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Quality of Canadian oilseed-type soybeans

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Summary

In 2020, the average oil content for Soybean, No. 1 and No. 2 grades combined was 21.8% on a dry matter basis (Tables 1 and 3). This was higher than last year's average of 21.1% (Table 1) and the 5-year average (2015 to 2019) of 21.5%. The average protein content for Soybean, No. 1 and No. 2 grades were 38.3%, which was similar to last year's average of 38.4%, but lower than the 5-year average of 39.1%. The oil and protein content averages for No. 1 and No. 2 grades combined varied between the western, eastern and Maritime provinces. Manitoba and Saskatchewan had an oil content of 21.3% and a protein content of 37.6%, whereas Ontario and Quebec had an oil content of 22.1% and a protein content of 38.8%. However, New Brunswick and Prince Edward Island had an oil content and protein content of 20.8% and 39.4%, respectively.

Introduction

There are two major types of soybeans grown in Canada: those commonly referred to as oilseed-type soybeans ("crush" or non-food grade) and food-grade soybeans (used for tofu and other soy products). This report deals with the oilseed-type soybean samples used for the feed or crushing industry. Oilseed-type soybeans are grown to produce oil and high-protein meal. Soybean oil is used in salad oil, shortening and margarine products, while the defatted soybean meal is a protein supplement in livestock rations.

Canadian soybean production area has expanded in recent years to include crop areas from the Maritimes to the Prairie provinces (Figure 1).

This harvest quality report is based on 506 samples of oilseed-type soybeans (also described as crush-type soybeans), which is more than what was received in 2019 (386). Samples were from Saskatchewan (14), Manitoba (206), Ontario (229), Quebec (36), New Brunswick (15) and Prince Edward Island (6). Of the submitted samples, 18.4% were graded as No. 1 (24.1% in 2019), 73.3% as No. 2 (72.3% in 2019), 5.1% as No. 3 (2.1% in 2019), 1.6% as No. 4 (1.0% in 2019), 1.2% as No. 5 (0.0% in 2019) and 0.4% as Sample (0.5% in 2019).

Quality data (oil, protein, free fatty acids, chlorophyll and fatty acid composition) are based on the means of Soybean, No. 1 and No. 2 Canada grades combined for all oilseed-type samples received from western Canada (Manitoba and Saskatchewan), eastern Canada (Ontario and Quebec) and the Maritimes (New Brunswick and Prince Edward Island). Table 1 compares this year's data to last year and to the 5-year average. The oil and protein content is provided on a dry matter basis and on a 13% moisture basis. Quality results for all combined grades for each province are in Tables 3 and 4.

Table 1 Soybeans, No. 1 and No. 2 Canada: quality data for 2020 and 2019 harvest plus the 5-year means

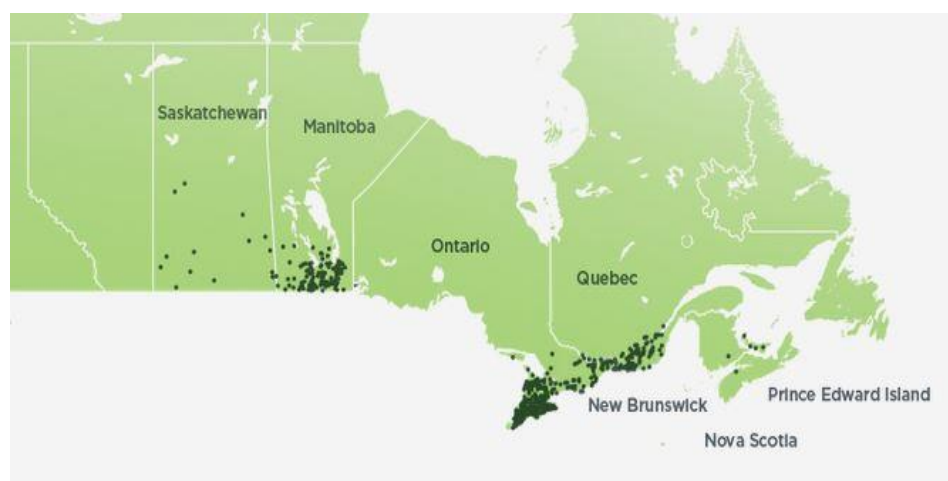
	2020	2019	2015-19 Mean
Number of Soybean, No. 1 and No. 2 Canada samples	464	372	337
Quality parameters			
Oil content (% , dry basis)	21.8	21.1	21.5
Oil content (% , 13% moisture)	18.9	18.4	18.7
Protein content ¹ (% , dry basis)	38.3	38.4	39.1
Protein content (% , 13% moisture)	33.3	33.4	34.0
Defatted meal protein of the meal (% , 13% moisture)	42.6	42.3	43.3
Chlorophyll content (mg/kg in seed)	0.8	0.2	0.3
Free fatty acids ² (%)	0.13	0.18	0.13
Oleic acid (% in oil)	20.3	18.8	21.6
Linoleic acid (% in oil)	54.9	55.5	53.9
Linolenic acid (% in oil)	8.8	9.9	8.9
Total saturated fatty acids ³ (% in oil)	15.2	15.0	15.3
Iodine value (units)	135.8	138.5	135.2

