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# Quality of western Canadian mustard 2012

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## Introduction

This report presents information on the oil, protein and glucosinolate contents and the fatty acid composition of oriental (*Brassica juncea*), brown (*Brassica juncea*) and yellow (*Sinapis alba*) mustard grown in western Canada in 2012 (Figure 1). The data was obtained from analyses of harvest survey samples collected by the Canadian Grain Commission (CGC).

**Figure 1 – Mustard crops grown in Canada**



## Summary

Top grade oriental, brown and yellow mustard in 2012 had a fixed oil content of 41.4%, 36.7% and 29.3% which was lower than the 10-year averages (2002-2011) of 41.9%, 39.3% and 30.3% respectively. Crude protein for the top grade oriental, brown and yellow mustard was 26.5%, 27.7% and 32.2% compared to the ten-year averages of 26.8%, 26.8% and 32.0%, respectively. In 2012 the top grade oriental mustard glucosinolate values were lower by 11 micromoles per gram ( $\mu\text{mole/g}$ ) to 117  $\mu\text{mole/g}$  while brown mustard glucosinolate values are 4  $\mu\text{mole/g}$  lower to 105  $\mu\text{mole/g}$  when contrasted to the 10-year averages.

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# Weather and production review

## Weather review

The 2012 growing season was a challenging year for many producers. Initial concerns about the lack of moisture in early spring were soon dispelled by heavy rains in April and May. In spite of a wet spring most of the mustard was seeded by mid-May. Along with excessive moisture conditions, the temperatures during May and June were also below normal in the southern-western regions of the Prairies. The weather during July and August was almost the opposite of spring conditions with the western areas of the Prairies (the primary mustard growing region) being warmer and drier than normal. Warm, dry conditions continued in September, allowing the harvest to progress ahead of normal. By the beginning of September, over half the mustard crop in Saskatchewan was harvested and by the first week in October, the harvest was essentially completed (Saskatchewan Crop Reports - <http://www.agriculture.gov.sk.ca/crop-report>).

Temperature and precipitation patterns for the 2012 western Canadian growing season can be found on the Agriculture and Agri-Food Canada web site (<http://www4.agr.gc.ca/DW-GS/historical-historiques.jsp?lang=eng>).

## Production and grade information

As shown in Table 1, mustard seed production for 2012 decreased by approximately 9% from 2011 to 118.6 thousand metric tonnes as a result of lower yields per hectare. The yield for 2012 was approximately 880 kg/hectare (Statistics Canada) which is lower than last year's yield of 1,010 kg/hectare but above the ten-year average of 869 kg/hectare. About 48.2% of the Saskatchewan mustard production was estimated to be the yellow type, followed by 30.4% brown and 21.4% oriental mustard according to Saskatchewan's 2012 Specialty Crop Report. Approximately 80% of the Alberta mustard is yellow type mustard. Saskatchewan accounted for 72% of western Canada's total seeded area and nearly 70% of the production of mustard, while Alberta accounted for most of the remainder. The growing and harvest conditions throughout the prairies produced a mustard crop with only some visible damage but there were other grading issues. In the 2012 CGC harvest survey only 62% of the mustard was in the top grade in contrast to 72% in 2011 and 71% for the 10-year period (2002-2011). Conspicuous admixtures from weed seeds and foreign material were the major factors that lowered the grades of the harvest survey samples in 2012.

Production data was provided for by Statistics Canada  
<http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0010010&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid>

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

Region	Seeded area <sup>1</sup>	Seeded area	Production	Production	Mean production
	2012	2011	2012	2011	2002-2011
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	n/a	n/a	n/a	n/a	2.3
Saskatchewan	97.1	107.3	82.7	103.2	138.8
Alberta	38.4	25.4	35.9	26.8	35.5
<b>Western Canada</b>	<b>135.5</b>	<b>132.7</b>	<b>118.6</b>	<b>130.0</b>	<b>176.5</b>

<sup>1</sup> Statistics Canada. Table 001-0010 - Estimated areas, yield, production and average farm price of principal field crops, in metric units.

