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Quality of western Canadian mustard 2002

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Canada

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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 throughout western Canada in 2002. The data are obtained from analyses of harvest survey samples collected by the Canadian Grain Commission (CGC).

Summary

Both the oriental and brown mustard 2002 survey samples had significantly lower average fixed oils and higher average protein contents than in 2001. The average glucosinolate content of the 2002 oriental mustard survey samples increased slightly while the average for brown mustard decreased slightly from the values in 2001. Compared to 2001, the yellow mustard survey samples were similar in average fixed oil and protein contents. However, when compared to the ten–year means, all three types of mustard seed were significantly lower in average fixed oil content but higher in average protein content.

Weather and production review

Weather review

The Weather and Crop Surveillance department of the Canadian Wheat Board provided the weather review (http://www.cwb.ca/en/growing/weather/crop_issues.jsp) for the 2002 harvest survey. In addition, detailed information on the seeding dates, growing and harvest conditions, along with production and yields by Saskatchewan crop districts can be found at: http://www.agr.gov.sk.ca/DOCS/crops/special_crops/production_information/specialtycroprpt.asp

Seeding

The extremely dry conditions, combined with cooler than normal weather in April and May, delayed seeding of cereal and oilseed crops. Planting in Western Canada was only 75 per cent complete by the end of May. Heavy rains fell in the southern areas of Saskatchewan and Alberta during the first week of June, further delaying planting in those regions. Seeding continued into the third week of June in those areas that received heavy rains. Northern and central growing areas of Saskatchewan and Alberta remained dry and crops were planted into dust. Germination was quite uneven in these regions, with some crops not emerging until rains fell in July. Seeding progressed rapidly in eastern Saskatchewan and Manitoba, with planting in these areas finishing during the first week of June.

Growing conditions

Cool weather during May and early June slowed crop growth and development across the Prairies. Heavy rains in the southern Prairies did improve soil moisture conditions, especially in Alberta and Saskatchewan. The heavy rains caused some flooding in all three provinces resulting in some reseeding, especially in southern Alberta. Warmer than normal temperatures during the second half of June increased crop stress, especially in the parched regions of northern Alberta and Saskatchewan. The dry conditions caused uneven emergence in oilseed crops, with many fields having three to four stages of development.

The warmer than normal weather continued through July, which caused severe stress to all crops. Yield potential for most crops declined rapidly under the stressful conditions. The rainfall pattern of the spring continued into July, with the heaviest rainfall reported in the southern Prairies. Northern regions reported minimal amounts during the month, with only isolated areas reporting enough rainfall to improve crop prospects. Even in the regions that

had received adequate moisture during the spring, severe heat stress took a toll on production prospects.

The warm temperatures accelerated crop development, especially in eastern areas of the Prairies. A cool, wet weather pattern settled over the Prairies during the first week in August, bringing significantly above normal rainfall to the dry areas in Saskatchewan. A significant frost during the first week of August caused damage to crop quality in northern and central areas of Saskatchewan and Alberta. The rains brought a flush of secondary growth in the drought regions and delayed maturity in southern areas.

Harvest conditions

The harvest started in southern Manitoba and southeastern Saskatchewan in the third week of August. Frequent rains during the last week of August and first two weeks of September resulted in a reduction in grade pattern of the mature crops in the eastern Prairies. Severe frost was reported by the middle of the month in Saskatchewan and Alberta, which brought an end to the growing season in most areas. Harvest during the last half of September continued to be plagued by frequent light to heavy showers. In eastern growing areas, significant harvest progress was made during the last two weeks of September, while western areas continued to struggle with poor drying conditions. The uneven growth of crops in Alberta and Saskatchewan continued to slow harvest activity into October. Frequent rainfall combined with cooler than normal temperatures delayed further progress. Snow during the last two weeks of October essentially brought an end to harvest activity. As with most crops grown in western Canada, a portion of the 2002 mustard crop could not be harvested during the fall of 2002.

Production and grade information

As shown in Table 1, mustard seed production for 2002 increased by 54% to 154.3 thousand metric tonnes due to a significant increase in seeded area. About 45% of western Canadian mustard production was estimated to be the yellow type, followed by 28% oriental and 27% brown mustard. Saskatchewan accounted for over 80% of western Canada's total seeded acreage and production of mustard. According to Saskatchewan Agriculture and Food, the 2002 Saskatchewan yield of 521 lb/acre (237 kg/acre) was 40% below the ten-year (1992-2001) average of 863 lb/acre (392 kg/acre) and 16% lower than the 2001 yield of 619 lb/acre (281 kg/acre). While mustard seed is traditionally grown in the drier, southern part of the Prairies, it was in the northern regions that the crop experienced the most severe drought conditions in 2002. The southern growing regions had close to average yields while yields in the northern regions were well below average.

