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Quality of Canadian soybeans

2008

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Canada

Quality Innovation Service

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For 2008, the Canadian average oil content of 21.6**%** was similar to the 21.7% in 2007 and 0.5% above the six-year (2002-2007) mean of 21.1%. The 2008 average protein content of 39.9**%** was lower than the 40.3% in 2007 and 1.0% below the six-year-mean value of 40.9%. However, there are notable regional differences in the quality parameters of the 2008 soybean crop. For the 2008 harvest survey, oil contents from Ontario and Manitoba soybeans were higher than those from Québec while protein contents from Ontario and Québec were notably higher than those in Manitoba.

Compared to 2007, the 2008 Ontario average oil content of 21.6% is 0.3% lower and the average protein content of 40.5% is 0.6% lower. Compared to 2007, the 2008 Québec average oil content of 21.2% is 1.0% higher while the average protein content of 41.1% is 0.2% higher. Compared to 2007, the 2008 Manitoba average oil content of 21.9% is 0.1% higher while the average protein content of 37.5% is 0.3% higher.

Introduction

This 2008 report provides quality data on the 180 non-food grade soybean samples submitted to the Grain Research Laboratory (GRL). This is slightly fewer than the 216 samples tested in 2007. The sample collection was coordinated by the Canadian Soybean Council, with assistance from the Manitoba Pulse Growers Association (MPGA), Ontario Soybean Growers (OSG) and the Federation des Producteurs de Cultures Commerciales du Québec. The data in this survey includes 123 samples from Ontario, 40 from Manitoba, 15 from Québec, and two from Saskatchewan. The data is been treated collectively but the information from the provinces is also compared. According to CGC grain inspectors, 85 of the samples graded Soybean, No.1 Canada, 91 graded Soybean, No.2 Canada, and 4 graded Soybean, No.3 Canada.

Some samples were “white hilum” types that typically contain higher amounts of seed protein. It is assumed in this report that these white hilum samples did not meet food grade specifications and would be used for crushing or feeding purposes.

Weather and production review

Weather review

Details of the entire Ontario and Manitoba growing seasons can be found at http://www.omafra.gov.on.ca/english/crops/field/reports/2008summary-d.htm and http://web2.gov.mb.ca/agriculture/mwcr/index.php respectively. Information on the other soybean growing areas can be found at http://www3.agr.gc.ca/apps/infohort/index.cfm?action=dspNCNCropNewsRpt&lang=eng.

Wet conditions resulted in a slow start to the Ontario soybean seeding with only about 25% of the Ontario crop being planted by May 15th. However, by the end of May, 90% of the fields were planted. The Ontario 2008 growing season was close to normal in terms of Crop Heat Units (CHU) but below last years' CHU's. Due to the abundant rainfall during July and August and warm temperatures in September near record yields were achieved. The 2008 Ontario soybean harvest progressed smoothly and 95% was harvested by November 20th.

The Manitoba soybean crop is usually grown in the south-central part of the province where there typically is a higher total accumulation of CHU. The majority of the Manitoba soybean crop was planted in the Red River Valley but the growing region stretched west to the area around Carman and Treherne (Figure 2). Temperature and precipitation patterns for the 2008 western Canadian growing season can be found on the PFRA web site (http://www.agr.gc.ca/pfra/drought/mapscc_e.htm).

The prairie provinces experienced cool spring weather to start the 2008 growing year. Precipitation during June was close to normal or above normal in most of the Prairie region. Temperatures during the month of May and June were significantly below normal, which delayed crop development. By the end of June, growth was 10 days to two weeks behind normal, but the crop condition was rated as mostly good to excellent. In July, moderate temperatures were reported, with many stations in the western Prairies reporting monthly averages that were 2 to 5 degrees Celsius below those received in July 2007. The cooler temperatures allowed crops to move through the reproductive stage without significant stress. For the early-planted soybean, the Manitoba harvest began in the second half of September and the harvest was estimated to be 75% completed by the end of October.

Production and grade information

Canadian soybean production in 2008 increased by 24% to 3.34 million tonnes from last year's production of 2.70 million tonnes (Table 1). In Ontario, soybean yields increased to 2.8 tonnes /ha from 2.3 tonnes/ha in 2007. The total Ontario crop was estimated at 2.48 million tonnes in the 2008 crop year, an increase of 24%. Other areas of significant soybean production for 2008 included Québec and Manitoba with 600,000 and 242,200 tonnes respectively. Yields for the 2008 Manitoba crop
(2.2 tonnes/ha) were notably lower than in Ontario (2.9 tonnes/ha) and Québec (2.6 tonnes/ha). While the average yield for Québec and Manitoba soybean remained similar to the 2007 values, the Ontario average yield increased by 32%. The 2007 Ontario crop yield was severely impacted by drought conditions.

