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CULTIVAR DESCRIPTION

AAC W1876 hard red spring wheat

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Abstract: AAC W1876 hard red spring wheat (*Triticum aestivum* L.) has grain yield and time to maturity within the range of the check cultivars: Katepwa, Laura, Lillian, Carberry, and CDC Kernen. AAC W1876 has an awned spike, a low lodging score indicative of strong straw, and a short plant stature typical of a semidwarf wheat. AAC W1876 expressed resistance to prevalent races of leaf rust, moderate resistance to stem rust, and intermediate resistance to *Fusarium* head blight, yellow rust, common bunt, and loose smut. Compared with the Canada Western Red Spring check cultivars, AAC W1876 had improved flour yield and lower flour ash. AAC W1876 is eligible for grades of Canada Western Red Spring.

Key words: Triticum aestivum L., wheat, cultivar description, grain yield, disease resistance, semidwarf, quality.

Résumé : Le rendement grainier et la précocité de la variété de blé roux vitreux de printemps (*Triticum aestivum* L.) AAC W1876 se situent dans la plage des cultivars témoins Katepwa, Laura, Lillian, Carberry et CDC Kernen. AAC W1876 se caractérise par un épi barbu, une faible tendance à la verse, signe d'une paille robuste, et un plant court, propre aux variétés semi-naines. AAC W1876 résiste aux races courantes de rouille de la feuille, résiste modérément à la rouille de la tige et affiche une résistance intermédiaire à la fusariose de l'épi, à la rouille jaune, à la carie et au charbon nu. Comparativement aux cultivars témoins de blé roux de printemps de l'Ouest canadien, AAC W1876 produit une plus grande quantité de farine renfermant moins de cendres. AAC W1876 est admissible aux classes du blé roux de printemps de l'Ouest canadien. [Traduit par la Rédaction]

Mots-clés : Triticum aestivum L., blé, description de cultivar, rendement grainier, résistance à la maladie, semi-nain, qualité.

Introduction

AAC W1876, a hard red spring wheat (*Triticum aestivum* L.) cultivar, was developed at the Swift Current Research and Development Centre (SCRDC), Agriculture and Agri-Food Canada (AAFC), Swift Current, SK. It received registration no. 7608 from the Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency (CFIA), Ottawa, ON, on 30 Sept. 2014. AAC W1876 was granted Plant Breeders' Rights certificate no. 5259 by the Plant Breeders' Rights office, CFIA, on 16 May 2016.

Pedigree and Breeding Methods

AAC W1876 was selected from the cross Prodigy/5602HR//Alsen made in 2004 at SCRDC. The cultivar Prodigy (Graf et al. 2003), which derives from SWP2242/Stoa, was crossed to 5602HR, which derives from AC Barrie/Norpro. The parents were haplotyped using the molecular markers associated with *Fusarium* head blight (FHB) (Bokore et al. 2017). The F_1 plants were top-crossed with Alsen (Frohberg et al. 2006). A total of 950 top cross F_1 seeds were increased in controlled environment facilities at SCRDC.

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In the spring of 2005, about 10 000 F_2 seeds were inoculated with common bunt [*Tilletia laevis* Kühn in Rabenh. and *T. tritici* (Bjerk.) G. Wint. in Rabenh.] races L16 and T19 (Hoffmann and Metzger 1976) and space-planted at 10-cm intervals within a row in an irrigated epiphytotic field nursery near Swift Current. Genotypes susceptible to prevalent races of leaf rust (*Puccinia triticina* Eriks.) and stem rust (*Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn.) were planted as disease spreaders every 10th row. Between the spreader rows, five rows of spring-planted winter wheat were alternated with four rows of F_2 seed at a row spacing of 23 cm. The winter wheat cultivar CDC Kestrel (Fowler 1997), which is susceptible to leaf and stem rust, was used to contribute to the multiplication of rust inoculum. Spreader rows were inoculated by injecting, with a syringe and needle, a water suspension of leaf rust and stem rust spores into a sample of plants every 3 m. Representative leaf rust races found the previous year were applied (McCallum and Seto-Goh 2006). The stem rust races used were QTHJF (C25), RHTSC (C20), RKQSC (C63), RTHJF (C57), TMRTF (C10), and TPMKC (C53) (Roelfs and Martens 1988; Fetch et al. 2015). Leaf spot diseases developed through natural infection. Individual plants were selected relative to the range of the checks in the nursery for reduced plant height, improved standability, maturity within the range of the checks in the nursery, and resistance to common bunt, leaf spot diseases, leaf rust, and stem rust. From the disease nursery, 308 disease-free, semidwarf-statured, strong-strawed, and early-maturing F_2 plants were selected, threshed individually, and further selected for kernel characteristics.

