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Quality of Canadian food-type soybeans

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Introduction

This report presents the quality data for the 2017 harvest survey of Canadian food-type soybeans conducted by the Canadian Grain Commission. Samples collected through the cooperation of Soy Canada, soybean processors and producers across the Prairies, Ontario, Quebec and the Atlantic regions were submitted to the Canadian Grain Commission's Grain Research Laboratory for analysis.

Growing and harvesting conditions

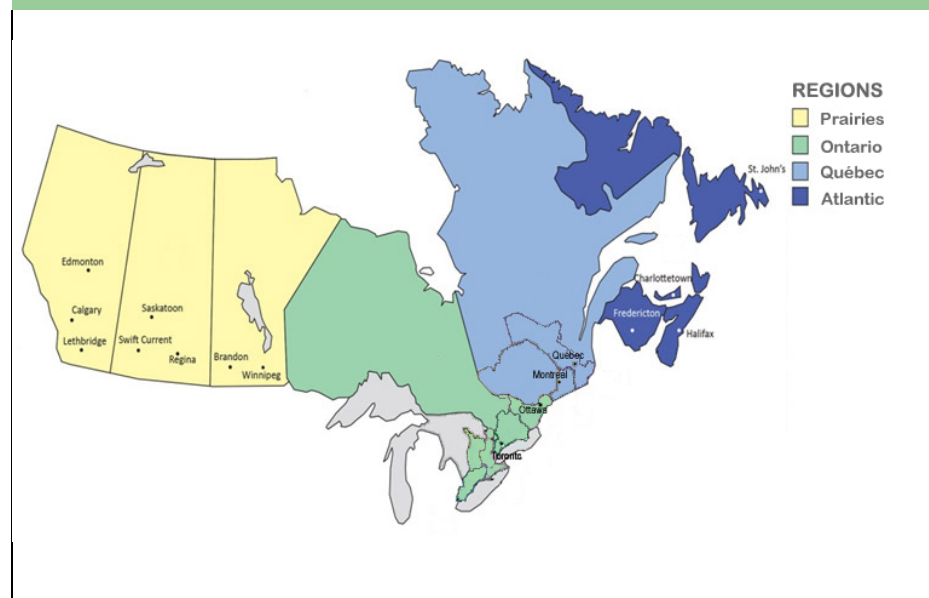
Cool temperatures in the Prairies in early spring resulted in planting being delayed until May, especially in the central and northern areas. Slightly above-normal temperatures coupled with a lack of rainfall in May allowed growers in most areas to complete spring planting by the first week of June. However, in some areas of the northern Prairies, planting was delayed due to rainfall during the last week of May. Above-normal temperatures and mostly dry growing conditions prevailed during June and July over most of western Canada. The primary growing areas in western Canada experienced stress which reduced yield expectations. The general lack of moisture during July and August negatively affected the soybean development during the pod filling stage, resulting in lower than expected yields and lower protein content. Excellent weather conditions in late August and September advanced crop maturity and allowed harvest to progress rapidly. Most crops were harvested by mid-October.

In Ontario, a wet spring, followed by a relatively cool summer resulted in challenging planting conditions, reduced stands, slow growth, and considerable white mould pressure, particularly in eastern Ontario. Some regions started the season with wet conditions but turned dry in August and September. Despite these challenges, overall yields turned out close to the 10-year average.

Harvest survey samples

The Canadian Grain Commission (CGC) received 17 natto-type and 368 generic food-type soybean samples including 2 from the Prairies, 239 from Ontario, 121 from Quebec and 6 from Atlantic region. All samples were graded by the CGC's Industry Services (IS) and were Canada No. 2 or higher. Composite samples were prepared according to region as shown in Figure 1. All composite samples were analyzed for 100-seed weight, water absorption capacity/ water uptake factor, protein, oil, sugar and total isoflavones content. Protein and oil content were determined using a Tecator Infratec 1241 Grain Analyzer near-infrared (NIR) spectrometer which was calibrated and verified against the appropriate laboratory reference method. Sugars and isoflavones were analyzed by high performance liquid chromatography (HPLC) methods. It is important to note that samples reported by grade do not necessarily represent the actual distribution of grade.

