AAC Gateway hard red winter wheat

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Graf, R. J., Beres, B. L., Randhawa, H. S., Gaudet, D. A., Badea, A., Laroche, A., Eudes, F. and Pandeya, R. S. 2013. **AAC Gateway hard red winter wheat**. Can. J. Plant Sci. **93**: 541–548. AAC Gateway is a hard red winter wheat (*Triticum aestivum* L.) cultivar eligible for grades of Canada Western Red Winter (CWRW) wheat. Evaluated relative to CDC Osprey, AC Bellatrix, Radiant, and CDC Buteo in the Western Winter Wheat Cooperative Registration trials from 2009 to 2011, AAC Gateway exhibited high grain yield, good winter survival, short straw of excellent strength, high grain protein concentration, and resistant to intermediate responses to stem rust, leaf rust, stripe rust and fusarium head blight. This combination of desirable traits makes AAC Gateway well-suited for production across western Canada. End-use suitability analysis indicated improvements in protein concentration, amylograph viscosity, dough rheology, loaf volume, and lower protein loss on milling.

Key words: *Triticum aestivum* L., wheat (winter), cultivar description, disease resistance, protein concentration

Graf, R. J., Beres, B. L., Randhawa, H. S., Gaudet, D. A., Badea, A., Laroche, A., Eudes, F. et Pandeya, R. S. 2013. **Le blé dur roux d'hiver AAC Gateway**. Can. J. Plant Sci. **93**: 541–548. AAC Gateway est une variété de blé dur roux d'hiver (*Triticum aestivum* L.) admissible à toutes les classes de blé rouge d'hiver de l'Ouest canadien (CWRW). Comparé aux cultivars CDC Osprey, AC Bellatrix, Radiant et CDC Buteo lors des essais d'homologation coopératifs de l'Ouest sur le blé d'hiver de 2009 à 2011, AAC Gateway s'est caractérisé par un rendement grainier élevé, une bonne rusticité, une paille courte très robuste, une forte concentration de protéines dans le grain et une réaction allant de modérée à résistante à la rouille de la tige, à la rouille des feuilles, à la rouille jaune et à la brûlure de l'épi par *Fusarium*. Pareille combinaison de caractères fait qu'AAC Gateway est bien adapté à sa culture partout dans l'Ouest canadien. Une analyse de la destination finale révèle des améliorations au niveau de la teneur en protéines, de la viscosité à l'amylographe, de la rhéologie de la pâte, du volume du pain et de la perte de protéines lors de la mouture.

Mots clés: *Triticum aestivum* L., blé (d'hiver), description de cultivar, résistance à la maladie, concentration de protéines

AAC Gateway hard red winter wheat (*Triticum aestivum* L.) was developed by the cereal research team at the Lethbridge Research Centre (LRC) of Agriculture and Agri-Food Canada (AAFC) in Lethbridge, AB. Tested as LG813 and W478, registration No. 7252 was granted by the Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency on 2012 Nov. 01. An application for Plant Breeders' Rights has been filed.

A combination of high grain yield and protein concentration, good winter survival, desirable productivity traits, adequate levels of resistance to all three wheat rusts and reasonable fusarium head blight (FHB) tolerance make AAC Gateway Canada Western Red Winter (CWRW) wheat well-suited for production in the eastern prairies, the moist parkland region of Alberta and Saskatchewan, and under irrigation. The name "Gateway" was chosen for this cultivar to reflect the enhanced market potential of the newly redefined CWRW wheat class, in the hope that the changes to cultivar eligibility will result in new markets, higher prices and greater adoption of this viable alternative to spring wheat in many parts of western Canada. The acronym "AAC" has recently been adopted to indicate development by Agriculture and Agri-Food Canada.

