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CULTIVAR DESCRIPTION

AAC Reid oat

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Abstract: AAC Reid is a white-hulled, covered spring oat (*Avena sativa* L.) cultivar developed by the Ottawa Research and Development Center, Agriculture and Agri-Food Canada. It is highly resistant to crown rust (*Puccinia coronata* f. sp. *avenae*) and demonstrated superior levels of grain yield, test weight, kernel weight, lodging resistance, β-glucan, and groat content in the crown rust-prone regions (Areas 2 and 3) of Ontario from 2016 to 2021.

Key words: oat, *Avena sativa* L., yield, β-glucan, crown rust.

Résumé : AAC Reid est une variété d'avoine de printemps (*Avena sativa* L.) blanche vêtue, créée au centre de recherche et de développement d'Agriculture et Agroalimentaire Canada d'Ottawa. La variété résiste fortement à la rouille couronnée (*Puccinia coronata* f. sp. *avenae*) et a affiché un rendement grainier, un poids spécifique, un poids d'amande, une résistance à la verse, une teneur en β-glucane et une teneur en gruau plus élevés dans les parties de l'Ontario où sévit la rouille couronnée (régions 2 et 3) de 2016 à 2021. [Traduit par la Rédaction]

Mots-clés : avoine, *Avena sativa* L., rendement, β-glucane, rouille couronnée.

Introduction

AAC Reid, tested under the code OA1444-4, is a white-hulled, covered spring oat (*Avena sativa* L.) cultivar developed by the Ottawa Research and Development Center (ORDC), Agriculture and Agri-Food Canada (AAFC). It was supported for full registration by the Ontario Cereal Crops Committee (OCCC) in January 2019 and granted registration by Canadian Food Inspection Agency (CFIA) in November 2020, with the registration number 9126. This article documents its breeding history, performance, and morphological characteristics.

Breeding History

AAC Reid was developed from the cross 10W06 (SA04213/OA1271-3), made in November 2010 at ORDC. SA04213, registered as Hidalgo, was a University of Saskatchewan line that was tested and registered in eastern Canada by Phytogene Inc.; it has high groat content and β-glucan content. OA1271-3 was an ORDC line, which demonstrated high yield, high β-glucan, and superior resistance to crown rust and other leaf diseases in the ORDC Registration trials during 2017–2019. However, this line was low in groat content and showed poor grain setting under some winter time greenhouse conditions. It was supported for registration by OCCC in 2010 but subsequent registration was not pursued. The cross 10W06 was increased to F_3 in a greenhouse at Ottawa. A total of 164 F_4 individuals were grown in the hill plot nursery in 2012 at Ottawa, and 75 were visually selected for plant and grain characteristics. Selected

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Table 1. Grain yield from the 2016–2018 ORDC Registration trials.

	All trials		Trials in ME1		Trials in ME2 + ME3	
Variety	kg ka^{-1}	% of AAC Bullet	kg ka^{-1}	% of AAC Bullet	kg ka^{-1}	% of AAC Bullet
AAC Reid	4987	106	3819	120	5765	101
AAC Bullet (CK)	4701	100	3194	100	5706	100
AAC Nicolas (CK)	4981	106	3342	105	6074	107
Number of trials	30		12		18	
LSD (P = 0.05)	150		283		157	

Note: The trials in mega-environment 1 (ME1) were conducted at Dundalk in 2016, Elora in 2017 and 2018, Heckston in 2016 to 2018, Ottawa in 2016 to 2018, and Palmerston in 2016 to 2018. The trials in MEs 2 and 3 were conducted at Brandon (MB) in 2016–2018, Lacombe (AB) 2016 to 2018, La Poctiere (QC) in 2016, New Liskeard (ON) 2016 to 2018, Normandin (QC) in 2016 to 2018, Harrington (PE) in 2016 to 2018, and Princeville (QC) in 2016 and 2017. CK, check.