The F_3 seed of 251 F_2 derived individuals was planted as 2-m-long head-rows in a contra season nursery near Lincoln, New Zealand. From these, 135 lines were selected on the basis of comparable performance to the check cultivars for time to maturity, plant height, straw strength, and shattering. The selected rows were harvested as individual rows. These $F_{2:4}$ lines were grown in four-row plots with a harvested area of 2.76 m^2 near Swift Current with two replicates and one replicate of each near Indian Head and Regina, SK, to assess agronomic performance. Agronomic plots were harvested at maturity and the grain weight of each plot was measured. Each F_4 genotype was also grown in a nursery near Portage La Prairie, MB, and inoculated with *Fusarium* [*Fusarium graminearum* Schwabe; teleomorph *Gibberella zeae* (Schwein.) Petch], leaf rust, and stem rust, followed by regular sprinkler irrigation as described by Bokore et al. (2017). The selection criteria combined over both nurseries were strong straw of a semidwarf height, maturity within the range of the control cultivars, non-shattering spike attributes, grain yield, and resistance to FHB, leaf rust, stem rust, common bunt, and leaf spotting diseases. Five spikes were collected from the FHB nursery plots of each F_4 line that met the selection criteria as well as five spikes from all yield trial plots at Swift Current.

Of the selected lines, grain protein concentration and volume weight were measured on whole grain of each sample within each location using a Foss Infratec 1241 near-infrared reflectance spectroscopy (Williams 1979) instrument coupled with a test weight module. A subsample was submitted to the Central Quality Lab, Cereal Research Centre, AAFC, Winnipeg, MB, to determine end-use suitability for the Canada Western Red Spring (CWRS) market class.

The best 39 families each with four lines per family were grown as the $F_{4;5}$ generation in 2-m-long head-rows near Irwell, New Zealand. The F_5 families were selected on the basis of grain quality and kernel attributes assayed on the grain from the F_4 yield trial. Experimental F_5 lines within acceptable families were selected on the same basis as in the F_3 generation. In the $F_{4:6}$ generation, 100 lines were grown in agronomic trials near Swift Current, Indian Head, and Regina, SK, following a protocol similar to that of the F_4 generation. Each $F_{4:6}$ genotype was also grown in a nursery near Portage La Prairie, MB, using a similar protocol as the F_4 generation. Five spikes were collected from plots of each F_6 line grown near Swift Current. Grain samples from harvested plots were measured for grain yield weight. Grain protein concentration and volume weight of each F_6 line were measured in the same way as in the F_4 generation on a whole grain sample within each location.

Twenty-eight families of four lines per family, selected from the yield trial plots at Swift Current prior to harvest, were grown as F_7 head-rows near Irwell. Families were selected on the basis of grain quality and kernel attributes assayed on grain from the F_6 yield trial. In the $F_{6:8}$ generation, 38 lines were grown in agronomic trials near Swift Current and Indian Head, and near Sutherland, SK, at the University of Saskatchewan Kernen Research Farm. Grain was harvested and processed in a similar manner to grain from the F_4 plots. In the F_8 generation, response to FHB was assessed in an inoculated nursery near Carman, MB, using the protocol described by Bokore et al. (2017). Selected F_8 lines were screened for reaction to a T2, T9, T10, and T39 mixture of races of loose smut [*Ustilago tritici* (Pers.) Rostr.] (Nielsen 1987) and races L16 and T19 of common bunt. Throughout this breeding process, the experimental line B0418-JB41A met all selection criteria at each generation.

B0418-JB41A was evaluated in the Western Bread Wheat A_3 test in 2009, Western Bread Wheat B test in 2010, entered in the Western Bread Wheat Cooperative (WBWC) test from 2011 to 2012 as BW957, and in the ICMS Private Wheat Registration (ICMS PR) test in 2013. Annually, the WBWC consisted of 25 experimental lines and five check cultivars grown in a 5×6 lattice design with three replications at up to 13 locations per year. The check cultivars were Carberry (DePauw et al. 2011), Katepwa (Campbell and Czarnecki 1987), Laura

Table 1. Grain yield (kg ha^{-1}) of AAC W1876 compared with check cultivars in the Western Bread Wheat Cooperative Test, 2011–2012.

