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AAC Prevail Canada Western Red Spring Wheat

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CULTIVAR DESCRIPTION

AAC Prevail Canada Western Red Spring Wheat

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Kumar et al. 2017. AAC Prevail Canada Western Red Spring Wheat.

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 three years 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 one day 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* Eriks.) and moderately resistant to stem rust (*Puccinia graminis* f. sp. *tritici*) but susceptible to bunt (*Tilletia caries*) and loose smut (*Ustilago tritici*). The *Fusarium* head blight (*Fusarium graminearum*) rating was intermediate for visual rating index (VRI), but the combined incidence, severity, and deoxynivalenol (ISD) rating was moderately resistant. During three years 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.

List of Abbreviations: CWRS: Canada Western Red Spring, DON: deoxynivalenol, FHB: *Fusarium* head blight, CBWC: Central Bread Wheat Cooperative test, DH: Double Haploid

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

AAC Prevail is a hard red spring wheat cultivar developed by the Agriculture and Agri-Food Canada (AAFC), Cereal Research Centre (CRC) in Winnipeg, Manitoba, Canada. It was granted Plant Breeders Rights on February 13, 2017 under the registration number 5416 by the Canadian Food Inspection Agency (CFIA). 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.

Introduction, Pedigree and Breeding Methodology

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 through the growing season. However, wheat has come under increasing pressure from hybrid canola, earlier maturing corn and soybean varieties. In order 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 occur annually. In addition, the orange wheat blossom midge (wheat midge) is a perennial problem in Western Canada. For sustainable production and profitability, the new wheat varieties need to include resistance to these important disease 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 doubled haploid (DH) wheat cultivar registered in Canada (Graf et al. 2003). RL4933 is derived from the cross Grandin*2/Caldwell, where the 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 F₁ seeds, and the embryos from the F₁ plants were subjected to the corn pollination for plant regeneration (Forster and Thomas 2010). A total of 605 doubled haploid 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, test weight), disease performance (leaf and stem rust, *Fusarium* head blight (FHB), 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” pre-registration trial in 2009. Ultimately, one line from the 605 initially generated DHs was advanced and designated as BW462, which was

evaluated in CBW “C” registration trials for three years (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). Days to maturity was recorded when seeds resisted denting by fingernail (16-18% moisture) and data from all the replicates were collected three times per week. The plant height was measured in centimeters from the ground to 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 CBW “C” trials from 2010-2012. A field nursery inoculated with a macroconidial spore suspension of 4 isolates of *Fusarium graminearum* was used to evaluate tolerance to *Fusarium* head blight at Glenlea and Carman, Manitoba. The visual rating index ($VRI = \% \text{ incidence} \times \% \text{ severity} / 100$) 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, Winnipeg. 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 (*P. striiformis*) near Lethbridge, Alberta (Randhawa et al. 2012). Common bunt (*Tilletia tritici*) 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 Canadian Grain Commission Grain Research Laboratory (GRL) in Winnipeg, Manitoba. 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 (%), and 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 (Anonymous 2015).

The PROC MIXED module (SAS, version 9.3) 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.

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

Performance and Adaptation

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 three years of testing, AAC Prevail was the highest yielding line in Manitoba. Unity out-yielded AAC Prevail two out of the three years and had higher mean yield over three years 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 to 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 for FHB at Carman, whereas its reaction ranged from resistant to intermediate at Glenlea. It had lower deoxynivalenol (DON) levels compared to 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 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 (American Association of Cereal Chemists, 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 to 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 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 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, Saskatchewan 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 10 m isolation distance from any other wheat near Glenlea, Manitoba 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 15m long rows maintaining 10m isolation distance from other wheat at Indian Head, Saskatoon 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, 1 row had speltoids contamination with glume blot). 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, 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

SLF designed the initial cross and performed the breeding work. SK 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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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 – Number 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	2006-7	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). 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	2010-12	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 rows exhibited high levels of glume blotch. The remaining uniform plots were inspected and harvested in bulk producing 150 kg of Breeder.

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

^a Manitoba test locations: 2010 - Glenlea, Dauphin, Portage la Prairie, Souris, Brandon, Morden; 2011 - Glenlea, Dauphin, Portage la Prairie, Souris; 2012 - Glenlea, Dauphin, Portage la Prairie, Souris, Brandon

^b Saskatchewan test locations: Kamsack, Kernen, Indian Head, Melfort, Regina

Appropriate LSD to make comparisons of AAC Prevail to McKenzie, CDC Teal, Unity VB and 5603HR. $P \leq 0.05$, includes the appropriate genotype by environment interaction.

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 ^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.

Table 4. *Fusarium* head blight 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.

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

Note: Bold indicates most resistant cultivar among all cultivars studied

^aFHB Visual Rating Index (VRI): (percentage of infected heads x percentage of diseased florets on infected heads)/100.

^bDisease rating class: R = resistant, MR = moderately resistant; I = intermediate; MS = moderately susceptible, S = susceptible.

^cDON: Deoxynivalenol concentration in parts per million

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

Cultivar	Leaf Rust ^a				Stem Rust ^b				Stripe Rust ^c			UG99 ^b	
	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

^aSeverity 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%).

^bSeverity is the percentage of stem infected with stem rust using the Modified Cobb Scale. Disease response category: R = resistant; MR = moderately resistant; I = intermediate; MS = moderately susceptible; S = susceptible.

^cSeverity is the percentage of leaf area affected by rust. Dominant pustule reaction for stripe rust. Disease response category: 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.

Cultivar	Common Bunt ^a				Loose smut ^b				Midge ^c		
	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

^aBunt 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.

^bLoose 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.

^cMidge rating R:S:U (Resistant:Susceptible: Undamaged).

Table 7. Wheat and flour analytical data for AAC Prevail (BW462) and check cultivars from the Central Bread Wheat Cooperative (2010-2012) tests. End-use quality testing was performed by the Grain Research Lab of the Canadian Grain Commission on a composite sample of each cultivar.

Cultivar	Grain protein (%)	Flour protein (%)	Protein loss %	Falling number (s)	Amylo-graph (BU)	Clean flour yield (%)	Flour yield (ash) (%)	Flour ash (%)	Starch damage (%)	Particle size index (%) ^a
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

^aAmerican Association of Cereal Chemists methods were followed by the Grain Research Laboratory, Canadian Grain Commission for determining the various end-use quality traits on a composite of 6-10 locations each year.

^bDexter and Tipples (1987). All millings at the Canadian Grain Commission's Grain Research Laboratory 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.

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) ^d						
Cultivar	^a Abs (%)	DDT (min) ^b	MTI (BU) ^c	Stability (min)	Loaf volume (cm3)	Abs (%)	Mixing energy (W h kg ⁻¹)	Mixing time (min)	Loaf appearance ^a	Crumb structure ^a	Crumb colour ^a
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

^aAmerican Association of Cereal Chemists (2002).

^bDDT: Farinograph Dough Development Time measured in minutes.

^cMTI: Farinograph Mixing Tolerance Index expressed in Brabender Units (BU).

^dPreston et al. (1982).

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