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Quality of western Canadian mustard 2014

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Canada

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The Canadian Grain Commission thanks mustard producers, grain handling offices and seed handling plants in western Canada for supplying samples of mustard harvested in 2014. The Canadian Grain Commission recognizes its Industry Services grain inspectors for grading samples from the harvest sample program and its Grain Research Laboratory staff for conducting the analyses and preparing the report.

Introduction

This report presents information on the oil, protein and glucosinolate content and the fatty acid composition of oriental (*Brassica juncea*), brown (*Brassica juncea*) and yellow (*Sinapis alba*) mustard grown in western Canada in 2014 (Figure 1). The data was obtained from analyses of harvest samples collected by the Canadian Grain Commission.

Figure 1 – Mustard crops grown in Canada



Summary

Mean fixed oil content for the top grade for oriental and yellow mustard in the 2014 harvest was similar to the 10-year average: oriental (42.7% versus 42.5%); yellow (30.7% versus 30.6%), while for brown it was lower (37.9% versus 39.1%) (Figures 2, 3 and 4). Mean crude protein for the top grade brown mustard was identical to the 10-year average (26.8%). Mean crude protein content for yellow and oriental was lower: yellow (30.9% vs 31.3%), oriental (25.5% versus 26.2%) (Figures 2, 3 and 4). Glucosinolate content in the top grade mustard was 109 micromoles for oriental and 99 micromoles per gram for brown, lower than the 10-year average of 123 micromoles per gram for oriental and 107 micromoles per gram for brown mustard (Figure 5).

Weather and production review

Weather review

The 2014 growing season was a challenging year for mustard production. In spring, there were concerns during seeding time because of a delayed snow melt and persistent cool, moist conditions. Although seeding started in mid-May in some places, it was not completed until mid-June. Near favourable weather conditions during July and the first part of August allowed the crop in Alberta and Saskatchewan to advance even though the crop in these provinces was behind in normal development by up to two weeks. Harvesting was delayed by periods of cool, wet conditions and snow in some regions from mid-August until September. By the middle of September only about 30% of the mustard crop in Saskatchewan was harvested. The harvest was only completed towards the third week of October (Saskatchewan Crop Reports - <http://www.agriculture.gov.sk.ca/crop-report>).

Temperature and precipitation patterns for the 2014 western Canadian growing season can be found on Agriculture and Agri-Food Canada's web site (<http://www.agr.gc.ca/DW-GS/historical-historiques.jsp?lang=eng&jsEnabled=true>).

Production and grade information

As shown in Table 1, mustard seed production increased by approximately 28% from 2013 to 198.0 thousand metric tonnes. The increase was a result of more hectares seeded. Yield was approximately 1,010 kilograms per hectare (Statistics Canada), which is slightly lower than last year's yield of 1060 kilograms per hectare but above the 10-year average of 933 kilograms per hectare.

About 43% of mustard production in Saskatchewan was estimated to be yellow, 33% brown and 24% oriental (including non-specified mustard), according to Saskatchewan's 2014 Specialty Crop Report. Saskatchewan accounted for 73% of western Canada's total seeded area and nearly 70% of mustard production, while Alberta accounted for most of the remaining seeded area and production (Table 1).

73% of samples in 2014 graded No. 1, in contrast to 70% in 2013 and 72% for the 10-year mean (2004-13). Growing and harvest conditions throughout the Prairies produced a mustard crop with some visible damage. However, conspicuous admixtures from weed seeds and foreign material were major factors in lowering grades of samples.

Table 1 – Seeded area and production for western Canadian mustard¹

Region	Seeded area	Seeded area	Production	Production	Mean production
	2014	2013	2014	2013	2004-2013
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	n/a	n/a	n/a	n/a	0.3
Saskatchewan	147.7	109.3	138.6	117.3	128.5
Alberta	54.6	38.5	59.4	37.2	37.0
Western Canada	202.3	147.8	198.0	154.5	165.8

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

<http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0010010&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid>

Harvest samples

This year's Harvest Sample Program included 387 samples, compared to 308 in 2013. This included 221 yellow, 98 brown and 68 oriental mustard samples. Overall, 71.6% of the samples came from Saskatchewan, followed by 27.4% from Alberta and 1.0% from Manitoba.

