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# Quality of western Canadian mustard 2004

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## Introduction

This report presents information on the oil, protein and glucosinolate contents and the fatty acid composition of Domestic Mustard Seed, Canada Oriental (*Brassica juncea*), Domestic Mustard Seed, Canada, Brown (*Brassica juncea*) and Domestic Mustard Seed, Canada, Yellow (*Sinapis alba*) mustard grown in western Canada in 2004. The data were obtained from analyses of harvest survey samples collected by the Canadian Grain Commission (CGC).

## Summary

Both Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown 2004 survey samples had higher average fixed oils and lower protein contents compared to 2003 values. Top grade Domestic Mustard Seed, Canada, Oriental had a fixed oil content of 44.4%, an increase of 5.2% from the 2003 value of 39.2%. Top grade Domestic Mustard Seed, Canada, Brown samples had a fixed oil content of 41.6%, a 3.3% increase from the 2003 value of 38.3%. Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown mustard samples decreased significantly in protein content to 25.1% and 24.8% respectively in 2004. The average glucosinolate content of the 2004 Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown samples decreased noticeably from the values in 2003. Compared to 2003, the Domestic Mustard Seed, Canada, Yellow survey samples were 3.5% higher in fixed oil at 31.6% and 3.1% lower in protein content at 31.6%. When compared to the ten-year means, all three types of mustard seed were significantly higher in average fixed oil content.

## Weather and production review

### Weather review

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/drmmaps\\_e.htm](http://www.agr.gc.ca/pfra/drought/drmmaps_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

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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 persisted through the month of June in the eastern Prairies, which delayed crop growth. 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 lack of heat stress. Temperatures in August returned to dramatically below normal levels, further delaying crop development. Freezing temperatures during the third week of August caused significant damage to immature crops in parts of Saskatchewan and Manitoba. 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. 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. Over 94% of the Saskatchewan mustard harvest was completed by October 31, 2004 compared to 100% in 2003.

### **Production and grade information**

As shown in Table 1, mustard seed production for 2004 increased by 35% to 305.5 thousand metric tonnes due to increases in yields. About 39% of western Canadian mustard production was estimated to be Domestic Mustard Seed, Canada, Yellow, followed by 32% Domestic Mustard Seed, Canada, Brown and 29% Domestic Mustard Seed, Canada, Oriental. Saskatchewan accounted for 82% of western Canada's total seeded acreage and production of mustard. According to *Saskatchewan Agriculture and Food*, the 2004 Saskatchewan yield of 898 lb/acre (407 kg/acre) was well above the

ten-year (1994-2003) average of 768 lb/acre (349 kg/acre) and 50% above the 2003 yield of 600 lb/acre (273 kg/acre). Detailed information on production factors and yields for Saskatchewan crop districts can be found at:

[http://www.agr.gov.sk.ca/DOCS/crops/special\\_crops/production\\_information/specialtycroprpt.asp](http://www.agr.gov.sk.ca/DOCS/crops/special_crops/production_information/specialtycroprpt.asp)

*Saskatchewan Agriculture and Food* estimated only 45% of the 2004 Saskatchewan mustard crop graded No.1 Canada, compared to 80% in 2003 and 78% for the 1994–2003 period. The wet, late harvest conditions produced a mustard crop with more visible damage and discoloration than in 2003. In addition there were significant numbers of samples downgraded due to admixture and frost damage. Compared to 2003, there were notably more Domestic Mustard Seed, Canada, Yellow samples in the lower grades.

**Table 1 – Seeded area and production for western Canadian mustard**

Region	Seeded area <sup>1</sup>	Seeded area <sup>2</sup>	Production <sup>1</sup>	Production <sup>2</sup>	Mean production
	2004	2003	2004	2003	1994-2003
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	3.2	10.1	2.7	10.4	5.0
Saskatchewan	259.0	273.1	250.4	176.9	188.3
Alberta	54.6	56.6	52.4	38.8	33.6
<b>Western Canada</b>	<b>316.8</b>	<b>339.8</b>	<b>305.5</b>	<b>226.1</b>	<b>234.0</b>

<sup>1</sup> *Field Crop Reporting Series No. 8*, December 8, 2004; Statistics Canada

<sup>2</sup> *Field Crop Reporting Series No. 8*, revised estimates for 1994-2003

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## Harvest survey samples

The 412 samples for the 2004 mustard survey included 232 Domestic Mustard Seed, Canada Yellow, 88 Domestic Mustard Seed, Canada, Brown mustard and 92 Domestic Mustard Seed, Canada, Oriental mustard. Over 76% of the 2004 harvest survey samples came from Saskatchewan.

