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# Quality of western Canadian flaxseed 2007

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# Table of contents

<b>Introduction .....</b>	<b>4</b>
<b>Summary .....</b>	<b>5</b>
<b>Weather and production review .....</b>	<b>5</b>
Weather review .....	6
Seeding .....	6
Growing conditions .....	6
Harvest conditions .....	7
Production and grade information.....	7
<b>Harvest survey samples .....</b>	<b>8</b>
<b>Quality of western Canadian flaxseed – 2007 .....</b>	<b>9</b>
Oil content .....	11
Protein content .....	12
Free fatty acids content .....	13
Fatty acid composition .....	14

## Tables

Table 1 – Flaxseed, No. 1 Canada Western Quality data for 2007 harvest survey .....	5
Table 2 – Flaxseed, No. 1 Canada Western Fatty acid composition for 2007 harvest survey .....	5
Table 3 – Seeded area and production for western Canadian flaxseed.....	7
Table 4 – Flaxseed, No. 1 Canada Western Quality data for 2007 harvest survey .....	9
Table 5 – Flaxseed, No. 1 Canada Western Fatty acid composition and free fatty acids content for 2007 harvest survey .....	10
Table 6 – Flaxseed, No. 1 Canada Western Comparison of 2007 harvest survey quality data with recent export shipments .....	10

## Figures

Figure 1 – Map of Canada showing traditional growing areas for flaxseed .....	4
Figure 2 - Flaxseed, No. 1 Canada Western Oil content of harvest survey samples, 1997–2007 .....	11
Figure 3 - Flaxseed, No. 1 Canada Western Protein content of harvest survey samples, 1997–2007 .....	12
Figure 4 - Flaxseed, No. 1 Canada Western Free fatty acids content of harvest survey samples, 1997–2007 .....	13

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Figure 5 – Flaxseed, No. 1 Canada Western Linolenic acid content of harvest survey samples, 1997–2007 .....	15
Figure 6 – Flaxseed, No. 1 Canada Western Iodine value of harvest survey samples, 1997–2007 .....	16

# Introduction

This report presents quality data and information based on the Canadian Grain Commission (CGC) 2007 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, grain companies and oilseed crushing plants 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 (CGC) harvest survey of western Canadian flaxseed shows the 2007 crop to have an average oil content but with higher than average protein content. The mean protein content is 1.2% higher while the mean oil content is similar to the 10-year mean. The oil from the 2007 harvest survey samples has a below average iodine value.

Compared to 2006, the oil content, 44.7%, is 1.2% lower while the protein content, 24.3%, is 0.7% higher. The linolenic acid content, 52.6%, is 3.2% lower than in 2006, resulting in an iodine value of 184, six units lower than in 2006. The 2007 flaxseed crop shows significant regional differences in oil, protein and fatty acid composition.

The GRL's long-term harvest survey results show warm, dry growing conditions tend to produce a flaxseed crop with lower oil contents and iodine values, but higher protein contents.

**Table 1 - Flaxseed, No. 1 Canada Western  
Quality data for 2007 harvest survey**

Quality parameter	2007	2006	1997-2006 Mean
Oil content <sup>1</sup> , %	44.7	45.9	44.7
Protein content <sup>2</sup> , %	24.3	23.6	23.2
Free fatty acids, %	0.16	0.16	0.22
Iodine value	183.5	189.8	192.7
Linolenic acid, % in oil	52.6	55.8	57.7

<sup>1</sup> Dry matter basis

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

**Table 2 - Flaxseed, No. 1 Canada Western  
Fatty acid composition for 2007 harvest survey**

Fatty acid <sup>1</sup> , % in oil	2007	2006	1997-2006 Mean
Palmitic	5.0	5.0	5.2
Stearic	3.6	3.6	3.4
Oleic	20.6	19.5	18.2
Linoleic	16.2	15.6	15.1
Linolenic	52.6	55.8	57.7

<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

Temperature and precipitation patterns for the 2007 western Canadian growing season can be found on the PFRA web site ([http://www.agr.gc.ca/pfra/drought/drmaps\\_e.htm](http://www.agr.gc.ca/pfra/drought/drmaps_e.htm)). The prairie provinces experienced wet spring weather to start the 2007 growing year. A drier and warmer than normal growing period eventually stressed many crops in the south, but also allowed for quicker crop maturity and an earlier than normal harvest. The Weather and Crop Surveillance department of the Canadian Wheat Board provided the majority of the detailed weather review for the 2007 crop year.