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## Harvest survey samples

This year's survey included 269 samples as compared to 188 in 2011 and 196 in 2010. This year's survey included 196 yellow mustard, 38 brown mustard and 35 oriental mustard. Approximately 72.5% of the 2012 harvest survey samples came from Saskatchewan, followed by 26.8% and 0.7% from Alberta and Manitoba, respectively.

Producers, grain companies and elevators that routinely handle mustard seed submitted samples of mustard grown in 2012 to the CGC. The individual samples were cleaned to remove dockage and graded by the CGC's Industry Services Division based on Chapter 12 of the Official Grain Grading Guide (<http://www.grainscanada.gc.ca/oggg-gocg/12/oggg-gocg-12-eng.htm>).

The oil, protein, and glucosinolate contents were determined on all individual whole seed samples using a FOSS NIRSystems 6500 scanning near infra-red spectrometer calibrated to and verified against the appropriate listed reference methods. The reference procedures are listed on the CGC web site under Oilseeds Methods <http://www.grainscanada.gc.ca/oilseeds-oleagineux/method-methode/omtm-mmao-eng.htm>.

Composite samples are used for oil, protein, glucosinolate and chlorophyll content as well as fatty acid composition analyses. Composites were prepared by combining No. 1 mustard samples by province and type; mustard, No. 2, No. 3, No. 4 and Sample grade by western Canada and by type. Composites were also prepared for the common mustard varieties.

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## Quality of western Canadian mustard – 2012

The mustard crop grown in western Canada in 2012 showed the general characteristics of a crop maturing under warmer and drier than normal conditions for the western prairies. The Grain Research Laboratory (GRL) long-term harvest survey results show that warm, dry growing conditions tend to produce an oilseed crop with lower oil contents but higher protein contents. Research also shows that glucosinolate levels may increase when *Brassica* crops are grown under warmer than normal conditions.

The oil, protein, and glucosinolate contents for oriental, brown and yellow mustard are summarized by grade in Table 2. The fatty acid compositions of the mustard oils are detailed in Table 3 and chlorophyll content and distinctly green count (DGR) in Table 4. Comparisons of the 2012 quality data with the previous years' surveys are provided in Figures 2 to 6.

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

Fixed oil, protein and glucosinolate contents are provided in Table 2. In 2012, the fixed oil content of Oriental Mustard, No. 1 Canada samples decreased 2.1% to 41.4% in contrast to the 2011 results (Figure 2) while the crude protein content increased by 1.2% to 26.4%. The fixed oil contents of Oriental Mustard, No. 1 Canada samples from producers in western Canada ranged from 36.9% to 47.4% where as the protein content ranged from 22.2% to 31.7%.

In 2012, the fixed oil content of Brown Mustard, No. 1 Canada decreased 2.1% from the 2011 results to 36.7% while the crude protein content increased to 27.6% from 26.9% (Figure 3). The fixed oil content of Brown Mustard, No. 1 Canada samples from producers in western Canada ranged from 32.7% to 40.7% while the protein content ranged from 25.3% to 33.0%.

In 2012, the glucosinolate contents for Oriental Mustard, No. 1 Canada increased from 2011 by 4  $\mu\text{mole/g}$  to 117  $\mu\text{mol/g}$  while the Brown Mustard, No. 1 Canada values increased 5  $\mu\text{mole/g}$  to 105  $\mu\text{mole/g}$  (Figure 5). The glucosinolate contents of Oriental Mustard, No. 1 Canada samples from producers in western Canada ranged from 84 to 137  $\mu\text{mole/g}$ . The glucosinolate contents of Brown Mustard, No. 1 Canada samples from producers in western Canada ranged from 85 to 125  $\mu\text{mol/g}$ .

Fatty acid compositions for the oriental and brown mustard composites are provided in Table 3. The 2012 average erucic acid (C22:1) levels for both Oriental Mustard, No. 1 Canada and Brown Mustard, No. 1 Canada were similar to 2011 values at 21.4% and 23.5%, respectively. These erucic acid values for oriental and brown mustards are typical of *Brassica juncea* condiment mustards. The oriental mustard variety Forge had higher values in oleic (C18:1), linoleic (C18:2) but lower values in erucic acid content compared to the variety Cutlass.