Pedigree and Breeding Method

AAC Gateway was derived from the cross CDC Osprey/N95L1226 made in 2000 at the AAFC, LRC

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Abbreviations: **AAFC**, Agriculture and Agri-Food Canada; **CGC**, Canadian Grain Commission; **CWRW**, Canada Western Red Winter; **CWGP**, Canada Western General Purpose; **DON**, deoxynivalenol; **FHB**, fusarium head blight; **GRL**, Grain Research Laboratory; **LRC**, Lethbridge Research Centre

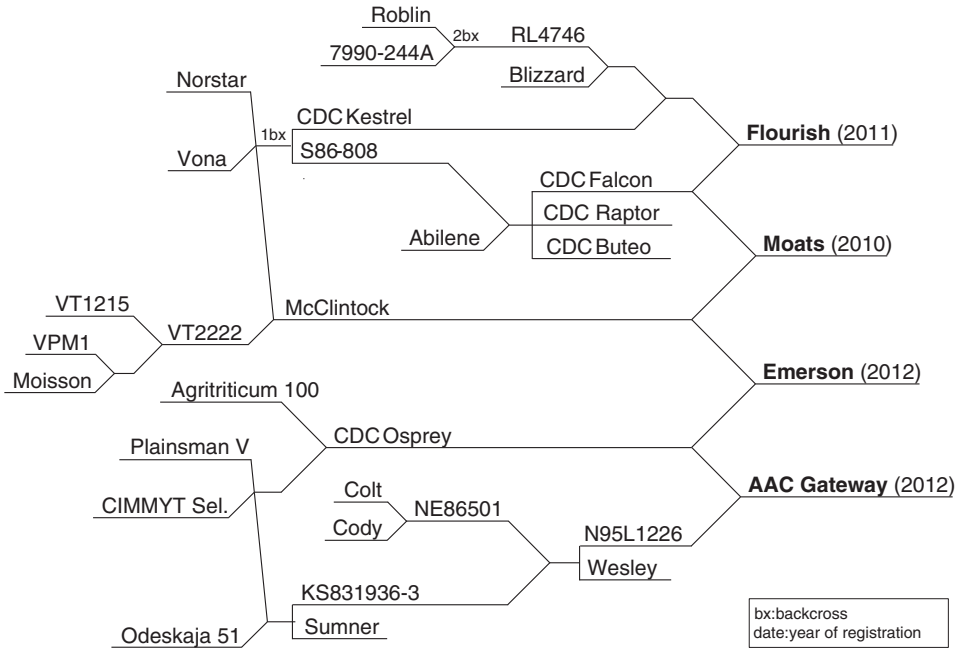

Fig. 1. Genealogy of CWRW wheat cultivars registered between 2008 and 2012. For a detailed genealogy of western Canadian winter wheat cultivars registered prior to 2008, please refer to McCallum and DePauw (2008).

in Lethbridge. It was selected using a pedigree breeding approach from the F_2 to F_5 generations. CDC Osprey is a registered CWRW wheat cultivar developed by the University of Saskatchewan Crop Development Centre with the parentage Plainsman V/CIMMYT Selection// Agritriticum 100 (Fowler 1997). N95L1226 is an experimental hard red winter wheat line developed by the United States Department of Agriculture, Agricultural Research Service (USDA-ARS) at Lincoln, NE, that was evaluated in the 1998 and 1999 Northern Regional Performance Nurseries. N95L1226 was derived from the same cross that resulted in the cultivar Wesley, and has the parentage KS831936-3/NE86501. KS831936-3 is a sib of Sumner with the pedigree Plainsman V/Odeskaja 51; NE86501 is a selection from the cross Colt/Cody (Peterson et al. 2001). The genealogies of AAC Gateway and other recently registered CWRW wheat cultivars are shown in Fig. 1.

