

Somerset hard red spring wheat

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Key words: *Triticum aestivum* L., cultivar description, red spring wheat, grain protein

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Mots clés: *Triticum aestivum* L., description de cultivar, blé roux de printemps, protéines du grain

Somerset is a high-protein hard red spring wheat (*Triticum aestivum* L.) developed by Agriculture and Agri-Food Canada (AAFC), Cereal Research Centre, Winnipeg, Manitoba, and released in 2004. Given the registration number 5961, it was registered by the Plant Variety Registration Office, Plant Production Division, Seed Section, Canadian Food Inspection Agency, Agriculture and Agri-Food Canada, on 2005 May 20. Somerset is adapted to the wheat-producing regions of the eastern Prairies and meets the kernel shape, kernel colour and end-use quality characteristics of the Canada Western Red Spring (CWRS) wheat class. Somerset is named after a small town in southern Manitoba.

Pedigree and Breeding Method

Somerset derives from the cross 90B01-AD4D/Pasqua, which was produced at the Cereal Research Centre in 1994. The line 90B01-AD4D came from the cross AC Minto*2/ND643 and contains a high-protein gene from *Triticum turgidum* L. (Zhuk.) *dicoccoides* (Körn. ex Asch.&Graebn.) Thell present in ND643 (Humphreys et al.

1998). Table 1 summarizes the selection activities at each generation of the development of this cultivar. After two generations (F₄, F₅) of selection, increase and testing for disease resistance, end use quality and agronomic characteristics, a spike designated 94B95-U5 was selected as an F₅, increased and entered in a single-replicate, three-location preliminary yield trial as an F₇ in 1998.

Following 2 yr of testing in multi-location yield trials in 1999 and 2000, 94B95-U5 (RL4966) was entered in the Central Bread Wheat Coop registration test in 2001 as BW307. Agronomic performance was evaluated using a three-replicate rectangular or square lattice yield test grown at 10 locations (Manitoba: Glenlea, Portage La Prairie, Souris, Morden, Brandon; Saskatchewan: Regina, Indian Head, Kelvington, Saskatoon, Melfort) operated by Agriculture and Agri-Food Canada, Agricore United, and the University of Saskatchewan. Disease evaluations were conducted at the Cereal Research Centre and Lethbridge Research Centre of AAFC. End-use quality was evaluated by the Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB.

Table 1. Activities at each generation leading to the registration and release of Somerset

Name	Gen.	Year	Activity – locations
94B95	F ₀	1994	Cross was made in a growth cabinet
94B95	F ₁	1994	F ₁ plants grown to produce seed; New Zealand, 2 × 2-m row, 15 seeds/row
94B95	F ₂	1995	Approximately 1200 seeds planted at Glenlea, MB in 100 seeds m ⁻² plots. Selection of spikes based on agronomic appearance and disease resistance to leaf and stem rust
94B95	F ₃	1995	New Zealand winter nursery hills. Selection for agronomics, seed appearance and leaf rust resistance
94B95-U	F ₄	1996	1-m row nursery, Glenlea. Selection for agronomics, seed appearance, resistance to rusts, protein concentration, flour yield, dough strength as measured by mixograph
94B95-U	F ₅	1997	Yield test, single replicate at Brandon, MB. Spike selections made for winter nursery based on agronomics, disease resistance and quality performance
94B95-U5	F ₆	1997	New Zealand winter nursery rows. Selection for agronomics, seed appearance and leaf rust resistance.
94B95-U5	F ₇	1998	Yield test, single replicate at three locations (Glenlea, Brandon, Morden, MB). Selections based on agronomics, disease resistance and quality performance
94B95-U5	F ₈	1999	Central Bread Wheat “A” test. Yield test, two replicates at four locations (Glenlea, Brandon, Regina, Melfort)
RL4966	F ₉	2000	Central Bread Wheat “B” test. Yield test, three replicates at eight locations (MB: Glenlea, Brandon, Morden; SK: Indian Head, Regina, Melfort, Saskatoon; AB: Beaverlodge)
BW307	F ₁₀ -F ₁₂	2001–2003	Central Bread Wheat “C” registration test. Yield test, three replicates at 10 locations (MB: Glenlea, Portage la Prairie, Brandon, Morden, Souris; SK: Indian Head, Regina, Melfort, Kelvington, Saskatoon)
BW307	F ₁₀	2001	Breeder seed spikes: 276 random spikes selected from rogued increase plot grown at Indian Head, SK
BW307	F ₁₁	2002–2003	Breeder seed isolation rows: 1-m rows grown in New Zealand with 10-m isolation distance from any other wheat. Of these rows, 208 lines were selected
BW307	F ₁₂	2003	Breeder seed rows: 15-m rows grown at Indian Head, SK, with 10-m isolation distance from other wheat. Five lines were discarded due to lack of uniformity leaving 203 lines that were harvested in bulk
BW307	F ₁₂ -F ₁₃	2003–2004	Plant Breeder’s Rights test: observations taken from trials to complete requirements for Plant Breeder’s Rights application

