

REGISTRATIONS OF CULTIVARS

Registration of 'Oklee' Wheat

'Oklee' is a hard red spring wheat (*Triticum aestivum* L.) (Reg. no. CV-963, PI 634553) developed and released by the Minnesota Agricultural Experiment Station in cooperation with USDA-ARS in January 2003. It was named after a town in its region of adaptation in northwest Minnesota. Oklee was released on the basis of its high grain yield, high grain volume weight, high grain protein content, and early maturity. In addition, Oklee has moderate resistance to Fusarium head blight (FHB, caused primarily by *Fusarium graminearum* Schwabe).

Oklee was derived from the cross '2375'/SBF0670, made by the former Pioneer Hi-Bred spring wheat breeding program in the USA. The cultivar 2375 (PI 601477, syn. Pioneer 2375) has the pedigree Olaf//Era/Suqamuxi 68/3/Chris/ND487//Lark and was widely grown in Minnesota during the mid-1990s due to its moderate resistance to FHB. SBF0670 is an unreleased line whose pedigree contains hard red spring lines once prominent in the region including 'Chris' (CItr 13751, Heiner and Johnston, 1967), 'Era' (CItr 13986, Heiner and McVey, 1971), and 'Butte'.

The F₂ population producing Oklee was selected for leaf rust (caused by *Puccinia triticina* Eriks.) and stem rust (caused by *Puccinia graminis* Pers.: Pers.) resistance in a field planting at St. Paul in 1993. The F₃ generation was advanced by single seed descent in a greenhouse. The selection resulting in Oklee was selected from a single plant in an F₄ headrow in 1994 and this seed was increased in a winter nursery in Arizona during 1994 and 1995. This selection was tested under the experimental designation MN95002 in trials from 1995 through 2000 and following purification as MN95002-A in 2001 and 2002. The purification process was initiated in 1999 when 100 heads from F₁₀ plants of MN95002 were harvested and grown as individual headrows in a winter increase in Arizona. Eighty of these rows were selected based on uniformity of height among and within rows. All selections were similar for other morphological and seed characteristics. The 80 selections were evaluated for agronomic characteristics, and reaction to Fusarium head blight, leaf rust, and stem rust at St. Paul in 2000. No significant differences in disease reaction were observed among the 80 lines. Nineteen of the 80 selections were discarded due to delayed heading and/or shorter height. Equal amounts of seed from the remaining 61 selections were bulked to form MN95002-A. MN95002-A and MN95002 were evaluated in replicated yield trials in 2001 and 2002. No significant differences ($P = 0.05$) in grain yield between MN95002 and MN95002-A were identified, although MN95002-A was more uniform for plant height and heading date than MN95002. Off-type plants that are approximately 10 cm taller occur in MN95002-A at a frequency of about 3 in 10 000. Approximately 1000 kg of Breeder seed of MN95002-A was produced in 2001 by the Minnesota Crop Improvement Association and further increased in California and in Minnesota in 2002. MN95002-A was released as Oklee in 2003.

Oklee has erect juvenile plant growth, a recurved flag leaf, white glumes with an apiculate shoulder, and an acuminate beak. The spike is awned, mid-dense, and tapering. The kernel is red and ovate in shape with angular cheeks and a narrow, mid-deep crease. The brush on the kernel has a collar and is medium in length.

Oklee was tested as MN95002 and MN95002-A in Minne-

sota statewide yield trials from 1998 through 2002. Oklee is relatively early maturing and produces spikes 1.3 d earlier than 2375 and 0.6 d earlier than Oxen (PI 596770), the most widely grown cultivar in Minnesota since the late 1990s. Oklee is a semidwarf cultivar and averages 75 cm, the same height as Oxen, and is 3 cm shorter than 2375 in Minnesota trials. In 35 Minnesota trials conducted from 1998 through 2002, Oklee yielded 3664 kg ha⁻¹ compared to 3482 kg ha⁻¹ for 2375 and 3825 kg ha⁻¹ for Oxen. Oklee was evaluated in 29 environments in the Uniform Regional Hard Red Spring Wheat Nursery in 1998 and 1999 and yielded an average of 3456 kg ha⁻¹ compared to an average of 3470 and 3503 kg ha⁻¹ produced by the check cultivars, 2375 and Verde (PI 592561, Busch et al., 1996), respectively. Oklee has moderately strong straw and a lodging rating of 2.3 when scored on a scale of 0 (erect) to 9 (lodged) in 21 environments at which lodging occurred from 1998 thru 2002. By comparison, the cultivars 2375, Oxen, and Verde had lodging ratings of 3.5, 2.6, and 2.1, respectively.

Oklee has moderate resistance to FHB in misted, inoculated field nurseries, similar to the resistance of 2375. In 11 FHB nurseries from 1998 through 2001, Oklee averaged 23.6% diseased spikelets, 16.7% visually scabby kernels (VSK), and 8.8 mg kg⁻¹ of the mycotoxin deoxynivalenol (DON). The cultivar 2375 averaged 22.7% diseased spikelets, 17.5% VSK, and 9.8 mg kg⁻¹ DON. In the same trials, the resistant check 'BacUp' (PI 596533, Busch et al., 1998) and the susceptible check 'Wheaton' (PI 469271, Busch et al., 1984) averaged 12.5 and 61.8% diseased spikelets, 8.5 and 45.5% VSK, and 6.1 and 38.3 mg kg⁻¹ DON, respectively. Oklee is resistant to currently prevalent races of stem rust as seedlings in greenhouse tests and as adults in field tests with the same races. Oklee is moderately susceptible in seedling plants to leaf rust race THBJ that is the most common race in the spring wheat area of Minnesota and the Dakotas, but is resistant in seedling plants to most other leaf rust races. Adult plants in the field are moderately resistant to prevalent races of leaf rust. Oklee is moderately resistant to the race 1 isolate Pti2 (ATCC 44143) of tan spot [caused by *Pyrenophora tritici-repentis* (Died.) Drechs.] based on greenhouse assays. Field reaction to the foliar diseases tan spot and Septoria tritici blotch (caused by *Septoria tritici* Roberge ex Desmaz.) is moderate, better than 2375.

The USDA Spring Wheat Quality Laboratory, Fargo, ND, evaluated bread-making properties of Oklee grown in a total of 17 yield trial plots from 1998 through 2001. Oklee had an average grain volume weight of 78.84 kg hL⁻¹, grain protein of 150 g kg⁻¹, and loaf volume of 202.5 cm³. Compared to 2375, Oklee is 1.35 kg hL⁻¹ higher in grain volume weight, 18 g kg⁻¹ higher in grain protein, and 6% greater in loaf volume. Compared to Oxen, Oklee is 2.73 kg hL⁻¹ higher in grain volume weight, 16 g kg⁻¹ higher in protein, and 0.8% greater loaf volume. Oklee has relatively weak mixing properties as indicated by mixograph patterns in which it was rated as 2.0 on a 1-to-9 scale (1 = weakest, 9 = strongest) whereas 2375 and Oxen were rated as 2.9 and 3.3, respectively. The industry evaluations by the Wheat Quality Council in 1999 (1 location) and 2000 (2 locations) indicated that Oklee was lower in quality than the high quality check, 'Grandin' (PI 531005). Compared with Grandin, Oklee was higher in protein (144 vs. 141 g kg⁻¹), lower in flour yield (71.8 vs. 73.3%),

higher in farinograph water absorption (61.5 vs. 61.1%), but lower in mixing tolerance [3.0 vs. 4.15 on a 1–5 scale (1 = weakest, 5 = strongest)]. Overall quality (1–5 scale, 1 = lowest, 5 = highest) based on three environments was rated as 3.3 for Oklee compared to 4.0 for Grandin.

The Minnesota Agricultural Experiment Station, St. Paul, MN 55108, will maintain Breeder seed of Oklee. Foundation seed will be produced and maintained by the Minnesota Crop Improvement Association, 1900 Hendon Ave., St. Paul, MN 55108. Application has been made for U.S. Plant Variety Protection with seed certification option. Small quantities of seed for research purposes may be obtained from J.A. Anderson.

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Registration of 'CP 89-2376' Sugarcane

'CP 89-2376' (Reg. no. CV-122, PI 634709) 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 a cross made at Canal Point, FL, but its parentage is unknown because a tag was lost in an early stage of selection. CP 89-2376 was developed through cooperative research conducted by the USDA-ARS, the University of Florida, and the Florida Sugar Cane League, Inc. and was released in the fall of 2002.

Stalk weight of CP 89-2376 averaged across three crops (plant cane, first and second ratoon) on organic soils was 4.0% higher than that of the only commercial check to which CP 89-2376 was compared, 'CP 70-1133' (Rice et al., 1978), but on sand soils, its stalk weight was only 88% of that of the check. Stalks of CP 89-2376 have a heavy wax layer, are yellow-green under the leaf sheath, and are maroon in areas exposed to the sun. CP 89-2376 has a light-green growth ring and the buds do not touch (subtends) the growth ring. Its leaf sheath is glabrous and it has a small or no auricle. CP 89-2376 tassels in December and is intermediate to late maturing. CP 89-2376 has shown tolerance to high water tables.

CP 89-2376 was evaluated in eight yield trials in the 1993 to 1994 through the 1995 to 1996 harvest seasons (eight plant-

cane, eight first- and eight second-ratoon crops) on organic soils where its cane yield was 6.7% higher than that of CP 70-1133. The sucrose content of CP 89-2376 was 5.2% higher than that of CP 70-1133. Its sucrose yield was 12.7% higher than that of CP 70-1133. The theoretical economic index which incorporates the cost of harvesting, hauling, and milling with sucrose content and cane yield (Deren et al., 1995) on organic soils for CP 89-2376 was predicted to be 19.3% higher than that of CP 70-1133.

CP 89-2376 was evaluated in two yield trials in the 1993 to 1994 through the 1995 to 1996 harvest seasons (two plant-cane, one first- and two second-ratoon crops) on sand soils. The cane yield of CP 89-2376 in these tests was 81.6% of that of CP 70-1133. The sucrose content for CP 89-2376 was 4.9% higher, but its sucrose yield was only 85% of that of CP 70-1133. The theoretical economic index on sand soils for CP 89-2376 was predicted to be only 84% of that of CP 70-1133.

CP 89-2376 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] and *Sugarcane mosaic virus* strain E. Inoculated test results indicated that CP 89-2376 is moderately resistant to ratoon stunting disease (caused by *Leifsonia xyli* subsp. *xyli* Evtushenko et al.). CP 89-2376 has a fiber content of 10.2% compared to 10.4% for CP 70-1133.

CP 89-2376 is being released primarily because of its high yield on organic soils and its outstanding response when subjected to high water tables. Seedcane will be maintained by USDA-ARS at the Sugarcane Field Station, Canal Point, FL for 5 yr and is available through the National Plant Germplasm System.

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Registration of 'HoCP 96-540' Sugarcane

'HoCP 96-540' sugarcane (a complex hybrid of *Saccharum officinarum* L., *S. spontaneum* L., *S. barberi* Jeswiet, and *S. sinense* Roxb. amend. Jeswiet) (Reg. no. CV-123, PI 635995) was selected at Houma (Ho), Louisiana from progeny of the cross 'LCP 86-454' (Martin et al., 1996) × 'LCP 85-384' (Milligan et al., 1994) made at Canal Point (CP), FL, in 1991. HoCP 96-540 is a product of cooperative research by the USDA-ARS, the Louisiana Agricultural Experiment Station of the Louisiana State University Agricultural Center, and the American Sugar Cane League of the U.S.A., Inc. HoCP 96-540 was released in the spring of 2003.

HoCP 96-540 has a moderate population of medium-sized stalks that turn amber when exposed to sunlight. Its leaf curva-

ture at the apex in a crop canopy is distinctively pointed, similar to parental clone LCP 86-454, rather than rounded. Unlike LCP 85-384, its leaf sheath pubescence is negligible. Newly exposed sheaths prominently display a white waxy coating. The dewlap is pale, and auricles are seldom more than one cm long.

Stalk number of HoCP 96-540 is 90% and stalk weight is 125% of Louisiana's principal cultivar, LCP 85-384, when averaged over plant-cane, first-ratoon, and second-ratoon crops. Similar to LCP 85-384, HoCP 96-540 is a very good ratooning cultivar. Yield data from a total of 58 mechanically harvested, replicated yield trials on both light- and heavy-textured soils indicate that HoCP 96-540 consistently produces 10 to 15% greater total recoverable cane and sugar per hectare than LCP 85-384 in plant-cane, first-ratoon, and second-ratoon crops. HoCP 96-540 is a midmaturing cultivar that produces levels of recoverable sugar per ton of cane and fiber content comparable to those of LCP 85-384. Field observations suggest that stalks of HoCP 96-540 are more erect and less brittle than LCP 85-384. In addition, leaf sheaths may be less tightly adhered to the stalks than LCP 85-384. These characteristics should minimize yield losses associated with both whole-stalk and combine harvesting.

HoCP 96-540 is resistant to *Sugarcane mosaic virus* (strains A, B, and D) and *Sorghum mosaic virus* (strains H, I, and M). The cultivar is resistant to smut (caused by *Ustilago scitaminea* Syd. and P. Syd.) and leaf scald [caused by *Xanthomonas albilineans* (Ashby) Dowson] diseases, and moderately resistant to rust (caused by *Puccinia melanocephala* Syd. and P. Syd.) under natural field infection conditions. Similar to essentially all sugarcane cultivars released in Louisiana, HoCP 96-540 may sustain significant reductions in yields of total recoverable sugar and cane in ratoon crops from ratoon stunting disease (caused by *Leifsonia xyli* subsp. *xyli*). It is essential that seed cane of this cultivar be free or nearly free of this disease to maximize its yield potential. Based on field observations and laboratory tests, HoCP 96-540 does not appear to be any more susceptible to the *Sugarcane yellow leaf virus* than current commercially grown cultivars. Like LCP 85-384, HoCP 96-540 is susceptible to the sugarcane borer (*Diatraea saccharalis* Fabricius) and should not be grown in areas where insecticides cannot be applied. Field observations also suggest that HoCP 96-540 is not any more susceptible to herbicides commonly used for the control of problematic weeds than LCP 85-384. HoCP 96-540 has good cold tolerance and is as responsive to glyphosate [isopropylamine salt of N-(phosphonomethyl) glycine] (Polado L, Monsanto, St. Louis, MO) as LCP 85-384, based on cold tolerance and ripener studies conducted thus far.

The following microsatellite markers were produced from HoCP 96-540 with the ABI PRIZM 310 Genetic Analyzer (PE Applied Biosystems, Foster City, CA) for identification purposes: two fragments of SMC334BS [145 and 162 base pairs (bp) in size], four fragments of SMC336BS (166, 169, 171, 177 bp), six fragments of MCSA068G08 (177, 180, 183, 186, 188, 194 bp), four fragments of SMC286CS (129, 132, 135, 144 bp), four fragments of SMC713BS (119, 357, 360, 369 bp), three fragments of MCSA053C10 (143, 147, 150 bp), five fragments of MCSA042E08 (123, 135, 151, 155, 197 bp), four fragments of mSSCIR5 (145, 168, 373, 378 bp), and three fragments of mSSCIR33 (320, 326, 335 bp). A more detailed description of primers and protocol has been published (Cordeiro et al., 2003)

Seed cane of HoCP 96-540 will be maintained at the USDA-ARS Southern Regional Research Center's Sugarcane Research Unit, located at Houma, LA, for five years. Application

for variety protection through plant or utility patents will not be pursued.

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Registration of 'CP 96-1602' Sugarcane

'CP 96-1602' (Reg. no. CV-121, PI 635107) 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 a polycross made at Canal Point, FL, in December 1994 with CP 81-1425 as the female parent. CP 81-1425 is a breeding clone that had higher stalk number and theoretical recoverable sucrose (TRS, kg sucrose Mg⁻¹ cane) than its commercial check, but it was not released because of its susceptibility, based on natural infection, to brown rust (caused by *Puccinia melanocephala* Syd. & P. Syd.). CP 96-1602 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.

CP 96-1602 is pubescent along the lower portion of the leaf sheath and has long auricles (>2.0 cm) on young leaves. It has a brownish growth ring, heavy wax bloom, is yellow-green under the leaf sheath, and has loosely adhering leaf trash. Stalk weight of CP 96-1602, averaged over three crops (plant cane, first and second ratoon), was 6% higher on sand soils than that of the commercial check 'CP 70-1133' (Rice et al., 1978). The stalk weights of CP 96-1602 and CP 70-1133 were similar on organic soils. CP 96-1602 had a fiber content of 9.5% compared with 10.4% for CP 70-1133. Although not grown extensively in Florida when CP 96-1602 was evaluated, a committee of growers, and public and private scientists selected CP 70-1133 as the most useful commercial check because it had an impressive history of commercial use on organic and sand soils in Florida. Other logical check candidates had limitations for use in small plots.