	Zone 1[a]		Zone 2		Zone 3		Mean[b]
	2011	2012	2011	2012	2011	2012	2011–2012
Katepwa	3336	2845	4185	2825	5920	3689	3683
Laura	3600	2822	4451	2587	5468	3114	3615
Lillian	3562	2622	4398	2768	6163	3413	3723
Carberry	3401	2989	4576	2891	6205	4236	3954
CDC Kernen	3727	3213	4645	3117	6597	4030	4095
Mean of checks	3525	2898	4451	2838	6071	3696	3814
AAC W1876	3823	2702	4422	2927	6129	3679	3839
$LSD_{0.05}$[c]	371	663	406	284	578	584	263
No. of tests	2	2	8	7	2	3	24

[a]Zone 1 locations: Swift Current and Stewart Valley (SK); Zone 2 locations: Dundurn, Goodale, Indian Head, and Kernen (SK). Scott (SK), Lethbridge (AB), Vulcan (AB), and Watrous (SK); Zone 3 locations: Lacombe (AB), Melfort (SK), and Ellerslie (AB).
[b]Means based on LSMEANS procedure of SAS.
[c]LSD, least significant difference ($p \leq 0.05$) includes the appropriate genotype × environment interaction variation.

(DePauw et al. 1988), Lillian (DePauw et al. 2005), and CDC Kernen (Hucl 2012). The check cultivars in the 2013 ICMS PR test were 5603HR (Anonymous 2017*a*), Carberry, Glenn (Mergoum et al. 2006), Lillian, and CDC Kernen (Anonymous 2017*b*). The variables measured and protocols followed in the WBWC test and the ICMS PR test were described in the operating procedures of the Prairie Recommending Committee for Wheat, Rye, and Triticale (Anonymous 2013; http://www.pgdc.ca/committees_wrt.html). The MIXED procedure of SAS® (Littell et al. 2006) was used to perform yearly and multi-year analyses for agronomic data with years, environments, and their interactions considered random effects and cultivar treated as a fixed effect. Mean separation tests were performed using Fisher's protected least significant difference (LSD) procedure.

Response to several diseases was assessed in specialized uniform disease nurseries from 2011 to 2013. Stem rust seedling reaction was assessed using stem rust races: QTHJF (C25), RHTSC (C20), RKQSC (C63), RTHJF (C57), TMRTF (C10), and TPMKC (C53) (Roelfs and Martens 1988; Fetch et al. 2015), while representative leaf rust races found the previous year were applied to determine seedling leaf rust reaction (McCallum and Seto-Goh 2006). Field evaluations of leaf and stem rust reactions, using leaf rust races representative of those found the previous year and the same stem rust races as for the seedling tests, were conducted annually in epiphytotic nurseries near Glenlea and Winnipeg, MB. Reaction to FHB was assessed in artificially inoculated field tests conducted annually near Glenlea and Carman, Ottawa, Lévis, QC, and Charlottetown, PE (Gilbert and Woods 2006). To determine the response to loose smut, a mixture of the prevalent races T2, T9, T10, and T39 was injected into florets at anthesis of plants grown in the field and the inoculated seed was subsequently grown out and rated for disease incidence in a greenhouse (Menzies et al. 2003). To determine the response to common bunt, a mixture of prevalent races L1, L16, T1, T6, T13, and T19 was used to inoculate the seed and planted in mid-April of each year near Lethbridge, AB (Gaudet and Puchalski 1989). The race designations are those described by Nielsen (1987) for loose smut and Hoffmann and Metzger (1976) for common bunt.

A grain sample of BW957 and the check cultivars from each location was submitted to the Canadian Grain Commission (CGC) to determine grain grade and protein concentration. End-use suitability was determined on a composite sample made up from sites with grain samples representative only of the top hard red spring wheat grades available. The quantity of grain from a location was adjusted to achieve a final composite protein concentration approximating that of the average for the crop that year. A consistent quantity of grain within a location for all experimental lines was used to make up the composite each year. All end-use suitability analyses were performed by personnel at the Grain Research Laboratory, CGC, Winnipeg, following protocols of the American Association of Cereal Chemists (AACC 2000).

