



Canadian Grain
Commission

Commission canadienne
des grains

ISSN 1498-9905



Quality of western Canadian mustard

2020

Bert Siemens

Chemist, Oilseeds Services

Véronique J. Barthet

Program Manager, Oilseeds Section

Contact: Bert Siemens

Chemist, Oilseeds Services

Tel : 204-984-6991

Fax : 204-983-0724

Email: bert.siemens@grainscanada.gc.ca

Grain Research Laboratory

Canadian Grain Commission

1404-303 Main Street

Winnipeg, MB, R3C 3G8

www.grainscanada.gc.ca



Table of contents

Introduction	4
Summary	4
Weather and production review	5
Weather review	5
Production and grade information	5
Harvest samples	6
Effects of weather on quality	6
Quality of Domestic Mustard Seed: Oriental and Brown	7
Quality of Domestic Mustard Seed: Yellow	8

Tables

Table 1 – Seeded area and production for western Canadian mustard	5
Table 2 – Quality of 2020 western Canadian mustard	8
Table 3 – Fatty acid composition, chlorophyll and free fatty acids of 2020 western Canadian mustard .	9

Figures

Figure 1 – Mustard crops grown in Canada	3
Figure 2 – Oriental Mustard, No.1 Canada Oil and protein content of harvest samples, 2010-20	10
Figure 3 – Brown Mustard, No.1 Canada Oil and protein content of harvest samples, 2010-20	10
Figure 4 – Yellow Mustard, No.1 Canada Oil and protein content of harvest samples, 2010-20	11
Figure 5 – Oriental and Brown Mustard, No.1 Canada Total glucosinolate content of harvest samples, 2010-20.....	11
Figure 6 – Oriental, Brown and Yellow Mustard, No.1 Canada Chlorophyll content of harvest samples, 2010-20	12

Acknowledgements

The Canadian Grain Commission thanks mustard producers and grain handling plants in western Canada for supplying samples of mustard harvested in 2020. 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, total glucosinolate content, and fatty acid composition of oriental (*Brassica juncea*), brown (*Brassica juncea*), and yellow (*Sinapis alba*) mustard grown in western Canada in 2020 (Figure 1). The Canadian Grain Commission obtained the data from analyses of samples collected through the Harvest Sample Program.

Figure 1 – Mustard crops grown in Canada



Summary

The mean oil content for the top grade for oriental, brown and yellow mustard in the 2020 harvest was lower than the 10-year average (Figures 2, 3, and 4) at 40.0%, 35.5%, and 27.6%, respectively. In contrast, the mean protein for the top grade oriental (27.6%), brown (29.3%), and yellow (33.1%) mustard was higher. Total glucosinolate content in the top grade mustard was 126 micromoles per gram ($\mu\text{mole/g}$) for oriental and 107 $\mu\text{mole/g}$ for brown, which is higher than the 10-year average of 117 $\mu\text{mole/g}$ (oriental) and 105 $\mu\text{mole/g}$ (brown; Figure 5). Oil, protein and glucosinolates are reported here on a dry matter basis.

Weather and production review

Weather review

Relatively good weather over the month of May, albeit drier than normal, allowed nearly all the mustard to be seeded by the end of May. Moisture levels in the soil were an early concern, but towards the end of June moisture conditions improved considerably along with the crop development.

The mustard crop continued to progress well into July with most reports claiming the crop was in good condition. The temperature reached near average and the crops were receiving an adequate amount of moisture. Toward the end of July and into August conditions turned warm and dry which in turn sped-up crop development.

Harvest started in mid-August and progressed steadily into September. The harvest was essentially complete by the third week of September. ([Saskatchewan Crop Reports](#) and [Walter Dyck's Olds Products 2020 Crop Reports](#)).

[Agriculture and Agri-Food Canada](#) has information on the temperature and precipitation patterns for the 2020 western Canadian growing season.

Production and grade information

As shown in Table 1, mustard seed production for 2020 decreased by at least 25% from 2019 to about 98.8 thousand metric tonnes. The decrease was primarily a result of fewer seeded hectares. Yield was approximately 980 kilograms per hectare (kg/ha; Statistics Canada), which is more than last year's yield of 870 kg/ha and slightly above the 10-year average of 965 kg/ha.

