CULTIVAR DESCRIPTION

Superb hard red spring wheat

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Key words: *Triticum aestivum* L., Canada Western Hard Red, hard red spring wheat, cultivar description, yield, pre-harvest sprouting tolerance, disease resistance

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Mots clés: *Triticum aestivum* L., description de cultivar, rendement, résistance aux maladies

Superb, a hard red spring wheat (*Triticum aestivum* L.), was developed at the Cereal Research Centre (CRC), Agriculture and Agri-Food Canada, Winnipeg, MB. It received restricted registration No. 5295 from the Variety Registration office of the Canadian Food Inspection Agency on 2001 Apr. 12. Superb is adapted to the wheat-growing regions of the Canadian prairies and meets the kernel shape, kernel colour, and end-use quality characteristics of the Canada Western Red Spring Wheat class.

Pedigree and Breeding Method

Superb derives from a single backcross of AC Domain (Townley-Smith and Czarnecki 2008) to Grandin (Grandin*2/AC Domain) made in 1993 at the Cereal Research Centre to develop a pre-harvest sprouting tolerant cultivar with the yield potential of Grandin. Doubled haploid lines were produced from F_1 plants using the maize pollen doubled haploid procedure (Aung et al. 1995). Doubled haploid lines were grown in a disease/dormancy nursery in 1994, increased at Brawley, CA, in 1994–1995, and evaluated for yield potential in field trials grown at Glenlea, MB, Portage la Prairie, MB, and Swift Current, SK, in 1995. Seventeen lines were entered into the Central Bread Wheat A test in 1996. One of these lines, 93B49*Q5$, was designated RL 4827, and subsequently entered into the Central Bread Wheat Cooperative (CBWC) test in 1997 as BW 252. Superb was evaluated in the CBWC test from 1997 to 1999 under the designation BW 252. The CBWC check cultivars were: Neepawa, Roblin, AC Majestic and McKenzie (1997–1999) and AC Barrie (1998–1999). Data for additional cultivars that were evaluated in the CBWC at the same time as Superb were included to permit comparisons with Superb. The variables measured and the protocols followed in the CBWC test have been described by Graf and Fox (2000). Each year, the data were analyzed using the S506 statistical program developed by the Statistical Research Services, AAFC.

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This program treats station-years independently so that the LSD values for multi-location and multi-year comparisons are based on genotype × environment interactions.

During the CBWC testing period, leaf and stem rust seedling infection types were assessed by plant pathologists at CRC. Stem rust (*Puccinia graminis* f. sp. *tritici*) races used for one or more years were: QTHST, RHTSK, RKQSR, RTHJT, TMRTK and TPMKR (Roelfs and Martens 1988; Fetch 2003). Leaf rust (*Puccinia recondita* f. sp. *tritici*) races used were those multiplied from field collections made the previous year (Kolmer 1998, 1999, 2001). Field evaluations of both leaf and stem rust reactions, using the same races as for the seedling tests, were measured in an epiphytotic nursery near Glenlea, MB. To determine the loose smut [caused by *Ustilago tritici* (Pers.) Rostr.] reaction type, a mixture of the prevalent races T2, T9, T10 and T39 (Menzies et al. 2003) was injected into florets at anthesis of plants grown in growth cabinets. A mixture of the common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. caries* (DC.) Tul.& C. Tul.] races L1, L16, T1, T6, T13 and T19 (Gaudet and Puchalski 1989a, b) were used to inoculate the seed planted in mid-April of each year near Lethbridge, AB. Race designations are described by Roelfs and Martens (1988) for stem rust, Nielsen (1987) for loose smut, and Hoffman and Metzger (1976) for common bunt. Screening for the reaction to *Fusarium* head blight was conducted near Morden, Manitoba in 1997 and near Glenlea, MB, in 1998 and 1999. Screening was carried as outlined in Gilbert and Woods (2006). Response to *Septoria tritici* and *S. nodorum* was scored in tests grown near Glenlea, MB. End use quality was evaluated by the Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB, using the American Association of Cereal Chemists methods. For the end-use quality evaluations, a 12–14 kg composite sample was generated each year from the seven to eight sites of the CBWC test with the highest grades and suitable grain protein content.

