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Quality of western Canadian mustard 2023

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Summary

In 2023, the mean oil content for No. 1 oriental, brown and yellow mustard (36.9%, 33.4% and 26.3%, respectively) was higher than last year (35.5%, 33.0% and 25.4%, respectively) but lower than each corresponding 10-year mean (Figures 6, 7, and 8). In contrast, the mean protein content for No.1 oriental, brown and yellow mustard (29.4%, 31.2% and 35.2%, respectively) was lower than last year for oriental mustard (30.3%) and similar to last year for brown and yellow mustard (31.2% and 35.2%, respectively). In addition, the mean protein content in 2023 was higher than the 10-year mean for oriental and brown mustard but lower than the 10-year mean for yellow mustard (Figures 6, 7 and 8). The total glucosinolate content for No. 1 oriental mustard was 135 micromoles per gram ($\mu\text{mol/g}$) of seeds, 131 $\mu\text{mol/g}$ of seeds for No. 1 brown mustard and 147 $\mu\text{mol/g}$ of seeds for No. 1 yellow mustard. These values are higher than the 10-year means of 122 $\mu\text{mol/g}$ of seeds (oriental) and 112 $\mu\text{mol/g}$ of seeds (brown) (Figure 9). The 10-year mean for total glucosinolate content in yellow mustard was not calculated as we started reporting data in 2020. However, for yellow mustard, the 2023 total glucosinolate content was slightly lower than that observed in 2022 (150 $\mu\text{mol/g}$ of seeds) and similar to the 3-year average (146 $\mu\text{mol/g}$ of seeds). Oil, protein and total glucosinolate content are reported on a dry matter basis in this report.

Introduction

This report presents harvest quality data for oriental (*Brassica juncea*), brown (*Brassica juncea*), and yellow (*Sinapis alba*) mustard grown in western Canada in 2023 (Figure 1). Mustard samples were submitted to the Canadian Grain Commission's Harvest Sample Program by producers and grain companies. Quality data is compiled from the results of [analytical tests](#) performed by the Oilseeds program staff from the Grain Research Laboratory.

Figure 1 Mustard grown in western Canada



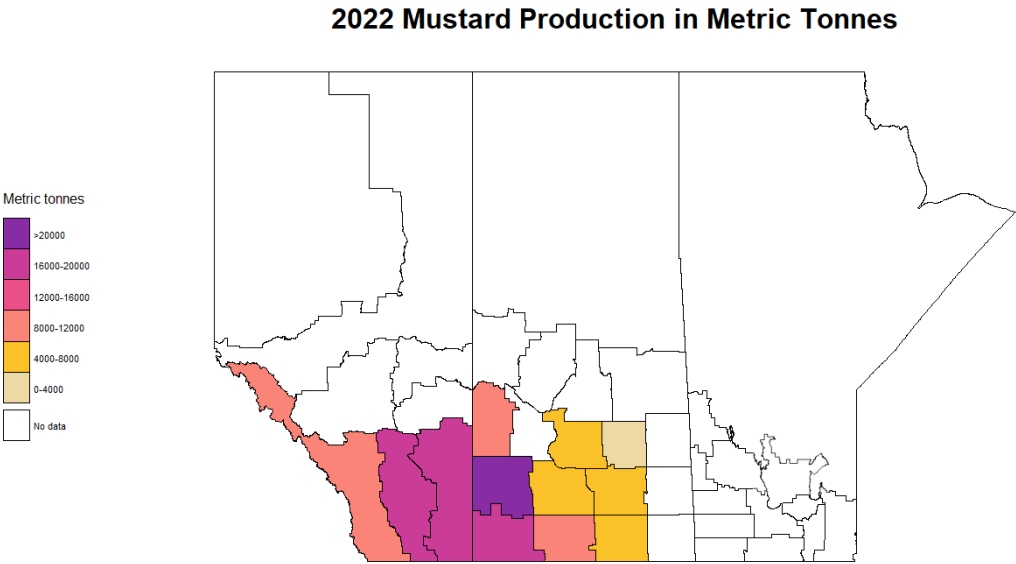
Oriental mustard (*Brassica juncea*)

Brown mustard (*Brassica juncea*)

Yellow mustard (*Sinapis alba*)

Figure 2 shows the estimated 2022 mustard production in metric tonnes (MT) by Small Area Data Regions from [Statistics Canada](#). The map shows that the main mustard growing areas are southeastern Alberta and southwestern Saskatchewan.

Figure 2 Estimated mustard production by Small Area Data Regions for 2022¹



¹ Source: [Statistics Canada](#).

