Quality of western Canadian flaxseed

1998

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Summary

The flaxseed from the 1998 harvest survey was near average in oil content, with below average protein content and iodine value.

Compared to 1997, the oil content, 43.6%, was similar, while the protein content, 22.9%, and iodine value, 190 units, were lower. The iodine value was 1 unit lower, the oil content was 0.2 percentage units higher and the protein content 0.8 percentage units lower than the 10-year means. The linolenic acid content, 56.8%, was lower than in 1997.

The warmer, drier areas had lower oil contents and iodine values than the reported means.

Table 1 • Quality data for harvest survey No. 1 Canada Western flaxseed

Quality parameter	1998	1997	1988–97 Mean
Oil content, % (dry matter basis)	43.6	43.9	43.8
Protein content, %N x 6.25, (dry matter basis)	22.9	23.5	23.7
Free fatty acids, %	0.2	0.2	0.2[1]
Iodine value	190	193	191
Linolenic acid content, % in oil	56.8	58.0	57.3

[1] free fatty acid data are for 1989–1997

Table 2 • Fatty acid composition[1] of harvest survey No. 1 Canada Western flaxseed

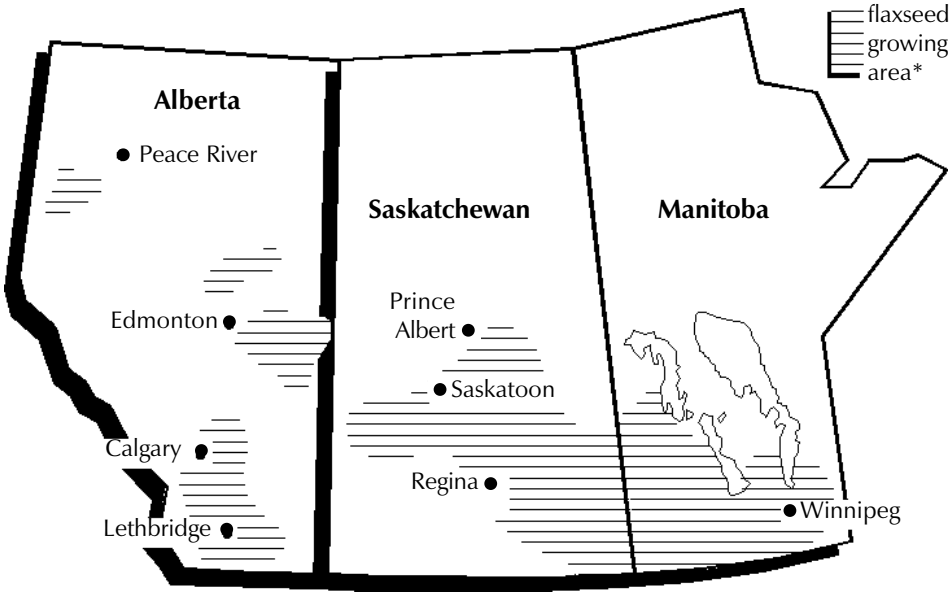
Fatty acid, % in oil	1998	1997	1988–97 Mean
	%	%	%
Palmitic	5.5	5.2	5.2
Stearic	3.6	3.5	3.2
Oleic	19.4	18.1	18.8
Linoleic	14.3	15.1	14.8
Linolenic	56.8	58.0	57.3

[1] percent of total fatty acids in the oil including palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3)

Introduction

This report presents information on the major quality parameters for the 1998 harvest survey of western Canadian flaxseed. Included is information on the oil, protein, free fatty acid content and the fatty acid composition, including iodine value, of harvest samples. Quality data presented were obtained from analyses of flaxseed survey samples submitted to the Grain Research Laboratory throughout the harvest period by producers, grain companies and oilseed crushing plants. The map shows the traditional growing areas for flaxseed in western Canada.

Figure 1 • Map of Canadian prairies showing traditional growing area for flaxseed



* Source: *Growing Flax*, Flax Council of Canada

Weather and production review

Western Canadian farmers planted 878,000 hectares of flaxseed in 1998, which was a 19 percent increase from 1997 (Table 3). With above average yields, total flaxseed production in western Canada was a record 1.11 million tonnes (Statistics Canada, *Field Crop Reporting Series No. 8*, December 7, 1998). Saskatchewan accounted for 63 percent of production in 1998, Manitoba for 33 percent and Alberta for 4 percent. The 1998 yield estimate of 1266 kg/ha was above both the 1220 kg/ha in 1997 and the 10-year value of 1199 kg/ha.

