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REGISTRATIONS OF GERMPLASM

Registration of High Fiber Strength Cotton Germplasm Line NM970513

NM970513 (Reg. no. GP-714, PI 613344) upland acala cotton (*Gossypium hirsutum* L.) germplasm line was developed by the New Mexico Agricultural Experiment Station and released in 2000. NM970513 will provide plant breeders a new source of genes for bundle fiber strength. NM970513 was selected from the cross 'Acala 1517-95'/NM24052 made in 1994 at the New Mexico Agricultural Experiment Station at Las Cruces, NM. Acala 1517-95 is a high quality acala cultivar with the pedigree Acala 3080/PD2165 (Cantrell and Escabedo, 1997). NM24052 is an experimental line derived from the cross St9/Del Cerro. Del Cerro is a complex population released in 1957 and contains introgression from *G. hirsutum* L., *G. hirsutum* var. *punctatum* (Schumach & Thonn.), *G. barbadense* L., *G. herbaceum* L., and *G. thurberi* Tod. (Smith et al., 1999; Staten, 1971). St9 is a stripper experimental line contributing earliness and compact growth habit to the cross.

In 1995, 122 F_2 plants from the cross Acala 1517-95/NM24052 were selfed in Las Cruces, NM, to produce $F_{2:3}$ progeny. These progeny were evaluated in replicated trials at Las Cruces and Artesia, NM, in 1996. Extensive transgressive segregation was observed in this population for fiber strength (Cantrell et al., 1995). All $F_{2:3}$ lines were grown also in 10-m rows in the genetics nursery at Las Cruces for selfing. Five random plants within each progeny row were selfed to generate $F_{3:4}$ progeny. Five $F_{3:4}$ lines that were selected on the basis of their 1996 fiber bundle strength in the replicated trials were grown in the 1997 Las Cruces genetics nursery. Fifty bolls were bulk harvested from each $F_{3:4}$ progeny row for fiber quality determination. The best 25% of the $F_{3:4}$ progeny rows were selected based on fiber strength and tolerance to Verticillium wilt (caused by *Verticillium dahliae* Kleb.). Five plants within each selected row were selfed to derive $F_{4:5}$ progeny. Open-pollinated seed ($F_{3:5}$) were also bulk harvested from each selected progeny row for 1998 replicated yield trials. NM970513 originated as a bulk of seed from a single $F_{4:5}$ progeny row grown in 1998. Bulked $F_{4:6}$ seeds were grown for multiplication and increase in 1999.

In six replicated tests from 1998 through 1999 in New Mexico, the fiber strength of NM970513 averaged 282.6 kN m kg^{-1} compared with 226.9 kN m kg^{-1} for Acala 1517-95. All fiber data originated from 50-boll hand-harvested samples from each plot. Fiber strength was measured on a plot-basis as the mean of two breaks on a 3.2-mm gauge stelometer (Uster Spinlab model 654) in the New Mexico State University fiber laboratory. Fiber length, short fiber index, and micronaire values of NM970513 and Acala 1517-95 were not different. Fiber elongation for NM970513 was lower than Acala 1517-95 (5.9 vs. 6.8). Samples from replicated tests in 1998 were sent to Starlab in Knoxville, TN, for micro-spinning evaluation. The yarn tenacity for 22-count yarn averaged 175.8 kN m kg^{-1} for NM970513 and 130.3 kN m kg^{-1} for Acala 1517-95. Similar fiber samples were submitted to the Texas Tech University International Textile Center for fineness and maturity testing on the Uster-Advanced Fiber Information System (AFIS). The maturity ratio is the ratio of fibers with a 0.50 (or greater) circularity ratio divided by the amount of fibers with a 0.25 (or less) circularity. The mean maturity ratio of NM970513 was 0.93 and 0.86 for Acala 1517-95. The immature fiber content of NM970513 was 8.5% compared with 11.1% for Acala 1517-95. The mean fiber fineness was 144 Mg M^{-1} (mTex) for both Acala 1517-95 and NM970513. This germplasm line has a very mature fiber, as defined by the AFIS instrumentation.