The total saturated fatty acids for the Oriental and Brown Mustard, No. 1 Canada composites were 6.1% and 6.0% respectively; similar to last year's values. The 2012 mustard composites had only slight changes in the levels of oleic, linoleic and linolenic acid and as a result, the iodine value (an indicator of oil unsaturation) were similar to the 2011 mustard samples at 118 and 119 units for oriental and brown mustard, respectively.

Chlorophyll content was 2.1 and 2.5 mg/kg for the Oriental and Brown Mustard, No. 1 Canada mustard, respectively (Table 4, Figure 6). The lower grades have increased levels of chlorophyll going as high as 11.5 mg/kg. Chlorophyll contents for Oriental, No. 1 Canada for 2012 are similar to the three-year average of 1.9 mg/kg while Brown, No. 1 Canada is lower compared to the three-year average of 3.8 mg/kg.



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## Quality of Domestic Mustard Seed, Canada, Yellow

The yellow mustard has the characteristically lower oil content and higher protein content than oriental and brown mustards (Table 2). For Yellow Mustard, No. 1 Canada samples in 2012, the fixed oil content decreased 2.3% from 2011 to 29.3% while crude protein content increased 1.3% to 31.9% (Figure 4). The fixed oil contents of Yellow Mustard, No. 1 Canada samples from producers in western Canada ranged from 22.8% to 35.5%. The crude protein content of Yellow Mustard, No. 1 Canada samples from producers in western Canada ranged from 24.4% to 38.5%.

The 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 acid (C18:3) compared to the oriental and brown mustard oils (Table 3). The oil from the 2012 Yellow Mustard, No. 1 Canada had a mean erucic acid content of 35.1% compared to the 35.6% in 2011. Total saturated fatty acids and iodine values were similar 2011 with values at 5.2% and 103, respectively.

Chlorophyll content in yellow mustard was 1.0 mg/kg for the No. 1 Canada (Table 4, Figure 6) which corresponds to the low DGR. The lower grades have increased levels of chlorophyll going as high as 9.3 mg/kg for sample grade. Chlorophyll contents for No. 1 Canada for 2012 are similar to the three-year average of 0.8 mg/kg.

**Table 2 – Quality of 2012 western Canadian mustard**

Grade	No. of samples	Oil content <sup>1</sup> %	Protein content <sup>2</sup> %	Glucosinolate content <sup>3</sup> µmole/g
<b>Domestic Mustard Seed, Canada, Oriental</b>				
<b>No. 1 - Average</b>	<b>27</b>	<b>41.4</b>	<b>26.4</b>	<b>117</b>
Saskatchewan	25	41.6	26.3	116
Alberta	2	38.9	28.1	128
No. 2	2	40.4	27.4	120
No. 4	6	40.7	26.6	116
Cutlass, No. 1	11	42.1	26.3	112
Forge, No. 1	12	41.2	26.2	123
<b>Domestic Mustard Seed, Canada, Brown</b>				
<b>No. 1 - Average</b>	<b>29</b>	<b>36.7</b>	<b>27.6</b>	<b>105</b>
Saskatchewan	26	36.6	27.7	106
Alberta	3	38.7	26.2	96
No. 2	2	36.0	28.6	115
No. 3	3	36.9	27.9	117
No. 4	2	37.9	25.9	102
Sample	2	37.6	26.5	102
Centennial Brown, No. 1	19	36.3	28.0	111
Duchess, No. 1	7	38.5	26.0	100
<b>Domestic Mustard Seed, Canada, Yellow</b>				
<b>No. 1 - Average</b>	<b>111</b>	<b>29.3</b>	<b>31.9</b>	—
Saskatchewan	66	28.8	32.3	—
Alberta	45	30.1	31.3	—
No. 2	26	28.7	32.8	—
No. 3	11	29.3	31.7	—
No. 4	30	29.8	31.4	—
Sample	18	29.7	31.7	—
AC Pennant, No. 1	12	31.1	31.0	—
Andante, No. 1	77	29.0	32.4	—

<sup>1</sup> Dry matter basis<sup>2</sup> % N x 6.25; dry matter basis<sup>3</sup> Total glucosinolates (µmoles/g); dry matter basis - ISO 9167-3:2007 (Glucose Release).

