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CULTIVAR DESCRIPTION

AAC Prevail Canada Western Red Spring wheat

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Abstract: AAC Prevail (BW462) is a high-yielding spring wheat (*Triticum aestivum* L.) with high protein content and is adapted to the growing conditions in the Canadian prairies. AAC Prevail yielded similar to Unity, the highest yielding check in the Central Bread Wheat Cooperative Registration tests (2010–2012). Over 3 yr of testing in Manitoba (zone 1), AAC Prevail achieved 1.5% higher yield than Unity whereas in Saskatchewan (zone 2), it yielded 98.4% of Unity. AAC Prevail matured 1 d later than Unity and McKenzie, the earliest maturing checks. AAC Prevail was taller than all the checks but had better lodging resistance than Unity, McKenzie, and 5603HR. The test weight and kernel weight of AAC Prevail were similar to the checks. AAC Prevail was rated resistant to leaf rust (*Puccinia triticina* Erikss.) and moderately resistant to stem rust (*Puccinia graminis* f. sp. *tritici*) but susceptible to bunt [*Tilletia caries* (DC) Tul. & C. Tul.] and loose smut [*Ustilago tritici* (Pers.) Rostr.]. The *Fusarium* head blight (*Fusarium graminearum* Schwabe) rating was intermediate for visual rating index but the combined incidence, severity, and deoxynivalenol rating was moderately resistant. During 3 yr of evaluation, AAC Prevail was resistant to orange wheat blossom midge (*Sitodiplosis mosellana* Géhin). AAC Prevail was registered under the Canada Western Red Spring class for its high protein as well as good milling and baking performance.

Key words: Triticum aestivum L., CWRS, grain yield, quality, disease resistance, orange blossom wheat midge, *Fusarium* head blight.

Résumé : AAC Prevail (BW462) est une variété de blé de printemps (*Triticum aestivum* L.) à haut rendement donnant un grain très protéiné. Le cultivar est acclimaté aux conditions de croissance caractéristiques aux Prairies canadiennes. Le rendement d'AAC Prevail est similaire à celui d'Unity, le témoin qui a enregistré le meilleur rendement lors des essais d'homologation coopératifs sur le blé panifiable du Centre du Canada, tenus de 2010 à 2012. Au cours des essais de trois ans réalisés au Manitoba (zone 1), le rendement d'AAC Prevail a dépassé celui d'Unity de 1,5 %, alors qu'en Saskatchewan (zone 2), il équivalait à 98,4 % du rendement de la même variété. AAC Prevail parvient à maturité une journée plus tard qu'Unity et McKenzie, les témoins les plus précoces. AAC Prevail est plus grand que toutes les variétés témoins, mais résiste mieux à la verse qu'Unity, McKenzie et 5603HR. Le poids spécifique et le poids du grain d'AAC Prevail sont similaires à ceux des témoins. AAC Prevail résiste à la rouille de la feuille (*Puccinia triticina* Erikss.) et résiste modérément à la rouille de la tige (*Puccinia graminis* f. sp. *tritici*), mais est sensible à la carie [*Tilletia caries* (DC) Tul. & C. Tul.] et au charbon nu [*Ustilago tritici* (Pers.) Rostr.]. La nouvelle variété possède une résistance intermédiaire à la brûlure de l'épi causée par *Fusarium* (*Fusarium graminearum* Schwabe), selon l'évaluation visuelle, mais sa résistance est qualifiée de modérée quand on combine l'incidence de la maladie, la gravité des symptômes et la concentration de désoxynivalénol. AAC Prevail a résisté à la cécidomyie du blé (*Sitodiplosis mosellana* Géhin) durant les trois années des essais. AAC Prevail a été homologué dans

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la catégorie « blé roux de printemps de l'Ouest canadien » en raison de son grain, très riche en protéines, et de son rendement élevé à la mouture et à la cuisson. [Traduit par la Rédaction]

Mots-clés : Triticum aestivum L., CWRS, rendement grainier, qualité, résistance à la maladie, cécidomyie du blé, brûlure de l'épi causée par *Fusarium*.

Introduction

AAC Prevail is a hard red spring wheat (*Triticum aestivum* L.) cultivar developed by the Cereal Research Centre (CRC), Agriculture and Agri-Food Canada (AAFC), in Winnipeg, MB. It was granted Plant Breeders' Rights on 13 Feb. 2017 under the registration number 5416 by the Canadian Food Inspection Agency (CFIA), Ottawa, ON. AAC Prevail meets the end-use quality specifications of the Canada Western Red Spring (CWRS) class and is best adapted to the Canadian prairie growing conditions.