Performance

Averaged over 24 trials in 2 yr, AAC W1876 yielded within the range of the checks (Table 1). In the 2013 ICMS PR test, there was no significant difference in yield between AAC W1876 and any of the checks (Table 2). AAC W1876 matured within the range of the checks in the WBWC (Table 3). It was the latest to mature in the ICMS PR test, however, there were no significant differences (Table 4). AAC W1876 is a semidwarf cultivar with plant

Table 2. Grain yield (kg ha^{-1}) of AAC W1876 compared with check cultivars in the ICMS Private Wheat Registration Test, 2013.

	Zone 1[a]	Zone 2	Zone 3	Mean[b]
5603HR	4751	3375	4245	3971
Glenn	4586	2761	4247	3662
Carberry	4860	2722	4427	3766
Lillian	4795	2832	4069	3681
Unity	4825	3392	4290	4010
Check mean	4763	3016	4256	3818
AAC W1876	4804	2753	4082	3652
$LSD_{0.05}$[c]	660	834	803	573
No. of tests	2	4	3	9

[a]Zone 1 locations: Swift Current and Stewart Valley; Zone 2 locations: Dundurn, Indian Head, Lethbridge, and Saskatoon; Zone 3 locations: Fort Saskatchewan (AB), Portage La Prairie (MB), and Thornhill (ON).
[b]Means based on LSMEANS procedure of SAS.
[c]LSD, least significant difference ($p \leq 0.05$) includes the appropriate genotype × environment interaction variation.

Table 3. Means[a] for agronomic characteristics of AAC W1876 compared with the check cultivars in the Western Bread Wheat Cooperative Test, 2011–2012.

	Maturity (d)	Height (cm)	Lodging score[b] (1–9)	Volume weight (kg hL^{-1})	Seed mass (mg)	Protein (%)
Katepwa	98.6	95.8	3.3	78.6	32.3	14.5
Laura	101.1	94.9	3.2	77.6	30.1	14.8
Lillian	98.9	93.8	2.7	77.5	34.8	15.6
Carberry	103.0	80.9	1.3	79.8	33.2	14.7
CDC Kernen	101.1	95.5	1.9	78.9	34.6	14.8
AAC W1876	102.4	82.1	1.8	78.8	33.4	15.1
$LSD_{0.05}$[c]	1.7	2.2	1.1	1.1	1.7	0.7
No. of tests	21	23	9	25	25	25

[a]Means based on LSMEANS procedure of SAS.
[b]Straw strength rated on a 1–9 scale, where 1 = all plants in plot are erect and 9 = all plants in a plot are lying horizontal.
[c]LSD, least significant difference ($p \leq 0.05$) includes the appropriate genotype × environment interaction variation.

Table 4. Means[a] for agronomic characteristics of AAC W1876 compared with the check cultivars in the ICMS Private Wheat Registration Test, 2013.

	Maturity (d)	Height (cm)	Lodging score[b] (1–9)	Volume weight (kg hL^{-1})	Seed mass (mg)
5603HR	101.5	103	2.5	77.1	33.4
Glenn	101.6	92	1.5	80.5	36.0
Carberry	101.5	85	1.1	77.8	36.4
Lillian	100.0	99	2.4	75.7	37.6
Unity	100.5	101	1.6	78.3	35.1
Check mean	101.0	96	1.8	77.9	35.7
AAC W1876	103.1	87	1.1	76.9	36.9
$LSD_{0.05}$[c]	3.1	2	1.0	3.0	2.8
No. of tests	8	9	5	9	9

[a]Means based on LSMEANS procedure of SAS.
[b]Straw strength rated on a 1–9 scale, where 1 = all plants in plot are erect and 9 = all plants in a plot are lying horizontal.
[c]LSD, least significant difference ($p \leq 0.05$) includes the appropriate genotype × environment interaction variation.

Table 5. Reactions of AAC W1876 and check cultivars to leaf, stem, and yellow rust, common bunt, and loose smut in the 2011 and 2012 Western Bread Wheat Cooperative Test grown at various locations.