**Table 3 – Fatty acid composition of 2012 western Canadian mustard**

Category	No. of samples	Fatty acid composition (%) <sup>1</sup>					Saturated fatty acids <sup>2</sup>	Iodine value
		C18:0	C18:1	C18:2	C18:3	C22:1		
<b>Domestic Mustard Seed, Canada, Oriental</b>								
<b>No. 1 - Average</b>	<b>27</b>	<b>1.5</b>	<b>22.2</b>	<b>22.5</b>	<b>12.0</b>	<b>21.4</b>	<b>6.1</b>	<b>118</b>
Saskatchewan	25	1.5	22.1	22.4	12.0	21.5	6.1	118
Alberta	2	1.5	23.5	23.7	11.7	19.6	6.2	119
No. 2	2	1.4	19.5	21.9	13.1	23.5	5.8	119
No. 4	6	1.5	21.6	22.4	12.2	21.7	6.1	118
Cutlass, No. 1	11	1.4	20.4	21.3	12.2	23.6	6.0	117
Forge, No. 1	12	1.5	23.6	23.6	12.0	19.6	6.1	119
<b>Domestic Mustard Seed, Canada, Brown</b>								
<b>No. 1 - Average</b>	<b>29</b>	<b>1.2</b>	<b>19.4</b>	<b>21.1</b>	<b>13.3</b>	<b>23.5</b>	6.0	119
Saskatchewan	26	1.2	19.3	21.1	13.3	23.5	6.0	119
Alberta	3	1.3	20.2	20.7	13.6	23.0	5.9	119
No. 2	2	1.2	18.9	21.1	13.5	23.8	5.9	119
No. 3	3	1.2	21.0	21.0	13.2	22.6	6.0	119
No. 4	2	1.3	20.3	21.5	12.7	23.0	6.2	118
Sample	2	1.3	19.7	21.6	13.5	22.9	6.0	120
Centennial Brown, No. 1	19	1.2	19.1	21.2	13.3	23.7	6.0	119
Duchess, No. 1	7	1.3	20.3	20.7	13.2	23.0	6.0	118
<b>Domestic Mustard Seed, Canada, Yellow</b>								
<b>No. 1 - Average</b>	<b>111</b>	<b>1.0</b>	<b>24.9</b>	<b>9.6</b>	<b>10.7</b>	<b>35.1</b>	<b>5.2</b>	<b>103</b>
Saskatchewan	66	1.0	24.8	9.8	10.6	35.1	5.2	103
Alberta	45	1.0	25.1	9.3	10.8	35.0	5.1	102
No. 2	26	1.0	24.6	9.7	10.8	35.3	5.1	103
No. 3	11	1.0	24.9	9.7	11.1	34.6	5.2	103
No. 4	30	1.0	24.9	9.8	10.7	35.0	5.2	103
Sample	18	1.0	25.5	10.1	11.3	33.7	5.2	104
AC Pennant, No. 1	12	1.0	25.0	9.3	10.4	35.8	5.1	102
Andante, No. 1	77	1.0	25.1	9.6	10.9	34.7	5.1	103

<sup>1</sup> Percentage of total fatty acids including: stearic (C18:0), oleic (C18:1), linoleic (C18:2), linolenic (C18:3), erucic (C22:1)

