Canadian Grain Commission
Commission canadienne des grains

Canada

Quality of western Canadian flaxseed 2003

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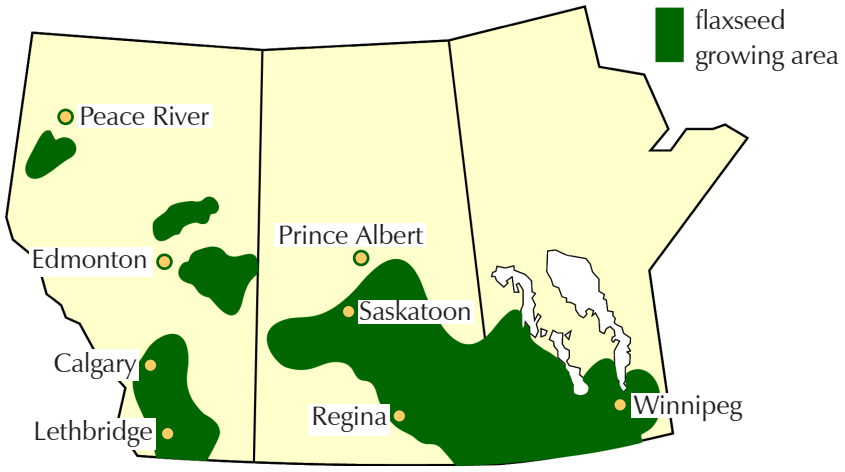
Introduction

This report presents quality data and information based on the Canadian Grain Commission (CGC) 2003 harvest survey of western Canadian flaxseed. Quality data presented includes oil, protein and free fatty acids content, the fatty acid composition, and the iodine value of harvest survey samples. Quality data are based on analyses of flaxseed samples submitted to the Grain Research Laboratory (GRL) 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 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 2003 crop to be well above average in protein content with a near average oil content but a significantly lower than average iodine value. The iodine value is 10 units lower while the oil content is 0.2% lower and the protein content is 3.0% higher than the 10-year means.

Compared to 2002, the oil content, 44.2%, is 1.3% lower while the protein content, 25.6%, is 1.9% higher. The linolenic acid content, 52.9%, is 6.0% lower than in 2002, resulting in an iodine value of 184, 11 units lower than in 2002.

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

Table 1 – No. 1 Canada Western flaxseed
Quality data for 2003 harvest survey

Quality parameter	2003	2002	1993–2002 mean
Oil content[1], %	44.2	45.5	44.4
Protein content[2], %	25.6	23.7	22.6
Free fatty acids, %	0.15	0.29	0.24
Iodine value	184	195	194
Linolenic acid, % in oil	52.9	58.9	58.5

[1] Dry matter basis
[2] N x 6.25; dry matter basis

Table 2 – No. 1 Canada Western flaxseed
Fatty acid composition for 2003 harvest survey

Fatty acid[1], % in oil	2003	2002	1993–2002 mean
Palmitic	5.2	4.9	5.3
Stearic	3.7	3.1	3.3
Oleic	22.4	17.3	17.8
Linoleic	15.0	15.1	14.7
Linolenic	52.9	58.9	58.5

[1] 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)

Weather and production review

Weather review

Temperature and precipitation patterns for the 2003 western Canadian growing season can be found on the PFRA web site (http://www.agr.gc.ca/pfra/drought/maps/td03_08e.pdf).

Of particular note this growing season was that both day and night temperatures were extremely high for long periods of time. The Weather and Crop Surveillance department of the Canadian Wheat Board provided the detailed weather review for the 2003 crop year (http://www.cwb.ca/en/growing/weather/crop_issues.jsp).

Seeding

A combination of rains during the 2002 harvest and normal to above normal winter precipitation greatly improved the soil moisture situation in Western Canada for the spring seeding season. The wetter than normal precipitation pattern continued through the month of April and into early May in Saskatchewan and Alberta. Amounts received during that period were 125 to 175 per cent of normal, which delayed seeding progress. The spring precipitation was accompanied by cooler than normal temperatures, which slowed planting progress as well. Temperatures recovered by May 15 and seeding advanced rapidly in the western prairies. Manitoba and parts of eastern Saskatchewan did not experience planting delays, due to drier and warmer weather in the first half of May. This allowed farmers to plant most oilseed crops before May 15 in the eastern growing region. Overall planting progress was 10 days to two weeks behind normal for the prairies. Planting of all grains and oilseeds in western Canada advanced rapidly during the second half of May and was complete by the first week in June. Germination and emergence of crops were very good, but some patches of severe frost in northern Saskatchewan and Alberta meant that some crops needed reseeding.