The lint yield of NM970513 averaged over six replicated trials in New Mexico was less ($P \leq 0.05$) than Acala 1517-95 (1224 vs. 1412 kg ha^{-1}). The handpicked lint percentage averaged 38.3 for NM970513 and 40.8 for Acala 1517-95. NM970513 has large seed with a seed index of 10.1 g. The bolls of NM970513 are ovate and are smaller ($P \leq 0.05$) than Acala 1517-95, 2.21 vs. 2.39 g of lint. The average plant height of NM970513 was 10 cm taller than Acala 1517-95, and the days to maturity of the two were not different. NM970513 has similar levels of tolerance to Verticillium wilt as Acala 1517-95.

Small amounts of seed of NM970513 will be provided upon written request to the corresponding author. Recipients are asked to make appropriate recognition of the source of the germplasm if used for research purposes, or for development of a parental line, cultivar, or hybrid.

R.G. CANTRELL* AND C. WADDELL

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Registration of Six Lentil Germplasm Lines with Combined Resistance to Viruses

Six lentil (*Lens culinaris* Medik.) germplasm lines, ILL 74 (Reg. no. GP-208, PI 612870), ILL 75 (Reg. no. GP-209, PI

612871), ILL 85 (Reg. no. GP-210, PI 612872), ILL 213 (Reg. no. GP-211, PI 612873), ILL 214 (Reg. no. GP-212, PI 612874), and ILL 6816 (Reg. no. GP-213, PI 612875) have been identified for resistance to viruses by the International Center for Agricultural Research in the Dry Areas (ICARDA), located at Aleppo, Syria. The germplasm lines are conserved at the Genetic Resources Unit of ICARDA under the auspices of the Food and Agriculture Organization, hence they are termed as "FAO-designated" germplasm. The Genetic Resources Unit of the Center maintains the lines with the identification code (L) which corresponds to our code (ILL), L 74 (ILL 74), L 75 (ILL 75), L 85 (ILL 85), L 213 (ILL 213), L 214 (ILL 214), and L 6816 (ILL 6816). Among the lines, ILL 75 has resistance to bean leaf roll virus (BLRV), faba bean necrotic yellows virus (FBNYV), and Soybean Dwarf Virus (SbDV) and ILL 74, ILL 85, ILL 213, ILL 214 and ILL 6816 are resistant to FBNYV and BLRV.

Although nine viruses have been reported to infect lentil in Syria (Makkouk et al., 1992, 1997, 1999), BLRV, FBNYV, and SbDV are most commonly encountered. One hundred ninety-one lentil lines originating from 14 countries and ICARDA's breeding program were evaluated for their reaction to BLRV, 162 for SbDV, and 128 were tested for FBNYV during the 1994 to 1995, and 1998 to 1999 cropping seasons. Field screenings were conducted in 1994 to 1995 for FBNYV and SbDV; 1995 to 1996 for BLRV and SbDV; 1996 to 1997 for BLRV, FBNYV, and SbDV; 1997 to 1998 for BLRV and FBNYV, and 1998 to 1999 for BLRV and FBNYV.

The viruses are known to spread in a persistent manner in nature only by aphids (Makkouk, 1998). The lines were subjected to artificial inoculation by viruliferous [*Acyrthosiphon pisum* (Harris)] aphid with Syrian isolates of BLRV (SV64-95), FBNYV (SV66-95), and SbDV (SL1-94). Aphids were kept on infected plants for 48 h to acquire the virus. Ten to fifteen viruliferous *A. pisum* were placed on each plant to be inoculated, and were killed with an insecticide spray 24 h later. Visual readings based on the characteristic symptoms of FBNYV, BLRV, and SbDV (yellowing, stunting, necrosis, reddening) were made 4 to 6 wk after inoculation. Symptom scores (SS) were taken based on a 0-to-3 scale (0 = no symptoms, 3 = severe symptoms) for each genotype. Yield loss (YL) was determined by comparing the yield of healthy and infected lines. Based on SS and YL, the test lines were grouped into: Highly resistant (SS # 0 and YL ≤ 1%), Resistant (SS # 1 and YL ≤ 10%), Moderately resistant (SS # 2 and YL ≤ 25%), and Susceptible (SS # 3 and YL > 25%). Reactions of the resistant genotypes with combined resistance to viruses in different years are summarized in Table 1.