CP 96-1602 was evaluated on organic soils at eight locations over a three-crop cycle (seven plant-cane, eight first- and seven second-ratoon crops) where its cane yield (Mg cane ha⁻¹) was 5.8% higher than that of CP 70-1133. The TRS of CP 96-1602 was 7.6% higher than that of CP 70-1133. Its sucrose yield (Mg sucrose ha⁻¹) was 14.2% higher than that of CP 70-1133. The theoretical economic index for CP 96-1602 was 23.6% higher than that of CP 70-1133 on organic soils. The economic

index estimates the value of a clone by considering the costs of producing, harvesting, hauling, and milling the cane (Deren et al., 1995). When comparing two clones with equal sucrose yields, the index favors the clone with a higher TRS.

CP 96-1602 was also evaluated on sand soils at two locations over a three-crop cycle (two plant-cane, two first- and two second-ratoon crops). The cane yield of CP 96-1602 in these tests was 14.4% higher than that of CP 70-1133. The TRS and sucrose yields for CP 96-1602 were, respectively, 8.0 and 23.7% higher than those of CP 70-1133. The theoretical economic index for CP 96-1602 was 35.9% higher than that of CP 70-1133 on sand soils.

CP 96-1602 has shown adequate levels of field resistance in Florida to eye spot [caused by *Bipolaris sacchari* (E.J. Butler) Shoemaker], smut (caused by *Ustilago scitaminea* Syd. & P. Syd.), brown rust, leaf scald [caused by *Xanthomonas albilineans* (Ashby) Dowson], and *Sugarcane mosaic virus* strain E. CP 96-1602 is susceptible to *Sugarcane yellow leaf virus*. Based on presence of colonized vascular bundles in inoculated tests, CP 96-1602 is moderately resistant to ratoon-stunting disease (caused by *Leifsonia xyli* subsp. *xyli* Evtushenko et al.).

CP 96-1602 was released because of its favorable TRS, high sucrose yields, and its resistance to most major diseases. Vegetative cuttings of CP 96-1602 will be maintained by USDA-ARS at the Sugarcane Field Station, Canal Point, FL, for five years.

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Registration of 'Ponoka' Barley

'Ponoka', a two-rowed, spring feed barley (*Hordeum vulgare* L.) (Reg. no. CV-313, PI 633982), was developed by the Field Crop Development Center (FCDC), Lacombe, AB, Canada. Ponoka has been registered in Canada (Canadian Reg. no. 5668) by the Canadian Food Inspection Agency (CFIA), Ottawa, ON. Ponoka was tested by FCDC as H93003006Z and in the Western Co-operative Two-Row Barley Registration Test as TR01656. Ponoka was selected from the cross H92001F₁/TR229. H92001F₁ was the F₁ generation of the cross 'Harrington'/'Camelot' made at FCDC. Harrington is a two-rowed, malting barley developed at the University of Saskatoon, Saskatoon, SK, Canada (Harvey and Rosnagel, 1984). Camelot is a two-rowed barley introduced to FCDC as entry no. 19 in the 13th International Barley Yield Trial (IBYT) supplied by the International Center for Agricultural Research in the Dry Areas (ICARDA)/International Wheat and Maize Improvement Center (CIMMYT), Mexico (F. Capet-

tini, personal communication, 2003). TR229 is a two-rowed, malting barley tested in the Western Cooperative Two-Row Barley Registration Test from 1990 to 1992 and granted interim registration in 1993. TR229 was selected by Dick Metcalfe, Agriculture and Agri-Food Canada (AAFC) Cereal Research Center, Winnipeg, MB, Canada and Bill Legge, AAFC Brandon Research Center, Brandon, MB, Canada from a cross of 'AC Oxbow' (TR226)/'Manley' (TR490).

The cross H92001F₁/TR229 was made in the field during the summer of 1993. Two hundred spikes were selected, based on a visual assessment, from the F₂ bulk population and advanced at the Crop Development Center in Saskatoon during the winter of 1994 to 1995 via single seed descent, with no further selection, to the F₅ generation. Two hundred F₅ head-rows were grown out in the field at Lacombe in the summer of 1995 from which the line H93003006Z was selected based on disease resistance to scald [caused by *Rhynchosporium secalis* (Oudem.) J.J. Davis] and smut (caused by *Ustilago* spp.), quality [protein and other traits based on NIRS analyses (Oatway and Helm, 1999)], and agronomic type (straw strength, maturity). Yield, quality, and further disease testing of H93003006Z began in the summer of 1996 at Lacombe. From 1996 to 2002, the line was tested in multilocation field tests throughout western Canada. In these trials, Ponoka yielded 15% higher than 'CDC Dolly', the feed check cultivar (Rosnagel and Harvey, 1994), when site mean yields were greater than 8.0 t ha⁻¹; while under low-yielding conditions (site mean yields less than 4 t ha⁻¹), yields of Ponoka were 1.0% higher than those of CDC Dolly.

In the Western Co-operative Two-Row Barley Registration Test (2001 and 2002), Ponoka had a mean grain yield over 31 sites of 4.72 t ha⁻¹, higher than the mean grain yield of 4.37 t ha⁻¹ for CDC Dolly. Over the 28 sites that maturity was measured, Ponoka reached maturity in approximately 95 d, 3 d later than CDC Dolly. Ponoka was taller at 67 cm than CDC Dolly at 64 cm (32 sites). Ponoka had the same test weight at 66 kg hL⁻¹ as CDC Dolly (31 sites), but its kernel weight was only 46 mg (31 sites) and percentage plump only 87% (18 sites) versus 47 mg and 93% for CDC Dolly.

Ponoka is resistant to the surface-borne smuts and true loose smut [caused by *U. nuda* (Jens.) Kellerman & Swingle]. Ponoka is moderately susceptible to the spot form of net blotch (caused by *Pyrenophora teres* Dreschs. f. *maculata* Smedeg.) but is moderately resistant to the net form (*P. teres* forma *teres*). Ponoka has a moderately susceptible seedling reaction to Race 1493C of scald [caused by *Rhynchosporium secalis* (Oudem.) J.J. Davis]; but as an adult plant in field tests at Lacombe and Edmonton, AB, it was moderately resistant to scald. Ponoka had ratings to Fusarium head blight (scab) {predominantly caused by *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch]} of 2.3 and 2.5 (0-5 scale) in two years of testing at Brandon, MB, similar to CDC Dolly and Harrington. In two years of testing at Lacombe, AB, for reaction to common root rot, Ponoka had a moderately resistant reaction in one year (lower percentage infection than CDC Dolly and Harrington) and moderately susceptible reaction the next (higher percentage infection than either CDC Dolly and Harrington). Ponoka is moderately susceptible to spot blotch [caused by *Cochliobolus sativus* (Ito and Kuribayashi) Dreschs. ex Dastur]. Ponoka is susceptible to stem rust (caused by *Puccinia graminis* Pers. f.sp. *tritici* Eriks. and Henn.), Septoria speckled leaf blotch (caused by *Septoria passerinii* Sacc.) and *Barley yellow dwarf virus*.

Ponoka has a green coleoptile with medium elongation. Its early growth habit is intermediate between prostrate and

upright. The lower leaves have glabrous green sheaths and blades. At the boot stage, leaves have a slight waxy bloom and glabrous sheaths. The flag leaf of Ponoka is long, medium in width, with an upright attitude, purple auricles, glabrous auricle margins and blade, and a waxy sheath. The spike of Ponoka tends to have only slight (0–3 cm) exertion. The stem has five elongated nodes, medium thickness, a medium green color, and a waxy bloom. The collar is V-shaped and the neck is slightly curved. The spike has a strap (parallel) shape with medium density, semi-erect attitude, and slight waxy bloom. The glumes are midlong with a purplish tip, covered with long hairs, and have rough awns equal in length to the glumes. The lemma awns are long and rough with a purplish color and a few barbs on the lateral veins. The kernels have colorless aleurones, long rachillas with long rachilla hairs, clasping lodicules, and incomplete horseshoe basal markings.

From the F₇ to F₉ generations, increase plots were grown from which spikes were selected to grow F₁₀ prebreeders rows. One hundred and ninety-five F₁₁ breeder rows and plots were grown from selected uniform F₁₀ rows. Seed from these rows and plots were bulked to form the Breeder seed. Breeder seed will be maintained by FCDC, Lacombe, AB, Canada. For research purposes, small quantities of seed are available from FCDC or USDA-ARS National Seed Storage Laboratory, 1111 South Mason Street, Fort Collins, CO 80521-4500. Commercial seed of Ponoka will be distributed through SeCan Association, 201-52 Antares Drive, Ottawa, ON, Canada, K2E 7Z1; email, seed@secan.com; and website, <http://www.secان.com>. Application has been made in Canada for plant breeders' rights (Appl. no. 03-3570).

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Registration of 'Manny' Barley

'Manny' barley (*Hordeum vulgare* L.) (Reg. no. CV-314, PI 633981) is six-rowed, hulled, and rough-awned spring barley with strong straw that is adapted to western Canada. Manny was developed at the Field Crop Development Centre (FCDC) of Alberta Agriculture, Food and Rural Development (AAFRD), and was approved for registration in February 2003 by the Prairie Registration Recommending Committee for Grain—Barley and Oats Subcommittee. Manny was registered in Can-

ada (Reg. no. 5675) on 21 July 2003. Manny was named after Manuel (Manny) J. Cortez, the late FCDC germplasm scientist involved in the early development of this and many other barley cultivars from FCDC. Manuel worked at FCDC for 14 years developing and evaluating a wide range of germplasm and maintaining the germplasm database.

Manny was evaluated as H90013004Z in the FCDC-AAFRD barley field tests and starting in 2001 as BT 562 in the Western Co-operative Six-Rowed Barley Tests. Manny was derived from the 1990 cross of lines BT 538 and BT 636. The line BT 538 was derived from a F₂ introduction into the FCDC breeding program from the International Maize and Wheat Improvement Center (CIMMYT) in 1979. Through generations, this introduction was tested, screened, and selected under the designation M78156005. The pedigree of M78156005 is 11012.2-MZQ(PRO-TOLIXCER2-TOLI/DWG1/API/POR/C58.1-4407-1Y). The line BT 636 originates from Agriculture and Agri-Food Canada (AAFC) at Lacombe. The pedigree of BT 636 is LA659-207/BT 324. LA659-207/BT 324 is a sister line of 'Diamond' (Kaufmann and Kibite, 1985), originating from the cross of 'Galt'/'Unitan' (Harder and Legge, 2000; Martin et al., 1991). Galt (Wells, 1967) is a Canadian cultivar and Unitan (Eslick and Hockett, 1965) is an introduced cultivar from the United States. BT 324 is from the cross of NDB 135/Br. 6355-14. NDB 135 is a North Dakota six-rowed feed barley developed in the 1960s that was noted then for its good leaf disease resistance. The pedigree of NDB 135 is Dickson/3/CIho 4738//Traill/UM 570 (Peterson et al., 1968; Lambert, 1958). The pedigree of UM 570 is Newal (CIho 6088)/Peatland (CIho 2613)//Montcalm (CIho7149). Br. 6355-14 is a line developed in 1963 at AAFC Brandon (likely a six-rowed malt cross) whose pedigree has been lost.

A modified pedigree-bulk breeding procedure was used to propagate early generation progeny of the breeding line H90013. The F₁ generation was grown as increase plots in a winter nursery (1990–1991) near El Centro, CA. The F₂ seed from California was grown in field plots at FCDC, Lacombe in 1991. Seeds from approximately 500 randomly selected spikes from F₃ plants were harvested in bulk and sown in the California winter nursery. The F₄ to F₆ generations were grown as bulk plots at FCDC from 1992 to 1994. The F₆ generation plants were selected to grow out as 200 individual F₇ headrows. The line H90013004Z was selected from the headrows based on grain yield, test weight, 1000-kernel weight, lodging resistance, and resistance to diseases such as scald [caused by *Rhynchosporium secalis* (Oudem.) J.J. Davis] and smuts (caused by several *Ustilago* spp.). Manny has good feed quality (determined by near-infrared spectroscopy) such as digestible energy and digestible proteins. The line H90013004Z was first yield tested in a single replicated trial located at FCDC in 1996, followed by replicated yield trials at multiple locations from 1997 to 2001. Purification of H90013004Z took place during this time, resulting in 196 F₁₂ headrows that were selected to form the Breeder seed.

Manny is a medium height cultivar with strong straw and lodging resistance. Manny has a juvenile growth habit between erect and intermediate. As a juvenile plant, it has a wide, long, and upright flag leaf with white auricles. It has short spikes with long awns that are slightly purple tipped. The kernels of Manny are short in length and medium in width with clasping lodicules and incomplete horseshoe-shaped basal markings.

In the 2001 and 2002 Western Co-operative Six-Rowed Barley Test, average grain yield for Manny from 34 locations was 4467 kg ha⁻¹ compared to 4538 kg ha⁻¹ for 'AC Lacombe' (Kibite, 1994) and 4854 kg ha⁻¹ for 'AC Rosser' (Therrien, 1998). From the FCDC yield data based on 50 station years, Manny had an overall mean yield of 6766 kg ha⁻¹ compared

to 6522 kg ha⁻¹ for AC Lacombe. Manny out-yielded the check cultivar AC Lacombe by 4 to 9% in the Western Black Soil Zone (five locations) in the 2001 and 2002 Western Co-operative Six-Rowed Barley Test. This trend was reflected in the High Yield Class (6.0–8.0 t ha⁻¹) of FCDC Tests based on 27 station years. Manny matures in 90 d. This is 1 to 3 d earlier than AC Lacombe or AC Rosser. This is based on the average of 44 station years at FCDC tests and 27 locations in two years of the Western Co-operative Six-Rowed Barley Test. Results of the FCDC Tests show Manny had an average 1000-kernel weight of 38.0 g compared to 41.6 g for AC Lacombe (29 station years), and a test weight of 61.5 kg hL⁻¹ (49 station years), which is similar to AC Lacombe. Manny had a higher plump seed percentage of 69% compared to 59% for AC Lacombe. The biomass yield (taken at the soft dough stage for ensiling) of Manny (12 557 kg ha⁻¹) was higher compared to that of AC Lacombe (11 651 kg ha⁻¹) by 7% in four station years at FCDC. Manny shows better water use efficiency than the moderately drought-tolerant check cultivars AC Lacombe and 'Harrington' (Harvey and Rossnagel, 1984). The water-use efficiency (the ratio of dry matter production to water consumption) was determined from simulated rain shed experiments that were conducted at the FCDC. Manny showed a tendency of yielding relatively higher dry matter compared to the check cultivars under simulated drought conditions.

Manny has good field resistance to scald, as shown in combined data from the Western Co-operative Six-Rowed Barley Test and CIMMYT. In Mexico under high scald pressure, BT 562 was rated as R (resistant) in both 2000 and 2001, and TR (trace resistant) in 2002. In inoculated tests for smut in 1996 to 1999 at FCDC, H90013004Z was shown to be resistant to loose smut [caused by *Ustilago nuda* (Jens.) Rostr.]. In the Western Co-operative Six-Rowed Barley Tests, BT 562 had good resistance to covered smut [caused by *U. hordei* (Pers.) Lagerh.]. Manny has moderate resistance or tolerance to false loose smut [caused by *U. nigra* Tapke (syn. *U. avenae* (Pers.) Rostr.)], and further testing has shown 60% of the lines to be resistant while the remaining lines are susceptible to loose smut. Manny is moderately susceptible to the both net form of net blotch (caused by *Pyrenophora teres* f. *teres* Drechs.) and the spot form of net blotch (caused by *P. teres* f. *maculata* Smedeg.). Manny is susceptible to common root rot [caused by *Cochliobolus sativus* (Ito & Kurib) Drechsler ex Dastur.] and is moderately susceptible to stem rust (caused by *Puccinia graminis* f. sp. *tritici* Eriks & E. Henn.). Manny is susceptible to both spot blotch [caused by *C. sativus* (Ito & Kurib) Drechsler ex Dastur.] and to Septoria speckled leaf blotch (caused by *Septoria passerinii* Sacc.). Manny is moderately susceptible to Fusarium head blight (scab) (mainly caused by *Fusarium graminearum* Schwabe [telemorph *Gibberella zeae* (Schwein.) Petch]).

The Field Crop Development Centre, Lacombe, Alberta, Canada will maintain the Manny Breeder seed. Small samples for breeding purposes may be obtained from the corresponding author on request. Commercial seed distribution rights were granted to SeCan Association, 201-52 Antares Drive Ottawa, ON, K2E 7Z1; telephone, 613-225-6891; fax, 613-225-6422; e-mail, seed@secan.com; website, http://www.secان.com.

