

AC Splendor hard red spring wheat

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Fox, S. L., Townley-Smith, T. F., Kolmer, J., Harder D., Gaudet, D. A., Thomas, P. L., Gilbert, J. and Noll, J. S. 2007. **AC Splendor hard red spring wheat**. Can. J. Plant Sci. **87**: 883–887. AC Splendor is a hard red spring wheat that meets the end-use quality and kernel visual distinguishability specifications of the Canada Western Red Spring class. AC Splendor was evaluated in the Central Bread Wheat Cooperative Registration Test in 1993, 1994 and 1995 and was found to be adapted to the wheat-growing regions of the Canadian prairies. In comparison to the check cultivars Neepawa, Katepwa, Columbus, Roblin and AC Majestic, AC Splendor grain yield was similar to Katepwa, Columbus and Roblin; however, AC Splendor exhibited earlier maturity by 2.8, 7.5 and 1.6 d, respectively. AC Splendor is resistant to *Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. E. Henn. that causes the disease stem rust and *P. triticina* Eriks. that causes leaf rust and has intermediate resistance to *Tilletia tritici* (Bjerk.) R. Wolff and *T. laevis* Kuhn in Rabenh. that causes common bunt. Resistance to *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch] that causes fusarium head blight is poor. End-use quality tests identified that AC Splendor had high protein concentration and was in the range of the checks for the other quality traits.

Key words: *Triticum aestivum* L., cultivar description, red spring wheat, early maturity

Fox, S. L., Townley-Smith, T. F., Kolmer, J., Harder D., Gaudet, D. A., Thomas, P. L., Gilbert, J. et Noll, J. S. 2007. **Le blé roux vitreux de printemps AC Splendor**. Can. J. Plant Sci. **87**: 883–887. AC Splendor est une variété de blé roux vitreux de printemps dont la qualité selon l'usage final et dont les spécifications de distinction visuelle des grains correspondent à celles de la classe du Blé roux de printemps de l'Ouest canadien. AC Splendor a été évalué lors des essais de 1993, 1994 et 1995 de la Central Bread Wheat Cooperative et est bien acclimaté aux régions des Prairies canadiennes où l'on cultive du blé. AC Splendor est plus précoce que les cultivars témoins Neepawa, Katepwa, Columbus, Roblin et AC Majestic de 2,8, 7,5 et 1,6 jours, respectivement. AC Splendor résiste à *Puccinia graminis* Pers. Pers. f. sp. *tritici* Eriks. E. Henn., responsable de la rouille de la tige, et à *P. triticina* Eriks., responsable de la rouille des feuilles. La variété résiste aussi modérément à *Tilletia tritici* (Bjerk.) R. Wolff et à *T. laevis* Kuhn in Rabenh., responsables de la carie. Elle résiste toutefois mal à *Fusarium graminearum* Schwabe [téléomorphe de *Gibberella zeae* (Schwein.) Petch], responsable de la brûlure de l'épi causée par fusarium. Les tests de qualité en fonction de l'usage final indiquent que le grain de AC Splendor est riche en protéines et se situe dans la fourchette de valeurs des témoins pour les autres paramètres de qualité.

Mots clés: *Triticum aestivum* L., description de cultivar, blé roux de printemps, précocité

AC Splendor is an early-maturing hard red spring wheat (*Triticum aestivum* L.) developed by Agriculture and Agri-Food Canada, Cereal Research Centre (AAFC-CRC), Winnipeg, Manitoba, and released in 1996. Given the registration number 4534, it was registered by the Plant Variety Registration Office, Plant Production Division, Seed Section, Canadian Food Inspection Agency, Agriculture and Agri-Food Canada, on 1997 Mar. 24.

AC Splendor is adapted to the wheat-producing regions of the Prairies and meets the kernel shape, kernel colour and end-use quality characteristics of the Canada Western Red Spring (CWRS) wheat class. The name AC Splendor is a commercial name with no specific significance.