The origin of ILL 74 is Chile; it flowers in 138 d in Syria, is 25 cm tall, has pink testa without a pattern, red cotyledons, and 100 seeds weigh 2.7 g. The origin of ILL 75 is Chile; it flowers in 140 d, it is 26 cm tall, the seeds are brown, testa without a pattern, red cotyledons, and 100 seeds weigh 2.4 g. ILL 85 is an introduction from Tadjikistan; it flowers in 135 d, is 31 cm tall, it has pink testa which are dotted with a brown pattern, red cotyledons and 100 seeds weigh 2.1 g. The source of ILL 213 is Afghanistan; it flowers in 138 d, is 30 cm tall, the testa are brown and without a pattern, cotyledons are red and 100 seeds weigh 2.2 g. ILL 214 was introduced from Afghanistan; it flowers in 151 d, seeds have brown testa which are marbled with a grey pattern, cotyledons are red and 100 seeds weigh 2.3 g. ILL 6816 is a breeding line developed at ICARDA from a cross between an accession (ILL 3527) from India and an accession from Ethiopia (ILL 5071). It has grey testa, which are dotted with a black pattern, cotyledons are red and 100 seeds weigh 2.0 g.

Table 1. Reactions of lentil genotypes to artificial inoculation with three different viruses.

		Bean Leaf Roll Virus			Soybean Dwarf Virus		Fababean Necrotic Yellows Virus			
Genotypes	Source	1997	1998	1999	1995	1997	1995	1997	1998	1999
ILL 74	Chile	HR	R	R	MR	MR	R	R	R	R
ILL 75	Chile	HR	R	R	R	R	HR	HR	HR	R
ILL 85	Tadjikistan	HR	R	R	S	MR	R	R	R	R
ILL 213	Afghanistan	HR	R	R	S	MR	R	HR	R	R
ILL 214	Afghanistan	HR	R	–	MR	MR	MR	R	R	–
ILL 6816	ICARDA	MR	R	R	S	S	R	R	R	R

HR = highly resistant; R = resistant; MR = moderately resistant; S = susceptible.
– = Not tested.

These accessions will be useful in developing lentil cultivars with resistance to a range of viruses. The Genetic Resources Unit of ICARDA is maintaining seed of these lines, and small quantities can be obtained upon written request to the corresponding author.

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Registration of KS 115 Sorghum

Grain sorghum [*Sorghum bicolor* (L.) Moench] germplasm source KS 115 (Reg. no. GP-590; PI 613536) was released by the Kansas Agricultural Experiment Station in April 2000. KS 115 produces exceptionally large grain and should be useful as a source of genes for improvement of seed size in sorghum breeding populations.

KS 115 was originally developed and coded as PL-1 by Dr. George Liang, Department of Agronomy, Kansas State University. The initial cross was made during the mid-1960s in a greenhouse in Manhattan, KS. Although the specific pedigree is not known, it appears that a large-seeded, photoperiod-sensitive, korgi-type sorghum introduction was crossed with KS 18 B (White Martin × Short Kaura) (Ross et al., 1972). F_1 progeny were selfed to produce F_2 seed under short-day conditions in the greenhouse during the winter season. A large population of F_2 plants was grown at the North Farm in Manhattan during the following summer season. Large-seeded, photoperiod-insensitive progenies were identified and advanced by pedigree selection. KS 115 represents the largest seeded selection from this population.

KS 115 is a very distinctive, durra-caudatum sorghum deriv-

Table 1. Analysis of seed weight in testcross hybrids produced by crossing KS 115 and TX 2737 with standard U.S. seed parent lines.