Application (Appl. no. 03-3571) has been made in Canada for Plant Breeder's Rights.

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Registration of 'Thoroughbred' Barley

'Thoroughbred' (Reg. no. CV-316, PI 634933) is a high-yielding, awned, six-rowed, hulled winter-feed barley (*Hordeum vulgare* L.) that was developed and released May 2003 by the Virginia Agricultural Experiment Station. Thoroughbred is well-adapted to winter barley production areas across the mid-Atlantic and southeastern regions of the U.S.A. The name Thoroughbred was selected to denote the superior seed quality of this cultivar, which produces exceptionally bright plump kernels in warm humid environments of the East Coast.

Thoroughbred was derived from a cross between VA90-44-110 and 'Plaisant' (PI 584894). The pedigree of the female parent VA90-44-110 is CIho 8618/'Surry'/'Sussex'/'3'/'Henry', 'Maury', VA79-44-167 (Starling et al., 1980a, 1980b, 1980c, 1984). CIho 8618 (PI 178381) is an awned winter barley accession from Turkey that was used as a source of resistance to scald [caused by *Rhynchosporium secalis* (Oudem.) J.J. Davis]. The parentage of VA79-44-167 is 'Cebada Capa' (PI 539113)/'Wong'/'Awnleted 'Hudson'/'3'/'Harrison'/'4'/'Harrison'/'3'/'Cebada Capa'/'Wong'/'Awnleted Hudson (Jensen, 1964; Caldwell et al., 1966). Plaisant is an awned French winter malting cultivar. The cross from which Thoroughbred originated was made in spring 1991, and the F₁ generation was grown in the field as a single 1.2-m headrow in 1992 to produce F₂ seed. The population was advanced from the F₂ to F₄ generation using a modified bulk breeding method. Barley spikes were selected from the population in each segregating generation on the basis of disease resistance, desirable maturity, short straw, and desirable head type and size. Selected spikes were threshed in bulk, and the seed was sown in a 20.9-m² block in the fall of each year. Spikes selected from the F₄ bulk were threshed individually and sown in separate 1.2-m headrows. Thoroughbred was derived from a single F_{4.5} headrow selected and harvested in bulk in 1996. The line was tested as entry 388 in nonreplicated observation yield tests in 1997 and was designated VA97B-388. In addition to high grain yield, Thorough-

bred was selected on the basis of very good straw strength, high test weight, and its exceptionally bright, plump, and superior seed quality.

Juvenile plants of Thoroughbred exhibit a semi-prostrate growth habit in early spring, flag leaves are slightly waxy and upright at booting, leaf sheaths, and stems are waxy, and anthocyanin is not visually apparent in leaves or stems. Stems are comprised of four nodes with moderate exertion between flag leaf and spike, have a closed collar and a slightly undulated neck. Spikes are erect, lax to dense and slightly waxy with no overlapping lateral kernels. The rachis is covered with hairs. Glumes are of medium length with short hairs confined to the band, and their awns are smooth and less than or equal to the glumes in length. Lemmas are hairless, have a depressed base, and their awns are long and rough. Rachilla hairs are long. Seed are hulled, midlong to long, slightly wrinkled, with colorless aleurone, and lacking hairs on the ventral furrow.

On average (22 station years), head emergence of Thoroughbred in Virginia is 2 d later than 'Wysor' and 4 d later than 'Nomini' (Starling et al., 1987, 1994). Average (19 station years) plant height of Thoroughbred (91 cm) is 8 to 10 cm taller than 'Callao' and 'Price', and 8 to 10 cm shorter than Wysor and Nomini (Price et al., 1996; Brooks et al., 2005). On the basis of Belgian lodging score (0.2 = no lodging, 10 = completely lodged), average (24 station years) straw strength of Thoroughbred (1.4) is similar to those of Price (1.5) and Nomini (1.7), and better than those of Wysor (2.8) and Callao (5.0). Winter hardiness of Thoroughbred is good and most similar to that of the hardy barley check 'Kentucky 1' (CIho 6050). In the 1999 to 2000 USDA-ARS Uniform Barley Winter Hardiness Nursery, Thoroughbred ranked 1st among 29 entries for winter hardiness with a mean survival score of 94%, compared with 81% for 'Tennessee Winter' (PI 11193), 85% for Kentucky 1, and 63% for 'Trebti' (Wiebe, 1965). In the 2000 to 2001 nursery, average winter survival of Thoroughbred (55%) was similar to that of Tennessee Winter (50%) and Kentucky 1 (59%) and significantly higher than that of Trebti (35%).

On the basis of disease assessments [Infection Type (IT), 0 = immune to 4 = highly susceptible] of seedlings conducted in greenhouse tests from 1999 to 2002, Thoroughbred is resistant (IT = 1) to powdery mildew [caused by *Blumeria graminis* (DC.) E.O. Speer f. sp. *hordei* Em. Marchal] but moderately susceptible (IT = 3) to leaf rust (caused by *Puccinia hordei* G. Oth) race 8 and race 30. In field tests (1999–2002), adult plants of Thoroughbred have expressed resistance (0 = resistant to 9 = susceptible) to powdery mildew (1.3) and Septoria leaf blotch (0.2) (caused by *Septoria passerinii* Sacc.). Thoroughbred has expressed susceptibility to leaf rust (7.0) and moderate susceptibility to net blotch (4.0) (caused by *Pyrenophora teres* Drechs.).

Thoroughbred was tested in Virginia's State Variety Trials from 1999 to 2002 (18 station years). Average grain yield of Thoroughbred (6450 kg ha⁻¹) in Virginia has been excellent in comparison with those of Nomini (6343 kg ha⁻¹), Price (6235 kg ha⁻¹), and Callao (5966 kg ha⁻¹). In three out of four years, grain yields of Thoroughbred exceeded those of Nomini by 323 to 753 kg ha⁻¹ and those of Callao by 430 to 968 kg ha⁻¹. In the USDA-ARS Uniform Winter Barley Yield Nursery, average grain yield of Thoroughbred (6128 kg ha⁻¹) over 10 states in 2000 was 538 to 753 kg ha⁻¹ higher than those of Nomini, Price, and Callao, and in 2001 over four states, average yield of Thoroughbred (5913 kg ha⁻¹) was 430 to 484 kg ha⁻¹ higher than those of Nomini and Callao. Over all locations, Thoroughbred ranked 1st among 23 entries in 2000 and 3rd among 23 entries in 2001.

Average (16 station years) test weight of Thoroughbred (659 kg m⁻³) in Virginia has been similar to those of Callao (663 kg m⁻³) and Price (655 kg m⁻³) and significantly ($P \leq$

0.05) higher than those of Wysor (629 kg m⁻³) and Nomini (622 kg m⁻³). In the 1999 to 2000 USDA-ARS Uniform Winter Barley Yield Nursery, average test weight of Thoroughbred (605 kg m⁻³) was similar to that of Price and 6 kg m⁻³ higher than that of Nomini. In the 2000 to 2001 nursery, Thoroughbred had an average test weight (618 kg m⁻³) that was similar to that of Callao and exceeded ($P \leq 0.05$) that of Nomini by 22 kg m⁻³.

An initial source of Thoroughbred Breeder seed was developed in 2002 via thorough removal of visual variants from a 0.12-ha F₁₁ seed increase strip sown at the Virginia Crop Improvement Association's Foundation Seed Farm. In fall 2003, a purer source of Thoroughbred Breeder seed, derived as a bulked composite of 396 F₁₂ headrows selected among 400 rows evaluated, was provided to the Virginia Crop Improvement Association. Breeder seed of Thoroughbred will be maintained by the Virginia Agricultural Experiment Station under the auspices of the Department of Crop and Soil Environmental Sciences, Virginia Polytechnic Institute and State University, Blacksburg. Authorized seed classes are Breeder, Foundation, Registered, and Certified. Protection of Thoroughbred will be applied for under the amended U.S. Plant Variety Protection Act of 1994. Request for availability of Foundation seed should be directed to Bruce Beahm (804-472-3500), Manager, Foundation Seed Farm, Mount Holly, VA 22524.

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Registration of 'Price' Barley

'Price' (Reg. no. CV- 315, PI 632708) is a short-awned, six-rowed, hulled winter feed barley (*Hordeum vulgare* L.) that was developed and released May 2002 by the Virginia Agricultural Experiment Station. The name Price was selected in recognition of Allen Manges Price, who devoted more than 40 years of his life to plant breeding, genetics, and the advancement of agriculture and the betterment of mankind. Under Allen Price's direction, the Virginia Tech Barley Breeding Program undertook a revolutionary change toward securing a future for barley as a viable crop in the mid-Atlantic region. Price barley was released to provide producers with a cultivar having high grain yield and test weight and improved straw strength and lodging tolerance.

Price was derived from the cross 'Callao' (PI 592800)/SC830366 (Price et al., 1996). The experimental line SC830366, derived from the cross 'McNair 601' (CIho 13644)/'Harrison'/'Gembloux'3/'Henry' (Caldwell et al., 1966; Starling et al., 1980), was developed at Clemson University and selected as a parent from the 1988 to 1989 USDA-ARS Uniform Winter Barley Yield Nursery. The cross from which Price originated was made in spring 1990, and the F₁ generation was grown in the field as a single 1.2-m headrow in 1991 to produce F₂ seed. The population was advanced from the F₂ to F₄ generation using a modified bulk breeding method. Barley spikes were selected from the population in each segregating generation (F₂-F₄) on the basis of disease resistance, early maturity, short straw, and desirable head type and size. Selected spikes were threshed in bulk, and the seed was planted in a 20.8-m² block in the fall of each year. Spikes selected from the F₄ bulk were threshed individually and sown in separate 1.2-m headrows. Price was derived from a single F₄₅ headrow selected and harvested in bulk in 1995. The line was tested as entry 321 in nonreplicated observation yield tests in 1996 and was designated VA96-44-321. In addition to high grain yield and test weight, Price was selected on the basis of earliness of head emergence, short plant height, and good straw strength.

Price is a midseason, short-stature, hulled winter feed barley. Juvenile plants exhibit semi-prostrate growth habit in early spring, flag leaves are glossy and upright at booting, leaf sheaths are waxy, and anthocyanin is not visually apparent in leaves or stems. Stems are comprised of five nodes, exertion is moderate, the collar is closed to V-shape, and the neck is straight. Spikes are erect, dense to lax, and slightly waxy with pronounced overlapping lateral kernels. The rachis is covered with hairs. Glumes are short, completely covered with long hairs, and their awns are rough and equal to the glumes in length. Lemmas are hairy, have a depressed base, and their awns are short and rough. Rachilla hairs are long. Seed are hulled, short to midlong, semiwrinkled, with colorless aleurone, and lacking hairs on the ventral furrow.

On average (18 station years), head emergence of Price in Virginia is 1 to 2 d later than 'Nomini', 2 to 3 d later than Callao, and 2 d earlier than 'Wysor' (Starling et al., 1987, 1994). Average (15 station years) plant height of Price (86 cm) is 4 cm taller than Callao, 11 cm shorter than Wysor, and 14 cm shorter than Nomini. On the basis of Belgian lodging score (0.2 = no lodging, 10 = completely lodged), average (21 station years) straw strength of Price (1.0) is excellent in comparison with Nomini (1.8), Wysor (2.0), and Callao (5.0). Price has expressed good winter-hardiness (92% survival) in comparison with Wysor (95%), a very winter-hardy cultivar. In the 1998 to 1999 and 1999 to 2000 USDA-ARS Uniform Barley Winter Hardiness Nurseries, Price had a three-year mean (19 station years) survival score of 72%, compared with 63% for 'Tennessee Winter' (PI 11193), 82% for 'Kentucky 1'

(CIho 6050), and 45% for the winter-tender check 'Trebli' (Wiebe, 1965).

On the basis of disease assessments (0 = immune to 4 = highly susceptible) of seedlings conducted in greenhouse tests from 1997 to 2000, Price is highly resistant (infection type = 0; N) to leaf rust (caused by *Puccinia hordei* G. Otth) race 8, but is moderately susceptible (IT = 2+) to race 30. Seedlings of Price are moderately susceptible (IT = 34) to powdery mildew [caused by *Blumeria graminis* (DC.) E.O. Speer f. sp. *hordei* Em. Marchal]. In field tests (1997–2001), adult plants of Price expressed resistance (0 = resistant to 9 = susceptible) to powdery mildew (0.4) and *Barley yellow dwarf virus* (1.5). Price expressed moderate resistance to moderate susceptibility to leaf rust (4.2), scald (4.0) [caused by *Rhynchosporium secalis* (Oudem.) J.J. Davis], and net blotch (4.6) (caused by *Pyrenophora teres* Drechs).

In Virginia's State Variety Trials (1997–2001), average grain yields of Price (6149 kg ha⁻¹) over 23 environments have been similar to those of Nomini and Callao. In the Uniform Winter Barley Yield Nurseries (1997–2000), average grain yields of Price (5483 kg ha⁻¹) were similar to those of Nomini, and 188 kg ha⁻¹ higher than those of Callao. Over all locations (11–12 per year), Price ranked 2nd among 20 entries in 1998, 1st among 18 entries in 1999, and 9th among 25 entries in 2000. Average test weight of Price (647 kg m⁻³) in Virginia's State Tests has been only slightly lower (9 kg m⁻³) than that of Callao, and has been significantly ($P \leq 0.05$) higher than those of Wysor (624 kg m⁻³) and Nomini (611 kg m⁻³). In the 1998 to 1999 and 1999 to 2000 USDA-ARS Uniform Winter Barley Yield Nurseries, average test weight of Price (610 kg m⁻³) was 6 kg m⁻³ lower than that of Callao, but nearly 39 kg m⁻³ higher than those of Wysor and Nomini.

An initial source of Price Breeder seed was developed in 2001 via thorough removal of visual variants from a 0.08-ha F₁₀ purification block. In fall of 2002, a purer source of Price Breeder seed, derived as a bulked composite of 365 F₁₁ headrows selected among 400 rows evaluated, was provided to the Foundation Seed Farm of Virginia Crop Improvement Association. Breeder seed of Price will be maintained by the Virginia Agricultural Experiment Station under the auspices of the Department of Crop and Soil Environmental Sciences, Virginia Polytechnic Institute and State University, Blacksburg. Authorized seed classes are Breeder, Foundation, Registered, and Certified. Price is protected under the amended U.S. Plant Variety Protection Act of 1994 (Certificate no. 200300132). Request for availability of Foundation seed should be directed to Bruce Beahm (804-472-3500), Manager, Foundation Seed Farm, Mount Holly, VA 22524.

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Registration of 'Doyce' Hulless Barley

'Doyce' (Reg. no. CV-317, PI 634932) is the first hulless, six-rowed, winter barley (*Hordeum vulgare* L.) developed by the Virginia Agricultural Experimental Station. It was released May 2003. Doyce was named in recognition of Dr. Doyce Graham, Professor Emeritus and former small grains breeder at Clemson University in South Carolina. Dr. Graham developed several hulless winter barley lines that were evaluated and used initially as parents in the Virginia hulless barley breeding program; one of them, 'H585', is a parent of Doyce. Doyce is high yielding, midseason maturity, and short in stature with stiff straw. Doyce provides winter barley producers and end-users with a new value-added crop having grain that is lower in fiber and higher in starch and metabolizable energy than traditional hulled winter barley. It has potential for use in feed, food, and ethanol production.

Doyce was selected from a population developed via a series of crosses comprised of 'Sangregado' sib (CMB79-54)//VA90-42-56//VA90-42-22/3/'Pamunkey'/4/H585 (Price et al., 1996a). CMB79-54 is a spring barley line obtained from the ICARDA-CIMMYT barley breeding program in Mexico and used as a parent for leaf rust (caused by *Puccinia hordei* G. Oth) resistance. The parentage of VA90-42-56 is 'Barsoy'*2/5/'Cebada Capa' (PI 539113)/'Wong'//Awnleted 'Hudson'/3/'Harrison'/4/Harrison/3/Cebada Capa/Wong//Awnleted Hudson/6/VA79-44-167 (Jensen, 1964; Caldwell et al., 1966; Finkner et al., 1968). The parentage of VA79-44-167 is Harrison/3/Cebada Capa/Wong//Awnleted Hudson/4/Harrison/3/Cebada Capa/Wong//Awnleted Hudson. Parental line VA90-42-22 was derived from the cross VA79-45-101/'Monroe'/'Sussex' (Starling et al., 1980a; 1984). VA79-45-101 was derived from an F₂ population comprised of two crosses: (i) CIho 7386/'Surry'//CIho 9623, CIho 9658, CIho 9708, BYDV Resistant 'Atlas'/Many Genotypes; (ii) CIho 7386/'Surry'//Barsoy/'Hanover' (Starling et al., 1970; 1980b). H585 previously tested as SC890585 is a hulless cultivar derived from the cross VA75-42-45/SC793556//CIho 2457.