Pedigree and Breeding Methods

Canada Western Red Spring wheat is the leading market class of wheat in Canada. Wheat grain yield has been increasing in western Canada due to warm summers and optimum moisture spread throughout the growing season. However, wheat has come under increasing pressure from hybrid canola, earlier maturing corn, and soybean varieties. To keep pace with these high-value crops, new higher-yielding wheat varieties are required, which will draw producers to wheat not only for its suitability as a rotation crop but also for its profitability. Diseases such as rusts and *Fusarium* head blight (FHB) occur annually. In addition, the orange wheat blossom midge (wheat midge) is a perennial problem in western Canada. For sustainable production and profitability, new wheat varieties need to include resistance to these important diseases and pests while maintaining quality and increasing yield.

AAC Prevail derives from the cross 99B60-EJ2G/Somerset made in 2004 at the CRC in Winnipeg. Somerset is a hard red spring wheat with high protein and good baking attributes (Fox et al. 2006). The line 99B60-EJ2G comes from the cross McKenzie/RL4933 and is a recombinant with *Sm1* and *Lr16* genes in coupling linkage (Thomas et al. 2005). McKenzie hard red spring wheat is the first double haploid (DH) wheat cultivar registered in Canada (Graf et al. 2003). RL4933 is derived from the cross Grandin*2/Caldwell, where Caldwell is the source of the orange blossom wheat midge antibiosis resistance gene *Sm1*. Caldwell (Patterson et al. 1982) likely contains the seedling resistance gene *Lr14a*, the adult plant resistance gene *Lr12*, and an uncharacterized adult plant resistance gene that provides an intermediate level of leaf rust resistance in field plots (Kolmer 2009). Grandin was one of the most popular spring wheat cultivars grown in North Dakota.

AAC Prevail was developed using the DH breeding method. A cross between 99B60-EJ2G and Somerset was made in a growth cabinet in 2004 to produce F_1 seeds and the embryos from the F_1 plants were subjected to corn pollination for plant regeneration (Forster and Thomas 2010). A total of 605 DH plants were generated and varying amounts of seeds were harvested from each plant. The DH lines were increased near Leeston (New Zealand; 2006–2007) as one progeny row per DH plant. Selections were made based on plant agronomic appearance and 365 DH lines were brought back to Canada in 2007. Selected lines were then tested in an un-replicated single-location yield test at Glenlea, MB, in 2007 and further selections were made based on agronomic traits (yield, height, maturity, lodging, and test weight), disease performance (leaf and stem rust, FHB, and bunt), and quality attributes (grain protein, flour yield, and mixograph). In 2008, 60 selected lines were yield-tested at three locations in Manitoba and Saskatchewan and selections were made based on agronomic traits, disease performance, and quality attributes as previously described. Selected lines were then evaluated in the central bread wheat (CBW) "B" preregistration trial in 2009. Ultimately, one line from the 605 initially generated DHs was advanced and designated as BW462, which was evaluated in the CBW "C" registration trials for 3 yr (2010–2012). A detailed description of the breeding history, population size, and cultivar evaluation is given in Table 1.

The CBW "C" registration trial consisted of 30 entries tested at 10 locations within Manitoba and Saskatchewan using a rectangular lattice design with 6 groups of 5 entries per group and 3 replicates. The yield data from all three replicates were collected and final plot yields at similar moisture content were converted to yield per unit area (kg ha^{-1}). Days to maturity was recorded when seeds resisted denting by a fingernail (16%–18% moisture) and data from all the replicates were collected three times per week. The plant height was measured in centimetres from the ground to the top of the spikes excluding the awns after the extension growth had ceased. Lodging was recorded on a 1–9 scale where 1 was upright and 9 was completely lodged. Test weight was measured on cleaned samples and reported as kilograms per hectolitre. Kernel weight was measured using at least 200 undamaged kernels and reported as milligrams per kernel.

Line BW462 was evaluated for disease reaction to FHB, leaf, stem, and stripe rust, common bunt, and loose smut in the CBW "C" trials from 2010 to 2012. A field nursery inoculated with a macroconidial spore suspension of four isolates of *Fusarium graminearum* Schwabe was used to evaluate tolerance to FHB at Glenlea and

Table 1. Population size and activities at each generation leading to the registration of AAC Prevail (BW462) hard red spring wheat.