Pedigree and Breeding Method

AC Splendor was selected from the complex cross Laura/RL4596//Roblin/BW107 made in 1986 at AAFC-CRC (Table 1). RL4596 derives from the cross Columbus/BW63//BW47/BW553 and BW107 derives from the cross Benito/BW42//Columbus/Katepwa. F₂ plants were selected for leaf and stem rust resistance and suitable plant height, and the F₃ was screened for common bunt resistance. Near Glenlea, MB, F₄ and F₆ head rows were selected for agronomic traits and disease resistance to the rusts, glume blotch caused by *Stagonospora nodorum* (Berk.) E. Castell. & Germano [teleomorph *Phaeosphaeria nodorum* (E. Müll.) Hedjar.], common bunt, and black point. F₆ derived lines were yield tested in F₈ and F₉ generations. The line

Table 1. Activities at each generation leading to the registration of AC Splendor

Name	Gen.	Year	Activity – locations
	F ₀	1986	Cross was made in a growth cabinet.
GC1036	F ₁	1987	F ₁ plants grown a growth cabinet.
HN1319	F ₂	1987	Approximately 1200 seeds planted near Glenlea, MB in 100 seeds m ⁻² plots. Selection of spikes based on agronomic appearance and disease resistance to leaf and stem rust.
GC468	F ₃	1988	Grown in growth cabinet with selection for common bunt and leaf rust resistance and kernel shape.
HN490-4	F ₄	1988	1 m row nursery, near Glenlea. Selection for agronomics, seed appearance, resistance to rusts, common bunt, protein concentration, flour yield, and dough strength measured by mixograph.
GC653	F ₅	1989	Grown in growth cabinet with selection for common bunt and rust resistance.
584	F ₆	1989	1 m row nursery, near Glenlea. Selection for agronomics, seed appearance, resistance to rusts, common bunt, protein concentration, flour yield, and dough strength measured by mixograph.
584-1	F ₇	1990	New Zealand winter nursery, 1.5 m row.
584-1	F ₈	1990	Yield test, single replicate at two locations (MB: Glenlea, Portage la Prairie). Selections based on agronomics, disease resistance and quality performance.
584-1	F ₉	1991	Central Bread Wheat “A” test. Yield test, 2 replicates at 5 locations (MB: Glenlea, Brandon; SK: Indian Head, Regina, Melfort).
RL4695	F ₁₀	1992	Central Bread Wheat “B” test. Yield test, 3 replicates at 8 locations (MB: Glenlea, Brandon, Morden; SK: Indian Head, Regina, Melfort, Saskatoon).
BW191	F ₁₁ F ₁₃	1993-5	Central Bread Wheat “C” registration test. Yield test, 3 replicates at 10 locations (MB: Glenlea, Portage la Prairie, Brandon, Morden, Elgin; SK: Indian Head, Regina, Melfort, Kelvington, Saskatoon).
<i>Breeder seed production</i>			
BW191	F ₁₁	1993	Breeder seed spikes: approximately 250 random spikes selected from rogued increase plot grown at Indian Head, SK.
BW191	F ₁₂	1994	Breeder seed isolation rows: 1 m rows grown near Glenlea with 10 m isolation distance from any other wheat. Of these rows, 217 lines were selected.
BW191	F ₁₃	1995	Breeder seed rows: 15 m rows grown at Indian Head, SK with 10 m isolation distance from other wheat. four lines were discarded due to lack of uniformity leaving 213 lines that were harvested in bulk.

Table 2. Grain yield (t00 kg ha⁻¹) of AC Splendor and check cultivars in the Central Bread Wheat Coop, 1993–1995

Cultivar	Manitoba				Saskatchewan				All sites			
	1993	1994	1995	Mean	1993	1994	1995	Mean	1993	1994	1995	Mean
Neepawa	26.5	38.3	28.0	30.8	34.3	37.5	34.4	35.4	30.4	37.9	31.2	33.1
Katepwa	28.0	39.6	28.8	32.1	36.2	39.9	34.7	36.9	32.1	39.7	31.8	34.5
Columbus ^z	26.2	39.8	–	30.0	40.7	40.4	–	39.1	33.4	40.1	–	34.6
Roblin	28.7	38.7	24.6	30.6	41.1	41.0	33.8	38.6	34.9	39.8	29.2	34.6
AC Majestic	29.5	41.5	25.5	31.9	44.6	42.5	35.0	40.7	37.1	42.0	30.3	36.4
AC Splendor	31.1	39.0	26.8	32.3	37.7	40.9	34.9	37.8	34.4	39.9	30.8	35.0
LSD (<i>P</i> = 0.05) ^y	4.9	2.7	2.1	3.7	2.3	3.1	3.6	4.0	3.0	1.9	2.0	3.2
No. of tests	5	4	5	14	5	4	5	14	10	8	10	28

^zColumbus was not grown in the Central Bread Wheat Coop in 1995.