A below average percentage—44%—of the 2002 Saskatchewan mustard crop was expected to grade No.1 Canada, compared to 82% in 2001 and 75% for the 1992–2001 period. The grade pattern of all 2002 crops was negatively affected by the cool, wet conditions experienced since August. A major concern for mustard was general weathering of the crop, which resulted in immature, underdeveloped and discoloured seed. In some areas, as a result of inadequate weed control, mustard samples were downgraded due to high levels of admixture.

Table 1 • Seeded area and production for western Canadian mustard

Region	Seeded area[1] 2002	Seeded area[2] 2001	Production[1] 2002	Production[2] 2001	Mean production[2] 1992-2001
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	12.1	4.0	10.0	3.4	3.7
Saskatchewan	242.8	133.5	125.2	91.2	187.0
Alberta	34.4	15.3	19.1	5.4	19.1
Western Canada	**289.3**	**152.8**	**154.3**	**100.0**	**223.8**

[1] *Field Crop Reporting Series No. 8*, December 5, 2002; Statistics Canada
[2] *Field Crop Reporting Series No. 8*, revised estimates for 1992-2001

Harvest survey samples

A total of 216 harvest survey samples for 2002 included 110 yellow mustard (*Sinapis alba*), 64 brown mustard (*Brassica juncea*) and 42 oriental mustard (*B. juncea*). Over 81% of the 2002 harvest survey samples came from Saskatchewan.

Samples of mustard grown in 2002 were submitted to the CGC by producers, grain companies and elevators that routinely handle mustard seed. The individual samples were cleaned to remove dockage and graded by the CGC's Industry Services division.

The oil, protein, and glucosinolate contents are determined on all individual whole seed samples using an NIR Systems 6500 scanning near infra-red spectrometer calibrated to and verified against the appropriate listed reference methods. The glucosinolate contents of oriental and brown mustard are expressed as µmoles/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 µmoles of allyl glucosinolate (sinigrin) to mg/g of allyl isothiocyanate. Composite samples are used for fatty acid composition.

Quality of western Canadian mustard harvest survey

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. A comparison of the 2002 quality data with the previous years' surveys is provided in Table 4. The means and standard deviations of the 2002 analytical data by grade and province can be found at http://grainscanada.gc.ca/Quality/grlreports/Mustard/mustardmenu-e.htm

Quality of oriental and brown mustard

The average fixed oil content of the 2002 No.1 Canada oriental mustard decreased 1.1% to 40.6% while the average protein content increased 1.4% to 28.4%. The fixed oil contents of No. 1 Canada oriental mustard from producers in western Canada varied from 34.2% to 44.6%. The protein content of No. 1 Canada oriental mustard from producers in western Canada varied from 24.9% to 33.3%.

The average fixed oil content of No. 1 Canada brown mustard decreased 0.6% to 38.8% while the average protein content increased 0.8% to 27.3%. The fixed oil content of No. 1 Canada brown mustard from producers in western Canada varied from 34.8% to 44.2%. The protein content of No. 1 Canada brown mustard from producers in western Canada varied from 23.8% to 31.5%.

In 2002, the average glucosinolate content for oriental mustard (133 µmol/g) was slightly higher while the average glucosinolate content (108 µmol/g) for brown mustard decreased slightly. The glucosinolate contents of No. 1 Canada oriental mustard from producers in western Canada varied from 123 to 147 µmol/g. The glucosinolate contents of No. 1 Canada brown mustard from producers in western Canada varied from 93 to 122 µmol/g. The provincial and grade differences are detailed in the statistical tables for oriental and brown mustard: http://grainscanada.gc.ca/Quality/grlreports/Mustard/mustardmenu-e.htm.

Fatty acid composition for the oriental and brown mustards were similar for the No. 1 Canada composites (Table 3). The 2002 erucic acid levels were 22.0% and 23.2% for oriental and brown mustard respectively. The total saturated fatty acids for the oriental and brown mustard samples were 6.1% and 6.2% respectively. These saturated fatty acid values are 0.2 percentage units lower than in 2001. The oriental mustard varieties Forge and Cutlass showed some differences in oleic (C18:1), linoleic (C18:2), and erucic acid (C22:1) content.

