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Quality of Canadian oilseed-type soybeans 2023

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Summary

Data on the quality of oilseed-type soybeans from 2023 was collected using composite samples of Canadian soybeans graded No. 1 and No. 2. The mean oil content (dry basis) was 21.8% (Tables 1 and 3), which is similar to the 2022 mean of 22.0% and the 5-year mean (2018 to 2022) of 21.9% (Table 1). The mean protein content (dry basis) was 38.6% (Tables 1 and 3), which is similar to the 2022 mean of 38.9% and the 5-year (2018 to 2022) mean of 38.6% (Table 1). The mean oil and protein content varied between composite samples from the western, eastern and Maritime provinces (Table 3). The western Canada (Manitoba and Saskatchewan) composite had a mean oil content of 22.2% and a mean protein content of 37.4%, whereas the eastern Canada (Ontario and Quebec) composite had a mean oil content of 22.6% and a mean protein content of 39.5%. The Maritime (New Brunswick and Prince Edward Island) composite had a mean oil content and protein content of 21.3% and 38.3%, respectively.

Introduction

The two major types of soybeans grown in Canada are:

- oilseed-type soybeans (“crush” or non-food grade)
- food-type soybeans (used for tofu and other soy products)

This report focuses on oilseed-type soybeans, which are used in the crushing industry and for animal feed production. Oilseed-type soybeans are grown for both oil and high-protein meal. Soybean oil is used in salad dressings, shortening and margarine products. Defatted soybean meal, which is protein rich, is used to supplement livestock rations.

Canadian soybean production has expanded in recent years and soybeans are now grown from the Maritimes through to Saskatchewan (Figure 1).

In 2023, 379 samples of oilseed-type soybeans were received by the Harvest Sample Program, much more than in 2022 (256 samples). Soybean samples originated from Saskatchewan (9), Manitoba (139), Ontario (177), Quebec (54), and the Maritimes (19), with 26% graded as Soybeans, No. 1 Canada and 72% graded as Soybeans, No. 2 Canada.

Oil, protein, free fatty acid and chlorophyll content, and fatty acid composition were determined using No. 1 and No. 2 soybean composite samples. Composites were prepared for western Canada (Manitoba and Saskatchewan), eastern Canada (Ontario and Quebec) and the Maritimes (New Brunswick and Prince Edward Island). Table 1 compares the 2023 data, the 2022 data and the 5-year means. Oil and protein content are provided on a dry basis and on a 13% moisture basis. Quality data for the No. 1 and No. 2 soybean composites from each location are given in Tables 3 and 4.

Table 1 Quality data for Soybeans, No. 1 Canada and Soybeans, No. 2 Canada composites in 2023 and 2022

Grade	Quality parameter	2023	2022	2018 to 2022 mean
Soybeans, No. 1 Canada and Soybeans, No. 2 Canada	Oil content, %, dry basis	21.8	22.0	21.9
	Oil content, %, 13% moisture	19.0	19.1	19.0
	Protein content ¹ , %, dry basis	38.6	38.9	38.6
	Protein content, %, 13% moisture	33.6	33.8	33.6
	Protein content of defatted meal, %, 13% moisture	42.9	43.4	43.0
	Chlorophyll content, mg/kg ² of seeds	0.3	0.5	0.5
	Free fatty acid content ³ , %	0.1	0.1	0.1
	Oleic acid, % in oil	20.4	20.3	20.3
	Linoleic acid, % in oil	54.1	54.5	54.5
	Alpha-linolenic acid, % in oil	9.3	8.7	8.8
	Total SFA ⁴ , % in oil	15.4	15.5	15.3
	Iodine value, units	136.0	135.0	135.0

¹ Protein content calculated from nitrogen (N) content using $N \times 6.25$.

² mg/kg = milligrams per kilogram.

³ Calculated as percentage of oleic acid.

⁴ Total SFA is the sum of all saturated fatty acids from C12:0 to C24:0.

Figure 1 Soybean production areas in Canada



Source: [Growing Areas : SOY Canada](#)

Weather and production review

Seeding and growing conditions

In Ontario and Quebec, seeding occurred during the first two weeks of May. Due to favorable soil temperatures and weather conditions, most of the soybean crop was planted by the end of May. The month of July was extremely wet, and crops showed a lot of variability. The slightly cooler temperatures also seemed to slow soybean development. Significant rainfall delayed harvesting, but most of the crop was harvested by late October.