^yLSD of means was based on the checks and AC Splendor and calculated using the SAS PROC MIXED procedure (SAS Institute, Inc. 2006).

584-1 was designated RL4695 and entered into the Central Bread Wheat “B” test in 1992 and into the Central Bread Wheat Cooperative (CBWC) test in 1993, designated as BW191.

In the CBWC, agronomic performance was evaluated using a 3-replicate rectangular or square lattice design yield test grown at 10 locations operated by AAFC, except where noted (Manitoba: Glenlea, Portage La Prairie, Elgin (Agricore United), Morden, Brandon; Saskatchewan: Regina, Indian Head, Kelvington (Agricore United), Saskatoon (University of Saskatchewan), Melfort. 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.

Breeder Seed of AC Splendor was produced by randomly selecting approximately 250 F₆-derived F₁₀ spikes from a rogued BW191 seed increase plot in 1993. These spikes were grown as an isolated group of 1-m rows near Glenlea, MB in 1994 where 217 lines were retained. These lines were grown as 15 m long rows at Indian Head, SK, in 1995 with four lines discarded because they contained offtypes. The remaining 213 uniform lines were inspected by the Canadian Food Inspection Agency (CFIA) and bulk harvested to produce the breeder seed. A second 0.4 ha breeder seed plot was grown in 1996. Four kinds of off-type

Table 3. Summary of agronomic traits of AC Splendor and check cultivars in the Central Bread Wheat Coop, 1993–1995

Cultivar	Maturity (d)			Height (cm)			Lodging ^z (1–9 scale)			Test weight (kg hL ⁻¹)			Kernel weight (mg kernel ⁻¹)										
	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	Mean							
Neepawa	109.1	97.3	93.7	99.8	108	109	108	109	98	105	105	2.9	2.6	2.6	2.7	75.0	79.3	78.4	77.5	29.0	32.7	32.1	31.2
Katepwa	109.1	96.4	93.3	99.4	109	108	109	108	98	105	105	3.1	2.7	2.6	2.8	75.2	79.5	79.0	77.8	30.8	33.8	33.1	32.5
Columbus	115.1	100.7	—	104.1	114	112	—	110	—	110	—	2.1	1.9	—	1.9	76.1	78.9	—	77.9	34.5	36.3	—	35.4
Robin	109.5	95.2	90.5	98.2	98	100	88	95	88	95	95	2.0	1.2	1.5	1.6	74.3	78.5	76.9	76.5	32.6	35.4	33.9	33.9
AC Majestic	114.2	99.7	95.1	102.8	105	103	94	101	94	101	101	1.8	1.4	1.6	1.6	76.1	79.9	78.9	78.3	34.3	35.9	32.9	34.3
AC Splendor	107.2	94.1	89.2	96.6	100	105	91	99	91	99	99	2.2	1.9	2.3	2.2	75.4	78.9	77.9	77.4	33.5	36.9	35.1	35.1
LSD (<i>P</i> = 0.05)	1.4	1.1	1.3	1.7	3	2	2	3	2	3	3	0.9	1.0	0.6	0.5	1.1	1.0	0.6	0.8	1.1	1.3	1.0	1.7
No. of tests	9	8	10	27	10	8	10	28	10	28	28	5	5	7	17	10	8	10	28	10	8	10	28

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

^yColumbus was not grown in the Central Bread Wheat Coop in 1995.