Weather and production review

Seeding and growing conditions

Below normal temperatures in April and spring snow storms delayed seeding over the entire mustard growing region. Dry and warm conditions in May, however, allowed seeding to proceed quickly. Although seeding started later than the 5-year average date, most of the mustard crop in Saskatchewan (94%) was in the ground in by the end of May. Warmer than normal temperatures occurred in June, while July and August had near normal average temperatures. In some areas, July nights were cold with temperatures in single digits, which lowered the daily averages. Timely rain (localized thundershowers) benefitted the crop during the growing season. Moisture was an issue again this year, however, since the growing season began with abnormally dry conditions (Figure 3) and ended with some mustard growing areas experiencing extreme drought (Figure 3). In Saskatchewan, the mustard harvest began in early August and ended at the end of September, similar to last year (Figure 5). In Alberta, most of the mustard crop (98.8%) was harvest by October 3. Some scattered rain occurred during the harvest, but the mustard harvest progressed without long interruptions for most producers (Figure 5).

More detailed information can be found at:

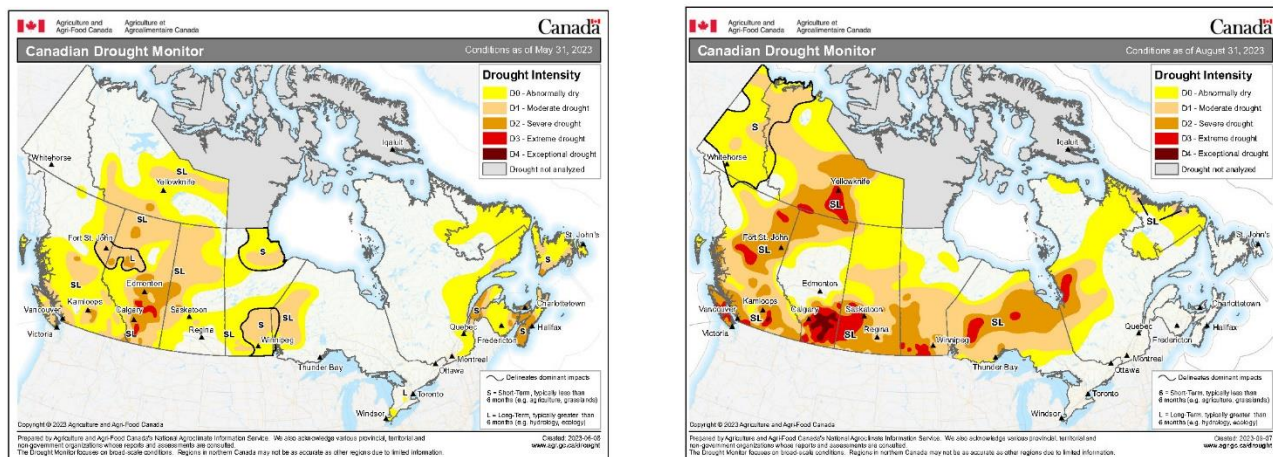
[Saskatchewan crop reports](#)

[Alberta crop reports](#)

[Walter Dyck's reports](#)

Information on the temperature and precipitation patterns from the 2023 growing season in western Canada can be obtained from [Agriculture and Agri-Food Canada](#).

Figure 3 Drought intensity in Canada on May 31 and August 31, 2023



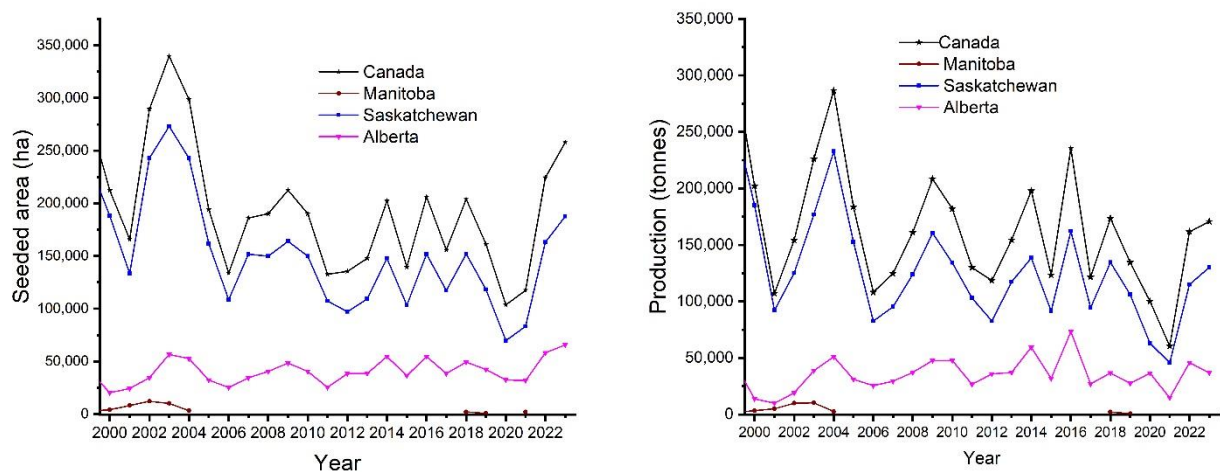
Source: [Agriculture and Agri-Food Canada](#)