Growing conditions

Moisture conditions began to deteriorate in the second half of June in the northern and central areas of Saskatchewan. The dryness, combined with above normal temperatures, resulted in stress to crops. The rest of the region received timely rainfall throughout June, but total amounts for the month were below normal over most of the prairie region. Although the crop was rated in mostly good to excellent condition in mid-June, the lack of sub-soil moisture was a major concern. These concerns were well founded, as hot and dry conditions dominated the weather on the prairies from mid-June to late August. The southern prairies received less than 50 per cent of normal precipitation in July and August, while the northern areas received less than 75 per cent of normal precipitation. The rains were very timely in northern Alberta and northwestern Saskatchewan over the summer months, which helped maintain crop potential. Temperatures were warmer than normal during the months of July and August, which increased stress to all crops. August temperatures were 2 to 5 degrees Celsius above normal across western

Canada. The warmer than normal temperatures caused yield reductions in all crops, dropping above average production potential back to average to slightly-below-average in most regions. Timely rains limited yield losses in northern growing areas of Alberta. The warm, dry weather during the summer months was ideal for grasshoppers, which resulted in significant damage to crops throughout the prairie region. The environmental conditions did keep plant diseases in check, with leaf and head diseases reported at the lowest levels in a decade. Crop development was boosted by the warmer than normal temperatures, with most crops reaching maturity by the end of July in the eastern prairies. Crops in western areas were not mature until the middle of August, while northern Alberta and the Peace River region were delayed until the end of the month

Harvest conditions

The harvest began the first week of August on the eastern prairies and was underway in all areas except northern Alberta by the middle of the month. Rainfall during August and September was well below normal, which resulted in a rapid harvest pace. The majority of the crop was harvested by the first week of September, with most of the unfinished harvest located in northern Alberta and Saskatchewan. Cool, rainy conditions in the northern areas slowed the harvest in the middle of September, but the return of warm, dry conditions by the end of the month allowed the harvest to proceed rapidly. The 2003 flaxseed harvest was over 95 percent completed by October 5th compared with just 75 percent complete at that time last year.

Production and grade information

Table 3 shows western Canadian farmers planted 745 thousand hectares of flaxseed in 2003, which was an eight percent increase from last year's area. The 2003 yield estimate of 1000 kg/ha was slightly lower than the 1100 kg/ha reported in 2002 and well below the 10-year mean of 1255 kg/ha. However total flaxseed production in western Canada is up 11 percent to 754 thousand tonnes according to estimates by Statistics Canada reported in *Field Crop Reporting Series No. 8*, December 5, 2003. In 2003, Saskatchewan accounted for 71 percent of flaxseed production while Manitoba and Alberta had 26 percent and three percent respectively. The below average yields for western Canada is largely due to the drought conditions in large parts of southeastern Saskatchewan and southwestern Manitoba.

The grade pattern of the 2003 flaxseed crop was not negatively affected by the hot, dry conditions of 2003. The early flax harvest produced a sound seed with minimal visible damage or discoloration. However, as discussed below, the extremely hot weather in 2003 affected the intrinsic seed oil and protein contents plus the fatty acid composition of the oil.

Table 3 – Seeded area and production for western Canadian flaxseed

	Seeded area[1]		Production[1]		Average production[2]
	2003	2002	2003	2002	1993–2002
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	158	174	196	215	298
Saskatchewan	567	498	533	444	531
Alberta	20	20	25	20	32
Western Canada	**745**	**692**	**754**	**679**	**861**

[1] Source—*Field Crop Reporting Series, No. 8*, December 5, 2003; Statistics Canada
[2] Source—*Field Crop Reporting Series*, revised final estimates for 1993–2002

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 No.1 Canada Western (CW) samples by province.

This year's harvest survey included 755 samples compared to 355 in 2002. Manitoba contributed 307 samples, Saskatchewan 433 samples and Alberta 15 samples during the harvest period from September 1 to November 15, 2003. The majority, 748, of the flaxseed samples received in the CGC survey were graded as No.1 CW. 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 5, 2003.