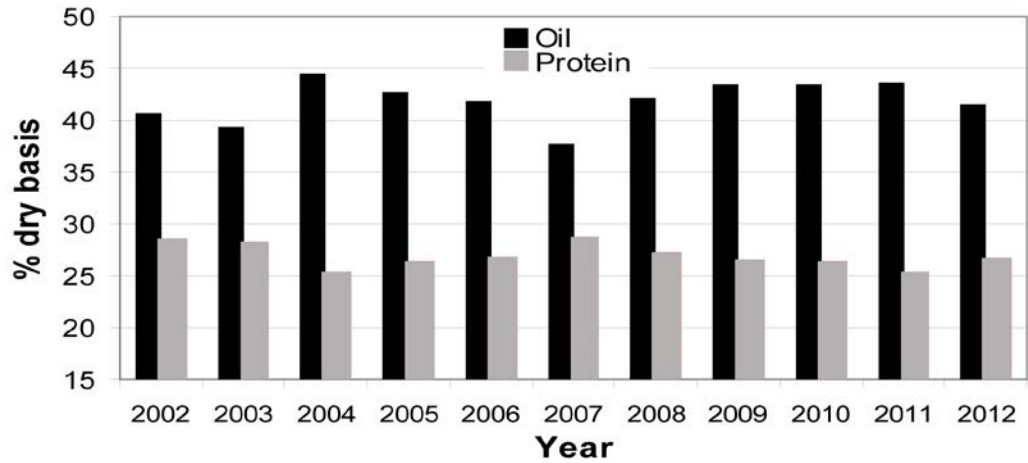
<sup>2</sup> Saturated fatty acids are defined as the sum of C16:0, C18:0, C20:0, C22:0, and C24:0.

**Table 4 – Chlorophyll Content and DGR in 2012 western Canadian mustard**

Category	No. of samples	Chlorophyll mg/kg	Distinctly green (% DGR) <sup>1</sup>	% DGR range
<b>Domestic Mustard Seed, Canada, Oriental</b>				
<b>No. 1 - Average</b>	<b>27</b>	<b>2.1</b>	<b>0.03</b>	<b>0.0 - 0.4</b>
Saskatchewan	25	2.2	0.03	0.0 - 0.4
Alberta	2	1.0	0.10	0.0 - 0.2
No. 2	2	5.8	0.00	0.0
No. 4	6	4.8	0.00	0.0
Cutlass, No. 1	11	2.8		
Forge, No. 1	12	1.7		
<b>Domestic Mustard Seed, Canada, Brown</b>				
<b>No. 1 - Average</b>	<b>29</b>	<b>2.5</b>	<b>0.00</b>	<b>0.0</b>
Saskatchewan	26	2.5	0.00	0.0
Alberta	3	2.5	0.00	0.0
No. 2	2	2.8	0.00	0.0
No. 3	3	2.6	0.00	0.0
No. 4	2	10.6	0.00	0.0
Sample	2	11.5	0.00	0.0
Centennial Brown, No. 1	19	2.8		
Duchess, No. 1	7	2.5		
<b>Domestic Mustard Seed, Canada, Yellow</b>				
<b>No. 1 - Average</b>	<b>111</b>	<b>1.0</b>	<b>0.01</b>	<b>0.0 - 0.6</b>
Saskatchewan	66	1.0	0.02	0.0 - 0.6
Alberta	45	0.9	0.00	0.0 - 0.2
No. 2	26	1.0	0.02	0.0 - 0.6
No. 3	11	3.5	0.40	0.0 - 2.4
No. 4	30	1.8	0.00	0.0
Sample	18	9.3	1.23	0.0 - 15.6
AC Pennant, No. 1	12	0.5		
Andante, No. 1	77	1.1		

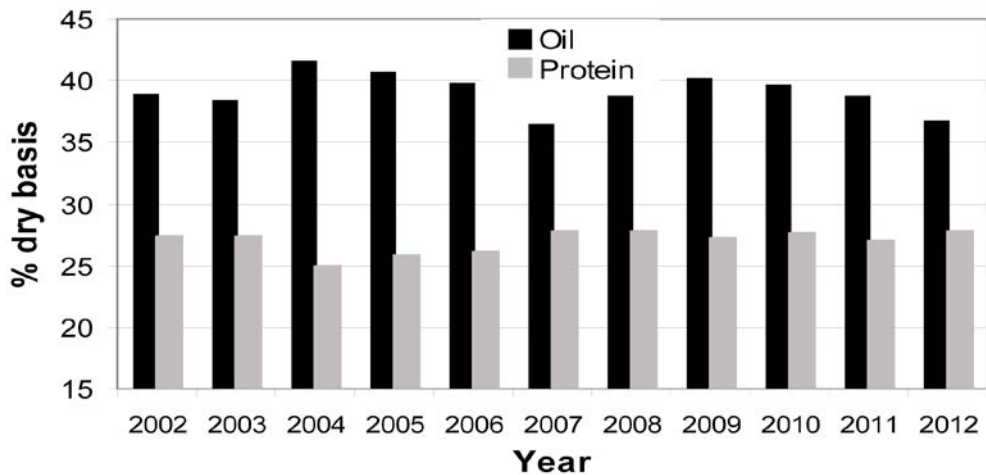
<sup>1</sup> Distinctly green tolerance is applied to crushed seeds which are a distinct green throughout. Pale green or immature seeds are taken into account in the evaluation of colour. The % DGR results are the averages of the individual samples included in the composite.