Following greenhouse growth of the F_1 hybrids, the resulting seed was grown in a thinly planted F_2 bulk plot at Lethbridge in 2002 from which 155 heads were collected and planted as F_3 head rows. In 2003, 42 of these rows were selected on the basis of winter survival, plant type and vigour, plant height, and straw strength; three heads from each row were collected prior to harvest. Grain protein concentration, as measured by whole grain near infrared reflectance spectroscopy (Williams 1979), and test weight (Thomas 1994) screening of the row samples prompted the planting of 51 heads derived from 17 rows into an artificially inoculated stem rust (*Puccinia graminis* Pers.: Pers. f.sp. *tritici* Eriks. & E. Henn.) and leaf rust (*P. triticina*

Table 1. Grain yield (t ha^{-1}) of AAC Gateway and the check cultivars, Western Winter Wheat Cooperative registration trials (2009–2011)

	2009[z]	2010	2011	Grand mean	Zone 1[y]	Zone 2	Zone 3	Zone 4
CDC Osprey	5.31	5.85	4.70	5.26	5.42	4.76	4.28	5.63
AC Bellatrix	5.10	5.67	4.42	5.04	4.89	4.60	4.17	5.59
Radiant	4.84	5.56	5.08	5.18	5.32	4.83	3.85	5.52
CDC Buteo	4.98	5.76	4.80	5.18	5.32	4.57	4.18	5.64
CDC Falcon	4.96	5.65	5.08	5.24	5.50	4.90	3.62	5.55
AAC Gateway	4.84	5.83	5.28	5.35	5.55	4.93	3.69	5.76
LSD ($P \leq 0.05$)[x]	0.45	0.55	0.51	0.34	0.77	0.78	0.51	0.38
No. of tests	8	10	11	29	9	7	2	11

[z]All means are weighted by the number of tests.
[y]Zone 1: Southern Alberta sites (Lethbridge ''dry land'', Lethbridge ''irrigated'', Vauxhall, Warner). Zone 2: Parkland sites (Beaverlodge, Lacombe, Olds, Melfort). Zone 3: Semi-arid prairie site (Swift Current). Zone 4: Eastern prairie rust-hazard sites (Brandon, Carman, Indian Head, Saskatoon, Winnipeg).
[x]Least significant difference includes variation from the genotype by environment interaction.

Table 2. Agronomic and seed characteristics of AAC Gateway and the check cultivars, Western Winter Wheat Cooperative registration trials (2009–2011)

Cultivar	Winter survival (%)	Heading[z] (d)	Maturity[z] (d)	Height (cm)	Lodging[y] (1–9)	Test weight (kg hL^{-1})	Seed mass (mg)	Grain protein[x] (%)	Grain protein yield (kg ha^{-1})
CDC Osprey	81	176	219	97	2.9	77.3	30.1	11.3	595
AC Bellatrix	77	178	221	96	3.4	78.5	33.8	11.9	603
Radiant	78	177	223	93	2.0	78.3	33.9	11.4	589
CDC Buteo	78	176	221	94	3.0	80.0	32.2	11.6	597
CDC Falcon	79	175	218	77	2.2	77.6	29.7	11.3	590
AAC Gateway	76	176	220	79	1.7	78.1	32.1	12.2	651
LSD ($P \leq 0.05$)[w]	5	1	1	2	0.5	0.6	1.0	0.3	40
No. of tests	19	22	24	28	15	30	30	28	28

[z]Days to heading and maturity expressed as day of the year.
[y]Lodging scale: 1 = all plants vertical, 9 = all plants horizontal.
[x]Grain protein concentration determined using whole grain near infrared reflectance analysis.
[w]Least significant difference includes variation from the genotype by environment interaction.

Eriks.) screening nursery grown in collaboration with the University of Manitoba in Winnipeg. Based on resistance to both rusts in 2004, three to seven heads per row were picked from 27 rows. The resulting 129 selections were grown as F_5 rows in Lethbridge. In fall 2005, 33 desirable rows were harvested, of which one was designated LG813. These lines were tested in an irrigated, single replicate preliminary agronomic trial in Lethbridge and the inoculated stem and leaf rust nursery in Winnipeg, in 2006. Promising yield and productivity traits, disease resistance, and end-use quality encouraged further evaluation at several locations in 2007 and 2008. Following 8 site-years of replicated testing in trials across western Canada, 3 yr of stem and leaf rust resistance screening, and 3 yr of progressively detailed end-use quality analysis, it was believed that LG813 had sufficient merit for registration testing.