Figure 1 – Map of Canada showing origin of 2017 food-type soybean samples from the CGC's Harvest Sample Program



Quality of 2017 Canadian food-type soybeans

Protein and oil content

Protein content for 2017 Canadian food-type soybeans ranged from 35.0 g to 51.4 g per 100 g dry matter (Table 1). The mean protein content in 2017 was 41.4 g per 100 g dry matter, which was lower than the mean in 2016 (42.2 g per 100 g dry matter). The mean protein contents for the Prairies, Ontario, Quebec and the Atlantic region for 2017 were 38.7, 41.0, 42.5 and 37.9 g per 100 g dry matter, respectively.

Oil content for 2017 Canadian food-type soybeans varied from 16.3 g to 23.4 g per 100 g dry matter (Table 2). The mean oil content in 2017 was 20.3 g per 100 g dry matter, which was lower than that for 2016 (21.7 g per 100 g dry matter). The mean oil content for the Prairies in 2017 was 21.2 g per 100 g dry matter. The mean oil content for Ontario in 2017 was 20.4 g per 100 g dry matter, which was lower than that in 2016. The mean oil content for Quebec in 2017 was 19.9 g per 100 g dry matter, which was lower than the mean for 2016. The mean oil content for the Atlantic region in 2017 was 21.2 g per 100 g dry matter.

Canadian generic food-type soybeans

Table 3 shows the quality data for 2017 Canadian generic food-type soybeans used for tofu, soymilk or miso. Mean 100-seed weight for 2017 generic food-type soybean was 19.9 g, which was lower than the mean for 2016 (21.6 g). Water absorption capacity was 1.18 g H₂O per g seeds, which was slightly higher than that for 2016. Water uptake factor was 2.18 for 2017. Seed size and water uptake are important quality characteristics of food-type soybeans for the production of tofu, soymilk and miso.

The mean protein content for 2017 Canadian generic food-type soybean was 41.1 g per 100 g dry matter (Table 3), which was lower than the mean for 2016 (42.4 g per 100 g dry matter). The mean oil content for 2017 was 20.3 g per 100 g dry matter, which was lower than the mean for 2016 (21.6 g per 100 g dry matter).

The mean sucrose content in 2017 generic food-type soybean was 70.4 g per kg dry matter, which was higher than the mean for 2016 (57.6 g per kg dry matter) (Table 3). The mean total oligosaccharides content for 2017 was 47.4 g per kg dry matter, which was close to the mean for 2016 (46.4 g per kg dry matter).

The mean total isoflavones content for 2017 Canadian generic food-type soybean was 3643 mg per kg dry matter, which was higher than the mean for 2016 (Table 3).

Canadian natto-type soybeans

Table 4 displays the quality data for 2017 Canadian natto-type soybeans. Mean 100-seed weight for 2017 natto-type soybean was 9.4 g, lower than that in 2016. Water absorption value was 1.25 g H₂O per g seeds and water uptake factor was 2.25, slightly higher than that for 2016.

The mean protein content for 2017 Canadian natto-type soybean was 39.5 g per 100 g dry matter, which was higher than that in 2016 (Table 4). The mean oil content was 19.6 g per 100 g dry matter, lower than the mean for 2016.

The mean sucrose content for 2017 Canadian natto-type soybean was 66.9 g per kg dry matter, higher than that in 2016 (Table 4). The mean oligosaccharides content was 49.9 g per kg dry matter, slightly higher than that in 2016. The mean total isoflavones content was 3207 mg per kg dry matter, which was higher than the mean for 2016.

Table 1 – Mean protein content for 2017 Canadian food-type soybeans by grade and province¹

Province/Region	Number of samples	Protein content, g/100 g DM (dry matter)		
		2017		2016
		Mean	Range	Mean
Prairies				
Soybean, No. 1 Canada	NS ²	NS	NS	NS
Soybean, No. 2 Canada	2	38.7	38.5–38.9	36.4
All grades	2	38.7	38.5–38.9	36.4
Ontario				
Soybean, No. 1 Canada	117	40.9	35.0–46.9	42.0
Soybean, No. 2 Canada	131	41.1	36.2–50.7	42.2
All grades	248	41.0	35.0–50.7	42.1
Quebec				
Soybean, No. 1 Canada	61	42.5	36.3–46.1	42.6
Soybean, No. 2 Canada	68	42.4	36.3–51.4	42.6
All grades	129	42.5	36.3–51.4	42.6
Atlantic				
Soybean, No. 1 Canada	6	37.9	36.0–40.8	NS
Soybean, No. 2 Canada	NS	NS	NS	NS
All grades	6	37.9	36.0–40.8	NS
Canada				
Soybean, No. 1 Canada	184	41.4	35.0–46.9	42.1
Soybean, No. 2 Canada	201	41.5	36.2–51.4	42.2
All grades	385	41.4	35.0–51.4	42.2

¹Protein content (Nx6.25) is determined by near infrared measurement calibrated against the Combustion Nitrogen Analysis reference method.