The cross from which Doyce originated was completed in spring 1994, and the F₁ generation was grown in the field as a single 1.2-m headrow in 1995 to produce F₂ seed. The population was advanced from the F₂ to F₄ generation using a modified bulk breeding method. Barley spikes were selected from the population in each segregating generation (F₂-F₄) on the basis of disease resistance, short plant height, desirable maturity, spike shape and size, and lack of hull adherence to kernels. Selected spikes were threshed in bulk, and the seed was sown in 20.8-m² blocks in the fall of each year. Spikes selected from the F₄ bulk were threshed individually and sown in separate 1.2-m headrows. Doyce was derived from a single F_{4,5} headrow selected and harvested in bulk in 1999. The line was tested as entry 137 in nonreplicated observation yield tests in 2000 and was designated VA00H-137. In addition to high grain yield and test weight, Doyce was selected on the basis of good straw strength and resistance to leaf rust.

Juvenile plants of Doyce exhibit a semi-prostrate growth habit; flag leaves are slightly waxy and drooping at boot stage; leaf sheaths and stems are waxy, and anthocyanin is not visually apparent in leaves or stems. Stems have five nodes, closed collars, straight necks, and a 3- to 10-cm exertion above the base of the flag leaf. Six-rowed spikes of Doyce are erect, lax to dense, and glossy with no overlapping lateral kernels. The rachis is covered with hairs. Glumes are of medium length, completely covered with long hairs, and their awns are rough and greater than the glumes in length. Lemma awns are rough and longer in length than the spike. The basal marking of the lemma is a slight crease. Rachilla hairs are long. Kernels are hulless and short with colorless aleurone and lacking hairs on the ventral furrow.

On average (14 station years), head emergence of Doyce is similar to that of 'Wysor', 3 d later than hulless cultivar H585, 2 d later than 'Nomini' and 'Price', and 5 d later than 'Callao' (Starling et al., 1987; 1994; Price et al., 1996b; Brooks et al., 2005). Average (10 station years) plant height of Doyce (81 cm) is similar to that of Price, 5 cm shorter than H585, 18 cm shorter than Nomini, and 5 cm taller than Callao. Straw strength assessed (12 station years) on the basis of Belgian Lodging Score (0.2 = no lodging to 10 = completely lodged) of Doyce (3.2) is good and similar to those of Nomini (2.4) and Price (2.5) and significantly ($P \leq 0.05$) better than that of Callao (6.1). Winter hardiness of Doyce is most similar to that of the semihardy check cultivar Tennessee Winter (PI 11193). In the 2002 to 2003 USDA-ARS Uniform Barley Winter Hardiness Nursery (9 station years), Doyce ranked 9th among 16 entries for winter hardiness with a mean survival score of 85%, compared with 76% for Tennessee Winter, 93% for 'Kentucky 1' (CIho 6050), and 61% for 'Trebil' (Wiebe, 1965).

On the basis of disease assessments [Infection type (IT), 0 = immune to 4 = susceptible] of seedlings conducted in greenhouse tests from 2001 to 2003, Doyce is moderately resistant (IT = 2.6) to powdery mildew [caused by *Blumeria graminis* (DC.) E.O. Speer f. sp. *hordei* Em. Marchal]. It is resistant (IT = 1) to leaf rust race 8 and race 30. In field tests conducted during 2001 to 2003, adult plants of Doyce expressed high levels of resistance (assessed on a scale of 0-9, where 0 = resistant and 9 = susceptible) to leaf rust with an average score of 1.0 compared with 7.7 for H585 and 3.0 for Callao. Doyce also expressed resistance to powdery mildew (0.1) and Septoria speckled leaf blotch (2.0) (caused by *Septoria passerinii* Sacc.). Doyce expressed moderate susceptibility (6.0) to net blotch (caused by *Pyrenophora teres* Drechs.). In a field test of entries in the 2002 to 2003 USDA-ARS Uniform Winter Barley Yield Nursery conducted at Mt. Vernon, WA, Doyce expressed resistance (IT = 0 and severity = 0%) to stripe rust (caused by *Puccinia striiformis* Westend. f. sp. *hordei*).

In Virginia's State Variety Trials (2001-2003), average (14 station years) grain yields of Doyce (5330 kg ha⁻¹) exceeded ($P \leq 0.05$) those of H585 (4829 kg ha⁻¹) by 501 kg ha⁻¹. Average grain yields of Doyce (5330 kg ha⁻¹) have been only 8 to 12% lower than those of the hulled check Callao (5820 kg ha⁻¹) and, therefore, are relatively good considering that grain yield of hulled barley is comprised of 10 to 13% hull weight. Average (12 station years) test weight of Doyce (717 kg m⁻³) was 30 kg m⁻³ higher than the overall test average (687 kg m⁻³), but lower than that of hulless check H585 (727 kg m⁻³). In the 2002 to 2003 USDA-ARS Uniform Winter Barley Yield Nursery, Doyce had an average grain yield of 4240 kg ha⁻¹ over six locations and ranked 2nd among 16 hulless lines and 8th among all 25 hulled and hulless entries. Doyce had an average test weight of 699 kg m⁻³ over five locations.

An initial source of Doyce Breeder seed was developed in 2001 via thorough removal of visual variants from a 0.4-ha F₇ seed-increase strip. In fall 2003, a purer source of Doyce Breeder seed, derived as a bulked composite of 395 F₉ head-rows selected among 400 rows evaluated, was provided to the Foundation Seed Farm of Virginia Crop Improvement Association. Breeder seed of Doyce will be maintained by the Virginia Agricultural Experiment Station under the auspices of the Department of Crop and Soil Environmental Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA. Authorized seed classes are: Breeder, Foundation, Registered, and Certified. Application will be made for protection of Doyce under the amended U.S. Plant Variety Protection Act of 1994. Request for availability of Foundation seed should be directed to Bruce Beahm (804-472-3500), Manager, Foundation Seed Farm, Mount Holly, VA 22524.

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Registration of 'Langara' Kentucky Bluegrass

Langara Kentucky bluegrass (*Poa pratensis* L.) (Reg. no. CV-83, PI 614776) is a turf-type cultivar released in August

1999 by Pickseed West, Inc., Tangent, OR. Langara was developed from germplasm obtained from the New Jersey Agricultural Experiment Station. The experimental designation of Langara was H94-301.

Langara Kentucky bluegrass originated as a single, highly apomictic plant selected from the open-pollinated progeny of C-74. C-74 is a vigorous, apomictic plant that originated from a plant collected from an old turf area in Exeter, RI, in 1987. C-74 is similar in appearance and performance to 'Unique' Kentucky bluegrass (Rose-Fricker et al., 1999).

A plant of C-74 was open-pollinated by 66 other Kentucky bluegrass cultivars and selections during the late winter of 1991 to 1992 in a greenhouse located on the Cook College campus of Rutgers University. These included typical plants of 'Princeton P-105' (Hurley et al., 2000), 'Rita', 'SR-2109', 'America' (Funk et al., 1982), 'Wabash', and 'Belturf'. The remainder of the plants were selections collected from old turf areas in the eastern U.S.A. Four plants of *P. ampla* Merr. and *P. ampla* Merr. × *P. pratensis* L. were also included in the open-pollinated crossing block. Environmental conditions before and during pollination were modified to increase sexual reproduction of facultatively apomictic Kentucky bluegrasses (Bashaw and Funk, 1987; Hintzen and van Wijk, 1985; Pepin and Funk, 1971). Seed from the C-74 female parent was harvested in the spring of 1992. Seedlings were grown in the greenhouse in the winter of 1992 to 1993 and hybrids were phenotypically identified. Selected hybrid plants were established in a spaced-plant nursery at the Rutgers University Plant Biology and Pathology Research and Extension Farm at Adelphia, NJ, during the spring of 1993. In June of 1994, an attractive F₁ hybrid plant designated 93-864-6 was harvested from this nursery. Seed from this plant was used to establish a turf plot at North Brunswick, NJ, in August 1994 with the designation H94-301. A spaced-plant progeny test was established in 1996 to evaluate the level of apomictic reproduction, produce seed for evaluation in turfgrass trials at North Brunswick and Adelphia, NJ, from 1996 through 1998, and produce Breeder seed. Breeder seed was sent to Tangent, OR, to establish an experimental Foundation seed increase field in 1997. The first Certified seed was harvested in August 1999.

Langara is a stable and uniform variety. Tests in New Jersey and Oregon have shown it to be greater than 95% apomictic. The 5% off-type plants are small and weak and do not detract significantly from the variety. Langara is a turf type Kentucky bluegrass with an attractive, medium dark-green color and low growth habit. It has performed well in the National Turfgrass Evaluation Program in most areas of Kentucky bluegrass adaptation in the U.S.A. (Morris, 2003). Langara produces a turf with fine leaves and high shoot density. It has shown good resistance to leaf spot and melting out [caused by *Drechslera poae* (Baudys) Shoem.] (Morris, 2003), powdery mildew (caused by *Erysiphe graminis* DC.) (Bonos et al., 2001b), stem rust (caused by *Puccinia graminis* Pers.:Pers. subsp. *graminicola* Urban) (Morris, 2003), and stripe smut [caused by *Ustilago striiformis* (Westend.) Niessl] (Bonos et al., 2001a). Langara exhibits good winter appearance and spring green up (Bonos et al., 2001a) and average color during winter months (Morris, 2003). Langara has shown acceptable performance under simulated fairway conditions in New Jersey, which included a cutting height of 1.7 cm, traffic stress, and *Poa annua* L. competition (Morris, 2003).

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

Breeder seed is maintained by Pickseed West, Inc. with the cooperation of the New Jersey Agricultural Experiment Station. Seed propagation is restricted to three generations of increase, Breeder, Foundation, and Certified. Application (no. 200000319) has been made for U.S. Plant Variety Protection.

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Registration of 'Moonshadow' Kentucky Bluegrass

Moonshadow Kentucky bluegrass (*Poa pratensis* L.) (Reg. no. CV- 84, PI 632265) is a turf-type cultivar released in July 2000 by Pickseed West, Inc., Tangent, OR. Moonshadow was developed from germplasm obtained from the New Jersey Agricultural Experiment Station. The experimental designations of Moonshadow were A95-439 and Pick 113-3.

Moonshadow Kentucky bluegrass originated as a single, 100% apomictic plant selected from the progeny of a highly sexual maternal plant, identified as an aberrant derivative of H86-974, pollinated by C-74. H86-974 was a moderately

apomictic F₁ hybrid selected from the progeny of the cross 'Warren's A-25' (Dale et al., 1975) × 'Blacksburg' (Alderson and Sharp, 1995) Kentucky bluegrass. C-74 is a vigorous, apomictic plant that originated from a plant collected from an old turf area in Exeter, RI, in 1987. It is similar in appearance and performance to 'Unique' (Rose-Fricke et al., 1999) Kentucky bluegrass.

A plant of C-74 pollinated an aberrant plant of H86-974 in the late winter of 1992 to 1993 in a greenhouse located on the Cook College campus of Rutgers University in New Brunswick, NJ. Environmental conditions before and during pollination were modified to increase sexual reproduction of facultatively apomictic Kentucky bluegrasses (Bashaw and Funk, 1987; Hintzen and van Wijk, 1985; Pepin and Funk, 1971). Approximately 1500 seedlings from this cross were established in a spaced-plant nursery at the Rutgers University Plant Biology and Pathology Research and Extension Farm at Adelphia, NJ, during the spring of 1994. An attractive F₁ hybrid plant with the designation, 94-113-3, was identified in this nursery in June 1995. Seed harvested from this plant was used to establish turf evaluation plot A95-439 at Adelphia in August 1995. A spaced-plant progeny test was established in 1995 to evaluate the level of apomictic reproduction, produce seed for evaluation in 1996 to 1998 turfgrass trials at North Brunswick and Adelphia, NJ, and additional spaced-plant nurseries. Breeder seed was produced in 1998 at Adelphia, NJ, and sent to Tangent, OR, to establish an experimental Foundation seed increase field in 1998. The first Certified seed was harvested in July 2000.

Moonshadow is a turf-type Kentucky bluegrass with an attractive, medium dark-green color and low growth habit. It has performed well in the National Turfgrass Evaluation Program in most areas of Kentucky bluegrass adaptation in the U.S.A. (Morris, 2003). Moonshadow produces a turf with fine leaves and medium-high shoot density. It has shown good resistance to leaf spot and melting out [caused by *Drechslera poae* (Baudys) Shoem.], stem rust (caused by *Puccinia graminis* Pers.:Pers. subsp. *graminicola* Urban), stripe smut [caused by *Ustilago striiformis* (Westend.) Niessl] (Bonos et al., 2001a; Morris, 2003), and powdery mildew (caused by *Erysiphe graminis* DC.) (Bonos et al., 2001b). Moonshadow exhibits poor color during winter months (Morris, 2003). Moonshadow has also performed well under simulated fairway conditions in New Jersey, which included a cutting height of 1.7 cm, traffic stress, and *Poa annua* L. competition (Morris, 2003).

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

Breeder seed is maintained by Pickseed West, Inc. with the cooperation of the New Jersey Agricultural Experiment Station. Seed propagation is restricted to three generations of increase, Breeder, Foundation, and Certified. Application (no. 200200271) has been made for U.S. Plant Variety Protection.

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Registration of ‘Condor’ Black Bean

‘Condor’ black bean (*Phaseolus vulgaris* L.) (Reg. no. CV-233, PI 635117) was developed cooperatively by the Michigan Agricultural Experiment Station and the USDA-ARS and released in 2004 as an upright, midseason, disease-resistant cultivar.

Condor, tested as B00101, was derived from a cross made in 1996 between black bean cultivars Phantom and Black Jack. Phantom is a mid-to-full season, upright, indeterminate growth habit Type II black bean cultivar (Kelly et al., 2000) with resistance to Races 7 and 73 of *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib., the cause of bean anthracnose. Black Jack is a more prostrate black bean cultivar with excellent canning quality. F₁ plants were advanced in the greenhouse and F₂ seed was space-planted in a nursery at the Saginaw Valley Bean and Sugarbeet Research Farm near Saginaw, MI. A single F₂ plant possessing the desired agronomic and black bean seed traits was selected. The F₃ progeny row was planted at the University of Puerto Rico Research Station at Isabela and mass selected based on agronomic and seed traits. A single-plant selection was made in a space-planted F₄ nursery in Michigan based on agronomic and black bean seed traits and resistance to bean rust [caused by *Uromyces appendiculatus* (Pers.:Pers.) Unger]. The F₅ progeny row was advanced at Isabela, Puerto Rico and the reaction to virus and anthracnose was confirmed by inoculating remnant seed in

the greenhouse for resistance to Races 7 and 73 of *C. lindemuthianum* and to the NL 3 strain of *Bean common mosaic necrosis virus* (BCMNV).

The F_{4.6} breeding line, coded B00101, was tested for yield and agronomic traits at 29 locations in Michigan from 2000 to 2003 before release. Condor averaged 3100 kg ha⁻¹ and was equivalent in yield to ‘Midnight’ at 13 locations. Condor outyielded three commercial black bean cultivars, namely ‘Jaguar’, ‘T-39’, and Black Jack by a margin of 5, 6, and 8% at 24, 29, and 12 locations, respectively.

Condor averages 49 cm in height and exhibits an upright indeterminate growth habit Type II, with moderate resistance to lodging. Condor has purple flowers and blooms 49 d after planting. Condor is a midseason bean, maturing 94 d after planting and has a range in maturity from 83 to 99 d, depending on season and location. Condor matures 1 d later than Jaguar (Kelly et al., 2001), T-39, and Black Jack, and 5 d earlier than Midnight. Plants of Condor mature uniformly and show excellent dry-down across a broad range of environments.

Condor carries the dominant *I* gene for resistance to *Bean common mosaic virus* (BCMV) but is sensitive to the temperature-insensitive necrosis-inducing strains of BCMNV such as NL 3 and NL 8. Condor carries the *Co-1* and *Co-2* genes, which condition resistance to Races 7, and 73 of *C. lindemuthianum*, and the *Ur-3* rust resistance gene, which conditions resistance to Race 53 and all indigenous bean rust pathogen races prevalent in Michigan. Condor is tolerant to Michigan isolates of root rot [caused primarily by *Fusarium solani* (Mart.) Sacc. f. sp. *phaseoli* (Burkholder) W.C. Snyder & H.N. Hans.] but is susceptible to common blight [caused by *Xanthomonas axonopodis* pv. *phaseoli* (Smith) Dye]. Condor has a higher level of tolerance (35% incidence) to white mold [caused by *Sclerotinia sclerotiorum* (Lib.) de Bary], as compared to T-39 (49% incidence), but exhibits less white mold avoidance (Kolkman and Kelly, 2002) compared to the more erect Jaguar (21% incidence).