LG813 was assessed as W478 in the Western Winter Wheat Cooperative Registration trial, which is grown under the auspices of the Prairie Recommending Committee for Wheat, Rye and Triticale. Performance relative to CDC Osprey, AC Bellatrix (Thomas et al. 2012b), Radiant (Thomas et al. 2012a), and CDC Buteo (Fowler 2010) was evaluated for 3 yr (2009–2011). The agronomic trial sites were in Alberta (Beaverlodge, Lacombe, Lethbridge "dry land", Lethbridge "irrigated", Olds, Warner), Saskatchewan (Indian Head, Melfort, Saskatoon, Swift Current), and Manitoba (Brandon, Carman, Winnipeg), through the collaborative efforts of AAFC, Alberta Agriculture and Rural Development, the University of Saskatchewan, and the University of Manitoba. Analyses of variance were conducted using a combined mixed effects model where environments were considered random and genotypes were fixed. The least significant difference (LSD) test was used to identify significant differences from the check cultivars.

During registration testing, resistance to the major diseases of economic importance to winter wheat in both the western and eastern prairies was assessed by AAFC, the University of Manitoba, and the agronomic trial collaborators when differential responses for various pathogens were observed. Supplementary checks were added as required to aid in making accurate assessments. The adult plant reactions to stem and leaf rust were determined in artificially inoculated field nurseries conducted by the University of Manitoba in Winnipeg using race composites supplied by the AAFC Cereal Research Centre, and reported using the modified Cobb scale (Peterson et al. 1948). The stem rust races used for 1 or more years included: MCCFC (C17), QTHJC (C25), RHTSC (C20), RKQSC (C63), RTHJC (C57), TMRTC (C95) and TPMKC (C53) (Fetch 2005; Jin et al. 2008). The leaf rust races used annually were a representative mixture collected in western Canada during the previous field season (McCallum et al. 2010, 2011). Seedling reactions to infection by individual races of stem and leaf rust prevalent in Canada were also

Table 3. Disease reactions of AAC Gateway and the check cultivars, Western Winter Wheat Cooperative registration trials (2009–2011)

	Year	CDC Osprey	AC Bellatrix	Radiant	CDC Buteo	CDC Falcon	AAC Gateway
Stem rust[z]	2009	60 S	60 S	50 S	30 MS-S	20 MR	2 R
	2010	40 S	70 S	40 S	5 R/40 S	20 MR	5 R-MR
	2011	50 S	50 S	70 S	60 I	30 MR	10 R-MR
Leaf rust[z]	2009	30 S	20 S	20 S	30 I	20 I	15 I
	2010	35 S	35 S	25 MS-S	15 R-MR	30 MR	10 MR
	2011	60 MS-S	40 MS-S	70 MS-S	20 MR	5 MR	30 MS
Stripe rust[z]	2010						
	Z60–69[y]	30	30	15	10	20	0
	Z71–75	50	80	30	35	25	0
	Mean	40 S	55 S	23 I	23 I	23 I	0 R
	2011						
	Z50–55	30	25	35	15	45	1
	Z60–69	35	35	30	35	45	2
	Z71–75	55	55	30	45	60	20
	Mean	40 S	38 S	32 MS	32 MS	50 S	8 R
Common bunt[z]	2009	36 S	9 R	39 S	77 VS	46 VS	54 VS
	2010	48 VS	20 MR	29 MS	50 VS	33 VS	61 VS
	2011	68 VS	12 MR	57 VS	63 VS	57 VS	73 VS
Leaf spots[xw]	2009	2.0	1.5	3.2	2.0	2.7	1.5
	2010	4.0	3.0	3.3	2.3	3.0	2.3
	2011	3.3	2.7	5.7	5.7	5.7	4.0
Powdery mildew[w]	2009	4.3	3.0	2.7	3.0	2.7	2.7
	2010	4.7	4.0	4.4	4.5	1.5	3.0
	2011	3.8	3.5	3.7	3.0	2.9	3.4

