001$) lower than Idaho 377s (OD 0.234), Lolo (OD 0.256), and Jefferson (OD 0.343). Durum seed (several cultivars were used as internal laboratory standard for null-PPO activity; Mahoney and Ramsey, 1992) had an average OD of 0.099, not significantly different from IDO580. The minimal PPO activity resulted in limited discoloration of Asian fresh noodles produced from flour of IDO580. In 2000 and 2001 (total of 5 environments and separate evaluations), we evaluated alkali noodles using the Commission Internationale De D'Elairage (CIE) L*a*b* color scale (Souza et al., 2004). IDO580 had a decline in CIE L* brightness over a 24-h period of 6.8. By comparison, the noodles of the moderately low PPO activity cultivars Lolo and Idaho 377s had declines in brightness of 8.5 and 8.6 CIE L* units, respectively, and the noodles of the high PPO activity cultivar Pristine had a decline of 11.6 CIE L* units. Therefore, IDO580 is a genetic source of improved alkaline noodle brightness and is suitable for use in germplasm enhancement.

Seed of IDO580 will be maintained by the Idaho Agricultural Experiment Station. Small quantities of IDO580 for research and crop improvement may be obtained by contacting the corresponding author.

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Registration of Spring Wheat Germplasm ND 744 Resistant to Fusarium Head Blight, Leaf, and Stem Rusts

ND 744 (Reg. no. GP-778, PI 634936) is a hard red spring wheat (*Triticum aestivum* L.) developed at North Dakota State University (NDSU), Fargo, ND, USA. ND 744 was released in January 2004 by the North Dakota Agricultural Experiment Station (NDAES) for its high level of resistance to Fusarium head blight (FHB) {caused by *Fusarium graminearum* Schwabe [telomorph *Gibberella zeae* (Schwein.) Petch]} and adaptation to the northern spring wheat region of the United States. ND 744 is also resistant to the prevalent races of stem rust (caused by *Puccinia graminis* Pers:Pers. f. sp. *tritici* Eriks. & E. Henn) and leaf rust (caused by *Puccinia triticina* Eriks.) in the region.

ND 744 was derived from a three-way cross, ND 2831/'Parshall'//ND 706, made at NDSU by Dr. R.C. Frohberg in 1997. ND 2831 is a hard red spring experimental line developed by NDSU breeding program from the cross 'Sumai 3' (PI 481542)/ 'Wheaton' (PI 469271)// 'Grandin' (PI 531005)/3/ND 688. Sumai 3, a spring wheat from China, is arguably the most used source of resistance to FHB in the world (Wilcoxson, 1993; Rudd et al., 2001). Parshall (PVP200000212) is a hard red spring wheat (HRSW) developed by NDSU and released in 1999 as a cultivar with good bread-baking properties and moderate tolerance to FHB. ND 706 (Grandin/3/IAS20*4/H567.71//'Amidon' (PI 527682)/4/ND674) is an experimental line developed by the NDSU breeding program with good adaptation and resistance to leaf and stem rust. The F_1 seeds from the three-way cross were grown in the field at Prosper, ND, in 1997. Ten spikes were harvested, bulked, and planted in the greenhouse as an F_2 in the fall of 1997. From the F_2 population, 100 spikes were harvested, bulked, and grown as F_3 in the greenhouse in the spring of 1998. Subsequently, 100 spikes selected from the F_3 were threshed individually and sown as $F_{3:4}$ hill plots in the FHB nursery at Prosper, ND, in the summer of 1998. The FHB nursery is inoculated with FHB pathogen using the "Spray inoculation" method (Rudd et al., 2001) and overhead mist irrigation to enhance disease development. Ten spikes from plants showing less than 10% FHB disease severity (Stack and Frohberg, 2000) were harvested from selected $F_{3:4}$ plots bulked and advanced as $F_{3:5}$ families in the New Zealand off-season nursery during the 1998–1999 crop cycle. Spikes selected in the F_2 and F_3 generations were based on reaction to artificial inoculation to leaf and stem rusts, and agronomic merits including plant vigor, height, and earliness. In New Zealand, selection was based mainly on visual uniformity, grain shattering, plant height, and lodging resistance.

