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Quality of western Canadian canola 2022

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Canada

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Summary

In 2022, there was a higher percentage of samples that graded Canola, No. 1 Canada (92.9%) compared to 2021 (90.6%) and the 5-year mean (87.1%; Table 1). Manitoba had the lowest percentage (89.3%) of canola samples that graded No. 1 (84.2% in 2021), followed by Alberta-Peace River with 91.7% (93.9% in 2021) and Saskatchewan with 95.8.% (94.3% in 2021). Crop districts No. 7 and No. 3 from Manitoba and No. 5 from Alberta-Peace River had the lowest percentages of canola samples that graded No. 1 (76.7%, 78.1%, 78.9%, respectively).

In western Canada, the canola crop graded No. 1 was characterized by a mean oil content that was higher than that for the 2021 crop (42.1% versus 41.3%) and a much lower mean protein content (22.4% versus 24.0%; Table 1). The mean chlorophyll content for No. 1 canola was slightly lower in 2022 (9 milligrams per kilogram (mg/kg)) than in 2021 (10 mg/kg; Table 1). In 2022, the mean total seed glucosinolate content (12 micro-mole per gram (µmol/g)) was identical to that in 2021 (12 µmol/g).

The fatty acid compositions of the 2022 and 2021 crops are presented in Table 1. The 2022 mean oleic acid content was slightly higher than in 2021 (64.6% versus 64.2%) and higher than the 5-year-mean (63.5%). Alpha-linolenic acid content in 2022 was slightly lower than in 2021 (8.2% versus 8.6%). Mean linoleic acid content was also lower in 2022 when compared to the 2021 value (18.1% versus 18.7%). Total saturated fatty acid content for the 2022 canola crop was slightly higher than in 2021 (6.9% versus 6.6%). This resulted in a slightly lower iodine value for the 2022 canola crop when compared to 2021 (109.5 units versus 110.9 units).

Mean free fatty acid content in No. 1 canola seed (0.26%) was slightly higher than in 2021 (0.24%; Table 1) with some Manitoba crop district means as high as 0.70%.

Table 1 Quality data for 2022 and 2021 harvest samples and 5-year means for Canola, No. 1 Canada

Quality parameter	2022	2021	2017 to 2021 mean
Number of samples received	1,895	2,185	2,346
Number of samples graded Canola, No. 1 Canada	1,761	1,979	2,385
Percentage of samples graded Canola, No. 1 Canada	92.9	90.6	87.1
Oil content (%, 8.5% moisture)	42.1	41.3	43.8
Protein content[1] (%, 8.5% moisture)	22.4	24.0	21.3
Oil-free protein of the meal (%, 12% moisture)[2]	39.9	42.0	39.2
Chlorophyll content (mg/kg[3] in seed)	9	10	11
Total seed glucosinolates (µmol/g[4], 8.5% moisture)	12	12	10
Oil-free total glucosinolates of the meal (µmol/g, 8.5% moisture)	21	20	19
Free fatty acids (%)	0.26	0.24	0.17
Oleic acid (% in oil)	64.6	64.2	63.5
Linoleic acid (% in oil)	18.1	18.3	18.5
α-Linolenic acid (% in oil)	8.2	8.6	9.2
Erucic acid (% in oil)	0.00[5]	0.01	0.00[5]
Total saturated fatty acids[6](% in oil)	6.9	6.6	6.6
Iodine value (unit of oil)	109.5	110.9	112.0
Total monounsaturated fatty acids (MUFA)[7] (% in oil)	66.1	65.8	65.1
Total polyunsaturated fatty acids (PUFA)[8] (% in oil)	26.3	27.0	27.7

[1] protein content calculated from nitrogen (N) content using N x 6.25

[2] trading rules for the North American sale of canola meal requires that calculations for protein claims must be reported on a 12% moisture basis with N x 6.25

[3] mg/kg = milligrams per kilogram

[4] µmol/g = micromoles per gram

[5] level was below the limit of quantification

[6] total saturated fatty acids are the sum of lauric (C12:0), myristic (C14:0), palmitic (C16:0), stearic (C18:0), arachidic (C20:0), behenic (C22:0) and lignoceric (C24:0)

[7] total monounsaturated fatty acids are the sum of palmitoleic (C16:1), oleic (C18:1), eicosenoic (C20:1), erucic (C22:1) and nervonic (C24:1) acids