¹ Protein content calculated from nitrogen content using N x 6.25.

² Calculated as % of oleic acid.

³ Sum of all saturated fatty acid from C12:0 to C24:0.

Figure 1 Soybean production areas in Canada



Source: [Soy Canada](#)

Weather and production review

Weather review

Soybeans are typically seeded in early May in eastern Canada and from the last week of May to the first week of June in western Canada. In New Brunswick, seeding was mainly finished by the first week in June. Dry conditions during the spring and summer delayed emergence and plant growth. The early seeded fields had average yields while later seeded fields suffered with low yields. Prince Edward Island also struggled with drought during the growing season.

This year, Ontario and Quebec experienced some delays in seeding, as most of the crop was seeded by the end May. June and July were dry, but timely rains in August and good harvest conditions in the fall brought record yields Ontario and average yields in Quebec.

In Manitoba and Saskatchewan, relatively good weather in spring allowed nearly all of the crop to be seeded by the end of May and early June. Despite challenging conditions, such as inconsistent rainfall and some frost, emergence and crop growth did well. Grasshoppers were a concern in some regions in July and August, and some damage incurred. The soybean crop continued to develop well into July and August with most reports stating the crop was in fair condition. While some regions received adequate moisture in August, but not every region received enough to reach their yield potential. Harvest started by the last week in September and was nearly complete by mid-October. The overall yield was better than expected.

Sources:

[Canada weather maps](#)

[New Brunswick crop report](#)

[Ontario crop report](#)

[Manitoba crop report](#)

[Saskatchewan crop report](#)

Production and grade information

Seeded area and production data for 2020 and 2019 are in Table 2. In 2020, seeded soybean areas decreased when compared to 2019. The decrease occurred in every region of the country where the seeded areas dropped by close to 10%.

Up until three years ago, Canada's soybean production had been increasing steadily since 2007 as production had been increasing in Ontario and Manitoba. Production in the west has decreased in recent years, mainly due to poor weather conditions for soybean production and uncertainty in the market.

In spite of a decrease in seeded area, the production in Canada increased slightly in 2020 by around 5% compared to 2019 (Table 2). In 2020, about 61.5% of Canadian soybeans were produced in Ontario, 18.3% in Manitoba and 18.2% in Quebec. The average yield in Canada was 3,115 kilograms per hectare (kg/ha), but the yields varied across the country (averages of 3,409 kg/ha in Ontario, 3,253 kg/ha in Quebec and 2,509 kg/ha in Manitoba).

