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# Quality of western Canadian flaxseed 2011

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Canada

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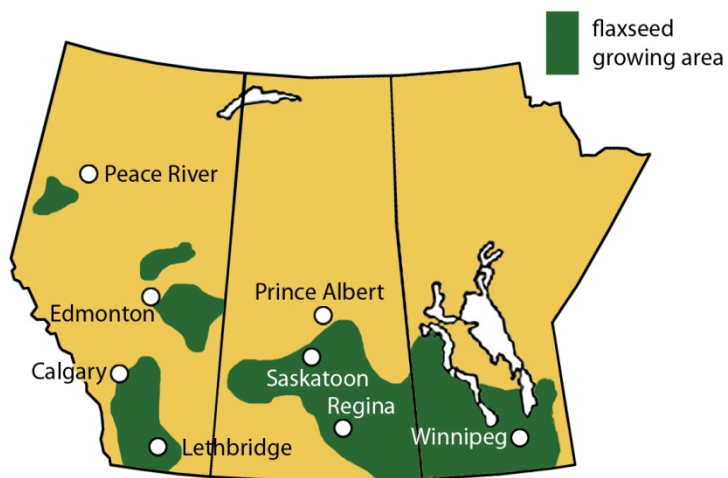
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# Introduction

This report presents quality data and information based on the Canadian Grain Commission (CGC) 2011 harvest survey of western Canadian flaxseed. The quality data includes oil, protein, free fatty acids, fatty acid composition and iodine values of harvest survey samples submitted to the Grain Research Laboratory (GRL). Producers and grain companies submitted the samples throughout the harvest period. The map shows the traditional growing areas for flaxseed in western Canada.

**Figure 1 – Map of western Canada showing traditional growing areas for flaxseed**



Source: Flax Council of Canada

## Summary

The Canadian Grain Commission's 2011 Harvest Survey of Western Canadian Flaxseed shows an increase in oil and protein content, and a decrease in iodine value when compared to the 2010 Harvest survey as seen in Tables 1 and 2.

Oil content for 2011 was 45.9% a 1.0% increase from 2010, and a 0.6% increase from the 10 year average. The protein content for 2011 was 21.9% a 0.8% increase from 2010 and a 1.2% decrease from the 10 year mean.

Environmental factors can play an important role in oil and protein content trends as well as fatty acid composition. For the 2010 growing season due to excessive moisture in Saskatchewan, where majority of our samples came from, only 73% of seeding was complete in the first week of June, whereas this year (2011) 82% of the seeding was completed for the same period in June. (Saskatchewan Crop Report 11). Earlier seeding has been suggested to lead to an increase in oil content and seed size when compared to later seeding (Flax Council, <http://www.flaxcouncil.ca/>). Daily temperatures and soil saturation can also play a role in oil and protein content. Cooler temperatures tend to produce higher oil and lower proteins. However, excess soil moisture has been shown to hinder the plants ability to absorb necessary nutrients for its development and growth.

**Table 1 - Flaxseed, No. 1 Canada Western**  
**Quality data for 2011 harvest survey**

Quality parameter	2011	2010	2001-2010 Mean
Oil content <sup>1</sup> , %	45.9	44.9	45.3
Protein content <sup>2</sup> , %	21.9	21.1	23.1
Free fatty acids, %	0.20	0.20	0.24
Iodine value	192.5	194.6	191.1

<sup>1</sup> Dry matter basis

<sup>2</sup> N x 6.25; 8.5% moisture basis

**Table 2 - Flaxseed, No. 1 Canada Western**  
**Fatty acid composition for 2011 harvest survey**

Fatty acid <sup>1</sup> , % in oil	2011	2010	2001-2010 Mean
Palmitic acid (C16:0)	5.1	5.2	5.0
Stearic acid (C18:0)	3.4	3.2	3.4
Oleic acid (C18:1)	17.9	16.8	18.3
Linoleic acid (C18:2)	15.1	15.2	15.5
$\alpha$ -Linolenic acid (C18:3)	57.6	58.8	56.8