Name	Gen.	Year	Activity – No. of lines – Locations
BD112	F_0	2004	Final cross made in a growth cabinet.
BD112A	F_1	2005	605 doubled haploids created.
BD112A*B0496	DH	2006–2007	Winter nursery rows at Leeston, New Zealand; Selections on height, lodging, maturity, and leaf rust resistance.
BD112A*B0496	DH	2007	365 lines were tested in an unreplicated yield test at one location (Glenlea, MB). Selections for agronomics, disease, grain protein, flour yield, and mixograph.
BD112A*B0496	DH	2008	60 lines were grown in unreplicated yield tests at three locations (MB: Brandon, Glenlea; SK: Saskatoon). Selection based on agronomics, disease resistance and quality.
BD112A*B0496	DH	2009	3 lines in the Central Bread Wheat "B" test. Yield test, three replicates at eight locations (MB: Glenlea, Brandon, Morden; SK: Indian Head, Regina, Melfort, Saskatoon; AB: Beaverlodge).
BW462	DH	2010–2012	1 line in the Central Bread Wheat "C" registration test. Yield test, three replicates at eleven locations/year (MB: Glenlea, Portage la Prairie, Brandon, Morden, Souris, Dauphin; SK: Indian Head, Kamsack, Regina, Melfort, Saskatoon).
Breeder seed production			
BW462	DH	2010	Breeder seed spikes: 256 random spikes were selected from a rogued increase plot grown at Indian Head, SK. These spikes were dissected to determine the type of midge feeding damage present and 37 spikes were discarded due to susceptible type feeding damage being observed.
BW462	DH	2011	Breeder seed isolation rows: 219 lines were grown in 1 m rows near Glenlea, MB, with a 10 m isolation distance from any other wheat. Nineteen lines removed due to agronomic appearance of the rows, 36 lines removed due to low seed amounts, and 3 lines discarded due to presence of piebald kernels.
BW462	DH	2012	Prior to bulk harvesting the breeder rows, 17 rows were discarded: 7 rows contained awned plants, 3 rows were taller than the rest, 2 rows contained tip-awned plants, 1 row contained 12 speltoids and rows exhibited high levels of glume blotch. The remaining uniform plots were inspected and harvested in bulk, producing 150 kg of breeder seed.

Carman, MB. The visual rating index (VRI = % incidence × % severity/100) was recorded as described by Gilbert and Woods (2006). Reactions to leaf and stem rust diseases were assessed using the modified Cobb scale (Peterson et al. 1948) in inoculated field nurseries at CRC, AAFC. Experiments were also conducted in the greenhouse to evaluate seedling reactions to four leaf rust races MBDS (12-3), MGBJ (74-2), TJBJ (77-2), and MBRJ (128-1) (McCallum and Seto-Goh 2006) and six stem rust races TMRTF (C10), RKQSC (C63), TPMKC (C53), RTHJF (C57), QTHJF (C25), and RHTSC (C20) (Fetch 2005; Jin et al. 2008). Natural field infections were used to assess the disease severity and reaction to stripe rust (*Puccinia striiformis* Westend.) near Lethbridge, AB (Randhawa et al. 2012). Common bunt [*Tilletia tritici* (Bjerk.) Winter] resistance was recorded at the AAFC Lethbridge Research Centre using a composite of races L1, L16, T1, T6, T13, and T19 and planting inoculated seed into cold soil (Gaudet and Puchalski 1989; Gaudet et al. 1993). The reaction to loose smut [*Ustilago tritici* (Pers.) Rostr.] was assessed by inoculating wheat plants with a composite of races T2, T9, T10, and T39 (Menzies et al. 2003). The reaction to midge feeding damage was assessed on seeds that were nearly ripe. Sixty spikes (20 spikes per replicate for three replicates) were collected per entry and were analyzed under a dissecting microscope for larval feeding damage symptoms. Based on type of damage, the entries were classified as resistant, susceptible, or undamaged.