Table 2 Seeded area and production for Canadian soybeans¹

Province	Seeded area		Production		5-Year average production
	2020	2019	2020	2019	2015-19
	Hectares		Tonnes		Tonnes
Manitoba	465,200	594,700	1,162,800	1,122,300	1,651,780
Saskatchewan	51,300	60,700	68,800	107,200	240,020
Alberta	1,000	2,800	ND	4,900	8,250
Western Canada	517,500	658,200	1,231,600	1,234,400	1,900,050
Ontario	1,153,400	1,260,400	3,908,700	3,708,200	3,772,600
Quebec	358,300	366,700	1,159,700	1,045,900	1,108,480
Eastern Canada	1,511,700	1,627,100	5,068,400	4,754,100	4,881,080
Prince Edward Island	15,500	18,800	39,300	36,400	43,020
New Brunswick	3,100	4,500	5,400	9,500	12,860
Nova Scotia	4,000	3,900	11,200	10,700	14,060
Maritimes	22,600	27,200	55,900	56,600	69,940
Total Canada	2,051,800	2,312,500	6,355,900	6,045,100	6,843,740

¹ Statistics Canada. Table 001-0010 - [Estimated areas, yield, production and average farm price of principal field crops, in metric units.](#)

ND – data too unreliable to be published

Harvest samples

In 2020, the Canadian Grain Commission's Harvest Sample Program received 506 soybean samples (386 in 2019): 21 were from the Maritimes (15 in 2019), 265 were from eastern Canada (219 in 2019) and 220 (152 in 2019) from western Canada (Table 3). Canadian Grain Commission inspectors graded these samples according to [the Official Grain Grading Guide](#). In 2020, 91.7% of the submitted samples were in the top two grades (96.4% in 2019), while 8.3% of the samples were graded as No. 3 Canada or lower. The grade distribution was not quite the same between eastern and western Canada. 96.5% of the samples from the east (Maritimes, Ontario, and Quebec) were graded Soybean, No. 1 and No. 2 Canada in comparison to 85.5% from the west (Manitoba and Saskatchewan).

Key quality factors for oilseed-type soybeans are oil content, protein content, free fatty acids (FFA), chlorophyll and fatty acid composition. Oil and protein content give quantitative estimates of the beans as a source of oil and of the defatted meal as a source of protein for animal feed. Fatty acid composition provides information about the nutritional, physical and chemical characteristics of the oil extracted from the beans.

Individual samples were analyzed for oil and protein content using a FOSS DS2500 near-infrared (NIR) spectrometer, calibrated and verified against the appropriate samples analyzed by reference methods. Grade composite samples were analyzed by reference methods for oil, protein, FFA, chlorophyll and fatty acid composition. The reference procedures are listed on the Canadian Grain Commission's website.

Oil and protein content

The average protein content was 38.3% on dry basis (equivalent at 33.3% at 13% moisture; Table 1), which is similar to last year's results (38.4% on dry basis or 33.4% at 13% moisture) but lower than the 5-year average of 39.1% (equivalent at 34.0% at 13% moisture). Samples from eastern Canada had a higher protein content (38.8%) than western Canada (37.6%), but lower than the Maritimes (39.4%; Table 3). For the top two grades combined, the protein content of individual producer samples ranged from 32.5% (or 28.3 at 13% moisture) to 43.3% (37.7% at 13% moisture). Figure 2 shows the protein content trend since 2006 between eastern and western Canada. Since 2006, western averages have been consistently lower and show higher yearly variability than eastern averages.

Figure 3 presents the protein content of fully defatted soybean meal. The protein content of the defatted soybean meal from western Canada is lower (47.8%) than the protein content of the samples from the east (49.8%). This reflects the difference in the protein content of the seed between the two sets of samples.

The average oil content was 21.8% dry basis (18.9% at 13% moisture) for soybean graded No. 1 and No. 2, which was higher than what was observed in 2019 at 21.1% (or 18.3% at 13% moisture) and the 5-year average of 21.5% (or 18.7% at 13% moisture) (Table 1). For the top two grades combined, the oil content of individual samples ranged from 17.2% (15.0% at 13% moisture) to 24.5% (21.3% at 13% moisture) on a dry basis. Figure 4 shows the oil content trend since 2006 for eastern, western and all of Canada.

Typically, there is an inverse relationship between oil and protein content for Canadian soybeans (as it is for all oilseeds): the higher the oil content the lower the protein. This year, protein was similar to last year while oil content increased when compared to 2019 averages.