ND 744 was produced from a bulk of one purified $F_{3:5}$ plot selected in 1999 at Christchurch, New Zealand. ND 744 was entered into yield trials as an $F_{3:6}$ line at Casselton and Prosper, ND, in 1999 and subsequently tested in advanced and elite yield trials at four locations in 2000 and 2001, respectively. ND 744 was also tested in ND State Trials in 2001 and in the Uniform Regional Nursery (URN) conducted in the states of North Dakota, Minnesota, South Dakota, Nebraska, Montana, Wyoming, Washington, and Manitoba, Canada in 2002 (Garvin, 2002). Therefore, ND 744 was tested for agronomic and quality traits over 29 location-years from 1999 to 2002. ND 744 was tested for FHB in six locations-years in the FHB nursery grown at Prosper, ND, and in four experiments under greenhouse conditions using the spray inoculation and overhead irrigation techniques. ND 744 was further purified by selecting 200 heads from the quality drill strips ($F_{3:9}$) at Prosper, ND. These spikes were threshed individually and seeded as head rows at Prosper in 2002. Non-uniform rows were discarded and the remaining rows were bulked to form Breeder seed.

On the basis of six location-years of testing in the FHB nursery conducted under field conditions, the FHB incidence (Stack et al., 1997) recorded for ND 744 (45%) was significantly lower ($P < 0.05$) than the incidence for susceptible check '2398' (98%) and the moderately resistant check 'Pioneer 2375' (66%). Similarly, FHB severity (Stack and Frohberg, 2000) recorded for ND 744 (25%) was significantly lower ($P < 0.05$) than 2398 (63%) and Pioneer 2375 (49%), respectively. Visual Scabby Kernels (VSK), also defined as Visual Damaged Kernels (VDK) by Stack and Frohberg (2000), of ND 744 (8%) was significantly lower ($P < 0.01$) than scores recorded on 2398 (58%) and similar to 'Alsen' (PI 615543) (13%). Alsen was released in 2000 as the first NDSU HRSW cultivar with resistance to FHB and has been widely grown in the northern plains since 2001. In four greenhouse tests, ND 744 scores for FHB severity and VSK (45 and 31%) were significantly lower ($P < 0.01$) than the susceptible check 2398 (97 and 92%) and similar to that of Alsen (45 and 36%). Data from the 2002 URN trials showed that average FHB severity, VSK, and deoxynivalenol (DON) levels in grain across three sites of ND 744 (12%, 6%, and 2.6 $\mu g\ g^{-1}$) were significantly lower ($P < 0.05$) than all checks including the susceptible cultivars 'Chris' (CItr 13751) (32%, 25%, and 6.8 $\mu g\ g^{-1}$) and 'Verde' (PI 592561) (24%, 24%, and 7.4 $\mu g\ g^{-1}$), and moderate resistant cultivars Pioneer 2375 (23%, 13%, and 4.2 $\mu g\ g^{-1}$) and 'Steele-ND' (21%, 16%, and 4.6 $\mu g\ g^{-1}$).

ND 744 is an awned, early maturing, and semi-dwarf HRSW. The awns are white and 11–13 cm in length. The glumes are medium, white, elevated, and acuminate; the shoulder and beak are medium width. The kernels are rounded, very hard, red, and oval; the germ is midsized; and the brush is medium. ND 744 has a lax spike type with plant height similar to Alsen (81 cm), 3 and 5 cm shorter than Parshall and Steele-ND, respectively. ND 744 (56 d) is 2 d earlier in heading than Alsen and Parshall. It is similar to Alsen for grain shattering and straw strength, but more resistant to grain shattering than Sumai 3.