**Figure 2 – Oriental Mustard, No. 1 Canada**  
**Oil and protein content of harvest survey samples, 2002-2012**



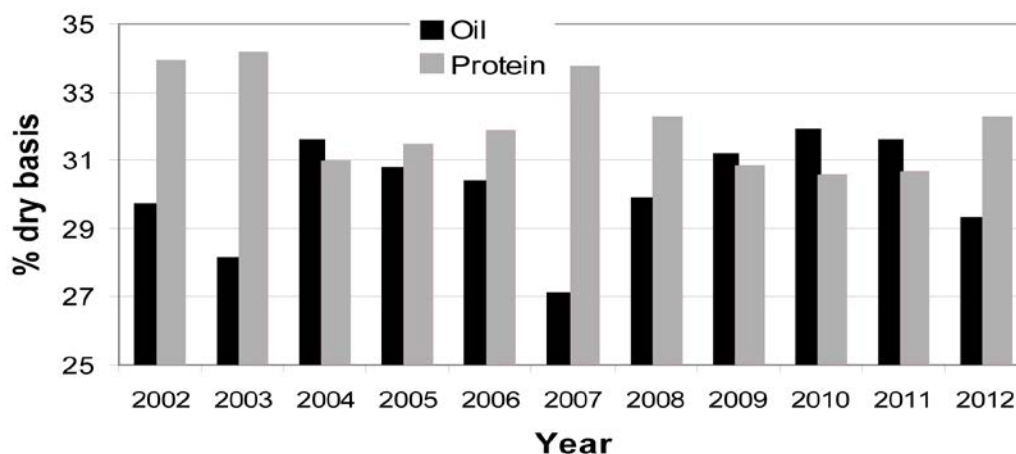
2012 Oil Content.....	41.4%	2012 Protein Content .....	26.4%
2011 Oil Content.....	43.5%	2011 Protein Content .....	25.2%
2002–2011 mean Oil Content .....	41.9%	2002–2011 mean Protein Content.....	26.8%

**Figure 3 – Brown Mustard, No. 1 Canada**  
**Oil and protein content of harvest survey samples, 2002-2012**



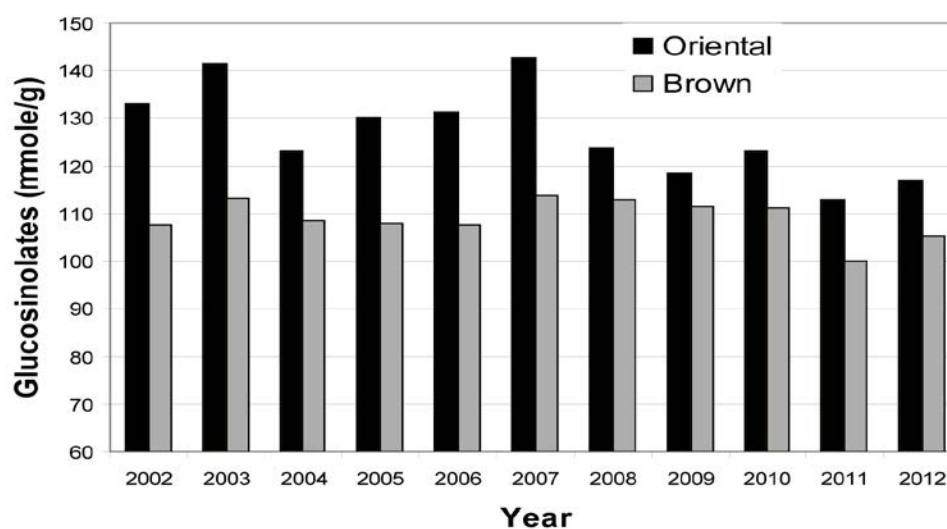
2012 Oil Content.....	36.7%	2012 Protein Content .....	27.6%
2011 Oil Content.....	38.8%	2011 Protein Content .....	26.9%
2002–2011 mean Oil Content.....	39.3%	2002–2011 mean Protein Content.....	26.8%