The planting of flaxseed in 1998 began two weeks earlier than normal. Flaxseed sowing was essentially complete by early May. Soil temperatures were much warmer than usual for the first part of May, due to the early start of spring and the absence of spring frosts. In western Saskatchewan, the seeding of flaxseed was delayed by of a lack of topsoil moisture. Most of western Canada was dry until the middle of June. Topsoil moisture was not as limiting north of Lethbridge, Alberta.

Dry weather prevailed across the western Prairies until the middle of June, and some flaxseed was seeded into dry topsoil. There were widespread areas of uneven germination in regions that had been dry at the outset, particularly in west central Saskatchewan. Eastern portions of the Prairies had more favorable soil moisture reserves. Overall, flaxseed germination was better than most crops in 1998.

In late May and early June, freezing temperatures occurred on more than one night over most of Saskatchewan and western Manitoba. Crop development had varied considerably across the region and damage varied accordingly. Temperatures were coolest in eastern and northern Saskatchewan as well as western Manitoba. Flaxseed stands did not receive major damage.

In mid-June, most of western Canada received at least 25 mm of precipitation. While these rains prevented significant yield losses, they promoted secondary germination in fields that had germinated unevenly under dry conditions. Excessive precipitation in western Manitoba and the eastern one-third of Saskatchewan caused drown out and made spraying operations difficult.

Conditions were dry again in western Canada for the first half of July, but the rains returned by the middle of the month, worsening wet conditions in parts of the eastern Prairies. Precipitation from the middle of June to the middle of July was average overall, but was below normal in the Peace River district and eastern Alberta. Hot, dry weather in the latter half of July and early August, affected late-planted flaxseed stands. Heat stress in portions of western Saskatchewan lowered yields in those areas.

The hot weather accelerated maturation and the flaxseed harvest began in mid August, two weeks ahead of normal. By early September, 20 percent of the crop was harvested. The majority of the 1998 flaxseed harvest was completed by the end of September.

Table 3 • Seeded area and production for the 1998 and 1997 crops of western Canadian flaxseed and average annual flaxseed production for the 10-year period 1988 to 1997

	Seeded area[1] thousand hectares		Production[1] thousand tonnes		Average production[2] thousand tonnes
	1998	1997	1998	1997	1988–97
Manitoba	283	267	368	356	305
Saskatchewan	567	445	699	508	368
Alberta[3]	28	24	39	32	38
Western Canada	**878**	**736**	**1106**	**895**	**711**

[1] source—*Field Crop Reporting Series*, *No. 8*, December 7, 1998, Statistics Canada

[2] source—*Field Crop Reporting Series*, revised final estimates for 1988–97

[3] includes the part of the Peace River area that is in British Columbia

Quality of 1998 flaxseed

Tables 4 and 5 show detailed information on the quality of Canadian flaxseed harvested in 1998. Table 6 compares the quality of recent flaxseed exports. The number of samples in 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 the 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. 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, that is, 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 flaxseed's increasing use as a component in some cereals and baked goods.

Table 4 • Quality data for 1998 harvest survey of No. 1 Canada Western flaxseed by province

	Number of samples tested	Oil content[1] %			Protein content[2] %			Iodine value		
		Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
Manitoba	119	43.4	38.6	47.9	23.1	18.2	27.1	191	183	203
Saskatchewan	187	43.7	40.0	49.2	22.8	18.4	27.9	189	184	199
Alberta[3]	9	44.5	40.3	47.2	22.9	19.1	26.6	191	188	197
Western Canada[4]	**315**	**43.6**	**38.6**	**49.2**	**22.9**	**18.2**	**27.9**	**190**	**183**	**203**

[1] dry matter basis
[2] dry matter basis, %N x 6.25
[3] includes the part of the Peace River area that is in British Columbia
[4] values are weighted averages based on estimated production by province (Statistics Canada)

Table 5 • Fatty acid composition and free fatty acid content for the 1998 harvest survey of No. 1 Canada Western flaxseed by province

Province	Number of samples tested	Fatty acid composition[1] C16:0 %	C18:0 %	C18:1 %	C18:2 %	C18:3 %	Free fatty acids %
Manitoba	119	5.3	3.4	19.4	14.1	57.2	0.26
Saskatchewan	187	5.7	3.6	19.3	14.4	56.6	0.15
Alberta[2]	9	5.0	3.8	19.4	14.5	56.9	0.19
Western Canada[3]	**315**	**5.5**	**3.6**	**19.4**	**14.3**	**56.8**	**0.19**

