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Quality of western Canadian solin 2004

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Table of contents

Summary	3
Introduction	3
Weather and production review	3
Harvest survey samples	5
Quality of western Canadian solin - 2004	6
Oil content	6
Protein content	7
Fatty acid composition.....	9

Tables

Table 1 - No. 1 Canada western solin Quality data for 2004 harvest survey	10
Table 2 - No. 1 Canada western solin Quality data for 2004 harvest survey by province.....	10
Table 3 - No. 1 Canada western solin Quality data for 2004 harvest survey by variety.....	11
Table 4 - No. 1 Canada western solin and conventional flaxseed Quality data for 2004, 2003 and historical harvest surveys	11

Figures

Figure 1 - No. 1 Canada western solin and flaxseed Oil content of harvest survey samples, 1994-2004	7
Figure 2 - No. 1 Canada western solin and flaxseed Protein content of harvest survey samples, 1994-2004	8
Figure 3 - No. 1 Canada western solin and flaxseed Sum of oil and protein contents of harvest survey samples, 1994-2004	8
Figure 4 - No. 1 Canada western solin and flaxseed Iodine value of harvest survey samples, 1994-2004.....	9

Summary

The 2004 Canadian Grain Commission (CGC) harvest survey of western Canadian solin shows significant increases in oil and linoleic acid content along with a significant decrease in protein content. The 2004 oil content, 48.0%, is 1.6% higher while the protein content, 23.4%, is 2.6% lower than in 2003. The linoleic acid content of the oil, 75.2%, is significantly higher than the 68.3% in 2003.

Introduction

This report presents quality data and information based on the CGC 2004 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 to distinguish yellow seeded, low linolenic acid flaxseed from conventional brown flaxseed.

See (<http://www.flaxcouncil.ca/38.htm>).

Weather and production review

Weather review

The weather and growing conditions for the 2004 solin crop were similar to those for the flaxseed crop. Temperature and precipitation patterns for the 2004 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 was the cooler than normal weather along with a series of mid-season frosts. The Weather and Crop Surveillance department of the Canadian Wheat Board provided the majority of the detailed weather review for the 2004 crop year.

Seeding

Extremely low soil moisture levels were present in Alberta and Saskatchewan at the beginning of the 2004 growing season. The dry soils delayed fieldwork in many areas of both provinces, until significant precipitation arrived in May. Planting of crops began in early May across the Prairies and advanced rapidly in the western growing areas. Cool temperatures and frequent frosts in the eastern growing areas slowed progress, particularly in southeastern Saskatchewan and the Red River Valley of Manitoba. General rains and snow in the third week of May slowed planting but provided much needed moisture for germination. The cool temperatures and frequent rains persisted in eastern areas well into June, resulting in late planting of some oilseed crops. Seeding was complete by mid-June, although some fields were not planted due to the wet conditions in parts of Manitoba and eastern Saskatchewan.

Growing conditions

Cool, wet weather slowed crop growth through the month of June in the eastern Prairies. The May through June period was one of the coolest on record in the eastern Prairies. Although western areas of the Prairies were warmer, below normal temperatures were also reported in Alberta and western Saskatchewan. Crop development was generally two to three weeks behind normal in the eastern Prairies by the end of June, while crops in the west were only one week behind normal. Temperatures improved in the month of July, allowing crops to develop rapidly. Western growing areas received the warmest temperatures, with most locations normal or slightly above normal for the month. Temperatures also improved in eastern areas, but the region still reported below normal temperatures for the month. Rainfall during July was close to normal across the Prairies, which encouraged good crop growth. Yield potential for most crops was above average due to the adequate rainfall and the lack of heat stress. Temperature levels in August were dramatically below normal, further delaying crop development. Freezing temperatures during the third week of August caused significant damage to immature crops in parts of Saskatchewan and Manitoba. A significant portion of the solin crop was either lost or damaged due to the frost. The cool temperatures persisted into September, resulting in delayed maturity of most crops. Growing season temperatures for May through August during the 2004 season were among the coolest reported in over 100 years.

