CULTIVAR DESCRIPTION

AAC Marchwell durum wheat

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Singh, A. K, Clarke, J. M., Knox, R. E., DePauw, R. M., Wise, I., Thomas, J., McCaig, T. N., Cuthbert, R. D., Clarke, F. R. and Fernandez, M.R. 2015. **AAC Marchwell durum wheat**. Can. J. Plant Sci. **95**: 189–195. AAC Marchwell durum wheat [*Triticum turgidum* L. subsp. *durum* (Desf.) Husn.] is adapted to the durum production area of th Canadian prairies. AAC Marchwell is the first durum genotype registered for commercial production in Canada with the *Sm1* gene for antibiosis-based resistance to orange wheat blossom midge [*Sitodiplosis modellana* (Gehin)]. It combines high grain yield, grain protein concentration, yellow pigment, test weight, and low grain cadmium concentration. AAC Marchwell has similar straw strength, plant height, and days to maturity as Strongfield. AAC Marchwell is resistant to leaf rust, stem rust, stripe rust, common bunt, loose smut, and common root rot. AAC Marchwell has end use quality suitable for the Canada Western Amber Durum class.

Key words: Durum wheat, orange wheat blossom midge, insect resistance, *Sm1*, grain yield

Singh, A. K, Clarke, J. M., Knox, R. E., DePauw, R. M., Wise, I., Thomas, J., McCaig, T. N., Cuthbert, R. D., Clarke, F. R. et Fernandez, M.R. 2015. **Le blé dur AAC Marchwell**. Can. J. Plant Sci. **95**: 189–195. AAC Marchwell est une variété de blé dur [*Triticum turgidum* L. sous-esp. *durum* (Desf.) Husn.] acclimatée à la zone des Prairies canadiennes consacrée à cette culture. Ce cultivar est le premier génotype de blé dur doté du gène *Sm1* codant la résistance par antibiose à la cécidomyie orangée du blé [*Sitodiplosis mosellana* (Gehin)]. Il se caractérise par un rendement grainier élevé, une forte concentration de protéines dans le grain, une abondante pigmentation jaune, un fort poids spécifique et une faible teneur en cadmium dans le grain. La robustesse de la paille, la hauteur du plant et le nombre de jours jusqu'à maturité d'AAC Marchwell sont semblables à ceux de Strongfield. AAC Marchwell résiste à la rouille des feuilles et de la tige, à la rouille jaune, à la carie, au charbon nu et au piétin. La qualité finale d'AAC Marchwell permet de classer le cultivar avec les blés durs ambrés de l'Ouest.

Mots clés: Blé dur, cécidomyie orangée du blé, résistance aux ravageurs, *Sm1*, rendement grainier

AAC Marchwell durum wheat was developed at the Semiarid Prairie Agricultural Research Centre (SPARC), Agriculture and Agri-Food Canada (AAFC), Swift Current, SK. Filing for Plant Breeders' Rights protection (13-8014) was accepted on 2013 Apr. 19, and AAC Marchwell received registration No. 7442 from the Variety Registration Office of Canadian Food Inspection Agency on 2013 Oct. 17.

Pedigree and Breeding Method

AAC Marchwell (experimental names: DT833, A0426-KV04) was selected from the cross A0039&DB764D18/ Strongfield (designated A0426) made in 2004 at the Semiarid Prairie Agricultural Research Centre, Swift Current, SK. A0039&DB764D18 is a doubled haploid breeding line developed at SPARC and derived from a cross of Kyle// 9560A-138/94B27-BR1C/3/Napoleon/ 4/AC Navigator/5/ 9687-CA4, where 9560A-138 is a breeding line from CIMMYT (Mexico) received in the 1995–1996 27th International Durum Screening Nursery with cross identity and selection history of CD92655-1PAP-2Y-040M-2Y-0PAP. 94B27-BR1C is a hexaploid wheat line derived from Caldwell/ 88B27-D3A1C, where Caldwell is a midge-resistant genotype. Kyle (Townley-Smith et al. 1987), Napoleon (Humphreys et al. 2010), AC Navigator (Clarke et al. 2000), and Strongfield (Clarke et al. 2005a) are registered durum cultivars. 9687-CA4 is a breeding line derived from Simento/ Green 34//AC Avonlea.