**Figure 4 – Yellow Mustard, No. 1 Canada  
Oil and protein content of harvest survey samples, 2002-2012**



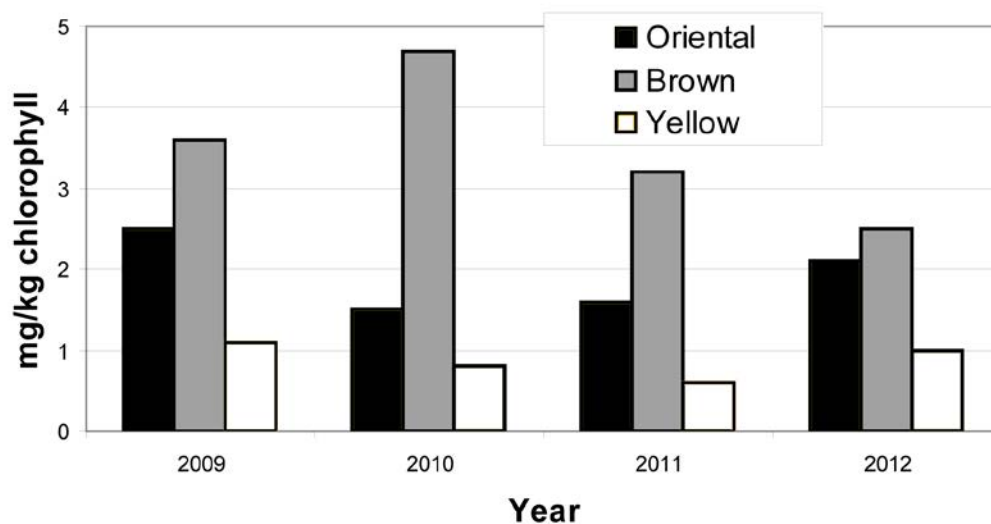
2012 Oil Content.....	29.3%	2012 Protein Content .....	31.9%
2011 Oil Content.....	31.6%	2011 Protein Content .....	30.6%
2002–2011 mean Oil Content.....	30.3%	2002–2011 mean Protein Content.....	32.0%

**Figure 5 – Oriental and Brown Mustard, No. 1 Canada  
Glucosinolate content of harvest survey samples, 2002-2012**



2012 Oriental Glucosinolate content.....	117 µmole/g	2012 Brown Glucosinolate content.....	105 µmole/g
2011 Oriental Glucosinolate content.....	113 µmole/g	2011 Brown Glucosinolate content.....	100 µmole/g
2002–2011 mean Oriental Glucosinolate content.....	128 µmole/g	2002–2011 mean Brown Glucosinolate content.....	109 µmole/g

**Figure 6 – Oriental, Brown and Yellow Mustard, No. 1 Canada Chlorophyll content of harvest survey samples, 2009-2012**



2012 Oriental Chlorophyll content.....2.1 mg/kg  
 2012 Brown Chlorophyll content.....2.5 mg/kg  
 2012 Yellow Chlorophyll content.....1.0 mg/kg

2009–2011 mean Oriental Chlorophyll content.....1.9 mg/kg  
 2009–2011 mean Brown Chlorophyll content.....3.8 mg/kg  
 2009–2011 mean Yellow Chlorophyll content.....0.8 mg/kg