Based on the 2008 CGC survey, 98% of the Canadian soybean samples received were in the top two grades. Immaturity or green beans were not a major issue in the 2008 Manitoba soybean crop, with all but two samples falling in the top two grades. For Ontario and Québec, over 99% of the samples received were in the top two grades. Seed size was reported to be normal for most Ontario samples.

Table 1 - Production of Canadian soybeans

Year	Seeded area	Production	Yield
	hectares	tonnes	tonnes/ha
1998	977 800	2 730 500	2.8
1999	1 002 000	2 775 000	2.8
2000	1 066 500	2 698 300	2.5
2001	1 058 000	1 594 100	1.5
2002	974 700	2 220 100	2.3
2003	1 050 800	2 268 300	2.2
2004	1 225 900	3 041 500	2.6
2005	1 176 400	3 161 300	2.7
2006	1 213 500	3 465 500	2.9
2007	1 180 100	2 695 700	2.3
2008	1 202 400	3 335 900	2.8

Source: Statistics Canada, *Field Crop Reporting Series*, *No.8*, 1998-2008

Harvest survey samples

This report provides quality data on the 180 non-food grade soybean samples submitted to the Grain Research Laboratory (GRL). The Canadian Grain Commission's Industry Services in Winnipeg, Manitoba graded the harvest survey samples. For the seventh consecutive year there were significant numbers of samples from Manitoba and Québec. While the data has been treated "collectively" the information from the provinces was also compared.

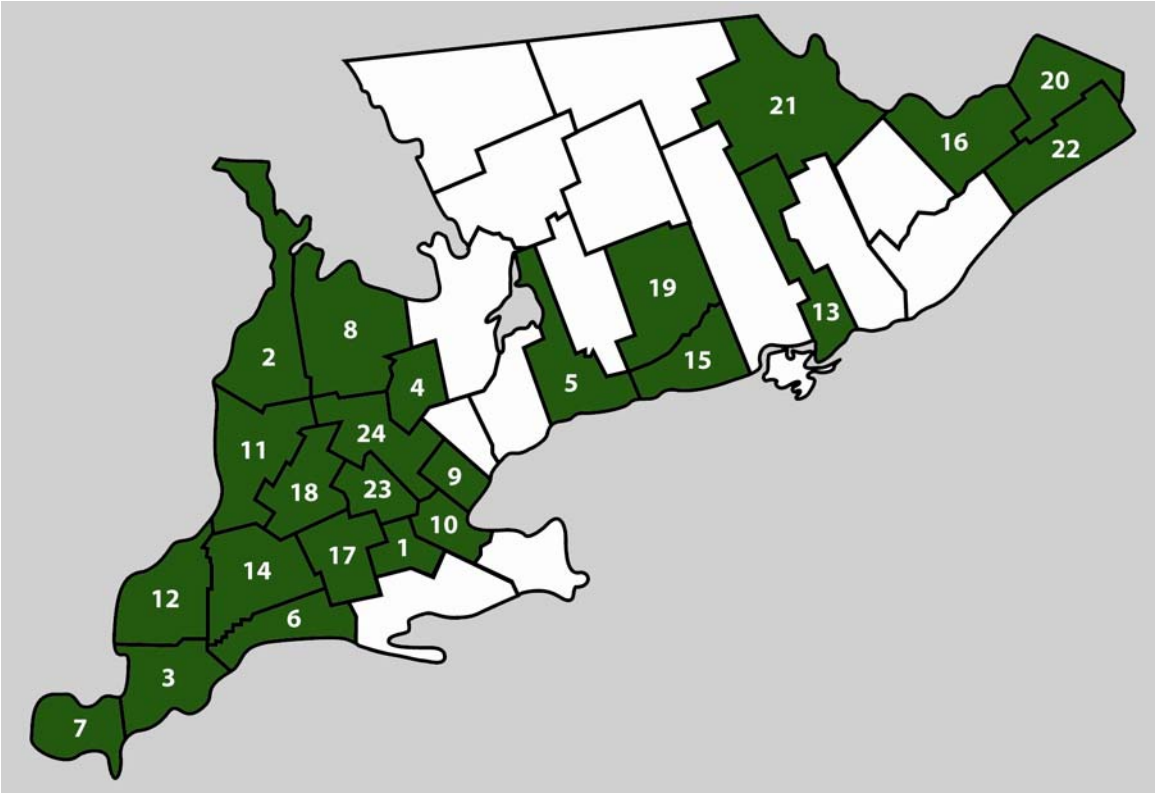
All samples were analyzed for oil and protein content using a Tecator Infratec 1241 Grain Analyzer near-infrared (NIR) spectrometer calibrated and verified against the appropriate laboratory reference method. Grade composite samples were analyzed for fatty acid composition and free fatty acids. The reference procedures are listed on the CGC web site under Oilseeds Methods http://www.grainscanada.gc.ca/Quality/Methods/oilseedmethods-e.htm.