Evaluation of end-use quality was conducted by the Grain Research Laboratory (GRL), Canadian Grain Commission (CGC) in Winnipeg. Protein content and grade of the check cultivars were used as criteria to prepare composite samples from all test locations, which were subsequently used in tests to measure grain protein (%), flour protein (%), protein loss, falling number (s), amylograph (BU), clean four yield (%), flour yield (ash; %), flour ash (%), starch damage (%), particle size index (%), farinograph properties, and dough development properties using standard analytical methods as outlined in the Prairie Recommending Committee for Wheat, Rye, and Triticale operating procedures (PRCWRT 2015).

The PROC MIXED module (SAS version 9.3, SAS Institute Inc., Cary, NC) with years, environments, and their interactions treated as random effects and cultivar as a fixed effect was used to generate least significant difference (LSD) for analyzing the improvements of AAC Prevail over the check cultivars.

Table 2. Yield (kg ha^{-1}) of AAC Prevail (BW462) and check cultivars in the Central Bread Wheat Cooperative (2010–2012) tests.

	Manitoba[a]				Saskatchewan[b]				All sites	
Cultivar	2010	2011	2012	Mean	2010	2011	2012	Mean	kg ha^{-1}	% Unity
Unity	4284	4798	3569	4183	4096	5243	4036	**4458**	**4321**	**100.0**
5603HR	4130	4831	3108	3976	3711	4854	3538	4034	4006	92.7
McKenzie	4191	4651	3542	4097	3408	4867	3592	3956	4026	93.2
CDC Teal	3600	4482	3161	3689	3376	4606	3121	3701	3695	85.5
Cardale	4071	**4935**	3597	4143	3344	4843	3025	3940	4042	93.5
AAC Prevail	**4315**	4931	**3611**	**4245**	**4221**	**4984**	**3952**	4386	4315	99.9
Mean of checks	4051	4691	3345	3986	3648	4893	3572	4037	4012	—
$LSD_{0.05}$	347	669	196	—	386	313	184	—	—	—
No. of tests	18	12	15	45	15	15	15	45	—	—

Note: Bold indicates highest value among all cultivars. LSD, least significant difference appropriate to make comparisons of AAC Prevail to Mckenzie, CDC Teal, Unity VB, and 5603HR; $p \leq 0.05$, includes the appropriate genotype × environment interaction.

[a]Manitoba test locations: 2010, Glenlea, Dauphin, Portage la Prairie, Souris, Brandon, and Morden, MB; 2011, Glenlea, Dauphin, Portage la Prairie, Souris; 2012, Glenlea, Dauphin, Portage la Prairie, Souris, Brandon.

[b]Saskatchewan test locations: Kamsack, Kernen, Indian Head, Melfort, and Regina.

Table 3. Summary of agronomic traits of AAC Prevail (BW462) and check cultivars in the Central Bread Wheat Cooperative (2010–2012) tests.

Cultivar	Maturity (d)	Height (cm)	Lodging score[a] (1–9)	Test weight (kg hL^{-1})	Kernel weight (mg kernel^{-1})
Unity	96	95	2.9	**78.4**	31.4
5603HR	**98**	96	2.3	77.2	30.8
McKenzie	96	95	**2.7**	77.8	31.2
CDC Teal	97	93	1.8	76.0	**31.8**
Cardale	**98**	87	1.8	76.5	30.6
AAC Prevail	97	**101**	2.2	77.1	31.2
Mean of checks	97	95	2.4	77.4	31.3
Standard error	0.6	0.6	0.2	0.5	0.2
No. of tests	51	87	51	30	30

Note: Bold indicates highest value among all cultivars.

[a]Lodging scale: 1 = vertical, 9 = flat.

The end-use quality data are non-replicated observations within years.

Performance

The 2010–2012 CBWC registration trials had Unity (BW362), 5603HR (BW388), McKenzie (BW205), and CDC Teal (BW616) as the recommended checks. Cardale, which is a newer semi-dwarf wheat cultivar (Fox et al. 2013), was added as an internal check for comparative purposes. AAC Prevail had average grain yield better than the mean of the checks and similar to Unity, the highest yielding check. It was higher yielding than 5603HR (7.2%), McKenzie (6.7%), CDC Teal (14.4%), and Cardale (6.3%) (Table 2). Across all 3 yr of testing, AAC Prevail was the highest yielding line in Manitoba. Unity out-yielded AAC Prevail in two out of the 3 yr and had higher mean yield over 3 yr of testing in Saskatchewan (Table 2).