[z]Percent infection and type of reaction: tr = trace, R = resistant, MR = moderately resistant, I = intermediate, MS = moderately susceptible, S = susceptible, VS = very susceptible.
[y]Growth stage (Zadoks et al. 1974).
[x]Specific leaf spotting pathogens were not determined.
[w]Rated using a 1–9 scale: 1 = disease free, 9 = very severe symptoms.

determined under controlled-environment conditions in 2011; the races of stem rust were the same as those used in the field nurseries, while the leaf rust races were: MBDS (12-3), MBRJ (128-1), MGBJ (74-2), TDBG (06-1-1), TJBJ (77-2). Stripe rust (*Puccinia striiformis* Westend.) ratings at two or three growth stages (Z50–55, Z60–69, Z71–75) (Zadoks et al. 1974) were determined under conditions of natural inoculum and artificially inoculated nurseries in Lethbridge in 2010 and 2011 (Puchalski and Gaudet 2011). The response to FHB {caused by *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch]} was determined by University of Manitoba personnel in a three replicate, mist-irrigated field nursery in Carman. Each line was spray-inoculated with a suspension of *F. graminearum* macroconidia at 50% anthesis and again three to four days later. Equal quantities of two 3-acetyldeoxynivalenol (3-ADON) and two 15-acetyldeoxynivalenol (15-ADON) producing chemotypes were used to prepare the spore suspension at a final concentration of 50 000 macroconidia mL^{-1}. Rating was done using a visual index (% incidence × % severity/100), typically 18 to 21 d after anthesis or when symptoms were well developed (Gilbert and Woods 2006; Cuthbert et al. 2007). In 2011, harvested grain from each inoculated row was used to prepare a 50-g sample to determine the percentage of fusarium damaged kernels. This sample was also used to quantify the deoxynivalenol (DON) content using enzyme-linked immunosorbent assays at the AAFC Eastern Cereal and Oilseed Research Centre in Ottawa, ON (Sinha et al. 1995; Sinha and Savard 1996). The reaction to common bunt was estimated in nurseries conducted at AAFC, LRC by inoculating seed with a composite of races that included L1, L16, T1, T6, T13, and T19 (Hoffman and Metzger 1976; Gaudet and Puchalski 1989) prior to planting into cold soil at two locations in October. The reactions to powdery mildew [*Blumeria graminis* (DC.) E.O. Speer] and unspecified leaf spotting pathogens were recorded at test sites expressing differential symptoms based on natural infection.

End-use quality analyses were performed by staff of the Canadian Grain Commission (CGC), Grain Research Laboratory (GRL), following protocols of the American Association of Cereal Chemists (2000). The grain used for these analyses was a composite sample consisting of unequal quantities of grain from those test sites where the check cultivars met top grades and produced a mean protein concentration of approximately 12.5%, which is a desired target for the marketing of CWRW wheat. Grain from test sites with serious down-grading factors was not included in the quality composite.

Performance

Data from across the Canadian prairies, collected at 29 sites over 3 yr, were used to establish the agronomic

Table 4. Fusarium head blight (FHB) reaction of AAC Gateway, check cultivars and supplementary checks, Western Winter Wheat Cooperative registration trials (2009–2012)