Condor has flat-to-round seed, which averages 23 g 100 seed⁻¹ (range: 19–25 g 100 seed⁻¹). The seed is similar in color and shape to T-39. In canning trials, Condor scored 4.7 on a seven-point hedonic scale (where 7 is most desirable, 1 is least desirable, and 4 is average); whereas T-39, Jaguar, and Black Jack scored 3.9, 4.4, and 5.1, respectively. After processing, Condor retains color better than Jaguar and T-39 but it does not differ significantly from other black bean cultivars for texture, hydration, and drained weight ratios (Hosfield and Uebersax, 1980).

Condor was released as a public nonexclusive variety, with the option that Condor may be sold for seed by name only under the Certified class. A research fee will be assessed on each hundredweight unit of Foundation seed sold. Breeder seed is maintained by the Michigan Agricultural Experiment Station, East Lansing, MI 48824, in cooperation with the Michigan Crop Improvement Association.

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Registration of 'NE426GT' Winter Triticale

'NE426GT' (Reg. no. CV- 28, PI 634537) is a grain and fall forage winter triticale (\times *Triticosecale* rimpau Wittm.) developed cooperatively and jointly released in 2004 by the Nebraska Agricultural Experiment Station and the Iowa Agriculture and Home Economics Experiment Station.

NE426GT was selected from the cross 'WB-UW24'/'TxTel #50'/'Fain Triticale'/'Centurk 78'/'NE69150'/'Jenkins' \times Unknown (probably 6A365/NE69150). WB-UW24 is a line of unknown pedigree that was sent to the program in the late 1980s as part of an international nursery. The cross was made in 1989 at the University of Nebraska. The F₁ generation was grown in the greenhouse in 1990, and the F₂ (1991) and F₃ (1992) generations were advanced in the field at Lincoln, NE, using the bulk breeding method. NE426GT is an F₃-derived F₄ line derived from a single plant family in 1993. The family was advanced with no additional within family selection and selected in 1995 (F₆ generation) for its high grain yield potential. It was released primarily for its superior grain production and fall forage production in rainfed winter cereal production systems in Nebraska, Iowa, and surrounding areas with similar climatic conditions.

NE426GT is an awned, white-glumed cultivar whose primary use will be as an annual grain or forage crop. Its appearance is most similar to 'Newcale' (Baenziger and Schmidt, 1991). Kernels are red colored, elliptical, large, and slightly wrinkled (as is common with triticale). After heading, the canopy is moderately closed and upright. The flag leaf is recurved and not twisted at the boot stage. The foliage is green with a waxy bloom at anthesis. The peduncle is pubescent. The spike is narrow, oblong in shape, midlong to long, and mid-dense. The glume is pubescent, tan, narrow, and long and the glume shoulder is wanting. The beak has an acuminate tip. The spike is usually nodding at maturity. Based on plump kernels, the kernel has no collar, a large brush of medium length, rounded cheeks, large germ, and a narrow and deep crease.

NE426GT was performance tested as NE95T426 in Nebraska grain yield nurseries starting in 1997 and in forage yield trials in 2001 to 2003 in Kansas (<http://www.wkarc.org/Research/ARCH/Soil/2003%20web%20pub.pdf>, verified 2 Nov. 2004). In Nebraska (19 environments), NE426GT had very good grain yield (4180 kg ha⁻¹) for a grain triticale. The grain yield was higher than 'Presto' (PI 564442, 3580 kg ha⁻¹), and much higher than the forage triticale cultivars NE422T (Baenziger and Vogel, 2003) (2890 kg ha⁻¹) and Trical (most likely 'Trical 100') (2380 kg ha⁻¹). For comparison, the grain yield of 'Arapahoe' (Baenziger et al., 1989) was 3120 kg ha⁻¹, which is lower than the grain triticale yields and might be explained by triticale yield nurseries generally being planted near, but earlier than the wheat yield trials. In two years of testing in Iowa (10 environments), NE426GT had excellent grain yield (5720 kg ha⁻¹) as compared to Presto (5071 kg ha⁻¹), Trical 100 (3850 kg ha⁻¹), NE422T (4040 kg ha⁻¹), or the wheat

check Arapahoe (3950 kg ha⁻¹). In three years of forage testing in Kansas cultivar performance trials, NE426GT performed well in the early fall, but it is not as suitable for hay as NE422T. The main advantages of NE426GT when compared to most other grain and forage triticale cultivars within its area of adaptation are its very high grain yield coupled with its relatively high fall forage yield. As such, it will be used as a feed grain triticale and as a component of forage triticale blends.

Other measurements of performance from comparison trials show that NE426GT is medium in maturity, about 0.5 d earlier than Presto, 1 d earlier than Arapahoe, and 6 d earlier than NE422T. The mature plant height of NE426GT at 120 cm is medium-tall and is 10 cm taller than Presto, 15 cm taller than Arapahoe, and 33 cm shorter than NE422T. NE426GT has moderate straw strength, similar to Presto and better than Arapahoe and NE422T. The winter-hardiness of NE426GT is good, similar to NE422T, which is one of the most winter-hardy triticale cultivars currently available to growers, and comparable to an average winter wheat. No winter damage was noted on NE426GT in nursery sites in Iowa, including two sites about 60 km south of the Minnesota border (Sutherland and Nashua).

Based on field observations, NE426GT is moderately resistant to the currently prevalent races of stem rust (caused by *Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks. & E. Henn; most likely containing *Sr31*) and leaf rust (caused by *P. trititica* Eriks.). Like most rye and triticale cultivars, NE426GT is moderately resistant to *Wheat streak mosaic virus*. Ergot [*Claviceps purpurea* (Fr.:Fr.) Tul.] has not been found in the cultivar when the disease was present in the other triticale cultivars under similar growing conditions. NE426GT (66.6 kg hL⁻¹) has an above average grain volume weight for triticale (where the standard is 61.8 kg hL⁻¹). The 1000 kernel weight of NE426GT is high (32.3 g) when compared to Presto (29.5 g) and Arapahoe (28.6 g).

In positioning NE426GT, based on performance data to date, it should be well adapted to most rainfed winter annual grain production systems in Nebraska, Iowa, and in regions with similar climates in adjacent states. It will also have good fall forage potential in Nebraska and Kansas.

NE426GT has been uniform and stable since 1999 (F₁₀ generation). Less than 0.1% of the plants were rogued from the Breeder's seed increase in 1999. The rogued variant plants were mainly taller in height (10-20 cm, 1:1000 plants). Up to 1% (10:1000) variant plants may be encountered in subsequent generations.

The Nebraska Foundation Seed Division, Department of Agronomy, University of Nebraska-Lincoln, Lincoln, NE 68583 had NE426GT Foundation seed available to qualified Certified seed enterprises in 2003. The seed classes will be Breeder, Foundation, Registered, and Certified. The Registered seed class will be a nonsalable seed class. A research and development fee will be assessed on certified seed sales.

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Registration of 'Durana' White Clover

'Durana' white clover (*Trifolium repens* L.) (Reg. no. CV-7, PI 633852) was developed by the University of Georgia Agricultural Experiment Stations and AgResearch Ltd. (New Zealand). It was tested experimentally as GA-43 and GC90.

Durana is an 84-parent synthetic variety tracing to 192 naturalized ecotypes collected from perennial grass pastures near Eatonton, GA. These 192 ecotypes were intermated and seed from the best 12 ecotypes based on seed-yielding ability were then established into a half-sib progeny performance trial to determine their grazing persistence in grass swards. The 7 best progeny genotypes from within each of the 12 half-sib families were then selected from this grazing persistence trial (84 total parental genotypes), intermated in field isolation in a replicated crossing block, and all seed from each genotype bulked to produce the prebreeder seed (Syn 1 generation). Breeder seed (Syn 2 generation) was increased in isolation from the prebreeder's seed.

Durana, an intermediate type white clover, is intended for use as a renovation legume for grass pastures in the southeastern U.S.A. It is a persistent, low-growing, densely spreading, profuse-flowering cultivar with a leaf color equivalent to green class 143A on the Royal Horticultural Society Color Chart (Anonymous, 1995). Its persistence when compared to ladino cultivars and its ability to enhance animal gains on both endophyte-infected and endophyte-free tall fescue pastures without the need for nitrogen fertilizer was found to be economically important (Bouton, 2003).

Durana is similar to 'Louisiana S-1' in heading date and frequency of cyanogenic plants. Cluster analysis based on SSR markers also showed a distinct dendrogram grouping for Durana that differed from 'Grasslands Huia', 'Grasslands Sustain', and 'Regal' (Jahufer et al., 2003). Durana differs from Regal in having more stolon growing points per unit area, shorter plant height, smaller leaflets, shorter petioles, earlier heading date, greater number of seedheads per plant, and a higher frequency of cyanogenic plants. Durana differs from Grasslands Huia in having more stolon growing points per unit area, shorter petioles, earlier heading date, more seedheads per plant, and higher frequency of cyanogenic plants. Durana differs from Grasslands Sustain in having more stolon growing points per unit area, shorter (height) but wider plants (length and width), smaller leaflets, shorter petioles, an earlier heading date, greater number of seedheads per plant, and a higher frequency of cyanogenic plants.

Seed increase is limited to one generation each of Breeder (Syn 2), Foundation (Syn 3), Registered (Syn 4), and Certified (Syn 5) seed classes. A 1-, 2-, 2-, and 2-yr stand life is permitted on fields producing Breeder, Foundation, Registered, and Certified classes, respectively. Minimum isolation distances for crops of less than 2 ha will be 200 m for Foundation and Registered crops and 100 m for Certified crops. These isolation distances reduce to 100 m and 50 m, respectively, for crops more than 2 ha.

Application was made for U. S. Plant Variety Protection on 1 Aug. 2003 (PVP 200300305). Seed production and marketing rights were exclusively assigned to Pennington Seed, Inc. Madison, GA, and Agricom, Ashburton, New Zealand.

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Registration of 'Patriot' White Clover

'Patriot' white clover (*Trifolium repens* L.) (Reg. no. CV-8, PI 633851) was developed by the University of Georgia Agricultural Experiment Stations and AgResearch Ltd. (New Zealand). It was tested experimentally as GA-21159 and GC89.

One hundred ninety-two naturalized ecotypes were selected from perennial grass pastures near Eatonton, GA. These were intermated and their seed bulked to produce the germplasm GA-ETN. Forty randomly selected plants from GA-ETN were hybridized by hand with 40 randomly selected plants from the germplasm SRVR. Equal amounts of seed from each individual hybridization were bulked and the bulked seed increased in isolation to produce prebreeder seed of Patriot (Syn 1 generation). Breeder seed (Syn 2 generation) was increased in isolation from the prebreeder seed.

Patriot is a ladino by intermediate-type hybrid white clover (*Trifolium repens* L.) intended for use as the legume component for high quality, grass-based grazing systems in the eastern U.S.A. It is a persistent, high-yielding, densely spreading, profuse-flowering cultivar with a leaf color equivalent to green class 143A on the Royal Horticultural Society Color Chart (Anonymous, 1995). It was found to be more persistent than the most popular ladino cultivar Regal and provided a better ability to combat fescue toxicosis by enhancing animal gains on endophyte-infected tall fescue pastures without the need for nitrogen fertilizer (Parish et al., 2002).

Patriot is most similar to 'Louisiana S-1' and 'Durana'. Patriot differs from Louisiana S-1 in having more stolon growing points per unit area, greater plant width and length, more seed heads per plant, and lower frequency of cyanogenic plants. Cluster analysis based on SSR markers also showed a distinct dendrogram grouping for Patriot that differed completely from Louisiana S-1 (Jahufer et al., 2003). Patriot differs from Durana in having taller individual plants, larger leaflets, longer petioles, later heading date, and lower frequency of cyanogenic plants. Patriot differs from the ladino cultivar Regal in having more stolon growing points per unit area, shorter plant height, smaller leaflets, shorter petioles, earlier heading

date, greater number of seed heads per plant, and a higher frequency of cyanogenic plants.

Seed increase is limited to one generation each of Breeder (Syn 2), Foundation (Syn 3), Registered (Syn 4), and Certified (Syn 5) seed classes. A 1-, 2-, 2-, and 2-yr stand life is permitted on fields producing Breeder, Foundation, Registered, and Certified classes, respectively. Minimum isolation distances for crops of less than 2 ha will be 200 m for Foundation and Registered crops and 100 m for Certified crops. These isolation distances reduce to 100 m and 50 m, respectively, for crops more than 2 ha.

Application was made for U.S. Plant Variety Protection on 1 Aug. 2003 (PVP 200300304). Seed production and marketing rights were exclusively assigned to Pennington Seed, Inc., Madison, GA and Agricom, Ashburton, New Zealand.

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Registration of 'Miser' Field Pea

'Miser' (Reg. no. CV-23, PI 634934), a semi-leafless field pea (*Pisum sativum* L.) with yellow cotyledons, small to medium seed size, and resistance to powdery mildew (caused by *Erysiphe pisi* DC.), was developed at Agriculture and Agri-Food Canada (AAFC), Morden Research Station (MRS), Morden, Manitoba, Canada. Registration no. 5627 was issued for Miser on 9 April 2003 by the Variety Section, Plant Health and Plant Products Division, Canadian Food Inspection Agency.

Miser was developed from the cross 'Highlight'/'Chorale' made at AAFC, MRS in 1994. Highlight is a semi-leafless, powdery mildew-resistant yellow pea cultivar developed by Svalof-Weibull, Svalof, Sweden, and Chorale is a yellow pea cultivar obtained from Danisco Seeds, Holeby, Denmark. Powdery mildew-resistant F₂ plants were selected in the summer of 1995. The F₃-F₄ was advanced in the greenhouse using single seed descent in the winter of 1995 to 1996. The F₅ was grown at Morden, Manitoba, Canada, in the summer of 1996. A single plant was selected from the F₅ population based on plant type, maturity, and resistance to powdery mildew and designated as 9406046. In the F₆, the line 9406046 was grown

at Brawley, CA, during the winter of 1996 to 1997. The F₇ was evaluated in a replicated trial at Morden, Manitoba, Canada in 1997, and the F₈ was evaluated at 6 locations in Manitoba, Saskatchewan, and Alberta, Canada with 2 locations in each province. In 1999, it was evaluated at 5, 4, and 3 locations in Manitoba, Saskatchewan, and Alberta, Canada, respectively. It was tested as entry MP1807 in the Field Pea Cooperative Test-A in 2000 and 2001. Breeder seed of Miser was derived from bulked seed of 125 F₁₂ single plant progenies in 2001.

Miser is adapted to all field pea-growing regions in western Canada. Compared with the check cultivars CDC Mozart, Carrera, and Eclipse over 21 station-years, Miser yielded 4558 kg ha⁻¹, 3% higher than CDC Mozart and 1% lower than Carrera and Eclipse. Miser matured in 99 d, identical to CDC Mozart, 3 d earlier than Eclipse and 1 d later than Carrera. Plant height of Miser was 77 cm, whereas the plant height of Carrera, Eclipse, and CDC Mozart was 63 cm, 75 cm, and 67 cm, respectively. Average preharvest lodging (PHL) score over 9 site-years was 5.4 for Miser, 4.7 for Carrera, 3.9 for Eclipse, and 5.4 for CDC Mozart based on a 1-to-9 scale (1 = upright, 9 = prostrate).

Using the description of pea morphological characteristics of Khvostova (1983), Miser is described as having white flowers, yellow cotyledons, an opaque seed coat color, and round seeds. The 1000-seed weight was 192 g for Miser compared to 241 g for Carrera, 236 g for Eclipse, and 209 g for CDC Mozart. Percentage seed coat breakage was 2.0 for Miser compared to 5.4 for Carrera, 3.6 for Eclipse, and 2.8 for CDC Mozart. Seed shape, scored on a 1-to-5 scale (1 = spherical, 2.5 = round, 5 = cubed), was 2.5, 2.6, 2.8, and 2.5 for Miser, Carrera, Eclipse, and CDC Mozart, respectively. Crude protein content was 23.8% for Miser compared to 24.2% for Carrera, Eclipse, and CDC Mozart.

For cooking quality, the puree color, scored on a 1-to-5 scale (1 = very good, 5 = poor), was 2.6 for Miser, 3.2 for Carrera and Eclipse, and 2.7 for CDC Mozart. Granulation score (scored on a 1-to-5 scale, 1 = very good, 5 = poor) was 2.7 for Miser, 2.3 for Carrera, and 2.7 for both Eclipse and CDC Mozart. The viscosity was evaluated on a scale of 1 to 24 (1 = very good, 24 = poor). Miser had a viscosity score of 21.7 compared with Carrera (20.8), Eclipse (23.1), and CDC Mozart (21.7).