On the basis on 16 locations of URN in 2002, mean grain yield and volume weight of ND 744 were 2983 kg ha^{-1} and 770 kg m^{-3}, respectively, compared to Verde (2701 kg ha^{-1} and 749 kg m^{-3}), Chris (2063 kg ha^{-1} and 721 kg m^{-3}), and 'Marquis' (Cltr 3641) (861 kg ha^{-1} and 723 kg m^{-3}). In the those same trials, protein of ND 744 was 157 g kg^{-1} compared to 155, 162, and 156 g kg^{-1} of Verde, Chris, and Marquis, respectively. On the basis of 13 location-years of testing in the ND yield trials, grain yield of ND 744 (4259 kg ha^{-1}) was significantly superior ($P < 0.05$) to grain yield of Alsen (3800 kg ha^{-1}), Parshall (3911 kg ha^{-1}), and Steele-ND (4044 kg ha^{-1}). Grain volume of ND 744 was 792 kg m^{-3} compared to 780, 783, and 790 kg m^{-3} of Steele-ND, Alsen, and Parshall, respectively. Water absorption was 68.4%, higher ($P < 0.05$) than Steele-ND (64.2%), Parshall (63.1%), and Alsen (63.3%). Mixogram mix time (after 3 h fermentation) was 2.08 min, similar to Steele-ND (2.04 min), but 0.15 min greater than Alsen and Parshall. The mixing tolerance scored (12.0 min) was lower than Steele-ND (14.3 min), Parshall (14.5 min), and Alsen (13.5 min). Loaf volume was 1083 mL compared to 1081, 1061, and 1100 mL of Parshall, Alsen, and Steele-ND, respectively. In those same trials however, ND 744 protein content (145 g kg^{-1}) was less ($P < 0.05$) than 151, 153, and 152 g kg^{-1} recorded for Steele-ND, Alsen, and Parshall, respectively. Similarly, flour yield of ND 744 was 635 g kg^{-1} which was 60, 45, and 51 g kg^{-1} less than Steele-ND, Alsen, and Parshall, respectively. ND 744 was therefore not released because its low protein and flour yield compared to Alsen.

On the basis of field reactions at 10 sites from 1999 to 2002 and seedling screening under greenhouse conditions, ND 744 exhibited a resistant reaction to pathotype THBL, the predominant race of leaf rust in the region. ND 744 was evaluated at the USDA-ARS, Cereal Crop Research Unit, Fargo, ND for resistance to stem rust and was found to be highly resistant to pathotypes Pgt-QCCJ, -QTHJ, -QFCQ, -RTQQ, -TPMK, -RHTS, and -HPHJ.

ND 744 is of interest to many breeders in the USA and worldwide where FHB and foliar diseases are an important problem of wheat. ND 744 is an experimental line that combines high level of FHB resistance and grain yield, good breadmaking attributes, and agronomic merits. Upon request to the corresponding author, 5 g seed of ND 744 can be obtained for research purposes and for use in transferring FHB resistance to cultivars. Appropriate recognition of the source should be noted if ND 744 contributes to research on FHB or to the development of new genetic stocks, molecular tools, germplasm, or cultivars.

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REGISTRATIONS OF GENETIC STOCKS

Registration of UC66049 *Triticum aestivum* Blue Aleurone Genetic Stock

UC66049 (Reg. no. GS-154, PI 633834) (*Triticum aestivum* L.), is a genetic stock carrying a dominant gene *Ba,* causing blue color in the endosperm of the caryopsis. *Ba* was transferred to wheat as a whole chromosome arm translocation, replacing the long arm of chromosome 4B by a chromosome arm from *Lophopyrum ponticum* (Podp.). The endosperm color is a useful marker for hybrid wheat, gene flow, gene expression, and other research (Soliman et al., 1980; Jan et al., 1981) or even for specialty food products.