Harvest conditions

Persistent rains in late August and early September delayed harvest progress across the Prairie region. For example, only seven per cent of the Saskatchewan flaxseed harvest was completed by the first week of October 2004 compared to 93% in 2003. The rains caused quality damage to most crops, especially in northern areas of the Prairies. Drier, milder weather in late September and early October resulted in rapid harvest progress. Final provincial crop reports issued in late November and early December listed the 2004 flaxseed harvest as 85% to 100% completed.

Production and grade information

Although Statistics Canada does not publish official production statistics for solin, the industry consensus is that solin production was significantly lower than in 2003. The grade pattern of the 2004 solin crop was negatively affected by an overall delayed maturity of the solin crop along with a major frost around August 20th. In addition, poor harvest weather in September resulted in additional downgrading. As a result, above average numbers of solin samples were assigned to lower grades because of damage factors such as frosted, immature, and lightweight seeds. Heavily frosted samples were light in test weight and often white and flaky in appearance. However, as is discussed below, the extremely cool weather in 2004 increased the final seed oil content and produced oil with higher than normal amounts of linoleic acid, desirable quality traits in solin.

Harvest survey samples

This year's solin harvest survey included 101 samples compared to 207 in 2003. Eighty of the samples came from Saskatchewan while 21 came from Manitoba. The CGC's Industry Services Division graded 53 samples as Solin, No. 1 Canada Western, 28 as Solin, No. 2 CW, 13 as Solin, No. 3 CW, and seven as Sample CW. Ninety-two, or about 91% of the total, were identified as variety 2047. In addition, there were 2 samples identified as 1084, one identified as 2090 and six samples were not identified. By comparison, 74% of the 2003 survey samples were identified as variety 2047.

The GRL received the solin samples representing the 2004 crop during the period September to December 2004. 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 2004, and the Weather and Crop Surveillance department of the Canadian Wheat Board for providing the review of the 2004 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 2004

Quality data for No. 1 CW solin 2004 harvest survey samples are shown in Table 1, including oil content, protein content, fatty acid composition and iodine value. Data for Solin, No. 1 CW are also summarized by province in Table 2 and by variety in Table 3. The quality of solin and conventional flaxseed from 2004 and 2003 is compared to the long-term means in Table 4. Trends in the solin and flaxseed quality data since 1994 are shown in graphical form in Figures 1 to 4. The means and standard deviations of the 2004 NIR survey data can be found at: <http://grainscanada.gc.ca/Quality/Solin/solinmenu-e.htm>.

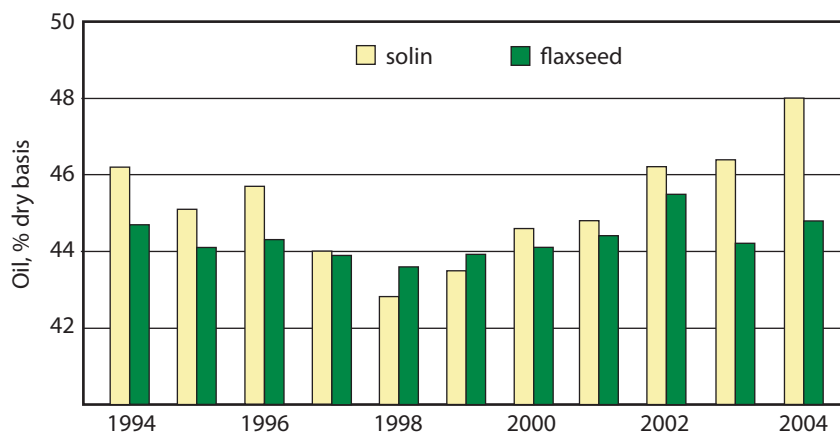
Oil content

The mean oil content of Solin, No. 1 CW 2004 survey samples is 48.0%, an increase of 1.6% compared to 2003. The average oil content of Manitoba samples was 0.6% higher than those from Saskatchewan. The oil content of Solin, No. 1 CW samples from producers across western Canada varied from 43.1% to 50.2%. Figure 1 shows that in 2004 both solin and flaxseed harvest survey samples increased in mean oil content. Lower grade solin samples have significantly lower mean oil contents with Flaxseed No. 2 CW and No. 3 CW samples averaging 45.9% and 46.6% oil respectively.