In Manitoba, seeding was approximately 25% complete by the second week of May. Most seeding was completed by the second week of June. Variable rainfall throughout the growing season helped improve yields in some areas. In regions with minimal rainfall, soybeans struggled under hot and dry conditions. Most of the crop was harvested by the end of October.

Source: [Prograin | Crop reports for Western & Eastern Canada and Maritimes](#)

Production

The data on seeded area and production in 2023 and 2022 are given in Table 2. In 2023, the area seeded with soybeans increased to 2,257,200 hectares (ha) from 2,111,000 ha in 2022.

Soybean production in Canada increased steadily from 2000 to 2023, primarily due to increased production in Ontario. Production in eastern Canada was 5,304,849 metric tonnes (MT) in 2023, while production in western Canada peaked at 2,742,300 MT in 2017. Production in the west has been slowly decreasing in recent years, mainly due to poor weather conditions and uncertainty in the market. In 2023, however, production increased to 1,611,514 MT, making 2023 the highest production year in the west since 2018.

Table 2 Seeded area and production for Canadian soybeans in 2023 and 2022¹

Location	Seeded area (hectares)		Production (metric tonnes)		Production, 5-year mean (metric tonnes)
	2023	2022	2023	2022	2018 to 2022
Manitoba	645,600	459,200	1,566,858	1,318,459	1,270,202
Saskatchewan	27,500	18,400	44,656	36,883	97,837
Western Canada	673,100	477,600	1,611,514	1,355,342	1,368,039
Ontario	1,178,900	1,246,600	4,036,036	3,996,015	3,93,857
Quebec	405,300	386,800	1,268,813	1,126,353	1,148,597
Eastern Canada	1,584,200	1,633,400	5,304,849	5,122,368	5,102,454
Total Canada	2,257,200	2,111,000	6,916,363	6,477,710	6,470,494

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

Harvest samples

In 2023, the Canadian Grain Commission's Harvest Sample Program received 379 oilseed-type soybean samples, 123 more than in 2022 (Table 3). The distribution of samples was:

- 19 from the Maritimes (4 in 2022)
- 212 from eastern Canada (155 in 2022)
- 148 from western Canada (97 in 2022)

Canadian Grain Commission inspectors graded the samples according to the [Official Grain Grading Guide](#). In 2023, almost all of the submitted samples were graded as Soybeans, No. 1 Canada or Soybeans, No. 2 Canada. The grade distribution was relatively similar between eastern and western Canada, with 99.6% of the samples from the east (Maritimes, Ontario, and Quebec) being graded No. 1 and No. 2, compared to 95.5 % from the west (Manitoba and Saskatchewan).

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

Individual samples were analyzed for oil and protein content using a FOSS NIRSTM DS2500 near-infrared 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. [Oilseed method and test procedures](#) are available on our website.

Oil and protein content

In 2023, the mean oil content was 21.8% on a dry basis (19.0% at 13% moisture) for the No. 1 and No. 2 soybean composite (Table 1). These values are similar to the 2022 means (22.0% on a dry basis, 19.1% at 13% moisture) and the 5-year means (21.9% on a dry basis, 19.0% at 13% moisture). The oil content of individual samples ranged from 19.5% to 24.8% on a dry basis and 16.9% to 21.6% at 13% moisture. Figure 4 compares the oil content trends for eastern Canada, western Canada and all of Canada since 2006.

The mean protein content for the No. 1 and No. 2 soybean composite was 38.6% on a dry basis and 33.6% at 13% moisture (Table 1). These values are slightly lower than the results in 2022 (38.9% on a dry basis and 33.8% at 13% moisture), but identical to the 5-year means. The protein content of samples from eastern Canada (39.5%) was higher compared to western Canada (37.4%) and to the Maritimes (38.3%) (Table 3). The protein content of individual samples ranged from 30.9% on a dry basis (26.9% at 13% moisture) to 43.1% on a dry basis (37.5% at 13% moisture). Figure 2 compares the protein content trends from eastern and western Canada and all of Canada since 2006. Mean protein content in western Canadian samples has been consistently lower and has slightly more yearly variability than the mean protein content in samples from eastern Canada.

Figure 3 compares the trends in protein content of fully defatted soybean meal since 2006. In 2023, the protein content of defatted soybean meal from western Canada (48.1%) was lower than that from eastern Canada (50.3%).