Production and grade distribution

In 2023, the estimated production of mustard in western Canada was 170,710 metric tonnes (MT), higher than the 2022 production (161,781 MT), the 5-year (2018 to 2022) mean (126,103 MT) and the 10-year (2013 to 2022) mean (146,361 MT) (Figure 4). The increase this year was due to an increase in hectares (ha) seeded with mustard (257,800 ha in 2023 versus 224,500 ha in 2022) (Figure 4). The estimated yield in western Canada decreased this year compared to last year, with 681 kilograms per hectare (kg/ha) produced in 2023 compared to 740 kg/ha in 2022. The estimated yield was 708 kg/ha (717 kg/ha in 2022) in Saskatchewan and 592 kg/ha (801 kg/ha in 2022) in Alberta. These yields are much lower than the 5-year means (812 kg/ha in Saskatchewan and 774 kg/ha in Alberta) and much lower than the 10-year means (903 kg/ha in Saskatchewan and 897 kg/ha in Alberta). Saskatchewan accounted for 73.1% (72.6% in 2022) of western Canada's total area seeded with mustard and 73.0% (71.1% in 2022) of western Canada's mustard production while most of the remaining seeded area and production were in Alberta (Figure 4). Some mustard was grown in Manitoba, but it represented less than 1% of the hectares seeded with mustard seed in western Canada. All production data is available from [Statistics Canada](#).

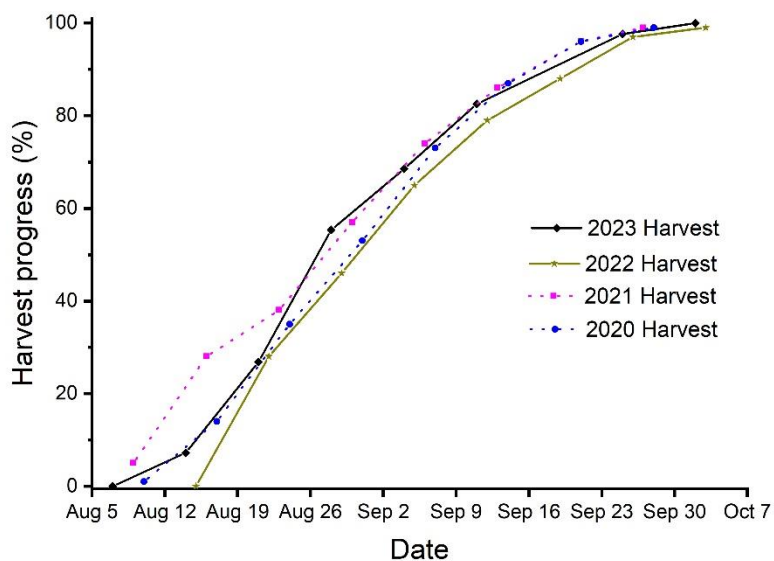
In 2023, 66.4% of all mustard samples received by the Harvest Sample Program were graded Domestic Mustard Seed No. 1, Canada. This is slightly higher than what was recorded in 2022 (64.6%) and higher than the 5-year and 10-year means of 61.1% and 62.6%, respectively. The highest percentage of samples graded No. 1 were brown mustard (70.9% in 2023 versus 70.3% in 2022), followed by oriental mustard (69.4% in 2023 versus 78.9% in 2022). Samples of yellow mustard had the most damage and only 56.6% of the samples were graded No. 1 in 2023 (58.8% in 2022). In 2023, the main downgrading factors were green seeds (31.9% of the samples had distinctly green seeds), conspicuous admixture (23.4% of the samples had inseparable seeds) and sprouting (18.6% of the samples had seeds with a ruptured seed coat and a sprout). Sprouting damage was observed only in brown mustard samples. Among the brown mustard samples, 59.8% showed sprouting but only 12.6% of samples were downgraded due to sprouting severity.