Quality of yellow mustard

The yellow mustard had the characteristically lower oil content and higher protein content than oriental and brown mustards. For No. 1 Canada yellow mustard, the average fixed oil content increased 0.1% to 29.7% while average protein content increased 0.2% to 34.0% (Table 4). The fixed oil contents of No. 1 Canada yellow mustard from producers in western Canada varied from 24.0% to 34.4%. The protein content of No. 1 Canada yellow mustard from producers in western Canada varied from 29.1% to 39.6%. Regional and grade differences in seed quality are detailed at: http://grainscanada.gc.ca/Quality/grlreports/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 2002 No.1 Canada Yellow mustard seed had a mean erucic acid content of 36.7% compared to the 35.8% in 2001. Total saturated fatty acids, at 5.1%, were similar to the 5.2% in 2001.

Table 2 • 2002 harvest survey • Quality of western Canadian mustard

Grade	Number of samples	Oil content[1]	Protein content[2]	Glucosinolate[3]	
		%	%	µmol/g	mg/g
Oriental					
Canada No. 1	19	40.6	28.4	133	13.2
Canada No. 2	7	40.8	27.8	135	13.3
Canada No. 3	7	42.6	28.1	130	12.8
Canada No. 4	4	42.5	27.4	132	13.1
Sample	5	38.9	29.7	137	13.6
Brown					
Canada No. 1	53	38.8	27.3	108	10.7
Canada No. 2	2	36.2	29.6	115	11.4
Canada No. 3	2	38.2	28.4	119	11.8
Canada No. 4	3	39.1	25.5	101	10.0
Sample	4	39.3	26.7	102	10.1
Yellow					
Canada No. 1	41	29.7	34.0		
Canada No. 2	19	29.6	34.1		
Canada No. 3	15	30.1	33.8		
Canada No. 4	14	30.4	33.9		
Sample	21	30.6	33.0		

[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 3a • 2002 harvest survey • Fatty acid composition of western Canadian mustard

Grade	Number of samples	Fatty acid composition[1] C16:0	C16:1	C18:0	C18:1	C18:2	C18:3	C20:0	C20:1	C20:2
		%	%	%	%	%	%	%	%	%
Oriental										
Canada No. 1 SK	14	2.9	0.2	1.5	21.6	22.0	12.4	0.9	12.3	1.1
Canada No. 1 AB	5	3.0	0.2	1.5	20.7	21.9	12.4	0.9	12.2	1.1
Canada No. 2	7	3.0	0.2	1.5	21.7	22.4	12.4	0.9	12.2	1.1
Canada No. 3	7	2.8	0.2	1.3	19.1	20.9	12.7	0.8	11.5	1.2
Canada No. 4	4	2.9	0.2	1.4	19.9	21.6	12.7	0.9	12.3	1.2
Sample	5	3.0	0.2	1.4	19.1	22.6	13.3	0.8	11.8	1.2
Cutlass, No. 1	7	2.8	0.2	1.4	19.3	20.3	12.5	1.0	12.9	1.2
Forge, No. 1	8	3.0	0.2	1.6	23.3	23.5	12.3	0.9	11.8	1.1
Brown										
Canada No. 1 MB	3	3.1	0.3	1.4	19.3	21.6	13.6	0.9	12.3	1.1
Canada No. 1 SK	44	3.1	0.3	1.4	20.2	21.1	13.2	0.9	12.4	1.1
Canada No. 1 AB	6	2.9	0.2	1.5	20.5	20.1	14.0	0.9	12.8	1.1
Canada No. 2	2	3.2	0.3	1.4	18.7	22.3	13.7	0.9	11.7	1.1
Canada No. 3	2	3.2	0.3	1.4	19.7	22.0	13.9	0.9	12.2	1.1
Canada No. 4	3	3.2	0.2	1.4	20.1	20.9	13.2	0.9	12.8	1.1
Sample	4	3.1	0.2	1.5	19.7	21.5	13.7	0.9	12.5	1.1
Yellow										
Canada No. 1 MB	3	2.6	0.2	1.0	24.5	9.5	10.9	0.7	10.4	0.3
Canada No. 1 SK	29	2.7	0.2	1.0	23.6	9.5	10.8	0.7	10.5	0.3
Canada No. 1 AB	9	2.6	0.2	0.9	22.8	9.5	11.1	0.6	10.2	0.3
Canada No. 2	19	2.7	0.2	1.0	23.2	9.6	10.9	0.6	10.4	0.3
Canada No. 3	15	2.7	0.2	1.0	23.2	9.4	10.8	0.7	10.5	0.3
Canada No. 4	14	2.6	0.2	1.0	23.0	9.6	11.2	0.6	10.1	0.3
Sample	20	2.7	0.2	1.0	24.0	10.1	11.0	0.7	10.3	0.3
AC Pennant	15	2.6	0.2	1.0	23.1	9.5	10.8	0.6	10.6	0.3

