## OAC Ramsay Soybean

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CULTIVAR DESCRIPTION

OAC Ramsay Soybean

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Abstract: OAC Ramsay is an indeterminate large-seeded food-grade soybean (Glycine max [L.] Merr.) cultivar with high yield potential, high seed protein and oil concentrations, and resistance to soybean cyst nematode (SCN). OAC Ramsay is developed and recommended for soybean growing areas in southwestern Ontario with 3050 or greater crop heat units, and has a relative maturity of 2.2 (MG 2.2).

Key words: Soybean [Glycine max (L.) Merr.], cultivar description, large-seeded, food-grade, SCN-resistant

OAC Ramsay is a large-seeded food-grade soybean with excellent yield potential, lodging resistance, with high protein and oil concentrations, and resistance to soybean cyst nematode (SCN). OAC Ramsay was developed at the University of Guelph, Ridgetown Campus, Ridgetown, ON, Canada, and it is intended and recommended for soybean growing areas with 3050 or more Crop Heat Unit (CHU). Certificate of Eligibility for Certification as food-grade soybean no. 1984-2017 was issued for SC 3313N (OAC Ramsay) by the Canadian Seed Growers’ Association on October 26th, 2017.
Pedigree and Breeding Methods

OAC Ramsay is an $F_4$-derived indeterminate soybean cultivar developed from the SC Starfield × SC2307 cross. The cross was made in an indoor growth room at the University of Guelph, Guelph Campus, in 2008. SC Starfield (pedigree: IA 1008 × Ln 955414) is an SCN-resistant food-grade soybean cultivar with a relative maturity (MG) of 2.8 [US Maturity Group Classification (Johnson 1987)] that was developed at the University of Guelph, Ridgetown Campus. SC 2307 (pedigree: Pro30-05 × OAC Kent) is an experimental soybean genotype with high seed protein concentration and large seed size adapted to MG 2.2. SC 2307 was also developed at the University of Guelph, Ridgetown Campus.

The $F_1$ seeds from the cross between SC Starfield and SC 2307 were grown in a growth room at the University of Guelph, Guelph Campus, to the first trifoliolate leaf stage when it was transplanted to an $F_1$ nursery field at Ridgetown Campus in 2008. The $F_2$ and $F_3$ populations were advanced using a modified single-seed descent method, in which one pod was harvested from each plant and the seeds were saved for replanting and establishing the next generations in a winter nursery in Costa Rica during winter 2008 and spring 2009. The $F_4$ generation seeds were space-planted in an $F_4$ nursery at Ridgetown in 2009 and single plants were selected and harvested on the basis of maturity date and excellent visual agronomic performance to establish $F_{4:5}$ lines. These lines were grown in 4-meter single rows at Ridgetown, in 2010, and selected for desirable agronomic characteristics as well as lodging resistance, plant height, and bottom pod height. A selection intensity of approximately 25% was applied to select the genotypes with the best performance among the $F_{4:5}$ lines. The soybean genotype SC 3313N was formed by bulking the seeds of a single $F_{4:6}$ rows that were grown at Ridgetown in 2010. The genotype was evaluated for yield and important agronomic traits as well as desirable seed quality traits,
including seed size and oil and protein concentrations, in preliminary yield trials at two locations (Inwood and Ridgetown) in 2011. SC 3313N was subsequently entered into advanced yield trials at three locations (Inwood, Ridgetown, and Palmyra) for two more years evaluation prior to its entry into Early Maturity Group 2 (EMG 2) of the Ontario Soybean Trials (OSTs) in 2014.

In order to produce Pre-Breeder seeds, seeds of individual $F_{4:8}$ plants were evaluated for uniformity of morphological traits and 43 uniform plants were selected and grown in separate rows for further purification from any off types in 2013. Breeder seed was produced by bulking seeds of 23 uniform plots of $F_{4:9}$ plants in 2014.

Performance

OAC Ramsay was entered as SC 3313N into the 3100 CHU (EMG 2) test locations of OSTs conducted by Ontario Soybean and Canola Committee (OSACC) in 2014. The agronomic and seed quality traits were evaluated over 9 location-years on clay (Inwood, Palmyra and Talbotvill) and 3 location-years on loam (Ridgetown) soil types for three consecutive years - 2015 to 2017. The experimental designs were randomized complete block designs with three replications per location. Test locations with coefficients of variation (CVs) lower than 15% were considered as valid tests and their data were used for statistical analyses. The field plots were evaluated and rated for seed yield and quality traits as well as plant height, lodging resistance, and maturity date. Seed yield was measured as kilogram per hectare ($kg \text{ ha}^{-1}$) and was adjusted to 130 g kg$^{-1}$ moisture. Seed size was determined by weighing 100 seed samples from each entry. Plant height, as the average distances from the soil surface to the apex of the main stem, was measured at maturity. Lodging was visually scored at maturity for all plots on a scale of 1 (all plants standing erect) to 5 (all plants prostrate). Maturity date was determined as the number of days...
from planting to the R8 growth stage, at which approximately 95% of the plots had reached mature pod colour (Fehr et al., 1971). Seed protein and oil concentrations were measured as gram per kilogram (g kg\(^{-1}\)) on a dry weight basis using an Infratec near-infrared spectroscopy (NIR) analyzer (Infratec 1241 Grain Analyser, Foss Inc., Eden Prairie, MN).