Figure 4 Seeded area and production of mustard in western Canada from 2000 to 2023¹



¹ data from Statistics Canada [Table 32-10-0359-01 Estimated areas, yield, production, average farm price and total farm value of principal field crops, in metric and imperial units](#)

Figure 5 Progress of mustard harvest in Saskatchewan from 2020 to 2023



Harvest samples

In 2023, the Harvest Sample Program received 295 mustard samples from producers and grain companies, more than in 2022 (246), higher than the 5-year mean (223) and the 10-year mean (281). We analyzed 123 yellow (136 in 2022), 83 brown (91 in 2022) and 58 oriental (19 in 2022) mustard samples. Most of the samples (74.6%) came from Saskatchewan (67.9% in 2022), 22.7% came from Alberta (29.3% in 2022) and 2.7% came from Manitoba (2.8% in 2022). Individual samples were cleaned to remove dockage and were graded by grain 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 content of all individual whole-seed samples. The total glucosinolate content was determined on individual brown and oriental mustard samples using NIR spectroscopy and all composite samples were analyzed using the high-performance liquid chromatography reference method. All [oilseed method and test procedures](#) are detailed on our website.

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

Quality of the 2023 mustard crop

The mustard crop grown in western Canada in 2023 had the general characteristics of a well matured crop but showed some stress due to warm and dry growing conditions. Historical data from the Harvest Sample Program indicate that warm and dry growing conditions tend to produce an oilseed crop with higher protein and lower oil content. Scientific literature also suggests that total glucosinolate levels increase in rapeseed when crops are exposed to dry conditions after flowering.

Oil, protein and total glucosinolate content

Table 1 contains a summary of the 2023 data for oil, protein and total glucosinolate content in oriental, brown and yellow mustard samples according to grade. Comparisons of the quality of oriental, brown, and yellow mustard from previous years can be found in Figures 6, 7 and 8.

Oriental mustard graded No. 1 had a mean oil content of 36.9%, higher when compared to 2022 (35.5%) but much lower than the 5-year mean (38.1%) and 10-year mean (40.4%). The mean protein content was noticeably lower in 2023 (29.4%) when compared to 2022 (30.3%) but higher than the 5-year mean and 10-year mean

(29.0% and 27.4%, respectively) (Figure 6). The oil content ranged from 32.5% to 43.7% (32.7% to 38.9% in 2022) and the protein content ranged from 24.4% to 32.8% (27.3% to 33.2% in 2022) (Table 1).

Brown mustard graded No. 1 also had a mean oil content (33.4%) that was higher when compared to 2022 (33.0%) but lower than the 5-year mean and 10-year mean (34.4% and 35.9%, respectively). The mean protein content in 2023 (31.2%) was identical to that in 2022 but higher than the 5-year mean and 10-year mean (30.3% and 29.0%, respectively) (Figure 7). The oil content ranged from 29.9% to 39.2% (27.6% to 40.6% in 2022) and the protein content ranged from 26.6% to 34.2% (23.8% to 34.1% in 2022) (Table 1).

Yellow mustard is characteristically lower in oil and higher in protein than oriental and brown mustard (Table 1). The mean oil content of yellow mustard graded No. 1 was higher in 2023 (26.3%) than in 2022 (25.4%) but lower than the 5-year mean (26.6%) and 10-year mean (28.3%). The mean protein content in 2023 (35.2%) was identical to the 2022 mean and higher than the 5-year mean (34.6%) and significantly higher than the 10-year mean (33.1%) (Figure 8). The oil content ranged from 22.8% to 28.5% (22.4% to 32.8% in 2022) and the protein content ranged from 28.6% to 40.0% (28.5% to 40.1% in 2022) (Table 1).

The mean total glucosinolate content of oriental mustard graded No. 1 was 135 $\mu\text{mol/g}$ of seeds, lower than the 2022 mean (143 $\mu\text{mol/g}$ of seeds) and higher than the 5-year mean and the 10-year mean (130 $\mu\text{mol/g}$ of seeds and 122 $\mu\text{mol/g}$ of seeds, respectively). The mean total glucosinolate content of No. 1 brown mustard was lower in 2023 than in 2022 (131 $\mu\text{mol/g}$ of seeds versus 143 $\mu\text{mol/g}$ of seeds) but higher than the 5-year mean and the 10-year mean (119 $\mu\text{mol/g}$ of seeds and 112 $\mu\text{mol/g}$ of seeds, respectively). The mean total glucosinolate content of yellow mustard seed graded No. 1 was 147 $\mu\text{mol/g}$ of seeds, similar to the 2022 mean and 2021 mean (150 $\mu\text{mol/g}$ of seeds and 147 $\mu\text{mol/g}$ of seeds, respectively).

In 2023, there was a decrease in the mean protein content for oriental mustard (-0.9%) compared to 2022, whereas the mean protein content for brown and yellow mustard was relatively unchanged compared to 2022. All three types of No. 1 mustard had a higher mean protein content in 2023 than their corresponding 5-year mean and 10-year mean. The opposite was observed for oil content, with all the 2023 means being higher than those in 2022 (+1.4%, +0.4% and +0.9% for oriental, brown and yellow mustard, respectively) but lower than their corresponding 5-year mean and 10-year mean.