Producers, grain companies and elevators that routinely handle mustard seed submitted samples of mustard grown in 2014 to the Canadian Grain Commission. The individual samples were cleaned to remove dockage and were graded by Canadian Grain Commission inspectors, following Chapter 12 of the Official Grain Grading Guide. (<https://www.grainscanada.gc.ca/oggg-gocg/ggg-gcg-eng.htm>)

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

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

Effects of weather on quality

The mustard crop grown in western Canada in 2014 showed general characteristics of a crop maturing well, even though it was under slightly less than normal conditions for the western prairies. The Grain Research Laboratory's long-term Harvest Sample Program results show that cool, moist growing conditions tend to produce an oilseed crop with higher oil but lower protein content and the converse is true for warm, dry conditions. Research also shows that glucosinolate levels may decrease when *Brassica* crops are grown under cooler than normal conditions.

Quality of Domestic Mustard Seed: Oriental and Brown

Oil, protein and glucosinolate content for oriental and brown mustard is summarized by grade in Table 2. Comparisons to previous years' data are in Figures 2, 3 and 5.

Mean fixed oil content (42.7 %) in Oriental Mustard, No. 1 Canada was lower than the mean in 2013 (44.9%) (Figure 2). Meanwhile, mean crude protein content (25.5%) was higher than the 2013 mean (24.2%) (Figure 2). Fixed oil content in samples of Oriental Mustard, No. 1 Canada from producers ranged from 37.9 to 46.2%, whereas protein content ranged from 22.1 to 30.2% (Table 2).

Mean fixed oil content (37.9%) in Brown Mustard, No. 1 Canada was lower than the mean in 2013 (39.5%). Meanwhile, mean crude protein content (26.8%) was higher than the 2013 mean (26.3%) (Figure 3). Fixed oil content in samples of Brown Mustard, No. 1 Canada from producers ranged from 33.8 to 41.2% while the protein content ranged from 21.2 to 30.2% (Table 2).

Glucosinolate content in Oriental Mustard, No.1 Canada was 109 micromoles per gram, a similar value to 2013 (108 micromoles per gram) (Figure 5). The value for Brown Mustard, No.1 Canada (99 micromoles per gram) was slightly higher than the value for 2013 (96 micromoles per gram) (Figure 5). Glucosinolate content in samples of Oriental Mustard, No. 1 Canada from producers ranged from 88 to 128 micromoles per gram. Glucosinolate content in samples of Brown Mustard, No. 1 Canada from producers ranged from 84 to 119 micromoles per gram (Table 2).

Fatty acid composition of oriental and brown mustard composites is provided in Table 3. Erucic acid (C22:1) levels for Oriental Mustard, No.1 Canada (21.8%) and Brown Mustard, No.1 Canada (23.2%) were slightly lower than the 2013 values (22.2% and 23.4% respectively for 2013)

<https://www.grainscanada.gc.ca/mustard-moutarde/harvest-recolte/2013/hqm13-qrm13-en.htm>). These values for oriental and brown mustard are typical of *Brassica juncea* condiment mustards.

Total saturated fatty acids for both Oriental and Brown Mustard, No.1 Canada composites was 6.0%, which was slightly higher than last year's values of 5.8%. There were only small changes in the levels of oleic, linoleic and linolenic acid (C18:3). As a result, the iodine value (an indicator of oil unsaturation) was similar to 2013 values for both oriental and brown mustard at 119 units.

Chlorophyll content of oriental and brown mustard composites is provided in Table 4. Chlorophyll content was 2.4 and 2.9 milligrams per kilogram for Oriental and Brown Mustard, No. 1 Canada, respectively (Figure 6). The lower grades in both types had higher levels of chlorophyll, ranging from 1.2 to 7.3 milligrams per kilogram.