Table 2. Yield of Somerset and check cultivars in the Central Bread Wheat Coop, 2001–2003

Cultivar	Manitoba				Saskatchewan				All sites			
	2001	2002	2003	Mean	2001	2002	2003	Mean	2001	2002	2003	Mean
	(kg ha ⁻¹)											
Katepwa	2873	2866	4049	3263	3537	3235	3219	3329	3168	3030	3680	3293
McKenzie	3321	3624	4522	3822	3529	3620	3500	3533	3414	3623	4067	3701
CDC Teal	3122	2925	4137	3395	3487	3147	3053	3234	3285	3024	3655	3321
AC Barrie	3001	3010	4071	3361	3259	3454	3207	3306	3115	3208	3687	3337
Superb ²	–	3475	4537	3818	–	3773	3373	3625	–	3607	4020	3730
Somerset	3199	3314	4190	3568	3476	3513	3309	3434	3322	3403	3799	3508
LSD (<i>P</i> = 0.05) ³	226	398	334	190	234	440	223	288	172	277	203	189
No. of tests	5	5	5	15	4	4	4	12	9	9	9	27

²Superb was not grown in the Central Bread Wheat Coop in 2001.

³LSD of means was based on the checks and Somerset and calculated using the SAS proc-mixed procedure.

Breeder Seed of Somerset was produced by randomly selecting 276 F₅-derived F₁₀ spikes from a rogued BW307 seed increase plot in 2001. These spikes were grown as an isolated group of 1-m rows in a New Zealand winter nursery in 2002, where 68 lines were discarded. The remaining 208 lines were grown as 15-m-long rows at Indian Head, SK, in 2003 with five lines discarded because they contained offtypes. The remaining 203 uniform lines were inspected by the Canadian Food Inspection Agency (CFIA) and bulk harvested to produce 300 kg of breeder seed. Using the closely linked flanking markers *Xucw71* and *Xucw79* that define a 0.3 cM interval around the high protein gene *Gpc-6B1* (Distelfeld et al. 2004), 20 of the 203 breeder lines forming the breeder seed were tested and were found to be uniform for the presence of the high-protein gene derived from ND643.

Performance

In 3 yr of testing in the Central Bread Wheat Cooperative test, Somerset grain yield was significantly higher yielding

(6.5%) than Katepwa, similar in yield to CDC Teal and AC Barrie, but significantly lower yielding (–5.2%) than McKenzie (Table 2) with days to maturity being 1 d earlier than AC Barrie, similar to Katepwa and CDC Teal (Table 3). Although taller than all of the check cultivars, lodging scores were only slightly higher than AC Barrie, CDC Teal and Superb. Somerset had a lower test weight than any of the checks and had a kernel weight higher than all of the checks except Superb (Table 2, Table 3).

Somerset is resistant to stem rust, leaf rust and loose smut (Table 4). Leaf rust ratings for Somerset were better than Katepwa, AC Barrie or Superb, but poorer than McKenzie. Ratings for common bunt were variable. Somerset showed resistance to fusarium head blight that was similar to AC Barrie, Katepwa and McKenzie.