Miser was resistant to powdery mildew, similar to Eclipse and CDC Mozart, while Carrera was susceptible to powdery mildew. Miser was moderately susceptible to *Mycosphaerella blight* [*Mycosphaerella pinodes* (Berk. & Blox.) Vestergr.] with the disease severity score of 7.1, similar to Carrera, Eclipse, and CDC Mozart, which had disease severity scores of 7.4, 6.9, and 7.3, respectively. Disease incidence score of *Fusarium wilt* [caused by race 2 of *Fusarium oxysporum* Schl. f. sp. *pisii* (van Hall) Snyder & Hans.] was rated at blooming or pod-filling stages. Disease incidence score was 8.4% for Miser, 6.7% for Carrera, 3.2% for Eclipse, and 2.8% for CDC Mozart.

Breeder seed of Miser is maintained at the Agriculture and Agri-Food Canada, Research Farm, Indian Head, Saskatchewan, Canada S0G 2K0. Miser has been released on an exclusive basis through a licensing arrangement with Quality Assured Seeds Inc. (422 McDonald Street, Regina, Saskatchewan, Canada, S4N 6E1), from whom pedigreed seed can be purchased. Small amounts of seed can be obtained from the corresponding author. Plant Breeder's Rights for Miser have been applied for from the Canadian Food Inspection Agency (application no. 03-3473). Application for U.S. Plant Variety Protection is not expected.

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Registration of ‘Blush’ Light Red Kidney Bean

‘Blush’ light red kidney bean (*Phaseolus vulgaris* L.) (Reg. no. CV-234, PI 635036) was developed cooperatively by the Washington Agricultural Research Center and the USDA-ARS and released in 1998. Blush is a large-seeded, upright, midseason maturity, and virus-resistant light red kidney adapted to the U.S. Pacific Northwest.

Blush was derived from the cross 84BR-1122/K-42. Breeding line 84BR-1122 was a root rot [caused by *Fusarium solani* (Mart.) Sacc. f. sp. *phaseoli* (Burkholder) W.C. Snyder & H.N. Hans] tolerant bush snap bean developed by USDA-ARS at Prosser, WA. K-42 is a light red kidney breeding line released by Burke et al. (1995). K-42 has shown resistance to halo blight [caused by *Pseudomonas syringae* pv. *phaseolicola* (Burkholder) Young et al.]. Blush is a F_{10:13} breeding line that was selected for individual plants possessing desirable virus resistance, seed quality, and architectural traits.

Blush has complete resistance to *Curly top virus* (CTV) and possesses the genes *I*, *bc-1*, for resistance to *Bean common mosaic virus* (BCMV). Blush also has moderate root rot tolerance from 84BR-1122. Blush has an upright bush growth habit, CIAT Type IA, similar to ‘Kardinal’ and is resistant to lodging (Singh, 1982). Blush was tested as LB4-2166, LB-2005, and USWA-33 in the advanced trials in Othello, WA, and yield was comparable to Kardinal (3-yr average yield was 2844 kg ha⁻¹ for Kardinal and 2856 kg ha⁻¹ for Blush). Blush was yield tested across 40 location years in 1997 and 1998 in the National Cooperative Dry Bean Nursery (CDBN) (Stewart-Williams, 1998, 1999). Blush was the top-yielding light red kidney cultivar among five tested in Scottsbluff, NE, Fruita, CO, and Safford, AZ. Blush out-yielded California Early Light Red Kidney (CELRK) at nine different locations. At North Platte, NE, Blush produced the highest yield at 2915 kg ha⁻¹, which

was 24, 52, and 65% higher than ‘Redkanner’, CELRK, and H-49, respectively (Lindgren et al., 1997). Blush matured in 90 d, which is 3 d later than Kardinal. Blush has 56 vs. 52 g 100 seed⁻¹ for Kardinal. Blush had acceptable canning quality in tests conducted by Cornell University, USDA-ARS East Lansing, and Michigan Agricultural Experiment Station and performed better than CELRK for color and shape.

Blush has been released as a nonexclusive public variety without Plant Variety Protection. The Washington State Crop Improvement Association, Inc. Department of Crop and Soil Sciences, WSU Seed House, Pullman, WA 99164-6420 will maintain Breeder and Foundation seed. A limited quantity of seed is available from Dr. A.N. Hang, WSU-IAREC, 24106 N. Bunn Road, Prosser, WA 99350. It is requested that appropriate recognition be given if this cultivar contributes to the development of a new breeding line or cultivar.

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Registration of ‘Fiero’ Dark Red Kidney Bean

‘Fiero’ dark red kidney bean (*Phaseolus vulgaris* L.) (Reg. no. CV-235, PI 635038) was developed cooperatively by the Washington Agricultural Research Center and USDA-ARS, and released in 1998. Fiero is a full-season, high-yielding, upright determinant bush bean adapted to the U.S. Pacific Northwest.

Fiero is an F_{6:9} line from the cross ‘Montcalm’/K-59. Montcalm is a very popular commercial cultivar released by Michigan State University and has been the dark red kidney standard; however, its yields are generally low. K-59 is a *Curly top virus* (CTV) resistant light red kidney germplasm line developed by Burke et al. (1995). Both parents have dominant *I* gene resistance to *Bean common mosaic virus* (BCMV) and an intermediate level of resistance to halo blight [caused by *Pseudomonas syringae* pv. *phaseolicola* (Burkholder) Young et al.]. The stems, leaves, and pods of K-59 are resistant to Race 2 of the halo blight bacterium. Fiero was selected from an individual plant possessing desirable disease resistance, seed quality, and architectural traits. Fiero has complete resis-

tance to CTV and *I* gene resistance to BCMV. Fiero also has tolerance to halo blight.

Tested across 40 location years in the Cooperative Dry Bean Nursery (CDBN) in 1997 and 1998, Fiero was the highest yielding of all dark red kidney entries, producing 17% greater yield than Montcalm (Stewart-Williams, 1998, 1999). Fiero had been tested in the advanced yield trials in Othello, WA, since 1995. Mean yield was 2420 kg ha⁻¹ averaging 18% higher than Montcalm in 4-yr trials and 44% higher than 'RedHawk' in 2-yr trials. Fiero has an upright determinant bush bean (Type I) growth habit similar to Montcalm and is resistant to lodging (Singh, 1982). Seed size is slightly larger than Montcalm, 57 vs. 55 g 100 seed⁻¹. Fiero matures in 100 d, 1 to 3 d later than Montcalm and RedHawk. Fiero had acceptable canning quality for overall appearance, color, and shape characteristics of the dark red kidney market class in tests conducted by Cornell Experiment Station, USDA-ARS, and Michigan Agricultural Experiment Station in 1997.

Fiero has been released as a nonexclusive public variety without Plant Variety Protection. The Washington State Crop Improvement Association, Inc., Department of Crop and Soil Sciences, WSU Seed House, Pullman, WA 99164-6420 will maintain Breeder and Foundation seed. A limited quantity of seed is available from Dr. A.N. Hang, WSU-IAREC, 24106 N. Bunn Road, Prosser, WA 99350. It is requested that appropriate recognition be given if this cultivar contributes to the development of a new breeding line or cultivar.

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Registration of 'Athena' Winter Rapeseed

Athena winter rapeseed [*Brassica napus* L. subsp. *oleifera* (Metzg) Sinsk. f. *biennis*] (Reg. no. CV- 22, PI 633734) was developed for use as an edible oilseed (canola-quality) cultivar and released by the Idaho Agricultural Experiment Station in December 2000.

Athena is a near-homozygous winter rapeseed cultivar with canola-quality seed oil and canola-quality seed meal, selected for its high adaptability to dryland and irrigated regions of the inland Pacific Northwest. This cultivar was developed from a single plant selection in 1997 from an F₅ population from

the cross 'Capricorn'/CPB.89606. Capricorn is a low-erucic acid (less than 20 g kg⁻¹), low-glucosinolate content cultivar (less than 30 μmol g⁻¹ of defatted seed meal), developed by the National Seed Development Organization, England, UK (PVP 8810022). CPB.89606 is an advanced breeding selection from Cambridge Plant Breeding, England, UK, derived from the cross 'Tapidor'/'Lindora-00'. Tapidor is a low-erucic acid, low-glucosinolate cultivar developed by Serasem (PVP 8810066). Lindora-00 is a low-erucic acid, low-glucosinolate cultivar developed by Deut Saatveredelung, Germany (PVP 8600037).

F₁ seeds from the original cross were produced in the spring of 1993 and F₂ seed produced in the greenhouse during the winter of 1993 to 1994. Individual F₂ field-grown plants were selected in 1995, with seed threshed separately. F₃ seeds from the F₂ plants were screened for glucosinolate content using a glucose-sensitive Tes-tape procedure (Lein, 1970) and for fatty acid composition using gas chromatography. Single plant selections were planted as F₃ head-rows (2 rows by 6 m) at a single location in northern Idaho in the fall of 1995. In the summer of 1996, each F₃ head-row was visually assessed before harvest and specific head-rows were selected based on visual yield potential, early maturity, short plant stature, lodging resistance, insect resistance to mainly cabbage seedpod weevil (*Ceutorhynchus assimilis* Paykull), and resistance to Sclerotinia white mold [caused by *Sclerotinia sclerotiorum* (Lib.) de Bary.] Ten single plant selections were taken from each selected plot. In addition, the remainder of the head-row plot was hand harvested and threshed as a head-row bulk. The 10 single plant selections were evaluated for oil content, glucosinolate content, and fatty acid composition, and planted as head-row plots (2 row by 6 m) in an F₄ replicated nested design in the fall of 1996, where each family was represented by two randomized plots, each containing five head-row plots grown adjacent to one another. In addition to the head-rows, families were evaluated in replicated yield trials at two locations in 1996 to 1997 for seed yield and several morphological characters using the head-row bulk seed. At harvest in 1997, the highest yielding families with desirable plant morphology (i.e., early maturity, short stature, and resistance to lodging) were selected based on the replicated yield trials. Thereafter, the F₅ head-row plots were visually inspected and the most agronomically desirable individual head-rows selected. As in 1996, the remainder of the plot was harvested and threshed by hand with this head-row bulk used to plant replicated yield trials at four locations in the 1997 to 1998 growing season. The process of single plant selection and head-row plots was repeated in the 1998 to 1999 season (F₆). At the 1999 harvest, 400 F₇ single plants were selected and used to plant Breeders Seed in the fall of 1999. At harvest in 2000, an additional 200 single F₈ plants were selected from the Breeders Seed and used to plant Foundation Seed in the fall of 2000.

Athena was evaluated in field trials in Idaho, Washington, and Oregon for six growing seasons from 1996 to 1997 through 2001 to 2002. Evaluation trials conducted during the 1998 to 1999 through 2001 to 2002 seasons were part of the Pacific Northwest Winter Canola Variety Trials (Brown et al., 1999; 2000; 2001; 2002). Performance was compared to four commercially available cultivars: Ericka, Ceres, Cascade, and Olsen. The cultivars Ericka (Brown et al., 1997), Cascade (Auld et al., 1987), Ceres, and Olsen [N. Deut. Pflanzenzucht (Germany)] have occupied almost the total acreage of winter canola in the region over the past 10 yr. Field trials were planted using bulked seed remaining from the Breeders Seed increase of single plant plots.

After fall seeding, Athena seedlings emerge quickly and produce a good fall stand compared to the other check culti-

vars. This is particularly true when planted late in the fall directly seeding into straw stubble. On average, Ericka flowered after Day of Year (DOY) 128, while Athena flowers significantly later, averaging DOY 131. The flowering date of Athena is not significantly different from Ceres or Olsen. Plant height of Athena is 144 cm, significantly taller than Ericka, but not significantly different from Ceres or Olsen. Despite producing tall plants, Athena is resistant to lodging and was found to be significantly less likely to lodge compared to Olsen. Athena plant maturity is intermediate, being significantly later than either Ericka or Cascade, but not significantly different from Olsen or Ceres. Athena has a determinate growth habit with plants drying down evenly at maturity, an advantage to growers because this can help avoid seed shatter and aids in harvesting. Seeds are dark brown in color and medium to large size, with 196 seed g^{-1} .

Averaged over 56 evaluation trials, Athena produced significantly higher seed yield (3332 $kg\ ha^{-1}$) than any check cultivar. Athena was highly adapted to later planting and direct seeding into cereal stubble. The yield advantage of Athena was particularly noted under these conditions. Athena was the highest yielding entry in five of the six years tested and was second highest in the other year.

Average oil content of Athena was significantly greater than Ericka and Ceres in 1999 but not significantly different from the control cultivars in the other years. Oil quality in Athena is high with less than 10 $g\ kg^{-1}$ erucic acid and less than 85 $g\ kg^{-1}$ linolenic acid. The remaining fatty acid profile was not significantly different from the high quality cultivars Cascade and Ericka. Seed meal glucosinolates were moderate to low (25 $\mu mol\ g^{-1}$). Although significantly higher than Ericka or Cascade, glucosinolate levels have always been less than the 30 $\mu mol\ g^{-1}$, which is the level required to be a certified as canola-quality.

Seed increases of Athena are limited by Plant Variety Protection (PVP Certificate No. 200300307) to Foundation and Certified Seed classes. Requests for seed of Athena for either experimental or commercial production can be made to the Idaho Agricultural Experiment Station, University of Idaho, Moscow, ID 83844-2331.

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Registration of 'Montola 2003' Safflower

'Montola 2003' (Reg. no. CV-25, PI 612967) safflower (*Carthamus tinctorius* L.) was developed at the Eastern Agricultural Research Center, Montana Agricultural Experiment Station, Sidney, MT, in cooperation with the Williston Research Extension Center, North Dakota Agricultural Experiment Station, Williston, ND. Montola 2003 was released by the Montana Agricultural Experiment Station in 1999.

Montola 2003 was tested as 95B7348 and derived from a single F_4 plant selected from a multicross/'Montola 2000'. The multicross involved 'S-317', 'Sidney Selection 87-14-6', 'Sidney Selection 87-42-3', 'Sidney Selection 88-45-4', 'USB', 'N4051', 'Gila', 'Cargill 1653', 'Cargill Dwarf', 'Royal', 'AC-1', 'Dart', 'VFR-1', '012-251-3-2', '012-251-3-5', 'S-304', and 'S-541'. A total of 22 crosses with recurrent selections were made in the breeding of Montola 2003. The cultivars involved in the breeding of the multicross and Montola 2000 (PI 538025) are briefly described below.

Montola 2000 is a normal hull, high oleic oil-type cultivar developed and released by Montana State University in 1991 to produce safflower oil with over 800 $g\ kg^{-1}$ oleic acid content when grown in Montana and the Dakotas (Bergman et al., 2000). S-317 is a high seed oil-content oleic oil-type cultivar with a striped hull developed by Seedtec International, Woodland, CA. S-317 has the genotype *ol ol* that produces seed with a high oleic acid content. Sidney Selection 87-14-6, Sidney Selection 87-42-3, and Sidney Selection 88-45-4 are 1965 selections made at Sidney, MT, for resistance to Alternaria leaf spot (caused by *Aliernaria carthami* Chow.). These selections were made from the 1964 bulk composite of 555 safflower introductions from the 1960 world safflower collection. The 1964 bulk composite was grown at a lower Yellowstone River Valley site near Sidney, MT, that had been continuously cropped to safflower since 1961. All selections have normal hull and linoleic oil type. USB is a normal hull, linoleic oil-type cultivar with resistance to Phytophthora root rot (caused by *Phytophthora drechsleri* Tucker). It is late in maturity and the seed has a low oil content (Thomas and Zimmer, 1971). N4051 is a normal hull, linoleic oil-type selection for vigorous growth habit and resistance to Verticillium wilt (caused by *Verticillium dahliae* Kleb.) and Fusarium wilt (caused by *Fusarium oxysporum* Schlechtend.: Fr. f. sp. *carthami* Klisiewicz & Houston). Gila is a normal hull, linoleic oil-type variety developed and released in 1958 by the University of Arizona for irrigated production with resistance to Phytophthora root rot. Cargill 1653 is a white normal hull, linoleic oil-type selection made in California by Cargill, Inc. Cargill Dwarf is a normal hull, linoleic oil-type selection for very short plant height made in California by Cargill, Inc. Royal is a purple-striped hull, linoleic oil-type variety developed and released in 1970 by the University of Arizona for high self-fertility, high oil content, resistance to Phytophthora root rot, and moderate resistance to Verticillium wilt. AC-1 is a cultivar high in oil seed linoleic oil content with a purple-striped hull; it was developed at the University of Arizona. Dart (PI 572435) is a gray-striped hull, linoleic oil-type variety developed and released in 1967 by the University of Arizona as a high oil line with seedling and

early growth stage cold tolerance and tolerance to Phytophthora root rot (Abel and Lorange, 1975). VFR-1 is a normal hull, linoleic oil-type selection out of N4051 with resistance to Verticillium wilt, Fusarium wilt, and Rhizoctonia blight [caused by *Thanatephorus cucumeris* (A.B. Frank) Donk]. 012-251-3-2 and 012-251-3-5 are striped-hull, linoleic oil-type selections made by the USDA-ARS for resistance to Fusarium, Phytophthora, and some strains of Verticillium wilt made by backcrossing striped hull into VFR-1. S-304 was developed by Seedtec International and is a normal white hull seed variety. S-304 has the genotype *ol ol* that produces an oil with approximately equal amounts of linoleic and oleic acid, but the relative amounts of each fatty acid are greatly influenced by growing temperature. S-541 was developed by Seedtec International, Woodland, CA, and is a striped hull, linoleic acid variety.