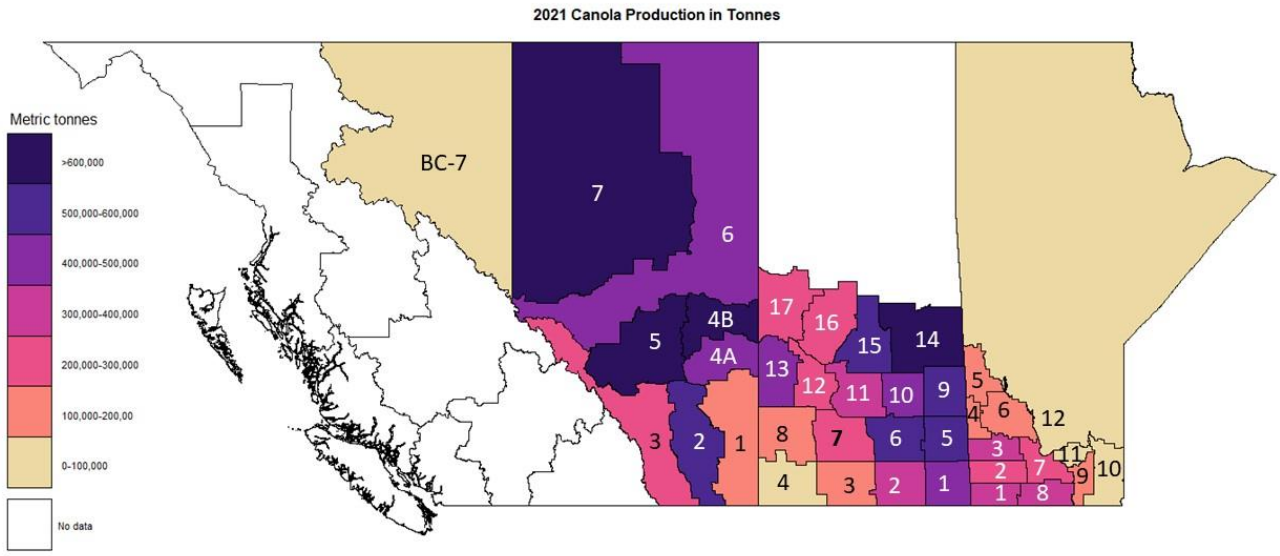
[8] total polyunsaturated fatty acids are the sum of linoleic (C18:2), α-linolenic (C18:3) and eicosadienoic (C20:2) acids

Introduction

This report presents quality data and information based on the Canadian Grain Commission's 2022 Harvest Sample Program results for western Canadian canola. Canola samples were submitted throughout the harvest period by producers, grain companies and oilseed crushing companies. The following canola quality parameters were measured: oil, protein, chlorophyll, total glucosinolates, free fatty acids and fatty acid composition.

Figure 1 shows the distribution of the 2021 canola production in western Canada according to crop districts in Manitoba and Alberta, and census agricultural regions (CARs) in Saskatchewan. Prior to 2018, all production reporting in the prairie provinces was based on small area data (SAD) that corresponded to crop districts. In 2018, Statistics Canada began using CAR to describe production areas in Saskatchewan instead of SAD. The new CAR approach did not correspond well with the crop districts in Saskatchewan, affecting the comparison of historical data. Samples received from the Peace River area of British Columbia (crop district No. 8) were combined with Alberta (crop district No. 7) samples. Data on the quality of theses samples are listed under Alberta-Peace River.

Figure 1 2021 canola production (tonnes) in western Canada according to crop districts (Manitoba and Alberta-Peace River) and census agricultural regions (Saskatchewan)



Weather and production review

The agroclimate maps (Figures 2 to 5) were obtained from Agriculture and Agri-Food Canada. Seeding and harvest progress graphs for each province (Figures 6a and 6b) were made using data reported by the provincial reports for Manitoba, Saskatchewan and Alberta. The number of hectares (ha) seeded with canola (Figure 7a) and production data (Figure 7b) were obtained from Statistics Canada.

Seeding

The season started with below normal temperatures in April and May (Figure 2), which delayed seeding by about a week in Alberta and Saskatchewan (Figure 6a). Seeding progressed quickly in southern Alberta, whereas the central, northwestern and northeastern parts of the province were still experiencing cold weather and delayed snow melt. However, 98.9% of seeding in Alberta was completed by the first week of June (Figure 6). Widespread rains in June (Figure 3) allowed the seeded crop to develop.

In Saskatchewan, seed progress was slower than normal this year (Figure 6a). Rains in the eastern part of the province improved the soil moisture conditions but slowed the seeding progress. By the end of May, producers were wrapping up their seeding in the western part of the province but the eastern part was only 50% complete. In early June, some fields in the western part of the province were showing signs of drought but in the eastern parts it was uncertain whether some fields would be seeded due to excess moisture. By mid-May, seeding was considered complete in Saskatchewan with 98% of the crop in the ground.

In Manitoba, extreme cold temperatures associated with large amounts of snow left fields unable to drain and dry properly before seeding. In May, Manitoba also experienced heavy rains that caused overland flooding and field saturation (Figure 3). This delayed the start of seeding by about a month (Figure 6a). Heavy rains also occurred in June (Figure 3), slowing the progress of seeding in Manitoba. By June 28, the Manitoba Crop Report stated that only 93% of the canola crop was seeded (Figure 6a).

Growing season

Alberta received much rain over the entire province in June but precipitation was variable in July and there was almost no rain in August (Figure 3). Warmer than normal temperatures accelerated crop development and 90% of canola fields were forming seed pods by early August. There was a once-in-50 years heat wave (Figure 2) with a significant number of days over 30°C (Figure 5) and a lack of moisture in the southeastern part of the province in August (Figure 3). By the end of August, the canola harvest had started in southern Alberta (Figure 6b).

In Saskatchewan there were warmer than normal temperatures in July (Figure 2). Some areas received too much moisture while others received too little (Figure 3) with crops experiencing drought-like conditions.

Manitoba experienced hot and humid conditions that brought unstable weather with a significant amount of precipitation (Figure 3) during the entire growing season. Crop development was quite uneven with some fields showing crop stress due to too much water early in the season.