The end-use quality of Somerset was deemed suitable for the CWRS class, exhibiting, on average, an advantage of about 1% more grain protein and slightly higher flour yield than the other check cultivars, but tended to lower falling numbers

Table 3. Summary of agronomic traits of Somerset and check cultivars in the Central Bread Wheat Coop, 2001–2003

Cultivar	Maturity			Height			Lodging ^z			Test weight			Kernel weight			
	2001	2002	2003	Mean	2001	2002	2003	Mean	2001	2002	2003	Mean	2001	2002	2003	
	— (days)			Mean	— (cm)			Mean	— (kg hL ⁻¹)			Mean	— (mg kernel ⁻¹)			
Katepwa	89.6	91.1	83.1	88.0	94	82	90	89	2.2	79.2	74.6	78.0	77.4	30.9	31.1	30.8
McKenzie	90.1	92.9	83.1	88.7	91	79	86	86	2.1	79.9	76.8	78.8	78.5	30.3	31.2	31.3
CDC Teal	89.5	91.2	83.9	88.2	90	75	85	84	1.6	78.0	75.1	77.3	76.8	30.6	31.5	31.1
AC Barrie	91.1	92.7	83.7	89.3	91	78	87	86	1.5	79.6	76.4	78.7	78.3	33.1	33.0	32.7
Superb ^y	—	95.6	85.2	90.4	—	76	81	79	—	—	77.5	78.6	78.1	—	37.2	36.7
Somerset	89.3	91.8	83.1	88.1	98	83	92	91	2.1	77.0	73.9	76.4	75.8	33.4	34.2	34.5
LSD (<i>P</i> = 0.05)	1.0	1.6	0.9	0.8	3	3	2	1	0.6	0.7	0.7	1.2	0.5	1.1	1.2	1.2
No. of tests	10	9	9	28	8	8	9	25	7	10	9	9	28	10	9	28

^zLodging scale: 1 = vertical, 9 = flat.

^ySuperb was not grown in the Central Bread Wheat Coop in 2001.

Table 4. Disease reactions of Somerset and check cultivars in the Central Bread Wheat Coop, 2001–2003

Cultivar	Stem rust ^z			Leaf rust ^y			Fusarium head blight index ^x			Loose smut ^w			Common bunt ^v			
	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003	
	(% severity, infection type)			(% severity, infection type)			(% Incidence × % Severity/100)			(% Infection)			(% Infection)			
Katepwa	3 RMR	R	0 R	40 MRMS	60 M	48 MR-S	38.3	69.3	26.0	29.2	40.7	0 R	10 R	15 I	0	3 R
McKenzie	3 RMR	3 MR	0 R	0 R	3 RMR	0 R	10.0	67.0	27.5	22.2	31.7	30 MR	47 I	56 MR	3 R	1 VR
CDC Teal	15 MRMS	3 MR	1 RMR	5 MR	15 M	16 MR-MS	54.0	87.2	66.7	68.0	69.0	0 R	13 MR	30 MR	13 I	0 TR
AC Barrie	10 RMR	10 RMR	7 RMR	55 MRMS	70 M	57 MR-MS	25.5	55.3	29.0	31.7	35.4	0 R	50 I	29 MR	10 MR	5 I
Superb ^u	—	3 R	1 R	—	25 M	47 MR-S	—	56.8	42.4	39.4	49.6	—	65 MS	54 S	—	2 I
Somerset	5 RMR	3 R	7 RMR	15 MR	25 MR	12 R-MR	18.0	58.3	34.2	41.6	38.0	0 R	2 R	28 MS	0	3 R

^zCaused by *Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks. E. Henn. Races used include TMRTK, RKQSR, TPMKR, QTHST, RHTSK and MCCFR.

^yCaused by *P. trititica*. Inoculum was a composite of all leaf rust disease survey collections made the previous year from Manitoba and Saskatchewan (McCallum and Seto-Goh 2004).

^xCaused by *Fusarium graminearum*, G = Glenlea, MB, C = Carman, MB.

^wCaused by *Ustilago tritici* (Pers.) Rostr. Races used include T2, T9, T10 and T39.

^vCaused by *Tilletia tritici* (Bjerk.) R. Wolff and *T. laevis* Kuhn in Rabenh. The inoculum used was a composite of races T-1, T-6, T-13, and T-19 of *T. tritici* and L-7 and L-16 of *T. laevis* mixed in a 1:1:1:2:2 ratio (vol/vol).

^uSuperb was not grown in the Central Bread Wheat Coop in 2001.