Table 2 – Quality data for harvest survey soybeans – non-food types
Soybean, No. 1 and No. 2 Canada grades combined data[1]

Quality parameter	2008	2007	2006	2005	2002-2007
Oil content[2],%	21.6	21.7	21.6	21.5	21.1
Protein content[3],%	39.9	40.3	40.0	40.2	40.9

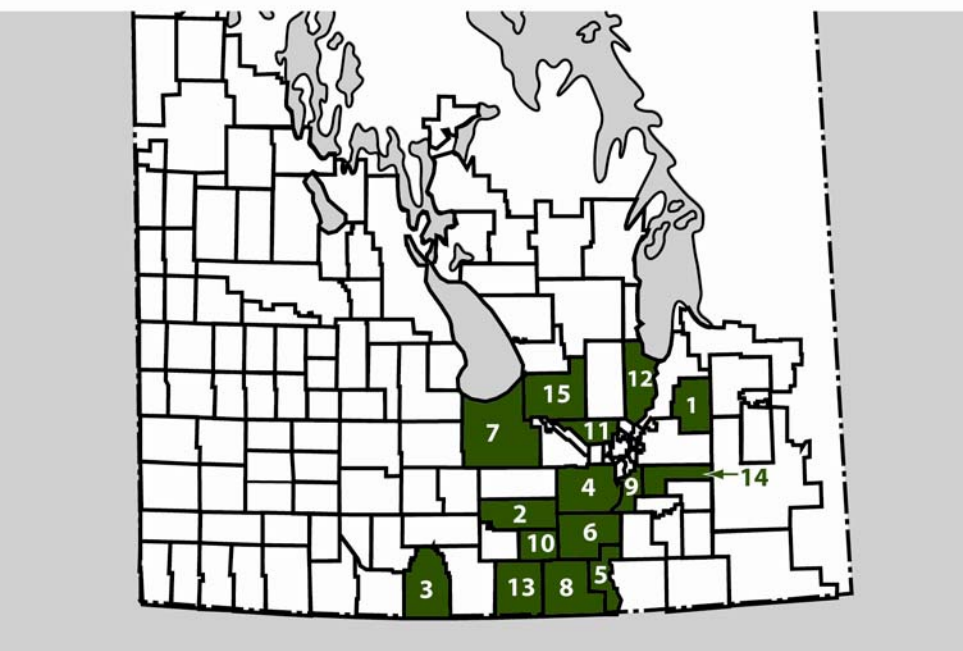
[1] Means for the combined grades
[2] Dry matter basis
[3] N x 6.25, dry matter basis

Figure 1 – Map of southern Ontario showing counties of origin for 2008 soybean survey samples