Individual plant selections were made during the F₂, F₃, and F₄ generations. Seed oil fatty acid profiles were determined by gas chromatography of individual seeds beginning in the F₂ generation. Plants producing oil with less than 70 g kg⁻¹ in total saturated fatty acids and greater than 800 g kg⁻¹ in oleic acid content were selected.

Montola 2003 was developed and released for production in Montana and other Northern Great Plains states to provide a safflower oil high in oleic fatty acid and low in saturated fatty acids, similar to Montola 2000, but with improved yielding ability, higher test weight, taller plants, and improved disease resistance to *Pseudomonas* bacterial blight (caused by *Pseudomonas syringae* van Hall).

The fatty acid composition of safflower oil from Montola 2003 at Sidney, MT, averaged 808 g kg⁻¹ oleic acid, 128 g kg⁻¹ linoleic, 39 g kg⁻¹ palmitic, and 15 g kg⁻¹ stearic acid compared with 805 g kg⁻¹, 121 g kg⁻¹, 41 g kg⁻¹, and 16 g kg⁻¹, respectively, for Montola 2000. Total saturated fatty acid content for both cultivars ranged from 66 to 70 g kg⁻¹. Montola 2003 oil has a neutral taste. Montola 2003 is recommended for dryland and irrigated production in Montana and western North Dakota and provides a high quality, high oleic, low saturated fatty acid safflower oil for the specialty oil market.

Montola 2003 plants have spines on the leaf tips and along leaf margins and involucre bracts. The flower color of Montola 2003 is yellow in the bud and full bloom. Upon drying, the flower color is light orange to orange. Seed of Montola 2003 has a predominantly bright white (normal) hull preferred by the birdseed market, is similar in seed size to Montola 2000 and averages 3.06 g per 100 seeds. Montola 2003 is classified as medium maturity (120 d) and flowers 1 to 2 d later than Montola 2000. Under dryland conditions at Sidney, MT, Mon-

tola 2003 is 4 cm taller than Montola 2000; and under irrigated conditions, it is approximately 8 cm taller.

On the basis of field disease ratings, Montola 2003 appears moderately resistant to *Alternaria* leaf spot and moderately resistant to *Pseudomonas* bacterial blight. Disease ratings indicate improved resistance for these diseases compared to Montola 2000.

In dryland trials at Sidney, MT, during the 1996 to 1999 period, Montola 2003 averaged 1922 kg ha⁻¹ with a test weight of 32.1 kg hL⁻¹, seed oil content of 380 g kg⁻¹, and plant height of 60.5 cm, compared with 1837 kg ha⁻¹; 29.9 kg hL⁻¹; 374 g kg⁻¹; and 55.0 cm, respectively, for Montola 2000. In irrigated trials at Sidney, MT, during the 1996 to 1999 period, Montola 2003 averaged 2616 kg ha⁻¹ with a test weight of 29.3 kg hL⁻¹, a seed oil content of 367 g kg⁻¹, and plant height of 71.0 cm compared with 2122 kg ha⁻¹, 27.3 kg hL⁻¹, and 370 g kg⁻¹, and 62.5 cm, respectively, for Montola 2000.

Breeder and Foundation seed will be maintained by the Foundation Seed Stocks Committee, Montana Agricultural Experiment Station, Montana State University, Bozeman, MT 59717. Limited seed of Montola 2003 for research purposes is available on request from the corresponding author for at least five years. U.S. Plant Variety Protection for Montola 2003 under the U.S. Plant Variety Protection Act has been granted (PVP certificate no. 200000160). The cultivar shall only be sold as a class of Certified seed.

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REGISTRATIONS OF GERmplASMS

Registration of Greenbug Resistant Sorghum Germplasm Lines KS 116 A/B through KS 120 A/B

Five biotype I greenbug (*Schizaphis graminum* Rond.) resistant A/B pairs of sorghum [*Sorghum bicolor* (L.) Moench] were developed and released by the Kansas Agricultural Experiment Station in 2003. These lines (KS 116 A/B-KS 120A/B) (GP-610 to GP-619, PI 634495 to PI 634504) are all white-seeded, tan plant types that represent a range of maturity including lines that are earlier than previously released tan steriles. All lines are dwarf (90-120 cm) in height and lack a pigmented testa. Exact pedigrees and other agronomic characteristics are given in Table 1. The source of greenbug resistance

in all of the lines is the plant introduction 'PI 550610' (Andrews et al., 1993). Hybrids with these lines have been tested and found to produce satisfactory grain yields.

All lines were developed by pedigree breeding following the initial cross. Individual F₂ plants from the initial cross were screened for greenbug resistance. For KS 116B, KS 117B, KS 119B, and KS 120B, progeny from resistant plants were grown and an individual head from the F₃ was backcrossed to a genetic sterile from KP 9B. BC₁F₂ plants were screened and progeny from resistant plants were grown and crossed to a tan plant source. After the last cross, tan plants from the F₂ generation were selected and F₃ and F₄ rows were grown. KS 116B and KS 117B were derived from different F₂ plants after

Table 1. Agronomic characteristics of five greenbug resistant A/B sorghum germplasm lines.

Line	Pedigree [†]	Days to 50% anthesis	Plant height	Greenbug rating [‡]	Glume color	Awns [§]
			cm			
KS 116B	KP9B ms ₃ //KP9B ms ₃ /PI 550610/3/BTxArg-1-11	76	90	3.0	sienna	–
KS 117B	KP9B ms ₃ //KP9B ms ₃ /PI 550610/3/BTxArg-1-13	74	100	1.0	sienna	–
KS 118B	ms ₃ tan//RTx436¶//PI 550610	70	95	1.0	sienna	+
KS 119B	ms ₃ tan-2/3/KP9B ms ₃ //KP9B ms ₃ /PI 550610	71	95	1.0	sienna	+
KS 120B	ms ₃ tan-4/3/KP9B ms ₃ //KP9B ms ₃ /PI 550610	72	120	1.0	sienna	+
BTx635		84	130	9.0	tan	–
BTxArg-1		80	130	9.0	tan	–

[†] KP9B ms₃ indicates a random genetic male sterile plant from the random mating population KP9B. ms₃ tan indicates a random tan plant genetic male sterile from a tan plant random mating population.

[‡] Leaf damage after 21 d of greenbug infestation. Rating scale based on percent of plant tissue killed where 1 = 0 to 10% and 9 = plant dead.

[§] +, denotes presence; –, denotes absence.

¶ Miller et al., 1992b.

the cross with BTxArg-1 (Miller et al., 1992a) while KS 119B and KS 120B resulted from crosses to different ms₃ tan plants. KS 118 resulted from a single resistant F₃ from the original cross crossed to a tan genetic male sterile plant. Progeny from the last cross were screened for seedling-stage greenbug resistance from the F₄ to the F₈. Initial crossing to the cytoplasmic male sterile source occurred with the F₄ generation. Each A line has been backcrossed to the recurrent parent at least 6 times. Occasionally, a genetic male sterile plant will appear in the B line parent.

All of these germplasm lines are susceptible to biotype K greenbug. They have not been tested for any other specific disease or insect pests and their reaction is not known.

These lines will add diversity to the germplasm available to produce biotype I resistant hybrids and to breed other A/B lines with resistance to biotype I greenbug. Seed of all lines will be maintained and distributed by the Kansas State University Agricultural Research Center–Hays, 1232 240th Ave., Hays, KS 67601-9228 and will be provided without cost on written request. Genetic material of this release has been deposited in the National Plant Germplasm System where it will be available for research purposes, including the development and commercialization of new cultivars and parental lines. It is requested that appropriate recognition be made if this germplasm contributes to the development of new breeding or parent lines.

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Registration of 20 Tropical Midaltitude Maize Line Sources with Resistance to Gray Leaf Spot

Twenty maize (*Zea mays* L.) inbred lines with resistance to foliar diseases and adaptation to tropical midaltitudes (Reg. no. GP-379 to GP-398, PI 635122 to PI 635141) were developed at the International Institute of Tropical Agriculture (IITA),

Ibadan, Nigeria. The lines are at the S₈ to S₉ stages of inbreeding and confer combined resistance to gray leaf spot (caused by *Cercospora zaeae-maydis* Tehon and E.Y. Daniels), *Maize streak virus* (MSV), northern leaf blight [caused by *Exserohilum turcicum* (Pass.) K. J. Leonard & E. G. Suggs.], and common rust (caused by *Puccinia sorghi* Schwein); diseases prevalent in the midaltitude ecology in West and Central Africa (Everett et al., 1994a, 1994b). Lines were released for use as sources of germplasm from 1999 to 2003.

Inbred lines were derived from single crosses of midaltitude-adapted inbred lines and broad-based populations (Coca-SR, Early-W-SR, and POP 43-SR) with resistance to MSV (Kim et al., 1985; Everett et al., 1994a, 1994b, 1994c). TZMI711 was derived from a cross between a maize variety grown in Tanzania, called National-1 Variety, and an IITA MSV-resistant population (TZSR), which was formed by intercrossing four populations, including TZB, TZPB, POP 21, and POP 22. TZMI712 and TZMI713 were selected from a cross between a midaltitude inbred line (TZMI501) from IITA and an inbred line from the International Maize and Wheat Improvement Center (CIMMYT) (ZSR 923 S4 bulk). TZMI714 and TZMI715 were extracted from a cross between two midaltitude-adapted inbred lines from IITA (87014 and Z28). TZMI716 was extracted from a cross between two midaltitude-adapted inbred lines (88069 and 87366) from IITA. TZMI717 was developed from a cross between two midaltitude-adapted inbred lines (89258 and Z28) from IITA. TZMI718 was selected from a cross between two midaltitude-adapted inbred lines (89302 and Z28) from IITA. TZMI719 to TZMI724 were derived from a cross between two midaltitude-adapted inbred lines with flint grain texture (TZMI101 and TZMI501). TZMI101 was extracted from a broad-based population, TZMSR, while TZMI501 was developed from a cross between a commercial hybrid from Zimbabwe (SR52) and an IITA population (TZSR). TZMI725 was developed from a cross between two midaltitude-adapted inbred lines (87036 and 87923) from IITA. TZMI726 and TZMI727 were extracted from two populations developed at IITA, Coca SR and Early-W-SR, respectively, while TZMI728 and TZMI729 were derived from a population developed at CIMMYT (POP43-SR) and improved for resistance to MSV at IITA. TZMI730 was derived from a cross of an inbred line from IITA (TZMI407) with a line from CIMMYT (8232/TZMSR-W/ZM607). The parental lines from IITA were derived from a MSV-resistant midaltitude population, TZMSR, crosses between lowland MSV-resistant populations, and midaltitude germplasm from Eastern and Southern Africa as well as germplasm sources from CIMMYT (Kim et al., 1985; Everett et al., 1994a, 1994b, 1994c).

S₁ lines extracted from each cross or population were evaluated in single rows under severe natural infection with northern leaf blight and common rust and artificial inoculation with

gray leaf spot at Tenti (9°48' N, 8°48' E, altitude 1350 m) and Vom (9°40' N, 8°50' E, altitude 1300 m) in Nigeria. Inoculation with gray leaf spot was done at the four- to six-leaf stage by placing a pinch of ground infected leaf samples with gray leaf spot collected in the previous season into the leaf whorls. At each location, gray leaf spot, northern leaf blight, and common rust severity were visually rated at 3 wk after silking on a scale of 1 to 5, where 1 = no visible infection and 5 = severe infection (Shagi Maroof et al., 1993). At the S₁ to S₃ stages of inbreeding, rows that exhibited disease severity ratings of 3.0 or less for the three foliar diseases in the two locations were selected. Single plant selections were then made from each selected row at each location on the basis of vigorous growth (visual assessment for bigger and sturdy plants with healthy leaves), low ear placement, resistance to lodging, synchrony between pollen shed, and silking, as well as well filled ears. At the S₄ stage, selected lines were evaluated in the field under artificial infestation with viruliferous leafhoppers (*Cicadulina* spp.) for resistance to MSV at IITA, Ibadan (7°26' N, 3°54' E, altitude 150 m).

S₄ lines with combined resistance to the four diseases were crossed to two inbred testers, TZMI102 and TZMI407, that are parents of the best single-cross hybrid marketed in Plateau State of Nigeria as '8535-23' to form testcrosses. The S₄ testcrosses and the check hybrid, 8535-23, were evaluated in single 5-m row plots at Tenti, Vom, and Saminaka (10°28' N, 8°41' E, altitude 800 m) in Nigeria in 1997 and 1998 by means of a simple lattice design. Selected S₄ lines that combined well with at least one of the inbred testers were advanced from S₅ to S₇ stages of inbreeding with repeated evaluation for resistance to gray leaf spot, northern leaf blight, and common rust at each stage. S₇ lines with combined resistance to the four diseases were selected to form experimental hybrids, which were again tested at Tenti, Vom, and Saminaka in Nigeria between 1999 and 2003. Inbred lines that did well in hybrid combinations and with better resistance to foliar diseases than the hybrid check, 8535-23, in field trials over 2 yr were selected and released to collaborators in the national agricultural research systems and seed companies in and outside of West and Central Africa.

On the basis of combining ability effects and mean grain yields of the lines in crosses with the two inbred testers, TZMI711 to TZMI718 were assigned to the TZMI102 heterotic group while TZMI719 to TZMI724 were placed in the TZMI407 heterotic group. The remaining six lines (TZMI725 to TZMI730) were found to be heterotic to both TZMI102 and TZMI407. In breeding nurseries evaluated at Tenti and Vom for six years (1998–2003), the average gray leaf spot scores for the tropical midaltitude lines varied from 1.6 to 2.9, which were similar to or significantly better than that of the standard check line, TZMI407 (2.7). In an evaluation trial conducted at Saminaka and Vom in 2003, the lines tasseled between 74 and 83 d, silked between 77 and 86 d, and had plant height varying from 91 to 188 cm and ear height varying from 40 to 96 cm. Most of the inbred lines had flint grain texture and can be used as sources of genes for combined resistance to the four foliar diseases as well as favorable alleles to broaden and diversify the genetic base of adapted germplasm in tropical midaltitude environments. They can also be used as promising sources of exotic germplasm to temperate environments because they should possess desirable traits fixed through several generations of inbreeding and selection.

Small quantities (30 kernels) of seed are available to crop researchers upon written request to the leader of the maize breeding unit at IITA, PMB 5320, Ibadan, Nigeria. It is requested that appropriate recognition of the source be given

when these germplasm lines contribute to the development of new lines, hybrids, and synthetic varieties.

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Registration of KS99WGRC42 Hessian Fly Resistant Hard Red Winter Wheat Germplasm

KS99WGRC42 (Reg. no. GP-779, PI 635054) is a hard red winter wheat (*Triticum aestivum* L.) with resistance to the Hessian fly [*Mayetiola destructor* (Say)] developed cooperatively by the USDA-ARS, the Kansas Agricultural Experiment Station, and the Wheat Genetics Resource Center. It was released as germplasm in August 1999.

KS99WGRC42 is homogeneous for resistance (antibiosis) to Biotype L of the Hessian fly based on greenhouse tests of seedlings. KS99WGRC42 is an F₅-derived line of the cross 'Karl 92'/PI 94641//'Jagger'*2/Karl 92. Hessian fly resistance of the germplasm is derived from PI 94641, an accession of cultivated emmer wheat [*T. turgidum* L. subsp. *dicoccum* (Schrank ex Schübler) Thell.] from Germany. The resistance of KS99WGRC42 to Hessian fly is controlled by a single partially dominant gene located on chromosome 1AS. Analysis of KS99WGRC42 with microsatellite markers indicates that a small, interstitial segment from *T. turgidum* subsp. *dicoccum* containing the Hessian fly resistance gene was transferred to the distal portion of 1AS. Two genes for resistance to Hessian fly have been located to wheat chromosome 1A: *H5* and *H11*. KS99WGRC42 provides effective resistance to Biotype L of the Hessian fly, which is virulent to *H5* (Ratcliffe and Hatchett, 1997). The gene *H11* was transferred to common wheat from durum wheat [*T. turgidum* L. subsp. *durum* (Desf.) Husnot], a species closely related to emmer wheat. Differential reactions were observed when seedlings of PI 94641, KS99WGRC42 and PI 562617 (*H11*) (Patterson et al., 1994) were infested with Biotype L of the Hessian fly at 20°C and at 26°C. PI 94641 and KS99WGRC42 were homogeneous for resistance at both temperatures. A heterogeneous reaction was observed

for PI 562617 at 20°C and a susceptible reaction was observed at 26°C. These data indicate that the gene in KS99WGRC42 is different from *H5* and *H11*.