<sup>1</sup> Percentage of total fatty acids in the oil including palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3)

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# Weather and production review

## Weather review, seeding and growing conditions

This year's growing season was characterized by extremes in weather conditions across the western prairies. In May and June the southern parts of the prairies experienced excessive amounts of precipitation with greater than 60mm of rain in some areas, flooding out important flax growing regions of southern Manitoba and south eastern Saskatchewan. In contrast the central and northern parts of the Prairie Provinces remained relatively dry with less than 30-40mm of precipitation. The average monthly mean temperatures for May was 1-2 degrees below average in the southern part of the prairies while central and north western Alberta experienced 1-2 degrees above normal temperatures.

In July and August, the southern regions were relatively warm and dry with less than 20mm of precipitation while central and northern regions were cool and wet with 20-30mm of precipitation in some areas and 60mm precipitation in north central Alberta.

The month of September was 3-4 degrees above normal monthly mean temperatures, but a severe frost was reported in mid September. The warm dry weather continued into October allowing for 90 percent of harvest to be completed by the first week of October.

Details on the 2011 growing season can be found at <http://www4.agr.gc.ca/DW-GS/historical-historiques.aspx?lang=eng&jsEnabled=true>.

Weather and Crop Surveillance department of the Canadian Wheat Board and AAFC provided the majority of the detailed weather review for the 2011 crop year.

## Production and grade information

Western Canadian farmers seeded 281 thousand hectares to flaxseed in 2011 (Table 3), which is a decrease when compared to 2010 (374 thousand hectares). The 2011 yield estimate of 1,300 kg/ha was higher than the yield reported in 2010 (1,200 kg/ha) and higher than the 10-year mean of 1,205 kg/ha. Western Canada flaxseed production had an overall decrease to 368 thousand metric tonnes when compared to last year's 423, thousand metric tonnes. Flaxseed production decreased in Manitoba to 38 thousand metric tonnes, Saskatchewan to 279 thousand metric tonnes but in Alberta production increased to 51 thousand metric tonnes when compared to 2010 production values as shown in *Field Crop Reporting Series No. 8*, November estimates. Saskatchewan accounted for 76% of flaxseed production while Manitoba and Alberta had 10% and 14%, respectively.

Over 98% of the samples received for the 2011 CGC Harvest Survey were graded as Flaxseed, No.1 CW.

**Table 3 - Seeded area and production for western Canadian flaxseed**

	Seeded area		Production <sup>1</sup>		Average production <sup>2</sup>
	2011	2010	2011	2010	2001-2010
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	38	71	38	81	162
Saskatchewan	217	287	279	311	567
Alberta	26	16	51	31	29
Western Canada	281	374	368	423	758

<sup>1</sup> Source—Source: *Field Crop Reporting Series, No. 8, December 6, 2011; Statistics Canada*

<sup>2</sup> Source—Source: *Field Crop Reporting Series*, revised final estimates for 2001-2010.

## Harvest survey samples

Flaxseed samples for the CGC harvest survey are collected and cleaned to remove dockage prior to testing. The samples are analyzed for oil, protein and iodine value using a NIRSystems 6500 scanning near-infrared spectrometer, calibrated to and verified against the appropriate reference method. Composite samples are used for free fatty acids and fatty acid composition analyses. Composites are prepared by combining Flaxseed samples by crop districts for each grade.

This year's harvest survey report includes 176 samples compared to 240 in 2010. Manitoba contributed 42 samples, Saskatchewan 115 samples and Alberta 16 samples during the harvest period from September 1 to December 1st, 2011. Weighting factors are used to calculate provincial and western Canadian means.

# Quality of western Canadian flaxseed – 2011

Tables 4 and 5 show detailed information on the quality of top grade western Canadian flaxseed harvested in 2011. Of the flax samples submitted to the GRL 98 % were graded as No. 1 Canada Western with the reminder 2% consisting of No. 2 Canada Western and Sample grade. The number of harvest survey samples collected from each province may not represent the actual production or grade distribution. However, there were sufficient samples to provide good quality information for each province. To calculate western Canadian averages, provincial averages are weighted by the Statistics Canada production estimate and an estimate of grade distribution.