Saskatchewan accounted for 67% of western Canada's total seeded area and nearly 63% of mustard production while Alberta accounted for most the remaining seeded area and production (Table 1).

This year, 71% of samples the Canadian Grain Commission received were graded No. 1, above the 10-year average of 64% (2010-19). Growing and harvest conditions produced a mustard crop with only minimal visible damage in all the mustards. However, in yellow mustard, conspicuous admixtures from weed seeds and foreign material were major factors in lowering the grades of samples received in 2020.

Table 1 – Seeded area and production for western Canadian mustard¹

Region	Seeded area		Production		Mean production
	2020	2019	2020	2019	2010-19
	thousand hectares		thousand tonnes		thousand tonnes
Manitoba	ND ²	0.7	ND ²	0.8	1.5
Saskatchewan	69.7	118.2	61.8	106.2	116.5
Alberta	32.4	42.4	36.5	27.6	40.4
Western Canada	103.7	161.1	98.8	134.6	157.2

¹ Statistics Canada. Table 001-0010 - [Estimated areas, yield and production of principal field crops in metric units](#).

² Not enough data to be reliably reported. Mustard samples from Manitoba were received in the Harvest Sample Program.

Harvest samples

This year's Harvest Sample Program included 277 mustard samples, up from the 153 samples received in 2019. This included 187 yellow, 60 brown and 30 oriental mustard samples. Overall, 66% of mustard samples came from Saskatchewan, 32% from Alberta and 2% from Manitoba.

Producers and grain companies submitted samples of mustard seeds grown in 2020 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](#).

The Canadian Grain Commission used a FOSS NIRSystems 6500 NIR spectrometer, calibrated to and verified against the appropriate listed reference methods, to determine the oil and protein contents on all individual whole-seed samples. Total glucosinolate content was also determined on individual brown and oriental mustard samples. [The reference procedures are listed under Oilseeds Methods](#).

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

Effects of weather on quality

The mustard crop grown in western Canada in 2020 showed general characteristics of a well matured crop but with some stress due to warm and dry

growing conditions. The Grain Research Laboratory's long-term Harvest Sample Program results indicate warm and dry growing conditions tend to produce an oilseed crop with higher protein and lower oil content. This trend was noticed in all mustard types. The current research also suggests total glucosinolate levels may increase when *Brassica* crops are grown under warmer than normal conditions.

Quality of Domestic Mustard Seed: Oriental and Brown

Table 2 summarizes this year's oil, protein and total glucosinolate content for oriental and brown mustard by grade. In addition, comparisons of oriental and brown mustard content to previous years' can be found in Figures 2, 3, and 5.

Oriental Mustard, No. 1 Canada mean oil content (40%) was lower than the mean in 2019 (41.4%), while protein content (27.6%) was noticeably higher (26.8%; Figure 2). Oil content in samples of Oriental Mustard, No. 1 Canada ranged from 34.5% to 45.1%, whereas protein content ranged from 21.5% to 31.8% (Table 2).

Similarly, Brown Mustard, No. 1 Canada mean oil content (35.5%) was lower in comparison to 2019 (36.1%). However, protein content (29.3%) remained the same (Figure 3). Oil content in samples of Brown Mustard, No. 1 Canada ranged from 31.4% to 39.2% while the protein content ranged from 25.7% to 32.8% (Table 2).

Total glucosinolate content in Oriental (126 $\mu\text{mole/g}$) and Brown (107 $\mu\text{mole/g}$) Mustard, No.1 Canada was higher than 2019's value of 109 and 104 $\mu\text{mole/g}$, respectively (Figure 5). Total glucosinolate content in samples of Oriental and Brown Mustard, No. 1 Canada ranged from 103 to 147 $\mu\text{mole/g}$ and 79 to 131 $\mu\text{mole/g}$ (Table 2).

[Fatty acid composition of oriental and brown mustard composites](#) is provided in Table 3. Erucic acid (C22:1) levels for Oriental (21.1%) and Brown Mustard, No.1 Canada (21.2%) were lower than the 2019 values of 21.8% and 22.7% respectively.