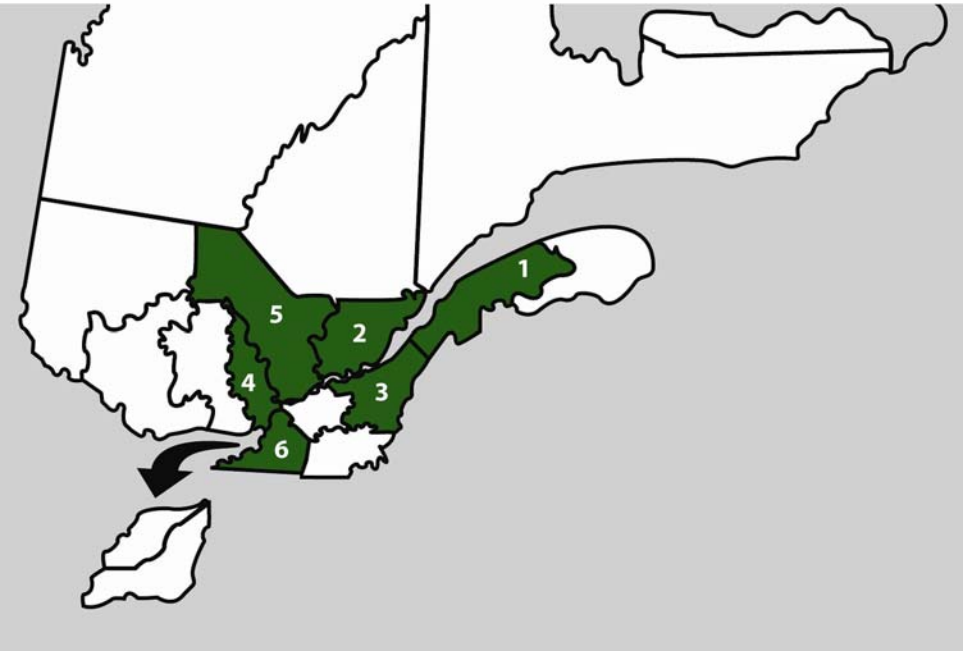
1. Brant
2. Bruce
3. Chatham-Kent
4. Dufferin
5. Durham
6. Elgin
7. Essex
8. Grey
9. Halton
10. Hamilton-Wentworth
11. Huron
12. Lambton
13. Lennox & Addington
14. Middlesex
15. Northumberland
16. Ottawa-Carleton
17. Oxford
18. Perth
19. Peterborough
20. Prescott & Russell
21. Renfrew
22. Stormont, Dundas & Glengarry
23. Waterloo
24. Wellington

Figure 2 – Map of southern Manitoba showing rural municipalities of origin for 2008 soybean survey samples



1. Brokenhead
2. Dufferin
3. Louise
4. Macdonald
5. Montcalm
6. Morris
7. Portage la Prairie
8. Rhineland
9. Ritchot
10. Roland
11. Rosser
12. St. Andrews
13. Stanley
14. Tache
15. Woodlands

Figure 3 – Map of Québec showing regions of origin for 2008 soybean survey samples



1. Bas-Saint Laurent
2. Capitale-Nationale
3. Chaudière-Appalaches
4. Lanaudière
5. Mauricie
6. Montérégie

Quality of Canadian soybeans – 2008

There are two major types of soybeans grown in Canada, commonly referred to as oil (or "crush") beans and food grade beans. This report deals with the "non-food grade" samples and thus could be considered those destined for the feed or crushing industry. A listing of Canadian soybean varieties is provided in *List of Varieties which are Registered in Canada*, Variety Registration Office, Variety Section, Plant Health and Production Division, Canadian Food Inspection Agency (http://www.cfia_acia.agr.ca/english/plant/variety/list_e.html).

Oil beans are grown for producing oil and high-protein meal. Soybean oil is used in salad oil, shortening and margarine products. Defatted soybean meal is used as a protein supplement in livestock rations. Key quality factors for oil beans are oil content, protein content, and the fatty acid composition. Oil and protein content give quantitative estimates of the beans as a source of oil, and defatted meal as a source of protein for animal feed. The fatty acid composition provides information about the nutritional, physical and chemical characteristics of the oil extracted from the beans.

Food beans are varieties of soybeans that have been bred for specific qualities required in the production of traditional soyfoods. The quality of these beans is measured by such attributes as a clear or white hilum, larger seed size, and higher protein content. White-hilum soybeans that do not meet quality standards for food processing are used as oil beans or feed beans. Some of these samples would have been part of the 2008 crush bean survey. Quality of the designated Canadian food grade samples is not discussed in this report.

Oil and protein content

The oil and protein data in this report was collected using a Tecator Infratec 1241 Grain Analyzer near-infrared (NIR) spectrometer calibrated and verified with the reference procedures listed under the Oilseeds Methods section. The data in the following oil and protein discussions is based on the Soybean, No. 1 and No. 2 Canada "combined grade means" for the entire non- food grade samples received from Ontario, Québec, Saskatchewan and Manitoba (Table 2). In addition, a comparison by all grades and provinces is provided in Tables 3.

For 2008, the Canadian average oil content of 21.6**%** was similar to the 21.7% in 2007 and 0.5% above the six-year (2002-2007) mean of 21.1%. Individual producer samples varied in oil content from 17.4% to 24.9%. The 2008 average protein content of 39.9**%** was lower than the 40.3% in 2007 and 1.0% below the six-year-mean value of 40.9% (Table 2). Individual producer samples varied in protein content from 33.8% to 47.3%.