Area of Adaptation

Superb is adapted to the wheat-growing areas of the Prairie Provinces.

Performance

Superb is a red-seeded, hollow-stemmed wheat with quality similar to the current CWRS class of wheat. In 3 yr of testing in the Central Bread Wheat Coop test (1997–1999), Superb yielded, on average, significantly more than Neepawa, Roblin, AC Majestic and 5500HR. Grain yield of Superb was 24.0% more grain than Neepawa, 29.4% more than Roblin, 18.2% more than AC Majestic, 7.0% more than 5500HR (Table 1). Grain yield of Superb was 1.5% more than McKenzie (Table 1). Based on 2 yr of testing (1998–1999), grain yield of Superb was significantly higher than AC Barrie, Kanata, Snowbird and Harvest. Grain yield of Superb was 14.7% higher than AC Barrie, 25.5% higher than Kanata, 8.1% higher than Snowbird and 5.4% higher than Harvest. Superb was significantly later maturing and shorter than all of the other cultivars tested. Superb had significantly better lodging resistance scores than Neepawa, McKenzie, 5500HR, Snowbird and AC Barrie and was similar in lodging resistance to AC Majestic, Roblin, Harvest and Kanata (Table 2). Superb has large kernels, similar to 5500HR and larger than all of the other cultivars tested, and has test weight similar to the checks (Table 2). Superb has good pre-harvest sprouting tolerance with sprouting score values significantly lower than Neepawa, Roblin, Kanata, Snowbird and AC Barrie. It also had significantly higher Hagberg Falling Number than Neepawa, Roblin and Harvest

Table 1. Grain yield (t ha^{-1}) for Superb and other cultivars by year, by province and over all locations in the Central Bread Wheat Cooperative test (1997–1999)

	Mean grain yield			1997–1999			1998–1999		
Cultivar	1997	1998	1999	Manitoba[z]	Saskatchewan[y]	Overall mean	Manitoba[z]	Saskatchewan[y]	Overall mean
AC Majestic	3.17	3.80	3.67	3.37	3.72	3.55	3.50	3.96	3.73
McKenzie	3.65	4.13	4.60	4.26	3.99	4.13	4.42	4.31	4.36
Neepawa	3.15	3.45	3.53	3.22	3.53	3.38	3.22	3.76	3.49
Roblin	2.80	3.34	3.57	3.06	3.41	3.24	3.28	3.63	3.46
5500HR	3.41	3.87	4.47	4.14	3.70	3.92	4.36	3.98	4.19
AC Barrie	–	3.36	3.89	–	–	–	3.59	3.96	3.77
Harvest	–	4.02	4.18	–	–	–	4.07	4.13	4.10
Kanata	–	3.46	3.43	–	–	–	2.38	3.61	3.44
Snowbird	–	3.96	4.04	–	–	–	4.04	3.96	4.00
Superb	3.92	4.19	4.46	4.16	4.23	4.19	4.19	4.46	4.32
LSD ($P < 0.05$)[x]	0.26	0.30	0.31	0.29	0.16	0.18	0.32	0.21	0.20
Station years	10	10	10	15	15	30	10	10	20

[z]Manitoba locations include Brandon, Elgin, Glenlea, Morden and Portage la Prairie.
[y]Saskatchewan locations include Indian Head, Kelvington, Saskatoon, Melfort, and Regina.
[x]LSD of means was based on the genotype × environment interaction for the cultivars tested in the relevant period.

Table 2. Agronomic data for Superb and other cultivars grown in the Central Bread Wheat Cooperative test (1997–1999)