Entries	Seed weight Manhattan, KS 1999	Seed weight Belleville, KS 1999
	g 1000 seed^{-1}	
SA3042 × TX 2737	28.3	28.5
SA3042 × KS 115	47.3	45.7
Wheatland × TX 2737	28.9	27.1
Wheatland × KS 115	48.2	49.4
Redlan × TX 2737	27.9	27.6
Redlan × KS 115	45.7	46.8

ative that produces large, yellow-endosperm seeds (55 g 1000 seed^{-1}) on plants with partially recurved peduncles. The line has purple plant color, short awns, and produces very large glumes that are covered with downy hairs. KS 115 generally flowers in 75 d in Kansas, about 2 to 3 d later than Wheatland. KS 115 grows to ≈1.2 m in height, but expresses a strongly prostrate and highly variable growth habit.

When crossed to most A-lines, KS 115 restores fertility but pollen shed is often poor. An analysis of testcross hybrids produced using Wheatland, SA3042, and Redlan indicated that seed size is inherited as an incompletely dominant trait (Table 1). Seed size in these hybrids ranged from 45 to 50 g 1000 seed^{-1}. Seed produced on KS 115 hybrids were nearly twice the size of seed produced on the standard check hybrids. The expression of increased seed size appears to be controlled both by increased grain fill rate and duration. Although exceptionally large seeded, this line should not be used as a parent line because of poor agronomic adaptation and grain weathering characteristics.

Breeder seed of KS 115 will be maintained at the Department of Agronomy, Kansas State University. Seed can be obtained by contacting the Sorghum Breeding Program, Kansas State University, Department of Agronomy, Manhattan, Kansas 66506-5501. 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 Four Soft Red Winter Wheat Germplasms Resistant to *Stagonospora nodorum* and Other Foliar Pathogens

GA84202 (Reg. No. GP-691, PI 611877), GA85240 (Reg. No. GP-692, PI 611878), GA85410AB (Reg. No. GP-693, PI 611879), and GA861460 (Reg. No. GP-694, PI 611880) are soft red winter wheat (*Triticum aestivum* L.) germplasms adapted to the southeastern USA with a high level of resistance to *Stagonospora nodorum* (Berk.) Castellani & E.G. Germano, cause of stagonospora nodorum blotch. The lines were advanced through the F_4 generations using a modified pedigree method with selection for agronomic type and foliar disease resistance. The lines were selected for resistance to foliar diseases and acceptable agronomic characters in F_5 preliminary yield trials. All four germplasms are awnless or awnletted, stiff-strawed, and vary in height from 60 to 90 cm, depending on growing conditions. These lines were developed and released by the Georgia Agricultural Experiment Station in May 2000 because of their superior resistance to stagonospora nodorum blotch.

GA84202 ('Novisad138'/2/VPM/'Moisson'//FL74265) has leaf rust genes *Lr17* and *Lr26* (Long, 1996). Novisad138/2/VPM/Moisson was entry IPM2093 in the 1980–1981 USDA-ARS International Powdery Mildew Nursery. FL74265 is a Florida elite line with the pedigree 'Predgornia 2'/3/'Blueboy II'/'Coker 68-8'//'Fulbarn'. GA85240 ('Hunter'/FL74265//IN71761/Coker 80-13), and is resistant to powdery mildew [caused by *Blumeria graminis* (DC) E.O. Speer]. Hunter (PI 468977) is from the cross 'Coker 68-15'/4/'Potomac'/3/'Coker 61-19' *3/'Purdue dwarf'//'Blueboy'. GA85410AB (Hunter/2*GA74-33) is resistant to most races of powdery mildew currently found in the southeastern USA and has leaf rust genes *Lr10* and *Lr26* (Long, 1996). GA 74-33 is a Georgia elite line with the pedigree 'Holley'/'McNair 701'. GA861460 (P9323/'Georgia 100') has leaf rust genes *Lr10* and *Lr26* (Long, 1996). P9323 is '9323' (PI 601263, Coker 9323) and Georgia 100 (PI 538257) is 'Omega 78'//'Stacy'//Stacy/'Tyler'. All parental lines except Novisad138/2/VPM/Moisson are soft red winter wheats.