Environmental growing conditions are usually responsible for year-to-year variations, whereas genetics (varietal differences) are usually responsible for trends over several years. The combination of genetics and environmental growing conditions are responsible for the east-west differences. Currently, breeding is primarily looking at yield and other agronomic factors. Quality factors, such as oil or protein contents, are not taken into account when registering new soybean varieties in Canada.

Fatty acid composition

Table 4 shows fatty acid composition for the combined No. 1 and 2 grade composites from the various provinces. Linolenic acid (C18:2), the main fatty acid found in soybean oil, averaged 54.9%, whereas last year's average was 55.5%. Oleic acid, the second most important fatty acid in soybeans, averaged 20.3% in 2020, which was much higher than the 2019 value of 18.8%. The other important unsaturated fatty acid, α -linolenic acid (C18:3), averaged 8.8% (9.9% in 2019). Total saturates averaged 15.2% in Canada, varying from 14.7% (Quebec) to 15.4% (Ontario).

Iodine value estimates the level of fatty acid unsaturation in oil. The higher the number of double bonds in the oil, the higher the iodine value and the level of unsaturation. For 2020, both α -linolenic acid and linoleic acid averages were lower than last year, hence the lower iodine values compared to last year (135.8 units in 2020 versus 138.5 units in 2019). Figure 5 presents the iodine value trend since 2006 for eastern Canada, western Canada and the overall Canadian averages. The yearly variations are a reflection of the environmental differences that includes geography (e.g. difference in temperature and precipitation).

There is no requirement to control the fatty acid composition of the Canadian oilseed-type soybeans. Therefore, varieties can show large variation in the fatty acid composition. These variations are amplified as weather also plays a part in year-to-year fatty composition changes. In hot and dry weather conditions, seeds tend to produce an oil with more saturation. For example, seeds will produce less polyunsaturated fatty acids, such as α -linolenic linolenic and linoleic acids, and more total saturates and oleic acids. The opposite is observed if seeds are grown in cool conditions.

Free fatty acids (FFA) content

Grade composites of, No. 1 Canada and, No. 2 Canada had FFA levels averaging 0.13% in 2020 (Table 1 and 3). This is slightly lower than last year's results (0.18%). High FFA values are mainly due to seed damage from wet harvest conditions and improper storage.

Chlorophyll content

Chlorophyll content is an indicator of maturity in soybeans, lower the chlorophyll the more mature the seed. Chlorophyll content for the top grades was higher in the western provinces at 1.3 milligrams per kilograms (mg/kg) compared to the eastern and Maritime provinces at 0.4 mg/kg and 0.6 mg/kg, respectively (Table 3). The lower grade soybeans in the western provinces had higher levels chlorophyll content with No. 5 and Sample grades having 6.4 mg/kg and 8.8 mg/kg, respectively.

Figure 2 Seed protein content averages of Canadian oilseed-type soybeans, 2006 to 2020

