Canadian Grain Commission | Commission canadienne des grains

ISSN 1498-962X

Quality of western Canadian solin 2005

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Summary

The 2005 Canadian Grain Commission (CGC) harvest survey of western Canadian solin shows an increase in oil content along with decreases in protein and linoleic acid contents. The 2005 oil content, 49.1%, is 1.1% higher while the protein content, 22.0%, is 1.4% lower than in 2004. The linoleic acid content of the oil, 73.3%, is lower than the record high of 75.2% in 2004.

Introduction

This report presents quality data and information based on the CGC 2005 harvest survey of western Canadian solin. Quality data presented include oil content, protein content, and fatty acid composition of solin harvest survey samples. Quality data are based on analyses of solin samples forwarded to the CGC Grain Research Laboratory (GRL).

Solin is the name adopted by the Flax Council of Canada (http://www.flaxcouncil.ca/38.htm) to distinguish yellow seeded, low linolenic acid flaxseed from conventional brown flaxseed.

Weather and production review

Weather review

Temperature and precipitation patterns for the 2005 western Canadian growing season can be found on the PFRA web site (http://www.agr.gc.ca/pfra/drought/drmaps_e.htm). Of particular note this growing season were the heavy rainfalls during the spring followed by moderate temperatures throughout the growing season. In Saskatchewan, June 2005 is tied with June 1953 for the wettest month on record in the last 90 years. The Weather and Crop Surveillance department of the Canadian Wheat Board provided the majority of the detailed weather review for the 2005 crop year.

Seeding

Precipitation from the beginning of April to the end of May 2005 was normal to above-normal in the Prairie region. Planting progress during the spring was dependent on location; the general trend saw western regions planted more rapidly than the eastern growing areas. The overall planting pace in western Canada was two to five days ahead of normal during the first three weeks of May, but rains slowed progress in the latter half of the month. Heavy rains in June delayed the completion of oilseed crop planting and caused some crop areas to be left unseeded.

Growing conditions

Persistent heavy rains throughout the southern Prairies in June caused flooding losses in Alberta and southern Manitoba. Manitoba was hardest hit by the wet conditions, with unseeded and drowned-out areas exceeding two million total crop acres. The rest of the Prairies received normal to above-normal amounts of precipitation during the June period, which helped increase crop yield potential. Precipitation during July was mostly normal across the Prairie region, with temperatures slightly below normal in western regions and above normal in the east. The moderate temperatures boosted crop growth, without causing stress to the crop. Crop development was significantly ahead of last year in most regions, due to the warmer temperatures received throughout the growing season. Cooler temperatures and frequent rainfall slowed crop development in Alberta and western Saskatchewan in August. The cooler weather also resulted in a number of locations in northwestern Saskatchewan and northern Alberta reporting spotty frost events in the first two weeks of the month. Eastern regions reported warmer-than-normal temperatures, which increased stress to crops in the late filling stage. Warm temperatures also boosted crop development in eastern Saskatchewan and Manitoba.

Harvest conditions

Southeastern areas of the Prairies began harvesting in the middle of August. The last week of August and the first two weeks of September were unseasonably wet, with heavy downpours falling across southern Alberta and into northeastern Saskatchewan. Crops in the regions that received the heaviest rainfall were downgraded. Weather conditions in the southern Prairies were better, with most of the harvest in Manitoba and the southern areas of Saskatchewan complete by the end of September. Harvesting in the northern areas of Saskatchewan and Alberta stretched into October. As of October 30, 2005 the flaxseed and solin harvest was over 99% completed in Manitoba, 95% completed in Saskatchewan and about 75% completed in Alberta.

Production and grade information

Although Statistics Canada does not publish official production statistics for solin, the industry consensus is that solin production was higher than in 2004. The grade pattern of the 2005 solin crop was considerably better than in 2004. For the 2005 CGC solin survey all but one of the samples graded Solin, No.1 CW. In 2004, the percentages of samples grading Solin; No.1 CW, No.2 CW, No.3 CW and Sple CW were 52%, 28%, 13%, and 7% respectively.