The overall higher oil contents seen in the 2004 solin survey are partly the result of the cool, wet weather that affected large portions of the solin growing area. The GRL's long-term harvest survey results show that cool growing conditions tend to produce an oilseed 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 2002, Solin, No. 1 CW survey samples of 2047 had an oil content of 48.3%, which was 2.5% higher than the 1084 samples. In 2003, in spite 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 2004 that was 3.1% above the ten-year mean of 44.9%.

**Figure 1 - No. 1 Canada western solin and flaxseed
Oil content of harvest survey samples, 1994-2004**

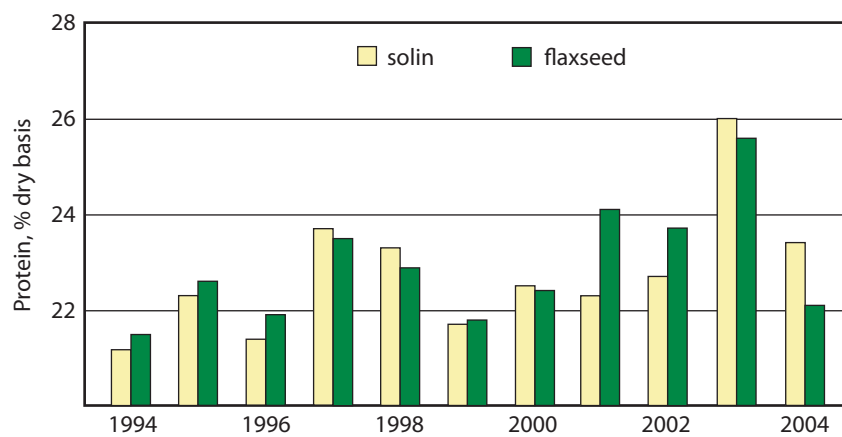


Protein content

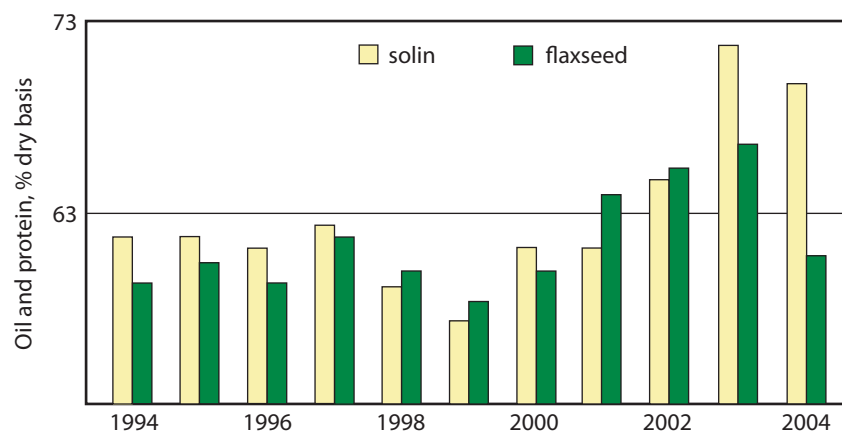
The average protein content of Solin, No. 1 CW from the 2004 survey was 23.4%, a decrease of 2.6% from the 2003 value of 26.0%. Heat and drought stress caused the 2003 protein values to be well above the ten-year average. The mean protein content of Manitoba and Saskatchewan samples were similar in 2004, both at 23.4%. The protein content of Solin, No. 1 CW samples from producers across western Canada varied from 20.9% to 26.3%. Lower grade solin samples had slightly lower mean protein contents with Flaxseed, No. 2 CW and No. 3 CW samples averaging 22.9% and 22.3% protein respectively.

Despite the cooler growing conditions, the 2004 mean protein values are still above the ten-year mean of 22.4%. In 2003, the average protein content of the newer variety, 2047, was 1.3% higher than that of the variety 1084. The high percentage of the new cultivar in the current survey contributed to an average protein content in 2004 that was still 0.7% above the ten-year mean. However, both solin and flaxseed showed decreases in protein content due to the overall cooler growing conditions in 2004. (Figure 2).