KS99WGRC42 is a hard red winter wheat similar to the Karl 92 (Sears et al., 1997) parent in height and days to heading. When evaluated in the field at Manhattan, KS, in 2002 and 2003, no visible symptoms of *Wheat soilborne mosaic virus* were observed on KS99WGRC42 and Karl 92. Intermediate and high levels of infection were observed for Jagger and 'TAM 107' with scores of 2 and 4, respectively, on a scale of 0 to 5 (0 = no visible symptoms and 5 = severe mottling and stunting). No stripe rust (caused by *Puccinia striiformis* Westend.) was observed on KS99WGRC42, Karl 92, or Jagger at Hutchinson, KS, in 2003, a year with heavy stripe rust infection. High levels of leaf rust (caused by *Puccinia triticina* Eriks.) were observed on KS99WGRC42 and both of the hard winter wheat parents at Manhattan and Hutchinson, KS, in 2003 and 2004.

Small quantities (3 g) of seed of KS99WGRC42 are available on written request to the corresponding author for at least 5 yr from the date of this publication. It is requested that the appropriate source be given when this germplasm contributes to research or development of new cultivars.

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Registration of Yellow Dwarf Viruses Resistant Wheat Germplasm Line P961341

P961341 soft red winter wheat (*Triticum aestivum* L.) germplasm (Reg. no. GP-780, PI 634825) was developed by Purdue University Agricultural Research Programs and USDA-ARS and released in 2003. P961341, a translocation line, has resistance to yellow dwarf viruses, *Barley yellow dwarf virus-PAV* luteovirus (BYDV) and *Cereal yellow dwarf virus-RPV* poliovirus (CYDV) from intermediate wheatgrass [*Thinopyrum intermedium* (Host) Barkworth & Dewey [syn. *Agropyron intermedium* (Host) P.B.]].

The parentage of P961341 is 'Abe'/*Th. intermedium*//'Compton'/3/'Arthur'/Caldwell'/4/Caldwell/5/'Oasis'*3/'Clark'*4/'Ning 7840'//Clark/'Roazon'/6/'Patterson'. After the backcross to Caldwell, an F₂ plant was identified as having a low concentration of BYDV and CYDV by ELISA testing (values of 0–0.1 in various tests) compared to susceptible Abe (values of 0.5–1.0) at 14 d after infestation of 2- to 3-leaf seedlings with viruliferous aphids (*Rhopalosiphum padi*). Cytologically this plant was 2n = 43 (21 II + 1I). F₃ plants that were resistant to BYDV and CYDV, determined by low ELISA values of 0 to 0.1 compared to susceptible Abe (0.5–1.0), were self-pollinated to produce F₄ plants. Four F₄ plants derived from this 2n = 43 F₂ plant were identified by cytology as 2n = 42 and resistant to BYDV and CYDV by ELISA, and self-pollinated seeds from these four plants were bulked and released as the chromosome substitution line P29 (Sharma et al., 1997). Another F₄ plant from the same 2n = 43 F₂ plant was 2n = 44 and resistant to BYDV and CYDV, and was designated P107. This chromosome addition line was not released. P107 was irradiated with γ rays from ⁶⁰Co using a 120-Gy radiation dose. Putative translocation plants in subsequent generations after selfing were selected on the basis of low or negligible ELISA values, as described above, and as having 42 chromosomes. Progenies were characterized in these subsequent generations by ELISA, chromosome analysis (counts and pairing), Southern hybridization using a *Thinopyrum*-specific probe A600 and group 7 chromosome RFLP markers, and slot blots and genomic in situ hybridization using the rye telomeric repetitive sequence pAW161, as described for progenies of P29 (Sharma et al., 1999; Crasta et al., 2000). An M₄ putative translocation plant with a low ELISA value and 2n = 42, was crossed to an F₅ plant selection with the parentage Oasis/3/Clark*4/Ning 7840//Clark/Roazon, and the F₁ was crossed to Patterson. After the cross to Patterson, F₂ and F₄ plants were selected using a pedigree breeding method. The germplasm line P961341 is the progeny of a single F₄ plant selection. DNA marker analysis showed that P961341 has most of the long arm of chromosome 7E combined with the short arm of chromosome 7D (7DS.7DL-7EL).

ELISA values in a four-replicate test, 14 d after infestation with aphids viruliferous for BYDV and CYDV, for P961341 and Abe were, respectively, 0.095 and 0.516, LSD_{0.05} = 0.264. Yellow dwarf symptom scores (0–9, 0 = no symptoms to 9 = severe leaf discoloration and plant stunting) in replicated field nurseries in 2002 at Lafayette, IN, with natural yellow dwarf viruses infection in winter wheat seedlings in fall 2001 for P961341, P29, Abe, and Caldwell were, respectively, 0.5, 0.5, 7.8, and 5.2, LSD_{0.05} = 0.7; when evaluated in June 2002. Eighty percent of wheat tissue collections at Lafayette, IN, in 2002 were determined to contain BYDV and 20% were determined to contain CYDV. Grain yield for P961341, 'Roane', and 'Ernie' were, respectively, 2882, 2382, and 2153 kg ha⁻¹ averaged over two locations in Indiana and two replicates at each location, LSD_{0.05} = 201 in 2002, a year characterized by considerable infection by yellow dwarf viruses. In 2003, with no or negligible yellow dwarf virus infection in wheat, grain yield for P961341, Roane, and Ernie were, respectively, 3056, 3051, and 2623 kg ha⁻¹ averaged over 7 locations in Indiana, with two replicates at each location, LSD_{0.05} = 213.

P961341 has resistance to leaf and glume blotch [caused by *Stagonospora nodorum* (Berk.) Castellani and Germano] typically averaging a score of 4 (0–9 scale in which 0 = no symptoms to 9 = severe disease in glumes). Cultivar Patterson had an average score of 6 in the same tests. P961341 develops patches of purple pigment in the glumes to variable degrees in different environments, giving the appearance of glume blotch. P961341 has *Lr37-Yr17-Sr38* linkage block from parent

line Roazon, having the diagnostic DNA marker locus, Xgwm682 (Helguera et al., 2003). It was free of leaf rust (caused by *Puccinia triticina* Eriks.) and stripe rust (caused by *Puccinia striiformis* Westend.) in tests where Patterson scored as 10 S (10 = percentage flag leaf infected, S = susceptible reaction type) for leaf rust and 70 S for stripe rust. Powdery mildew (caused by *Blumeria graminis* DC. f. sp. *tritici* Em. Marchal) develops more slowly on P961341 than on susceptible wheat lines; P961341 is typically scored at 2 to 4 (0–9, 0 = no lesions to 9 = severe disease) compared to scores of 6 to 8 for cultivar Patterson in the same tests in Indiana. P961341 is resistant to *Soilborne mosaic virus*, scored as 0 to 1 (0 = no yellow mottling, 9 = severe mottling and plant stunting) compared to cultivar Roane, with a score of 4, and cultivar 'Coker 9375', score of 8, in a severely infested plot area at Urbana, IL. Flowering date of P961341 in Indiana is similar to that of cultivar Patterson. P961341 has yellow anthers, with awnlets typically 3 to 5 mm long.

P961341 is intended to provide a source of resistance to BYDV and CYDV for wheat breeding and genetic research. Small quantities of seed are available on written request to the corresponding author. Appropriate recognition of source should be given when this germplasm contributes to research or development of a new breeding line or cultivar.

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Registration of Common Bacterial Blight Resistant Pinto Bean Germplasm Line ABCP-8

Pinto bean (*Phaseolus vulgaris* L.) germplasm line ABCP-8 (Reg. no. GP-237, PI 635118) was developed by the University of Nebraska Agricultural Research Division in cooperation with USDA-ARS and released in 2004. This line was bred specifically for enhanced resistance to common bacterial blight [caused by *Xanthomonas campestris* pv. *phaseoli* (Smith) Dye]. Pinto and other dry bean market classes (dark red kidney, great northern, navy, etc.) grown in the U.S.A. east of the continental divide are often attacked by common bacterial blight, a seed-transmitted disease that causes up to 40% yield

loss in susceptible cultivars as well as reduction of seed quality through discoloration of infected seed. Development of cultivars with genetic resistance combined from different sources is the most cost effective method to control common bacterial blight.

ABCP-8 is the first pinto bean to combine the XAN 159 and great northern Montana No. 5 (Miklas et al., 2003) sources of common bacterial blight resistance. Combined resistance was confirmed by the presence of previously developed SCAR markers SU91 (Pedraza et al., 1997) and SAP6 (Miklas et al., 2003) tightly linked with quantitative trait loci (QTL) from XAN 159 and Montana No. 5, respectively. In addition to common bacterial blight resistance, ABCP-8 possesses the *Ur-3* gene for resistance to rust [caused by *Uromyces appendiculatus* (Pers.:Pers.) Unger] as indicated by resistance to rust Races 41, 53, and 108, and the *bc-1²* gene for resistance to *Bean common mosaic virus* (BCMV) and *Bean common mosaic necrosis virus* (BCMNV) Pathogroups 1, 2, 3, and 5 and partial resistance to NL-3 strain of Pathogroup 6 of BCMNV.

ABCP-8 pinto is a BC₃F_{3,5} line obtained from five backcrosses ('Chase'*5/XAN 159) between the donor parent XAN 159 and recurrent parent Chase pinto. Seeds of XAN 159 are medium (25 g 100 seed⁻¹) with a flat cylindrical shape and a gray-speckled fine-dotting seed coat pattern. XAN 159 was developed for resistance to common bacterial blight at the Centro Internacional Agricultura Tropical (CIAT) by selection from the interspecific cross 'UI 114' pinto/PI 319441//PI 319443 (*P. acutifolius* A. Gray)/'Masterpiece' made by Thomas and Waines (1984). XAN 159 was estimated to have up to five QTL for resistance to common bacterial blight (Eskridge and Coyne, 1996). It is susceptible to rust and BCMV. Chase was derived from a cross between a great northern breeding line, GN-WM-84-17, and a pinto breeding line, P-WM-84-45, from the University of Nebraska dry bean breeding program. Chase is resistant to rust (*Ur-3* gene) and moderately resistant to bacterial brown spot (caused by *Pseudomonas syringae* pv. *syringae* van Hall) and common bacterial blight, and expresses moderate avoidance to white mold [caused by *Sclerotinia sclerotiorum* (Lib.) de Bary] due to a porous canopy, but is susceptible to BCMV (Coyne et al., 1994).

The first cross was made in the spring 1997. Only BC_nF₁ plants resistant to common bacterial blight isolates DR-7 and EK-11 as determined by multiple-needle leaf inoculation tests in the greenhouse (Andrus, 1948) were used for successive backcrossing. In addition to common bacterial blight resistance, selection for desirable pinto seed characteristics began after BC₃. Single plant selections were made from inbred BC₅ lines expressing the highest common bacterial blight resistance. Field evaluation of selected BC₅F_{3,5} lines were conducted at the West Central Research and Extension Center (North Platte) and Panhandle Research and Extension Center (Scottsbluff) in Nebraska in 2001, 2002, and 2003 and at the Washington State University Experiment Station in Othello, WA, in 2002. In addition to phenotypic selection for common bacterial blight resistance, marker-assisted selection for the SU91 and SAP6 markers was conducted in the BC₁F₁ and BC₂F₁.

The seed size (30 g 100 seed⁻¹) for ABCP-8 across locations was less than Chase (33 g 100 seed⁻¹). The yield for ABCP-8 was 117, 148, and 129% of the yield of Chase in Nebraska (2001 and 2003) and Washington (2002), respectively. ABCP-8 matured 4 d later than Chase in Washington. The line exhibits an indeterminate semi-prostrate growth habit similar to Chase. ABCP-8 exhibited greater resistance to common bacterial blight (6% infection in field and greenhouse tests) than the

recurrent parent Chase (33% field and 46% greenhouse) and susceptible check 'Othello' pinto (59% field and 100% greenhouse), and similar resistance to the donor parent XAN 159 (8% in field and 5% in greenhouse). Disease scores were recorded as percentage diseased plants (leaves and pods) in the field under natural infection and percentage common bacterial blight symptoms visible within the inoculated leaf area of greenhouse grown plants.

The ABCP-8 breeding line will be useful for improving resistance to common bacterial blight in the pinto bean market class. Limited quantity of seed is available from P.N. Miklas (pmiklas@pars.ars.usda.gov). We ask that appropriate recognition of source be given when this germplasm contributes to the development of a new cultivar.

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Registration of MD 52ne High Fiber Quality Cotton Germplasm and Recurrent Parent MD 90ne

Cotton (*Gossypium hirsutum* L.) germplasm MD 52ne (Reg. no. GP-787, PI 634930) and its recurrent parent MD 90ne (Reg. no. GP-788, PI 634931) were developed by the USDA-ARS, Stoneville, MS, and released in August 2003. The two germplasms were each produced by using the backcross breeding method and using MD 65-11ne in both cases

as the donor parent. Both MD 52ne and MD 90ne possess high fiber bundle strength combined with the nectariless trait ($2_{ne1, ne2}$) and semi-smooth leaf ($2t_3$) and offer breeders and cotton physiologists opportunities to manipulate and study a fiber property deemed essential by modern yarn manufacturing technologies.

The first backcross program produced MD 90ne. It is a BC₄ line in about F₈ that was produced by using 'Deltapine Acala 90'¹ as the recurrent parent and germplasm line MD 65-11ne as the donor parent. MD 65-11ne has not been officially released, but has been used in studies of canopy physiology (Wells et al., 1986) and lint trash content (Novick et al., 1991) and in breeding programs (Meredith, 1993). Deltapine Acala 90 was a widely grown cultivar until about 2001, first produced in 1981, and a major cultivar since 1982 (USDA-AMS, 1982-2003). It possesses high yield potential, good fiber bundle strength by stelometer measurement, and the semi-smooth leaf trait. The semi-smooth leaf trait results in less trash in ginned lint (Novick et al., 1991; Williford et al., 1987) and results in lower populations of the cotton aphid (*Aphis gossypii* Glover) compared with hirsute cottons (Weathersbee et al., 1994). The nectariless trait's yield, yield components, and fiber quality are similar to those of near isogenic nectaried cultivars unless tarnished plant bugs [*Lygus lineolaris* (Palisot de Beauvois)] are present in large numbers (Meredith, 1975). In those cases, cultivars possessing the nectariless trait produce similar yield components and fiber quality and result in significantly higher yields.

MD 65-11ne was produced by five backcrosses to Deltapine 16ne as the recurrent parent and FTA 263-20 as the donor parent (GP 154, Culp and Harrel, 1980). In each segregating generation, selection was practiced for high bundle strength. 'Deltapine 16'¹ was a popular commercial cultivar in the 1960s and 1970s and is half the parentage of Deltapine Acala 90 (Calhoun et al., 1997). The high bundle strength of MD 65-11ne descends from FTA 263-20. It has a complex parentage involving Sea Island (*G. barbadense* L.) and Triple Hybrid [*G. arboretum* L. × *G. thurberi* Todaro] × *G. hirsutum*] germplasm.

The second backcross program produced MD 52ne by using MD 90ne as the recurrent parent in five backcrosses and MD 65-11ne was the donor parent. Selection in each backcross was for high bundle strength. MD 52ne has about 10% higher bundle strength, 22% less short fibers, and 7% longer mean fiber length than its near-isoline recurrent parent MD 90ne (Meredith, 2005). The unique aspect of MD 52ne is that the inheritance of improved fiber quality appears to be controlled by a small number of genes. A genetic study conducted with BC₆ F_{2.3} progenies estimated bundle strength was controlled by 1.23 (± 0.16) genes (Meredith, 2005). The small number of genes conferring high fiber strength implies small segregating populations are needed to recover high fiber strength. However, as found in many fiber quality studies, yield and lint percentage are negatively correlated with high fiber strength.

MD 90ne is included in the release to provide a near-isogenic check for those wishing to study physiological-genetic associations. Small quantities of seed (100 seed) of these germplasm lines may be obtained from the corresponding author for research purposes. Recognition of the source of the germplasm is expected if it is used in the development of a new cultivar or in genetic-physiological host plant resistance studies.

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¹ Mention of trade names or commercial products in this release are solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U. S. Department of Agriculture.

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