Growing conditions are usually responsible for year-to-year variations in oil and protein content, whereas genetics or varietal differences are usually responsible for trends observed over several years. A combination of genetics and growing conditions is responsible for differences between eastern and western soybeans. Breeding currently focuses primarily on yield and other agronomic factors. Quality factors, such as oil or protein content, are not considered when registering new soybean varieties in Canada.

Fatty acid composition

Table 4 contains the 2023 data on the fatty acid composition of the No. 1 and No. 2 soybean composites according to location. Linoleic acid (C18:2), the main fatty acid found in soybean oil, had a mean value of 54.1% in the Canada-wide composite, compared to 54.5% in 2022. Oleic acid (C18:1), the second most important fatty acid in soybeans, had a mean value of 20.4%, similar to that in 2022 (20.3%). The unsaturated fatty acid, alpha-linolenic acid (C18:3), had a mean value of 9.3%, compared to 8.7% in 2022. The mean value of total saturated fatty acids was 15.4%.

Iodine value in oil estimates the degree of unsaturation in fatty acids. The higher the number of double bonds in the oil, the higher the iodine value and degree of unsaturation. In 2023, the mean alpha-linolenic acid content was higher than in 2022, while the mean linoleic acid content was slightly lower than in 2022. As a result, the iodine value in 2023 (136.0 units) was higher than in 2022 (135.0 units). Figure 5 compares the iodine value trends since 2006 for eastern Canada, western Canada and Canada. The yearly variations reflect environmental differences, including geographic factors and climatic factors such as temperature and precipitation.

There is no requirement to control the fatty acid composition in Canadian oilseed-type soybeans and varieties can show much variation. Weather also plays a role in the variability of fatty acid composition between years. In hot and dry conditions, seeds tend to produce oil with more saturation. For example, seeds will produce less polyunsaturated fatty acids, such as alpha-linolenic and linoleic acids, and more total saturated fatty acids and oleic acid. The opposite is observed if seeds are grown in cool conditions.

Free fatty acid content

The No. 1 and No. 2 soybean composite in 2023 had a mean free fatty acid (FFA) content of 0.1% (Tables 1 and 3), the same as in 2022. High FFA content in soybeans is due mainly to seed damage caused by wet harvest conditions and improper storage.

Chlorophyll content

Chlorophyll content is an indicator of maturity in soybeans: the lower the chlorophyll, the more mature the seed. In 2023, the chlorophyll content for the top grades of soybeans was higher in the western provinces at 0.3 milligrams per kilogram (mg/kg) compared to the eastern and Maritime provinces at 0.2 mg/kg and 0.1 mg/kg, respectively (Table 3).

Figure 2 Protein content (% dry basis) for Canadian oilseed-type soybeans from 2006 to 2023