²NS=insufficient number of samples to generate a representative value.

Table 2 – Mean oil content for 2017 Canadian food-type soybeans by grade and province¹

Province/Region	Oil content, g/100 g DM (dry matter)			
	Number of samples	2017 Mean	2017 Range	2016 Mean
Prairies				
Soybean, No. 1 Canada	NS ²	NS	NS	NS
Soybean, No. 2 Canada	2	21.2	21.0–21.4	22.5
All grades	2	21.2	21.0–21.4	22.5
Ontario				
Soybean, No. 1 Canada	117	20.4	16.9–23.4	21.9
Soybean, No. 2 Canada	131	20.4	16.3–22.6	21.8
All grades	248	20.4	16.3–23.4	21.8
Quebec				
Soybean, No. 1 Canada	61	20.0	17.9–23.0	21.9
Soybean, No. 2 Canada	68	19.9	16.4–21.9	21.4
All grades	129	19.9	16.4–23.0	21.5
Atlantic				
Soybean, No. 1 Canada	6	21.2	19.8–23.1	NS
Soybean, No. 2 Canada	NS	NS	NS	NS
All grades	6	21.2	19.8–23.1	NS
Canada				
Soybean, No. 1 Canada	184	20.3	16.9–23.4	21.9
Soybean, No. 2 Canada	201	20.2	16.3–22.6	21.7
All grades	385	20.3	16.3–23.4	21.7

¹Oil content is determined by near infrared measurement calibrated against the ISO 10565:1992(E) reference method.

²NS=insufficient number of samples to generate a representative value.

Table 3 Quality data for 2017 Canadian generic food-type soybean composites¹

Quality parameter	Number of samples	2017	2016
Physical characteristic			
100-seed weight, g/100 seeds	259	19.9	21.6
Water absorption, g H ₂ O/g seeds	259	1.18	1.14
Water uptake factor, g soaked wt/g seeds	259	2.18	2.14
Chemical composition (g/100 g DM)			
Protein content	259	41.1	42.4
Oil content	259	20.3	21.6
Sugar content (g/kg DM)			
Sucrose	259	70.4	57.6
Raffinose	259	9.3	9.0
Stachyose	259	37.5	36.9
Verbascose	259	0.56	0.50
Total oligosaccharides ²	259	47.4	46.4
Isoflavones (mg/kg DM)			
Total isoflavones ³	259	3643	2211

¹Soybean, No. 1 Canada and No. 2 Canada combined.

²Sum of raffinose, stachyose and verbascose.

³Sum of isoflavone aglycones (daidzein, genistein and glycitein), glucosides, malonyl glucosides and acetyl glucosides.

Table 4 Quality data for 2017 Canadian natto-type soybean composites¹			
Quality parameter	Number of samples	2017	2016
Physical characteristic			
100-seed weight, g/100 seeds	8	9.4	9.9
Water absorption, g H ₂ O/g seeds	8	1.25	1.18
Water uptake factor, g soaked wt/g seeds	8	2.25	2.18
Chemical composition (g/100 g DM)			
Protein content	8	39.5	39.0
Oil content	8	19.6	21.8
Sugar content (g/kg DM)			
Sucrose	8	66.9	57.4
Raffinose	8	7.9	8.9
Stachyose	8	41.3	37.6
Verbascose	8	0.71	0.23
Total oligosaccharides ²	8	49.9	46.7
Isoflavones (mg/kg DM)			
Total isoflavones ³	8	3207	2415

¹Soybean, No. 1 Canada and No. 2 Canada combined.

²Sum of raffinose, stachyose and verbascose.

³Sum of isoflavone aglycones (daidzein, genistein and glycitein), glucosides, malonyl glucosides and acetyl glucosides.