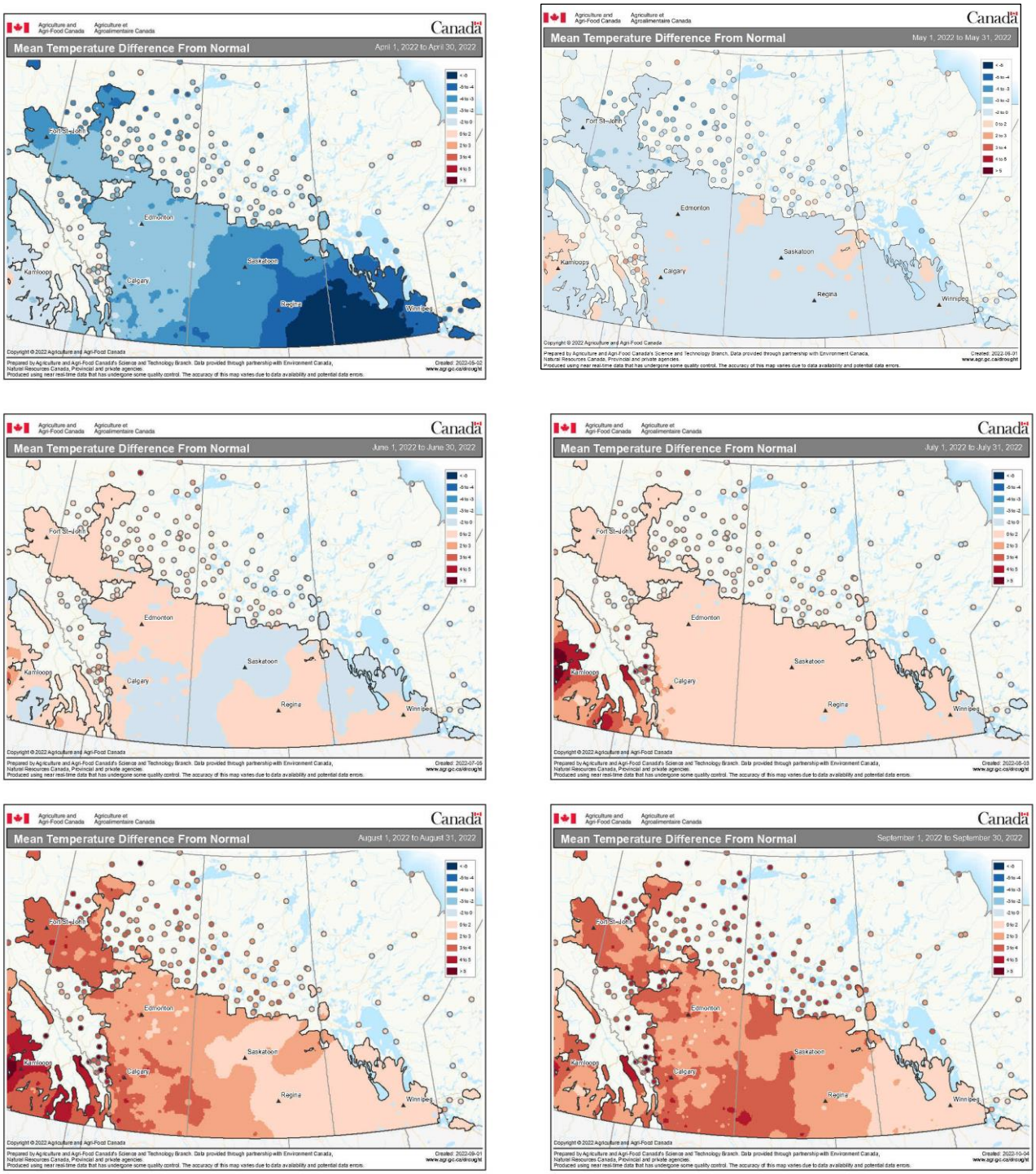
Harvest conditions

Once started, the harvest progressed quickly in Alberta due to below normal precipitation and warm temperatures (Figure 2). Similar to 2021, the harvest was considered complete by the first week of October (Figure 6b).

In Saskatchewan, the harvest began in the first week of October, which was earlier than usual. By the first week of September, over half of the canola fields in southwestern Saskatchewan were harvested while in the northeastern part of the province harvesting had just begun. In mid-September, rains slowed and sometimes stopped harvest but this was followed by warm and dry conditions that helped producers complete their harvest in early October.