Harvest survey samples

This year's solin harvest survey included 128 samples compared to 101 in 2004 and 207 in 2003. Eighty-two percent of the samples came from Saskatchewan while 13% and 5% of the samples came from Manitoba and Alberta respectively. The CGC's Industry Services Division graded 127 samples as Solin, No.1 CW and one as Solin, Sample Account Admixture. One hundred and five samples, about 82% of the total, were identified as variety 2047. In addition, there were eight samples identified as 1084, five identified as 2090, one identified as CDC Gold and nine samples were not identified. By comparison, 91% of the 2004 survey samples were identified as variety 2047.

The GRL received the solin samples representing the 2005 crop during the period September to December 2005. For the harvest survey, individual samples are cleaned to remove dockage and graded by CGC Industry Services prior to testing. Solin samples are analyzed for oil content, protein content, linolenic acid, linoleic acid, and iodine value using a NIRSystems 6500 scanning near infrared spectrometer, calibrated to and verified against the appropriate reference method. For this report, composite samples were used for measuring complete fatty acid profiles by gas liquid chromatography. Composite samples were prepared by combining Solin, No.1 CW samples by province and variety.

Acknowledgements

The CGC acknowledges the cooperation of solin producers and Agricore United for supplying the samples of solin harvested in 2005, and the Weather and Crop Surveillance department of the Canadian Wheat Board for providing the review of the 2005-growing season. The CGC recognizes Industry Services grain inspectors for grading the solin survey samples and the GRL staff for conducting the analyses and writing the report.

Quality of western Canadian solin 2005

Quality data for Solin, No.1 CW samples from the 2005 CGC survey are shown in Table 1, including oil content, protein content, fatty acid composition and iodine value. Data for Solin, No.1 CW samples are also summarized by province in Table 2 and by variety in Table 3. The quality of solin and conventional flaxseed from 2005 and 2004 is compared to the long-term means in Table 4. Trends in the solin and flaxseed quality data since 1995 are shown in graphical form in Figures 1 to 4. The means and standard deviations of the 2005 NIR survey data can be found at: http://grainscanada.gc.ca/Quality/Solin/solinmenu-e.htm.

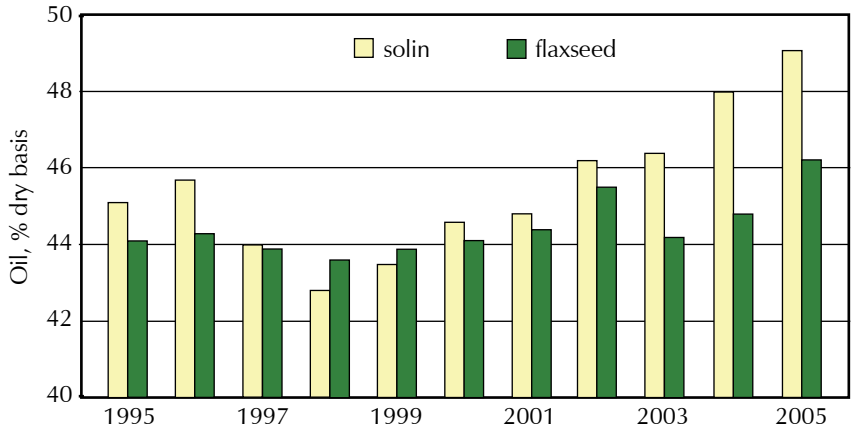
Oil content

The average oil content of the Solin, No.1 CW from the 2005 survey was 49.1%, an increase of 1.1% compared to 2004. The average oil content of Manitoba samples (48.2%) was lower than those from Saskatchewan (49.3%) and Alberta (49.1%). The oil content of Solin, No.1 CW samples from producers across western Canada varied from 44.5% to 51.2%. Figure 1 shows that in 2005 both solin and flaxseed harvest survey samples increased in average oil content.

The increased oil contents seen in the 2005 survey are a result of the generally good growing conditions; i.e. moderate temperatures and ample moisture, in much of the Saskatchewan and Alberta regions of the solin growing area. In Manitoba there was a higher proportion of late-seeded solin that tends to lower oil contents. The GRL's long-term harvest survey results have shown that cool growing conditions tend to produce a flaxseed crop with higher oil contents and iodine values, but lower protein contents (http://grainscanada.gc.ca/Cdngrain/flax/flaxq-e.htm#quality).