Compared to 2007, the Ontario 2008 samples contained 0.6% less protein and 0.3% less oil. Compared to 2007, the Québec 2008 samples contained 0.2% more protein and 1.0% more oil.

Because of the increasing amounts of white-hilum beans being produced in Ontario and Québec, long-term oil and protein trends may not be as clear as in

earlier years when surveys contained mainly dark hilum, “crush” beans. Some white-hilum soybeans that do not meet quality standards for food processing are also used as “crush” beans and may be submitted to this survey.

Compared to 2007, the Manitoba 2008 samples contained 0.3% more protein and 0.1% more oil. For the 2008 survey (Table 3), samples from Manitoba, which had below average heat units, were notably lower in protein but not significantly different in oil content than samples from Ontario. The differences in the mean oil and protein contents for the Ontario and Manitoba samples are most evident in the top two grades of soybean. The Soybean, No. 2 Canada grade includes sufficient numbers of samples for meaningful comparisons (Table 3). While quality parameters can be strongly affected by environmental conditions such as heat and drought stress, the variety of soybean planted plus soil fertility can also affect quality parameters. The strong inverse relationship between oil and protein content is illustrated in Figure 4 for both growing regions.

Fatty acid composition

The fatty acid composition of the Ontario soybean grade composites from the 2008 harvest survey showed only small differences between the top two grades (Table 5). However, compared to 2007, the grade composites had some changes in the fatty acid profiles. For the Ontario Soybean, No. 1 and No. 2 Canada grade composites there were increases in linolenic acid of 1.2% and 1.1% respectively. The sum of the two major saturated fatty acids, palmitic and stearic acid, were about 0.3% lower than in the 2007 composites. Compared to 2007, the oil from the 2008 Ontario Soybean, No. 1 and No. 2 Canada grade composites had iodine values that were 2 units higher.

The fatty acid composition of the Québec soybean grade composites from the 2008 harvest survey showed minor differences between the top two grades (Table 5). For the Québec Soybean, No. 1 and No. 2 Canada grade composites there were changes in linolenic acid of -1.2% and +0.1% respectively. The sum of the two major saturated fatty acids, palmitic and stearic acid, were about 0.9% lower than the 2007 top grade composite but similar for the No. 2 Canada grade composite. Compared to 2007, the 2008 oil from the Québec Soybean, No. 1 and No. 2 Canada grade composites had similar iodine values.

The fatty acid composition of the Manitoba soybean grade composites from the 2008 harvest survey showed only small differences between the top two grades. Compared to 2007, the Manitoba Soybean, No.1 and No.2 Canada composites had similar amounts of linolenic acid of 10.2 and 10.1% respectively. Compared to 2007 the sum of the two major saturated fatty acids, were similar for both the Soybean, No. 1 and No. 2 Canada grade composites. Compared to 2007, the oil from the 2008 Manitoba Soybean, No. 1 and No. 2 Canada grade composites had similar iodine values of 138 units. Because of the relatively few samples tested from Québec the fatty acid profiles should be used with caution.

The growing conditions and variety selection likely contributed to the differences in the fatty acid composition between the Manitoba and Ontario top grade composites (Table 5). The Manitoba Soybean, No. 1 and No. 2 Canada grade composites had significantly more linolenic and linoleic acid but less oleic acid than the Ontario composites in 2008. In addition, the Manitoba composites had an overall iodine value that was 3 units higher than the Ontario Soybean, No. 1 and No. 2 Canada grade composites.

Free fatty acid (FFA) content

The grade composites analyzed in 2008 had very low levels of FFA, most less than 0.1%. Unlike some years, when the majority of lower grade samples were down graded due to damage from insects boring into the seeds, the 2008 down-graded seeds were not from insect damage. Any damage which exposes the inside of the seed to moisture and oxygen may result in oxidation of the oil and a notable rise in FFA content.