Producers, grain companies and elevators that routinely handle mustard seed submitted samples of mustard grown in 2004 to the CGC. The individual samples were cleaned to remove dockage and graded by the CGC's Industry Services division.

The oil, protein, and glucosinolate contents were determined on all individual whole seed samples using a NIRSystems 6500 scanning near infra-red spectrometer calibrated to and verified against the appropriate listed reference methods. The glucosinolate contents of Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown are expressed as  $\mu\text{moles/g}$  of allyl glucosinolate and  $\text{mg/g}$  of allyl isothiocyanate on a whole-seed, dry moisture basis. A molar mass of 99.16  $\text{g/mole}$  for allyl isothiocyanate is used to convert  $\mu\text{moles}$  of allyl glucosinolate (sinigrin) to  $\text{mg/g}$  of allyl isothiocyanate. Composite samples were tested for fatty acid composition.

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# Quality of western Canadian mustard 2004

The Grain Research Laboratory (GRL) long-term harvest survey results show that cool, wet growing conditions tend to produce an oilseed crop with higher oil contents and iodine values, but lower protein contents. Research also shows that glucosinolate levels may decrease when *Brassica* crops are grown under cool, wet conditions. The three mustard crops grown in western Canada in 2004 showed the general characteristics of a crop grown under cool conditions.

The oil, protein, and glucosinolate contents for Domestic Mustard Seed, Canada, Yellow, Domestic Mustard Seed, Canada, Brown and Domestic Mustard Seed, Canada, Oriental are summarized by grade in Table 2. The fatty acid compositions of the mustard oils are detailed in Table 3. A comparison of the 2004 quality data with the previous years' surveys is provided in Table 4. The means and standard deviations of the 2004 analytical data by grade and province can be found at

<http://www.grainscanada.gc.ca/Quality/Mustard/mustardmenu-e.htm>

## Quality of Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown

The average fixed oil content of 2004 Domestic Mustard Seed, No. 1 Canada, Oriental increased 5.2% to 44.4% while the average protein content decreased by 3.0% to 25.1%. The fixed oil contents of Domestic Mustard Seed, No. 1 Canada, Oriental from producers in western Canada ranged from 35.3% to 53.4%. The protein content of Domestic Mustard Seed, No. 1 Canada, Oriental from producers in western Canada ranged from 21.1% to 32.2%.

The average fixed oil content of Domestic Mustard Seed, No. 1 Canada, Brown increased 3.3% to 41.6% while the average protein content decreased by 2.4% to 24.8%. The fixed oil content of Domestic Mustard Seed, No. 1 Canada, Brown from producers in western Canada ranged from 37.5% to 44.5%. The protein content of Domestic Mustard Seed, No. 1 Canada, Brown from producers in western Canada ranged from 21.0% to 30.1%.

In 2004, the average glucosinolate contents for both Domestic Mustard Seed, Canada, Oriental (123  $\mu\text{mol/g}$ ) and Domestic Mustard Seed, Canada, Brown (109  $\mu\text{mol/g}$ ) decreased. The glucosinolate contents of Domestic Mustard Seed, No. 1 Canada, Oriental from producers in western Canada ranged from 97 to 151  $\mu\text{mol/g}$ . The glucosinolate contents of Domestic Mustard Seed, No. 1 Canada, Brown from producers in western Canada ranged from 98 to 120  $\mu\text{mol/g}$ . The provincial and grade differences are detailed in the statistical tables for Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown mustard:

<http://www.grainscanada.gc.ca/Quality/Mustard/mustardmenu-e.htm>

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Fatty acid compositions for the Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown composites are provided in Table 3. The 2004 erucic acid levels increased 2.3% and 0.7% respectively for Domestic Mustard Seed, No. 1 Canada, Oriental and Domestic Mustard Seed, No. 1 Canada, Brown. The mean 2004 erucic acid values of 23.0% and 23.3% for Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown are typical of *Brassica juncea* condiment mustards. Domestic Mustard Seed, Canada, Oriental varieties Forge and Cutlass showed varietal differences in oleic (C18:1), linoleic (C18:2), and erucic acid (C22:1) content.