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Abbreviation: **FHB**, *Fusarium* head blight

In 2004, F_1 seeds from A0039&DB764D18/Strongfield were increased in the greenhouse and approximately 8000 F_2 seed were space-planted in a disease epiphytotic field nursery in 2005 near Swift Current. An irrigated leaf rust and stem rust epiphytotic nursery was established by planting leaf and stem rust susceptible spreader rows between four rows of F_2 space-planted genotypes. Spreader rows were inoculated by injecting with a syringe and needle, a sample of plants every 3 m with leaf rust (*Puccinia triticina* Eriks.) and stem rust (*Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. and E. Henn.) spores suspended in water. Representative leaf rust races found the previous year were applied (McCallum and Seto-Goh 2006). Stem rust races used were: QTHST (C25), RHTSK (C20), RKQSR (C63), RTHJT (C57), TMRTK (C10), and TPMKR (C53) (Roelfs and Martens 1988; Fetch 2005). Leaf spot disease assessment was based on natural infection. F_2 plants were selected based on rust and leaf spot responses, plant height, straw strength, and maturity. Seed from each selected F_2 plant spike was screened with the *Barc35* simple sequence repeat marker, which is linked to the wheat midge resistance gene *Sm1*. The F_3 seeds of individual F_2 spikes from selected plants and with the presence of molecular variant associated with the *Sm1* gene were grown in 220 2-m-long F_3 rows near Leeston, New Zealand in 2005–2006. Based on plant height, days to maturity and straw strength, 171 genotypes were selected, and the rows were individually harvested to serve as the seed source for agronomic trials in Canada. In 2006, near Swift Current and Indian Head, SK, the 171 F_4 genotypes were grown in single replication 2.74-m^2 four-row plot tests that also included the parents and other check cultivars. Five heads per F_4 line from the test grown in Swift Current were selected for plant height, straw strength, disease resistance (from natural infection). Based on further evaluation of agronomic performance, disease resistance (primarily natural infection leaf spots and *Fusarium* head blight (FHB) reaction in a FHB disease nursery at Portage la Prairie, MB) (Gilbert and Woods 2006), and quality (protein concentration, yellow pigment concentration, and gluten strength) 50 F_4 genotypes were selected. In 2006–2007, 250 F_5 lines (from 50 F_4 lines $\times$ 5 heads per F_4 line) were grown in 2-m rows near Leeston, New Zealand, and selected primarily on plant height, straw strength, and days to maturity. After selection in F_5, 136 F_6 lines were identified and grown in 2007 under dryland conditions near Swift Current, Regina and Indian Head, SK. Twenty-seven genotypes were selected based on agronomic performance, disease resistance (primarily natural infection leaf spots in yield plots), FHB reaction in a FHB disease nursery at Portage la Prairie, MB (Gilbert and Woods 2006), and quality (protein concentration, yellow pigment concentration and gluten strength). Leaf spot reaction (field rating of natural infection, primarily tan spot [*Pyrenophora tritici-repentis* (Died.) Drechs., anamorph *Drechslera tritici-repentis* (Died.) Shoemaker], and stagonospora nodorum blotch [*Phaeosphaeria nodorum* (E. Müll.) Hedjaroude, anamorph *Stagonospora nodorum* (Berk.) Castell. & E.G. Germano] was noted in yield plots. From these, 11 F_7 genotypes including A0426-KV04 were grown in the 2008 Durum Central A (DCA) test as four-row plots in a two-replication lattice design near Swift Current, Regina, Indian Head, SK, Lethbridge, AB, and Brandon, MB, to assess agronomic performance. Remnant seed from the yield trials was used to assess end-use suitability by the Central Quality Lab, Cereal Research Centre, MB, and included grain protein, pigment, milling properties, gluten strength, and Hagberg Falling Number. Disease evaluations included response to loose smut [*Ustilago tritici* (Pers.) Rostr.] assessment with a mixture of races T26, T32 and T33 under field conditions near Swift Current, SK. Response to leaf rust and stem rust were evaluated in hill plots in a rust nursery near Glenlea, MB, using a mixture of races. Response to leaf spotting pathogens was assessed from within the yield plots under conditions of natural inoculums. Response to *Fusarium graminearum* Schwabe (teleomorph *Gibberella zeae* (Schwein. Petch) was assessed in FHB nursery near Portage la Prairie, MB. Midge reaction was assessed near Glenlea, MB, in a midge nursery. Midge reaction was noted as resistant or susceptible. Molecular marker screening with *Barc35* was utilized to confirm the presence of molecular variant associated with the *Sm1* gene.