	Visual rating[z] (index and response[y])					DON[x] (ppm)		FDK[w] (%)	
	2009	2010	2011	2012	Mean	2011	2012	2011	2012
CDC Osprey	7.3 R	32.7 MS	29.9 I	18.0 I	22.0	25.4	6.8	11.0	4.2
AC Bellatrix	13.3 MR	20.8 I	34.9 I	11.3 MR	20.1	42.2	6.7	12.2	3.4
Radiant	45.6 S	21.5 I	54.0 S	40.3 MS	40.4	47.0	6.8	20.0	3.2
CDC Buteo	11.5 MR	12.4 MR	16.7 MR	8.0 MR	12.2	26.8	4.7	8.4	1.5
CDC Falcon	50.5 S	35.7 MS	50.4 S	25.7 MS	40.6	49.5	5.5	15.2	3.0
AAC Gateway	18.8 I	12.1 MR	24.0 I	11.1 MR	16.5	27.8	5.6	15.0	3.3
Supplementary checks[v]									
FHB148	5.8 R	4.7 R	9.7 R	6.0 R	6.6	13.8	4.2	1.8	0.6
Freedom	13.0 MR	14.2 MR	57.2 S	36.7 MS	30.3	29.4	2.3	14.0	1.7
DH01W43I*45	15.4 I	26.0 I	28.2 I	19.1 I	22.2	28.7	4.6	6.2	1.5
Caledonia	40.7 S	36.8 MS	67.2 S	49.3 S	48.5	80.0	10.9	16.3	6.2
Hanover	42.2 S	58.5 S	71.7 S	54.0 S	56.6	81.7	11.3	26.6	7.8

[z]Visual rating index = % incidence × % severity/100.
[y]Disease response category: R = resistant, MR = moderately resistant, I = intermediate, MS = moderately susceptible, S = susceptible.
[x]Deoxynivalenol content.
[w]Fusarium damaged kernels = damaged kernel weight/total weight × 100.
[v]Supplementary checks were chosen to differentiate resistance levels based on long term data collection.

performance of AAC Gateway relative to the check cultivars. The data for CDC Falcon (Fowler 1999), a registration trial check for the Canada Western General Purpose (CWGP) wheat class, have also been reported as it has been the predominant winter wheat cultivar in the eastern prairies since 2002 (M. Grenier, personal communication, Canadian Wheat Board, Winnipeg, MB).

The mean grain yield of AAC Gateway was 103.6% of the CWRW checks (NS) across all sites over 3 yr (Table 1). On a regional basis, AAC Gateway demonstrated a numerical yield advantage (NS) over all of the CWRW checks in southern Alberta (Zone 1), the parkland region (Zone 2), and the eastern prairie rust-hazard region (Zone 4), but was lower yielding in the semi-arid prairie zone (Zone 3), where only 2 site-years of data were available. Compared with CDC Falcon, AAC Gateway showed zonal yield advantages of 0.7–3.7%, with the smallest difference in Zone 2 and the largest difference in Zone 4.

AAC Gateway exhibited winter survival that was similar to the majority of the check cultivars (Table 2). The dates for heading and maturity were within the range of the CWRW checks; CDC Falcon was significantly earlier for both characteristics. Plant height was 14–18 cm shorter than the CWRW checks and 2 cm taller than CDC Falcon ($P \leq 0.05$); the resistance to lodging was significantly improved over all of the comparative cultivars except Radiant. The test weight and seed mass of AAC Gateway did not differ from the mean of the CWRW checks ($P \leq 0.05$). AAC Gateway produced grain of significantly higher protein concentration than AC Bellatrix, the highest protein check. Grain protein yield per hectare was also significantly higher than all of the check cultivars ($P \leq 0.05$). The simultaneous improvement of grain yield and protein concentration shown by AAC Gateway suggests enhanced nitrogen use efficiency through improved soil nitrogen uptake and remobilization into the developing seeds (DePauw et al. 1989; Ortiz-Monasterio et al. 2001).

AAC Gateway was rated as resistant to the prevalent races of stripe rust, moderately resistant to stem rust, and intermediate in resistance to leaf rust (Table 3). The reactions to powdery mildew and leaf spotting diseases were within the range of the check cultivars. AAC Gateway was highly susceptible to common bunt; producers in all areas of western Canada remain strongly advised to treat bunt-susceptible winter wheat cultivars with effective fungicides prior to planting (Gaudet et al. 2013). FHB tolerance was categorized as intermediate, based on 3 yr of visual ratings and a DON concentration similar to CDC Buteo, which has shown a moderately resistant response over several years. Additional FHB data collected for the 2012 Western Winter Wheat Cooperative Registration trial also support this conclusion (Table 4).