The total saturated fatty acids for the Domestic Mustard Seed, No. 1 Canada, Oriental and Domestic Mustard Seed, No. 1 Canada, Brown samples decreased by 0.6% and 0.4% respectively to produce means of 5.9% and 6.0%. In addition, the 2004 mustard composites also had increased levels of linolenic acid and decreased levels of oleic acid. This was a general trend that all western Canadian oilseed crops exhibited in the 2004 surveys. The growing season temperatures for May through August during the 2004 season were among the coolest reported in over 100 years. This likely caused the oilseed plants to increase the amount of unsaturation in the oil. One needs to remember that 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. The iodine value, an indicator of oil unsaturation, will be higher in most 2004 oilseed samples.

## Quality of Domestic Mustard Seed, Canada, Yellow

Domestic Mustard Seed, Canada, Yellow had the characteristically lower oil content and higher protein content than Domestic Mustard Seed, Canada, Oriental and Domestic Mustard Seed, Canada, Brown. For Domestic Mustard Seed, No. 1 Canada, Yellow, the average fixed oil content increased 3.5% to 31.6% while average protein content decreased 3.1% to 31.0% (Table 4). The fixed oil contents of Domestic Mustard Seed, No. 1 Canada, Yellow from producers in western Canada ranged from 26.7% to 36.0%. The protein content of Domestic Mustard Seed, No. 1 Canada, Yellow from producers in western Canada ranged from 25.0% to 37.4%. Regional and grade differences in seed quality are detailed at:

<http://www.grainscanada.gc.ca/Quality/Mustard/mustardmenu-e.htm>

Fixed oil in yellow mustard contained higher amounts of oleic (C18:1) and erucic acid (C22:1) but lower amounts of linoleic (C18:2) and linolenic (C18:3) acid compared to the oriental and brown mustard oils. The oil from the 2004 Domestic Mustard Seed, No. 1 Canada, Yellow had a mean erucic acid content of 37.9% compared to the 35.7% in 2003. Total saturated fatty acids, at 5.1%, were lower than the 5.3% in 2003.



**Table 2 – Quality of 2004 western Canadian mustard**

Grade	Number of samples	Oil content <sup>1</sup>	Protein content <sup>2</sup>	Glucosinolate content <sup>3</sup>	
		%	%	µmol/g	mg/g
<b>Domestic Mustard Seed, Canada, Oriental</b>					
No. 1 Canada	64	44.4	25.1	123	12.2
No. 2 Canada	13	44.4	25.2	122	12.1
No. 3 Canada	6	41.8	27.2	129	12.7
No. 4 Canada	6	42.9	25.7	126	12.5
Sample Canada	3	42.3	26.4	130	12.9
<b>Domestic Mustard Seed, Canada, Brown</b>					
No. 1 Canada	67	41.6	24.8	109	10.8
No. 2 Canada	7	40.6	25.7	110	10.9
No. 3 Canada	2	39.5	26.1	109	10.8
No. 4 Canada	1	41.4	24.1	108	10.7
Sample Canada	11	39.9	25.4	108	10.7
<b>Domestic Mustard Seed, Canada, Yellow</b>					
No. 1 Canada	115	31.6	31.0	—	—
No. 2 Canada	48	31.8	31.1	—	—
No. 3 Canada	12	32.0	30.7	—	—
No. 4 Canada	26	31.4	31.4	—	—
Sample Canada	31	31.5	29.6	—	—

<sup>1</sup> Dry matter basis

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

<sup>3</sup> Allyl glucosinolate (µmoles/g) and allyl isothiocyanate (mg/g); dry matter basis

