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Quality of western Canadian mustard 2010

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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 2010 (figure 1). The data were obtained from analyses of harvest survey samples collected by the Canadian Grain Commission (CGC).

Figure 1 – Mustard crops grown in Canada



Summary

Compared to the 10-year average (2000-2009) all three types of mustard were higher in fixed oil in 2010. The crude protein content was lower for oriental and yellow mustard while it increased for brown mustard. Top grade oriental, brown and yellow mustard in 2010 had a fixed oil content of 43.4%, 39.6% and 31.9% compared to the 10-year averages of 41.5%, 39.3% and 29.9% respectively. While the protein content in 2010 for the top grade mustard dropped 0.8% and 1.8% compared to the 10-year averages for oriental and yellow mustard to 26.2% and 30.6%, respectively, it increased 0.9% to 27.5% in brown mustard. Compared to the long-term values the glucosinolate content of the 2010 top grade oriental mustard decreased 7 micrograms per gram to 123 micromoles per gram while brown mustard had similar glucosinolate content of 111 micromoles.

Weather and production review

Weather review

The 2010 growing season was a difficult year for many producers. The western prairie provinces (the mustard growing areas) initially had concerns of drought but this changed as these regions experienced wetter than normal conditions in May and June which not only delayed seeding in some areas but also threatened crop development. Wet conditions along with the lack of heat and sunshine continued for the remainder of the growing season which delayed maturity and raised quality concerns going into harvest.

Temperature and precipitation patterns for the 2010 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.aspx?lang=eng>).

For more detailed information of this year's growing season read the 'Growing season in review' by the Weather and Crop Surveillance department of the Canadian Wheat Board. (<http://www.cwb.ca/public/en/farmers/grain/crop/>).

Production and grade information

As shown in Table 1, mustard seed production for 2010 decreased by approximately 10% to 186.8 thousand metric tonnes as a result of decreased planted area and lower yields. About 53% of the Saskatchewan mustard production was estimated to be the yellow type, followed by 19% brown and 28% oriental (and non-specified) mustard. Approximately 77% of the Alberta mustard is the yellow type. Saskatchewan accounted for 77% of western Canada's total seeded acreage and 72% of the production of mustard. According to *Saskatchewan Ministry of Agriculture 2010 Specialty Crop Report*, the 2010 Saskatchewan yield of 846 lb/acre (384 kg/acre) was above the ten-year (2000-2009) average of 730 lb/acre (331 kg/acre) but below the 2009 yield of 885 lb/acre (401 kg/acre). Detailed information on production factors and yields for Saskatchewan crop districts can be found at:

http://www.agriculture.gov.sk.ca/Specialty_Crop_Report. Saskatchewan's 2010 Specialty Crop Reports estimated 62% of the 2010 Saskatchewan mustard crop graded No. 1 Canada, compared to 87% in 2009 and 72% for the 10-year provincial average. The poor growing and harvest conditions throughout the prairies

produced a mustard crop with some visible damage. Compared to the 2009 CGC survey results there were notably more mustard samples in the lower grades.

Table 1 – Seeded area and production for western Canadian mustard

Region	Seeded area ¹	Seeded area ²	Production ¹	Production ²	Mean production ²
	2010	2009	2010	2009	2000-2009
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	n/a	n/a	n/a	n/a	3.0
Saskatchewan	149.7	163.9	134.3	160.6	145.3
Alberta	44.5	48.5	52.5	47.7	29.8
Western Canada	194.2	212.4	186.8	208.3	178.1

¹ November Estimates of Production of Principal Field Crops, vol. 89 no. 8 Released Dec. 3, 2010; Statistics Canada

² Small Area Data 1976-2009 Statistics Canada, Agriculture Division, Crop Section

Harvest survey samples

The 196 samples from the 2010 mustard survey included 92 yellow mustard, 35 brown mustard and 69 oriental mustard. Approximately 79.6% of the 2010 harvest survey samples came from Saskatchewan, followed by 18.9% and 1.5% from Alberta and Manitoba, respectively.

Producers, grain companies and elevators that routinely handle mustard seed submitted samples of mustard grown in 2010 to the CGC. The individual samples were cleaned to remove dockage and graded by the CGC's Industry Services Division based on the 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 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://grainscanada.gc.ca/oilseeds-oleagineux/method-methode/omtm-mmao-eng.htm>.