Total saturated fatty acids (Table 3) for Oriental and Brown Mustard, No.1 Canada composites were 6.4% and 6.3% and are similar to last year's values. There were slight changes in the levels of oleic, linoleic and linolenic acid, but iodine values (an indicator of oil unsaturation) for both oriental (116 units) and brown (117 units) mustard were found to be similar to the 2019 values. There are some varietal differences in fatty acid distribution for both oriental and brown mustard. Most notably the new brown mustard variety, AAC Brown 18, has significantly higher amounts of oleic acid and lower erucic acid values than the established varieties.

Chlorophyll content of oriental and brown mustard composites are provided in Table 3. Chlorophyll was 1.0 and 2.7 milligrams per kilograms (mg/kg) for Oriental and Brown Mustard, No. 1 Canada, respectively (Figure 6). This year's recorded chlorophyll average is lower than the long-term average of 1.7 and 3.4 mg/kg. Low chlorophyll is an indicator of well matured seeds. The lower grades found within brown mustard are associated with higher levels of chlorophyll content.

Free fatty acids (FFA) are an indicator of oil degradation; the lower grade mustards usually have more damage and, therefore, higher FFA. Common types of damage this year included sprouting and insect damage. The FFA values for the top grade are considered low and are similar to the 2019 values.

Quality of Domestic Mustard Seed: Yellow

This year's oil and protein contents for yellow mustard is summarized by grade in Table 2. In addition, comparisons to the data from previous years are found in Figure 4.

Yellow mustard has characteristically lower oil content and higher protein content than oriental and brown mustard (Table 2). Mean oil content (27.6%) in Yellow Mustard, No. 1 Canada was the same value as in 2019. However, mean protein content (33.1%) was slightly lower in comparison to the 2019 value (33.3%; Figure 4). Oil content in samples of Yellow Mustard, No. 1 Canada ranged from 23.3% to 33.0% while protein ranged from 27.6% to 39.0% (Table 2). Protein content for all mustards, but yellow mustard in particular, has been higher than normal for 2020 when compared to the long-term average. Warm and dry conditions during the seed development stage has attributed to this increase in protein content. Yellow mustard protein has seen a 1.2% increase from the 10-year average. Conversely oil content for all the mustards are lower than normal for the same reasons.

[Fatty acid composition for yellow mustard composites](#) is provided in Table 3. Compared to the oil in oriental and brown mustard, the 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). Mean erucic acid content in Yellow Mustard, No.1 Canada was 34.0%, compared to 35.5% in 2019. Total saturated fatty acids (5.3%) and iodine values (101 units) were similar to the 2019 values.

Chlorophyll content of yellow mustard composites is provided in Table 3. Chlorophyll in Yellow Mustard, No. 1 Canada was 0.9 mg/kg (Figure 6 and Table 3) while the lower grades had slightly elevated levels of chlorophyll going as high as 2.2 mg/kg for Sample grade. Chlorophyll content for No. 1 Canada was similar to the long-term mean of 0.8 mg/kg.