Cultivar	Maturity (d) 1997–1999	Maturity (d) 1998–1999	Height (cm) 1997–1999	Height (cm) 1998–1999	Lodging (1–9 scale)[z] 1997–1999	Lodging (1–9 scale)[z] 1998–1999	Test weight (kg hL^{-1}) 1997–1999	Test weight (kg hL^{-1}) 1998–1999	Kernel weight (mg) 1997–1999	Kernel weight (mg) 1998–1999	Sprout score (1–9)[y] 1997–1999	Sprout score (1–9)[y] 1998–1999	Artificial FNO (s)[x] 1997–1999	Artificial FNO (s)[x] 1998–1999
AC Majestic	94.4	95.8	95.3	97.6	2.1	2.3	79.3	78.6	33.0	33.3	1.7	1.6	330.1	356.8
Neepawa	92.4	93.8	101.8	103.9	3.1	3.3	78.8	78.1	31.8	31.9	4.5	4.5	214.5	242.3
McKenzie	93.3	94.6	96.0	97.5	3.3	3.3	80.7	80.1	32.8	33.2	1.9	2.7	317.1	358.3
Roblin	91.3	92.7	94.6	97.3	1.9	2.0	78.0	78.6	34.2	34.6	7.8	8.4	152.0	160.0
5500HR	94.0	95.4	95.0	96.8	2.8	3.0	81.2	80.5	36.2	36.1	1.9	2.2	302.1	341.3
AC Barrie	–	95.1	–	98.3	–	2.5	–	79.6	–	34.0	–	5.1	–	365.3
Harvest	–	94.3	–	93.2	–	1.6	–	79.9	–	33.7	–	1.5	–	244.5
Kanata	–	94.0	–	93.3	–	1.8	–	80.1	–	33.0	–	4.8	–	309.0
Snowbird	–	94.6	–	99.5	–	2.8	–	79.3	–	31.7	–	4.8	–	368.8
Superb	96.1	97.0	88.2	89.8	1.9	1.9	80.5	79.5	37.2	36.9	1.5	1.7	314.1	360.8
LSD(P < 0.05)	0.82	1.11	1.70	1.88	0.50	0.55	0.5	0.6	0.9	1.3	2.0	1.8	60.7	97.4
Station years	28	18	27	18	19	14	28	18	28	18	3	2	3	2

[z]Lodging score: 1 = erect, 9 = horizontal.
[y]Sprouting score: 1 = no sprouting; 9 = greater than 10 kernels sprouted.
[x]Hagberg falling number determined as described in Rasul et al. (2009).

after artificial weathering of spikes. Pre-harvest sprouting scores and Hagberg Falling Number testing was conducted as outlined in Rasul et al. (2009).

Other Characteristics

SPIKE: Parallel sided, medium, erect, medium length, waxy bloom weak to absent, white at maturity, awned; glumes are narrow to medium width, medium to long, glabrous; lower glume shoulders are straight and narrow to medium width; lower glume beak is slightly to moderately curved, medium length.

KERNEL: Medium red in colour, medium size, mid-long, mid-wide, oval; cheeks are rounded to slightly angular; brush is mid-size with short to mid-long hairs; midsize and oval embryo; mid-wide and mid-deep crease.

DISEASE REACTION: Leaf and stem rust reactions were evaluated as part of the cooperative testing in an epiphytotic nursery. Superb was resistant to leaf and stem rust (Table 3). Its disease reaction was "intermediate" to loose smut and common root rot, and moderately resistant to common bunt (Table 3). The reaction of Superb to tanspot, *Septoria tritici* and *Septoria nodorum* was similar to the check varieties. Superb had an intermediate reaction to Fusarium head blight (Table 3).

END-USE SUITABILITY: Superb is eligible for all grades of the Canada Western Hard Red wheat class. End-use quality test results are summarized in Table 4. Superb had, on average, 1.2% less grain protein than Roblin but was similar to the other check cultivars. Superb had significantly lower Hagberg falling number than AC Majestic but was similar to other check cultivars. Superb had significantly higher flour yield than AC Majestic, Neepawa and Roblin but was similar to 5500HR and McKenzie. However, flour colour was significantly lower than all check cultivars except Roblin. Flour absorption was similar to check cultivars. Farinograph dough development time (FDDT) for Superb was intermediate compared to the check cultivars. Superb had FDDT significantly shorter than Roblin, significantly longer than McKenzie and Neepawa and similar to 5500HR and AC Majestic. In contrast, Superb had a Canadian short process mixing time similar to Roblin and significantly longer than all other check cultivars (Table 4).