The glucosinolate contents of oriental and brown mustard are expressed as μ moles/g of allyl glucosinolate and mg/g of allyl isothiocyanate on a whole-seed, dry moisture basis. A molar mass of 99.16 g/mole for allyl isothiocyanate is used to convert μ moles of allyl glucosinolate (sinigrin) to mg/g of allyl isothiocyanate. Composite samples were tested for fatty acid composition and chlorophyll content. 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.

Quality of western Canadian mustard – 2010

The three mustard crops grown in western Canada in 2010 showed the general characteristics of a crop grown under a cooler and a higher than normal moisture conditions for the western prairies. The Grain Research Laboratory (GRL) long-term harvest survey results show that cool, moist 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 cooler conditions. Because mustard processors generally prefer lower fixed oils, the quality of the 2010 mustard crop might be considered less than ideal for some end-users.

The oil, protein, and glucosinolate contents for yellow, brown and oriental 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. A comparison of the 2010 quality data with the previous years' surveys is provided in Table 5.

Quality of Domestic Mustard Seed, Canada, Oriental

Fixed oil, protein and glucosinolate contents are provided in Table 2. In 2010, the average fixed oil content of the Oriental Mustard, No.1 Canada samples had similar values of 43.4% when compared to 2009 while the average crude protein content decreased slightly by 0.2% to 26.2%. The fixed oil content of Oriental Mustard, No. 1 Canada samples from producers in western Canada ranged from 39.7% to 46.4%. The protein content of Oriental Mustard, No. 1 Canada samples ranged from 22.3% to 29.6%.

In 2010, the average glucosinolate content for Oriental Mustard, No.1 Canada increased from 2009 by 5 $\mu\text{mol/g}$ to 123 $\mu\text{mol/g}$. The glucosinolate content of Oriental Mustard, No. 1 Canada samples from producers in western Canada ranged from 99 to 146 $\mu\text{mol/g}$.

Fatty acid composition for the oriental mustard composites are provided in Table 3. The 2010 average erucic acid (C22:1) level decreased slightly to 21.1% for Oriental Mustard, No.1 Canada from 2009. This erucic acid value for oriental mustard is 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 No.1 Canada composites was 6.1%, slightly higher than last year's values but still relatively low because of the cool growing season. The 2010 mustard composites had only slight changes in the level of linolenic acid and oleic acid and as a result, the iodine value (an indicator of oil unsaturation) were similar to the 2009 mustard samples at 117 units for oriental mustard.

Chlorophyll content was 1.5 mg/kg for the No. 1 Canada for oriental mustard (Table 4). The lower grades have increased levels of chlorophyll going as high as 10.2

mg/kg for No. 3 Canada which is also reflected in the higher distinctly green count (DGR).

Quality of Domestic Mustard Seed, Canada, Brown

In 2010, the average fixed oil content of Brown Mustard, No. 1 Canada decreased 0.5% from the 2009 results to 39.6% while the average crude protein content increased by 0.4% to 27.5% (Table 2). The fixed oil content of Brown Mustard, No. 1 Canada samples from producers in western Canada ranged from 35.4% to 43.4%. The protein content of Brown Mustard, No. 1 Canada samples ranged from 22.9% to 32.2%.

In 2010, the average glucosinolate content for Brown Mustard, No.1 Canada were similar to last year at 111 $\mu\text{mol/g}$. The glucosinolate content of Brown Mustard, No. 1 Canada samples ranged from 97 to 122 $\mu\text{mol/g}$.

Fatty acid composition for brown mustard composites are provided in Table 3. The 2010 average erucic acid (C22:1) for Brown Mustard, No.1 Canada remained the same at 23.5%. As with oriental mustard the erucic acid values for brown mustard are typical of *Brassica juncea* condiment mustards. The brown mustard varieties Centennial Brown and Duchess had similar values for all the major fatty acids.

The total saturated fatty acids for Brown, No.1 Canada composites was 5.9%; slightly higher than last year's values. The 2010 mustard composites had only slight changes in the level of linolenic acid and oleic acid and as a result, the iodine value (an indicator of oil unsaturation) were similar to the 2009 mustard samples 119 units for brown mustard.

Chlorophyll content was 4.7 mg/kg for the No. 1 Canada brown mustard (Table 4). The lower grades have increased levels of chlorophyll going as high as 12.5 mg/kg.

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 2010, the average fixed oil content increased 0.7% to 31.9% while average crude protein content decreased slightly 0.2% to 30.6% (Table 6). The fixed oil content of Yellow Mustard, No. 1 Canada samples from producers in western Canada ranged from 24.2% to 36.3%. The crude protein content of Yellow Mustard, No. 1 Canada samples ranged from 24.6% to 37.2%.