This procedure identified A0426-KV04, which met all of the selection criteria at each stage of selection. A0426-KV04 was advanced to the Durum Cooperative Test and evaluated as DT833 from 2009 to 2012. The Durum Cooperative test was grown as a four-row test at up to 12 locations annually in a 6×5 lattice design including five check cultivars, with two replications in two repetitions. The check cultivars were AC Avonlea (Clarke et al. 1998), AC Morse, AC Navigator (Clarke et al. 2000), Commander (Clarke et al. 2005b), and Strongfield (Clarke et al. 2005a). The Durum Wheat Cooperative test operating protocols are described in the Prairie Recommending Committee for Wheat Rye and Triticale operating procedures (link can be found at http://www.pgdc.ca/committees_wrt.html). The durum wheat cooperative test entries were evaluated in inoculated nurseries to determine the response to leaf rust, stem rust, and loose smut near Glenlea, MB. Fusarium head blight was assessed in inoculated nurseries near Carman and Glenlea, MB, Ottawa, ON, and Charlottetown, PEI. Stem rust inoculum consisted of races of TPM, TMR, QTH, RKQ, RHT, RTH, which comprised of select historical races representing a range of virulence genes (Fetch 2005), whereas the leaf rust inoculums was representative of recently occurring races (McCallum and Seto-Goh 2006). The loose smut inoculum consisted of races T26, T32 and T33. Response to common bunt caused by *Tilletia laevis* Kuhn in Rabenh. and *T. tritici*

Table 1. Grain yield (kg ha^{-1}) of AAC Marchwell and check cultivars in the Durum Cooperative Test, 2009 to 2012 in Zones 1 and 2[z]

	2009			2010			2011			2012			2009–2012		
	Zone 1	Zone 2	Mean[y]	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean
AC Avonlea	6211	4279	4922	4466	3607	3895	4312	3700	3823	2947	3008	2991	4521	3658	3919
AC Morse	5961	4172	4771	4907	3746	4133	4245	3876	3949	2723	3352	3162	4495	3786	4005
AC Navigator	5772	4499	4921	3635	3631	3633	3793	3667	3692	2138	3055	2780	3857	3724	3752
Commander	6244	4569	5128	4307	3767	3943	4164	3940	3983	2794	3302	3152	4396	3909	4050
Strongfield	6258	4405	5021	4658	3749	4053	4487	3886	4008	2934	3359	3232	4617	3860	4088
AAC Marchwell	6445	4226	4967	4236	3911	4022	4212	3846	3920	2983	3704	3490	4554	3941	4126
$LSD^{x}_{0.05}$	525	216	250	446	338	279	908	207	231	473	382	308	364	219	211
No. tests	4	8	12	3	6	9	2	8	10	3	7	10	12	29	41
Mean of checks	6089	4385	4953	4395	3700	3931	4200	3814	3891	2707	3215	3064	4378	3787	3963

[z]Zone 1 (Black Soils): Indian Head (2009, 2011, 2012), Souris, Brandon (2009, 2010, 2012), Langdon (2009, 2010).
Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley (2009, 2011, 2012), Saskatoon, Regina, Lethbridge, Vulcan, Moose Jaw, Pense (2009), Scott (2011).
[y]Means are LS means obtained from PROC MIXED procedure of SAS software.
[x]Least significant difference, $P \leq 0.05$, includes the appropriate genotype by environment interaction variation.

(Bjerk.) G. Wint. in Rabenh. was assessed from a nursery grown near Lethbridge, AB, using mixture of prevalent races: T-1, T-6, T-13, T-19, L-1 and L-16 (Gaudet and Puchalski 1989). The race designations are those described by Roelfs and Martens (1988) for stem rust, Long and Kolmer (1989) for leaf rust, Hoffmann and Metzger (1976) for common bunt, and Nielsen (1987) for loose smut. Leaf spot reaction was determined with natural infestation at Saskatchewan and Manitoba locations. Common root rot reaction was determined near Swift Current, SK. Reaction to stripe rust (*Puccinia striiformis* f. *tritici* Eriks) was determined in nurseries in 2011 and 2012 near Lethbridge, AB. Midge reaction was determined from wheat midge screening nurseries near Glenlea or Portage la Prairie, MB.