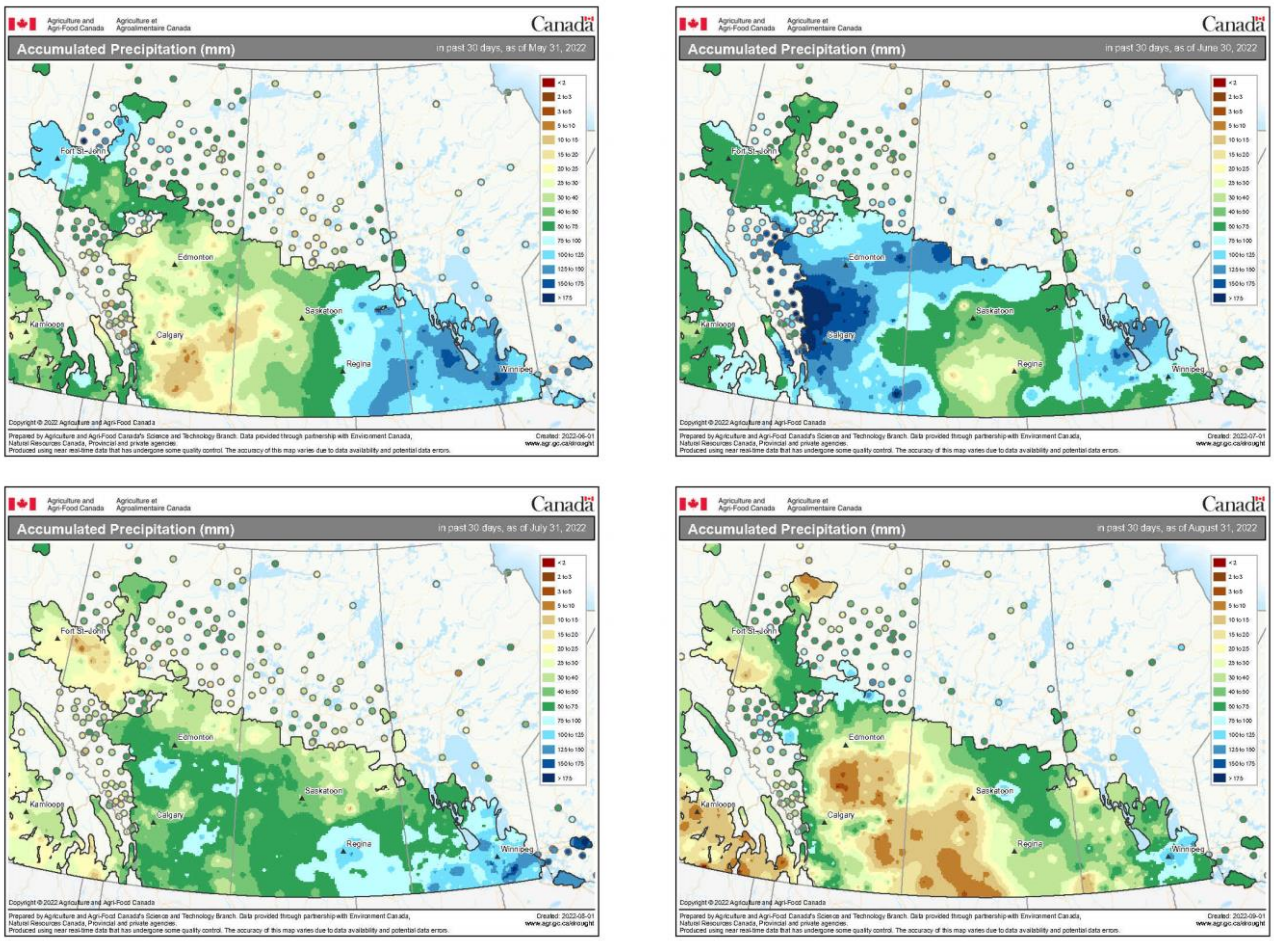
In Manitoba, the canola harvest started the first week of September, which was much later than normal (Figure 6b). By the third week of September, steady widespread rains caused harvest progress to almost stop for about a week. A warmer than normal October (Figure 2) allowed harvest to proceed and the harvest was considered complete by the end of October, much later than normal (Figure 6b).

Figure 2 Mean temperature differences from normal in the prairie region from April 1 to September 30, 2022



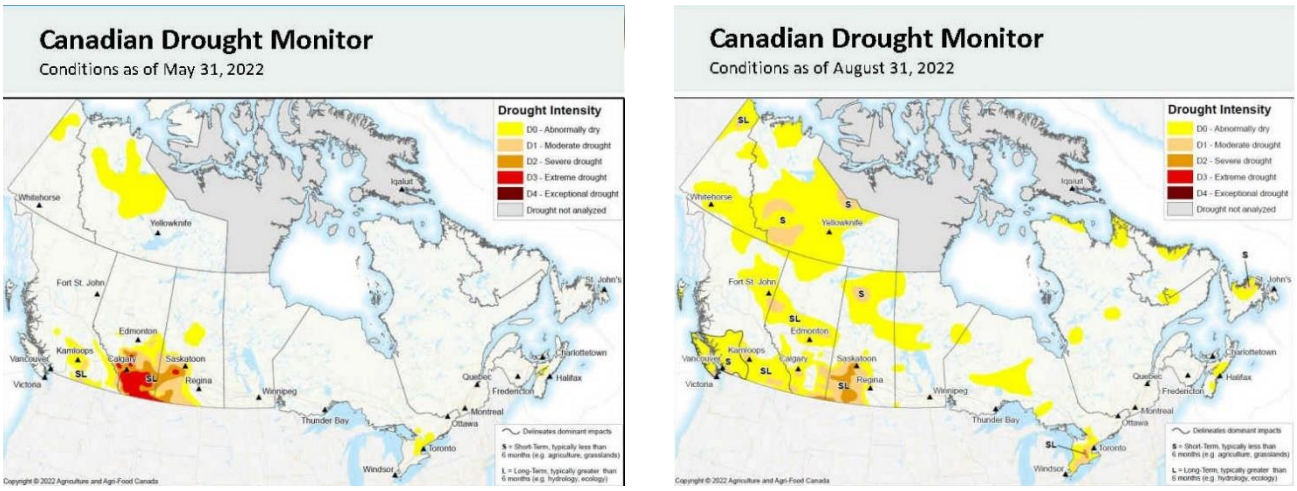
Source: [Drought watch and agroclimate, Agriculture and Agri-food Canada]

Figure 3 Accumulated precipitation (mm) in the prairie region from May 1 to August 31, 2022