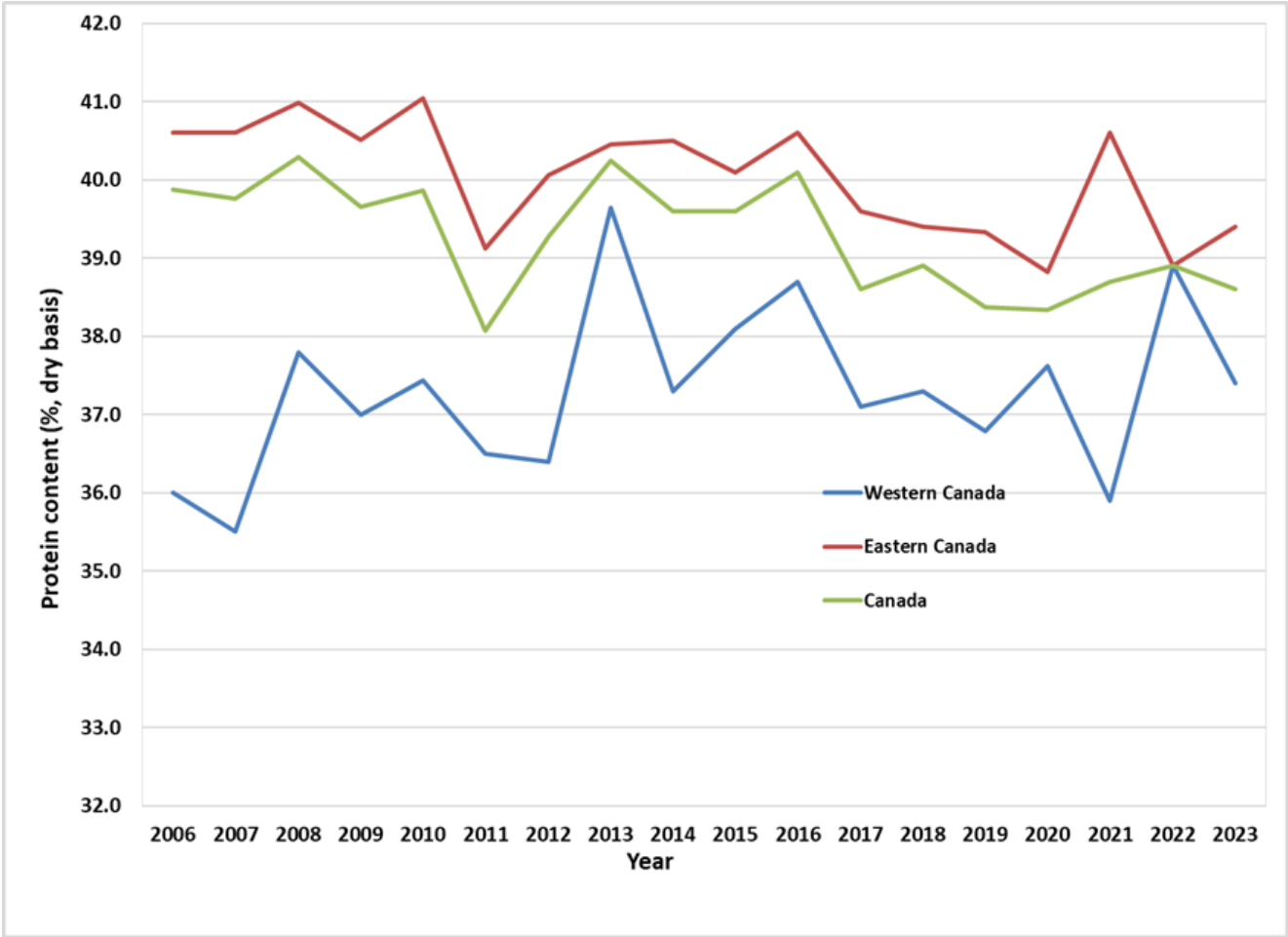


Figure 3 Protein content (% dry basis) of defatted meal for Canadian oilseed-type soybeans from 2006 to 2023