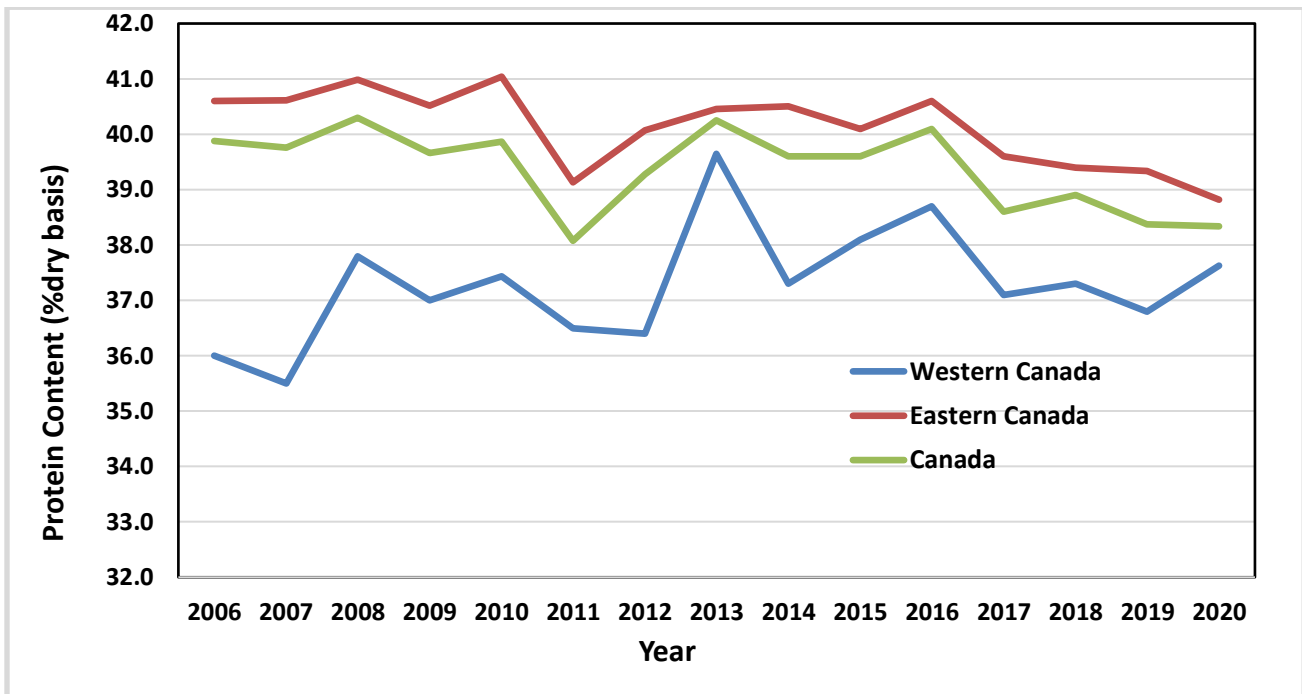


Figure 3 Defatted meal protein content averages of Canadian oilseed-type soybeans, 2006 to 2020