[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), gadoleic (C20:1), eicosadienoic (C20:2), behenic (C22:0), erucic (C22:1), docosadienoic (C22:2), lignoceric (C24:0), and nervonic (C24:1)

Table 3b • 2002 harvest survey • Fatty acid composition of western Canadian mustard

Grade	Number of samples	Fatty acid composition[1]						
		C22:0	C22:1	C22:2	C24:0	C24:1	Saturated fatty acids[2]	Iodine value
		%	%	%	%	%	%	units
Oriental								
Canada No. 1 SK	14	0.5	21.8	0.4	0.3	1.5	6.0	118
Canada No. 1 AB	5	0.5	22.8	0.5	0.3	1.5	6.3	117
Canada No. 2	7	0.5	21.4	0.4	0.3	1.4	6.0	119
Canada No. 3	7	0.5	25.7	0.6	0.3	1.6	5.8	118
Canada No. 4	4	0.5	23.5	0.5	0.3	1.6	5.9	118
Sample	5	0.5	22.9	0.5	0.3	1.7	6.0	120
Cutlass, No. 1	7	0.5	24.9	0.5	0.3	1.6	6.0	116
Forge, No. 1	8	0.4	19.4	0.4	0.3	1.4	6.1	120
Brown								
Canada No. 1 MB	3	0.5	23.5	0.5	0.3	1.4	6.1	120
Canada No. 1 SK	44	0.5	23.2	0.4	0.3	1.3	6.2	118
Canada No. 1 AB	6	0.4	23.0	0.4	0.2	1.4	6.0	119
Canada No. 2	2	0.5	23.1	0.5	0.3	1.4	6.3	120
Canada No. 3	2	0.5	22.2	0.4	0.3	1.4	6.2	121
Canada No. 4	3	0.5	23.1	0.4	0.3	1.3	6.3	118
Sample	4	0.5	22.7	0.4	0.3	1.4	6.3	120
Yellow								
Canada No. 1 MB	3	0.5	35.7	0.3	0.3	2.4	5.1	103
Canada No. 1 SK	29	0.5	36.6	0.3	0.3	2.4	5.1	103
Canada No. 1 AB	9	0.6	37.4	0.3	0.3	2.5	5.0	103
Canada No. 2	19	0.5	36.9	0.3	0.3	2.5	5.1	103
Canada No. 3	15	0.6	36.8	0.3	0.3	2.4	5.2	102
Canada No. 4	14	0.6	37.0	0.3	0.3	2.5	5.1	103
Sample	20	0.5	35.5	0.3	0.3	2.4	5.2	103
AC Pennant	15	0.6	37.1	0.3	0.3	2.4	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), gadoleic (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 • Quality of western Canadian mustard for harvest survey samples, 1992-2002

Year	Number of samples	Oil content[1]	Protein content[2]	Glucosinolate content[3]	
		%	%	µmol/g	mg/g
Oriental - No. 1 Canada					
2002	19	40.6	28.4	133	13.2
2001	36	41.7	27.0	131	13.0
1992-2001	701	43.0	25.8	122	12.1
Oriental - No. 2 Canada					
2002	7	40.8	27.8	135	13.3
2001	6	41.8	27.3	130	12.9
1992-2001	58	42.9	26.4	119	11.8
Oriental - No. 3 Canada					
2002	7	42.6	28.1	130	12.8
2001	0				
1992-2001	38	43.3	25.4	119	11.8
Brown - No. 1 Canada					
2002	53	38.8	27.3	108	10.7
2001	29	39.4	26.5	109	10.8
1992-2001	588	40.3	25.8	101	10.0
Brown - No. 2 Canada					
2002	2	36.2	29.6	115	11.4
2001	5	37.9	28.3	112	11.1
1992-2001	21	38.0	28.0	109	10.8
Brown - No. 3 Canada					
2002	2	38.2	28.4	119	11.8
2001	3	37.3	28.3	108	10.7
1992-2001	82	39.3	26.3	102	10.1
Yellow - No. 1 Canada					
2002	41	29.7	34.0		
2001	58	29.6	33.8		
1992-2001	551	31.5	30.9		
Yellow - No. 2 Canada					
2002	19	29.6	34.1		
2001	8	30.3	33.0		
1992-2001	100	31.0	31.5		
Yellow - No. 3 Canada					
2002	15	30.1	33.8		
2001	6	29.6	33.7		
1992-2001	53	32.3	30.1		

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