Another contributing reason for the improvement in the solin mean oil content in the past few years is the continuing trend of planting more of the newer high quality Canadian solin cultivars. The introduction of variety 2047 in 2002 has been a major influence on average solin oil contents. In 2003, inspite of the heat and drought stress, 2047 still had a mean oil content of 46.8% which was 1.8% higher than 1084. The varietal improvements in solin oil content potential (Table 3) contributed significantly to an average oil content in 2005 that was 4.0% above the ten-year mean of 45.1%.

Figure 1 - No. 1 Canada western solin and flaxseed
Oil content of harvest survey samples, 1995-2005



Protein content

The average protein content of Solin, No.1 CW from the 2005 survey was 22.0%, a decrease of 1.4% from the 2004 value of 23.4%. The average protein content of Alberta samples (23.9%) was notably higher than those from Manitoba (22.4%) and Saskatchewan (21.8%). The protein content of Solin, No.1 CW samples from producers across western Canada varied from 17.7% to 25.9%. Both solin and flaxseed showed decreases in protein content due to the relatively cool growing conditions in 2005. (Figure 2).

Figure 2 - No. 1 Canada western solin and flaxseed
Protein content of harvest survey samples, 1995-2005

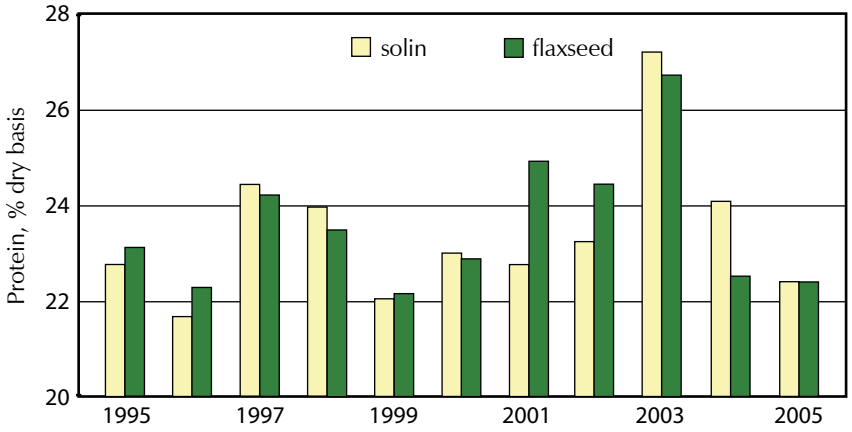
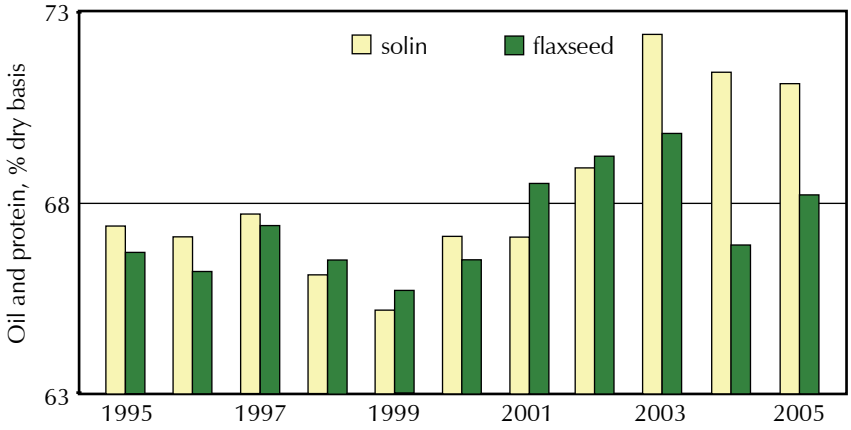


Figure 3 - No. 1 Canada western solin and flaxseed
Sum of oil and protein contents of harvest survey samples, 1995-2005



Fatty acid composition

The average linolenic acid (C18:3) content of the 2005 solin samples was 2.2%, lower than the 2.4% in 2004. This is well below the maximum 5% linolenic acid specified for solin. The linolenic acid of Solin, No. 1 CW samples from producers across western Canada varied from 1.7% to 2.6%. The average linoleic acid (C18:2) content of the 2005 solin survey samples decreased to 73.3% from 75.2% in 2004. The linoleic acid of Solin, No. 1 CW samples from producers across western Canada varied from 68.9% to 77.8%.