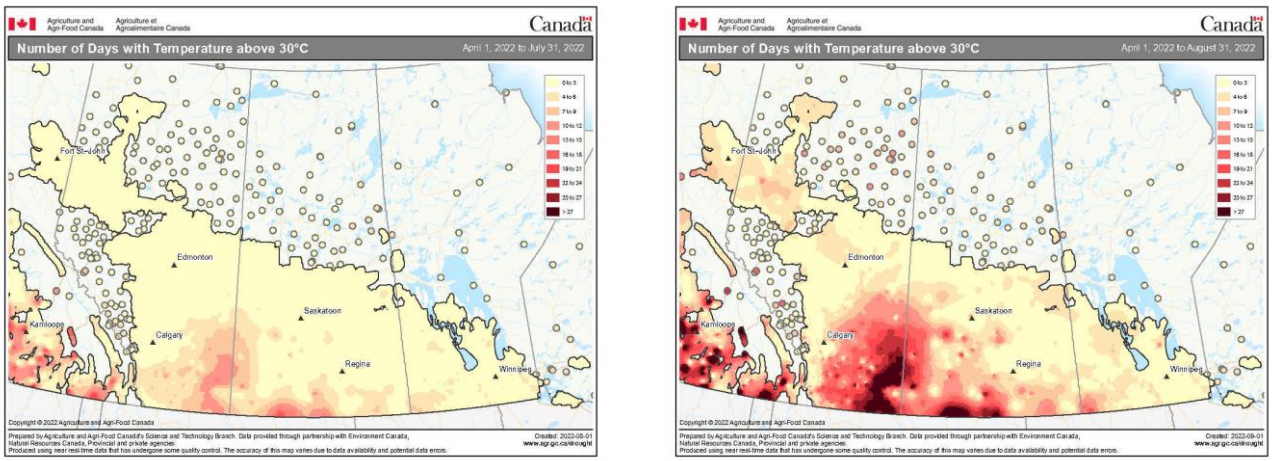
Source: [Drought watch and agroclimate, Agriculture and Agri-food Canada]

Figure 4 Drought intensity in Canada on May 31 and August 31, 2022



Source: Drought watch and agroclimate, Agriculture and Agri-food Canada

Figure 5 Number of days with temperatures above 30°C in the prairie region from April 1 to July 31 and April 1 to August 31, 2022



Source: Drought watch and agroclimate, Agriculture and Agri-food Canada

Figure 6a Seeding progress in Manitoba, Saskatchewan and Alberta during the 2021 and 2022 growing seasons

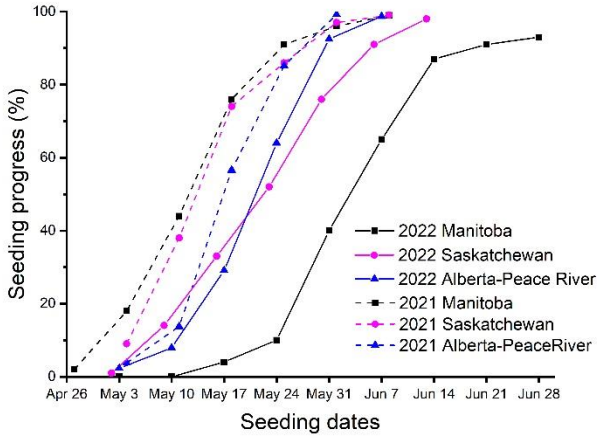
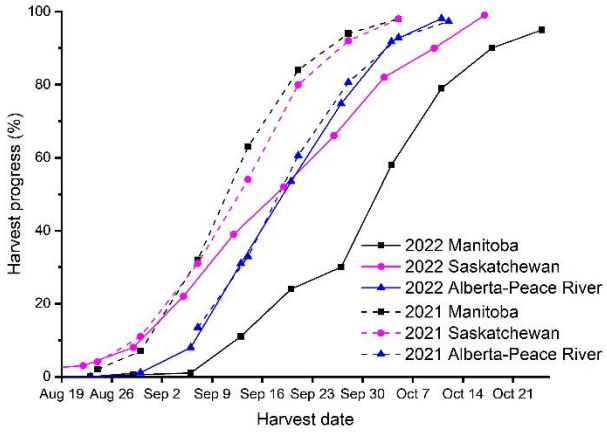


Figure 6b Harvest progress in Manitoba, Saskatchewan and Alberta during the 2021 and 2022 growing seasons



Production

The number of hectares seeded with canola in Canada since 2000 is presented in Figure 7a. In 2022, it was estimated that canola producers seeded approximately 356,900 ha less than in 2021 (8,658,600 versus 9,015,600 ha). This is approximately 2.8% less than the 5-year average of 8,908,600 ha and 573,600 ha less than the record set in 2017 when 9,313,400 ha of canola were seeded (Figure 7a).

Statistics Canada estimated the average yield of canola in western Canada to be 2,114 kilograms per hectare (kg/ha). This is much higher than the yield reported in 2021 (1,537 kg/ha) and almost similar to the 5-year average yield (2,160 kg/ha). The yield in 2022 showed a large increase compared to 2021 but was still lower than the yields observed from 2015 to 2020 when average yields ranged from 2,200 to 2,400 kg/ha. In 2022, the highest average yield was reported in Manitoba at 2,208 kg/ha (1,662 kg/ha in 2021 and 2,321 kg/ha in 2020), followed by Alberta at 2,134 kg/ha (1,551 kg/ha in 2021 and 2,253 kg/ha in 2020) and Saskatchewan at 2,076 kg/ha (1,231 kg/ha in 2021 and 2,395 kg/ha in 2020). This year, the lowest yield was observed in British Columbia at 1,699 kg/ha, which is a slight improvement compared to 2021 (1,600 kg/ha) but similar to what was recorded in 2020 (1,681 kg/ha).