The increased oil content associated with decreased protein content in 2023 suggests that the 2023 growing season had overall lower temperatures than last year's growing season. Mean temperatures in July were lower than normal for most of Saskatchewan and only about 2°C higher than normal for most of Alberta. Nevertheless, the number of days over 30°C from April 1 to July 31 was somewhat higher in 2023 than in 2022. The main difference between the 2023 and 2022 growing seasons was the low night temperatures (single digits) experienced in July in most of the prairies. It is likely that these low night temperatures helped the mustard crop recover from the heat of the day, leading to an increase in oil content.

Data on the chlorophyll content of oriental, brown and yellow mustard samples from 2023 is contained in Table 2. For No. 1 oriental and brown mustard, the chlorophyll content was 0.9 milligrams per kilogram (mg/kg) (1.4 mg/kg in 2022) and 2.4 mg/kg (3.2 mg/kg in 2022), respectively (Figure 10). The chlorophyll content of No. 1 yellow mustard was similar to that observed in 2022 (0.7 mg/kg in 2023 versus 0.8 mg/kg in 2022) (Figure 10 and Table 2).

Fatty acid composition

Table 2 contains the fatty acid composition data for brown, oriental and yellow mustard samples received in 2023.

The oil of yellow mustard had more oleic acid (C18:1) and erucic acid (C22:1) than the oils of brown and oriental mustard. Concurrently, the amount of linoleic acid (C18:2) and alpha-linolenic acid (C18:3) was higher in brown and oriental mustard oils than in yellow mustard oil. The mean erucic acid content of No. 1 yellow mustard oil was 32.1% (33.5% in 2022), while the mean erucic acid content of brown and oriental mustard oils was 22.3% and 21.6%, respectively (22.3% and 20.7% in 2022, respectively). This resulted in a higher iodine value for the oil of yellow mustard (102.0 units in 2023 versus 101.4 units in 2022) and lower iodine values for the oils of brown mustard (117.7 units in 2023 versus 118.8 units in 2022) and oriental mustard (116.1 units in 2023 versus 116.8 units in 2022). The mean total saturated fatty acids levels ranged from 5.5% (yellow mustard oil) to 6.5% (oriental and brown mustard oils).

The erucic acid content of mustard seeds (g/kg) was calculated using the relative fatty acid composition of the oil and the oil content of the seeds. The results presented in Table 2 showed that in 2023, the erucic acid content of seeds ranged from 0.45 g/kg to 0.99 g/kg for No.1 western Canadian mustard.

There were some varietal differences in the distribution of fatty acids in the mustard samples. Cutlass oil contained more erucic acid and less oleic acid than Forge oil. The same trend was observed when comparing the oils of Centennial Brown and AAC Brown 18. The oil of Andante samples from Saskatchewan contained less oleic acid and more erucic acid than the oil of Andante samples from Alberta (25.6% versus 26.8% for oleic acid and 34.1% versus 32.7% for erucic acid). The total amount of mono-unsaturated fatty acids, however, was the same (73.1%). The oil of AAC Yellow 80 contained more oleic acid and less erucic acid than Andante oil.

Free fatty acid (FFA) content is an indicator of seed stress and oil degradation. In 2023, the mean FFA content of No. 1 mustard was low (0.05% to 0.14%), similar to what was observed in 2022 (0.06% to 0.13%). Samples of No. 1 brown mustard showed sprouting damage, but the mean FFA content of brown mustard was not statistically different from No. 1 oriental mustard. This suggests that sprouting was not the main parameter affecting FFA content. As in 2022, the 2023 brown mustard samples received by the Harvest Sample Program were from southwestern Saskatchewan and southeastern Alberta, where hot and dry conditions prevailed during most of the growing season. The high FFA content observed in the samples may be due to heat stress.

Table 1 Oil, protein and total glucosinolate¹ content of 2023 western Canadian mustard