In addition, the 2005 solin composites had increased levels of oleic acid. This was a general trend that all western Canadian oilseed crops exhibited in the 2005 surveys. As a result, the iodine value, an indicator of oil unsaturation, will be slightly lower in most 2005 oilseed samples. The growing season temperatures for the 2004 season were among the coolest reported in over 100 years. That caused the oilseed plants to increase the amount of unsaturation in the oil in 2004. The plant's objective in making the oil unsaturated is to give a more liquid (i.e. unsaturated) oil at lower temperatures. To do this, the plants have evolved mechanisms in the form of enzyme systems that are more active in making the oil unsaturated when the weather is cool and less active when it is hot. A return to somewhat warmer temperatures in 2005 resulted in the observed shifts in fatty acid profiles.

Figure 4 illustrates that both the solin and flaxseed crops had lower iodine values compared to 2004. It has also been shown in previous surveys that the variety 2047 produces notably higher amounts of linoleic acid than other varieties (Table 3). This factor contributed to the 2005 linoleic acid values remaining significantly above the ten–year mean of 71.2%.

Figure 4 - No. 1 Canada western solin and flaxseed Iodine value of harvest survey samples, 1995-2005

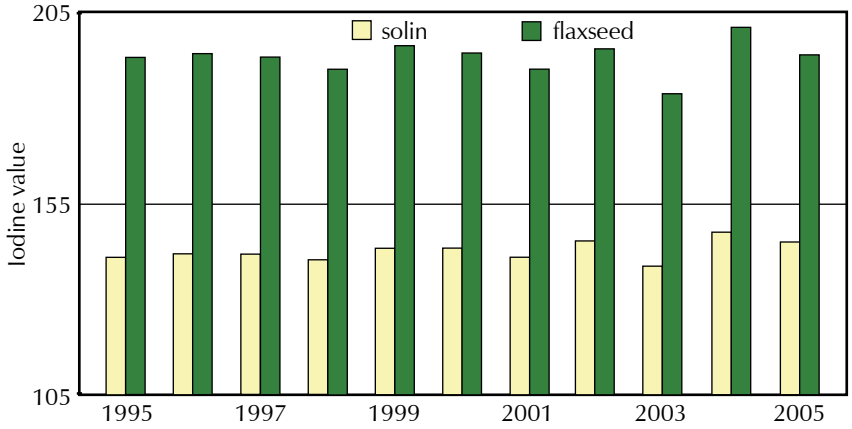


Table 1 - No. 1 Canada western solin
Quality data for 2005 harvest survey

Quality parameter	Mean	Standard deviation	Minimum	Maximum	Range
Oil content[1], %	49.1	1.1	44.5	51.2	6.7
Protein content[2], %	22.0	1.5	17.7	25.9	8.2
Palmitic acid[3], %	5.7	0.4	4.9	6.2	1.3
Stearic acid[3], %	3.2	0.5	2.7	4.3	1.6
Oleic acid[3], %	14.4	1.8	12.6	18.2	5.6
Linoleic acid[3], %	73.3	2.0	68.9	77.8	8.9
Linolenic acid[3], %	2.2	0.3	1.7	2.6	0.9
Iodine value	145.3	2.1	140.2	149.4	9.2

[1] Dry matter basis
[2] N x 6.25; dry matter basis
[3] Percentage of total fatty acids including: palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3)

Table 2 - No. 1 Canada western solin
Quality data for 2005 harvest survey by province

Province	Number of samples	Average oil content[1]	Average protein content[2]	Average linolenic acid content[3]	Average linoleic acid content[3]	Average iodine value
		%	%	%	%	units
Manitoba	16	48.2	22.4	2.0	72.4	143.6
Saskatchewan	105	49.3	21.8	2.3	73.5	145.5
Alberta	6	49.1	23.9	2.2	73.8	145.6
Western Canada	**127**	**49.1**	**22.0**	**2.2**	**73.3**	**145.3**

[1] Dry matter basis
[2] N x 6.25; dry matter basis
[3] Percentage of total fatty acids in oil for linolenic (C18:3) and linoleic (C18:2) acid

Table 3 - No. 1 Canada western solin
Quality data for 2005 harvest survey by variety