Table 4. Disease severities and reactions^z of AC Splendor and check cultivars in the Central Bread Wheat Coop, 1993–1995

Cultivar	Stem rust ^y (% severity, reaction)			Leaf rust ^x (% severity, reaction)			Fusarium head blight index ^w (% incidence × % severity/100, reaction)			Loose smut ^u (% Infection)			Common bunt ^u (% Infection)			
	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	Mean
Neepawa	10 RMR	5 R	20 RMR	40 MRS	40 MR	50 MR	—	12.4	41.2	26.8	9 R	6 R	8 R	15 I	13 I-	10 I
Katepwa	5 R	10 R	15 RMR	20 MR	30 MR	50 MR	—	16.7	34.7	25.7	4 R	0 R	15 R	5 R	3 R	6 I-
Columbus ^t	20 MRMS	15 MRMS	—	3 R	5 R	—	—	24.2	—	24.2	22 MR	56 MR	—	1 R+	1 R-	—
Roblin	5 R	10 RMR	20 R	5 M	30 MR	5 M	—	47.4	74.4	60.9	12 MR	0 R	25 MR	25 S	23 I+	26 S
AC Majestic	10 MR	10 R	20 RMR	5 R	10 R	10 R	—	17.4	34.6	26.0	0 MS	40 MS	61 S	1 R+	1 R-	0 R+
AC Splendor	5 R	5 R	20 R	5 VR	10 VR	trace R	—	37.0	55.3	46.2	8 MR	4 R	41 MS	7 R	13 I-	9 I

^zDisease reaction class: VR = very resistant, R = resistant, RMR = resistant to moderately resistant, MR = moderately resistant; I = intermediate reaction; MRMS = moderately resistant to moderately susceptible, MSS = moderately susceptible to susceptible, S = susceptible.

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

^x Caused by *P. tritici* Eriks. Inoculum was a composite of all leaf rust disease survey collections made the previous year from Manitoba and Saskatchewan (McCallum and Seto-Goh 2006).

^w Caused by *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Peck]. Fusarium head blight index = (% infected spikelets × % infected spikes)/100.

^v Caused by *Ustilago tritici* (Pers.) Rostr. Races used include T2, T9, T10 and T39. Rating based on previous and current tests after artificial inoculation.

^u Caused 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).

^tColumbus was not grown in the Central Bread Wheat Coop in 1995.

plants were rogued from the plot with the following frequencies: tall plants (1:1000), speltoids (1:1300), awned plants (1:8000), short plants (1:23 000).

Performance

AC Splendor grain yield was similar to Katepwa, Columbus and Roblin in 3 yr of testing in the Central Bread Wheat Cooperative test (Table 2); however, AC Splendor exhibited earlier maturity by 2.8, 7.5 and 1.6 d, respectively (Table 3). Although shorter than all of the check cultivars except Roblin, lodging scores were only slightly better than Katepwa and Neepawa. AC Splendor had a slightly lower test weight compared with the checks and had a kernel weight higher than all of the checks except Columbus (Table 3).

AC Splendor is resistant to the prevalent races of leaf and stem rust, moderately resistant to common bunt and moderately susceptible to loose smut which is caused by *Ustilago tritici* (Pers.) Rostr. (Table 4). AC Splendor has poor resistance to fusarium head blight expressing a reaction between Katepwa and Roblin. Kolmer and Lui (2002) investigated the genetics of leaf rust resistance in this variety and confirmed the presence of the resistance genes *Lr13*, *Lr16* and *Lr34*.

The end-use quality of AC Splendor was deemed suitable for the CWRS class, exhibiting, on average, an advantage of about 1% more grain protein than Neepawa and Katepwa (Table 5). The milling and baking performance of this cultivar was similar to the check cultivars.

Since the release of AC Splendor in 1996, its uptake by growers has been highest in the more western and northern areas of the prairies where early maturity is a favoured characteristic and fusarium head blight infection is less likely.

Other Characteristics

The observations of plant characteristics were made using an experiment grown in 2002 near Glenlea, MB, for collection of data for Plant Breeders Rights. This trial was grown as a four replicate, randomized complete block experiment using 3.25 m² plots seeded at 250–300 seeds m⁻². This experiment has allowed reference to more recently released cultivars that were not present when AC Splendor was originally registered.

SEEDLING CHARACTERISTICS

Coleoptile colour. Absent or very weak.

Juvenile growth habit. Erect.

Seedling leaves. Glabrous leaf sheaths and blades of lower leaves.

ADULT PLANT CHARACTERISTICS

Growth habit. Semi-erect.

Leaves. Moderately recurved.