lines were grown in four-row plots in the 2013 observation nursery, and six lines were visually selected for canopy, plant, and grain characteristics. Selected lines were advanced to the 2014 Home Test, which was conducted at four locations (Ottawa ON, New Liskeard ON, Normandin QC, and Harrington PE) with two replicates. All six lines, designated as OA1444-1 to OA14444-6, respectively, were advanced to the 2015 Preliminary/ENCORE Test, which were conducted at 10 locations (Brandon MB, Fargo ND, Lacombe AB, New Liskeard ON, Normandin QC, Ottawa ON, Palmerston ON, Harrington PE, Princeville QC, and Saskatoon SK), with two or three replicates depending on the location. OA1444-2, OA1444-4, and OA1444-5 were advanced to the ORDC Registration Test in 2016, which was conducted at 10 locations across Canada (see Table 1 for the list of locations). OA1444-4 and OA1444-5 were further tested in 2017 and 2018. OA1444-4 demonstrated superior yield, grain and milling quality, and resistance to crown rust, and was supported for registration by the OCCC in January 2019. It was granted registration as AAC Reid by the Canadian Food Inspection Agency (CFIA) in November 2020, with the registration number 9126.

Yield performance

The grain yield performance of AAC Reid in the 2016–2018 ORDC Registration trials is summarized by mega-environments (MEs) in Table 1, with AAC Bullet (Yan et al. 2017) and AAC Nicolas (Yan et al. 2016) as check cultivars. The oat growing regions in Canada consist of three MEs (Yan et al. 2021). ME1 consists of Areas 2 and 3 of Ontario, characterized by relatively low latitude and heavy crown rust pressures. ME2 consists of northern Ontario, Quebec, and the Maritimes, and ME3 consists of the Canadian prairies. Currently, AAC Bullet is the dominant oat cultivar in ME1 and AAC Nicolas is one of the most popular cultivars in ME2.

When viewed across all trials covering all three MEs, AAC Reid yielded higher than AAC Bullet but not higher than AAC Nicolas; however, it yielded 14% higher than AAC Nicolas and 20% higher than AAC Bullet in ME1 (Table 1). AAC Reid yielded lower than AAC Nicolas in other regions. Thus, it is an oat cultivar specifically adapted to ME1.

AAC Reid continued to perform well in the OCCC performance trials after registration. From 2019 to 2021, it yielded 25.6% higher than AAC Bullet in Area 2 of Ontario when no fungicide was applied; however, it yielded only 3.5% higher when a fungicide was applied, because the yield of AAC Bullet was significantly increased by fungicide application (Table 2). This suggests that the yield advantage of AAC Reid over AAC Bullet was mainly due to its superior resistance to crown rust and possibly other fungal diseases. Two sprays of a fungicide is a common practice for a profitable oat production using AAC Bullet in Area 2 of Ontario (Martin Quentin, personal communication, Crebit Seeds, 2018)

Agronomic traits and crown rust resistance

AAC Reid had similar days to maturity to that of AAC Bullet and AAC Nicolas. It was taller than both checks but was not more susceptible to lodging, which may be related to its superior resistance to crown rust (Table 3). Between the two parents of AAC Reid, SA04213 is highly susceptible to crown rust. Thus, the crown rust resistance of AAC Reid must be from OA1271-3. The parentage of OA1271-3 was TAMO-312/07085-15-5-3//Coker 234/07085-15-5-3. TAMO-312 was known to carry *Pc59* and Coker 234 was known to carry *Pc61* (Simons et al. 1978). In addition, the line 07085-15-5-3 has a parent carrying *Pc62*. Thus, OA1271-3 and, therefore, AAC Reid may carry one or more of the crown rust resistance genes *Pc59*, *Pc61*, and *Pc62*. Menzies et al. (2019) reported that *Pc59* was highly effective and *Pc62* moderately effective against crown rust in eastern Canada as of 2015. Brouwer (1983) reported *Pc59* resistance being conditioned by three unlinked genes.