Oil and protein content give quantitative estimates of the value of the seed as a source of oil and of the resulting meal as a source of protein for animal feed.  $\alpha$ -linolenic acid is an omega-3 ( $\omega$ -3) fatty acid which literature has shown can play an important role in maintaining good health in humans and animals. It is the main factor for the increase use of whole and ground flaxseed in cereals and baked goods, and flaxseed oil in salads. Flax seeds are also used in animal feeds, for example in chicken to produce  $\omega$ -3 eggs. Iodine value is a measure of the overall unsaturation of the oils and can be calculated from the fatty acid composition. Oils with higher iodine values, *i.e.*, with more unsaturation, polymerize more rapidly in the presence of air. In flax, iodine value is directly related to the amount of  $\alpha$ -linolenic acid present in the oil.  $\alpha$ -linolenic acid is one of the most important quality factor for industrial use as it is this fatty acid, which is responsible for most of flaxseed oil's drying properties.

**Table 4 - Flaxseed, No. 1 Canada Western  
Quality data for 2011 harvest survey**

Province	Number of samples tested	Oil content <sup>1</sup> , %			Protein content <sup>2</sup> , %			Iodine value		
		Mean	min.	max.	mean	min.	max.	mean	min.	max.
Manitoba	42	45.4	41.3	48.5	22.6	18.4	26.9	192.2	184.3	209.9
Saskatchewan	115	46.1	41.8	49.5	21.6	17.4	25.7	192.4	182.7	209.0
Alberta	16	46.2	43.0	47.7	22.1	19.2	24.8	193.8	189.2	197.7
<b>Western Canada<sup>3</sup></b>	173	45.9	41.3	49.5	21.9	17.4	26.9	192.5	182.7	209.9

<sup>1</sup> Dry matter basis

<sup>2</sup> N x 6,25; dry matter basis

<sup>3</sup> Mean values are weighted averages based on estimated production by province (Statistics Canada).

**Table 5 – Flaxseed, No. 1 Canada Western  
Fatty acid composition and free fatty acids content of 2011 harvest survey**

Province	Number of samples	Free fatty acid composition, % <sup>1</sup>					Free fatty acids
		C16:0	C18:0	C18:1	C18:2	C18:3	
Manitoba	42	5.1	3.4	18.0	15.1	57.5	0.26
Saskatchewan	115	5.1	3.4	17.9	15.1	57.6	0.16
Alberta	16	5.0	3.5	17.4	15.0	58.4	0.10
<b>Western Canada<sup>2</sup></b>	<b>173</b>	<b>5.1</b>	<b>3.4</b>	<b>17.9</b>	<b>15.1</b>	<b>57.6</b>	<b>0.20</b>

<sup>1</sup> Percentage of total fatty acids in the oil including palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3)

<sup>2</sup> Mean values are weighted averages based on estimated production by province (Statistics Canada).

Table 6 compares the quality of recent flaxseed exports with this year's harvest survey data. The harvest survey data are from producer samples that have been cleaned to remove dockage, while recent exports of flaxseed from Thunder Bay and Vancouver contained from 0.8% to 7.7% dockage. Dockage will affect quality factors such as oil content, iodine value and free fatty acids. Flaxseed exports containing over 2.5% dockage are considered not commercially clean.