Table 2 – Quality of 2020 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	26	40.0	34.5	45.1	27.6	21.5	31.8	126	103	147
Manitoba	1	37.7	-	-	31.8	-	-	147	-	-
Saskatchewan	23	40.4	35.0	45.1	27.3	21.5	31.3	124	103	145
Alberta	2	36.6	34.5	38.7	29.5	28.0	30.9	135	125	145
No. 4	4	42.1	36.8	44.9	26.7	22.1	31.4	111	105	130
Cutlass, No.1	9	41.9	37.9	45.1	26.3	21.5	31.0	119	105	151
Forge, No.1	11	38.5	34.9	42.0	27.7	23.5	31.3	129	121	146
Domestic Mustard Seed, Canada, Brown										
No. 1 - W. Canada	52	35.5	31.4	39.2	29.3	25.7	32.8	107	79	131
Saskatchewan	48	35.5	31.4	39.2	29.2	25.7	32.8	108	79	131
Alberta	4	34.8	33.6	36.3	30.0	27.5	30.8	107	103	115
No. 2	1	32.8	-	-	31.5	-	-	124	-	-
No. 3	2	37.5	35.2	39.8	27.8	25.3	30.2	106	96	116
No. 4	3	33.0	32.6	33.2	32.1	31.3	31.5	117	114	119
Sample	2	37.0	36.8	37.2	28.4	27.5	29.2	103	100	107
AAC Brown 18, No. 1	7	36.0	34.5	38.8	28.6	25.7	30.3	108	92	116
Centennial Br., No. 1	22	35.0	31.4	39.1	29.9	25.9	32.8	109	93	118
Domestic Mustard Seed, Canada, Yellow										
No. 1 - W. Canada	117	27.6	23.3	33.0	33.1	27.6	39.0	-	-	-
Saskatchewan	57	27.7	23.8	33.0	33.2	27.6	39.0	-	-	-
Alberta	60	27.5	23.3	31.5	33.0	29.2	37.1	-	-	-
No. 2	20	27.5	24.0	31.8	33.2	28.0	36.0	-	-	-
No. 3	12	27.9	26.4	33.0	32.6	31.1	34.6	-	-	-
No. 4	29	27.8	23.4	33.6	32.8	26.6	38.3	-	-	-
Sample	9	27.3	23.0	34.7	32.5	27.2	37.2	-	-	-
AC Pennant, No. 1	7	27.9	24.0	31.3	32.7	28.3	39.0	-	-	-
Andante, No. 1	86	27.6	23.3	33.0	33.1	28.4	37.1	-	-	-

¹ Dry matter basis.² % N x 6.25; dry matter basis.³ Total glucosinolates ($\mu\text{mole/g}$); dry matter basis - near infrared instrument calibrated to ISO 9167-3:2007 (Glucose Release).

Table 3 – Fatty acid composition, chlorophyll and free fatty acids of 2020 western Canadian mustard