	Field leaf rust				Field stem rust						Yellow rust				Common bunt				Loose smut			
	Glenlea				Portage		Winnipeg		Glenlea		Lethbridge				Lethbridge				Glenlea			
	2011		2012		2011		2011		2012		2011		2012		2011		2012		2011		2012	
	Severity[a]	Rating[a]	Severity	Rating	Severity[b]	Rating[c]	Severity	Rating	Severity	Rating	Severity[d]	Rating[e]	Severity	Rating	Infection[f]	Reaction[e]	Infection	Reaction	Infection[g]	Reaction[e]	Infection	Reaction
Katepwa	30	I	57	MS	5	R	10	MR	2	R	30	I	28	MS	22	I	26	I	0	R	8	R
Laura	0		5	R	5	R	10	R	2	R	47	S	13	I	40	MS	41	S	29	MR	24	MR
Lillian	0.3	R	5	R	5	R	7	MR	3	R	2	R	0	R	6	MR	31	MS	69	MS	15	R
Carberry	0	R	8	R	5	R	10	MR	5	R	10	R	3	R	1	MR	6	R	5	R	67	MS
CDC Kernen	0	—	27	MR	5	R	1	R	10	MR	47	S	33	MS	23	I	32	MS	0	R	4	R
AAC W1876	Tr	—	5	R	5	R	5	R	10	I	18	I	5	I	14	I	22	I	6	R	47	I
LSD	—	—	—	—	—	—	—	—	—	—	24	—	10	—	10	—	13	—	—	—	—	—

[a]Severity is the percentage of leaf area affected by leaf rust; rating is the descriptive classification of disease resistance or susceptibility based on percent severity, where R (resistant) = 0%–10%, MR (moderately resistant) = 11%–30%, I (intermediate resistance) = 31%–39%, MS (moderately susceptible) = 40%–60%, and S (susceptible) >60%.
[b]Severity is the percentage of the stem infected with stem rust using the Modified Cobb Scale.
[c]Disease response categories: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; and S, susceptible.
[d]Severity is the percentage of leaf area affected by yellow rust.
[e]Disease reaction categories: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; and S, susceptible.
[f]Percentage of spikes with common bunt symptoms.
[g]Percentage of plants with loose smut symptoms.

Table 6. Response to *Fusarium* head blight and the mycotoxin deoxynivalenol of AAC W1876 and check cultivars based on the 2011 and 2012 Western Bread Wheat Cooperative test grown in inoculated nurseries near Glenlea and Carman (MB), Ottawa (ON), Levis (QC) and Charlottetown (PEI).

	Glenlea									Carman				Ottawa		Levis	PEI					
	2011					2012				2012				2011	2012	2011	2011			2012		
	Index[a]	Rating[b]	DON[c]	ISD[d]	Rating[e]	Index	Rating	ISD[f]	Rating[e]	Index	Rating	FDK[g]	DON	Index	Index	Index	Index	DON	FDK[h]	Index	FDK	DON
Katepwa	16	MS	1.6	3.3	I	16	MS	18	I	33	I	16.3	—	48	50	65	68	13.4	8	48	8	1.0
Laura	16	MS	4.8	24.9	I	6	MR	14	MR	48	MS	15.9	15	48	72	79	87	35.2	9	53	8	0.7
Lillian	41	S	10.7	8.2	S	11	I	17	I	76	S	22.8	32	73	77	90	83	13.9	7	54	7	1.7
Carberry	6	MR	3.2	2.7	MR	11	I	17	I	15	MR	3.9	5.6	22	32	32	44	17.6	7	45	6	0.2
CDC Kernen	11	I	4.5	20.8	I	8	MR	15	I	26	I	14.6	—	27	45	57	55	11.9	7	52	6	1.8
AAC W1876	2	R	2.5	10.0	R	26	S	24	MS	25	I	13		30	38	65	43	15.6	5	43	4	1.7

[a]*Fusarium* head blight disease index = (percentage of infected heads × percentage of diseased florets on infected heads)/100.
[b]Disease response category: R, resistant; MR, moderately resistant; I, intermediate in reaction; MS, moderately susceptible; S, susceptible.
[c]DON, deoxynivalenol (ppm).
[d]ISD, 2011 incidence severity DON index = [(0.3 × Incidence) + (0.3 × Severity) + (0.4 × DON)].
[e]Response rating based on ISD.
[f]2012 incidence severity DON index = [(0.2 × Incidence) + (0.2 × Severity) + (0.6 × DON)]. The ISD was changed to place greater weight on DON.
[g]FDK, *Fusarium*-damaged kernels; weight of kernels with *Fusarium* symptoms as a percent of the total sample weight.
[h]*Fusarium*-damaged kernels on a 1 (low) to 10 (high) scale.