As of February 2022, Statistics Canada reported an estimated Canadian canola production of 18.173 million metric tonnes (MMT). This is more than 4.41 MMT higher than the 2021 production (13.757 MMT), which was the lowest in the last 10 years (Figure 7). The 2022 production is still lower than the 5-year average (19.067 MMT) by about 893,426 tonnes. Since 2017, the decrease in canola production in Canada (Figure 7) has been attributed to the decrease in area seeded with canola combined with adverse growing conditions.

In 2022, Saskatchewan grew 52.5% of the canola in Canada (47.5% in 2021 and 54.5% in 2020). Alberta, Manitoba and British Columbia grew 30.8%, 15.8% and 0.4%, respectively (33.1%, 18.2% and 0.5% in 2021, respectively)

Figure 7a Area seeded with canola (hectares) in western Canada from 2000 to 2022

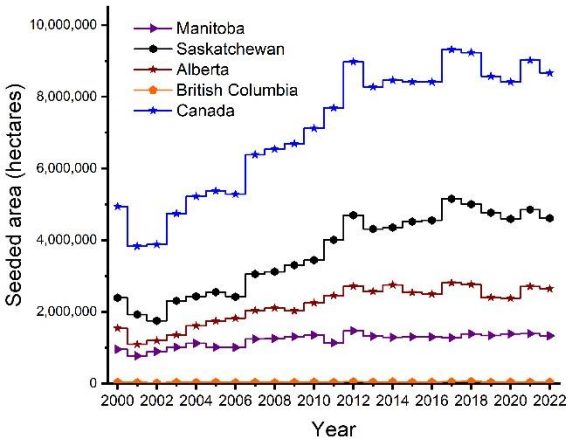
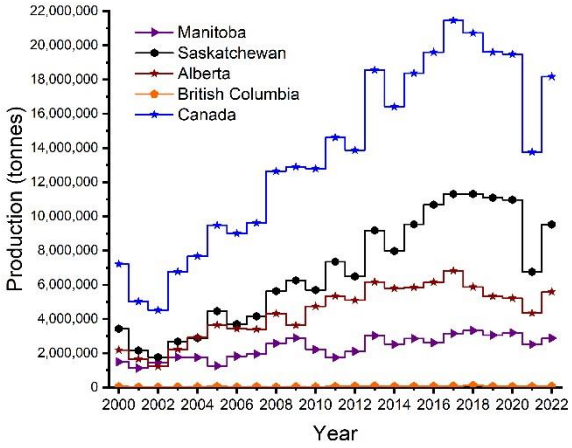


Figure 7b Canola production (metric tonnes) in western Canada from 2000 to 2022



Harvest samples and grade distribution

The Canadian Grain Commission's Harvest Sample Program collected canola samples from producers, crushing plants and grain handling offices across western Canada. The samples were cleaned to remove dockage prior to grading and testing. Canadian Grain Commission grain inspectors assigned grades based on Chapter 10 (Canola and rapeseed) of the Official Grain Grading Guide.

Individual harvest samples were analysed for oil, protein, chlorophyll and total glucosinolates using a near-infrared (NIR) spectrometer. This report, however, is based on the analyses, by reference methods, of composite samples. Composites were prepared by combining:

- Canola, No. 1 Canada samples by provincial crop district or CARs
- Canola, No. 2 and Canola, No. 3 Canada samples by province
- Canola, Sample Canada samples prepared for western Canada

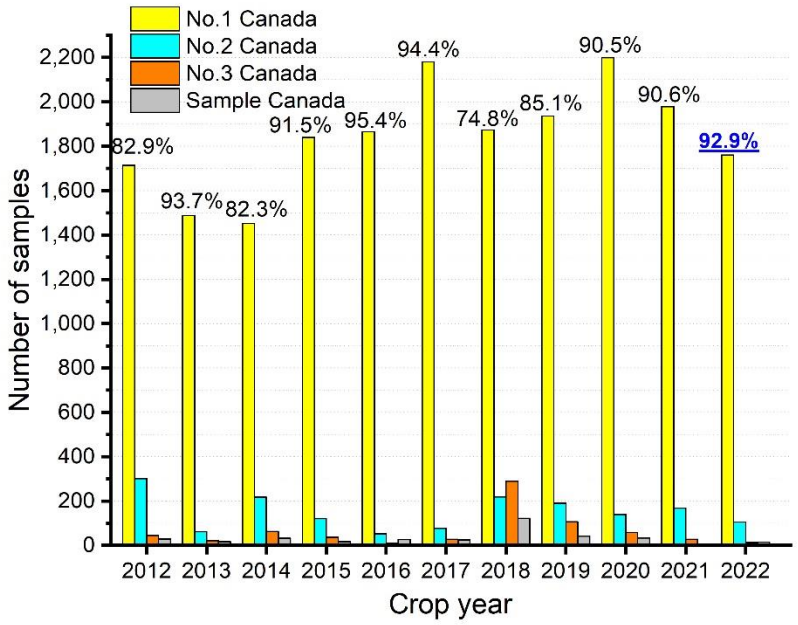
Oil, protein and total seed glucosinolate content are reported on an 8.5% moisture basis to permit annual and regional comparisons. Protein content of oil-free meal is reported on a 12% moisture basis, while the glucosinolate content of oil-free meal is reported on an 8.5% moisture basis to reflect meal-trading rules established by the Canadian Oilseed Processors Association (COPA).