Quality of Domestic Mustard Seed: Yellow

Oil and protein content for yellow mustard is summarized by grade in Table 2. Comparisons to previous years' data are in Figures 4 and 6.

Yellow mustard has characteristically lower oil content and higher protein content than oriental and brown mustard (Table 2). Mean fixed oil content (30.7%) in Yellow Mustard, No. 1 Canada was lower than the mean in 2013 (32.3%). Meanwhile, mean crude protein content (30.9%) was higher than the 2013 mean (29.5%) (Figure 4). Fixed oil content in samples of Yellow Mustard, No. 1 Canada from producers ranged from 25.1 to 34.7% while crude protein ranged from 26.3 to 37.7%.

Fatty acid composition for yellow mustard composites is provided in Table 3. 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 oil in oriental and brown mustard. Mean erucic acid content in Yellow Mustard, No.1 Canada was 34.3%, compared to 34.7% in 2013. Total saturated fatty acids (5.1%) and iodine values (101 units) were slightly lower than 2013 values.

Chlorophyll content of yellow mustard composites is provided in Table 4. Chlorophyll content in Yellow Mustard, No. 1 Canada was 0.9 milligrams per kilogram (Figure 6), which corresponds to the low distinctly green seed count (%DGR). The lower grades had slightly increased levels of chlorophyll, as high as 4.1 milligrams per kilogram for No. 4 Canada. Chlorophyll content for No. 1 Canada was similar to the 5-year mean of 0.8 milligrams per kilogram.

Table 2 – Quality of 2014 western Canadian mustard

Grade	No. of samples	Oil content % ¹			Protein content % ²			Glucosinolate content $\mu\text{mole/g}^3$		
		Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.

Domestic Mustard Seed, Canada, Oriental										
No. 1 - W. Canada	58	42.7	37.9	46.2	25.5	22.1	30.2	109	88	128
Saskatchewan	53	42.7	37.9	46.2	25.5	22.1	30.2	109	88	128
Alberta	5	42.2	41.3	43.4	25.4	23.9	26.2	111	99	124
No. 2	6	42.1	40.4	43.7	26.5	24.3	28.8	115	102	124
No. 4	4	42.0	41.4	43.0	25.9	24.4	26.9	115	104	127
Cutlass, No. 1	33	42.8	37.9	46.2	25.9	22.1	30.2	109	88	128
Forge, No. 1	20	42.6	40.1	45.0	24.7	22.4	27.6	110	93	124
Domestic Mustard Seed, Canada, Brown										
No. 1 - W. Canada	94	37.9	33.8	41.2	26.8	21.2	30.2	99	84	119
Saskatchewan	80	38.1	34.4	41.2	26.6	23.6	29.4	98	84	119
Alberta	14	36.9	33.8	39.0	27.7	21.2	30.2	106	97	118
No. 2	2	37.7	36.6	38.7	26.6	25.4	27.7	98	93	103
Sample	2	38.4	36.9	39.9	25.1	24.5	25.6	91	83	100
Centennial Br., No. 1	38	37.8	33.8	40.9	26.9	23.6	31.2	100	91	119
Duchess, No. 1	9	37.6	34.9	39.0	26.9	25.1	29.8	102	97	113
Domestic Mustard Seed, Canada, Yellow										
No. 1 - W. Canada	131	30.7	25.1	34.7	30.9	26.3	37.7	—		
Saskatchewan	71	30.9	26.7	34.3	30.5	26.3	36.2	—		
Alberta	60	30.4	25.1	34.7	31.3	26.6	37.7	—		
No. 2	33	29.8	26.1	34.0	31.7	25.5	37.6	—		
No. 3	17	29.9	26.8	33.2	31.9	26.8	34.8	—		
No. 4	25	29.6	25.7	33.0	31.6	26.5	35.6	—		
Sample	15	30.1	25.0	34.2	30.4	26.6	34.0	—		
AC Pennant, No. 1	19	32.4	29.0	34.7	29.1	26.6	33.2	—		
Ace, No. 1	14	31.7	30.4	33.0	30.6	28.7	32.4	—		
Andante, No. 1	93	30.1	25.1	34.3	31.3	26.3	37.7	—		

¹ Dry matter basis

² % N x 6.25; dry matter basis

³ Total glucosinolates (µmoles/g); dry matter basis - ISO 9167-3:2007 (Glucose Release).