Maintenance and Distribution of Pedigreed Seed

The breeder lines were derived from heads taken at random from a fifth generation increase plot. These heads were grown in isolation as rows at Glenlea, MB, in 1998, as plots at Lincoln, New Zealand in 1998–1999, and again as plots at Indian Head, SK, in 1999. The Superb breeder seed was generated from a bulk of 105 breeder's lines. Breeder seed will be maintained by the AAFC Seed Increase Unit, Indian Head, SK. Distribution and multiplication of pedigree seed stocks is the

Table 3. Disease reactions of Superb and other cultivars grown in the Central Bread Wheat Cooperative test (1997–1999)

	Stem rust[z]			Leaf rust[y]			Common root rot[x]			Loose smut[w]			Common bunt[v]		
Cultivar	1997	1998	1999	1997	1998	1999	1997	1998	1999	1997	1998	1999	1997	1998	1999
AC Majestic	1 R	1 R	tr R	5 R	30 MRMS	40 MR	3	15	68	65 S	43 MS	3 R	21 I+	8 R	8 MR
McKenzie	1 R	5 R	tr R	tr R	tr R	tr R	7	9	53	45 MS	33 MR	0 R	3 R	3 R	2 R
Neepawa	3 MR	3 R	5 RMR	30 MR-S	50 MR-S	60 MS	7	11	57	0 R	0 R	0 R	25 I	23 I	29 MS
Roblin	1 R	1 R	tr R	10 M	5 M	10 MR	5	20	44	24 MR	18 MR	0 R	38 S	39 S	39 S
5500HR	15 MRMS	50 MRMS	30 MRMS	tr R	tr R	tr R/40MRMS	15	19	88	52 MS	19 MR	0 R	10 R	6 R	1 R
AC Barrie	–	5 R	5 R	–	30 MRMS	40 MRMS	–	21	83	–	3 R	0 R	–	16 R–I	25 MS
Harvest	–	3 R	5 R	–	10 MR	5 R	–	7	59	–	17 MR	17 MR	–	24 I	31 S
Kanata	–	30 MRMS	tr R	–	tr R	10 RMR	–	29	67	–	17 MR	45 MS	–	35 S	34 S
Snowbird	–	20 MR	tr R	–	tr R	5 R	–	21	67	–	67	24 MS	–	8 R	27 MS
Superb	1R	15 R	1 R	tr R	tr R	5R/20 MRMS	13	11	45	50 MS	11 R	27 MR	6 R	11 R–I	13 I

Table 3. Continued.

	Fusarium head blight index[u]			Tan spot			*Septoria nodorum* score[t, s]			*Septoria tritici* score[s]		
Cultivar	1997	1998	1999	1997	1998	1999	1997	1998	1999	1997	1998	1999
AC Majestic	33 MS	34 I	13 I	–	10.0	5.0	10.6	10.0	9.3	–	10.0	2.0
McKenzie	20 I	39 I–MS	18 I	–	10.0	5.0	10.8	9.7	9.5	–	9.3	2.0
Neepawa	23 I	40 I–MS	10 I	–	9.7	5.0	11.0	10.0	9.8	–	10.3	2.0
Roblin	35 MS	70 S	62 S	–	10.3	5.0	11.0	10.0	9.8	–	10.3	2.0
5500HR	30 MS	42 I-MS	21 I	–	9.3	5.0	9.5	10.0	8.8	–	10.0	2.0
AC Barrie	–	29 I	13 I	–	10.0	5.0	–	9.7	9.5	–	10.3	1.0
Harvest	–	57 MS	50 MS	–	9.7	5.0	–	10.0	9.8	–	10.0	3.0
Kanata	–	34 I	25 I	–	10.0	5.0	–	10.3	10.0	–	10.0	2.0
Snowbird	–	26 I	22 I	–	9.7	5.0	–	10.3	9.3	–	10.0	2.0
Superb	22 I	26 I	22 I	–	10.0	5.0	10.5	10.3	10.5	–	10.0	2.0

[z]Caused by *Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn. Races used include TPMKR, TMRTK, RKQSR, QFCSH, RTHJT, and QTHST (Roelfs and Martens 1988; Fetch 2003). Ratings indicate percent severity and pustule type, respectively.

[y]Caused by *Puccinia triticina* Eriks. Inoculum was a composite of all leaf rust races increased from collections made the previous year (Kolmer 1998, 1999, 2001). Ratings indicate percent severity and pustule type, respectively.