Blue aleurone (*Ba*) is found in the endosperm of several species related to wheat, including *Lophopyrum (*syn: *Elytrigia, Agropyron*). C.A. Suneson's perennial wheat development program at Davis, CA (Suneson et al., 1963a), included some blue aleurone materials which appeared in Wheat Composite Cross I (CC I), developed at Davis by Suneson and collaborators from other locations in the USA (Suneson et al., 1963b). El Sharkawy (1965) selected blue aleurone plants from wheat CCI that were *Triticum aestivum* L. types with $2n = 44$ chromosomes. The blue aleurone character was contributed by *Lophopyrum ponticum* (Podp.) Á. Löve $2n = 10x = 70$ [syn. *Elytrigia pontica* (Podp.) Holub, *Agropyron elongatum* (Host) P.B.].

One of these blue aleurone lines (SH 152-2) was crossed to *T. aestivum* L. 'Sonora 64' (CI*tr* 13930). C.O. Qualset and H.E. Vogt selected single spikes from F_2 plants and scored them for intraspike segregation of seeds with blue aleurone. Due to xenia, hetero- or hemizygous plants showed blue and red seed segregation. Blue seeds from about 125 segregating plants were planted in F_3 progeny rows and the plants segregating for blue aleurone color were selected and blue seeds were planted. This selection process was repeated through F_{11} when homozygous blue and nonblue congenic lines were extracted from each F_2-derived F_{11} line. The expectation was that repeated opportunities for recombination would increase the probability of incorporating the blue aleurone gene into a chromosome of common wheat, either as a whole chromosome pair substitution or as a translocation of a segment of the *Lophopyrum* chromosome to a wheat chromosome. At F_{11} about 75 of the original 150 lines remained.

K.M. Soliman (1975) examined 20 of the congenic blue lines for mitotic chromosome number. Nineteen of them had $2n = 44$ chromosomes, and one had $2n = 42$ chromosomes. The $2n = 42$ line was designated UC66049 and it was subsequently shown by C.C. Jan and J. Dvořák to have a whole arm translocation (Jan et al., 1981). The long arm of chromosome 4B was replaced by an arm of the *Lophopyrum* chromosome that carried a gene for blue aleurone. The translocation event most likely originated from simultaneous misdivision of univalents and subsequent joining of the wheat chromosome 4B short arm with the homoeologous *Lophopyrum* chromosome arm. The chromosome 4B designation is consistent with the correction in labeling 4A and 4B recommended by Dvořák (1983). It was also concluded by Jan et al. (1981) that the *Lophopyrum* chromosome involved was homoeologous to chromosome $4el_1$ of *Lophopyrum ponticum*, isolated by R. Larson at Lethbridge, AB, Canada, also known to carry a blue aleurone gene.

Soliman and Qualset (1984) conducted field trials with the blue and nonblue congenic pairs of lines. UC66049 (blue) was comparable in grain yield to its nonblue counterpart, 4890 and 4680 kg ha^{-1}, respectively in 1975, but grain yield was lower than extant wheat varieties used in California, for example grain yield of 'Anza' (CI*tr* 15284) was 6520 kg ha^{-1} compared to 4890 kg ha^{-1} ($P < 0.05$) for UC66049. In a less favorable environment, the yields of UC66049, Sonora 64, and Anza were 2130, 5600, and 3600 kg ha^{-1} ($P < 0.01$ for UC66049 vs. the standard varieties), respectively. In contrast, the blue $2n = 44$ lines were generally lower yielding than the nonblue $2n = 42$ lines, for example, 2960 and 3920 kg ha^{-1} ($P < 0.01$), respectively. Seed fertility of UC66049 was good, but slightly lower than standard varieties: 2.2 seeds/spikelet vs. 2.4 for Anza and Sonora 64 ($P > 0.05$). Grain protein concentration of the $2n = 44$ blue lines was higher than nonblue lines (1.1%, $P < 0.01$, over 6 experiments). The elevated protein effect was not found in the blue aleurone translocation line ($2n = 42$) (Soliman et al., 1980; Soliman and Qualset 1984) and the higher protein in $2n = 44$ lines was attributed to reduced grain yield due to aneuploidy.