Table 3 – Fatty acid composition of 2014 western Canadian mustard

Category	No. of samples	Fatty acid composition (%) ¹					Saturated fatty acids ²	Iodine value
		C18:0	C18:1	C18:2	C18:3	C22:1		
Domestic Mustard Seed, Canada, Oriental								
No. 1 - W. Canada	58	1.5	21.9	22.1	12.4	21.8	6.0	119
Saskatchewan	53	1.5	21.7	22.0	12.5	22.1	6.0	119
Alberta	5	1.6	24.5	23.6	11.9	19.1	6.1	119
No. 2	6	1.5	21.1	22.0	12.8	22.3	5.9	119
No. 4	4	1.5	21.0	22.2	12.5	22.4	6.0	119
Cutlass, No. 1	33	1.4	20.4	21.4	12.5	23.4	5.9	118
Forge, No. 1	20	1.6	24.8	23.3	12.0	18.8	6.1	119
Domestic Mustard Seed, Canada, Brown								
No. 1 - W. Canada	94	1.2	19.8	21.2	13.2	23.2	6.0	119
Saskatchewan	80	1.3	19.7	21.2	13.3	23.2	6.0	119
Alberta	14	1.2	19.9	21.0	13.2	23.3	6.0	119
No. 2	2	1.3	20.1	22.0	13.6	22.4	6.1	120
Sample	2	1.4	20.5	21.6	13.0	22.4	6.2	119
Centennial Br., No. 1	38	1.2	19.8	21.0	13.2	23.2	6.0	119
Duchess, No. 1	9	1.2	19.2	21.2	13.3	23.6	6.0	119
Domestic Mustard Seed, Canada, Yellow								
No. 1 - W. Canada	131	1.0	26.3	9.3	10.2	34.3	5.1	101
Saskatchewan	71	1.0	26.3	9.4	10.1	34.4	5.2	101
Alberta	60	1.0	26.3	9.3	10.2	34.3	5.1	102
No. 2	33	1.0	26.5	9.4	10.4	34.0	5.1	102
No. 3	17	1.0	26.2	9.3	10.6	34.4	5.1	102
No. 4	25	1.0	26.0	9.4	10.7	34.1	5.1	102
Sample	15	1.1	27.0	9.7	11.2	32.5	5.2	104
AC Pennant, No. 1	19	1.0	26.3	8.9	10.0	35.0	5.0	101
Ace, No. 1	14	1.0	23.6	9.2	9.9	37.8	5.1	100
Andante, No. 1	93	1.0	26.8	9.3	10.3	33.6	5.1	102

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

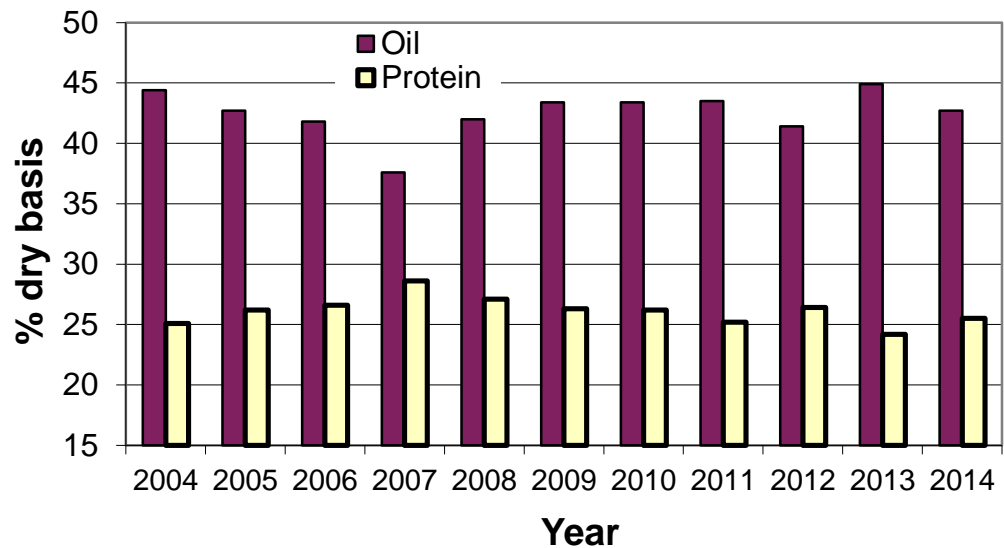
² Saturated fatty acids are defined as the sum of C16:0, C18:0, C20:0, C22:0, and C24:0.