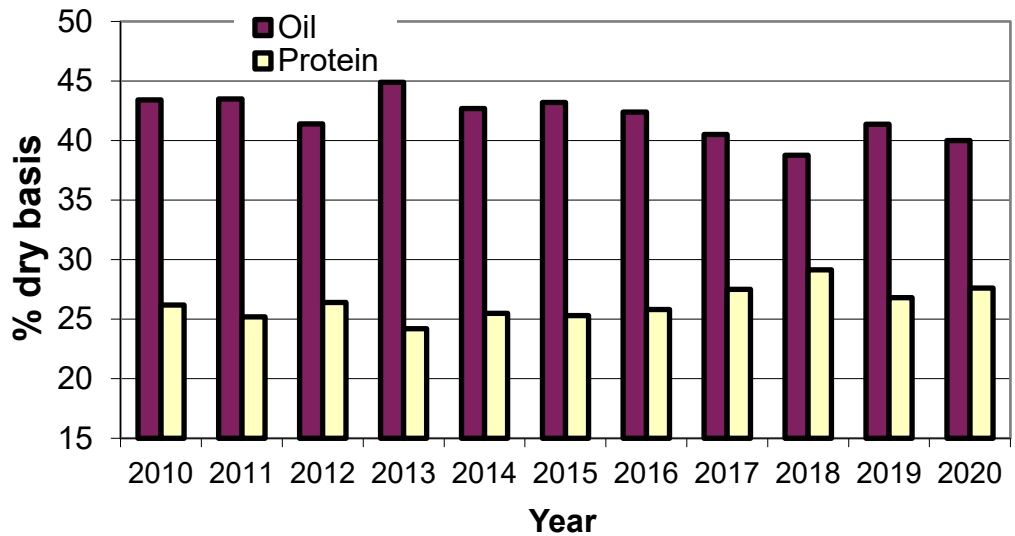
Grade	No. of samples	Fatty acid composition (%) ¹				Saturated fatty acids ²	Iodine value	Chlorophyll mg/kg	FFA ³
		C18:1	C18:2	C18:3	C22:1				
Domestic Mustard Seed, Canada, Oriental									
No. 1 - W. Canada	26	23.3	22.4	11.0	21.1	6.3	116	1.0	0.12
Manitoba	1	19.3	22.1	12.6	24.3	5.7	119	0.9	0.15
Saskatchewan	23	23.3	22.3	11.1	21.2	6.3	116	1.0	0.11
Alberta	2	25.9	24.6	9.8	18.2	6.7	116	0.4	0.15
No. 4	4	20.4	20.8	12.2	23.7	6.0	116	1.4	0.36
Cutlass, No.1	9	22.2	21.3	11.5	22.5	6.1	116	1.2	0.12
Forge, No.1	11	26.3	23.8	10.2	18.0	6.6	116	0.8	0.12
Domestic Mustard Seed, Canada, Brown									
No. 1 - W. Canada	52	22.7	21.7	12.3	21.2	6.4	117	2.7	0.08
Saskatchewan	48	22.6	21.6	12.3	21.3	6.4	117	2.5	0.08
Alberta	4	24.1	22.5	12.1	19.6	6.7	118	4.8	0.15
No. 2	1	21.3	21.6	11.9	22.7	6.3	117	3.3	0.12
No. 3	2	21.3	20.0	12.9	23.0	5.9	117	2.0	0.08
No. 4	3	20.5	21.5	11.8	23.5	6.3	116	6.5	0.14
Sample	2	19.6	21.2	12.6	23.4	6.2	117	1.6	0.43
AAC Brown 18, No. 1	7	29.7	24.3	12.8	13.3	7.2	121	3.8	0.07
Centennial Br., No. 1	22	21.4	21.1	12.0	22.8	6.3	116	1.9	0.10
Domestic Mustard Seed, Canada, Yellow									
No. 1 - W. Canada	117	26.7	9.5	9.6	34.0	5.3	101	0.9	0.06
Saskatchewan	57	26.5	9.6	9.9	33.9	5.2	101	1.1	0.06
Alberta	60	26.9	9.4	9.3	34.1	5.3	100	0.8	0.06
No. 2	20	26.3	9.7	10.1	33.7	5.3	102	0.9	0.07
No. 3	12	25.8	9.7	10.0	34.4	5.2	101	1.3	0.07
No. 4	29	25.9	9.6	10.4	34.1	5.3	102	2.0	0.09
Sample	9	28.0	10.0	9.9	32.3	5.4	102	2.2	0.07
AC Pennant, No. 1	7	25.8	9.6	9.6	34.9	5.3	100	1.0	0.06
Andante, No. 1	86	27.1	9.5	9.7	33.5	5.3	101	1.1	0.06

¹ Percentage of total fatty acids including: 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.

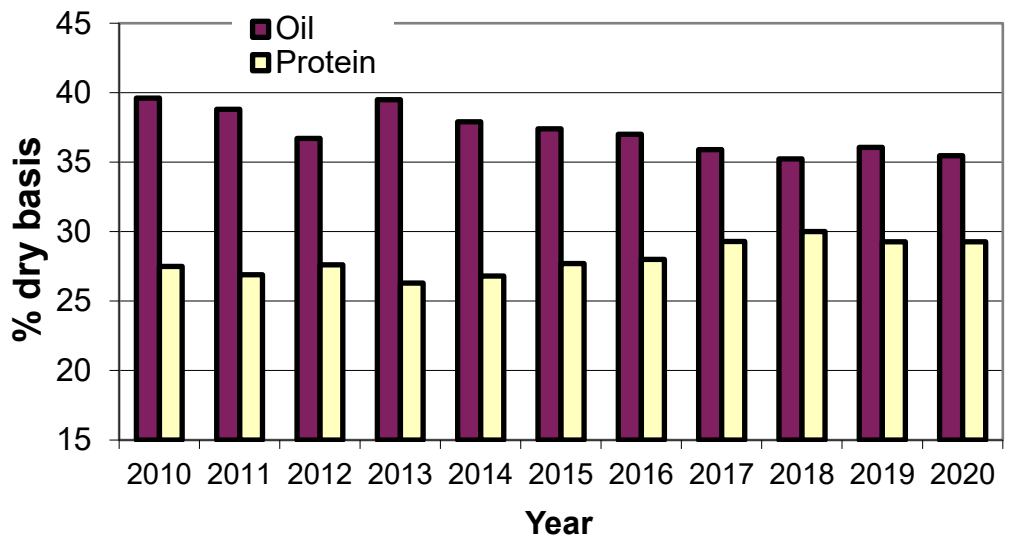
³ Free Fatty Acid Content in percentage.