**Table 6 – Flaxseed, No. 1 Canada Western  
Comparison of 2011 harvest survey quality data with recent export shipments**

Quality parameter	2011 survey	2011 exports
Oil content <sup>1</sup> %	45.5	43.9
Protein content <sup>2</sup> %	21.9	20.1
Free fatty acids, %	0.2	0.5
Iodine value	192.5	193.5
Palmitic acid, % in oil	5.1	5.1
Stearic acid, % in oil	3.4	3.2
Oleic acid, % in oil	17.9	17.5
Linoleic acid, % in oil	15.1	15.7
$\alpha$ -Linolenic acid, % in oil	57.6	57.8
<b>Number of samples</b>	<b>173</b>	<b>10</b>

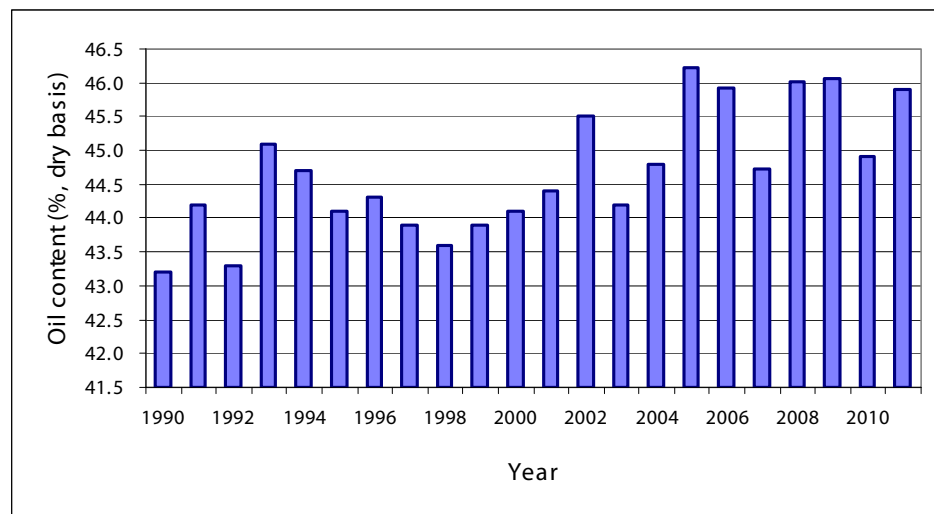
<sup>1</sup> Dry matter basis

<sup>2</sup> N x 6.25; dry matter basis

## Oil content

The average oil content of 45.9 % for Flaxseed, No.1 CW from the 2011 harvest survey is higher when compared to the 2010 oil content of 44.9% (Figure 2). The oil content for Manitoba, 45.4% is lower than in Saskatchewan and Alberta, which had oil content of 46.1% and 46.2% respectively. When comparing to 2010 the average oil contents in 2011 are 1.0% higher for both Manitoba and Saskatchewan samples and 0.4% higher for Alberta samples. The oil content of Flaxseed, No.1 CW samples from producers across western Canada ranged from 41.3% to 49.5%.

**Figure 2 – Flaxseed, No. 1 Canada Western  
Oil content of harvest survey samples, 1990-2011**



2011 average .....	45.9%
2010 average .....	44.9%
2001–2010 mean .....	45.3%

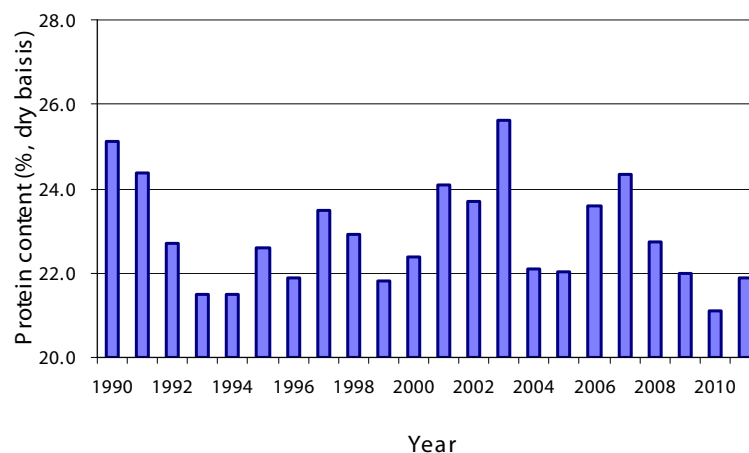
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## Protein content