Table 5. Wheat and flour analytical data for Somerset and checks in the Central Bread Wheat Coop, 2001–2003. 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 Coop

Cultivar	Test weight (kg hL ⁻¹)	Kernel weight (mg kernel ⁻¹)	Farinograph										Canadian Short Process (150 ppm ascorbic acid)										
			Wheat protein (%)	Flour protein (%)	Falling number (s)	Amylo-graph (BU)	Flour yield (%)	Flour ash (%)	Flour Cotour (%)	Agtron (%)	Starch damage (%)	Particle size index	Absorp-tion (%)	Dough develop-ment time(min)	Mixing index (BU)	Stability Index (min)	Loaf Volume (cm ³)	Loaf appearance	Crumb structure	Crumb colour	Absorp-tion (%)	Mixing energy (W h kg ⁻¹)	Mixing time (min)
Katepwa	80.0	33.2	15.0	14.3	402	567	73.9	0.43	76	7.3	56	66.4	5.83	28	8.7	1160	7.8	6.1	7.8	70.3	10.9	7.1	
McKenzie	80.8	33.3	14.9	14.3	408	635	75.4	0.44	77	8.2	52	67.7	6.25	33	8.0	1120	7.8	6.2	8.0	72.0	11.6	8.1	
CDC Teal	79.7	34.1	15.4	14.9	400	633	74.9	0.43	74	6.8	57	66.4	8.25	18	20.2	1203	7.8	6.0	8.0	70.3	14.5	9.4	
AC Barrie	81.2	35.8	15.3	14.7	412	688	75.8	0.43	77	6.9	56	65.1	7.42	23	11.5	1135	7.6	6.2	8.0	69.3	15.4	9.9	
Superb ^z	79.9	39.3	15.1	14.4	380	613	74.8	0.42	68	7.8	53	68.6	7.88	30	19.8	1173	7.5	5.8	8.1	72.5	13.5	8.8	
Somerset	79.4	37.0	16.1	15.3	392	532	75.9	0.45	78	6.8	56	67.4	6.58	23	10.8	1167	7.7	6.3	7.9	72.7	13.6	8.7	
LSD																							
(P = 0.05)	1.1	2.1	0.5	0.4	15	98	0.5	0.03	4	0.6	1.6	1.5	0.65	11	10.2	34	0.4	0.4	0.1	1.5	2.5	1.7	

^zSuperb was not grown in the Central Bread Wheat Coop in 2001.

(FN) and lower starch gelatinization properties as indicated by the Amylograph (Table 5). The milling and baking performance of Somerset was similar to the check cultivars.

Other Characteristics

SEEDLING CHARACTERISTICS

Coleopile Colour. Green.

Juvenile Growth Habit. Erect to semi-erect.

Seedling Leaves. Glabrous leaf sheaths and lower leaves.

ADULT PLANT CHARACTERISTICS

Growth Habit. Semi-erect.

Leaves. Moderately to strongly recurved.

Flag Leaf. Very light pubescence with glabrous sheath. The auricle colouration is green with auricle margins being mostly glabrous. The leaf sheath has medium glaucousness but light glaucousness for the lower side of the flag leaf.

Flag Leaf Attitude. Horizontal to slightly drooping.

Upper Culm Internode: Straight at maturity and no pubescence. It is hollow stemmed and has a thin pith.

Culm Colour. Absent or very weak glaucosity.

Maturity. Medium early, similar to Katepwa and CDC Teal. The straw is yellow-brown at maturity, lacking any anthocyanin colouration.

Plant Height. This line is about 10 cm taller than AC Barrie.

Lodging Resistance. Good; intermediate compared to the check cultivars.

SPIKE CHARACTERISTICS

Shape. Oblong (paralled-sided).

Size. Similar to AC Barrie.

Density. Medium dense, similar to Pasqua and Roblin.

Attitude. Inclined.

Rachis. Medium hairiness of convex surface of apical segment.

Colour. Very weak glaucosity; white colour at maturity.

Awns. Apically awnletted.

SPIKELET CHARACTERISTICS

Glumes. Medium length; medium width; lower glume is glabrous; glume shoulders are slightly sloping; medium shoulder width; glume beak is slightly curved, short; sparse internal glume hairs.

Lemma. Slightly curved beak shape.

KERNEL CHARACTERISTICS

Shape. CWRS; elliptical in shape with rounded cheeks.

Size. Medium-sized with medium length and narrow to medium width.

Brush. Midlong brush hairs that form a small brush.

Embryo. Round; crease is narrow and mid-deep.

Maintenance and Distribution of Pedigreed Seed Stocks

The Agriculture and Agri-Food Canada Experimental Farm, Indian Head, Saskatchewan, will maintain the Breeder Seed of Somerset. Multiplication and distribution of other classes of pedigreed seed will be handled by Secan, 201-52 Antares Drive, Ottawa, Ontario, Canada K2E 7Z1.

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