Quality of Western Canadian flaxseed 2003

Tables 4 and 5 show detailed information on the quality of top grade western Canadian flaxseed harvested in 2003. A complete summary of the survey by province and lower grades can be found at:

http://grainscanada.gc.ca/Quality/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 the 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 5.6% and 2.0% 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 – No. 1 Canada Western flaxseed
Quality data for 2003 harvest survey

Province	Number of samples	Oil content[1]			Protein content[2]			Iodine value		
		Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
			%			%				
Manitoba	303	44.6	38.9	48.9	24.7	18.6	30.2	186	168	210
Saskatchewan	430	44.0	39.6	48.2	25.9	21.8	29.6	183	166	201
Alberta	15	44.7	38.0	48.1	25.1	21.7	28.9	190	179	203
Western Canada[3]	**748**	**44.2**	**38.0**	**48.9**	**25.6**	**18.6**	**30.2**	**184**	**166**	**210**

[1] Dry matter basis
[2] N x 6.25; dry matter basis
[3] Mean values are weighted averages based on estimated production by province (Statistics Canada).

Table 5 – No. 1 Canada Western flaxseed
Fatty acid composition and free fatty acids content for 2003 harvest survey

Province	Number of samples	Fatty acid composition, %[1]					Free fatty acids
		C16:0	C18:0	C18:1	C18:2	C18:3	
Manitoba	303	5.2	3.5	21.4	15.0	54.2	0.15
Saskatchewan	430	5.2	3.8	23.0	15.0	52.3	0.15
Alberta	15	4.8	3.7	19.3	15.1	56.4	0.14
Western Canada[2]	**748**	**5.2**	**3.7**	**22.4**	**15.0**	**52.9**	**0.15**

[1] 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)

[2] Mean values are weighted averages based on estimated production by province (Statistics Canada).

Table 6 – No. 1 Canada Western flaxseed
Comparison of 2003 harvest survey quality data with recent export[1] shipments

Quality parameter	2003 survey	November exports	2002-2003 exports
Oil content[2], %	44.2	44.0	44.7
Protein content[3],%	25.6	25.3	23.6
Free fatty acids, %	0.15	0.42	0.47
Iodine value	184	183	193
Palmitic acid, % in oil	5.2	5.1	5.0
Stearic acid, % in oil	3.7	3.7	3.4
Oleic acid, % in oil	22.4	22.5	18.1
Linoleic acid, % in oil	15.0	15.5	15.3
Linolenic acid, % in oil	52.9	52.5	57.8
Number of samples	748	3	29

[1] Commercially clean exports containing less than 2.5% dockage

[2] Dry matter basis

[3] N x 6.25; dry matter basis

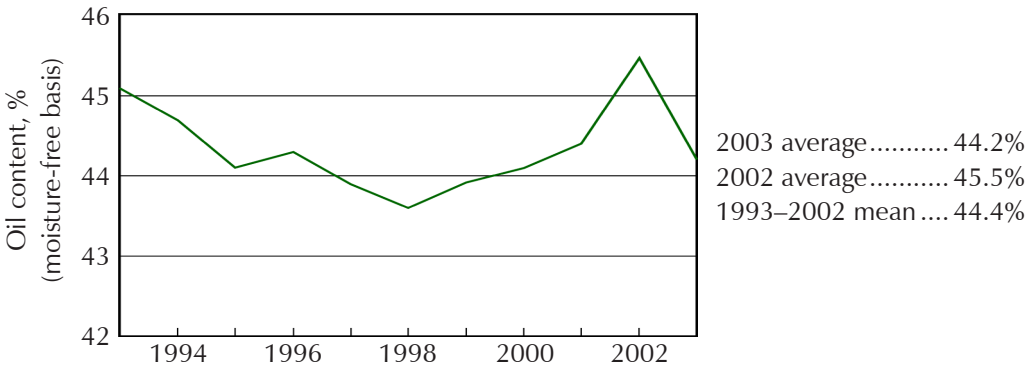
Oil content

The average oil content of 44.2% for No. 1 CW flaxseed from the 2003 survey is lower than both the 45.5% in 2002 and the 10-year mean of 44.4%. The oil content of 44.0% for Saskatchewan is lower than the 44.6% and 44.7% in Manitoba and Alberta samples. Compared to 2002, mean oil contents are 1.4% and 1.1% lower for Saskatchewan and Manitoba respectively. For Alberta, the mean oil content was 0.1% higher than in 2002. The hot, dry growing conditions in some regions resulted in those samples having significantly lower oil contents than the reported provincial means. The oil content of No. 1 CW flaxseed samples from producers across western Canada varied from 38.0% to 48.9%.