OAC Ramsay is classified as a 3050-CHU (MG 2.2) cultivar adapted to southwestern Ontario. Across 36 environments of the EMG 2 OSTs during 2015 to 2017, the average yield for OAC Ramsay was 3965 kg ha\(^{-1}\) (Table 1). There is no significant (P<0.05) difference detected between yield performance of OAC Ramsay and DF-155 (4141 kg ha\(^{-1}\)) or AAC 26-15 (3877 kg ha\(^{-1}\)); however, it was significantly (P<0.05) lower than OAC Brooke (Eskandari et al. 2017a) which had an average yield production of 4249 kg ha\(^{-1}\) (Table 1). Across these environments, OAC Ramsay, on average, matured 126 d after planting, which was 2 d later maturing than OAC Brooke and 2 and 3 d earlier maturing than DF-155 and AAC 26-15, respectively (Table 1). OAC Ramsay, with the average height of 90.5 cm, was significantly (P<0.05) taller than OAC Brooke (77.8 cm) and slightly taller than DF-155 (86.7 cm) and AAC 26-15 (87.7 cm) (Table 1). The average protein and oil concentrations of OAC Ramsay, across all the environments, were measured as 418 g kg\(^{-1}\) and 215 g kg\(^{-1}\), respectively (Table 1). No significant (P<0.05) differences for seed oil and protein concentrations have been found between OAC Ramsay and the check cultivars (Table 1). The average 100-seed weight of OAC Ramsay, across 12 environments, was 23.2 g, which was significantly (P>0.05) greater than that of DF-155 (21.7 g) and AAC 26-15 (21.4), and slightly larger than that of OAC Brooke (22.6) (Table 1).

**Disease Response**
OAC Ramsay is an SCN-resistant cultivar that inherited its SCN resistance genes from PI 88788 through its SCN-resistant parent, SC Starfiled. In a controlled greenhouse environment and replicated root inoculations with SCN cysts, OAC Ramsay showed high level of resistance to SCN, with a female index (FI) of 12%, compared to FI of 100% for Lee 74 (susceptible check) and 4.2% for PI 88788 (resistance check). The SCN bioassay was conducted in Welacky lab - in a greenhouse at the Harrow Research and Development Center, Harrow. The high level of SCN resistance in OAC Ramsay should provide soybean growers a yield advantage in SCN-infested environments.

Other Characteristics

OAC Ramsay has an indeterminate growth habit with white flowers, green hypocotyls, brown pods, and grey pubescence. The seeds are spherical rounded with yellow seed coat and hilum colour.

Maintenance and Distribution of Pedigree Seed

Breeder seed of OAC Ramsay is maintained by the Department of Plant Agriculture at the University of Guelph, Ridgetown Campus, Ridgetown, ON, Canada, N0P 2C0. Pedigreed seed is distributed through SeCan @ 501-300 March Rd., Kanata, Ontario, Canada K2K 2E2. SeCan has exclusive rights to OAC Ramsay soybean cultivar for contract production of pedigreed seed for use in contract production.
Acknowledgements

The authors acknowledge the technical assistance of Lin Liao from the University of Guelph for making the cross and growing F₁ plants. The development of this variety was made possible through generous funding support by the Grain Farmers of Ontario (GFO) and SeCan.

References


Table 1. Seed yield, composition traits, and agronomic performance of the OAC Ramsay, DF-155, OAC Brooke, and ACC 26-15 soybean cultivars in Ontario Soybean Trials during 2015 to 2017

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield&lt;sup&gt;b&lt;/sup&gt; (kg ha&lt;sup&gt;-1&lt;/sup&gt;)</th>
<th>Maturity&lt;sup&gt;c&lt;/sup&gt; (d)</th>
<th>Protein&lt;sup&gt;d&lt;/sup&gt; (g kg&lt;sup&gt;-1&lt;/sup&gt;)</th>
<th>Oil&lt;sup&gt;d&lt;/sup&gt; (g kg&lt;sup&gt;-1&lt;/sup&gt;)</th>
<th>Weight&lt;sup&gt;b&lt;/sup&gt; (g 100 seed&lt;sup&gt;-1&lt;/sup&gt;)</th>
<th>Height (cm)</th>
<th>Lodging (1-5)&lt;sup&gt;e&lt;/sup&gt;</th>
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<tr>
<td>OAC Ramsay</td>
<td>3965</td>
<td>126</td>
<td>418</td>
<td>215</td>
<td>23.2</td>
<td>90.5</td>
<td>1.1</td>
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<tr>
<td>DF-155</td>
<td>4141</td>
<td>129</td>
<td>429</td>
<td>202</td>
<td>21.7</td>
<td>86.7</td>
<td>1.4</td>
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<td>OAC Brooke</td>
<td>4249</td>
<td>124</td>
<td>419</td>
<td>204</td>
<td>22.6</td>
<td>77.8</td>
<td>1.1</td>
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<tr>
<td>AAC 26-15</td>
<td>3877</td>
<td>128</td>
<td>419</td>
<td>210</td>
<td>21.4</td>
<td>87.7</td>
<td>1.3</td>
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<tr>
<td>LSD&lt;sup&gt;f&lt;/sup&gt; (a=0.05)</td>
<td>262.3</td>
<td>3.5</td>
<td>2.71</td>
<td>3.14</td>
<td>1.63</td>
<td>4.13</td>
<td>0.3</td>
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<tr>
<td>No. of sites</td>
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<sup>a</sup> Performance based on 36 trials conducted at Inwood, Palmyra, Talbotville and Ridgetown from 2015 to 2017.

<sup>b</sup> Seed yield and weight on a 13% moisture basis.

<sup>c</sup> Number of days from planting to R8 - when 95% of the pods reach mature pod colour.

<sup>d</sup> Seed protein and oil concentrations on a dry weight basis measured by a near infrared spectroscopy.

<sup>e</sup> Visual score with 1 designated as plants standing erect and 5 as plants prostrate.

<sup>f</sup> Least significant difference at 95% confidence level.