**Figure 2 - No. 1 Canada western solin and flaxseed
Protein content of harvest survey samples, 1994-2004**



**Figure 3 - No. 1 Canada western solin and flaxseed
Sum of oil and protein contents of harvest survey samples, 1994-2004**



Fatty acid composition

The mean linolenic acid (C18:3) content of the 2004 solin samples was 2.4%, higher than the 1.8% in 2003. 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 2.0% to 3.0%. The mean linoleic acid (C18:2) content of the 2004 solin survey samples increased to 75.2% from 68.3% in 2003. The linoleic acid of Solin, No. 1 CW samples from producers across western Canada varied from 71.9% to 77.1%. Lower grade solin samples had slightly lower mean linoleic acid contents with Flaxseed, No. 2 CW and No. 3 CW samples averaging 74.5% and 73.1% respectively

In 2004, the cool weather during the time of seed development contributed to a much more unsaturated oil. Figure 4 illustrates that both the solin and flaxseed crops had higher iodine values compared to 2003. It has also been shown in previous surveys that the variety 2047 produces notably higher amounts of linoleic acid than earlier varieties such as 1047 (Table 3). This factor also contributed to the 2004 linoleic acid values being significantly above the ten-year mean of 70.9%.

Figure 4 - No. 1 Canada western solin and flaxseed iodine value of harvest survey samples, 1994-2004



**Table 1 - No. 1 Canada western solin
Quality data for 2004 harvest survey**

Quality parameter	Mean	Standard deviation	Minimum	Maximum	Range
Oil content ¹ , %	48.0	1.5	43.1	50.2	7.1
Protein content ² , %	23.4	1.3	20.9	26.3	5.4
Palmitic acid ³ , %	5.5	0.2	5.4	6.0	0.6
Stearic acid ³ , %	2.8	0.2	2.4	3.2	0.8
Oleic acid ³ , %	12.8	1.1	11.1	15.2	4.1
Linoleic acid ³ , %	75.2	1.3	71.9	77.1	5.2
Linolenic acid ³ , %	2.4	0.2	2.0	3.0	1.0
Iodine value	147.7	1.7	143.7	149.9	6.2

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 2004 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	48.4	23.4	2.5	76.2	149
Saskatchewan	37	47.8	23.4	2.4	74.8	147
Western Canada	53	48.0	23.4	2.4	75.2	148

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 2004 harvest survey by variety**

Variety	2047 MB	2047 SK	1084	Unknown	All
Number of samples	15	35	1	2	53
Oil content ¹ , %	48.4	47.9	44.0	48.3	48.0
Protein content ² , %	23.3	23.4	23.7	25.4	23.4
Palmitic acid ³ , %	5.5	5.6	n/a	n/a	5.5
Stearic acid ³ , %	2.5	2.9	n/a	n/a	2.8
Oleic acid ³ , %	12.1	13.0	n/a	n/a	12.8
Linoleic acid ³ , %	76.2	75.0	72.1	75.2	75.2
Linolenic acid ³ , %	2.4	2.4	2.4	2.3	2.4
Iodine value	149	147	144	148	148

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 2004, 2003, and historical harvest surveys**

Parameter	Solin			Flaxseed		
	2004	2003	1994-2003	2004	2003	1994-2003
Oil content ¹ , %	48.0	46.4	44.9	44.8	44.2	44.3
Protein content ² , %	23.4	26.0	22.7	22.1	25.6	23.0
Palmitic acid ³ , %	5.5	5.9	6.0	4.9	5.2	5.3
Stearic acid ³ , %	2.8	4.0	3.8	3.0	3.7	3.4
Oleic acid ³ , %	12.8	18.3	16.0	14.5	22.4	18.4
Linoleic acid ³ , %	75.2	68.3	70.9	15.8	15.0	14.7
Linolenic acid ³ , %	2.4	1.8	2.0	61.6	52.9	57.8
Iodine value	148	139	142	201	184	192

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)