## Seeding

Central Alberta and north-eastern Saskatchewan received heavy rains during the spring planting season which resulted in significant reduction in sown area. Late planting was also common in these areas, with significant acreage switched to earlier maturing crops. Planting in the northern areas wrapped-up during the first weeks of June, with significant cropped area left fallow in certain areas. The southern Prairies, conversely, were dry during the spring, which resulted in early planting in the region. The dryness also raised concerns about poor soil moisture levels, which have persisted since the 2006 growing season in the southern Prairies. Planting conditions in Manitoba were good across the province, with early planting reported in all areas except the north-western region.

## Growing conditions

Precipitation during June was close to normal or above normal in most of the Prairie region, except in the southern areas of Alberta and Saskatchewan. These areas received enough moisture during June to sustain crop growth, but not enough to add to subsoil moisture reserves. Crop conditions at the end of June were mostly good to excellent. Above normal temperatures moved into the western areas of the Prairies during early July and migrated to eastern regions by the middle of the month. Temperature records were set in a number of locations in Alberta and Saskatchewan during July. The hot, dry conditions reduced yield expectations, especially in the southern growing areas of Alberta and Saskatchewan. In northern areas, the hot weather did help boost the development of crops that had been seeded later than normal. Cooler weather returned to the Prairies by the middle of August, with some scattered frosts reported in Alberta and Saskatchewan before the end of the month. The dry, hot conditions during July did help keep disease levels in check in most areas.

## Harvest conditions

Flaxseed harvesting started during late August and was 50-60% complete in the southern Prairies by the end of September, due to mostly dry weather during the month of August. Central and northern areas of the Prairies received cooler temperatures and more rainfall during August and September, which caused harvesting delays. Most of the northern growing areas finished the harvest by late-October. The delays were most acute in the Peace River district, where cool, wet conditions persisted through the growing season and into the harvest.

## Production and grade information

Western Canadian farmers planted 528 thousand hectares of flaxseed in 2007 (Table 3), a 52% decline from last year's area. The 2007 yield estimate of 1200 kg/ha was less than the 1300 kg/ha reported in 2006 but slightly above the 10-year mean of 1182 kg/ha. Western Canada flaxseed production declined 36% to 633,000 tonnes, the result of significant decreases in both seeded area and yields. According to the Statistics Canada estimates in *Field Crop Reporting Series No. 8*, Saskatchewan accounted for 81 percent of flaxseed production while Manitoba and Alberta had 17 percent and two percent respectively.

For the 2007 Saskatchewan flaxseed crop, *Saskatchewan Agriculture, Food and Rural Revitalization Report Number 28* estimated the portion of Flaxseed, No. 1 CW to be 89% compared to 89% in 2006 and 80% for the ten-year mean. However, poor weather in September and October resulted in some regional downgrading in northern areas of Saskatchewan and Alberta.

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

	Seeded area		Production <sup>1</sup>		Average production
	2007	2006	2007	2006	1997-2006
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	81	155	105	193	228
Saskatchewan	435	625	512	760	584
Alberta	12	24	16	36	31
<b>Western Canada</b>	<b>528</b>	<b>804</b>	<b>633</b>	<b>989</b>	<b>843</b>

<sup>1</sup> Source—Source: *Field Crop Reporting Series, No. 8*, December 2007; Statistics Canada

<sup>2</sup> Source—Source: *Field Crop Reporting Series*, revised final estimates for 1997-2006.

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## Harvest survey samples

Flaxseed samples for the CGC harvest survey are collected from producers, grain handling offices and oilseed crushing plants across western Canada. The samples are 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, No. 1 Canada Western (CW) samples by province.