[1] % of total fatty acids including: palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), linolenic (C18:3)
[2] includes the part of the Peace River area that is in British Columbia
[3] values are weighted averages based on estimated production by province (Statistics Canada)

Table 6 • Comparison of quality factors of No.1 Canada Western flaxseed from the 1998 harvest survey with export shipments of No. 1 Canada Western flaxseed

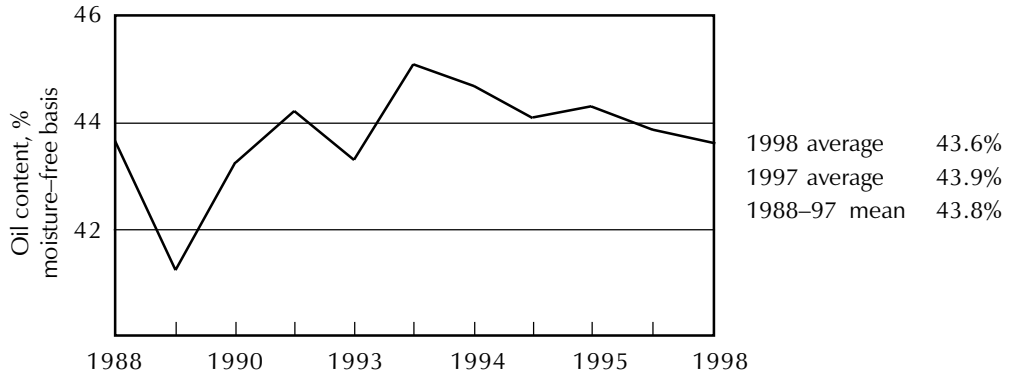
Quality parameter	1998 survey	1997–98 exports	October 1998 exports
Oil content, %	43.6	43.4	43.0
Protein content, %	22.9	23.1	22.6
Free fatty acids,%	0.2	0.5	0.3
Iodine value	190	192	190
Palmitic acid, %	5.5	5.2	5.5
Stearic acid, %	3.6	3.5	3.5
Oleic acid, %	19.4	18.1	19.8
Linoleic acid, %	14.3	15.4	14.5
Linolenic acid, %	56.8	57.4	56.4

Oil content

The oil content of 43.6% for No. 1 CW flaxseed from the 1998 survey is slightly lower than 43.9% in 1997 and the 10-year mean of 43.8%. The hot, dry growing conditions in parts of the Prairies contributed to the lower mean oil content for 1998. Compared to 1997 samples, the Manitoba mean oil content of 43.4% is 0.5 percentage units lower while the Saskatchewan mean oil content of 43.7% is 0.1 percentage units lower. The small number of samples received from Alberta make comparisons less reliable.

The oil content of the October 1998 flaxseed exports averaged 43.0%, a decrease from the 1997–98 export mean of 43.4% (Table 6). This suggests that the oil content of 1998–99 flaxseed exports will be about one-half percentage unit lower than in the previous year.

Oil content of 1988–98 harvest survey samples of No. 1 Canada Western flaxseed

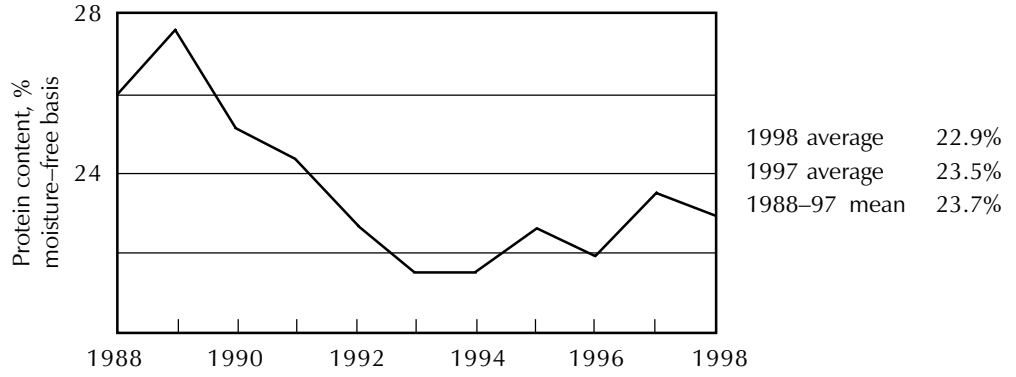


Protein content

At 22.9%, the seed protein content of No. 1 CW flaxseed from the 1998 survey was 0.6 percentage units lower than in 1997 and 0.8 percentage units lower than the 10-year average of 23.7%. The 1998 protein contents were very similar for the three prairie provinces (Table 4). Compared to 1997, protein content of Manitoba samples was unchanged at 23.1%, while in Saskatchewan it decreased 0.9 percentage units to 22.8%.