Quality data for Manitoba and Alberta crop districts and Saskatchewan CARs can be acquired through the Canadian Grain Commission. Canola variety data is also published yearly.

This report for the 2022 harvest is based on the analyses of 1,895 individual canola samples which included 1,761 that were graded No.1 (Table 1). Composites of No. 1 canola were made from samples from each crop district and from each province. Crop district composites of No. 1 canola samples were prepared using 1,742 samples. Specialty oil samples, such as high oleic acid, low linolenic acid and high erucic acid, are excluded from this report. In 2022, we received 290 less samples than in 2021 which represents 451 less samples than the 5-year mean (Table 1). We received only half the number of the samples from CARs No. 5, 7 and 12 in Saskatchewan compared to 2021.

Exports of commercially clean (CC) canola from August 2022 to December 2022 had a mean dockage of 1.39% and ranged from 0.60% to 2.50%. This negatively affected quality factors such as oil, chlorophyll and free fatty acid content. Canola exports containing more than 2.5% dockage are considered not commercially clean (NCC) and the values of their quality parameters are usually reduced even further.

Figure 8 Number of canola samples received by the Harvest Sample Program and their grade distribution from 2012 to 2022



In 2022, 92.9% of the canola harvest samples were graded No. 1. This is 2.3% higher than in 2021 (90.6%) and 5.8 % higher than the 5-year mean of 87.1% (Figure 8). The grade distribution of the 2022 canola crop varied greatly between provinces and between crop districts within a province. Distinctly green (DGR) seed count,

oxidized brown seeds, sprouting and admixture were the main degrading factors observed in the 2022 canola crop. The level of DGR seed was 0.56% (0.60% in 2021) for No. 1 canola, 3.13% (2.70% in 2021) for No. 2 canola, 7.33% (7.10% in 2021) for No. 3 canola and 0.94% (3.70% in 2021) for Sample grade.

It is important to note that the numbers of samples in each grade or province may not be representative of the total production or grade distribution. There were sufficient samples, however, to provide good quality information for each province and grade. Provincial and western Canadian means were calculated using the quality results for each crop district or CAR, weighted with the production data (5-year mean) and the grade percentile per crop district or CAR.

Quality characteristics

Tables 2 and 3 contain detailed information on the quality of western Canadian canola harvested in 2022, while Table 4 compares the quality of harvest samples to recent canola exports.

Oil content

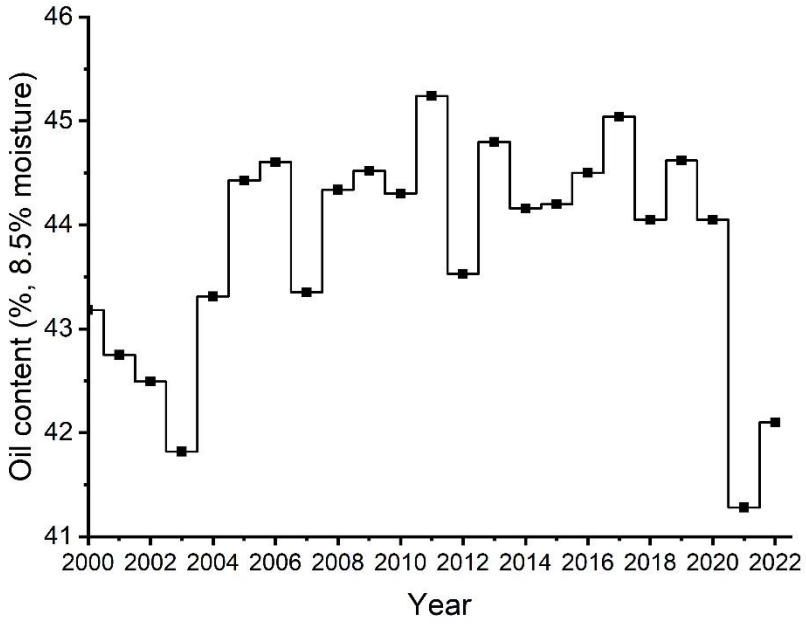
In 2022, canola graded No.1 had an oil content of 42.1%. This is slightly higher than the 2021 mean of 41.3% but still much lower than the 5-year mean of 43.8% (Table 1). The 2022 mean oil content for No. 1 canola was the third lowest recorded since 2000, just ahead of 41.3% in 2021 and 41.8% in 2003 (Figure 9). In 2022, just over 32% of canola samples graded No. 1 had an oil content higher than the 5-year mean.

Canola graded No. 1 from the Alberta-Peace River region had a mean oil content of 42.6% (41.6% in 2021), higher than canola No. 1 from Manitoba (42.1%; 41.1% in 2021) and Saskatchewan (41.9%; 41.1% in 2021) (Table 2). The oil content of individual canola samples graded No. 1 ranged from 39.3% to 49.2% in Manitoba (36.2% to 47.2% in 2021), 34.9% to 48.2% in Saskatchewan (33.9% to 49.4% in 2021) and 35.5% to 48.7% in the Alberta-Peace River region (34.2% to 48.9% in 2021) (Table 2).

