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Cultivar description

AAC Sorel barley

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Abstract

"AAC Sorel" is a spring, two-row, general-purpose barley (*Hordeum vulgare* L.) released by the Ottawa Research and Development Centre, Agriculture and Agri-Food Canada. AAC Sorel is similar in yield to the check cultivars with very good lodging resistance and moderately susceptible to Fusarium head blight (caused by *Fusarium graminearum* Schwabe). AAC Sorel is recommended for barley growing areas in eastern Canada.

Key words: cultivar description, *Hordeum vulgare* L., general-purpose barley, test weight

Résumé

AAC Sorel est une variété d'orge de printemps à deux rangs (*Hordeum vulgare* L.) d'utilité générale créée au centre de recherche et de développement d'Agriculture et Agroalimentaire Canada, à Ottawa. AAC Sorel donne un rendement similaire à celui des variétés témoins. Le cultivar se caractérise par une excellente résistance à la verse et est modérément sensible à la brûlure de l'épi causée par *Fusarium graminearum* Schwabe. La variété AAC Sorel est recommandée pour les régions de l'est du Canada où on cultive l'orge. [Traduit par la Rédaction]

Mots-clés : description de cultivar, *Hordeum vulgare* L., orge d'utilité général,e poids spécifique,

Introduction

AAC Sorel is a high-yielding barley (*Hordeum vulgare* L.) cultivar with very good lodging resistance. It was developed at the Ottawa Research and Development Centre, Agriculture and Agri-Food Canada (AAFC), Ottawa, ON. AAC Sorel was evaluated as CH1009-1 in the Quebec Two-Row Barley Registration and Recommendation Tests. CH1009-1 received support for registration from the Quebec Recommending Committee for Cereal in February 2021 and was subsequently registered in Canada by the Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency, Ottawa, ON on 30 June 2022 (Registration No. 9653) with the name AAC Sorel.

Pedigree and breeding methods

The cross leading to AAC Sorel was made in the fall of 2009 between AC Legend and AC Parkhill. AC Legend (Ho et al. 2000*b*) is a six-row barley cultivar with high yield and good resistance to scald. AC Parkhill (Ho et al. 2000*a*) is a two-row barley cultivar that was developed by Ottawa Research and Development Centre in 1998. AC Parkhill had high yield and good resistance to powdery mildew. The rationale for the six-row/two-row cross was to identify a two-row cultivar with high yield and stiffness of straw for lodging resistance.

The population was advanced using a bulk breeding method. The F_1–F_4 bulks were grown at Harrington, PEI, from 2010–2013. In 2013, eighty-two spikes were selected for head type from the F_4; the $F_{4:5}$ generation was planted as in a single row at Harrington, PEI, in 2014, and four $F_{4:6}$ lines were selected from single row based on head type, lodging resistance, and plant height. One of four lines was advanced into preliminary yield trials and grown in a randomized complete block design (RCBD) in three replicates with five-row plots 4 m in length spaced 15.6 cm apart at Harrington, PEI, in 2016. AAC Sorel was advanced into the Maritime two-row barley screening trials in 2017. The advanced trials were grown as yield plots in an RCBD with four replicates at Harrington (PE), Truro (NS), Beloeil (QC), Ottawa (ON), and Brandon (MB). Selection criteria included grain yield, plant height, lodging resistance, and days to maturity.

AAC Sorel was entered into the Quebec Two-Row Barley Registration and Recommendation Trial from 2018–2020. The trial was grown at eight locations, Zone 1 that included St-Hugues (clay soil) and N-D-de-St-Hyacinthe (clay soil), Zone 2 that included Princeville (sandy loam soil) and St-Agustin (sandy loam soil), and Zone 3 that included St-Bruno (clay soil), Normandin (clay), La Pocatière (clay), and Causapscal (loam soil), representing three cereal production zones in Quebec. The criteria used for evaluation included

Table 1. Grain yield (kg ha^{-1}) of AAC Sorel compared with the check cultivars in the Quebec Two-Row barley Registration and Recommendation Test, 2018 to 2020*.