**Table 3a – Fatty acid composition of 2004 western Canadian mustard**

Grade/variety	Number of samples	Fatty acid composition <sup>1</sup>								
		C16:0 %	C16:1 %	C18:0 %	C18:1 %	C18:2 %	C18:3 %	C20:0 %	C20:1 %	C20:2 %
<b>Domestic Mustard Seed, Canada, Oriental</b>										
No. 1 Canada										
Saskatchewan	57	2.7	0.2	1.5	21.5	21.1	12.5	0.9	12.5	1.1
Alberta	7	2.7	0.2	1.4	20.0	21.6	12.7	0.9	12.2	1.2
No. 2 Canada	13	2.7	0.2	1.5	19.6	20.7	13.1	0.9	12.7	1.2
No. 3 Canada	6	2.9	0.2	1.5	20.4	22.0	13.5	0.8	12.3	1.2
No. 4 Canada	6	2.9	0.2	1.6	22.2	22.1	12.6	0.9	12.4	1.1
Sample Canada	3	2.8	0.2	1.5	20.2	22.3	13.2	0.8	12.1	1.2
AC Vulcan	3	2.6	0.2	1.4	19.5	19.9	12.9	0.9	13.4	1.2
Cutlass	21	2.7	0.2	1.5	19.8	20.0	12.6	0.9	13.2	1.2
Forge	30	2.8	0.1	1.6	23.2	22.4	12.4	0.9	12.1	1.1
<b>Domestic Mustard Seed, Canada, Brown</b>										
No. 1 Canada										
Saskatchewan	57	2.9	0.2	1.5	20.7	20.2	13.6	0.9	13.0	1.1
Alberta	10	2.8	0.2	1.5	21.5	20.3	13.0	0.9	13.0	1.0
No. 2 Canada	7	2.9	0.2	1.4	19.4	20.8	14.5	0.9	12.4	1.1
No. 3 Canada	2	3.0	0.2	1.5	20.4	21.0	14.3	0.9	12.2	1.1
No. 4 Canada	1	2.9	0.2	1.5	20.8	20.1	13.4	0.9	13.2	1.0
Sample Canada	11	3.0	0.2	1.6	19.8	21.3	14.5	0.9	12.4	1.1
Common	11	2.8	0.2	1.5	20.4	20.3	13.8	0.9	12.9	1.1
Duchess	35	2.9	0.2	1.5	20.9	20.1	13.4	0.9	13.0	1.0
<b>Domestic Mustard Seed, Canada, Yellow</b>										
No. 1 Canada										
Manitoba	1	2.5	0.2	1.0	21.8	9.0	10.7	0.6	10.3	0.3
Saskatchewan	59	2.6	0.2	1.0	23.1	9.1	10.7	0.7	11.0	0.3
Alberta	54	2.5	0.2	1.0	23.3	9.0	10.1	0.7	10.9	0.3
No. 2 Canada	47	2.6	0.2	1.0	23.5	9.0	11.1	0.7	10.8	0.3
No. 3 Canada	12	2.6	0.2	1.0	23.4	9.2	10.9	0.7	10.7	0.3
No. 4 Canada	26	2.6	0.2	1.0	23.6	9.2	11.1	0.7	10.6	0.3
Sample Canada	31	2.8	0.2	1.1	25.1	9.6	11.3	0.7	10.8	0.3
AC Base	3	2.8	0.2	1.0	24.1	8.4	11.6	0.7	11.8	0.3
Andante	4	2.6	0.2	1.0	24.5	8.8	10.8	0.7	11.4	0.3
Ace	20	2.6	0.2	1.0	22.2	9.2	10.1	0.7	10.7	0.3
AC Pennant	31	2.6	0.2	1.0	23.7	9.1	10.4	0.7	11.1	0.3

<sup>1</sup> Percentage of total fatty acids including: 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)

<sup>2</sup> Saturated fatty acids are defined as the sum of C16:0, C18:0, C20:0, C22:0, and C24:0.