The average protein content of 21.9% for Flaxseed, No.1 CW from the 2011 harvest survey is 0.8% higher than in 2010 but 1.2% lower than the 10-year mean of 23.1%(Figure 3). The Manitoba average protein content of 22.6% was higher than the 22.1% in Alberta and the 21.6% in Saskatchewan. Compared to 2010, the average protein contents for Manitoba and Saskatchewan increased at 0.7% and 0.9%, respectively, while the protein content for Alberta remained similar with a very slight decrease of 0.1%. The protein content of Flaxseed, No.1 CW samples from producers across western Canada ranged from 17.4% to 26.9%.

As Table 6 shows, the protein content of Flaxseed, No.1 CW exports averaged 21.2% for the 2010–2011 shipping season. The protein content of flaxseed exports in 2011–2012 should be similar to the export shipments of the previous season.

**Figure 3 – Flaxseed, No. 1 Canada Western  
Protein content of harvest survey samples, 1990–2011**



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2011 average.....	21.9%
2010 average.....	21.1%
2001–2010 mean .....	23.1%

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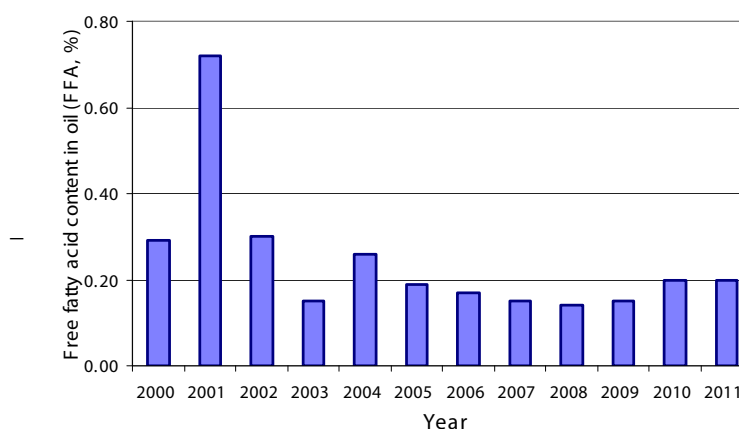
## Free fatty acids content

The average free fatty acids (FFA) content of 0.20 % in top grade 2011 survey samples is similar to the 2009 average and below the 10-year mean of 0.24%( Figure 4). The average FFA content of Manitoba samples, 0.26% is higher than Saskatchewan's and Alberta's FFA value of 0.16% and 0.17%, respectively. Higher FFA values are mainly due to seed damage resulting from exposure to moisture and oxygen, for example during wet harvesting conditions or improper storage.

The lower grade samples (No.2 CW to Canada Sample Grade) had a mean FFA content of 1.00%.

The FFA content of Flaxseed, No.1 CW exports for 2010-2011 exports was 0.50%.

Figure 4– Flaxseed, No. 1 Canada Western  
Free fatty acids content of harvest survey samples, 2000–2011



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<b>2011 average .....</b>	<b>0.20%</b>
<b>2010 average .....</b>	<b>0.20%</b>
<b>2001–2010 mean .....</b>	<b>0.24%</b>