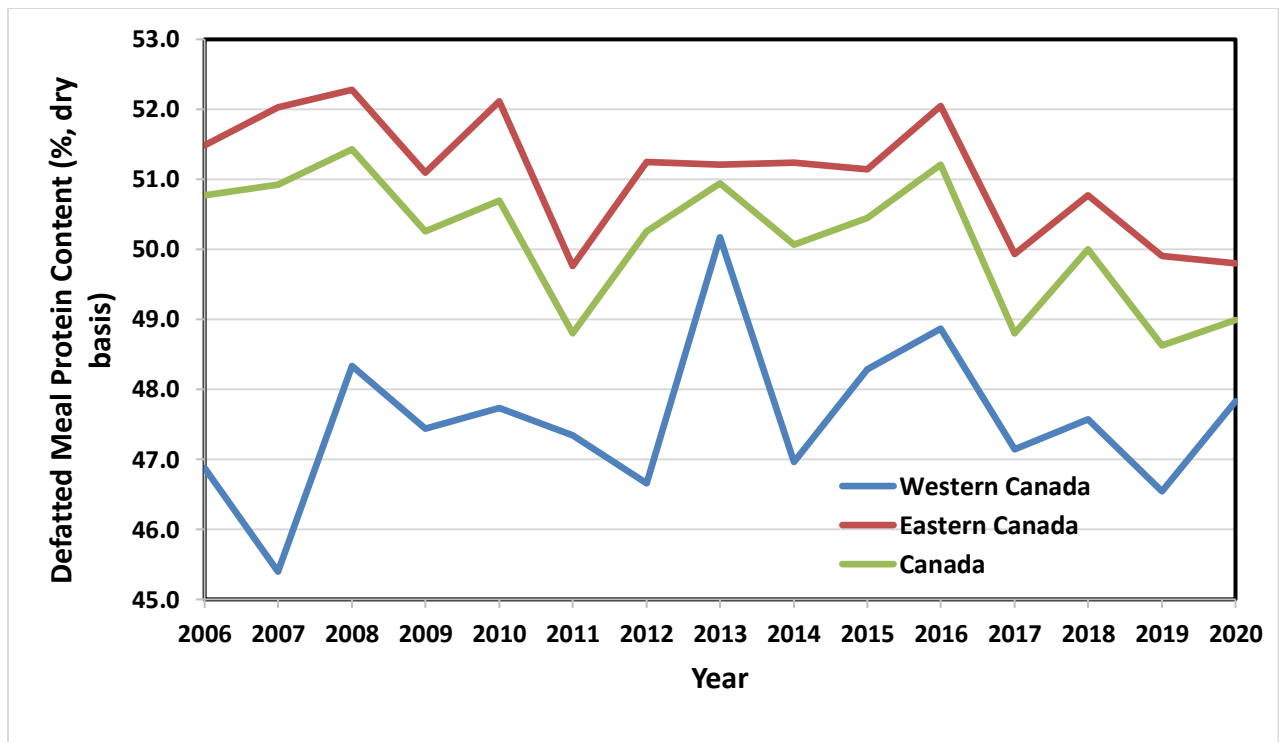


Figure 4 Seed oil content averages of Canadian oilseed-type soybeans, 2006 to 2020

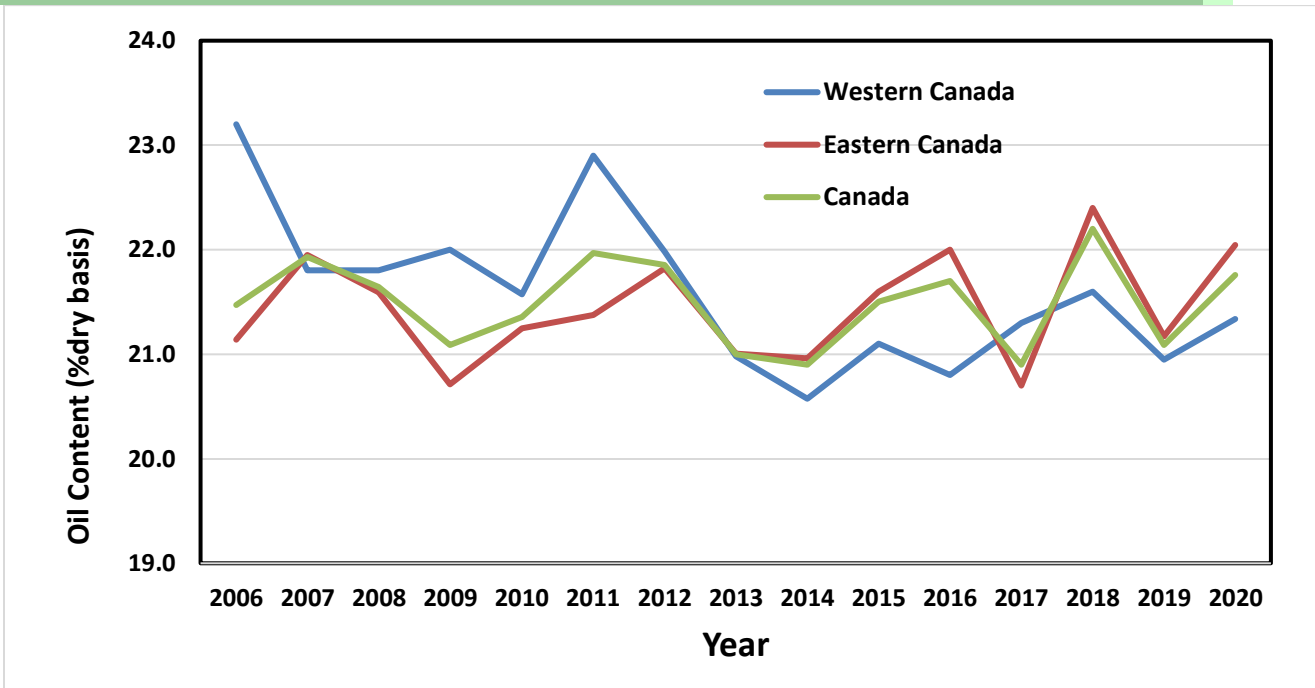


Figure 5 Oil iodine value averages of Canadian oilseed-type soybeans, 2006 to 2020