The overall lower oil contents seen in the 2003 flaxseed survey are a result of the extreme heat and drought that affected large portions of the flaxseed growing area. In particular, the southeast parts of Saskatchewan and the southwest parts of Manitoba appear to be the most severely affected regions. The GRL's long-term harvest survey results have shown that hot, dry growing conditions tend to produce a flaxseed crop with lower oil contents and iodine values, but higher protein contents (http://grainscanada.gc.ca/Cdngrain/flax/flaxq-e.htm).

One reason for the relatively small decrease in the western Canada mean oil content in the 2003 survey may be due to the continuing trend of planting more of the newer high quality Canadian flaxseed cultivars. The 2002 varietal data from the GRL survey indicated certain varieties had significantly higher mean oil contents than other varieties. Of note, is that the two varieties that ranked highest in oil content for 2002 accounted for nearly 50% of survey samples received in 2003. The oil content of November 2003 No. 1 CW flaxseed exports averaged 44.0%, lower than the 2002–2003 export mean of 44.7%. This suggests the oil content of the 2003–2004 flaxseed exports will be lower than the previous year. Flaxseed exports that are not commercially clean will have significantly lower oil contents than exports that are cleaned to contain less than 2.5% dockage.

Figure 2 - No. 1 Canada western flaxseed
Oil content of harvest survey samples, 1993–2003

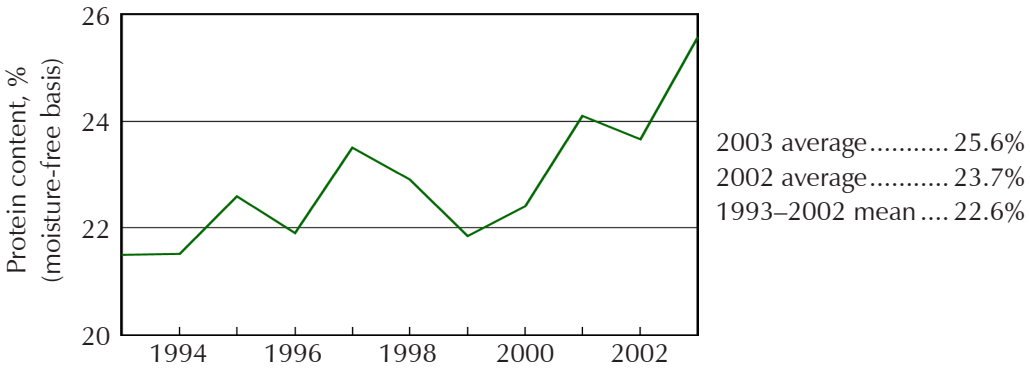


Protein content

The average protein content of 25.6% for No. 1 CW flaxseed from the 2003 harvest survey is 1.9% higher than in 2002 and 3.0 % higher than the 10-year mean of 22.6%. The Saskatchewan mean protein content of 25.9% was significantly higher than the 24.7% in Manitoba and the 25.1% in Alberta. Compared to 2002, the protein contents increased by 2.3%, 1.2% and 1.0% respectively for Saskatchewan, Alberta and Manitoba samples. The protein content of No. 1 CW flaxseed samples from producers across western Canada varied from 18.6% to 30.2%.

As Table 6 shows, the protein content of 25.3% for November 2003 flaxseed exports is significantly higher than the 23.6% for the 2002–2003 shipping season. The protein content of flaxseed exports in 2003–2004 should be significantly higher than the export shipments of the previous season.

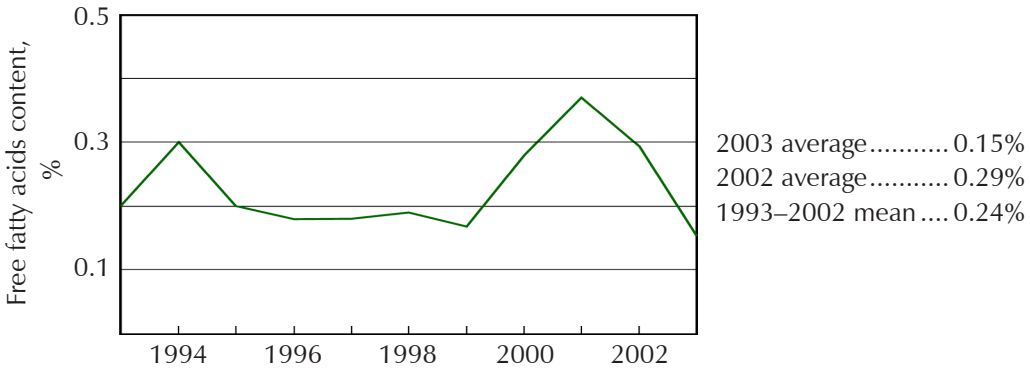
Figure 3 - No. 1 Canada western flaxseed
Protein content of harvest survey samples, 1993–2003



