CULTIVAR DESCRIPTION

AAC Innova general purpose spring wheat

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Received 19 January 2015, accepted 2 March 2015. Published on the web 10 March 2015.

Randhawa, H. S. Graf, R. J. and Sadasivaiah, R. S. 2015. **AAC Innova general purpose spring wheat**. Can. J. Plant Sci. **95**: 787–791. AAC Innova is a high-yielding spring wheat cultivar eligible for the Canada Western General Purpose (CWGP) wheat class. Based on 32 site-years of testing over 3 yr in the General Purpose Wheat Cooperative Registration trial (2008–2010), AAC Innova yielded 4% higher than AC Andrew and was 1 d later in maturity. Compared with AC Andrew, AAC Innova had similar test weight and the soft white kernels were slightly larger. AAC Innova was resistant to the prevalent races of leaf rust and was resistant to moderately resistant to stem rust and leaf spotting diseases. It was susceptible to common bunt, loose smut and *Fusarium* head blight.

Key words: *Triticum aestivum* L., cultivar description, general purpose wheat, grain yield, disease resistance

Randhawa, H. S. Graf, R. J. et Sadasivaiah, R. S. 2015. **Le blé de printemps de classe « fins générales » AAC Innova**. Can. J. Plant Sci. **95**: 787–791. AAC Innova est une variété de blé de printemps à haut rendement admissible à la classe « blé à des fins générales de l'Ouest canadien » (CWGP). Après 32 sites-années d'essais répartis sur trois ans lors des essais d'homologation coopératifs pour cette classe (2008–2010), AAC Innova a donné un rendement de 4 % supérieur à celui d'AC Andrew, qui parvenait à maturité un jour plus tôt. Le poids spécifique d'AAC Innova est semblable à celui d'AC Andrew et le cultivar produit des grains tendres blancs légèrement plus gros. AAC Innova résiste aux races courantes de la rouille des feuilles et résiste modérément à la rouille de la tige ainsi qu'à la septoriose. Cette variété est sensible à la carie, au charbon nu et à la brûlure de l'épi causée par *Fusarium*.

Mots clés: *Triticum aestivum* L., description de cultivar, blé à des fins générales, rendement grainier, résistance à la maladie

AAC Innova, (experimental names 07-EB14, GP47) is a high-yielding Canada Western General Purpose (CWGP) spring wheat (*Triticum aestivum* L.) cultivar developed by the Agriculture and Agri-Food Canada (AAFC), Lethbridge Research Centre (LRC), Lethbridge, Alberta and released in 2011. It was granted registration number 7360 by the Variety Registration Office, Canadian Food Inspection Agency on 2013 Apr. 12. An application for Plant Breeders' Rights has been filed. AAC Innova is well adapted to western Canada.

Pedigree and Breeding Methods

AAC Innova was developed from the cross AC Andrew/N9195 (L01164) made in 2001 at the AAFC-LRC in Lethbridge, AB. AC Andrew (Dirkwin/8021-V2//Treasure/Blanca) is a soft white spring wheat cultivar, also developed by AAFC-LRC (Sadasivaiah et al. 2004). N9195 is an experimental line of unknown parentage that had resistance to the prevalent races of leaf, stem and stripe rust.

F_1 plants were increased in a greenhouse in fall 2001. Following selection of F_2 heads from space-planted bulk plots grown in Vauxhall, AB, in 2002, F_3 head rows were grown in a contra-season nursery in Lincoln, New Zealand, in 2002/03. One F_4 line was grown in an initial yield trial in Lethbridge in 2003. Based on superior agronomic characteristics, four heads were selected and grown in Lincoln, New Zealand, in 2003/04. In 2004, an F_6 line was grown in a yield trial in Lethbridge and based on agronomic traits, eight heads were selected and grown in Leeston, New Zealand, in 2004/05. One F_8 line was grown in a preliminary yield trial in Lethbridge in 2005 and was advanced to a multi-location test grown in Lethbridge, Vauxhall, and Bow Island in 2006. In 2007, it was evaluated in an 'Ethanol B' test at six locations in western Canada. Based on favourable agronomic performance and disease resistance, 07-EB14 was evaluated in the General Purpose Wheat Cooperative Registration trial (GP Coop) as GP47 from 2008 to 2010 in which AC Andrew (Canada Western Soft White Spring wheat class) and Unity (Canada Western Red Spring wheat class) (Fox et al. 2010) were used as checks. The trials were conducted at 11 locations per year across western Canada (Alberta: Ellerslie, Lacombe, Lethbridge Irrigated; Saskatchewan: Indian Head, Kernen, Melfort, Regina, Swift Current;