Grade	Location	Number of samples	Oil content ² (%)			Protein content ³ (%)			Glucosinolate content (μmol/g) ⁴		
			Mean	Min ⁵	Max ⁶	Mean	Min	Max	Mean	Min	Max
Domestic Mustard Seed, Oriental, Canada											
No. 1	Canada	44	36.9	32.5	43.7	29.4	24.4	32.8	135	113	164
	Saskatchewan	40	37.2	32.5	43.7	29.2	24.4	32.8	135	113	134
	Alberta	4	34.4	33.8	36.1	31.7	30.9	32.4	139	133	160
No. 2	Canada	11	38.1	32.9	42.8	29.4	25.5	31.6	125	58	156
No. 3	Canada	3	38.5	35.5	40.6	30.1	28.4	31.3	129	122	138
Cutlass, No. 1	Canada	25	37.6	32.5	43.7	28.9	24.4	32.0	134	113	142
Forge, No. 1	Canada	9	35.8	33.0	38.2	30.3	28.3	32.8	137	123	164
Domestic Mustard Seed, Brown, Canada											
No. 1	Canada	68	33.4	29.9	39.2	31.2	26.6	34.2	131	86	139
	Manitoba	1	n/a ⁷	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Saskatchewan	64	33.5	29.9	39.2	31.1	26.6	33.7	130	86	139
	Alberta	4	31.6	30.2	37.1	33.2	28.4	34.2	146	113	138
No. 2	Canada	10	35.1	33.0	37.8	29.7	26.8	31.8	125	81	134
No. 3	Canada	5	33.6	31.0	35.7	31.3	30.2	32.3	130	120	134
AAC Brown 18, No. 1	Canada	12	34.3	29.9	39.2	30.4	26.6	33.6	133	111	137
Centennial Brown, No. 1	Canada	34	32.9	29.9	38.8	31.6	27.4	34.2	138	110	139
Domestic Mustard Seed, Yellow, Canada											
No. 1	Canada	72	26.3	22.8	28.5	35.2	28.6	40.0	147	n/a	n/a
	Saskatchewan	42	26.7	23.1	30.7	34.7	28.6	38.7	143	n/a	n/a
	Alberta	30	25.7	22.8	28.5	36.0	31.5	40.0	152	n/a	n/a
No. 2	Canada	24	25.6	23.1	26.9	36.0	29.3	39.6	150	n/a	n/a
No. 3	Canada	12	25.5	22.2	27.6	36.3	29.3	39.6	153	n/a	n/a
No. 4	Canada	10	28.0	24.4	26.3	33.4	28.3	37.5	140	n/a	n/a
Sample	Canada	5	28.4	24.1	25.7	33.5	31.4	37.6	147	n/a	n/a
Andante, No. 1	Canada	41	25.6	22.8	30.7	35.8	28.6	40.0	148	n/a	n/a
	Saskatchewan	22	25.3	23.1	30.7	36.0	28.6	38.7	150	n/a	n/a
	Alberta	19	25.9	22.8	28.5	35.6	33.0	40.0	146	n/a	n/a
AAC Yellow 80, No. 1	Canada	7	27.1	25.0	29.5	35.5	33.3	38.6	142	n/a	n/a

¹ No NIR models were developed to predict total glucosinolate content in yellow mustard.

² Determined on a dry matter basis.

³ Protein content calculated from nitrogen (N) content using N x 6.25 on a dry matter basis.

⁴ µmol/g = micromoles per gram; total glucosinolate content was calculated on a dry matter basis.

⁵ Min = minimum obtained from the NIR predictions.

⁶ Max = maximum obtained from the NIR predictions.

⁷ n/a = not applicable.

Table 2 Relative fatty acid composition of the oil, chlorophyll content, free fatty acid content and erucic acid content of 2023 western Canadian mustard