	Grain yield (kg ha^{-1})			
Cultivar	2018	2019	2020	Mean (2018–2020)
Island	5196	5641	4081	4972
Selena	5153	5772	4061	4995
AAC Sorel	**4781**	**6074**	**3733**	**4862**
$LSD_{0.05}$	400	243	482	
No. of replicates	24	24	12	

*Lines were evaluated at St-Hugues, N-D-de-St-Hyacinthe, Princeville, St-Agustin, Hébertville, Normandin, La Pocatière, and Causapscal.

grain yield, plant height, resistance to lodging, and days to maturity and were tested under the guidelines set by the Quebec Recommending Committee for Crops. The two-row barley cultivars Selena and Island (Choo et al. 2003) were used as agronomic checks. Analyses of variance were conducted using a mixed-effect model with locations and their interactions treated as random effects, and cultivars were treated as fixed effects in SAS version 9.4 (SAS Institute 2003).

AAC Sorel along with checks was evaluated in artificial-disease nurseries for reactions to net form of net blotch (*Pyrenophora teres f. teres*) isolates WRS102 and WRS858 and spot blotch (*Cochliobolus sativus* (Ito & Kuribayashi) Drechs., ex Dastur [asexual state *Bipolaris sorokiniana* (Sacc.) Shoemaker]) isolate WRS 857 in seedling at Morden Research and Development Centre, AAFC, in 2017 and 2018. Similarly, AAC Sorel was also evaluated against spot blotch in seedling test at Brandon Research and Development Centre, AAFC, in 2017 and 2018. Fusarium head blight resistance was evaluated based on deoxynivalenol (DON) concentration of the grain. AAC Sorel was grown at eight site-years in three years using grain spawn method in Ste-Foy, Beloeil, and Normandin in Quebec. Analyses for DON concentration were done at the Mycotoxin Research Laboratory, Ottawa Research and Development Centre, AAFC, using a 30 g seed subsample from each plot. Samples were ground to a fine powder in a Retsch Ultra-Centrifugal Mill Type ZM-1 (Brinkman Instruments Inc., Rexdale, ON) with a 0.75 mm wire mesh. A ground sample of 1.00 g was used for DON analysis. The concentration of DON was determined by the competitive direct enzyme-linked immunosorbent assay procedure using monoclonal antibodies as described by Sinha et al. (1995).

Performance

Based on data from 24 location-years evaluated over 3 years in the Quebec Two-Row Barley Registration and Recommendation Trials (2018–2020), AAC Sorel had similar grain yield compared to Selena and Island (Table 1).

AAC Sorel had significantly higher 1000 kernel weight compared to Selena and Island. AAC Sorel matured 4 days later than both checks, and its plant height was 9 and 3 cm taller than Selena and Island, respectively. AAC Sorel was taller than both checks but better in lodging resistance compared to the checks (Table 2).

Other characteristics

Plant: Erect juvenile growth; white long coleoptile; dark green leaves; short and narrow upright flag leaf attitude; purple auricles; thin thickness and medium green stems; 0–3 cm stem exertion; V-shaped collar; straight neck.

Spike: Two-row type, parallel shape, lax density, long; long rough lemma awns; long (longer than the length of the glume) and rough glume awns; green lemma awn tip; green glume awn tip.

Kernel: Covered (hulled), 9 mm length, 3–4 mm width; long rachilla; short rachilla hairs; yellow aleurone; horseshoe basal marking.

Quality: General Purpose (GP), Non-malting.

Disease Reactions: In artificial inoculation tests, AAC Sorel showed MR-MS reactions to net blotch isolates WRS102 and MBV25 and showed MS reaction to net blotch isolate WRS858. AAC Sorel showed S-MS reaction to scald isolate WRS2275. AAC Sorel had susceptible reaction to spot blotch in both seedling and adult plant stages (Table 3). Under natural infection in the Quebec Two-Row Registration and Recommendation Trials from 2018 to 2020, AAC Sorel had superior foliar and leaf rust resistances than the checks (Table 4). AAC Sorel showed moderately susceptible reaction in artificial inoculation tests with *Fusarium* spp. with low in-deoxynivalenol accumulation across eight sites over three years (Table 5).

Maintenance and distribution of pedigreed seed

Breeder seed is maintained by the Ottawa Research and Development Centre, Ottawa, ON K1A 0C6. An application for Plant Breeders' Rights of AAC Sorel was accepted by the Plant Breeders' Rights Office, Canadian Food Inspection Agency on xx xx xx with application number xx. In 2020, AAC Sorel was planted in the greenhouse at the Ottawa Research and Development Centre, AAFC, for purification and multiplication of seed. In total, 154 breeder lines were bulked, and this F_{10} seed formed the first breeder seed. Small amounts of seeds (5 g) are available for research purposes and can be requested from the corresponding author. It is requested that appropriate recognition of source be given when this cultivar contributes to development of new germplasm or cultivars. AAC Sorel has been released on an exclusive basis for seed

Table 2. Agronomic characteristics of AAC Sorel and the check cultivars in the Quebec Two-Row Barley Registration and Recommendation Test during 2018–2020*.