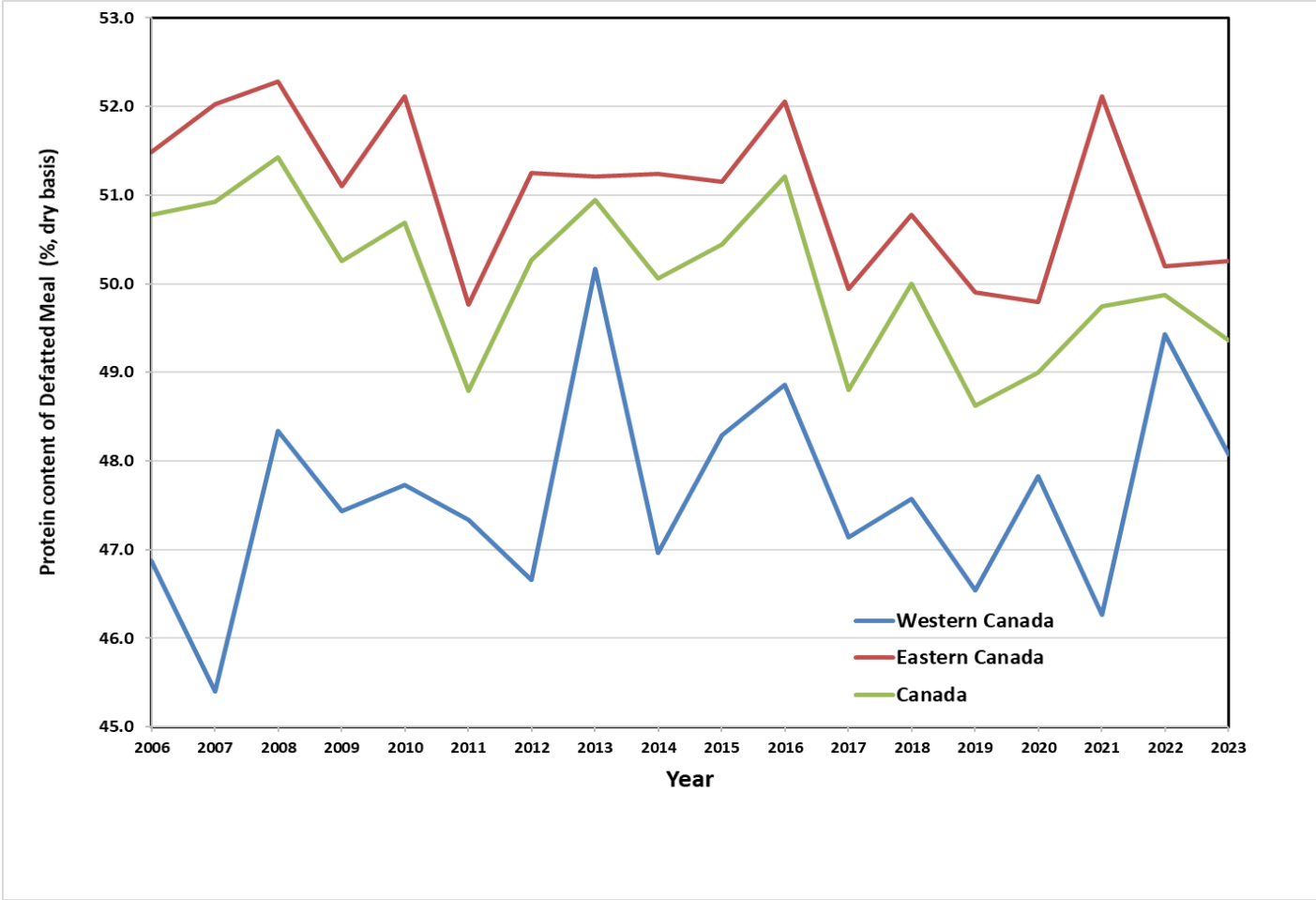


Figure 4 Oil content (% dry basis) for Canadian oilseed-type soybeans from 2006 to 2023