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 2010 Yellow Mustard, No.1 Canada seed had a mean erucic acid content of 35.2% compared to the 35.7% in 2009. Total saturated fatty acids, at 5.2%, were similar to the value in 2009 at 5.1%.

Chlorophyll content in yellow mustard was 0.8 mg/kg for the No. 1 Canada (Table 4) which corresponds to the low DGR. The lower grades have increased levels of chlorophyll going as high as 12.9 mg/kg for sample grade.

Table 2 – Quality of 2010 western Canadian mustard

Grade	No. of samples	Oil content ¹	Protein content ²	Glucosinolate content ³	
		%	%	µmol/g	mg/g
Domestic Mustard Seed, Canada, Oriental					
No. 1 – Average	56	43.4	26.2	123	12.2
Saskatchewan	51	43.4	26.2	123	12.2
Alberta	5	43.1	26.7	114	11.3
No. 2	7	43.8	26.0	116	11.5
No. 3	5	44.5	26.2	109	10.8
No. 4	1	47.4	23.1	91	9.0
Cutlass , No. 1	21	44.3	25.9	120	11.9
Forge , No. 1	29	42.4	26.6	125	12.4
Domestic Mustard Seed, Canada, Brown					
No. 1 – Average	32	39.6	27.5	111	11.0
Manitoba	1	40.2	26.4	97	9.6
Saskatchewan	23	39.3	27.6	111	11.0
Alberta	8	40.4	27.2	111	11.0
No. 2	1	41.6	26.5	103	10.3
Sample	2	40.9	25.4	89	8.8
Centennial Brown, No. 1	15	39.5	27.2	111	11.0
Duchess, No. 1	10	40.3	27.3	110	10.9
Domestic Mustard Seed, Canada, Yellow					
No. 1 – Average	50	31.9	30.6	—	—
Saskatchewan	31	32.1	30.1	—	—
Alberta	19	31.7	31.3	—	—
No. 2	7	32.5	29.8	—	—
No. 3	10	32.3	30.0	—	—
No. 4	8	32.5	29.7	—	—
Sample	17	31.7	29.8	—	—
AC Pennant, No. 1	12	32.5	30.3	—	—
Andante, No. 1	29	31.3	31.0	—	—

¹ Dry matter basis

² % N x 6.25; dry matter basis

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

Table 3 – Fatty acid composition of 2010 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 – Average	56	1.6	22.7	22.0	12.1	21.1	6.1	117
Saskatchewan	51	1.6	22.7	22.0	12.0	21.2	6.1	117
Alberta	5	1.5	22.8	22.7	12.9	20.2	5.9	120
No. 2	7	1.5	21.1	21.7	12.8	22.2	5.9	118
No. 3	5	1.4	18.1	20.6	13.8	25.2	5.7	119
No. 4	1	1.4	22.4	19.5	12.7	23.0	5.7	116
Cutlass , No. 1	21	1.5	20.9	21.0	12.4	23.1	6.0	117
Forge , No. 1	29	1.6	24.0	23.3	11.9	19.2	6.3	118
Domestic Mustard Seed, Canada, Brown								
No. 1 – Average	32	1.4	19.4	20.4	13.9	23.5	5.9	119
Manitoba	1	1.5	20.6	21.3	13.2	22.6	6.2	118
Saskatchewan	23	1.3	19.1	20.4	13.8	23.7	6.0	119
Alberta	8	1.4	20.0	20.4	14.1	23.3	5.8	119
No. 2	1	1.5	20.1	20.6	14.5	23.0	5.9	120
Sample	2	1.5	20.4	21.3	13.9	21.8	6.1	120
Centennial Brown, No. 1	15	1.3	19.3	20.3	13.8	23.6	6.0	119
Duchess, No. 1	10	1.4	19.9	20.5	13.9	23.3	5.9	119
Domestic Mustard Seed, Canada, Yellow								
No. 1 – Average	50	1.0	25.0	9.0	10.7	35.2	5.2	102
Saskatchewan	31	1.1	25.3	9.0	10.6	35.6	5.1	102
Alberta	19	1.0	24.5	8.9	10.9	36.1	5.0	102
No. 2	7	1.1	25.5	9.0	10.9	35.5	5.1	102
No. 3	10	1.1	25.4	9.3	10.8	35.1	5.1	102
No. 4	8	1.1	25.8	9.1	10.7	36.3	5.0	102
Sample	17	1.1	25.4	9.5	11.2	35.6	5.2	103
AC Pennant, No. 1	12	1.0	24.6	8.8	10.7	35.8	5.1	102
Andante, No. 1	29	1.1	25.2	9.1	10.7	35.0	5.1	102