**Figure 2 – Oriental Mustard, No.1 Canada
Oil and protein content of harvest samples, 2010-20**



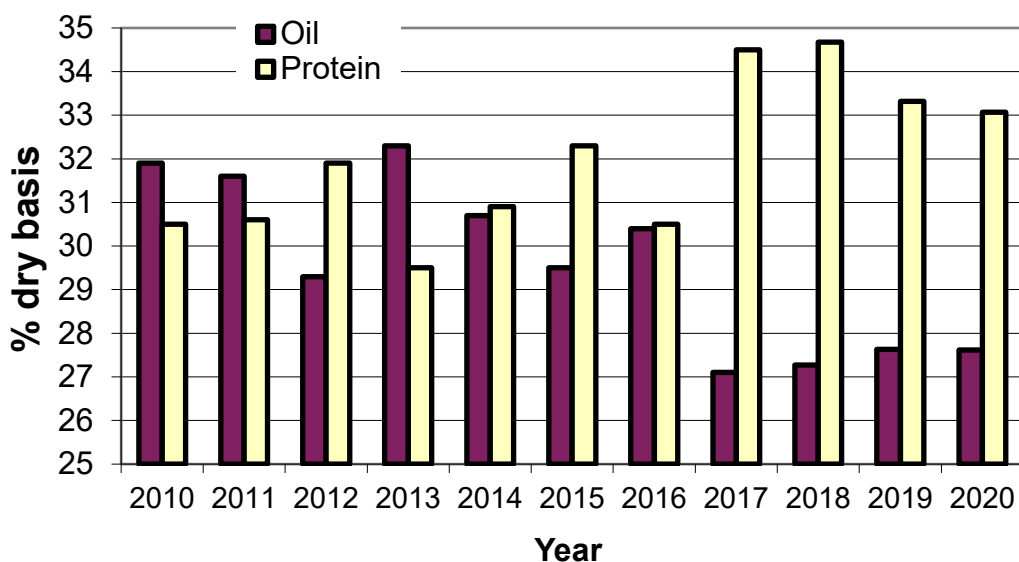
2020 oil content.....	40.0%	2020 protein content	27.6%
2019 oil content	41.4%	2019 protein content	26.8%
2010-19 mean oil content.....	42.2%	2010-19 mean protein content.....	26.2%

**Figure 3 – Brown Mustard, No.1 Canada
Oil and protein content of harvest samples, 2010-20**



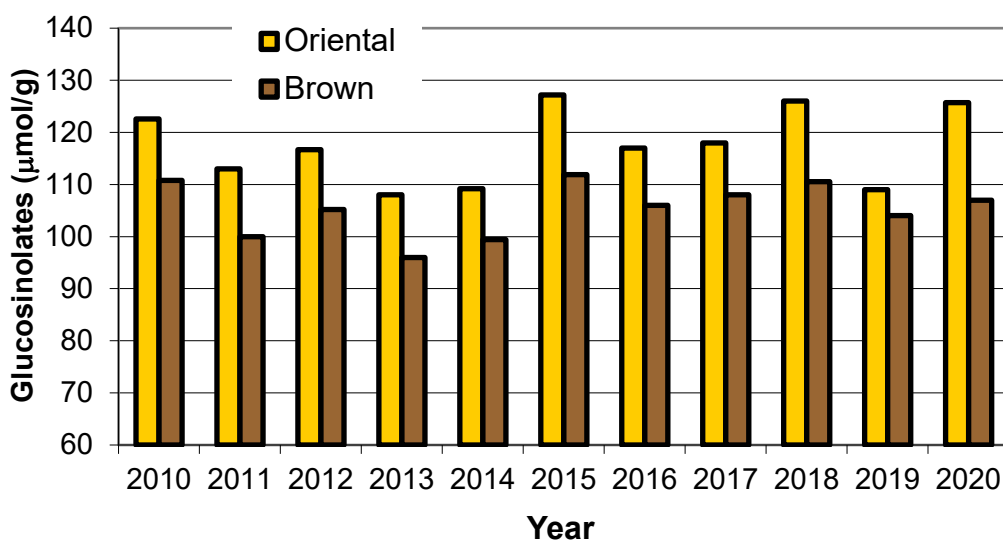
2020 oil content.....	35.5%	2020 protein content	29.3%
2019 oil content	36.1%	2019 protein content	29.3%
2010-19 mean oil content.....	37.4%	2010-19 mean protein content.....	27.9%