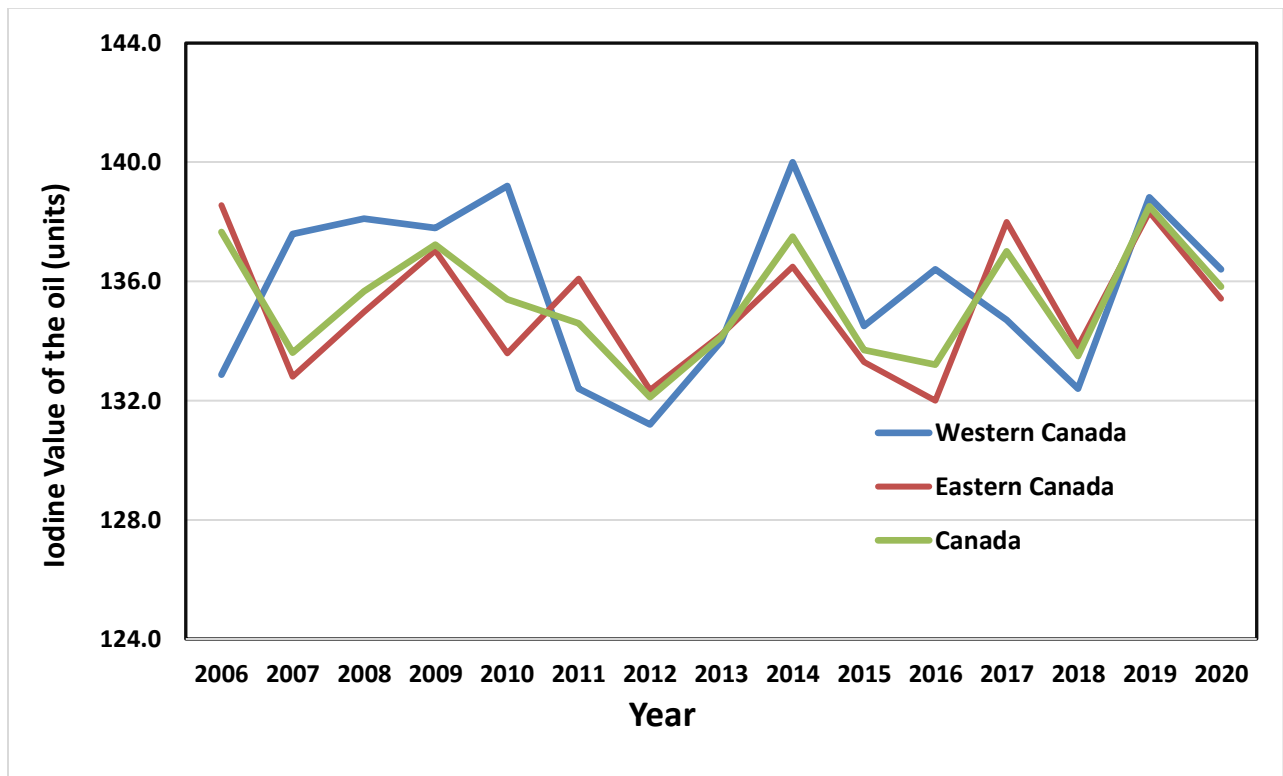


Table 3 Oil, protein, chlorophyll and free fatty acids content in 2020, by province and grade