Grade	Location	Relative fatty acid composition (%) ¹					Iodine value (units)	Chlorophyll content (mg/kg ²)	FFA ³ (%)	C22:1 (g/kg, DM) ⁴
		C18:1	C18:2	C18:3	C22:1	Total SFA ⁵				
Domestic Mustard Seed, Oriental, Canada										
No. 1	Canada	22.0	22.9	11.0	21.6	6.5	116.1	0.9	0.11	0.45
	Saskatchewan	21.9	22.7	11.0	21.8	6.5	115.9	0.9	0.11	0.46
	Alberta	23.2	24.4	11.0	19.6	6.7	117.4	1.0	0.21	0.37
No. 2	Canada	21.1	22.2	11.8	22.6	6.3	116.9	2.5	0.15	0.49
No. 3	Canada	19.0	21.7	13.1	24.5	5.7	119.0	4.5	0.29	0.58
Cutlass, No. 1	Canada	21.1	22.2	11.3	22.7	6.5	115.9	1.1	0.10	0.49
Forge, No.1	Canada	24.3	24.1	10.3	19.4	6.7	116.1	0.4	0.12	0.36
Domestic Mustard Seed, Brown, Canada										
No. 1	Canada	20.9	21.7	12.3	22.3	6.5	117.7	2.4	0.14	0.48
	Saskatchewan	21.1	21.7	12.5	22.2	6.5	117.6	2.4	0.14	0.47
	Alberta	18.3	21.4	13.9	23.9	6.0	120.0	2.5	0.17	0.55
No. 2	Canada	26.1	23.2	13.0	16.7	6.9	120.2	1.4	0.10	0.27
Sample	Canada	26.3	24.1	13.3	15.6	7.2	121.5	4.3	0.11	0.23
AAC Brown 18, No.1	Canada	24.9	23.0	12.9	18.0	6.8	119.8	2.7	0.14	0.31
Centennial Brown, No.1	Canada	20.0	21.3	12.5	23.3	6.4	117.2	2.2	0.13	0.52
Domestic Mustard Seed, Yellow, Canada										
No. 1	Canada	27.5	10.3	10.0	32.1	5.5	102.0	0.7	0.05	0.99
	Saskatchewan	28.4	10.4	9.9	31.1	5.5	102.0	0.8	0.05	0.93
	Alberta	26.2	10.2	10.1	33.4	5.4	102.0	0.5	0.05	1.08
No. 2	Canada	25.9	10.0	10.5	33.6	5.3	102.5	0.9	0.07	1.09
No. 3	Canada	27.3	10.1	10.5	32.2	5.3	102.8	1.1	0.07	1.0
No. 4	Canada	27.3	10.0	10.6	32.1	5.3	102.9	3.3	0.16	0.99
Sample	Canada	28.6	10.3	10.5	30.6	5.5	103.1	2.6	0.12	1.00
Andante, No. 1	Canada	26.2	10.2	10.1	33.4	5.4	101.9	1.1	0.06	1.08
	Saskatchewan	25.6	10.2	10.2	34.1	5.4	101.9	1.4	0.06	1.12
	Alberta	26.8	10.3	10.0	32.7	5.5	101.8	0.7	0.07	1.08
AAC Yellow 80, No. 1	Canada	31.9	10.8	9.8	27.3	5.7	102.6	0.3	0.05	0.72

¹ Total fatty acids include oleic (C18:1), linoleic (C18:2), alpha-linolenic (C18:3) and erucic (C22:1).

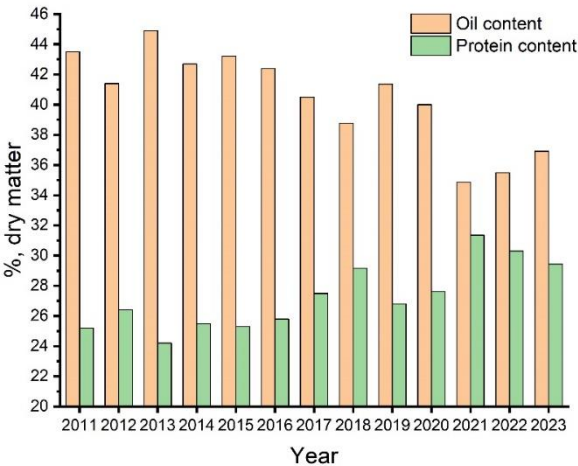
² mg/kg = milligrams per kilogram.

³ FFA = free fatty acids.

⁴ Erucic acid (grams per kilogram of seeds) was calculated using oil content and the erucic acid relative content, on a dry matter basis.

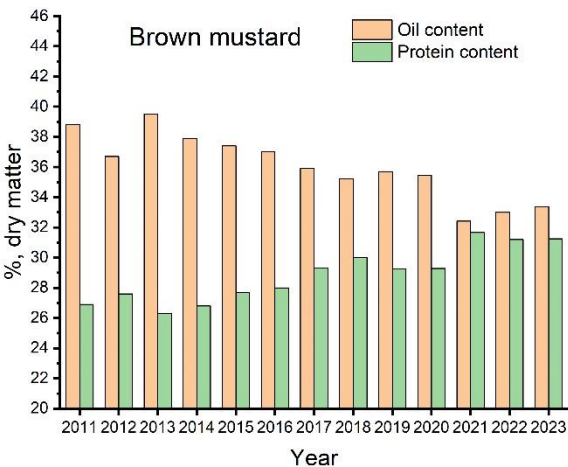
⁵ SFA = saturated fatty acids, total SFA are the sum of palmitic (C16:0), stearic (C18:0), arachidic (C20:0), behenic (C22:0) and lignoceric (C24:0).