Table 3 – Oil and protein content of 2008 soybean survey by province and grade

Province	Number of samples	Oil content[1] %			Protein content[2] %		
		mean	min.	max.	mean	min.	max.
Soybean, No. 1 Canada							
Manitoba	11	22.2	20.2	23.4	37.0	35.6	39.1
Ontario	72	21.7	19.5	24.9	40.4	35.7	44.5
Québec	2	23.0	22.7	23.2	40.1	40.1	40.1
All provinces	**85**	**21.8**	**19.5**	**24.9**	**40.0**	**35.6**	**44.5**
Soybean, No. 2 Canada							
Manitoba	27	21.7	20.0	24.1	37.7	34.1	41.7
Saskatchewan	1	21.1	21.1	21.1	33.8	33.8	33.8
Ontario	50	21.6	20.2	24.6	40.7	36.0	44.4
Québec	13	20.9	17.4	23.0	41.3	37.3	47.3
All provinces	**91**	**21.5**	**17.4**	**24.6**	**39.8**	**33.8**	**47.3**
Soybean, No. 3 Canada							
Manitoba	2	21.1	20.8	21.4	38.3	37.8	38.7
Saskatchewan	1	21.8	21.8	21.8	33.1	33.1	33.1
Ontario	1	22.1	22.1	22.1	39.1	39.1	39.1
All provinces	**4**	**21.5**	**20.8**	**22.1**	**37.2**	**33.1**	**39.1**
Soybean, all grades							
Manitoba	40	21.8	20.0	24.1	37.5	34.1	41.7
Saskatchewan	2	21.5	21.1	21.8	33.4	33.1	33.8
Ontario	123	21.6	19.5	24.9	40.5	35.7	44.5
Québec	15	21.2	17.4	23.2	41.1	37.3	47.3
All provinces	**180**	**21.6**	**17.4**	**24.9**	**39.8**	**33.1**	**47.3**

[1] Dry matter basis
[2] N x 6.25; dry matter basis

Table 4 – Comparison of 2005 to 2008 soybean data with six year means
Soybean, No. 1 and No. 2 Canada grades combined

Year and region	Oil content[1] %	Protein content[2] %	Sum of oil and protein[2] %
2008			
All regions	21.6	39.9	61.5
Manitoba	21.9	37.5	59.3
Ontario	21.6	40.5	62.2
Québec	21.2	41.1	62.3
Saskatchewan	21.1	33.8	54.9
2007			
All regions	21.7	40.3	62.0
Manitoba	21.8	37.2	59.0
Ontario	21.9	41.1	62.9
Québec	20.2	40.9	61.1
Saskatchewan	22.7	36.0	58.7
2006			
All regions	21.6	40.0	61.6
Alberta	22.0	38.4	60.4
Manitoba	23.5	36.8	60.3
Ontario	21.4	40.5	61.9
Québec	20.0	41.6	61.6
Saskatchewan	22.6	38.7	61.3
2005			
All regions	21.5	40.2	61.7
Alberta	n/a	n/a	n/a
Manitoba	20.2	39.9	60.1
Ontario	22.6	40.6	63.2
Québec	22.5	39.3	61.8
Saskatchewan	n/a	n/a	n/a
2002-2007 means			
All regions	21.1	40.9	62.0
2002-2007 Ontario	21.5	41.3	62.8
2002-2007 Manitoba	21.3	39.2	60.4
2002-2007 Québec	20.6	41.4	62.0

[1] Dry matter basis
[2] N x 6.25; dry matter basis
n/a No Soybean, No. 1 or No. 2 Canada samples in survey

Table 5 – Fatty acid composition and FFA content for 2008 harvest survey soybean grade composites

Province	Fatty acid composition[1]					Iodine value[3]	Free fatty acids %
	C16:0	C18:0	C18:1	C18:2	C18:3		
Soybean, No. 1 Canada							
Manitoba	10.0	3.8	20.2	54.4	10.2	138	0.04
Ontario	9.9	4.2	22.2	53.3	9.1	135	0.10
Québec	9.5	3.5	21.0	56.7	8.0	137	0.03
Soybean, No. 2 Canada							
Manitoba	10.2	3.8	20.3	54.4	10.1	138	0.04
Saskatchewan	9.6	3.9	19.9	52.8	12.3	141	0.13
Ontario	9.8	4.3	22.7	52.9	8.9	134	0.08
Québec	9.7	4.1	21.5	53.9	9.4	137	0.10
Soybean, No. 3 Canada							
Manitoba	10.1	3.6	20.0	53.8	11.2	140	0.04
Saskatchewan	9.7	4.4	20.8	52.1	11.5	138	0.08
Ontario	10.4	4.0	21.3	54.5	8.5	135	0.11

[1] Percentage of total fatty acids including palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3); other minor fatty acids totaled 1.4% to 2.0%
[2] As designated on the sample envelope
[3] Calculated from the fatty acid composition

Figure 4 – Relationship between oil and protein content for 2008