[1]*Deceased.*

Abbreviations: **CWGP**, Canada Western General Purpose; **DON**, deoxynivalenol; **FHB**, *Fusarium* head blight

Table 1. Grain yield (kg ha^{-1}) of AAC Innova (GP47) compared with the check cultivars in the 2008–2010 General Purpose Cooperative test

	Zone 1[z]				Zone 2[z]				Zone 3[z]				Zone 4[z]			Western Canada				
Cultivar	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	Mean[y]	2008	2009	2010	Mean	% of Andrew
AC Andrew	5606	6276	2671	4851	5159	5511	3860	4843	7264	8235	6889	7463	9786	8704	9245	6444	6870	4286	5867	100
Unity	4915	4973	3691	4526	4131	4337	3950	4139	5540	6368	6446	6118	5289	6960	6125	4922	5312	4475	4903	84
AAC Innova	5605	6700	3227	5178	5114	5613	3901	4876	7793	8196	7470	7820	9434	8328	8881	6610	6968	4699	6092	104
No. stations	3	4	4	11	3	3	3	9	4	3	3	10	1	1	2	11	11	10	32	32
$LSD_{0.05}$	674	708	515	525	538	494	561	491	1002	636	994	821	660	1014	720	494	448	481	451	

[z]Zone 1: Brandon, Glenlea, Indian Head, Rosebank; Zone 2: Kernen, Regina, Swift Current; Zone 3: Ellerslie, Lacombe, Melfort; Zone 4: Lethbridge (Irrigated).
[y]Mean is 2008–2009 data only as 2010 data were dropped due to a high CV.

Table 2. Days to maturity of AAC Innova (GP47) compared with the check cultivars in the 2008–2010 General Purpose Cooperative test

	Zone 1				Zone 2				Zone 3				Zone 4				Western Canada			
Cultivar	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	2010[z]	Mean[y]	2008	2009	2010	Mean
AC Andrew	100	110	101	104	106	114	118	112	106	110	117	111	121	124	–	122	105	112	111	109
Unity	98	104	97	100	104	111	115	110	99	101	105	102	119	117	–	118	102	107	105	105
AAC Innova	100	111	102	104	100	113	116	110	105	110	117	111	122	124	–	123	106	113	111	110
No. stations	3	4	4	11	3	3	3	9	4	2	3	9	1	1	–	2	11	10	10	31
$LSD_{0.05}$	2	3	3	2	3	2	3	2	3	5	5	5	1	2	–	2	2	2	3	2

[z]No data for 2010.
[y]Mean is 2008–2009 data only.

Table 3. Other agronomic traits of AAC Innova (GP47) compared with the check cultivars in the 2008–2010 General Purpose Cooperative test

	Height (cm)				Lodging (1–9)				Test weight (kg hL^{-1})				1000-Kernel weight (g)			
Cultivar	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	2010	Mean
AC Andrew	86	87	83	85	2.0	1.7	1.9	1.9	77.8	78.7	72.2	76.2	39.7	38.8	32.2	36.9
Unity	92	96	95	94	3.0	3.2	2.1	2.8	79.8	81.0	77.5	79.5	36.7	38.1	34.0	36.3
AAC Innova	88	89	85	87	3.0	2.0	2.2	2.4	77.0	78.8	72.7	76.2	40.3	39.8	35.7	38.6
No. stations	11	11	11	33	4	6	6	16	11	11	11	33	11	11	11	33
$LSD_{0.05}$	3.0	3.0	3.0	2.0	1.0	1.0	1.0	1.1	1.2	1.3	1.6	1.3	1.8	1.8	2.4	1.8

Manitoba: Brandon, Glenlea, Rosebank). The Glenlea site was lost due to seeding error in 2008. The criteria used for agronomic evaluation included grain yield, maturity, plant height, straw strength, test weight and kernel mass. Analyses of variance were conducted using a combined mixed effects model with years, environments, and their interactions treated as random effects, and cultivar treated as a fixed effect. The least significant difference ($LSD_{0.05}$) test was used to identify significant differences from the check cultivars. Disease reactions were assessed for leaf rust (*Puccinia triticina* Eriks. = *P. recondita* Roberge ex. Desmaz.), stem rust (*Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks. & e. Henn.), *Fusarium* head blight (FHB) {caused by *Fusarium graminearum* Schwabe [telomorph *Gibberella zeae* (Schwein.) Petch]}, common bunt [*Tilletia laevis* Kuhn in Rabenh. and *T. tritici* (Bjerk.) (Bjerk.) R. Wolff], leaf spot (*Pyrenophora tritici-repentis*, *P. nodorum*, *Mycosphaerella graminicola*, and *Cochliobolus sativus*) and for loose smut [*Ustilago tritici* (Pers.) Rostr.].