This year's harvest survey report included 359 samples compared to 600 in 2006. Manitoba contributed 100 samples, Saskatchewan 246 samples and Alberta 13 samples during the harvest period from September 1 to November 15, 2007. Weighting factors used to calculate provincial and western Canadian means are derived from the previous five-year average production for each crop district and this year's provincial production estimates in Statistics Canada's *Field Crop Reporting Series No. 8*, December, 2007.



# Quality of western Canadian flaxseed – 2007

Tables 4 and 5 show detailed information on the quality of top grade western Canadian flaxseed harvested in 2007. A complete summary of the survey by province including a few lower grade samples can be found at: <http://grainscanada.gc.ca/Quality/grlreports/Flax/flaxmenu-e.htm>. 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.

Table 6 compares the quality of recent flaxseed exports with this year's harvest survey data. The harvest survey data is from producer samples that have been cleaned to remove dockage, while recent exports of flaxseed from Thunder Bay and Vancouver contained 5.9% and 1.5% dockage respectively. 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.

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. Iodine value is a measure of the overall unsaturation of the oils and is calculated from the fatty acid composition. Oils with higher iodine values, *i.e.*, with more unsaturation, polymerize more rapidly in the presence of air. For flaxseed, the high level of linolenic acid is an important quality factor as it is this fatty acid, which is responsible for most of flaxseed oil's drying properties. Linolenic acid is also the omega-3 fatty acid considered to contribute to good health in humans and is responsible for the increasing use of whole and ground flaxseed in cereals and baked goods, and flaxseed oil in salads.

**Table 4 - Flaxseed, No. 1 Canada Western  
Quality data for 2007 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	100	44.2	39.6	47.3	24.0	21.0	28.4	184	171	210
Saskatchewan	246	44.8	38.2	49.8	24.4	19.4	30.8	183	157	205
Alberta	13	45.4	40.9	48.3	24.5	22.0	27.8	188	171	206
<b>Western Canada<sup>3</sup></b>	<b>359</b>	<b>44.7</b>	<b>38.2</b>	<b>49.8</b>	<b>24.3</b>	<b>19.4</b>	<b>30.8</b>	<b>184</b>	<b>157</b>	<b>210</b>

<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 2007 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	100	5.2	3.3	20.4	16.0	52.9	0.16
Saskatchewan	246	5.0	3.6	20.7	16.2	52.4	0.15
Alberta	13	4.8	3.7	18.2	16.2	55.1	0.17
<b>Western Canada<sup>2</sup></b>	<b>359</b>	<b>5.0</b>	<b>3.6</b>	<b>20.6</b>	<b>16.2</b>	<b>52.6</b>	<b>0.16</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 - Flaxseed, No. 1 Canada Western**  
**Comparison of 2007 harvest survey quality data with recent export<sup>3</sup> shipments**

Quality parameter	2007 survey	November 2007 exports	2006-2007 exports
Oil content <sup>1</sup> %	44.7	44.5	45.9
Protein content <sup>2</sup> %	24.3	24.1	22.7
Free fatty acids, %	0.16	0.40	0.40
Iodine value	184	186	192
Palmitic acid, % in oil	5.0	5.0	4.9
Stearic acid, % in oil	3.6	3.6	3.5
Oleic acid, % in oil	20.6	20.0	18.6
Linoleic acid, % in oil	16.2	15.7	16.0
Linolenic acid, % in oil	52.6	53.9	56.6
<b>Number of samples / shipments</b>	<b>359</b>	<b>2</b>	<b>26</b>

<sup>1</sup> Dry matter basis

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

<sup>3</sup> Commercially clean exports containing less than 2.5% dockage

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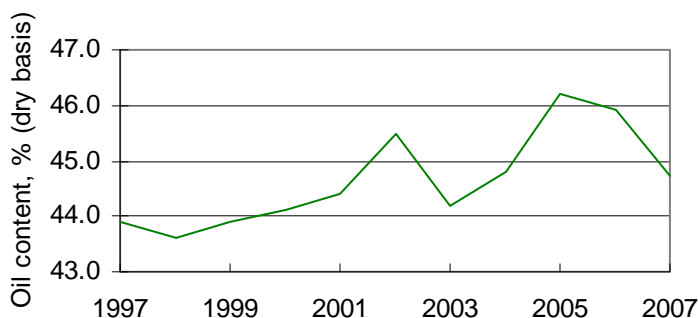
## Oil content