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Table 7. End-use suitability[a] analyses, using a 74% extraction flour for all flour testing, of AAC W1876, the check cultivars, and the mean of the control cultivars based on the Western Bread Wheat Cooperative test (2011 and 2012).

	Wheat protein (%)	Flour protein (%)	Protein loss (%)	Hagberg Falling no. (s)	Amylo-graph viscosity (BU)[b]	Flour yield 0.50 ash (%)	Flour ash (%)	Flour colour[c] L^*	Starch damage (megazeme)	Particle size index
Katepwa	14.0	13.2	0.8	433	573	75.8	0.47	94.2	8.9	53.5
Laura	14.1	13.2	0.9	443	648	76.8	0.45	94.8	7.5	56.0
Lillian	14.6	14.0	0.7	430	568	73.8	0.51	94.1	8.6	55.0
Carberry	14.0	13.1	0.9	398	583	77.3	0.44	94.3	8.7	52.5
CDC Kernen	13.8	13.3	0.5	455	550	77.5	0.43	94.2	8.7	54.0
Check mean	14.1	13.3	0.7	432	584	76.2	0.46	94.3	8.5	54.2
AAC W1876	14.2	13.5	0.7	415	590	78.3	0.42	94.5	7.9	55.5
SD[d]	0.05	0.05		15	5	0.34	0.005	0.9	0.08	0.9

[a]American Association of Cereal Chemists methods were followed by the Grain Research Laboratory, Canadian Grain Commission for determining the various end-use suitability traits on a composite of 6 to 10 locations each year.
[b]Amylograph viscosity expressed in Brabender Units (BU).
[c]Flour color by spectrophotometer colour L^* = brightness on the CIE scale.
[d]SD, standard deviation based on repeated testing of Allis mill check samples and standard bake flour sample with replicate tests carried out over an extended period of time each season, provided by Grain Research Laboratory, Canadian Grain Commission.

Table 8. Farinograph and Canadian short process characteristics of AAC W1876, the check cultivars, and the mean of the control cultivars based on the Western Bread Wheat Cooperative test (2011 and 2012).

	Farinograph				Canadian short process (150 ppm ascorbic acid)						
	Absorption (%)	DDT[a] (min)	MTI[b]	Stability (min)	Baking absorption (%)	Mixing energy[c] (Wh kg^{-1})	Mixing time (min)	Loaf volume (cc)	Appearance	Crumb structure	Crumb color
Katepwa	68.1	6.5	13.5	15.0	67.0	6.6	3.2	1043	7.5	6.3	7.8
Laura	67.2	8.5	16.0	12.5	67.0	7.4	3.6	1110	7.6	6.1	7.9
Lillian	70.1	5.1	8.3	25.0	69.0	6.1	3.1	1080	7.4	6.0	7.4
Carberry	67.5	6.6	10.3	25.0	67.0	8.2	4.1	1065	7.4	6.1	7.8
CDC Kernen	68.0	5.9	11.8	22.5	68.0	7.7	3.8	1058	7.5	6.5	7.8
Check Mean	68.2	6.5	12.0	20.0	67.6	7.2	3.5	1071	7.5	6.2	7.7
AAC W1876	66.6	7.5	18.8	17.5	66.0	8.6	3.9	1138	7.6	6.0	7.7
SD[d]	0.2	0.4	2.6	1.4	N/A[e]	0.3	0.2	45	N/A	N/A	N/A

[a]DDT is the Farinograph dough development time measured in minutes.
[b]MTI is the Farinograph mixing tolerance index.
[c]Mixing energy expressed as watt hours per kg.
[d]SD, standard deviation based on repeated testing of Allis mill check samples and standard bake flour sample with replicate tests carried out over an extended period of time each season, provided by Grain Research Laboratory, Canadian Grain Commission.
[e]N/A, not available.

height significantly shorter than all of the checks except Carberry. AAC W1876 displayed significantly lower lodging than Katepwa and Laura (Table 3) and significantly less lodging than 5603HR and Lillian (Table 4).

AAC W1876 had higher test weight than Laura and Lillian (Table 3). The kernel size of AAC W1876 was within the range of the checks, greater than Laura in the WBWC test, and greater than 5603HR in the ICMS PR test. AAC W1876 had a grain protein concentration within the range of the checks.

AAC W1876 expressed resistance to prevalent races of leaf rust, moderate resistance to stem rust, and intermediate resistance to yellow rust (*Puccinia striiformis* f. *tritici* Eriks.), common bunt, and loose smut (Table 5). AAC W1876 tended to have lower FHB symptoms than Laura or Lillian and expressed intermediate resistance (Table 6).