After its release in 1983 (Qualset et al., 1983), UC66049 was distributed to researchers on request. Seeds may be obtained from the National Small Grains Collection, USDA-ARS, 1691S 2700W, Aberdeen ID 83210.

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Registration of Guichao 2 *eui* Rice Genetic Stock

The Agricultural Research Service, U.S. Department of Agriculture released rice genetic stock Guichao 2 *eui* (GSOR 11) (Reg. no. GS-1, PI 634574) in 2004. The Guichao 2 *eui* genetic stock carries the recessive tall *eui* (elongated uppermost internode) gene in an *indica* background, as opposed to *eui* mutants previously found in *japonica* rices. The *eui* plant type is potentially useful for better pollen transfer in hybrid rice seed production by raising the male line panicles above female line panicles or by obtaining better panicle exsertion of female line panicles from the flag leaf boot.

The Guichao 2 *eui* genetic stock was found in a gamma ray–mutagenized (200 Gy) M_2 population of the semidwarf *indica* cultivar Guichao 2 (PI 615013), grown at Stuttgart, AR in 1996. Among approximately 1000 M_1 panicle-to-M_2 rows, 5 out of 16 plants in a single row were observed to have the *eui* phenotype, which is characterized by near doubling in length of the uppermost internode (Rutger and Carnahan, 1981), resulting in the panicle being noticeably extruded above the flag leaf. Progeny tests of the 5 *eui* plants showed then to be true-breeding for the *eui* phenotype. Progeny tests of the remaining 11 normal semidwarf plants, conducted in the greenhouse in 2002–2003, showed that 5 were true-breeding for the normal semidwarf plant type, while the other 6 segregated for normal and *eui* plant type. The composite segregation was 103 normal:24 *eui*, a satisfactory fit ($0.10 < P < 0.25$) to the 3:1 ratio also observed for *japonica eui* stocks (Rutger and Carnahan, 1981; Mackill et al., 1994). In height measurements of 20 *eui* and 20 normal plants in these populations, the *eui* plants averaged 107 cm tall compared to 76 cm for the normal plants. Much of the height difference was due to the elongated uppermost internode in the *eui* plants, 39 cm versus 22 cm in the normal plants

Being inherited as a recessive tall plant type, the first *eui* (CI 11055, found in California *japonica* germplasm) was postulated as being useful in the male parent in hybrid seed production fields, in order to facilitate transfer of pollen from tall males to short females in crossing blocks (Rutger and Carnahan, 1981). Subsequently three groups have transferred the *eui* gene into *indica* rice (Virmani et al., 1988; He and Shen, 1991; Yang et al., 2000). The *eui* gene has been shown to be a recurring mutation in California *japonica* rice (Mackill et al., 1994). In the cross CI 11055/Guichao 2 *eui*, four F_1 plants had the tall *eui* phenotype, as did all 119 resulting F_2 plants, indicating that this new *eui* also is allelic to the previous source. Having *eui* in an *indica* background is useful in that this circumvents the need to cross and backcross the *japonica* source into *indicas*. A composite of approximately 100 *eui* panicles from a 2002 AR planting was made to form the Guichao *eui* release

Genetic stock amounts (about 1 g) Guichao 2 *eui* have been placed in the Genetic Stocks–*Oryza* (GSOR) collection and are available for distribution to geneticists, breeders, and other research personnel upon written request to: J. Neil Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160. Genetic stock also will be deposited in the National Center for Genetic Resources Preservation, 1111 S. Mason Street, Ft. Collins, CO 80521-4500. If this genetic stock contributes to the development of new genetic information or germplasm, it is requested that appropriate recognition be given to the source.

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