



Canadian Grain Commission
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Quality of western Canadian mustard 2001

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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 (*B. juncea*) and yellow (*Sinapis alba*) mustard grown throughout western Canada in 2001. The data are obtained from analyses of harvest survey samples collected by the Canadian Grain Commission (CGC).

Summary

Both the oriental and brown mustard 2001 survey samples had similar fixed oils but slightly higher protein contents than in 2000. The glucosinolate content of the 2001 oriental and brown mustard survey samples increased slightly from the values in 2000. Compared to 2000, the yellow mustard survey samples were significantly lower in oil content and higher in protein content.

Weather and production review

Weather review

The Weather and Crop Surveillance department of the Canadian Wheat Board provided the weather review for the 2001 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](http://www.agr.gov.sk.ca/DOCS/crops/special%20crops/production%20information/specialtycroprpt.asp)

Seeding

Overall, 2001 seeding progress was ahead of normal for the prairie crop, although not as rapid as what was experienced in 2000.

Dry conditions in Alberta and a large portion of Saskatchewan during the fall and winter of 2000 resulted in very poor soil moisture levels going into the 2001 planting season. Exceptions to this were Manitoba and southeastern Saskatchewan where above normal precipitation during the fall of 2000 provided ample soil moisture reserves for spring planting. Dry, warm conditions during late April and May resulted in rapid seeding of most crops in the western Prairies.

However, planting of some smaller seeded crops such as mustard was delayed in some areas due to the lack of soil moisture. In the driest areas, plant populations were reduced markedly by the extreme conditions as germination was quite uneven. Planting in the western Prairies was over 50 percent complete by the middle of May and was wrapped up by the end of the month. The excess soil moisture and persistent precipitation in eastern areas slowed planting until late May and into June in parts of southeastern Saskatchewan and Manitoba.

Growing conditions

Cooler temperatures through most of the month of June kept crop stress to a minimum, despite the very dry conditions. Rains during the month of June were isolated to the eastern Prairies with only scattered rainfall reported in western areas. June precipitation ranged

from significantly above normal in the eastern Prairies to well below normal in southern Alberta. Central and northern Alberta, including the Peace River region, received moderate amounts of precipitation during the last half of the month which provided much needed moisture for crops. The rainfall caused some problems as ungerminated seeds started to grow and many fields had two to three different growth stages for the remainder of the season. Other than the southeast, Saskatchewan remained extremely dry and crop conditions began to deteriorate rapidly by the end of the month.

Above normal temperatures during the first two weeks of July caused severe stress to all crops and yield potentials declined in the western areas of the Prairies. Most locations in Saskatchewan and southern Alberta received less than fifty percent of normal precipitation for the month. Northern Alberta received frequent moderate amounts of precipitation during the month, which helped improve the condition of the crop in that region. Moderate to heavy rainfall events covered parts of Manitoba and eastern Saskatchewan during July which resulted in increased disease pressure and caused some losses due to flooding.

Harvest conditions

The harvest began in many regions during the first two weeks in August, although activity was not general until the third week in August. Harvest weather was ideal with most locations in the prairie region receiving minimal amounts of precipitation (less than half of normal) and warmer than normal temperatures. The harvest was over one-third complete by the end of August and essentially finished by the third week of September. The uneven growth in central and northern Alberta slowed harvest activity in those regions, with harvesting essentially complete by the first week of October.

Production and grade information

As shown in Table 1, mustard seed production for 2001 decreased by 56% to 89 thousand metric tonnes. About 45% of western Canadian mustard production was the yellow type, followed by 35% oriental and 20% brown mustard. Saskatchewan accounted for 90% of western Canada's total seeded acreage and production of mustard. In Saskatchewan, the 2001 yield of 281 kg/acre was well below both the ten-year (1991-2000) average of 404 kg/acre and the 2000 yield of 407 kg/acre (Saskatchewan Agriculture and Food). Mustard seed is traditionally grown in the southern part of the Prairies, which experienced severe drought conditions.

An above average percentage—82%—of the 2001 Saskatchewan mustard crop was expected to grade No.1 Canada, compared to 79% in 2000 and 78% for the 1991–2000 period. Insect excreta and admixtures from weed seeds were two of the major factors that lowered the grades of some harvest survey samples in 2001.