Three years of end-use suitability testing by the CGC, GRL and evaluation by the Prairie Recommending Committee for Wheat, Rye and Triticale Quality Evaluation Team established that AAC Gateway was equal in quality to the CWRW check cultivars and eligible for grades of CWRW wheat (Table 5). AAC Gateway was within the range of the check cultivars for most parameters and showed several notable improvements: higher grain and flour protein concentration, lower protein loss on milling, higher amylograph viscosity, stronger dough rheology, and greater Remix loaf volume.

Table 5. End-use quality characteristics[z] of AAC Gateway and check cultivars, Western Winter Wheat Cooperative registration trials (2009–2011)

Cultivar	Wheat protein (%)	Flour protein (%)	Protein loss (%)	Hagberg falling no. (s)	Amylograph peak viscosity (BU)	Flour yield (0.5% ash)	Flour ash (%)	Flour colour (Agtron)	Starch damage (%)	Particle size index
CDC Osprey	11.7	11.0	0.7	387	613	82.6	0.36	89	5.8	61
AC Bellatrix	12.2	11.4	0.8	418	478	80.1	0.40	84	6.7	59
Radiant	12.0	11.0	0.9	398	612	81.9	0.38	85	6.5	59
CDC Buteo	12.2	11.3	1.0	400	467	82.8	0.35	84	6.4	59
Check mean[y]	12.0	11.2	0.9	401	543	81.9	0.37	85	6.4	59
AAC Gateway	12.6	12.1	0.5	407	692	81.6	0.39	84	5.8	61
SD[w]	0.1	0.1	0.1	15	5	0.3	0.01	0.9	0.1	0.9

	Farinograph			Remix-to-peak bake						
	Water absorption (%)	DDT[x] (min)	Stability (min)	Baking absorption (%)	Peak time (min)	Mixing energy (W h kg^{-1})	Loaf volume (cm^3)	Loaf appearance (1–10)	Crumb structure (1–10)	Crumb colour (1–10)
CDC Osprey	56.8	6.67	13.7	57	2.4	5.2	802	8.8	5.2	5.8
AC Bellatrix	62.3	5.67	8.7	61	2.5	5.3	818	8.7	5.5	5.7
Radiant	58.2	7.25	11.3	58	3.2	6.3	818	8.7	5.7	5.6
CDC Buteo	59.5	6.67	9.5	59	3.0	5.9	810	8.8	5.5	6.0
Check mean[y]	59.2	6.56	10.8	59	2.8	5.7	812	8.7	5.5	5.8
AAC Gateway	59.4	8.25	14.2	60	2.7	5.8	865	8.8	5.2	6.0
SD[w]	0.2	0.4	1.4	0.0	0.1	0.3	14	NA[v]	NA	NA

[z]American Association of Cereal Chemists (AACC) methods were followed by the Canadian Grain Commission (CGC), Grain Research Laboratory (GRL) for determining the various end-use quality characteristics on a composite of several locations per year.
[y]Grand mean of the annual check means.
[x]Farinograph dough development time.
[w]Standard deviation is based on repeated testing of Allis–Chalmers mill check samples and standard bake flour samples with replicate tests performed over an extended period of time each year. Values provided by the CGC, GRL.
[v]Not available.

Several recent changes to the wheat classification system in western Canada have had a considerable impact on new winter wheat cultivar registrations. Following extensive consultation, the requirement for kernel visual distinguishability in all wheat classes was dropped in 2008. Prior to the elimination of these strict regulatory standards, the last CWRW wheat releases were Radiant, CDC Buteo and McClintock in 2001. The CWGP wheat class was also introduced in 2008 to encourage the development and segregation of high-yielding cultivars for industrial uses such as ethanol production or livestock feed, without the constraints of specific quality parameters. In 2010, based on feedback from producers and other Canadian industry stakeholders, the CGC announced that several lower protein, poorer milling quality CWRW cultivars would be reclassified as CWGP. It is expected that these revisions in variety designation will enhance the global competitiveness of CWRW wheat by increasing its overall consistency and suitability in various end-use markets.