**Table 3b – Fatty acid composition of 2003 western Canadian mustard**

Grade/variety	Number of samples	Fatty acid composition <sup>1</sup>					Saturated fatty acids <sup>2</sup>	Iodine value
		C22:0	C22:1	C22:2	C24:0	C24:1		
		%	%	%	%	%		
<b>Domestic Mustard Seed, Canada, Oriental</b>								
No. 1 Canada								
Saskatchewan	57	0.5	22.9	0.4	0.3	1.5	5.9	118
Alberta	7	0.5	23.8	0.5	0.3	1.6	5.7	118
No. 2 Canada	13	0.5	24.1	0.4	0.3	1.6	5.8	118
No. 3 Canada	6	0.4	22.0	0.4	0.3	1.6	5.9	120
No. 4 Canada	6	0.5	21.1	0.4	0.3	1.4	6.1	119
Sample Canada	3	0.4	22.4	0.4	0.3	1.6	5.8	120
AC Vulcan	3	0.5	24.9	0.4	0.3	1.5	5.7	117
Cutlass	21	0.5	24.8	0.5	0.3	1.5	5.8	117
Forge	30	0.4	20.5	0.4	0.3	1.4	6.0	119
<b>Domestic Mustard Seed, Canada, Brown</b>								
No. 1 Canada								
Saskatchewan	57	0.5	23.3	0.4	0.2	1.3	6.0	119
Alberta	10	0.5	23.1	0.4	0.3	1.2	6.0	118
No. 2 Canada	7	0.4	23.5	0.4	0.2	1.4	5.8	121
No. 3 Canada	2	0.4	22.5	0.4	0.2	1.4	6.0	121
No. 4 Canada	1	0.5	23.0	0.4	0.2	1.3	6.0	118
Sample Canada	11	0.4	22.3	0.4	0.2	1.4	6.1	121
Common	11	0.4	23.4	0.4	0.2	1.3	5.9	119
Duchess	35	0.5	23.4	0.4	0.2	1.3	6.0	118
<b>Domestic Mustard Seed, Canada, Yellow</b>								
No. 1 Canada								
Manitoba	1	0.5	39.5	0.3	0.3	2.5	4.9	102
Saskatchewan	59	0.5	37.6	0.3	0.3	2.3	5.1	102
Alberta	54	0.6	38.2	0.3	0.3	2.4	5.0	101
No. 2 Canada	47	0.5	37.0	0.3	0.3	2.3	5.0	103
No. 3 Canada	12	0.5	37.0	0.3	0.3	2.4	5.1	102
No. 4 Canada	26	0.5	36.7	0.3	0.3	2.5	5.1	103
Sample Canada	31	0.5	33.9	0.2	0.3	2.5	5.4	103
AC Base	3	0.5	35.6	0.2	0.2	2.2	5.2	103
Andante	4	0.5	36.1	0.2	0.3	2.3	5.1	102
Ace	20	0.6	39.0	0.3	0.3	2.4	5.1	101
AC Pennant	31	0.6	37.3	0.3	0.3	2.3	5.1	101

<sup>1</sup> Percentage of total fatty acids including: 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)

<sup>2</sup> Saturated fatty acids are defined as the sum of C16:0, C18:0, C20:0, C22:0, and C24:0.

**Table 4 – Quality of western Canadian mustard from CGC surveys**

Year	Number of samples	Oil content <sup>1</sup>	Protein content <sup>2</sup>	Glucosinolate content <sup>3</sup>	
		%	%	µmol/g	mg/g
<b>Domestic Mustard Seed, No. 1 Canada, Oriental</b>					
2004	64	44.4	25.1	123	12.2
2003	54	39.2	28.1	142	14.0
1994-03	611	42.0	26.4	127	12.6
<b>Domestic Mustard Seed, No. 2 Canada, Oriental</b>					
2004	13	44.4	25.2	122	12.1
2003	11	39.3	28.9	146	14.5
1994-03	59	41.9	27.1	128	12.7
<b>Domestic Mustard Seed, No. 3 Canada, Oriental</b>					
2004	6	41.8	27.2	129	12.7
2003	1	43.1	24.9	127	12.6
1994-03	27	43.0	25.6	124	12.2
<b>Domestic Mustard Seed, No. 1 Canada, Brown</b>					
2004	67	41.6	24.8	109	10.8
2003	80	38.3	27.2	113	11.2
1994-03	570	39.8	26.1	105	10.4
<b>Domestic Mustard Seed, No. 2 Canada, Brown</b>					
2004	7	40.6	25.7	110	10.9
2003	1	36.2	28.7	120	11.9
1994-03	23	37.6	27.9	111	11.0
<b>Domestic Mustard Seed, No. 3 Canada, Brown</b>					
2004	2	39.5	26.1	109	10.8
2003	3	35.9	29.5	124	12.3
1994-03	52	38.7	26.7	107	10.7
<b>Domestic Mustard Seed, No. 1 Canada, Yellow</b>					
2004	115	31.6	31.0	—	—
2003	66	28.1	34.1	—	—
1994-03	573	30.6	31.8	—	—
<b>Domestic Mustard Seed, No. 2 Canada, Yellow</b>					
2004	48	31.8	31.1	—	—
2003	20	29.6	32.7	—	—
1994-03	114	30.5	32.0	—	—
<b>Domestic Mustard Seed, No. 3 Canada, Yellow</b>					
2004	12	32.0	30.7	—	—
2003	4	29.0	33.2	—	—
1994-03	54	31.5	31.1	—	—

<sup>1</sup> Dry matter basis<sup>2</sup> % N x 6.25; dry matter basis<sup>3</sup> Allyl glucosinolate(µmoles/g) and allyl isothiocyanate (mg/g); dry matter, seed basis