Free fatty acids content

The average free fatty acids (FFA) content of 0.15 % in top grade 2003 survey samples is lower than both the 2002 average of 0.29% and the 10-year mean of 0.24%. The FFA content of Manitoba, Saskatchewan and Alberta samples were all very similar. Flaxseed from northern regions where the harvest was later may have higher FFA levels. The No. 2 CW, No. 3 CW, and Sample grade composites had FFA levels of 1.18%, 0.62% and 0.19% respectively. The FFA content of No.1 CW flaxseed exports in November 2003 averaged 0.42%; suggesting the levels in 2003-2004 may be lower than the 2002–2003 mean value of 0.47% (Table 6).

Figure 4 - No. 1 Canada western flaxseed
Free fatty acids content of harvest survey samples, 1993–2003



Fatty acid composition

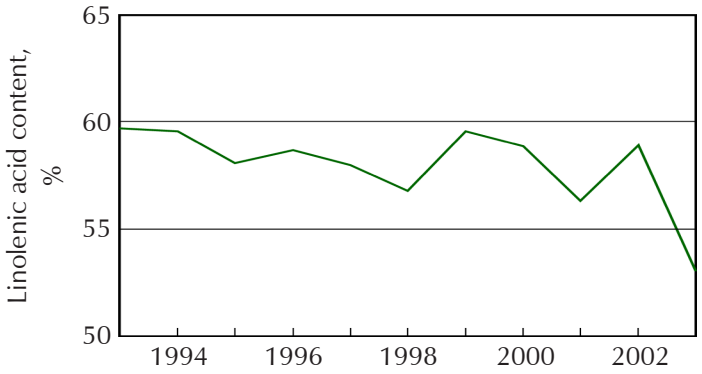
The average linolenic acid content in 2003 harvest survey No.1 CW samples is 52.9%, significantly lower than both the 58.9% in 2002 and the 10-year mean of 58.5%. Compared to 2002, the average linolenic acid content decreased by 7.1%, 3.9% and 3.5% respectively in Saskatchewan, Manitoba, and Alberta samples. No. 1 CW flaxseed samples from producers across western Canada had a range of linolenic acid content from 41.0% to 68.8%.

The average iodine value of the oil is 184 units. This is 11 units lower than in 2002 and 10 units below the 10-year mean of 194 units. The average iodine value decreased by 14, 8, and 5 units respectively for Saskatchewan, Manitoba, and Alberta samples. No. 1 CW flaxseed samples from producers across western Canada varied in iodine value from 166 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. In 2003, both day and night temperatures were extremely high for a long period of time during seed development and the flaxseed plants responded to this by producing a much less unsaturated oil.

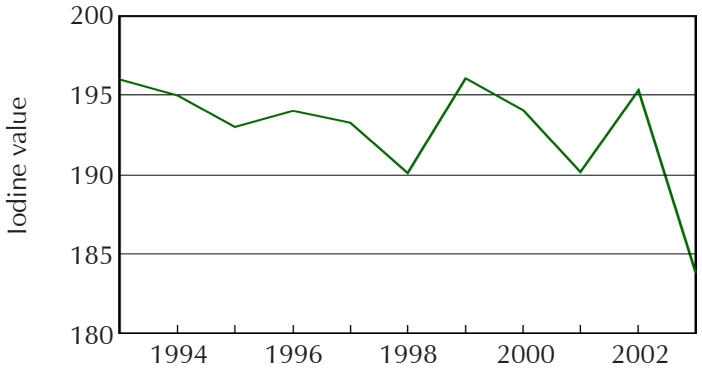
The November 2003 export data in Table 6 shows the linolenic acid content at 52.5% and the iodine value at 183 units, significantly lower than the 2002–2003 mean export values. The No. 1 CW flaxseed exports will likely produce oils with iodine values around 183 to 185 units. Flaxseed exports that are not commercially clean may have significantly lower iodine values than those exports that are cleaned to contain less than 2.5% dockage.

Figure 5 – No. 1 Canada western flaxseed
Linolenic acid content of harvest survey samples, 1993–2003



2003 average..... 52.9%
2002 average..... 58.9%
1993–2002 mean 58.5%

Figure 6 – No. 1 Canada western flaxseed
Iodine value of harvest survey samples, 1993-2003



2003 average..... 184
2002 average..... 195
1993–2002 mean 194