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Quality of Canadian food-type soybeans 2021

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Table of Contents

Tables

Figures

Introduction

This report presents information on the quality of food-type soybeans grown in Canada in 2021. The Canadian Grain Commission analysed soybean samples collected from processors and producers across the prairies, Ontario, Quebec and Prince Edward Island through the Harvest Sample Program.

Growing and harvesting conditions

In western Canada, crops experienced stress due to very little rain and extremely high temperatures during the growing period. In late August, above average rain and low overnight temperatures benefitted the growth of long season soybean varieties. Soybean harvest began during the first 2 weeks of September. From mid-September to October, rain alleviated drought conditions in portions of eastern and central Manitoba. Heavy frost came later than usual to Manitoba on October 20. Overall, crop yields were below average except for some areas which received timely rainfall.

In eastern Ontario, dry soil allowed seeding to start early and finish by the end of May. Although soybeans germinated and looked good, a significant frost in eastern and northern Ontario damaged some crops and replanting was required. Soybeans in this area also experienced stress due to high temperatures and lack of rain. Seeds in some plants did not fill and were aborted. Soybean harvest was delayed in eastern Ontario due to high humidity, preventing crops from drying adequately. Reported crop yield was lower than average.

In eastern Quebec, low temperatures and good soil moisture allowed seeding to occur from late April to the end of May. Frost in May also resulted in some crops being replanted. Rain fell on June 20, providing relief to plants suffering under drought conditions. Rain came regularly in July and temperatures were above normal in August. Plants had normal height and a lot of vegetative development. Favorable conditions in the first half of October allowed harvest to progress. Less seeds per pod and lower yields were reported. In western Quebec, dry soil conditions enabled producers to start seeding early. Rain came during the last 10 days of June. Extreme heat affected the development and uniform germination of soybeans. Cool night temperatures in July gave plants relief from the hot conditions. Low precipitation and high temperatures affected grain filling and caused plants to ripen early. Harvest began in early September but was paused occasionally due to rain.

Canadian food-type soybeans 2021

Harvest samples

Through the Harvest Sample Program, the Canadian Grain Commission received 18 natto-type and 222 generic food-type soybean samples including:

- 10 from the prairies
- 141 from Ontario
- 87 from Quebec
- 2 from the Atlantic region

All samples were graded by Canadian Grain Commission inspectors and were Canada No. 2 or higher.

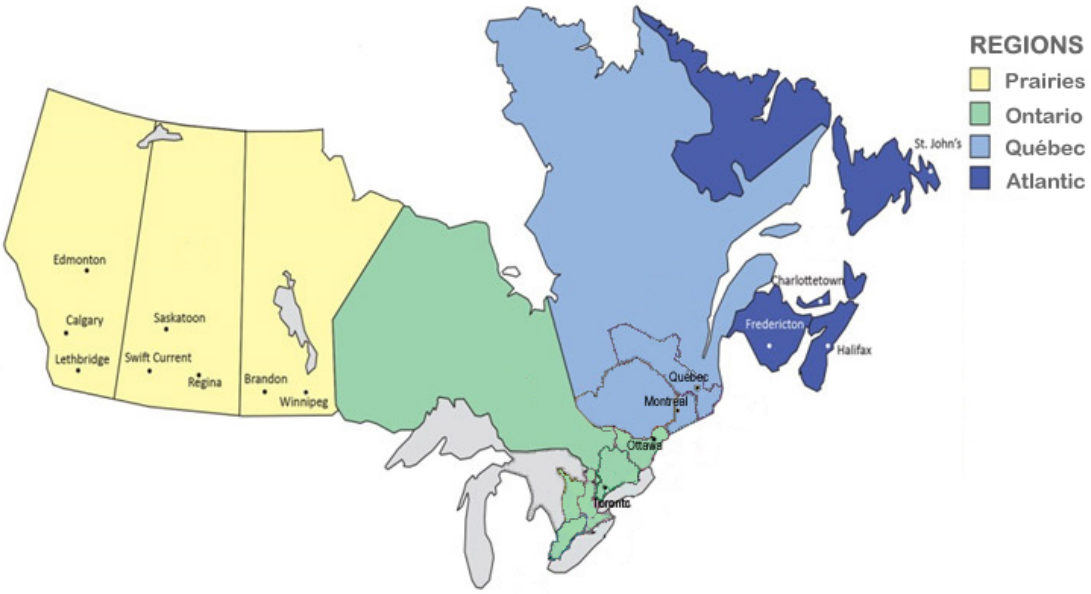
Composite samples were prepared from each region shown in Figure 1. All composite samples were analyzed for:

- 100-seed weight
- water absorption capacity/water uptake factor
- protein content
- oil content
- sugar content
- 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 using the appropriate laboratory reference methods. Sugars and isoflavones were analyzed by high performance liquid chromatography (HPLC).