Performance

In 4 yr of cooperative testing, grain yield of AAC Marchwell was not significantly different from the checks AC Avonlea, AC Morse, Strongfield, and Commander (Table 1). AAC Marchwell had significantly higher grain yield than AC Navigator. Days to maturity of AAC Marchwell was similar to Strongfield in both soil zones and significantly earlier than AC Navigator (Table 2). Test weight (kg hL^{-1}) of AAC Marchwell was similar to the other checks and significantly higher than AC Morse (Table 2), while the 1000-kernel weight (g) was significantly less than the checks. AAC Marchwell had similar plant height as AC Avonlea and Strongfield. Straw strength was similar to AC Avonlea and Strongfield, and significantly weaker than AC Morse (Table 2). Grain protein concentration of AAC Marchwell was similar to AC Avonlea and Strongfield, and significantly higher than other checks (Table 3).

AAC Marchwell was resistant to leaf and stem rust, and common bunt (Table 4). AAC Marchwell was resistant to loose smut in 2009, 2010 and 2011, which is an improvement over other checks including Strongfield (Table 4). AAC Marchwell has leaf spot similar to AC

Table 2. Agronomic characteristics of AAC Marchwell and check cultivars in the Durum Cooperative Test, 2009–2012[z]

	Days to maturity[zy]			Test Weight (kg hL^{-1})[z]					
	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	1000-kernel wt (g)[z]	Height (cm)[z]	Lodging (1–9)[x]
AC Avonlea	100.8	110	107.8	75.0	78.4	77.3	41.3	89.8	2.5
AC Morse	100.7	109.8	107.6	74.1	78.1	76.8	41.2	86.3	1.7
AC Navigator	101.6	110.9	108.7	74.4	79.4	77.7	44.0	78.5	2.2
Commander	101.3	110.5	108.2	74.1	78.6	77.1	44.2	76.1	2.0
Strongfield	100.4	109.8	107.5	75.9	79.6	78.4	42.1	88.0	2.8
AAC Marchwell	100.6	110.4	108.1	74.6	79.3	77.8	39.4	88.3	3.1
$LSD^{w}_{0.05}$	1.4	0.7	0.6	1.2	0.7	0.7	1.1	1.5	0.7
No. tests	8	25	33	12	29	41	41	40	14

[z]Zone 1 (Black Soils): Indian Head (2009, 2011, 2012), Souris, Brandon (2009, 2010, 2012), Langdon (2009, 2010).
Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley (2009, 2011, 2012), Saskatoon, Regina, Lethbridge, Vulcan, Moose Jaw, Pense (2009), Scott (2011). 2012 Regina was not used for plant height analysis.
[y]All Zone 1 and Zone 2 locations, except Langdon (in Zone 1), Souris in 2010 and 2011, and Stewart Valley (in Zone 2).
[x]Regina, Saskatoon (2009, 2011, 2012), Souris (2010, 2012), Brandon (2009), Swift Current (2010), Moose Jaw (2011, 2012), Stewart Valley (2012).
[w]Least significant difference, $P \leq 0.05$, includes the appropriate genotype by environment interaction variation.

Table 3. Grain protein concentration (13.5% moisture basis) measured on grain samples bulked across replications at each location of AAC Marchwell and checks from the 2009–2012 durum cooperative test

	Protein concentration (%)												
	2009			2010			2011			2012			4-yr
	Z1[z]	Z2[z]	Mean[y]	Z1	Z2	Mean	Z1	Z2	Mean	Z1	Z2	Mean	mean
AC Avonlea	12.7	14.4	13.9	15.4	13.3	13.8	15.8	12.5	13.2	16.1	15.2	15.5	14.1
AC Morse	12.5	13.8	13.5	14.2	12.7	13.1	15.3	12.4	13.0	15.4	14.1	14.5	13.5
AC Navigator	12.6	13.4	13.2	14.7	12.5	13.1	14.5	12.0	12.5	15.3	14.3	14.6	13.4
Commander	12.7	13.3	13.1	14.8	12.8	13.3	14.9	11.8	12.4	14.9	14.3	14.5	13.4
Strongfield	13.1	14.1	13.9	15.8	13.4	14.0	15.4	12.4	13.0	16.2	14.9	15.3	14.1
AAC Marchwell	13.2	14.6	14.2	16.4	13.1	13.9	15.1	12.2	12.8	16.3	14.0	14.7	13.9
$LSD_{0.05}$[x]	0.5	0.4	0.3	0.9	0.5	0.4	0.9	0.4	0.4	0.9	0.6	0.5	0.3
No. tests	3	8	11	2	6	8	2	8	10	3	7	10	39