The impending removal of CDC Falcon from the CWRW class, tentatively scheduled for August 2014, has created tremendous concern for winter wheat growers in the eastern prairies, where it has been very popular. AAC Gateway joins two other recently registered CWRW wheat cultivars from AAFC LRC, Flourish (Graf et al. 2012) and Emerson (Graf et al. 2013), which have characteristics desired by producers in this region, making them suitable CDC Falcon replacements that will also enhance access to the highest quality CWRW milling and baking markets.

Other Characteristics

Seedling Characteristics

Coleoptile anthocyanin colouration: absent.
Juvenile growth habit: erect to semi-erect (unvernalized).
Lower leaf sheath pubescence: glabrous.
Lower leaf blade colour: medium to dark green.
Lower leaf blade pubescence: glabrous to slight.
Tillering capacity (at low densities): high.

Plant Characteristics at Booting

Growth habit: semi-erect to intermediate.
Pubescence of flag leaf sheath: glabrous.
Waxiness of flag leaf sheath: moderate.
Flag leaf colour: dark green.
Pubescence of flag leaf blade: glabrous.
Waxiness of flag leaf blade: pronounced.
Flag leaf length: medium-short.
Flag leaf width: medium-short.
Frequency of recurved flag leaves: medium-low.
Flag leaf attitude: intermediate to drooping.
Anthocyanin colouration of flag leaf auricles: absent.
Pubescence of flag leaf auricle margins: glabrous to very slight.

Plant Characteristics After Heading

Culm neck shape: barely perceptible curve.
Pubescence of upper internode: glabrous.
Waxiness of upper internode: medium-high.
Rachis margin pubescence: medium-long and abundant.
Stem colour at maturity: yellow.
Anthocyanin intensity of straw at maturity: absent.
Pith in cross-section (at middle of internode below the neck): hollow.

Spike Characteristics

Shape: tapering.
Attitude at maturity: erect to moderately inclined.
Density: medium.
Length: medium.
Colour at maturity: yellow.
Awnedness: awned.
Length of awns at tip of spike: shorter than spike.
Awn colour: light brown.
Awn attitude: intermediate to strongly spreading.
Supernumary spikelets: absent.
Hairiness of convex surface of apical rachis segment: absent.

Lower Glume Characteristics

Length: medium.
Width: medium.
Pubescence: glabrous to very slight.
Shoulder shape: apiculate.
Shoulder width: mid-wide.
Beak shape: acuminate.
Beak length: medium-long.
Internal imprint: absent to small.
Colour at maturity: white to yellow.

Kernel Characteristics

Texture: hard.
Colour: medium red.
Phenol reaction: very dark brown.

Maintenance and Distribution of Breeder Seed

Breeder Seed development of AAC Gateway was initiated in 2010, by planting random head selections taken from a rogued F_4-derived F_{10} increase plot grown in Lethbridge. In fall 2011, seed was harvested from 61 of the 95 head-rows grown under isolation in Lethbridge and replanted at the AAFC Seed Increase Unit at Indian Head. Elimination of the 34 rows was based on minor differences in plant appearance and leaf rust infection. Following the removal of three additional pre-breeder seed lines in summer 2012, the remaining 58 lines were inspected by the Canadian Food Inspection Agency in cooperation with the Canadian Seed Growers' Association, sampled individually, and then harvested in bulk to produce 437 kg of cleaned Breeder Seed. The Breeder Seed of AAC Gateway will be maintained at the facilities in Indian Head. All other classes of pedigreed

seed will be multiplied and distributed by Seed Depot Corp., 4–5 Londesboro Road, Pilot Mound, Manitoba, Canada R0G 1P0.

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