Other Characteristics

Spike: Tapering to parallel sided, medium density, nodding to inclined attitude at maturity, strong glaucosity, chaff colour at maturity white to blond, medium length awns.

Lower glume: Glabrous with medium width, medium to long length.

Table 9. End-use suitability[a] analyses, using a 74% extraction flour for all flour testing, of AAC W1876, the check cultivars, and the mean of the control cultivars based on the ICMS Private Wheat Registration test (2013).

									Farinograph				No time dough baking[e]			
	Wheat protein (%)	Flour protein (%)	Protein loss (%)	Hagberg Falling no. (s)	Amylo-graph viscosity (BU)[b]	Flour yield 0.50 ash (%)	Flour ash (%)	Starch damage (megazeme)	Absorption (%)	DDT[c] (min)	MTI[d]	Stability (min)	Baking absorption (%)	Mixing time (min)	Mixing energy[f] (W-h kg^{-1})	Loaf volume (cc)
Unity	12.2	11.4	0.8	438	840	79.6	0.43	20.5	60.8	4.90	41	5.7	62	4.6	118	864
Glenn	12.5	12.1	0.4	398	780	76.5	0.45	18.4	63.5	6.40	34	8.1	65	4.4	144	882
Carberry	13.2	12.1	1.1	401	570	79.5	0.44	20.6	61.8	4.40	42	5.7	63	3.4	134	871
Lillian	13.4	12.9	0.5	484	660	77.7	0.48	20.2	63.5	4.20	35	6.2	65	3.4	129	900
5603HR	11.9	11.6	0.3	437	670	75.2	0.48	19.0	58.1	4.50	33	7.1	60	4.9	113	895
Check mean	12.6	12.0	0.6	431	704	77.7	0.45	19.7	61.5	4.88	37	6.6	63	4.1	128	882
AAC W1876	13.4	12.5	0.9	438	580	81.3	0.42	20.6	60.9	5.00	31	6.9	63	3.2	137	958
SD[g]	0.05	0.05		15	5	0.34	0.005	0.08	0.2	0.4	2.6	1.4	N/A[h]	N/A	N/A	N/A

[a]American Association of Cereal Chemists methods were followed by the Grain Research Laboratory, Canadian Grain Commission for determining the various end-use suitability traits on a composite of 6 to 10 locations each year.

[b]Amylograph viscosity expressed in Brabender Units (BU).

[c]DDT is the Farinograph dough development time measured in minutes.

[d]MTI is the Farinograph mixing tolerance index.

[e]AACC method (10-10.03).

[f]Mixing energy expressed as watt hours per kg.

[g]SD, standard deviation based on repeated testing of Allis mill check samples and standard bake flour sample with replicate tests carried out over an extended period of time each season, provided by Grain Research Laboratory, Canadian Grain Commission.

[h]N/A, not available.

Lower glume shoulder: Medium width elevated to strongly elevated with second point present

Kernel: Hard red type, medium red colour, medium size, oval to broad elliptical shape, rounded to angular cheek shape, narrow and shallow crease, and medium to long brush hairs.

Germ: Medium to large, round in shape.

End-use suitability: In general, AAC W1876 had quality attributes within the range of the check cultivars (Tables 7–9). Relative to the mean of the five checks, AAC W1876 expressed improved flour yield and lower flour ash. AAC W1876 is eligible for grades of CWRS.

Maintenance and Distribution of Pedigreed Seed

The 108 Breeder Lines originate from random $F_{6:12}$ single plants of B0418-JB41A grown as 108 pre-Breeder Lines in 3-m-long rows in isolation near Swift Current in 2010 and again as 15-m rows near Indian Head in 2013. Breeder Seed will be maintained by the Seed Increase Unit of the Research Farm, Indian Head, SK S0G 2K0, Canada. AAC W1876 has been released to Warburton's Ltd for subsequent Identity Preserved contract production through Warburton Foods Canada, 409 McKay Street, St. Francois Xavier, MB R4L 1A9, Canada; www.warburons.co.uk. The distribution and multiplication of pedigreed seed stocks will be handled through a sublicense to Canterra Seeds, 201–1475 Chevrier Boulevard, Winnipeg, MB R3T 1Y7, Canada; www.canterra.com.

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