[z]Z1, Zone 1 (Black Soils): Indian Head (2010 excluded), Souris, Brandon (2008–2010). Z2, Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Vulcan (2009–2011), Avonlea (2008), Moose Jaw (2009–2011), Pense (2009), Scott (2011).
[y]Means are LS means obtained from PROC MIXED procedure of SAS software.
[x]Least significant difference, $P \leq 0.05$, includes the appropriate genotype by environment interaction variation.

Morse, AC Navigator and Commander, but not as good as AC Avonlea and Strongfield (Table 4). AAC Marchwell expressed resistance to stripe rust better than other checks (Table 4). AAC Marchwell has better resistance to common root rot compared with Strongfield. The FHB reaction and deoxynivalenol accumulation of AAC Marchwell were similarly susceptible as the checks (Table 5). AAC Marchwell carries the *Sm1* gene and is

Table 4. Summary of disease reactions of AAC Marchwell and check cultivars grown in the Durum Cooperative Test, 2009–2012

		Stem rust[z]										
		Garden	Field	Leaf	Common bunt	Loose smut	Leaf spot		Stripe rust			Root
	Year	Rtn[z]/ Rxn[y]	Rtn[z]/ Rxn[y]	rust[x]	Rtn[z]/ Rxn[y]	Rtn[z]/ Rxn[y]	GL	SK[w]	LB-1	LB-2	LB-3	rot
AC Avonlea	2009	5 (R)	10 (RMR)	R	1 (R)	90 (S)	24.0 (MR)	–	–	–	–	34
	2010	10 (R)	3 (R)	R	20 (MS)	51 (I)	10.0 (R)	7.2 (I)	–	–	–	0
	2011	20 (MR)	5 (R)	R	1 (MR)	27 (MR)	37.0 (MS)	8.5 (MS)	25 (I)	25 (I)	–	–
	2012	20 (MR)	–	R	1 (R)	37 (I)	4.6 (R)	8.5 (MS)	2 (R)	5 (R)	–	–
AC Morse	2009	5 (R)	3 (R)	R	0 (R)	75 (MS)	31.7 (MR)	–	–	–	–	11
	2010	5 (R)	1 (R)	R	7 (R-MR)	56 (MS)	19.0 (MR)	9.7 (S)	–	–	–	14
	2011	10 (MR)	1 (R)	R	2 (MR)	70 (MS)	39.3 (MS)	10.5 (S)	20 (I)	10 (R)	5 (VR)	–
	2012	20 (MR)	–	R	0 (R)	69 (MS)	3.4 (R)	9.8 (S)	5 (R)	0 (R)	–	–
AC Navigator	2009	10 (RMR)	10 (RMR)	R	2 (R)	67 (MS)	28.0 (MR)	–	–	–	–	10
	2010	10 (R)	2 (R)	R	2 (R-MR)	29 (MR)	36.0 (MS)	8.5 (MS)	–	–	–	14
	2011	5 (R)	1 (R)	R	0 (R)	15 (R)	49.7 (S)	10.0 (S)	1 (VR)	35 (I)	1 (VR)	–
	2012	30 (I)	–	R	0 (R)	44 (I)	12.2 (I)	10.0 (S)	2 (R)	0 (R)	–	–
Commander	2009	1 (R)	1 (R)	R	1 (R)	100 (S)	50.3 (MS)	–	–	–	–	9
	2010	3 (R)	2 (R)	R	1 (R-MR)	41 (I)	28.0 (I)	7.7 (I)	–	–	–	7
	2011	1 (R)	1 (R)	R	0 (R)	9 (R)	41.0 (S)	9.8 (S)	8 (R)	35 (I)	5 (VR)	–
	2012	5 (R)	–	R	1 (R)	71 (MS)	13.0 (I)	9.5 (S)	1 (R)	5 (R)	–	–
Strongfield	2009	5 (R)	5 (R)	R	2 (R)	70 (MS)	39.7 (I)	–	–	–	–	7
	2010	5 (R)	2 (R)	R	2 (R-MR)	52 (I)	17.0 (MR)	7.7 (I)	–	–	–	10
	2011	1 (R)	1 (R)	R	2 (MR)	26 (MR)	43.3 (S)	8.5 (MS)	1 (VR)	30 (I)	10 (R)	–
	2012	15 (MR)	–	R	2 (R)	33 (MR)	6.6 (MR)	7.8 (I)	5 (R)	0 (R)	–	–
AAC Marchwell	2009	1 (R)	10 (RMR)	R	2 (R)	10 (R)	48.7 (I)	–	–	–	–	5
	2010	5 (R)	2 (R)	R	1 (R/RMR)	0 (R)	37.3 (MS)	10.2 (S)	–	–	–	8
	2011	1 (R)	1 (R)	R	1 (MR)	0 (R)	34.7 (MS)	10.5 (S)	2 (VR)	10 (R)	1 (VR)	–
	2012	5 (R)	–	R	2 (R)	23 (MR)	14.0 (I)	9.5 (S)	1 (R)	0 (R)	–	–