AAC Prevail had similar days to maturity as CDC Teal but matured a day earlier than Cardale and 5603HR and a day later than Unity and McKenzie (Table 3). AAC Prevail was taller than all the checks but had better lodging resistance compared with Unity, 5603HR, and McKenzie. The test weight and kernel weights were similar to the mean of the checks (Table 3).

AAC Prevail had acceptable resistance to diseases prevalent in the Canadian prairies. It was rated intermediate to moderately susceptible to FHB at Carman, whereas its reaction ranged from resistant to intermediate at Glenlea. It had lower deoxynivalenol (DON) levels compared with all the checks except 5603HR (Table 4). AAC Prevail was eventually rated intermediate for FHB resistance. AAC Prevail was rated as resistant to leaf rust

Table 4. *Fusarium* head blight (FHB) visual rating index[a], rating class[b], and DON[c] for AAC Prevail (BW462) and check cultivars in the Central Bread Wheat Cooperative (2010–2012) tests.

	Carman FHB						Ottawa FHB			Glenlea FHB								
	2010		2011		2012		2010	2011	2012	2010			2011			2012		
Cultivar	Index	Class	Index	Class	Index	Class	Index	Index	Index	Index	Class	DON	Index	Class	DON	Index	Class	DON
Unity	29	I	35	I	38	I	52	37	37	14	MR	**11**	4	**R**	1.9	**6**	**MR**	3.8
5603HR	28	I	**21**	**I**	48	MS	**18**	23	33	21	I	8	4	**R**	1.1	8	**MR**	3.5
McKenzie	37	MS	38	MS	45	MS	47	33	**28**	14	MR	13	4	**R**	2.7	9	**MR**	3.6
CDC Teal	64	S	64	S	87	S	73	72	72	41	S	73	19	MS	5.4	13	I	7.6
Cardale	**15**	**MR**	33	I	**15**	**MR**	45	**9.4**	30	**8**	**R**	12.9	**1**	**R**	**0.4**	11	I	3.3
AAC Prevail	29	I	37	MS	41	I	37	33	30	9	R	**11**	7	MR	1.6	12	I	**3.1**

Note: Bold indicates most resistant cultivar among all cultivars studied.
[a]FHB visual rating index (VRI): (percentage of infected heads × percentage of diseased florets on infected heads)/100.
[b]Disease rating class: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.
[c]DON, deoxynivalenol concentration in parts per million.

and moderately resistant to Canadian races of stem rust (Table 5). It was susceptible to stripe rust, common bunt, and loose smut (Table 6). AAC Prevail was resistant to the orange wheat blossom midge based on low feeding damage on wheat kernels by the midge larvae (Table 6).

Grain protein, milling, and flour baking properties of AAC Prevail were tested by GRL, CGC. End-use quality assessment (AACC 2002) was done on a composite sample formulated from trial locations with grain samples representative of the best hard red spring wheat grades available. A pre-determined quantity of final grain amount from every location was made up by varying the proportion of grain from each location used to form the composite to achieve the final protein concentration approximating the average for the crop in the given year. AAC Prevail met the milling and baking performance of CWRS class of wheat. The grain and flour protein (%) were lower than the mean of the checks. The clean flour yield, flour ash (%), and the starch damage were improved compared with the mean of the checks (Table 7). Water absorption measured on the farinograph directly relates to the amount of bread that can be produced from a given weight of wheat flour. The farinograph absorption was similar to checks for the CWRS class of wheat (Table 8).

Other Characteristics

The morphological characteristics were recorded on experimental field plots grown in 2013 and 2014 at Saskatoon, SK.

Seedling characteristics

Coleoptile colour: absent or very weak.
Juvenile growth habit: semi-erect to intermediate.
Seedling leaves: medium green, glabrous.
Tillering capacity (at low densities): moderately high.

Adult plant characteristics

Growth habit: semi-erect to intermediate.
Flag leaf attitude: intermediate.
Flag leaf: medium green, low to medium recurved curvature, glabrous, slightly waxy blade, medium length and medium width, medium sheath glaucosity, leaf auricle with absent to very weak anthocyanin and glabrous margins.
Culm: glabrous.

Spike characteristics

Shape: parallel sided and oblong.
Length: long.
Density: lax.
Attitude: erect.
Colour: yellow at maturity.
Awns: awnlets present, apically awnleted.

Spikelet characteristics

Glumes: lower glumes white at maturity; long length and medium width; glabrous; broad width and straight

Table 5. Rust disease severities and ratings of AAC Prevail (BW462) and check cultivars in the Central Bread Wheat Cooperative (2010–2012) tests.