Table 4 – Chlorophyll Content and DGR in 2014 western Canadian mustard

Category	No. of samples	Chlorophyll mg/kg	Distinctly green (%DGR) ¹	%DGR range
Domestic Mustard Seed, Canada, Oriental				
No. 1 - W. Canada	58	2.4	0.19	0.0-0.8
Saskatchewan	53	2.5	0.20	0.0-0.8
Alberta	5	1.2	0.08	0.0-0.4
No. 2	6	1.3	0.10	0.0-0.2
No. 4	4	3.7	0.00	0.0
Cutlass, No. 1	33	2.8		
Forge, No. 1	20	2.5		
Domestic Mustard Seed, Canada, Brown				
No. 1 - W. Canada	94	2.9	0.06	0.0-1.2
Saskatchewan	80	3.0	0.06	0.0-1.2
Alberta	14	2.2	0.04	0.0-0.4
No. 2	2	7.3	0.30	0.0-0.6
Sample	2	6.0	0.00	0.0
Centennial Br., No. 1	38	3.3		
Duchess, No. 1	9	3.7		
Domestic Mustard Seed, Canada, Yellow				
No. 1 - W. Canada	131	0.9	0.07	0.0-0.6
Saskatchewan	71	1.1	0.10	0.0-0.6
Alberta	60	0.7	0.05	0.0-0.6
No. 2	33	2.4	0.21	0.0-1.2
No. 3	17	2.6	0.48	0.0-1.8
No. 4	25	4.1	0.58	0.0-3.5
Sample	15	5.6	1.28	0.0-14.2
AC Pennant, No. 1	19	0.7		
Ace, No. 1	14	1.1		
Andante, No. 1	93	1.3		

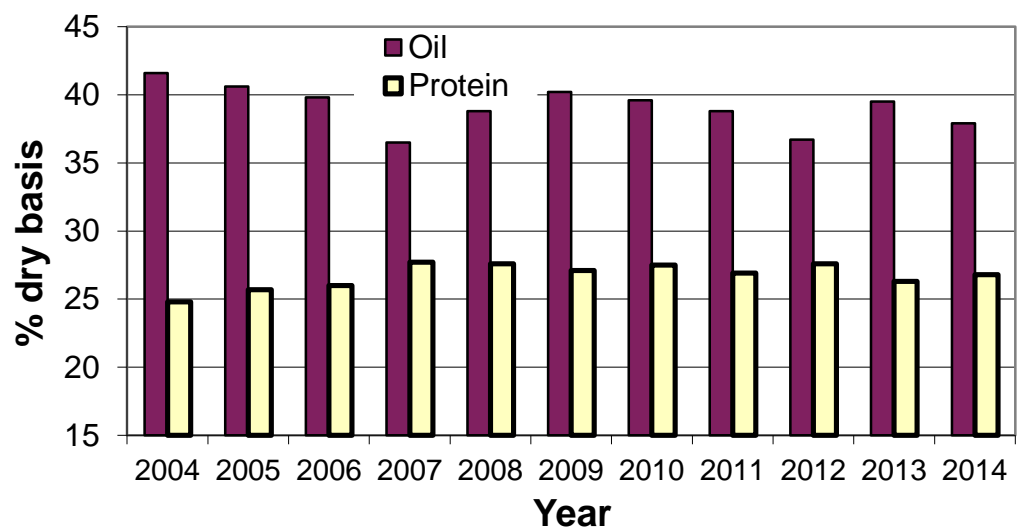
¹ Distinctly green tolerance is applied to crushed seeds which are a distinct green throughout. Pale green or immature seeds are taken into account in the evaluation of colour. The %DGR results are the averages of the individual samples included in the composite.