¹ 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)

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 2010 western Canadian mustard

Category	No. of samples	Chlorophyll mg/kg	Distinctly green (%DGR) ¹	%DGR range
Domestic Mustard Seed, Canada, Oriental				
No. 1 – Average	56	1.5	0.2	0.0 - 1.4
Saskatchewan	51	1.5	0.2	0.0 - 1.4
Alberta	5	1.7	0.1	0.0 - 0.4
No. 2	7	2.7	0.5	0.0 - 1.5
No. 3	5	10.2	2.4	1.8 - 3.5
No. 4	1	1.5	0.0	0.0
Cutlass , No. 1	21	1.6		
Forge , No. 1	29	2.0		
Domestic Mustard Seed, Canada, Brown				
No. 1 – Average	32	4.7	0.3	0.0 - 1.4
Manitoba	1	6.1	1.0	1.0
Saskatchewan	23	4.0	0.2	0.0 - 1.4
Alberta	8	6.3	0.7	0.0 - 1.4
No. 2	1	12.5	2.0	2.0
Sample	2	11.7	0.0	0.0
Centennial Brown, No. 1	15	5.6		
Duchess, No. 1	10	5.4		
Domestic Mustard Seed, Canada, Yellow				
No. 1 – Average	50	0.8	0.1	0.0 - 1.0
Saskatchewan	31	0.8	0.1	0.0 - 1.0
Alberta	19	0.8	0.1	0.0 - 0.4
No. 2	7	1.9	0.0	0.0
No. 3	10	5.8	1.4	0.0 - 3.0
No. 4	8	2.1	0.3	0.0 - 2.0
Sample	17	12.9	4.1	0.0 - 15.0
AC Pennant, No. 1	12	0.6		
Andante, No. 1	29	1.0		

¹ Distinctly green tolerances are 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.

Table 5 – Quality of western Canadian mustard from CGC surveys

Year	No. of samples	Oil content ¹	Protein content ²	Glucosinolate content ³		Chlorophyll Content
		%	%	µmol/g	mg/g	mg/kg
Domestic Mustard Seed, No. 1 Canada, Oriental						
2010	56	43.4	26.2	123	12.2	1.5
2009	98	43.4	26.4	118	11.7	2.5
2000-09	602	41.5	27.0	130	12.9	—
Domestic Mustard Seed, No. 2 Canada, Oriental						
2010	7	43.8	26.0	116	11.5	2.7
2009	5	44.7	24.6	115	11.4	1.3
2000-09	97	41.7	27.0	131	13.0	—
Domestic Mustard Seed, No. 3 Canada, Oriental						
2010	5	44.5	26.2	109	10.8	10.2
2009	3	44.0	26.8	130	12.9	6.0
2000-09	34	42.0	27.3	130	12.9	—
Domestic Mustard Seed, No. 1 Canada, Brown						
2010	32	39.6	27.5	111	11.0	4.7
2009	62	40.1	27.1	112	11.1	3.6
2000-09	675	39.3	26.6	110	10.9	—
Domestic Mustard Seed, No. 2 Canada, Brown						
2010	1	41.6	26.5	103	10.2	12.5
2009	1	40.1	26.8	108	10.7	13.5
2000-09	38	38.8	27.1	111	11.0	—
Domestic Mustard Seed, No. 3 Canada, Brown						
2010	0	—	—	—	—	—
2009	0	—	—	—	—	—
2000-09	21	38.3	27.2	112	11.2	—
Domestic Mustard Seed, No. 1 Canada, Yellow						
2010	50	31.9	30.6	—	—	0.8
2009	114	31.2	30.8	—	—	1.1
2000-09	851	29.9	32.4	—	—	—
Domestic Mustard Seed, No. 2 Canada, Yellow						
2010	7	32.5	29.8	—	—	1.9
2009	11	31.7	30.8	—	—	1.2
2000-09	11	30.4	32.2	—	—	—
Domestic Mustard Seed, No. 3 Canada, Yellow						
2010	10	32.3	30.0	—	—	5.8
2009	8	33.4	28.4	—	—	0.8
2000-09	91	30.8	31.7	—	—	—

¹ Dry matter basis² % N x 6.25; dry matter basis³ Allyl glucosinolate(µmoles/g) and allyl isothiocyanate (mg/g); dry matter, seed basis