	Leaf rust[a]			Stem rust[b]			Stripe rust[c]		UG99[b]	
Cultivar	2010	2011	2012	2010	2011	2012	2011	2012	2011	2012
Unity	1.7 MR	**0.3 R**	5 MR	**10 MR**	20 I	**10 MR**	47 S	38 S	—	40 M
5603HR	**0 R**	1 R	22 MR	25 MR	20 I	10 I	**43 S**	28 MS	—	15 M
McKenzie	**0 R**	1 R	5 MR	20 MR	20 I	**10 MR**	53 S	45 S	—	40 M
CDC Teal	3.3 R	1 R	23 MR	20 MR	7 I	5 I	**43 S**	**0 R**	—	20 MS
Cardale	**0 R**	**0.3 R**	**10 R**	**10 MR**	10 MR	20 MR	63 S	23 I	—	20 M
AAC Prevail	1.7 R	0.7 R	17 MR	**10 MR**	**5 R**	5 I	60 S	25 I	**5 MR**	**5 R**

Note: Bold indicates most resistant cultivar among all cultivars studied; —, no value.

[a]Severity is the percentage of leaf area affected by rust. Reaction is the descriptive classification of disease based on percent severity. Disease rating class: R, resistant (1%–10%); MR, moderately resistant (11%–30%); I, intermediate (31%–39%); MS, moderately susceptible (40%–60%); S, susceptible (>60%).

[b]Severity is the percentage of stem infected with stem rust using the modified Cobb scale. Disease response categories: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.

[c]Severity is the percentage of leaf area affected by rust. Dominant pustule reaction for stripe rust. Disease response categories: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.

Table 6. Bunt, smut, leaf spot, and midge ratings of AAC Prevail (BW462) and check cultivars in the Central Bread Wheat Cooperative (2010–2012) tests.

	Common bunt[a]			Loose smut[b]			Midge[c]		
Cultivar	2010	2011	2012	2010	2011	2012	2010	2011	2012
Unity	**1 R/MR**	**1 R**	**1 MR**	54 I	**17 MR**	44 I	—	—	**15:1:14**
5603HR	8 R/MR	3 R	3 MR	41 I	—	**40 I**	—	—	0:30:0
McKenzie	2 R/MR	5 MR	5 MR	42 I	36 I	62 MS	0:23:8	0:20:9	0:29:1
CDC Teal	21 MS	25 I	25 I	**25 MR**	47 I	49 I	0:25:5	0:21:9	0:29:1
Cardale	34 S	5 MR	13 MR	48 I	24 MR	76 S	—	—	0:28:2
AAC Prevail	29 MS	42 S	42 S	27 MR	25 MR	84 S	**18:5:15**	**9:1:20**	23:0:17

Note: Bold indicates most resistant cultivar among all cultivars studied; —, no value.

[a]Bunt data represented as severity (percentage of spikes with bunt symptoms) and ratings. Disease rating class: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.

[b]Loose smut data represented as severity (percentage of plants with loose smut symptoms) and ratings. Disease rating class: R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.

[c]Midge rating R:S:U (Resistant:Susceptible:Undamaged).

shoulder shape, beak is short in length with strongly curved shape.

Lemma: slightly curved.

Kernel characteristics

Type: hard, dark red in colour.

Size: medium, short, wide; oval shape; rounded cheeks; medium brush hairs; medium wide and medium deep crease.

Embryo: round.

Maintenance and Distribution of Pedigreed Seed

Breeder Seed of AAC Prevail was produced using 256 random spikes from a rogued increase plot grown at Indian Head, SK, in 2010. Spikes were analysed for signs of midge damage and 37 spikes were discarded based on evidence of midge feeding damage. The remaining 219 lines were grown as 1-m rows with a 10 m isolation distance from any other wheat near Glenlea in 2011. Nineteen lines were removed due to non-uniform plant phenotype, 36 lines were removed due to low seed amounts, and 3 lines were removed due to piebald kernels. One hundred and sixty-one Breeder Seed rows were grown as 15-m-long rows maintaining a 10 m isolation distance from other wheat at Indian Head, SK, in 2012. An additional 30 rows were further discarded (17 rows due to non-uniformity, 7 rows with awned plants, 3 rows were taller than the rest, 2 rows were tipped awned, and 1 row had speltoids contamination with glume bloth). The remaining uniform plots were inspected and bulk harvested, producing 150 kg of Breeder Seed. Multiplication and distribution of all other pedigreed seed classes will be handled by Alliance Seed, 24th Floor, 333 Main Street, Winnipeg,

Table 7. Wheat and flour analytical data for AAC Prevail (BW462) and check cultivars from the Central Bread Wheat Cooperative (2010–2012) tests.