Figure 6 Oil and protein content of oriental Domestic Mustard Seed, No. 1 Canada from 2011 to 2023 harvest samples



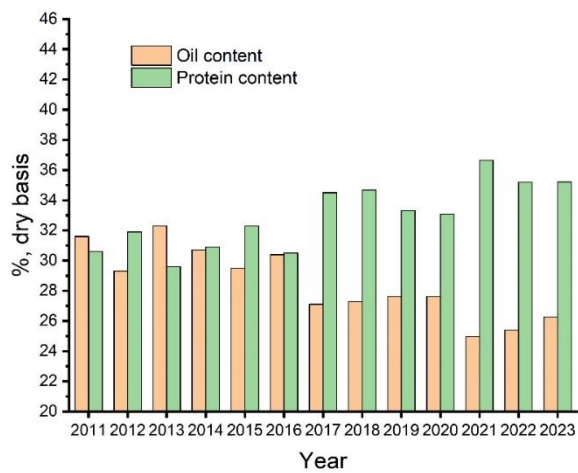
2023 oil content.....	36.9%	2023 protein content	29.4%
2022 oil content	35.5%	2022 protein content	30.3%
2013 to 2022 mean oil content	40.4%	2013 to 2022 mean protein content	27.4%

Figure 7 Oil and protein content of brown Domestic Mustard Seed, No. 1 Canada from 2011 to 2023 harvest samples



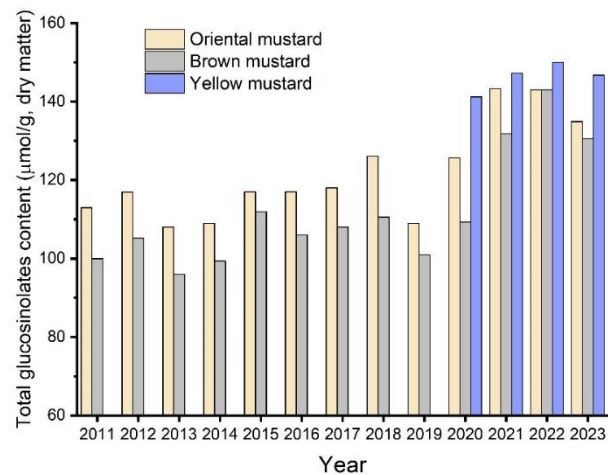
2023 oil content.....	33.4%	2023 protein content	31.2%
2022 oil content	33.0%	2022 protein content	31.2%
2013 to 2022 mean oil content.....	36.0%	2013 to 2022 mean protein content.....	29.0%

Figure 8 Oil and protein content of yellow Domestic Mustard Seed, No. 1 Canada from 2011 to 2023 harvest samples



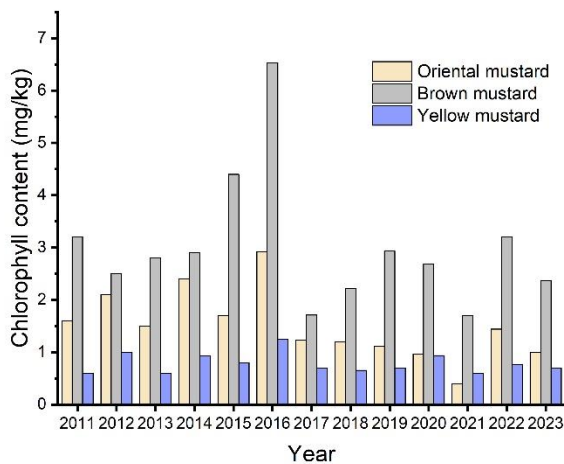
2023 oil content.....	26.3%	2023 protein content	35.2%
2022 oil content	25.4%	2022 protein content	35.2%
2013 to 2022 mean oil content.....	28.3%	2013 to 2022 mean protein content.....	33.1%

Figure 9 Total glucosinolate content of oriental, brown and yellow Domestic Mustard Seed, No. 1 Canada from 2011 to 2023 harvest samples



2023 total glucosinolate content of oriental mustard	135 µmol/g	2023 total glucosinolate content of brown mustard	131 µmol/g
2022 total glucosinolate content of oriental mustard	143 µmol/g	2022 total glucosinolate content of brown mustard	143 µmol/g
2013 to 2022 mean total glucosinolate content of oriental mustard	122 µmol/g	2013 to 2022 mean total glucosinolate content of brown mustard	112 µmol/g
2023 total glucosinolate content of yellow mustard	147 µmol/g		
2022 total glucosinolate content of yellow mustard	150 µmol/g		
2021 total glucosinolate content of yellow mustard.....	147 µmol/g		

Figure 10 Chlorophyll content of oriental, brown and yellow Domestic Mustard Seed, No. 1 Canada from 2011 to 2023 harvest samples



2023 chlorophyll content of oriental mustard	1.0 mg/kg	2013 to 2022 mean chlorophyll content of oriental mustard	1.5 mg/kg
2023 chlorophyll content of brown mustard	2.4 mg/kg	2013 to 2022 mean chlorophyll content of brown mustard	3.1 mg/kg
2023 chlorophyll content of yellow mustard	0.7 mg/kg	2013 to 2022 mean chlorophyll content of yellow mustard	0.8 mg/kg

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