The germplasms were evaluated and selected in the field and greenhouse over a 6 yr period and were compared to 100 or more advanced and elite lines and standard check cultivars each year. GA85410AB and GA85240 yielded 80% of the average of elite lines and cultivars in five state trials. Grain yield of GA84202 and GA861460 was similar to that of the other lines in preliminary yield trials. GA84202 has medium to late season maturity whereas the other three lines have medium maturity. Data were collected in trials at Griffin and Plains, GA, and during one season at Fairhope, AL, under moderate to severe disease pressure from powdery mildew, leaf rust (caused by *Puccinia triticina* Eriks.), and stagonospora nodorum blotch. Adult plants also were inoculated in the field with *S. nodorum*. The germplasms were evaluated for Area Under Disease Progress Curve in the field during two years. The lines exhibit partial resistance in which the progress of stagonospora nodorum blotch is considerably slower than in fully susceptible genotypes. The four germplasms were selected as resistant (<20% leaf blight) in eight or more greenhouse tests when inoculated at the 4-5 leaf stage with *S. nodorum*. The susceptible cultivar Holley averaged >50% leaf blight. The germplasms have resistance to *S. nodorum*, which is equal to or better than that of the resistant cultivar Oasis (Table 1). All four lines possess other undocumented genes for resistance to leaf rust. They are resistant to MBRQ, MGBL, and TLGG, the most common races of leaf rust in the southeastern USA during the period of evaluation (Long, 1996). The germplasms are resistant to biotypes E, M, and O of Hessian fly [*Mayetiola destructor* (Say)] as determined by the USDA Cereal Insects Laboratory, Purdue University and by field tests at Plains, GA. They vary in their resistance to powdery mildew (Table 1).

GA84202 and GA85410AB were highly resistant to stripe rust (*Puccinia striiformis* Westend.) and leaf rust in a field trial at La Estanzuela, Colonia, Uruguay. GA84202 is also resistant to *Septoria tritici* Roberge in Desmaz. and *Drechslera tritici-repentis* (Died.) Shoemaker in Uruguay (B. Cunfer and M. Diaz de Ackermann, unpublished data, 1995).

Table 1. Resistance (R) and susceptibility (S) to powdery mildew, leaf rust, and Hessian fly, and Area Under Disease Progress Curve (AUDPC) and disease severity values for stagonospora nodorum blotch.

Genotype	Powdery mildew	Leaf rust	Hessian fly	AUDPC	Percent disease severity
GA84202	R	R	R	60a†	36a
GA85240	R	R	R	75a	20a
GA85410AB	R	R	R	63a	25a
GA861460	S	R	R	60a	22a
Holley (susceptible)				187b	75b
Oasis (resistant)				59a	20a

† Means in columns followed by the same letter are not significantly different according to Duncan's New Multiple Range Test ($P = 0.05$). Analysis made on arc sine transformed values.

Small quantities (20 g) of seed are available upon written request. Appropriate recognition of the source should be noted if these germplasms contribute to development of new breeding lines or cultivars.

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Registration of Hard and Soft Homozygous Waxy Wheat Germplasm

A soft wheat (*Triticum aestivum* L.) germplasm, WQL6K107-BHWX2-2a (Reg. no. GP-689, PI 612545), and a hard wheat germplasm, WQL6K107-BHWX14-7 (Reg. no. GP-690, PI 612546), homozygous waxy (*Wx-A1b*, *Wx-B1b*, *Wx-D1b*) for breeding and experimental purposes were cooperatively developed at the USDA-ARS Western Wheat Quality Laboratory and Northwest Plant Breeding Co. (NPB), Pullman, WA. These germplasms were released by USDA-ARS and NPB in 2000 due to their unique *Waxy* gene combination, starch composition and end-use quality characteristics.

These germplasms were derived by crossing the Chinese wheat land race Bai Huo (PI 606717) (*Wx-D1b*) (Morris and Konzak, 2000) with the Japanese breeding line, Kanto 107 (cf. NSGC 5961, status = inactive) (*Wx-A1b*, *Wx-B1b*) and are released due to the combination of *waxy* alleles at all three homoeologous loci. As fully waxy lines, they lack the *Waxy* gene product, granule bound starch synthase (GBSS, EC 2.4.1.21) and have <1% starch amylose. Waxy wheat has unique processing properties due to its altered starch composition (Morris et al., 1998).