Table 1 • Seeded area and production for western Canadian mustard

Region	Seeded area ¹	Seeded area ²	Production ¹	Production ²	Mean production ²
	2001	2000	2001	2000	1991-2000
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	4.0	4.0	3.4	3.3	4.3
Saskatchewan	117.4	188.1	80.1	185.1	186.1
Alberta	15.3	20.2	5.4	13.8	35.5
Western Canada	136.7	212.3	88.9	202.2	225.9

¹ Field Crop Reporting Series No. 8, December 5, 2001; Statistics Canada

² Field Crop Reporting Series No. 8, revised estimates for 1991-2000

Harvest survey samples

A total of 194 harvest survey samples for 2001 included 95 yellow mustard (*Sinapis alba*), 53 brown mustard (*Brassica juncea*) and 46 oriental mustard (*B. juncea*). Over 88% of the 2001 harvest survey samples came from Saskatchewan.

Samples of mustard grown in 2001 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 NIRSystems 6500 scanning near infra-red spectrometer calibrated to and verified against the appropriate listed reference methods. The glucosinolate content of oriental and brown mustard are expressed as mmoles/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 mmoles 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 2001 quality data with the previous years' surveys is provided in Table 4. The means and standard deviations of the 2001 analytical data by grade and province can be found at:

<http://www.cgc.ca/Quality/qualmenu-e.htm#Mustard>

Quality of oriental and brown mustard

The oil content of the 2001 No.1 Canada oriental mustard decreased 0.2% to 41.7% while the protein content increased 0.4% to 27.0%. The oil content of No. 1 Canada brown mustard increased 0.5% to 39.4% while the protein content increased 0.2% to 26.5%. In 2001, slightly more allyl isothiocyanate was found in both the oriental mustard (13.0 mg/g) and brown mustard (10.8 mg/g) crops. The provincial and grade differences are detailed in the statistical tables for oriental and brown mustard:

<http://www.cgc.ca/Quality/qualmenu-e.htm#Mustard>

The two *Brassica juncea* mustard oils had similar fatty acid compositions for the No. 1 Canada composites (Table 3). The 2001 erucic acid levels were 22.4% and 22.2% for oriental and brown mustard respectively. The total saturated fatty acids for the oriental and brown mustard samples were 6.1% and 6.3% respectively. These saturated fatty acid values are 0.2 percentage units lower than in 2000. 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, oil content decreased 0.9% to 29.6% while protein content increased 1.1% to 33.8% (Table 4). Regional and grade differences in seed quality are detailed at:

<http://www.cgc.ca/Quality/qualmenu-e.htm#Mustard>.

The yellow mustard oils 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 2001 No.1 Canada Yellow mustard seed had a mean erucic acid content of 35.8%, similar to the 36.2% in 2000. Total saturated fatty acids, at 5.2%, were similar to those in 2000.

Table 2 • 2001 harvest survey • Quality of western Canadian mustard

Grade	Number of samples	Oil content ¹	Protein content ²	Glucosinolate content ³	
		%	%	µmol/g	mg/g
Oriental					
No. 1	36	41.7	27.0	131	13.0
No. 2	6	41.8	27.3	130	12.9
No. 4	2	41.2	27.3	136	13.5
Sample	2	39.2	29.7	142	14.1
Brown					
No. 1	29	39.4	26.5	109	10.8
No. 2	5	37.9	28.3	112	11.1
No. 3	3	37.3	28.3	108	10.7
No. 4	6	36.2	28.6	114	11.3
Sample	10	38.3	26.8	99	9.8
Yellow					
No. 1	58	29.6	33.8		
No. 2	8	30.3	33.0		
No. 3	6	29.6	33.7		
No. 4	11	29.9	33.4		
Sample	12	30.0	33.4		