[z]Rtn = rating as% infection.
[y]Rxn = reaction type; Reaction types: VR, very resistant; R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.
[x]Checks and AAC Marchwell had 0% leaf rust infection in all 4 yr.
[w]Adult plant, McFadden scale (0 = no symptoms, 11 = severe symptoms) (McFadden 1991).
LB = Lethbridge (LB-1, -2 and -3: three distinct stripe rust nurseries).
GL = Glenlea.

Table 5. Response of AAC Marchwell and check cultivars to fusarium head blight (FHB) grown in the Durum Cooperative Test, 2009–2012 nurseries

		FHB							DON (ppm)	
		Carman		Glenlea		PEI (Indx[y])				
	Year	Indx[y]	Rxn[x]	Indx[y]	Rxn[x]	Early	Late	Ottawa	GL	ISD[z]
AC Avonlea	2009	26	MS	49	S	32	55	–	23.9	19
	2010	65	S	38	S	86	100	98	41.0	20
	2011	–	–	17	MS	55	95	62	4.5	5
	2012	34	I	23	S	60	–	83	11.1	25
AC Morse	2009	34	MS	54	S	47	66	–	36.9	27
	2010	68	S	21	I	75	98	54	38.1	18
	2011	–	–	25	S	54	90	80	10.5	8
	2012	55	MS	24	S	41	–	88	29.5	37
AC Navigator	2009	36	MS	41	S	21	47	–	35.6	25
	2010	59	S	43	S	71	99	90	40.2	20
	2011	–	–	21	S	54	100	83	11.3	8
	2012	66	S	10	I	40	–	85	33.7	33
Commander	2009	29	MS	57	S	38	61	–	27.2	21
	2010	61	S	59	S	82	99	53	52.4	26
	2011	–	–	15	MS	27	88	58	13.6	8
	2012	79	S	26	S	47	–	72	42.6	49
Strongfield	2009	38	MS	59	S	24	40	–	27.3	21
	2010	61	S	44	S	80	91	72	49.0	24
	2011	–	–	15	I	31	80	73	7.7	6
	2012	55	MS	12	I	45	–	90	12.5	22
AAC Marchwell	2009	29	MS	65	S	–	–	–	36.0	19
	2010	58	S	25	I	65	98	72	37.6	18
	2011	–	–	15	I	21	88	57	8.7	6
	2012	53	MS	19	MS	50	–	65	12.4	27

[z]ISD [Incidence, Severity, Deoxynivalenol (DON)] is calculated as (0.3 × AvgIncidence) + (0.3 × AvgSeverity) + (0.4 × DON) for a given entry.
[y]Fusarium head blight index: [(mean percent incidence × mean percent severity)/100].
[x]Rxn = reaction type; Reaction type were: I, intermediate; MS, moderately susceptible; S, susceptible.

resistant to orange wheat blossom midge [*Sitodiplosis modellana* (Gehin)] insect (Table 6) (McKenzie et al. 2002).

AAC Marchwell has low grain cadmium concentration similar to Strongfield (Table 7). Hagberg Falling Number of AAC Marchwell was lower than the checks, while the hard vitreous kernel count was similar to that of AC Navigator and lower than Strongfield. Semolina yield of AAC Marchwell was lower than the checks. AAC Marchwell has good gluten properties, similar to Strongfield. Grain yellow pigment concentration of AAC Marchwell was greater than the checks.