Please note that samples reported by grade do not necessarily represent the actual distribution of grade.

Figure 1 Origin of 2021 food-type soybean samples received by the Canadian Grain Commission's Harvest Sample Program



Quality of 2021 Canadian food-type soybeans

Protein and oil content

Protein content for 2021 Canadian food-type soybeans ranged from 34.0 to 50.0 grams (g) per 100 g dry matter (Table 1). The mean protein content for 2021 was 42.1 g per 100 g dry matter, which was higher than the mean in 2020 (41.7 g per 100 g dry matter). The mean protein contents for the prairies, Ontario and Quebec for 2021 were 38.7, 42.4 and 41.8 g per 100 g dry matter.

Oil content for 2021 Canadian food-type soybeans varied from 16.9 to 24.4 g per 100 g of dry matter (Table 2). The mean oil content for 2021 was 21.6 g per 100 g of dry matter, which was higher than that for 2020 (20.9 g per 100 g dry matter). The mean oil contents for the prairies, Ontario and Quebec for 2021 were 21.1, 21.6, and 21.7 g per 100 g of dry matter.

Canadian generic food-type soybeans

Table 3 shows the quality data for 2021 Canadian generic food-type soybeans used for tofu, soymilk and miso. Mean 100-seed weight for 2021 generic food-type soybean was 20.5 g, which was close to the mean for 2020 (20.6 g). Water absorption capacity was 1.15 grams of water per gram of seeds, which was similar to that for 2020. Water uptake factor was 2.15 for 2021. Seed size and water uptake are important quality characteristics of food-type soybeans used to produce tofu, soymilk and miso.

The mean protein content for 2021 Canadian generic food-type soybean was 42.4 g per 100 g of dry matter (Table 3), which was higher than the mean for 2020 (41.5 g per 100 g of dry matter). The mean oil content for 2021 was 21.5 g per 100 g of dry matter, higher than the mean for 2020 (21.1 g per 100 g of dry matter).

The mean sucrose content for 2021 generic food-type soybean was 51.7 g per kilogram (kg) of dry matter, which was lower than the mean for 2020 (64.6 g per kg of dry matter) (Table 3). The mean total oligosaccharides content for 2021 was 39.7 g per kg of dry matter, which was higher than the mean for 2020 (34.5 g per kg of dry matter).

The mean total isoflavones content for 2021 Canadian generic food-type soybean was 2632 milligrams (mg) per kg of dry matter, which was lower than the mean for 2020 (Table 3).

Canadian natto-type soybeans

Table 4 displays the quality data for 2021 Canadian natto-type soybeans. Mean 100-seed weight for 2021 natto-type soybean was 8.8 g, which is slightly lower than for 2020 (9.0 g). The water absorption value was 1.19 g of water per g of seeds and water uptake factor was 2.19, similar to that for 2020.

The mean protein content for 2021 Canadian natto-type soybean was 38.3 g per 100 g of dry matter, lower that for 2020 (Table 4). The mean oil content was 22.0 g per 100 g of dry matter, higher than the mean for 2020.

The mean sucrose content for 2021 Canadian natto-type soybean was 50.9 g per kg of dry matter, lower than in 2020 (Table 4). The mean oligosaccharides content was 44.3 g per kg of dry matter, which was similar to that for 2020. The mean total isoflavones content was 3419 mg per kg of dry matter, which was lower than the mean for 2020.

Acknowledgements

The Grain Research Laboratory acknowledges the cooperation of the soybean processors, producers and grain handling facilities from eastern and western Canada for supplying the samples of newly harvested food-type soybeans. We are also grateful for the assistance of the Industry Services Division of the Canadian Grain Commission in grading the samples. Furthermore, we would like to extend our thanks to the Pulse Research Program staff for technical assistance as well as to Multimedia services for their assistance in the publication of this document.