The average oil content of 44.7% for Flaxseed, No. 1 CW from the 2007 survey is 1.2% below the 45.9% of 2006 but is similar to the ten-year (1997-2006) mean of 44.7%. The mean oil content of 44.2% for Manitoba samples is lower than the 44.8% and 45.4% for Saskatchewan and Alberta samples. Compared to 2006, average oil contents changed by -1.3%, -1.1% and -1.0% respectively for Saskatchewan, Manitoba and Alberta samples. The oil content of Flaxseed, No. 1 CW samples from producers across western Canada varied from 38.2% to 49.8%.

The decreased oil contents seen in the 2007 survey are a result of the generally hot and dry growing conditions experienced during July over much of the western Canadian flaxseed growing area. In most southern flaxseed growing areas there was a high proportion of heat stressed flaxseed that tends to significantly lower oil contents. In general, hot growing conditions at flowering tend to produce flaxseed seed with lower oil contents but higher protein content. Weather summary maps of the 2007-growing season can be found at: [http://www.agr.gc.ca/pfra/drought/drmmaps\\_e.htm](http://www.agr.gc.ca/pfra/drought/drmmaps_e.htm). However, there is an overall improvement in the western Canada mean oil content in the past decade due to the continuing trend of planting more of the newer high quality Canadian flaxseed cultivars. Quality information on the varieties from the 2007 survey will be available at a later date on the CGC website.

The oil content of November 2007 Flaxseed, No. 1 CW exports averaged 44.5%, notably lower than the 2006–2007 export mean of 45.9% (Table 6). This suggests the oil content of the 2007–2008 flaxseed exports will be lower than the previous year. Flaxseed exports that are not commercially clean will have lower oil contents than exports that are cleaned to contain less than 2.5% dockage.

**Figure 2 – Flaxseed, No. 1 Canada Western  
Oil content of harvest survey samples, 1997-2007**



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2007 average.....	44.7%
2006 average.....	45.9%
1997–2006 mean .....	44.7%

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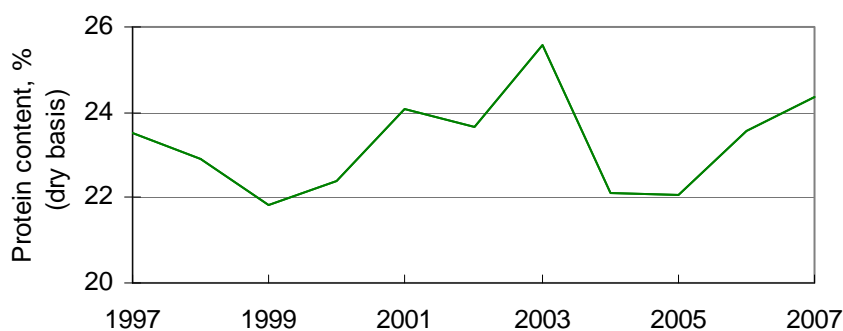
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## Protein content

The average crude protein content of 24.3% for Flaxseed, No. 1 CW from the 2007 harvest survey is 0.7% higher than in 2006 and 1.2% higher than the 10-year mean of 23.2%. The Manitoba average protein content of 24.0% was slightly lower than the 24.4% in Alberta and the 24.5% in Saskatchewan. Compared to 2006, the average protein contents changed by +0.3%, -1.0% and -1.0% respectively for Manitoba, Saskatchewan, and Alberta samples. The protein content of Flaxseed, No. 1 CW samples from producers across western Canada varied from 19.4% to 30.8%.

As Table 6 shows, the protein content of 24.1% for November 2007 flaxseed exports is 1.4% higher than the 22.7% for the 2006–2007 shipping season. The protein content of flaxseed exports in 2007–2008 should be notably higher than the export shipments of the previous season.