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 • 2001 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										
No. 1	36	2.9	0.2	1.5	22.1	21.9	11.9	0.9	12.2	1.1
No. 2	6	2.9	0.2	1.4	19.5	21.4	12.4	0.9	12.3	1.1
No. 4	2	2.9	0.2	1.5	22.4	22.3	12.1	0.9	12.4	1.1
Sample	2	3.3	0.2	1.6	25.5	24.4	10.8	0.9	11.9	1.0
Cutlass, No. 1	5	2.9	0.2	1.5	21.7	22.0	12.4	0.9	12.6	1.1
Forge, No. 1	9	3.2	0.2	1.6	24.9	23.8	11.4	0.9	12.0	1.0
Brown										
No. 1	29	3.0	0.2	1.5	21.7	21.0	12.9	1.0	12.8	1.0
No. 2	5	3.0	0.2	1.4	20.5	21.3	13.6	0.9	12.3	1.1
No. 3	3	3.1	0.3	1.4	20.2	21.6	13.6	0.9	12.3	1.1
No. 4	6	3.0	0.2	1.4	20.7	21.3	13.3	0.9	12.4	1.1
Sample	10	3.2	0.3	1.5	20.8	21.6	13.2	0.9	12.6	1.1
Yellow										
No. 1	58	2.7	0.2	1.0	24.5	9.6	10.4	0.7	10.9	0.3
No. 2	8	2.7	0.2	1.0	25.1	9.8	10.2	0.7	10.7	0.3
No. 3	6	2.7	0.2	1.0	25.3	9.6	10.5	0.7	10.8	0.3
No. 4	11	2.7	0.2	1.0	25.4	9.6	10.9	0.6	10.7	0.3
Sample	12	2.8	0.2	1.1	26.4	10.2	10.8	0.7	11.0	0.3
AC Pennant	7	2.6	0.2	1.0	23.7	9.5	10.5	0.6	10.5	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)

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

Table 3b • 2001 harvest survey • Fatty acid composition of western Canadian mustard

Grade	Number of samples	Fatty acid composition ¹					Saturated fatty acids ²	Iodine value
		C22:0	C22:1	C22:2	C24:0	C24:1		
		%	%	%	%	%	%	units
Oriental								
No. 1	36	0.5	22.4	0.5	0.3	1.4	6.1	117
No. 2	6	0.6	24.5	0.5	0.3	1.5	6.2	117
No. 4	2	0.5	21.4	0.4	0.3	1.4	6.0	118
Sample	2	0.5	17.8	0.4	0.3	1.2	6.6	118
Cutlass, No. 1	5	0.5	21.7	0.4	0.3	1.4	6.1	118
Forge, No. 1	9	0.5	18.2	0.4	0.3	1.3	6.4	118
Brown								
No. 1	29	0.5	22.2	0.4	0.3	1.2	6.3	118
No. 2	5	0.5	22.9	0.4	0.3	1.3	6.1	120
No. 3	3	0.5	22.8	0.4	0.3	1.3	6.2	120
No. 4	6	0.5	22.8	0.5	0.3	1.3	6.1	119
Sample	10	0.5	22.3	0.4	0.3	1.3	6.3	119
Yellow								
No. 1	58	0.6	35.8	0.3	0.3	2.3	5.2	102
No. 2	8	0.6	35.5	0.3	0.3	2.3	5.2	102
No. 3	6	0.6	34.9	0.3	0.3	2.3	5.2	102
No. 4	11	0.5	34.8	0.3	0.3	2.3	5.2	103
Sample	12	0.5	32.7	0.2	0.3	2.2	5.3	104
AC Pennant	7	0.6	37.0	0.3	0.3	2.5	5.0	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, 1991-2001

Year	Number of samples	Oil content ¹	Protein content ²	Glucosinolate content ³	
		%	%	µmol/g	mg/g
Oriental - No. 1 Canada					
2001	36	41.7	27.0	131	13.0
2000	44	41.9	26.6	128	12.6
1991-2000	690	42.8	25.8	119	11.8
Oriental - No. 2 Canada					
2001	6	41.8	27.3	130	12.9
2000	21	41.7	27.1	129	12.8
1991-2000	55	42.8	26.3	115	11.4
Oriental - No. 3 Canada					
2001	0				
2000	9	43.9	25.5	122	12.1
1991-2000	41	42.8	25.8	118	11.7
Brown - No. 1 Canada					
2001	29	39.4	26.5	109	10.8
2000	59	38.9	26.3	106	10.5
1991-2000	598	40.2	25.9	99	9.9
Brown - No. 2 Canada					
2001	5	37.9	28.3	112	11.1
2000	1	38.9	26.3	103	10.2
1991-2000	17	38.0	27.8	107	10.3
Brown - No. 3 Canada					
2001	3	37.3	28.3	108	10.7
2000	4	39.3	25.6	100	9.9
1991-2000	83	39.0	26.4	101	10.0
Yellow - No. 1 Canada					
2001	58	29.6	33.8		
2000	34	30.5	31.7		
1991-00	514	31.7	30.7		
Yellow - No. 2 Canada					
2001	8	30.3	33.0		
2000	19	30.1	32.6		
1991-2000	107	31.0	31.6		
Yellow - No. 3 Canada					
2001	6	29.6	33.7		
2000	9	29.8	32.5		
1991-2000	50	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