Figure 2 – Oriental Mustard, No.1 Canada
Oil and protein content of harvest samples, 2004-2014



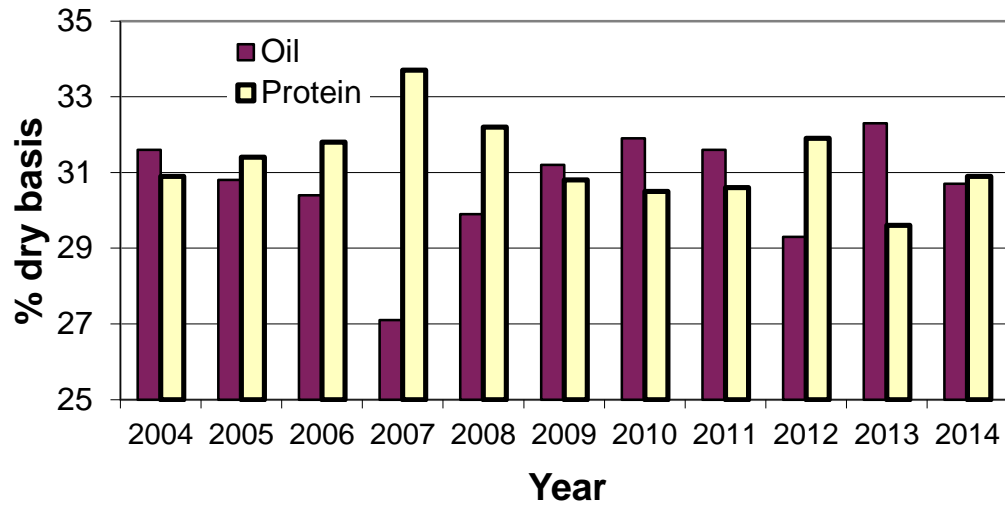
2014 Oil content.....42.7%	2014 Protein content25.5%
2013 Oil content44.9%	2013 Protein content24.2%
2004–2013 Mean oil content.....42.5%	2004–2013 Mean protein content.....26.2%

Figure 3 – Brown Mustard, No.1 Canada
Oil and protein content of harvest samples, 2004-2014



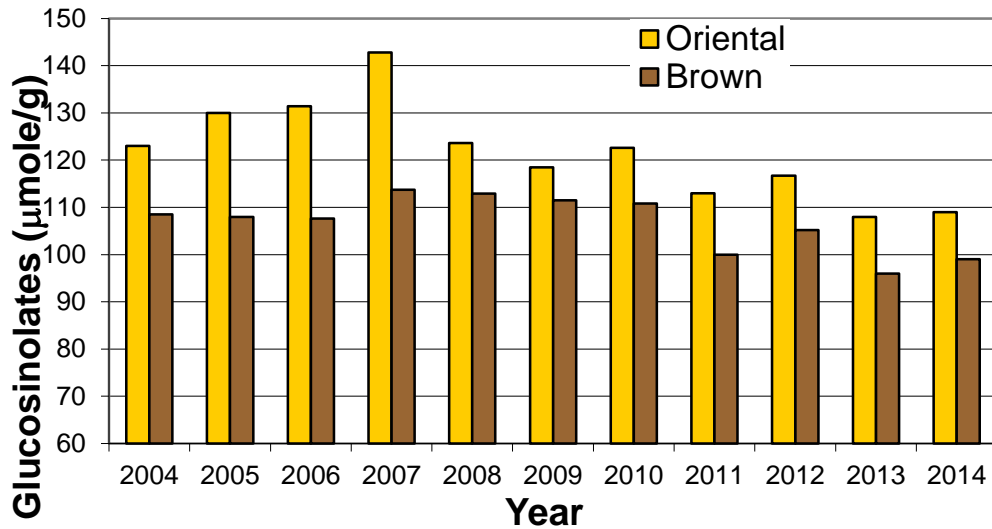
2014 Oil content.....37.9%	2014 Protein content26.8%
2013 Oil content39.5%	2013 Protein content26.3%
2004–2013 Mean oil content.....39.1%	2004–2013 Mean protein content.....26.8%