[x]Percentage of plants with moderate to large lesions on the subcrown internode.

[w] Caused by *Ustilago tritici* (Pers.) Rostr. Races include T2, T9, T10 and T39 (Nielsen 1987; Menzies et al. 2003).

[v] Caused by *Tilletia laevis* Kuhn in Rabenh and *T. tritici* (Bjerk.) R. Wolf. The inoculum used was a composite of races L1, L16 of *T. laevis*, and T1, T6, T13 and T19 of *T. tritici* mixed (vol/vol) in a 1:1:1:1:2:2 ratio (Gaudet and Puchalski 1989b), and represents the virulence spectrum of bunt isolates in western Canada (Gaudet and Puchalski 1989a). Rating indicates percent infection and relative classification.

[u]Caused by *Fusarium graminearum* Schwabe. Fusarium head blight index = (% severity × % incidence)/100.

[t]Assessment made on less than 10 plants.

[s]McFadden's scale <5 = R; 6 = MR; 7 = I; 8–9 = MS; 10–11 = S (McFadden 1991).

Table 4. Wheat and flour analytical data for Superb and check cultivars based on data from the Central Bread Wheat Cooperative test (1997–1999). End-use quality testing was performed by the Grain Research Lab of the Canadian Grain Commission on a composite from each year of the Central Bread Wheat Cooperative test

Cultivar	Test weight (kg hL^{-1})	Kernel weight (mg)	Grain protein (%)	Flour protein (%)	Protein loss (%)	Falling number (s)	Amylo-graph (BU)	Flour yield (%)	Flour ash (%)	KJ colour (Farrand)	Agtron colour (%)	Starch damage (%)	Particle size index (%)
AC Majestic	81.7	33.8	14.3	13.6	0.7	415	1015	75.3	0.42	−2.2	77	6.3	54
McKenzie	82.9	34.5	14.1	13.3	0.8	393	687	75.9	0.44	−2.1	76	7.1	52
Neepawa	81.5	33.2	14.1	13.2	0.9	390	638	74.2	0.45	−2.2	76	6.4	55
Roblin	80.9	35.9	15.3	14.5	0.8	375	527	74.9	0.43	−1.9	74	5.4	58
5500HR	83.5	38.1	14.1	13.3	0.8	398	697	76.6	0.48	−2.2	77	6.7	53
Superb	81.6	39.9	14.1	13.2	0.9	383	775	76.2	0.43	−1.6	71	6.5	53
LSD ($P<0.05$)[z]	0.6	1.0	0.3	0.3	0.1	16	66	0.4	0.02	0.3	3	0.4	1
Station Years	3	3	3	3	3	3	3	3	3	3	3	3	3

Table 4. Continued.

	Farinograph				Canadian short process (150 ppm ascorbic acid)						
Cutlivar	Absorption (%)	Dough development time (min)	Mixing tolerance index (BU)	Stability index (min)	Loaf volume (cm^3)	Loaf appearance	Crumb structure	Crumb colour	Absorption (%)	Mixing energy (Whr kg^{-1})	Mixing time (min)
AC Majestic	66.3	5.08	33	7.00	1095	7.6	6.2	8.1	70	14.7	10.3
Neepawa	65.7	4.17	32	7.00	1120	7.6	6.0	7.9	69	10.0	7.1
McKenzie	66.9	4.92	35	7.17	1078	7.5	6.1	8.1	71	12.4	9.1
Roblin	66.8	7.83	20	17.17	1150	7.7	6.1	8.1	71	16.4	12.0
5500HR	65.7	5.33	32	8.50	1105	7.7	6.1	8.1	69	13.4	8.9
Superb	66.3	5.67	30	9.67	1091	7.6	6.0	7.8	70	16.8	12.3
LSD ($P<0.05$)[z]	0.7	0.61	6	3.28	49	0.2	0.2	0.2	1	2.0	1.4
Station Years	3	3	3	3	3	3	3	3	3	3	3

[z]LSD of means was based on the checks and Superb calculated using Agrobase 21 (Agronomix Software Inc., Winnipeg, Manitoba, Canada).

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