Cultivar	Maturity (d) 2018–2020	Height (cm) 2018–2020	Lodging (1–9) 2018–2020	Test weight (kg hL^{-1}) 2018–2020	1000 Kernel weight (g) 2018–2020
Island	81.6	70	1.1	67.6	48.1
Selena	82.1	62	1	67.8	48
AAC Sorel	**86**	**73**	**0.7**	**66.3**	**56.6**
Number of trials	20	20	20	20	20

*Data were collected from St-Hugues, N-D-de-St-Hyacinthe, Princeville, St-Agustin, Hébertville, Normandin, La Pocatière, and Causapscal.

Table 3. Disease reactions of AAC Sorel and check cultivars Island and Leader against net blotch, scald, and spot blotch, according to the Morden Research and Development Centre, AAFC, in 2018 and 2019.

Cultivar	Net blotch 102[a]	Net blotch 858[a]	Net blotch MBV25[b]	Scald 2275[c]	Spot blotch 1903[d]	Spot blotch[e]
Island	4	6.5	2.5	S-MS	6	4
Leader	3	6.5	3.5	S-MS	6.5	6
AAC Sorel	**4**	**5.5**	**3**	**S-MS**	**6.5**	**5**
No. of tests	2	2	2	2	2	2

[a]*Pyrenophora teres* net-form isolates WRS102 and WRS858.
[b]*Pyrenophora teres* spot-form isolate MBV25.
[c]*Rhynchosporium secalis* isolate WRS2275; reaction categories: 10representsVS, 9 represents S, 7 represents MS, 5 represents MR-MS, 3 represents MR, and 1represents R.
[d]*Cochliobolus sativus* isolate WRS1903 at seedling stages (0–9 scale; 0 represents no visible lesions, 4 represents small, and 9 represents very large lesions).
[e]Reactions at adult stages, conducted by James Tucker at the Brandon Research and Development Centre in 2018 and 2019 (0–9 scale; 1 represents no visible lesions, and 9 represents many large legions).

Table 4. Disease ratings for AAC Sorel and check cultivars, according to the Quebec Two-Row Barley Registration and Recommendation Test during 2018–2020.

Cultivar	Foliar diseases[a] (0–9)[b] 2018	2019	2020	Leaf rust (0–9)[b] 2018	2019	2020
AAC Sorel	**4.7**	**4.3**	**3.9**	**Not present**	**0.3**	**Not present**
Island	5.6	5.1	4.1	Not present	0.8	Not present
Selena	5.6	5.4	4	Not present	0.0	Not present
Average of trials	5.3	4.9			0.7	
No. of tests	8	8	4		1	

[a]Natural mixtures of net blotch, spot blotch, and scald.
[b]Visual disease ratings determined for yield plots, where 0representsno disease and 9 represents severe disease.

Table 5. Deoxynivalenol concentration (mg kg^{-1}) for AAC Sorel and check cultivars across eight sites in three years in artificial inoculation tests in Quebec.

Cultivar	2018 Beloeil	2018 St-Foy	2018 Normandin	2019 Beloeil	2019 St-Foy	2019 Normandin	2020 Beloeil	2020 St-Foy	Mean
Angus (MS)	0.45	43.9	1.6	4.8	66.1	5.3	10.0	39.8	21.5
Océanik (MS)	0.32	45.9	1.6	5.9	66.7	8.6	4.5	36.0	21.2
Alyssa (MS/S)	0.4	52.2	2.9	5.8	46.6	11.2	5.4	39.7	20.5
Chapais (S)	1.26	51	3.2	28.3	84.1	8.3	8.6	73.9	32.3
AC Klinck (S)	1.14	58.1	2.9	11.9	70.4	10.8	8.3	65.0	28.6
Viviane (HS)	2.75	76.2	3.9	13.3	90.0	14.8	9.9	93.3	38.0
AAC Sorel	**0.65**	**37.7**	**1.2**	**4.5**	**68.2**	**6.0**	**7.5**	**37.3**	**20.4**
$LSD_{0.05}$	0.92	19	1	5.9	21.1	4.8	6.8	14	

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Primary data is available from the corresponding author on request.

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Thin Meiw Choo is retired.

Competing interests
The authors declare there are no competing interests.

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