Artificially inoculated field nurseries were used to determine reactions to leaf rust and stem rust at the AAFC Cereal Research Centre (CRC), Winnipeg, MB, using the modified Cobb scale (Peterson et al. 1948). Seedling infection reactions were determined in a greenhouse for leaf rust races MBDS (12-3), MGBJ (74-2), TJBJ (77-2) TDBG (06-1-1) and MBRJ (128-1) (McCallum and Seto-Goh 2006) and for stem rust races TMRTK (C10), RKQSR (C63), TPMKR (C53) RTHJT (C57), QTHST (C25) and RHTSK (C20) (Roelfs and Martens 1988; Fetch 2005). *Fusarium* head blight tolerance was evaluated at Glenlea and Carman, MB, in field nurseries that were spray inoculated with a macroconidial suspension and rated using a visual index (% incidence × % severity/100) as described by Gilbert and Woods (2006). For leaf spot reactions, disease severity was observed from natural infection in the field at Glenlea, MB, but specific pathogens were not determined. Resistance to loose smut was estimated as described by Menzies et al. (2003). Evaluation of common bunt resistance was conducted at AAFC-LRC using a composite of races L1, L16, T1, T6, T13 and T19, and planting into cold soil (Gaudet and Puchalski 1989; Gaudet et al. 1993).

Performance and Adaptation

AAC Innova is a semi-dwarf spring wheat with an awned spike, hollow stem and soft white grain suitable for the CWGP wheat class. Based on 32 site-years of evaluation over 3 yr (2008–2010) in the GP Coop, AAC Innova yielded 6092 kg ha^{-1}, as compared with 5867 kg ha^{-1} for AC Andrew and 4903 kg ha^{-1} for Unity. Across western Canada, AAC Innova yielded 4% more than AC Andrew ($P \geq 0.05$) and 24% more than Unity ($P \leq 0.05$) (Table 1). On a regional basis, AAC Innova out-yielded AC Andrew by 7% in zone 1, 1% in zone 2, 5% in zone 3, but was 4% lower in irrigated zone 4. Overall, AAC Innova matured in 110 d ($P \geq 0.05$) as compared with 109 d for AC Andrew and 105 d for Unity ($P \leq 0.05$). AAC Innova was similar in maturity to AC Andrew in zones 1 and 3 but 2 d earlier in zone 2 and 1 d later in zone 4 (Table 2). AAC Innova was 2 cm taller ($P \geq 0.05$) than AC Andrew (Table 3). AAC Innova had good straw strength, exhibiting a slightly higher lodging score of 2.4 ($P \geq 0.05$) as compared with 1.9 for AC Andrew. The test weight of AAC Innova was equal to AC Andrew (76.2 kg hL^{-1}) and the 1000-kernel mass was slightly greater than that of AC Andrew (Table 3).

In 3 yr of disease resistance testing in the GP Coop (Table 4a, b), AAC Innova showed resistance to the prevalent races of leaf rust and was resistant to moderately resistant to stem rust and leaf spotting diseases. AAC Innova was susceptible to common bunt, loose smut and *Fusarium* head blight. Overall, AAC Innova

Table 4a. Disease reactions[z] of AAC Innova (GP47) and check cultivars based on data from 2008–2010 General Purpose Cooperative test

	Leaf rust			Stem rust			Leaf spots		
Cultivar	2008	2009	2010	2008	2009	2010	2008	2009	2010
AC Andrew	33 I	13.3 MR	32.5 I	5 R	1 R	10 RMR	3 R	19 R	36 MS
Unity	1.7 R	2.5 R	0 R	10 RMR	7 R	20 MR	3 R	25 MR	22 MR
AAC Innova	0 R	2.5 R	0 R	10 RMR	1 R	15 MR	2 R	19 R	22 MR

[z]Disease rating: R = resistant, RMR = resistant/moderately resistant, MR = moderately, resistant, I = intermediate in reaction, MS = moderately susceptible, S = susceptible.