**Figure 4 – Yellow Mustard, No.1 Canada
Oil and protein content of harvest samples, 2010-20**



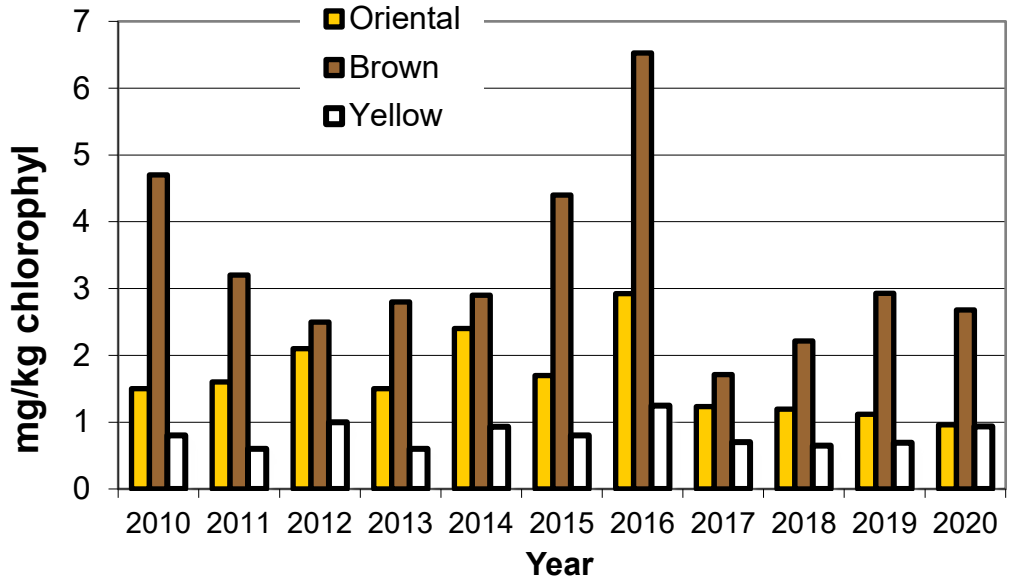
2020 oil content.....	27.6%	2020 protein content	33.1%
2019 oil content	27.6%	2019 protein content	33.3%
2010-19 mean oil content.....	29.8%	2010-19 mean protein content.....	31.9%

**Figure 5 – Oriental and Brown Mustard, No.1 Canada
Total glucosinolate content of harvest samples, 2010-20**



2020 Oriental glucosinolate content.....	126 µmole/g	2020 Brown glucosinolate content.....	107 µmole/g
2019 Oriental glucosinolate content.....	109 µmole/g	2019 Brown glucosinolate content.....	104 µmole/g
2010-19 mean Oriental Glucosinolate content.....	117 µmole/g	2010-19 mean Brown glucosinolate content.....	105 µmole/g

**Figure 6 – Oriental, Brown and Yellow Mustard, No.1 Canada
Chlorophyll content of harvest samples, 2010-20**



2020 Oriental chlorophyll content.....1.0 mg/kg
 2020 Brown chlorophyll content..... 2.7 mg/kg
 2020 Yellow chlorophyll content.....0.9 mg/kg

2010-19 mean Oriental chlorophyll content.....1.7 mg/kg
 2010-19 mean Brown chlorophyll content.....3.4 mg/kg
 2010-19 mean Yellow chlorophyll content.....0.8 mg/kg