The protein content of flaxseed exports, which averaged 23.1% during the 1997–98 shipping season, decreased to 22.6% by October 1998. As suggested in Table 6, the protein content of 1998–99 flaxseed exports may be one-half percentage units lower than in 1997–98.

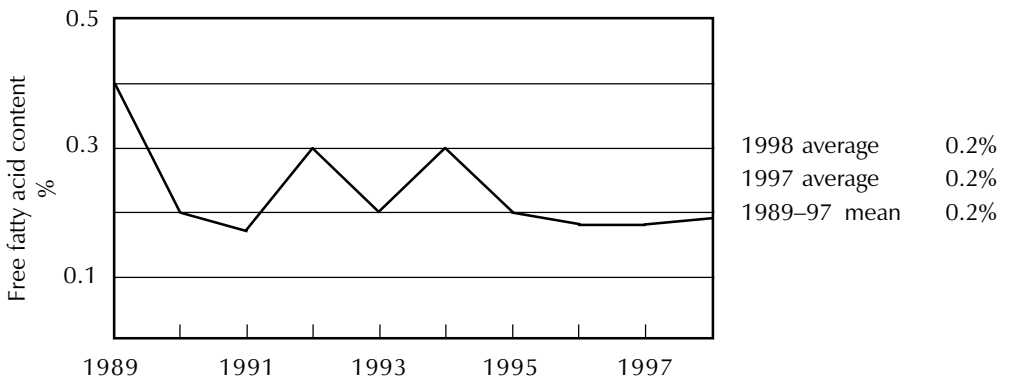
Protein content of 1988–98 harvest survey samples of No. 1 Canada Western flaxseed



Free fatty acid content

The free fatty acid (FFA) content of the 1998 flaxseed survey samples, 0.2 %, was similar to the 1997 and 10-year means. Flaxseed from regions where the harvest was delayed may have higher FFA levels. Because FFA data was not collected on harvest survey samples until 1993, FFA data for earlier years were obtained from inspection composite samples to produce the 1989–97 mean of 0.2%. As of October 1998, the FFA content of No. 1 CW flaxseed exports averaged 0.3%, slightly lower than the 1997–98 value of 0.5% shown in Table 6.

Free fatty acid content of 1989–98 harvest survey samples of No. 1 Canada Western flaxseed



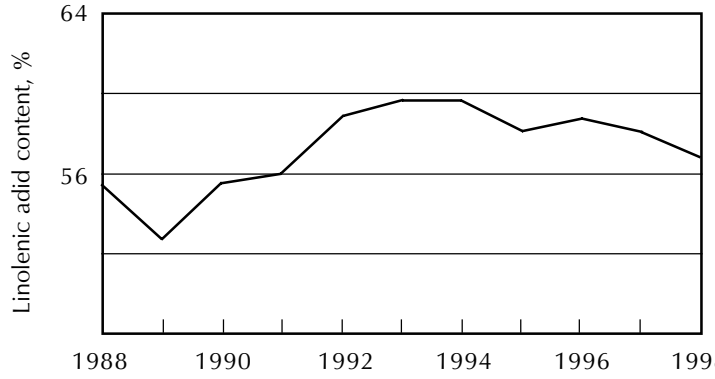
Fatty acid composition

The mean iodine value of the oil from the 1998 harvest survey samples was 190 units. This is two units lower than in 1997 and one unit below the 10-year mean of 191 units. The linolenic acid content was 56.8% in 1998, significantly lower than in 1997 at 58.0% and below the 10-year mean of 57.3%. Compared to 1997, the Manitoba survey samples averaged 1.6 percentage units lower in linolenic acid and 2 units lower in iodine value. In Saskatchewan samples, linolenic acid decreased by 0.8 percentage units while the iodine value decreased by one unit compared to 1997.