Table 6. Midge scores of AAC Marchwell and checks from 2008 A-test, and 2009–2012 Durum cooperative tests grown in a midge nursery at Glenlea, MB

	Year	Midge rating
AC Navigator	2008	–[z]
	2010	S
	2011	–
	2012	S
Strongfield	2008	S
	2010	S
	2011	–
	2012	S
AAC Marchwell	2008	R
	2010	R
	2011	R
	2012	R

[z]Midge rating not available.

Other Characteristics

SPIKES: Tapering, mid-dense to dense, erect; awned; white awns; glumes mid-wide, mid-long, glabrous.

KERNEL: Colour amber; kernel size medium, elliptical.

GLUME: glabrous, oblique to square shoulder shape, shoulder width narrow, beak shape acuminate.

END-USE SUITABILITY: Eligible for the grades of Canada Western Amber Durum wheat market class.

ORANGE WHEAT BLOSSOM MIDGE: First durum cultivar registered in Canada with antibiosis-based resistance to orange wheat blossom midge.

Maintenance and Distribution of Pedigreed Seed

The 98 breeder lines originate from spikes picked from a space-planted row grown near Swift Current in 2009. Spikes from $F_{4:8}$ plants were picked and planted in 108 (3 m) rows in 2010 near Swift Current, SK. From these, the 101 $F_{4:10}$ rows deemed most uniform were grown in 2012 as paired breeder rows near Indian Head, SK, which led to the 98 most uniform breeder rows of AAC

Table 7. End-use suitability[z,y,x] of AAC Marchwell and check cultivars from 2009, 2011 and 2012 Durum cooperative tests

	FN (s)	Testwt. (kg hL^{-1})	HVK (%)	Cd (mg kg^{-1})	Semoyld (%)	Semoash (%)	Whtprot (%)	Semoprot (%)	GI (%)	P/L	W (ergs)	Semo YP (ppm)	Colour 85C b^*	Colour 85C a^*	Cooked pasta texture Cut force (g)
AC Avonlea	408	82.6	89	0.21	67.4	0.66	13.8	12.9	10	0.48	107	8.66	65.2	5.5	635.0
AC Morse	445	81.3	88	0.17	66.9	0.67	13.3	12.3	49	0.83	170	8.42	63.7	5.5	607.0
AC Navigator	442	82.8	87	0.25	68.2	0.67	13.0	12.0	60	1.02	208	9.64	65.7	7.2	618.0
Commander	452	81.9	87	0.25	67.9	0.64	12.9	12.0	91	1.56	296	9.83	66.6	6.6	604.0
Strongfield	420	82.9	93	0.08	67.1	0.62	13.8	12.7	55	0.69	181	8.92	64.6	5.6	607.5
AAC Marchwell	380	82.4	86	0.07	66.3	0.66	13.6	12.7	52	0.52	154	10.66	68.0	6.8	577.5
Std dev[w]	5			0.001	0.4	0.006	0.06	0.05	3	0.04	6	0.04	0.3	0.1	34

[z]American Association of Cereal Chemists methods were followed by the Grain Research Laboratory (GRL), Canadian Grain Commission (CGC) for determining the various end-use suitability traits on a composite of eight to nine locations each year. 2010 durum cooperative test was not used for end-use suitability traits due to poor seed quality resulting from excessively wet weather.
[y]FN = Hagberg falling number; HVK = hard vitreous kernel; Cd = grain cadmium; Semo yld = semolina yield; Wht prot = wheat protein; GI = gluten index; P/L and W values determined through alveograph; YP = yellow pigment; spectrophotometer colour b^* = yellowness; a^* = redness on the CIE scale.
[x]Means are from 2009, 2011 and 2012 durum composites, except colour (85°) and cooked pasta texture cut force that are mean from 2011 and 2012.
[w]Std. dev. is the standard deviation based on repeated testing of check samples with replicate tests carried out over an extended period of time each season, provided by GRL, CGC.

Marchwell (DT833; A0426-KV04). Breeder seed will be maintained by the Seed Increase Unit, Agriculture and Agri-Food Canada, Indian Head, Saskatchwewan, Canada S0G 2K0. Distribution and multiplication of pedigreed seed stocks will be handled by SeCan, 501-300 March Road, Kanata, Ontario, Canada K2K 2E2.

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