Grain and compositional quality

Across the 2016–2018 ORDC Registration Trials, AAC Reid showed slightly lower test weight and kernel weight than AAC Bullet (Table 4); however, it had much higher test weight and kernel weight than AAC Bullet under severe crown rust pressures (data not presented). Importantly, AAC Reid showed significantly higher

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Table 2. Yield index (% of trial mean) of AAC Reid and AAC Bullet with and without fungicide application in Area 2 of Ontario.

	2019–2021		2020–2021		2021	
Variety	No fungicide	With fungicide	No fungicide	With fungicide	No fungicide	With fungicide
AAC Reid	113	117	115	116	107	110
AAC Bullet (CK)	90	113	94	115	80	109
AAC Reid as % of AAC Bullet	125.6	103.5	122.3	100.9	133.8	100.9
Trial mean (t ha^{-1})	3.86	4.54	3.71	4.29	4.01	4.88
Number of trials	6		4		2	

Note: Data source: Ontario Cereal Crops Committee 2021 Spring Cereals Report. CK, check.

Table 3. Data of agronomic traits from the 2016 to 2018 ORDC Registration trials.

Variety	Days to heading	Days to maturity	Plant height (cm)	Lodging (0–9)	Crown rust (0–9)
AAC Reid	60	91	99	1.1	0.7
AAC Bullet (CK)	59	92	90	1.4	3.7
AAC Nicolas (CK)	63	91	94	1.4	4.6
Number of trials	13	13	28	12	6
LSD (P = 0.05)	1	1	2	0.6	1.7

Note: CK, check; LSD, least significant difference.

Table 4. Grain and compositional quality from the 2016 to 2018 ORDC Registration trials.

Variety	β-glucan (%)	Groat (%)	Oil (%)	Protein (%)	Test weight (kg hl^{-1})	1000-kernel weight (g)
AAC Reid	4.6	75.0	7.5	15.2	51.3	37.4
AAC Bullet (CK)	4.1	72.0	7.0	14.3	52.7	38.9
AAC Nicolas (CK)	4.4	73.0	6.2	14.3	49.4	34.7
Number of trials	19	19	19	19	27	26
LSD (P = 0.05)	0.1	0.8	0.1	0.4	1.5	1.2

Note: CK, check; LSD, least significant difference.

levels of β-glucan, groat, and protein than both check cultivars (Table 4), making it a superior milling oat. AAC Reid had higher oil content than the check cultivars (Table 4), but the oil level is within the limit for milling oat (<8.5%).

Morphological characteristics

Coleoptile color: green
Seedling growth habit: semi-erect

Leaf characteristics

Leaf blade pubescence: absent to very sparse
Leaf sheath pubescence: absent to very sparse
Leaf color: medium green
Leaf margin pubescence: absent to very sparse
Frequency of plants with curved flag leaves: medium
Flag leaf length: long
Flag leaf width: medium to narrow

Panicle characteristics

Panicle orientation of branches: equilateral (symmetrical)
Panicle density: medium
Panicle attitude of branch position: erect
Side branch angle: less than 30 degrees

Rachilla characteristics

Rachilla length between primary and secondary florets: long
Rachilla pubescence: absent to very sparse
Length of grooves: absent to very short

Spikelet characteristics

Spikelet separation: fracture
Spikelet attitude: semi-nodding
Glum length: medium to long
Number of grains per spikelet: two

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Lemma characteristics

Lemma color at maturity: white to cream
Lemma pubescence: sparse
Lemma waxiness: weak
Lemmas tendency to be awned: infrequent
Lemma overlap: medium

Kernel characteristics

Seed length: long
Groat color: cream
Kernel basal hair presence: present
Kernel basal hair length: short
Groat pubescence: medium
Scutellum shape: pointed
Scutellum size: medium

Seed stock and maintenance

AAC Reid is licensed to SeCan Inc. and the Breeder Seed is maintained at the Seed Increase Unit of AAFC at Indian Head, SK, Canada.

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