Oils with iodine values greater than 188 units are desired for products in the coatings (paints, varnishes, inks) industry, while oils with iodine values around 183 units may be more desirable in 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.

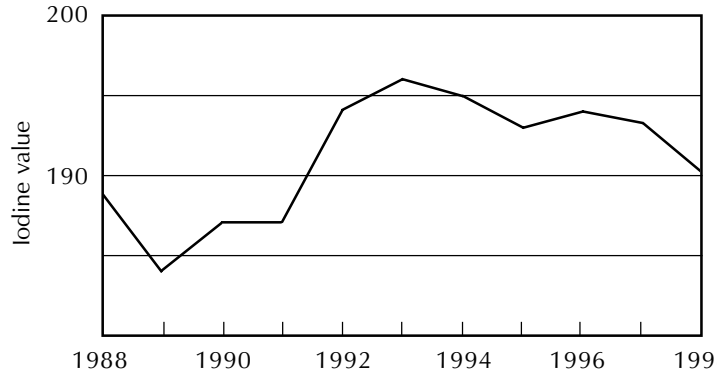
The October 1998 export data in Table 6 shows that the linolenic acid at 56.4% and the iodine value at 190 units, were lower than the 1997–98 mean export values. The No. 1 CW flaxseed exports will likely produce oils with iodine values around 190 units.

Linolenic acid content of 1988–98 harvest survey samples of No. 1 Canada Western flaxseed



1998 average	56.8%
1997 average	58.0%
1988–97 mean	57.3%

Iodine value of 1988–98 harvest survey samples of No. 1 Canada Western flaxseed



1998 average	190
1997 average	193
1988–97 mean	191

Methods and definitions

Harvest Survey

Samples of flaxseed grown in 1998 were submitted to the Grain Research Laboratory by producers, grain companies and crushing plants from across western Canada. The individual samples were cleaned to remove dockage and then analyzed for oil, protein and iodine value with a NIRSystems 6500 scanning near infrared (NIR) spectrometer. The NIR instrument was calibrated to and verified against the appropriate listed reference method. Samples grading No. 1 CW were combined by province for free fatty acid and fatty acid composition analyses.

This year's harvest survey included 315 samples from across western Canada: 119 from Manitoba, 187 from Saskatchewan and 9 from Alberta. Results are based on samples received during the harvest period from September 1, 1998 to November 30, 1998. Weighting factors used to calculate provincial and western Canadian means are derived from the previous five-year average production for each crop district and the 1998 provincial production estimates in Statistics Canada's *Field Crop Reporting Series No. 8*, December 7, 1998.

Oil content is determined by nuclear magnetic resonance (NMR) according to International Organization for Standardization method ISO 10565:1993(E), *Oilseeds—Simultaneous determination of oil and moisture contents—Method using pulsed nuclear magnetic resonance spectroscopy*. Results were obtained with a Bruker NMS 110 Minispec NMR Analyzer and are reported as percentage, calculated to a dry matter basis.

Protein content is determined by the AOCS Official Method Ba 4e-93, *Generic combustion method for determination of crude protein*. Results were obtained with a LECO FP-428 Nitrogen Determinator and are converted to percentage protein by multiplying percentage nitrogen x 6.25, calculated to a dry matter basis.

Free fatty acid content is determined by a method adapted from the procedure of Ke et al, *Analytica Chemica Acta* 99:387–391 (1978), and is expressed as percent free fatty acids in the oil as oleic acid.

Fatty acid composition is determined by the International Organization for Standardization method ISO 5508:1990 (E), *Animal and vegetable fats and oils—Analysis by gas chromatography of methyl esters of fatty acids*. A 15-m by 0.32-mm column with a 0.5-micrometer Supelcowax 10 coating is used. Major fatty acids are reported although samples may also contain as much as 1% of other minor fatty acids, which are included in the calculations.

Iodine value is calculated from the fatty acid composition, according to AOCS Recommended Practice Cd 1c-85, *Calculated Iodine Value*.

Acknowledgments

The Grain Research Laboratory acknowledges the cooperation of flaxseed producers, grain companies and oilseed crushing plants in western Canada for supplying the samples of newly-harvested flaxseed. The assistance of the Industry Services Division in grading producer survey samples is also acknowledged. A major portion of the weather and production review was from the Weather and Crop Surveillance department of the Canadian Wheat Board. The technical assistance of the GRL staff, in particular Ken Howard, Michelle Kisilowsky, Barry Misener, and Bert Siemens is acknowledged.