Individual kernels exhibiting the waxy phenotype were selected in the F_2 and grown in a glasshouse. F_3 grain was harvested from approximately 63 selected F_2 plants, three plants each were grown in a glasshouse without vernalization. Approximately 12 of these $F_{2:3}$ lines were selected on the basis of spring habit, earliness of heading, shorter plant stature, general plant vigor, higher kernel number/fertility per spike (visual assessment), and oblong as opposed to fusiform spike shape. Individual plants (1–16 per line) were harvested from the 12 $F_{2:3}$ families for a total of 79 $F_{3:4}$ lines. These selections were grown in field plots at Spillman Agronomy Farm, Washington State University, Pullman, WA, in 1997. Plants were hand-harvested and the F_5 grain was assessed for hardness using the Single Kernel Characterization System (SKCS) 4100 on a 300-kernel aliquot (Perten Instruments, Huddinge, Sweden). WQL6K107-BHWX2-2a had a SKCS hardness of 47 ± 16 and WQL6K107-BHWX14-7 had a SKCS hardness of 80 ± 15. Larger-scale production in the Imperial Valley of California during the 1998–1999 winter produced grain with the qualities shown in Table 1. The original germplasm deposited in the NPGS came from the Spillman Farm plot (WQL6K107-BHWX14-7) or from a field plot grown near Brawley, CA, during the 1997–1998 winter (WQL6K107-BHWX2-2a).

Table 1. Grain quality chharacteristics of homozygous waxy wheat germplasm produced in the Imperial Valley of California in the winter of 1998–1999.†

	Test weight	Protein	NIR hardness	SKCS Hardness	SKCS weight
	kg m^{-3}	g kg^{-1}	–	–	mg
WQL6K107-BHWX2-2a	772	103	27	63 ± 17	24.2 ± 6.6
WQL6K107-BHWX14-7	748	117	62	83 ± 19	27.6 ± 8.8

† NIR = near infrared reflectance spectroscopy, SKCS = Single Kernel Characterization System.

WQL6K107-BHWX2-2a carries the soft, wild-type hardness allele (*Ha*) with the puroindoline genotype, *Pina-D1a* and *Pinb-D1a*, derived from Kanto 107. WQL6K107-BHWX14-7 carries the hard allele (*ha*) with the puroindoline genotype, *Pina-D1a* and *Pinb-D1b* (Giroux and Morris, 1997, 1998) derived from Bai Huo. Both have red grain color (one or more *R* genes) (the parents have at least one gene in common as no white seeds were recovered from this cross).

Small quantities of seed are available on written request from Dr. Craig F. Morris, Director, USDA-ARS Western Wheat Quality Laboratory, E-202 Food Sci. & Human Nutrition Facility East, P.O. Box 646394, Washington State University, Pullman, WA 99164-6394 or e-mail: morrisc@wsu.edu. Genetic material of this release has been deposited in the National Plant Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. It is requested that appropriate recognition be made if this germplasm contributes to research or the development of a new breeding line or cultivar.

C.F. MORRIS* AND C.F. KONZAK

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REGISTRATIONS OF GENETIC STOCK

Registration of Hard and Soft Near-Isogenic Lines of Hexaploid Wheat Genetic Stocks

Twenty hard and soft near-isogenic line (NIL) genetic stocks of hexaploid wheat (*Triticum aestivum* L.) (Reg. no. GS-127–GS-148, PI 612547–PI 612568) (Table 1) were identified and selected at the USDA-ARS Western Wheat Quality Laboratory, Pullman, WA. The genetic stocks were released by the USDA-ARS in 2000 due to the utility of such NILs in researching the effects of the *hardness* gene (*ha*) on wheat end-use quality, utilization, and processing. A more complete description of the material and how it was derived appears elsewhere (Morris et al., 2001).