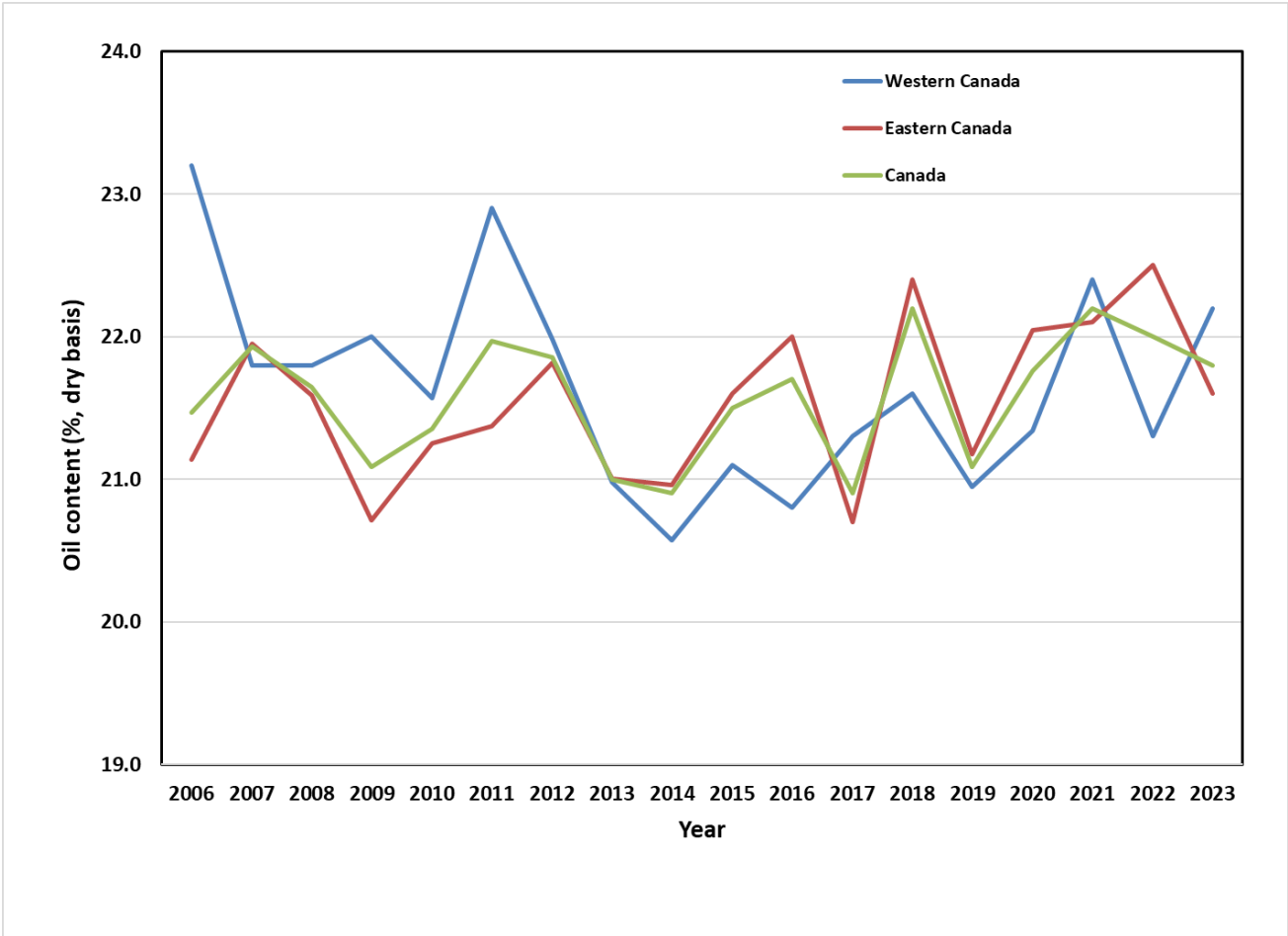


Figure 5 Iodine value of the oil (units) for Canadian oilseed-type soybeans from 2006 to 2023