Province	N	Oil			Protein ¹			Chlorophyll Mg/Kg	Free Fatty Acids ² %, in oil
		Mean	Min	Max	Mean	Min	Max		
Soybean, No. 1 Canada and Soybean No. 2 Canada									
Manitoba	180	21.3	17.2	24.1	37.7	32.5	42.2	1.3	0.10
Saskatchewan	8	21.5	19.4	23.7	36.3	34.7	39.1	0.9	0.26
Western Canada	188	21.3	17.2	24.1	37.6	32.5	42.2	1.3	0.10
%, in dry basis									
Ontario	220	22.3	20.5	24.5	38.6	33.0	42.0	0.4	0.14
Quebec	35	20.9	19.4	23.6	39.7	34.6	43.3	0.6	0.20
Eastern Canada	255	22.1	19.4	24.5	38.8	33.0	43.3	0.4	0.15
Prince Edward Island	6	22.1	21.3	23.7	37.8	36.9	39.5	0.2	0.12
New Brunswick	15	20.3	19.9	22.1	40.1	36.6	43.3	0.8	0.15
Maritimes	21	20.8	19.9	23.7	39.4	36.6	43.3	0.6	0.14
Canada	464	21.8	17.2	24.5	38.3	32.5	43.3	0.8	0.13
Soybean, No. 3 Canada									
Western Canada	19	20.9	19.3	22.4	37.8	34.2	39.9	2.6	0.14
Eastern Canada³	7	21.1	20.3	24.3	38.6	36.4	39.9	0.8	0.48
Canada	26	21.0	19.3	24.3	38.0	34.2	39.9	2.1	0.23
Soybean, No. 4 Canada									
Western Canada	5	20.9	19.3	24.0	38.0	36.3	38.5	7.1	0.19
Eastern Canada	3	21.0	20.0	22.9	41.5	38.6	40.9	0.4	0.12
Canada	8	20.9	19.3	24.0	39.3	36.3	40.9	4.6	0.16
Soybean, No. 5 Canada									
Western Canada	6	20.6	19.4	22.4	37.3	33.7	39.6	6.4	0.12
Eastern Canada	NA								
Canada	6	20.6	19.4	22.4	37.3	33.7	39.6	6.4	0.12
Soybean, Sample									
Western Canada	2	21.7	20.9	22.5	35.7	34.3	37.1	8.8	0.12
Eastern Canada	NA								
Canada	2	21.7	20.9	22.5	35.7	34.3	37.1	8.8	0.12

¹ Calculated from nitrogen content with N x 6.25.

² Calculated as % of oleic acid.

³ Eastern Canada also represents the Maritimes.

NA non-applicable, no samples

Table 4 Main fatty acid contents and iodine value of the oil in 2020, by province and grade

Province	N	C16:0	C18:0	C18:1	C18:2	C18:3	SATS ¹	Iodine Value ² Units
%, in oil								
Soybean, No. 1 Canada and Soybean No. 2 Canada								
Manitoba	180	10.2	4.0	20.1	54.9	9.1	15.1	136.4
Saskatchewan	8	10.0	4.2	20.4	54.5	9.0	15.2	135.9
Western Canada	188	10.2	4.0	20.1	54.9	9.1	15.1	136.4
Ontario	220	10.6	4.0	20.8	54.5	8.5	15.4	134.9
Quebec	35	10.6	3.4	18.9	56.0	9.4	14.7	138.3
Eastern Canada	255	10.6	3.9	20.5	54.7	8.6	15.3	135.3
Prince Edward Island	6	10.2	3.7	19.5	56.5	8.5	14.7	137.1
New Brunswick	15	10.2	4.0	19.4	56.1	8.4	15.2	136.3
Maritimes	21	10.2	3.9	19.5	56.2	8.4	15.0	136.5
Canada	464	10.4	3.9	20.3	54.9	8.8	15.2	135.8
Soybean, No. 3 Canada								
Western Canada	19	10.0	3.8	19.5	55.6	9.4	14.7	137.9
Eastern Canada³	7	10.8	4.1	18.8	55.1	9.4	15.8	136.5
Canada	26	10.2	3.9	19.3	55.5	9.4	15.0	137.5
Soybean, No. 4 Canada								
Western Canada	5	10.0	4.1	20.2	54.8	9.0	15.1	136.1
Eastern Canada	3	10.0	3.7	19.8	56.9	8.0	14.4	137.0
Canada	8	10.0	4.0	20.1	55.6	8.6	14.8	136.4
Soybean, No. 5 Canada								
Western Canada	6	10.0	4.1	19.8	54.6	9.8	15.0	137.3
Eastern Canada	NA							
Canada	6	10.0	4.1	19.8	54.6	9.8	15.0	137.3
Soybean, Sample								
Western Canada	2	9.5	4.2	22.6	53.5	8.3	14.7	134.2
Eastern Canada	NA							
Canada	2	9.5	4.2	22.6	53.5	8.3	14.7	134.2

¹ Sum of all saturated fatty acid from C12:00 to C24:0.

² Calculated from the fatty acid composition.

³ Eastern Canada also represents the Maritimes.

NA non-applicable, no samples