These genetic stocks were derived from four different genetic sources: (i) three different accessions of 'Gamenya', which were mixtures of soft and hard types, (ii) two purported hard–soft near-isogenic lines (NILs) from the 'Heron' (soft) and 'Falcon' (hard), which proved also to be mixtures of soft and hard types, (iii) an advanced-generation backcross program involving 'Paha' and 'Early Blackhull' for spike architecture (club vs. lax), and (iv) an advanced-generation backcross program involving 'Early Blackhull Derivative' and 'Nugaines' for maturity (heading date).

In total, 20 hard and soft NILs (9 hard and 11 soft), and Early Blackhull and Early Blackhull Derivative parental lines were released due to their value and utility in studying wheat kernel texture—that is, whether grain is soft or hard, and the effects of kernel texture on wheat grain quality and processing. Further, the role of puroindoline proteins in kernel texture may be studied. Table 1 gives the experimental line designations, genetic stock designations, plant introduction numbers, source reference numbers to germplasm collections where appropriate, the pedigree or origin, and the nominal U.S. market class.

Table 1. Experimental line designation, genetic stock number, Plant Introduction (PI) number, reference number to appropriate germplasm collection, pedigree or origin, and nominal market class of hard and soft near-isogenic lines derived from Gamenya, Falcon and Heron, Paha and Early Blackhull (EB), and Early Blackhull Derivative (EBD) and Nugaines wheat cultivars.

Line designation	GS no.	PI no.	Collection ref. no.	Pedigree/origin	Nominal class
Set 1					
WQL2GAM329S	GS-127	PI612547	PI268329	Gamenya sel.	SWS†
WQL2GAM329H	GS-128	PI612548	PI268329	Gamenya sel.	HWS
WQL2GAM503S	GS-129	PI612549	PI274503	Gamenya sel.	SWS
WQL2GAM503H	GS-130	PI612550	PI274503	Gamenya sel.	HWS
WQL2GAM909S	GS-131	PI612551	PI290909	Gamenya sel.	SWS
WQL2GAM909H	GS-132	PI612552	PI290909	Gamenya sel.	HWS
Set 2					
WQL3F-H077S	GS-133	PI612553	AUS90077	Heron/7*Falcon sel.	SWS
WQL3F-H077H	GS-134	PI612554	AUS90077	Heron/7*Falcon sel.	HWS
WQL3F-H254S	GS-135	PI612555	AUS90254	Heron/7*Falcon sel.	SWS
WQL3F-H254H	GS-136	PI612556	AUS90254	Heron/7*Falcon sel.	HWS
Set 3					
WQL4EB-P655H	GS-137	PI612557	–	Paha*2//EB/5*Paha	HRW
WQL4EB-P656H	GS-138	PI612558	–	Paha*2//EB/5*Paha	HWW
WQL4EB-P651S	GS-139	PI612559	–	Paha*2//EB/5*Paha	SWW
WQL4EB-P653S	GS-140	PI612560	–	Paha*2//EB/5*Paha	SRW
WQL4EB-P678S	GS-141	PI612561	–	Paha*2//EB/5*Paha	SWW
WQL4EB-P661S	GS-142	PI612562	–	Paha*2//EB/5*Paha	SWW
WQL4EB-680H	GS-143	PI612563	CItr8856	Early Blackhull sel.	HRW
Set 4					
WQL5EBD-NV60-1142H	GS-144	PI612564	–	EBD/5*Nugaines sel.	HWW
WQL5EBD-NV75-1153H	GS-145	PI612565	–	EBD/5*Nugaines sel.	HWW
WQL5EBD-NV68-1145S	GS-146	PI612566	–	EBD/5*Nugaines sel.	SWW
WQL5EBD-NV112-1166S	GS-147	PI612567	–	EBD/5*Nugaines sel.	SWW
WQL5EBD-1112H	GS-148	PI612568	–	EBD‡ sel.	HRW

† Where SWS is soft white spring, HWS is hard white spring, HRW is hard red winter, HWW is hard white winter, SWW is soft white winter, and SRW is soft red winter.

‡ Early Blackhull Derivative is a plant selection from Early Blackhull of unknown origin (Haro and Allan, 1997).