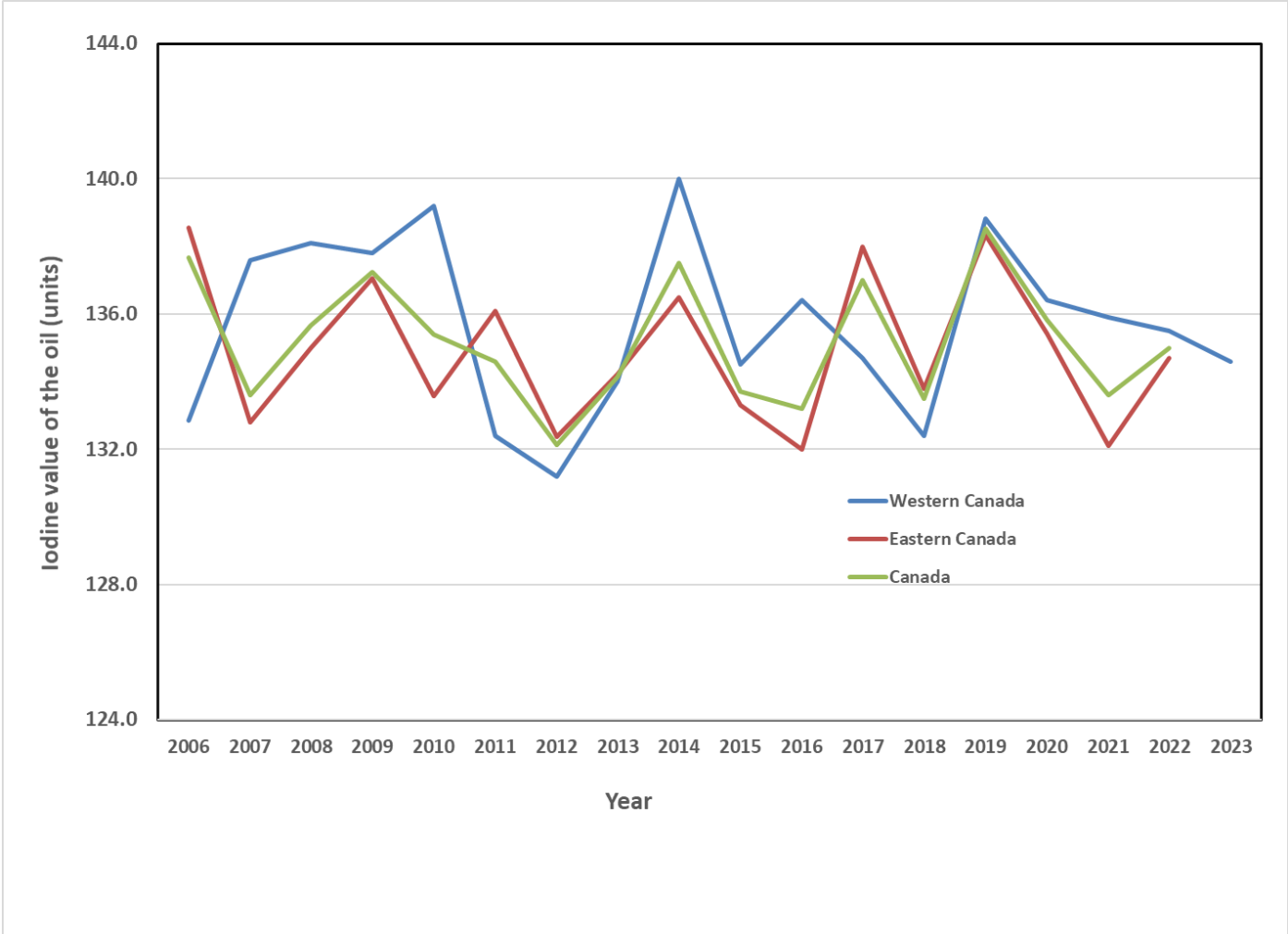


Table 3 Oil, protein, chlorophyll and free fatty acid content for composites of No.1 and No. 2 Canadian oilseed-type soybeans in 2023

Location	Number of samples	Oil content,%, dry basis			Protein content ¹ , %, dry basis			Chlorophyll content, mg/kg ²	Free fatty acid content ³ , %
		Mean	Min ⁴	Max ⁵	Mean	Min	Max		
Manitoba	139	22.2	20.3	24.8	37.4	30.9	39.8	0.29	0.09
Saskatchewan	9	21.9	21.4	23.1	36.6	33.8	37.9	0.54	0.07
Western Canada	148	22.2	20.3	24.8	37.4	30.9	39.8	0.30	0.10
Ontario	177	21.6	19.4	23.6	39.4	34.6	42.7	0.25	0.09
Quebec	51	21.6	20.4	24.5	40.0	36.4	43.1	0.21	0.06
Eastern Canada	212	22.6	19.4	24.5	39.5	34.6	43.1	0.20	0.10
Maritimes	19	21.3	20.4	23.0	38.3	35.6	40.6	0.10	0.10
Canada	379	21.8	19.4	24.8	38.6	30.9	43.1	0.30	0.10

¹ Protein content is calculated from nitrogen (N) content using N x 6.25.

² mg/kg = milligrams per kilogram.

³ Calculated as percentage of oleic acid.

⁴ Min = minimum.

⁵ Max = maximum.

Table 4 Main fatty acid content and iodine value of oil for composites of No.1 and No. 2 Canadian oilseed-type soybeans in 2023

Location	Number of samples	C16:0	C18:0	C18:1	C18:2	C18:3	SFA ¹	Iodine value ² , units
		Fatty acid composition,%, in oil						
Manitoba	139	10.6	4.2	20.8	53.7	8.9	15.7	134.6
Saskatchewan	9	10.1	4.2	20.9	54.4	8.7	15.2	135.3
Western Canada	148	10.6	4.2	20.8	53.8	8.9	15.7	134.6
Ontario	177	10.6	4.0	20.5	54.0	9.4	15.3	136.0
Quebec	51	10.5	3.7	19.7	55.1	9.4	15.0	137.2
Eastern Canada	212	10.6	3.9	20.3	54.2	9.4	15.3	136.2
Maritimes	19	10.9	3.6	17.4	56.2	10.4	15.3	139.7
Canada	379	10.6	4.0	20.4	54.1	9.3	15.4	135.8

¹ Total SFA is the sum of all saturated fatty acids from C12:0 to C24:0.

² Calculated from the fatty acid composition.

Acknowledgments

The Grain Research Laboratory acknowledges the cooperation of the soybean producers, grain handling facilities and oilseed crushing plants in eastern and western Canada for supplying the samples of newly harvested soybeans. We also acknowledge Canadian Grain Commission grain inspectors for grading the soybean samples and staff from the Oilseeds program for their technical assistance.