**Figure 4 – Yellow Mustard, No.1 Canada
Oil and protein content of harvest samples, 2004-2014**



2014 Oil content.....30.7%	2014 Protein content30.9%
2013 Oil content32.3%	2013 Protein content29.5%
2004–2013 Mean oil content.....30.6%	2004–2013 Mean protein content....31.3%

**Figure 5 – Oriental and Brown Mustard, No.1 Canada
Glucosinolate content of harvest samples, 2004-2014**

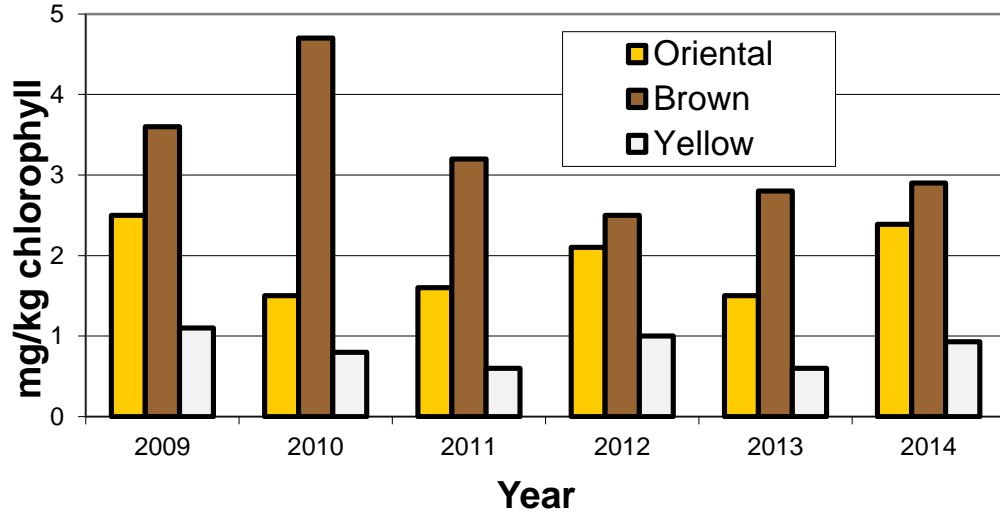


2014 Oriental glucosinolate content.....109 µmole/g	2014 Brown glucosinolate content.....99 µmole/g
2013 Oriental glucosinolate content.....108 µmole/g	2013 Brown glucosinolate content.....96 µmole/g

2004–2013 Mean Oriental Glucosinolate content.....123 μ mole/g

2004–2013 Mean Brown glucosinolate content.....107 μ mole/g

Figure 6 – Oriental, Brown and Yellow Mustard, No.1 Canada Chlorophyll content of harvest samples, 2009-2014



2014 Oriental chlorophyll content.....2.4 mg/kg
 2014 Brown chlorophyll content.....2.9 mg/kg
 2014 Yellow chlorophyll content.....0.9 mg/kg

2009–2013 Mean Oriental chlorophyll content.....1.8 mg/kg
 2009–2013 Mean Brown chlorophyll content.....3.4 mg/kg
 2009–2013 Mean Yellow chlorophyll content.....0.8 mg/kg