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## Fatty acid composition

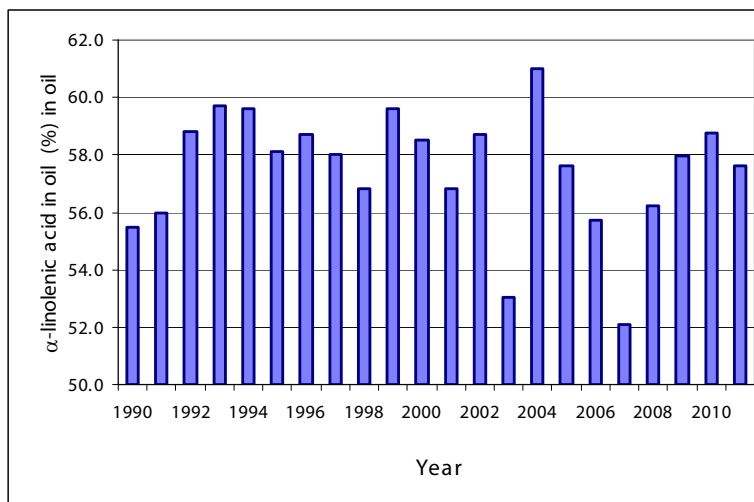
The average  $\alpha$ -linolenic acid content of 2011 harvest survey Flaxseed, No.1 CW samples is 57.6%, lower than 2010 at 58.8% and higher than the 10-year mean of 56.8%(Figure 5). Compared to 2010, the average  $\alpha$ -linolenic acid content increased by 0.4%, for Manitoba and decreased by 1.7% and 5.0 % for Saskatchewan and Alberta. Flaxseed, No. 1 CW samples from producers across western Canada had a range of linolenic acid content from 51.6% to 61.6%.

The average iodine value of the oil from Flaxseed, No.1 CW samples is 192.5 units. Iodine value is a measure of the total degree of unsaturation of the oil and in flaxseed is heavily influenced by the linolenic acid content of the oil. The 2011 iodine value is 2.1 units lower than in 2010 and 1.4 units higher than the 10-year mean of 191.1 units(Figure 6). The average iodine value increased by 0.8 units, for Manitoba and decreased by 3.6 and 4.5 units respectively for Saskatchewan and Alberta samples. Flaxseed, No.1 CW samples from producers across western Canada varied in iodine value from 182.7 to 209.9 units.

Oils with iodine values greater than 188 units are desired by the coatings industry for products such as paints, varnishes and inks, while oils with iodine values around 183 units are preferred by the linoleum industry. Iodine value, like oil content, is influenced by growing temperatures and length of photoperiod.

The 2010–2011 mean export values in Table 6 shows the  $\alpha$ -linolenic acid content at 58.0% and the iodine value at 194.2 units. Flaxseed, No.1 CW exports will likely produce oils with iodine values of 190 units and higher. Flaxseed exports that are not commercially clean may have lower iodine values than those exports that are cleaned to contain less than 2.5% dockage.

**Figure 5 – Flaxseed, No. 1 Canada Western  
Percent  $\alpha$ -Linolenic acid content of harvest survey samples,  
1990–2011**

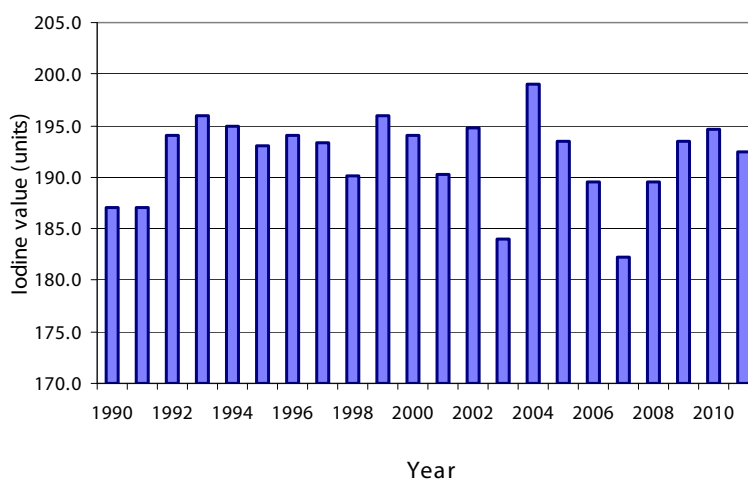


**2011 average.....57.6%**

**2010 average.....58.8%**

**2001–2010 mean .....56.8%**

**Figure 6 – Flaxseed, No. 1 Canada Western  
Iodine value of harvest survey samples, 1990–2011**



**2011 average ..... 192.5**

**2010 average ..... 194.6**

**2001–2010 mean..... 191.1**