**Figure 3 – Flaxseed, No. 1 Canada Western  
Protein content of harvest survey samples, 1997–2007**



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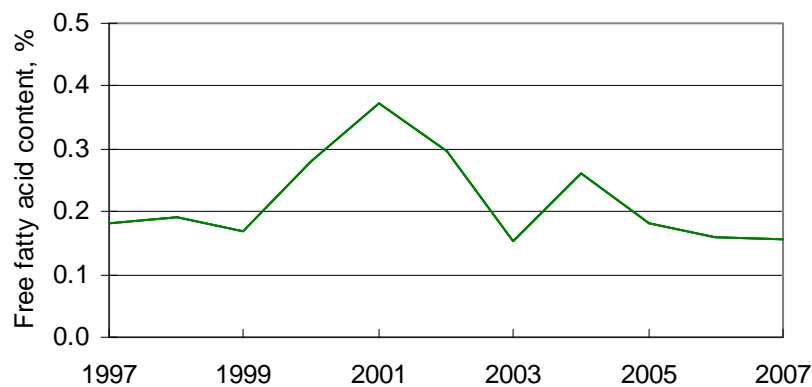
2007 average .....	24.3%
2006 average .....	23.6%
1997–2006 mean.....	23.2%

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# Free fatty acids content

The average free fatty acids (FFA) content of 0.16 % in top grade 2007 survey samples is similar to the 2006 average of 0.16% and below the 10-year mean of 0.22%. Flaxseed from regions where the crop was heat stressed or delayed due to wet harvest conditions will have FFA levels above the provincial means. The FFA content of Flaxseed, No. 1 CW exports in November 2007 averaged 0.40%; suggesting the levels in 2007-2008 will be similar to the 2006–2007 values (Table 6).

**Figure 4– Flaxseed, No. 1 Canada Western**  
**Free fatty acids content of harvest survey samples, 1997–2007**



2007 average .....	0.16%
2006 average .....	0.16%
1997–2006 mean.....	0.22%

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## Fatty acid composition

Beginning with the 2007/2008 crop year there was a change to the manner in which the fatty acid profiles for flaxseed samples are calculated and reported. Prior to 2007/2008 fatty acid profiles for flaxseed samples were considered to include only the following five major fatty acids found in flaxseed oil: palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3). Fatty acid profiles and Calculated Iodine Values were based on just those 5 major fatty acids, normalized to 100%.

Flaxseed samples contain as much as 0.5% of other minor fatty acids such as arachidic (C20:0), eicosenoic (C20:1), behenic (C22:0), and lignoceric (C24:0). In addition, export composite loading samples, often contain trace amounts of other oilseed crops which can contribute 1% to 1.5% of additional minor fatty acids to the complete profile. As a result, a flaxseed export shipment fatty acid profile can contain any or all of the following fatty acids: myristic (C14:0), palmitic (C16:0), palmitoleic (C16:1), stearic (C18:0), oleic (C18:1), linoleic (C18:2), linolenic (C18:3), arachidic (C20:0), eicosenoic (C20:1), eicosadienoic (C20:2), behenic (C22:0), erucic (C22:1), docosadienoic (C22:2), lignoceric (C24:0), and nervonic (C24:1). Now they are all included in the fatty acid profile and calculated iodine Value.

Compared to previous calculations, iodine Values for flaxseed samples are approximately 2 to 3 IV units lower than were previously reported for an identical sample. These changes are particularly important to keep in mind as the 2007 crop is also significantly lower in linolenic acid, the major influence on calculated iodine Value. While the lower linolenic acid content of the 2007 flaxseed crop is partly due to the extreme heat experienced in much of the flaxseed growing regions of western Canada the change in calculation method has resulted in a 2 to 3 unit drop in the calculated iodine Values in this report.