Table 4b. Disease reactions of AAC Innova (GP47) and check cultivars based on data from 2008–2010 General Purpose Cooperative test

	Loose smut			Common bunt			FHB index (Glenlea)			FHB index (Carman)			FHB-DON (Glenlea)		
Cultivar	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
AC Andrew	59 MS	100 S	67 MS	27 I	31 I	22 MS	31 S	36 MS	64 S	56 S	21 MS	45 S	18.3	21.5	25.4
Unity	11 R	30 MR	54 I	1 VR	0 R	2 R/MR	4 MR	12 MR	15 MR	20 I	7 MR	20 I	4.1	10.4	12.0
AAC Innova	4 R	89 S	60 MS	44 S	21 I	25 MS	7 MR	34 MS	51 S	54 S	46 S	73 S	11.0	20.5	25.9

had better leaf rust resistance than AC Andrew but was otherwise similar to it for other disease resistance characteristics. AAC Innova is eligible for grades of Canada Western General Purpose Wheat class.

Other Characteristics

Plant characteristics were recorded from experimental field plots grown in 2012 at Lethbridge, AB.

Seedling characteristics

Coleoptile colour: Anthocyanin colouration absent.
Juvenile growth habit: Erect.
Seedling leaves: Dark green leaves, glabrous leaf sheaths and blades of lower leaves.
Tillering capacity (at low densities): High.

Adult plant characteristics

Growth habit: Erect.
Flag leaf: Long and wide, slightly curved, dark green with glabrous sheath and blade; weak auricle colouration, with glabrous margins, slightly curved flag leaf.
Flag leaf attitude: Drooping.
Culm: Hollow with thin walls, glabrous, upper internode straight with weak waxiness.

Spike characteristics

Shape: Tapering.
Length: Long, similar to AC Andrew.
Density: Dense.
Attitude: Erect.
Rachis: Slightly pubescent.
Colour: White at maturity.
Awns: Awned.

Spikelet characteristics.

Glumes: Medium length and wide; lower glume is glabrous; glume shoulders are oblique; wide lower glume shoulder; glume beak is acuminate and of medium length, internal imprint of lower glume is absent. Glumes are white in colour at maturity.

Kernel characteristics.

Type: Soft, white in colour.
Shape: Oval shape with rounded angular cheeks.
Size: Medium length and width.
Brush: Medium-sized with medium long brush hairs.
Embryo: Round and medium sized.

Maintenance and Distribution of Pedigreed Seed

Breeder seed development of AAC Innova was initiated in 2011 by planting random head selections taken from a rogued F_8-derived F_{12} increase plot grown in Lethbridge. In 2011/2012, 105 pre-breeder seed lines were harvested from 120 head-rows that were grown near Lincoln, New Zealand. One hundred lines were subsequently replanted at the AAFC Seed Increase Unit at Indian Head, SK. Following the elimination of variant and off type rows in summer 2012, the remaining 76 F_{14} lines were inspected by the Canadian Food Inspection Agency in cooperation with the Canadian Seed Growers' Association and harvested in bulk. The breeder seed of AAC Innova will be maintained by the Indian Head Research Farm, AAFC, Indian Head, Saskatchewan, Canada S0G 2K0. Multiplication and distribution of the pedigreed seed will be handled by Alliance Seed Corporation, 24th Floor, 333 Main Street, Winnipeg, Manitoba, Canada R3C 4E2.

Financial support from the producer supported Western Grains Research Foundation check-off on wheat and the Alberta Crop Industry Development Fund is gratefully acknowledged. Appreciation is expressed to the following: A. Brûlé-Babel (University of Manitoba) and J. Gilbert (AAFC-CRC, Winnipeg) for assessing reaction to *Fusarium* head blight; J.G. Menzies (AAFC-CRC, Winnipeg) for determining reaction to loose smut; T. Fetch and B. McCallum (AAFC-CRC, Winnipeg) for assessing reactions to stem and leaf rust; D.A Gaudet and T. Despins (AAFC-LRC, Lethbridge) for assessing reaction to common bunt; D. Gehl, (AAFC Seed Increase Unit, Indian Head) for production of Breeder Seed; M. Virginillo and K. Ryan (AAFC-LRC, Lethbridge) for their expert technical assistance in conducting and analyzing field trials.

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