Table 1 Mean protein content (g/100 g dry matter) for 2021 Canadian food-type soybeans by grade and province [1]

		2021			2020
		Number of samples	Mean	Range	Mean
Prairies	Soybean, No. 1 Canada	1	35.6	35.6 to 35.6	37.8
	Soybean, No. 2 Canada	9	39.1	35.7 to 46.1	39.5
	All grades	10	38.7	35.6 to 46.1	39.4
Ontario	Soybean, No. 1 Canada	29	42.4	38.2 to 46.8	41.4
	Soybean, No. 2 Canada	112	42.4	34.0 to 47.9	41.7
	All grades	141	42.4	34.0 to 47.9	41.6
Quebec	Soybean, No. 1 Canada	17	40.8	35.9 to 46.6	42.2
	Soybean, No. 2 Canada	70	42.1	36.9 to 50.0	42.6
	All grades	87	41.8	35.9 to 50.0	42.5
Canada	Soybean, No. 1 Canada	47	41.7	35.6 to 46.8	41.5
	Soybean, No. 2 Canada	191	42.2	34.0 to 50.0	41.8
	All grades	238	42.1	34.0 to 50.0	41.7

Table 2 Mean oil content (g/100 g dry matter) for 2021 Canadian food-type soybeans by grade and province [2]

		2021			2020
		Number of samples	Mean	Range	Mean
Prairies	Soybean, No. 1 Canada	1	21.4	21.4 to 21.4	22.0
	Soybean, No. 2 Canada	9	21.1	18.2 to 22.5	20.6
	All grades	10	21.1	18.2 to 22.5	20.7
Ontario	Soybean, No. 1 Canada	29	21.7	18.4 to 24.4	21.3
	Soybean, No. 2 Canada	112	21.6	18.0 to 24.2	21.1
	All grades	141	21.6	18.0 to 24.4	21.2
Quebec	Soybean, No. 1 Canada	17	21.9	19.2 to 23.9	20.7
	Soybean, No. 2 Canada	70	21.6	16.9 to 23.8	20.2
	All grades	87	21.7	16.9 to 23.9	20.3
Canada	Soybean, No. 1 Canada	47	21.8	18.4 to 24.4	21.2
	Soybean, No. 2 Canada	191	21.6	16.9 to 24.2	20.7
	All grades	238	21.6	16.9 to 24.4	20.9

[1] Protein content (N x 6.25) is determined by near infrared measurement calibrated against the Combustion Nitrogen Analysis reference method and is expressed on a dry basis.

[2] Oil content is determined by near infrared measurement calibrated against the ISO 10565:1992(E) reference method and is expressed on a dry basis.

Table 3 Quality data for 2021 Canadian generic food-type soybean composites [1]

Quality category	Quality parameter	Number of samples	2021	2020
Physical characteristic	100-seed weight, g/100 seeds	210	20.5	20.6
	Water absorption, g H_2O/g seeds	210	1.15	1.13
	Water uptake factor, g soaked wt/g seeds [2]	210	2.15	2.13
Chemical composition (g/100 g) [3]	Protein content	210	42.4	41.5
	Oil content	210	21.5	21.1
Sugar content (g/kg DM) [4]	Sucrose	210	51.7	64.6
	Raffinose	210	7.7	6.4
	Stachyose	210	30.9	27.7
	Verbascose	210	1.1	0.4
	Total oligosaccharides [5]	210	39.7	34.5
Isoflavones (mg/kg DM) [6]	Total isoflavones [7]	210	2632	3316

Table 4 Quality data for 2021 Canadian natto-type soybean composites [1]

Quality category	Quality parameter	Number of samples	2021	2020
Physical characteristic	100-seed weight, g/100 seeds	16	8.8	9.0
	Water absorption, g H_2O/g seeds	16	1.19	1.21
	Water uptake factor, g soaked wt/g seeds [2]	16	2.19	2.21
Chemical composition (g/100 g) [3]	Protein content	16	38.3	39.0
	Oil content	16	22.0	20.7
Sugar content (g/kg DM) [4]	Sucrose	16	50.9	54.6
	Raffinose	16	7.5	5.5
	Stachyose	16	35.5	39.5
	Verbascose	16	1.3	1.2
	Total oligosaccharides [5]	16	44.3	46.3
Isoflavones (mg/kg DM) [6]	Total isoflavones [7]	16	3419	3625

[1] Soybean, No. 1 Canada and No. 2 Canada combined
[2] g soaked wt/g seeds = grams soaked weight/gram seeds
[3] Results are expressed on a dry basis
[4] g/kg DM = gram/kilogram dry matter
[5] Sum of raffinose, stachyose and verbascose
[6] mg/kg DM = milligram/kilogram dry matter
[7] Sum of isoflavone aglycones (daidzein, genistein and glycitein), glucosides, malonyl glucosides and acetyl glucosides