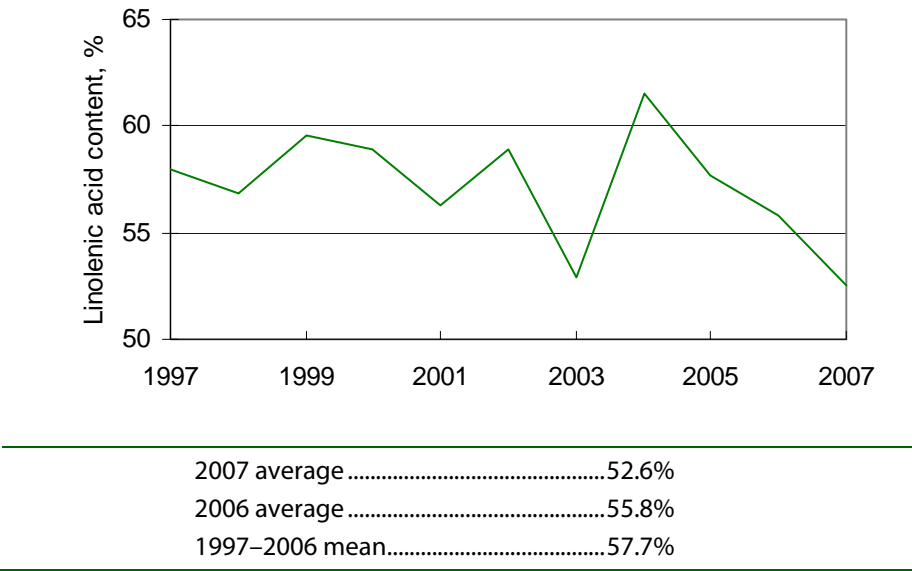
The average linolenic acid content of 2007 harvest survey Flaxseed, No. 1 CW samples is 52.6%, significantly lower than both the 55.8% in 2006 and the 10-year mean of 57.7%. Compared to 2006, the average linolenic acid content decreased by 3.3%, 3.0% and 2.9% respectively in Saskatchewan, Alberta, and Manitoba. Approximately 1.0% to 1.3% of these decreases are due to the above mentioned calculation changes. Flaxseed, No. 1 CW samples from producers across western Canada had a range of linolenic acid content from 36.0% to 63.7%.

The average iodine value of the oil from Flaxseed, No. 1 CW samples is 183 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 2007 iodine value is 6 units lower than in 2006 and 9 units below the 10-year mean of 193 units. The average iodine value decreased by 7, 6 and 6 units respectively for Saskatchewan, Manitoba, and Alberta samples. Flaxseed, No. 1 CW samples from producers across western Canada varied in iodine value from 157 to 210 units.

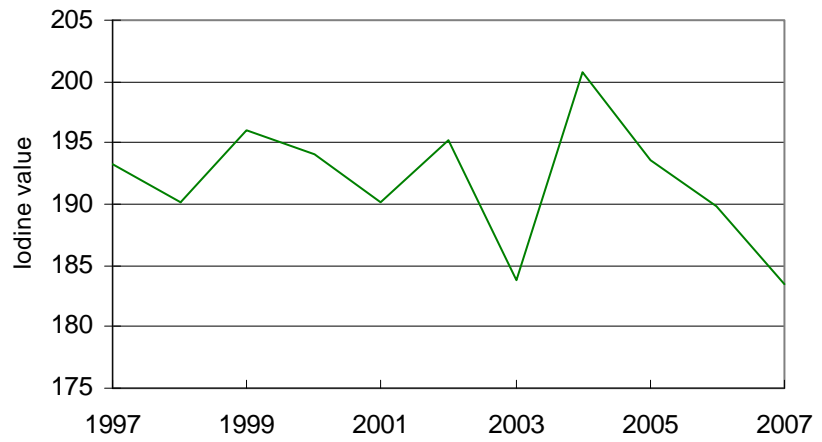
Oils with iodine values greater than 188 units are desired by the coatings industry for products such as paints, varnishes and inks, while oils with iodine values around 183 units are preferred by the linoleum industry. Iodine value, like oil content, is influenced by growing temperatures and length of photoperiod. Generally, cooler growing conditions and longer photoperiods will result in both higher iodine value and oil content. The warmer growing season temperatures in 2007 contributed to the decrease in the mean iodine value.

The November 2007 export data in Table 6 shows the linolenic acid content at 53.9% and the iodine value at 186 units, lower than the 2006–2007 mean export values. Flaxseed, No. 1 CW exports will likely produce oils with iodine values between 184 and 186 units. 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  
Linolenic acid content of harvest survey samples, 1997–2006**



**Figure 6 – Flaxseed, No. 1 Canada Western  
Iodine value of harvest survey samples, 1997–2007**




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2007 average .....	184
2006 average .....	190
1997–2006 mean.....	193

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