Flag leaf. Very light sheath pubescence with glabrous blade. The auricle colouration is absent or very weak auricle margins being glabrous.

Flag leaf attitude. Horizontal.

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

Table 5. Wheat and flour analytical data for AC Splendor and checks in the Central Bread Wheat Coop, 1993–1995. End-use quality testing was performed by the Grain Research Lab of the Canadian Grain Commission using American Association of Cereal Chemists methods on a composite from each year of the Central Bread Wheat Coop

Cultivar	Farinograph										Canadian Short Process (150 ppm ascorbic acid)								
	Kernel weight (mg kernel ⁻¹)	Test weight (kg hL ⁻¹)	Wheat protein (%)	Flour protein (%)	Falling number (s)	Amylo-graph (BU ³)	Flour yield (%)	Flour ash (%)	Flour particle size index	Absorption (%)	Dough development time (min)	Mixing tolerance index (BU)	Stability Index (min)	Loaf volume (cm ³)	Loaf appearance (1–10 scale)	Crumb structure (1–10 scale)	Absorption (%)	Mixing energy (W-h kg ⁻¹)	Mixing time (min)
Neepawa	33.7	80.8	13.6	13.1	340	365	75.4	0.46	56.8	65.5	4.2	41.7	7.2	2167	7.2	6.2	69.7	9.4	7.1
Katepwa	34.9	81.2	13.7	13.2	340	438	76.0	0.46	54.6	65.6	4.6	36.7	8.3	2143	7.2	6.3	70.0	9.2	7.5
Columbus ²	37.9	81.5	14.2	13.7	369	714	76.7	0.47	53.2	68.5	5.2	33.4	8.1	2095	6.8	6.2	72.6	11.3	8.9
Roblin	36.4	80.3	14.5	14.1	343	398	76.1	0.44	58.6	66.0	7.3	21.7	13.2	2220	7.1	6.3	70.0	13.5	11.0
AC Majestic	36.5	81.4	14.4	13.9	402	947	76.7	0.45	55.0	67.5	4.9	35.0	7.7	2205	7.2	6.1	71.7	11.3	8.9
AC Splendor	37.5	80.0	14.6	14.0	377	605	76.0	0.47	58.5	66.4	6.7	21.7	13.2	2230	7.5	6.1	70.3	14.1	10.7
LSD (P = 0.05)	1.7	0.6	0.4	0.4	53	172	0.4	0.01	1.8	1.0	0.7	12.2	1.5	109	0.6	0.2	1.3	2.5	1.2

²Columbus was not grown in the Central Bread Wheat Coop in 1995.

³Breander units.

Culm colour. Absent or very weak glaucosity.

Maturity. Early, 2.8 d earlier than Katepwa, 1.6 d earlier than Roblin. The straw is white at maturity, lacking any anthocyanin colouration.

Plant height. This line is intermediate in height between Roblin, CDC Teal and Harvest.

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

SPIKE CHARACTERISTICS

Shape. Oblong (parallel-sided).

Size. Intermediate between AC Barrie and Harvest.

Density. Medium dense, similar to Harvest.

Attitude. Erect.

Rachis. Sparse hairiness of convex surface of apical segment.

Colour. Weak to medium glaucosity; white colour at maturity.

Awns. Apically awnletted.

SPIKELET CHARACTERISTICS

Glumes. Medium length; medium width; lower glume is slightly pubescent; glume shoulders are slightly sloping; very wide shoulder width; glume beak is slightly curved, short; sparse internal glume hairs. Glumes are yellow in colour at maturity.

Lemma. Slightly curved beak shape.

KERNEL CHARACTERISTICS

Shape. CWRS; elliptical in shape with rounded cheeks.

Size. Large-sized with long length and narrow width.

Brush. Short brush hairs that form a small brush.

Embryo. Small, oval shape; crease is midwide and shallow.

Maintenance and Distribution of Pedigreed Seed Stocks

The Agriculture and Agri-Food Canada Experimental Farm, Indian Head, Saskatchewan, will maintain the Breeder Seed of AC Splendor. Multiplication and distribution of other classes of pedigreed seed will be handled by Secan, 501-300 March Road, Kanata, ON K2K 2E2.

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