Variety Region	2047 Manitoba	2047 Saskatchewan	2047 Alberta	2090 W. Canada	1084 W. Canada
Number of samples	13	85	6	5	9
Oil content[1], %	48.3	49.4	49.0	49.3	48.0
Protein content[2], %	22.8	22.0	23.9	20.8	20.8
Palmitic acid[3], %	6.0	5.7	5.8	5.2	5.2
Stearic acid[3], %	3.3	3.1	3.1	3.6	3.4
Oleic acid[3], %	14.9	14.0	14.1	16.0	15.1
Linoleic acid[3], %	72.5	73.7	73.6	72.0	72.9
Linolenic acid[3], %	2.1	2.2	2.1	1.9	2.1
Iodine value	143.8	145.7	145.3	143.7	144.9

[1] Dry matter basis
[2] N x 6.25; dry matter basis
[3] Percentage of total fatty acids including: palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3)

Table 4 - No. 1 Canada western solin and conventional flaxseed
Quality data for 2005, 2004, and historical harvest surveys

	Solin			Flaxseed		
Parameter	2005	2004	1995-2004	2005	2004	1995-2004
Oil content[1], %	49.1	48.0	45.1	46.2	44.8	44.3
Protein content[2], %	22.0	23.4	22.9	22.0	22.1	23.1
Palmitic acid[3], %	5.7	5.5	5.9	5.0	4.9	5.2
Stearic acid[3], %	3.2	2.8	3.7	3.3	3.0	3.4
Oleic acid[3], %	14.4	12.8	15.8	16.8	14.5	18.2
Linoleic acid[3], %	73.3	75.2	71.2	16.3	15.8	14.9
Linolenic acid[3], %	2.2	2.4	2.0	57.7	61.6	58.0
Iodine value	145	148	143	194	201	193

[1] Dry matter basis
[2] N x 6.25; dry matter basis
[3] Percentage of total fatty acids including: palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3)

Chlorophyll content

Chlorophyll content is determined by International Organization for Standardization method reference number ISO 10519:1997 (E), Rapeseed—Determination of chlorophyll content—Spectrometric method. Results are expressed as milligrams per kilogram (mg/kg), seed basis.

Fatty acid composition

Fatty acid composition is determined by the International Organization for Standardization methodreference number ISO 5508:1990 (E), Animal and vegetable fats and oils—Analysis by gas chromatography of methyl esters of fatty acids. A 15m by 0.32mm column with a 0.25μm Supelcowax 10 coating is used. Major and important fatty acids are reported although samples may also contain as much as 1% of other minor fatty acids which are included in the calculations.

Free fatty acid content

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 a percentage by weight of oleic acid in the oil. Oleic acid with a molecular weight of 282 is used as the fatty acid for the expression of the results.

Glucosinolate content

Glucosinolate content is determined by International Organization for Standardization method reference number ISO 9167–1:1992(E), Rapeseed—Determination of glucosinolate content—Part 1: Method using high performance liquid chromatography. Results are total seed glucosinolates expressed as micromoles per gram (μmol/g), calculated to an 8.5% moisture basis for canola or on a dry matter basis for all mustard seeds.

Iodine value

Iodine value is a measure of unsaturation calculated from the fatty acid composition according to AOCS Recommended Practice Cd 1c-85, revised 1995 and re-approved 1997, Calculated Iodine Value.

Oil content

Oil content is determined by nuclear magnetic resonance (NMR) according to the International Organization for Standardization, reference number ISO 10565:1992(E) Oilseeds—Simultaneous determination of oil and moisture contents—Method using pulsed nuclear magnetic resonance spectroscopy. A Bruker NMS 110 Minispec NMR Analyzer calibrated with appropriate oilseed samples extracted with petroleum ether is used. Results are reported as a percentage, calculated to a specified moisture basis. Canola is calculated to an 8.5% moisture basis, and flaxseed, solin, soybean and all mustard seeds are calculated on a dry matter basis.

Protein content

Protein content is determined by the AOCS Official Method Ba 4e-93, revised 1995 and re-approved 1997, Combustion method for determination of crude protein, using a LECO FP-428 Nitrogen and Food Protein Determinator. Results are reported as a percentage, N x 6.25, calculated to specified moisture basis. Canola is calculated to an 8.5% moisture basis, and flaxseed, solin, soybean and all mustard seeds are calculated on a dry matter basis.