Cultivar	Grain protein (%)	Flour protein (%)	Protein loss (%)	Falling number (s)	Amylograph (BU)	Clean flour yield[a] (%)	Flour yield (ash) (%)	Flour ash (%)	Starch damage (%)	Particle size index (%)[b]
Unity	14.7	13.9	0.8	438	**750**	**76.4**	75.7	**0.5**	8.3	54
5603HR	14.6	13.8	0.8	**440**	618	75.7	75.5	**0.5**	8.0	55
McKenzie	14.7	13.9	0.8	**440**	570	75.6	75.8	**0.5**	**8.8**	53
CDC Teal	**15.3**	**14.7**	0.6	430	520	75.0	75.5	**0.5**	7.0	**59**
Cardale	15.2	14.3	**0.9**	427	602	75.9	75.8	**0.5**	**8.8**	53
Mean of checks	14.9	14.1	0.7	437	614	75.7	75.6	**0.5**	8.0	55
AAC Prevail	14.5	13.6	**0.9**	427	572	76.2	**76.8**	0.4	7.8	56

Note: Bold indicates highest value among all cultivars. End-use quality testing was performed by the Grain Research Laboratory (GRL) of the Canadian Grain Commission (CGC) on a composite sample of each cultivar.

[a]Dexter and Tipples (1987). All millings at the GRL, CGC are performed in rooms with environmental control maintained at 21 °C and at 60% relative humidity. Common wheat is milled on an Allis-Chalmers laboratory mill using the GRL sifter flow as described by Black et al. (1980). Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis.

[b]American Association of Cereal Chemists methods were followed by the GRL, CGC for determining the various end-use quality traits on a composite of 6–10 locations each year.

Table 8. Dough properties for AAC Prevail (BW462) and check cultivars from the Central Bread Wheat Cooperative (2010–2012) tests.

Dough properties											
	Farinograph				Canadian short process (150 ppm ascorbic acid)[a]						
Cultivar	Abs (%)[b]	DDT (min)[c]	MTI (BU)[d]	Stability (min)	Loaf volume (cm^3)	Abs (%)	Mixing energy (W h kg^{-1})	Mixing time (min)	Loaf appearance[b]	Crumb structure[b]	Crumb colour[b]
Unity	66.9	6.2	**31.7**	7.5	1107	67	5.3	5.5	7.6	6.1	7.8
5603HR	65.1	6.6	25.0	10.7	1083	65	**6.5**	6.1	7.5	**6.3**	7.7
McKenzie	68.4	5.7	30.0	8.5	1105	**68**	5.4	5.2	7.5	6.0	7.7
CDC Teal	66.9	**9.2**	18.3	**16.2**	**1192**	66	5.5	5.2	**7.8**	6.0	7.8
Cardale	**68.7**	6.8	25.0	8.7	1112	**68**	5.3	**6.2**	7.5	6.0	7.7
Mean of checks	66.8	6.9	26.3	10.7	1122	66	5.6	5.6	7.6	6.1	7.8
AAC Prevail	66.5	7.3	23.3	10.5	1103	66	6.1	**6.2**	7.5	**6.3**	**7.9**

Note: Bold indicates highest value among all cultivars; Abs, absorption.

[a]Preston et al. (1982).

[b]AACC (2002).

[c]DDT, farinograph dough development time measured in minutes.

[d]MTI, farinograph mixing tolerance index expressed in Brabender units (BU).

MB R3C 4E2, Canada (http://www.allianceseed.com). AAC Prevail is a midge-resistant variety and to maintain the effectiveness of the *Sm1* gene against wheat orange blossom midge, the certified seed will include CDC Plentiful as a 10% interspersed susceptible refuge.

Contributions

S.L. Fox designed the initial cross and performed the breeding work. S. Kumar analysed the registration trial data, generated varietal identification data for Variety Registration and Plant Breeders' Rights including the necessary documentation, and wrote the manuscript. The other authors contributed agronomic and disease evaluation data from the registration trials.

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