In 2022, the oil content of No. 2 canola (41.7%) was lower than that of No. 1 canola (42.1%). Oil content for canola, samples graded No. 2 from western Canada ranged from 35.4% to 47.2% compared to 34.2% to 48.9% in 2021 (Table 2). In 2022, the mean oil content for canola graded No. 3 and Sample was 42.3% and 42.1%, respectively.

Oil content is influenced by both genetic and environmental factors. For any known canola variety, hot and dry growing conditions rather than cool conditions, will result in canola seeds with lower oil content. 2022 was another very dry season. Seeds were planted in fields suffering from extreme drought in Alberta and moderate to severe drought in most of Saskatchewan (Figure 4). Most fields in Manitoba received extreme rain falls (Figure 3). Temperatures were above normal in July, August and September in all 3 provinces. There were less days over 30°C than last year, but a significant number of days over 30°C (Figure 5) were still recorded post flowering, especially in Alberta and the western part of Saskatchewan. Combined with a lack of precipitation during the 2022 growing season (Figure 3), the warm weather was again responsible for an oil content lower than the 5-year mean. Precipitation was extremely localized in 2022, especially in Alberta and Saskatchewan, and this explains why some samples still had a high oil content.

Figure 9 Oil content of seed (%, 8.5% moisture) for Canola, No. 1 Canada



The mean oil content of CC No.1 canola exports was 41.3% for December 2022 and 41.0% for August to November 2022 (Table 4). Compared to the oil content from harvest samples, the CC and the NCC exports of No.1 canola had a lower mean oil content due to dilution from dockage. Harvest samples are completely clean (0.00% dockage). Mean dockage for the CC exports was 1.31% for December 2022 and 1.41% for August to November 2022. Dockage for the 2021 to 2022 shipping season was 1.64% (Table 4). NCC exports had a mean dockage of 2.94% for August to December 2022 (Table 4). The exports from the beginning of this year's shipping season showed an increase in oil content compared to last year, which corresponds to the increase in oil content found in the 2022 harvest samples.

Protein content

The mean protein content of canola seeds (8.5% moisture) and the calculated protein content of oil-free meal (12% moisture) from 2000 to 2022 are presented in Figures 10a and 10b, respectively. The mean crude protein content was 22.4% for No. 1 canola, 22.9% for No. 2 canola, 22.1% for No. 3 canola and 22.0% for canola graded Sample (Table 2). Mean protein seed content for No. 1 canola in 2022 was much lower than the record high observed in 2021 (22.4% versus 24.0%) but still higher than the 5-year mean of 21.3% (Table 1 and Figure 10a). Protein content of individual producer samples ranged from 15.5% to 29.7% for No. 1 canola and from 17.9% to 29.3% for No. 2 canola. The protein content of No. 3 canola and Sample grade canola ranged from 18.9% to 28.2% and 20.0 to 25.0%, respectively (Table 2).

Research has shown that there is a strong inverse relationship between oil content and protein content in canola seeds. In 2022, seed oil content was 0.9% higher than in 2021 and seed protein content concurrently decreased by 1.6% compared to 2021.

The seed mean protein content of CC exports of No. 1 canola was 22.9% for December 2022 and 23.6% for August to November 2022 (Table 4). Mean protein content for the latest shipping season (August to December 2022) was lower than that for last year's shipping season (23.69% for August 2021 to July 2022), which is consistent with the 2022 canola protein content of harvest samples (Table 4).

Figure 10a Protein content of seed (%, 8.5% moisture) for Canola, No. 1 Canada

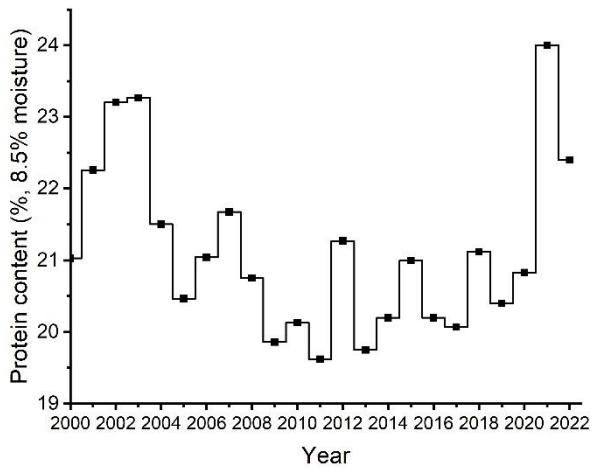
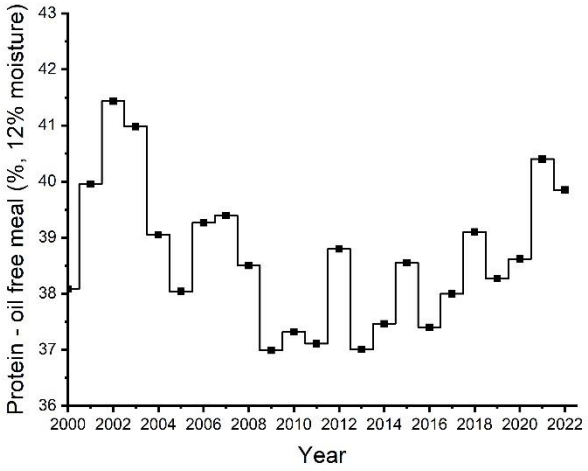


Figure 10b Protein content of meal on oil-free basis (%, 12% moisture) for Canola, No. 1 Canada



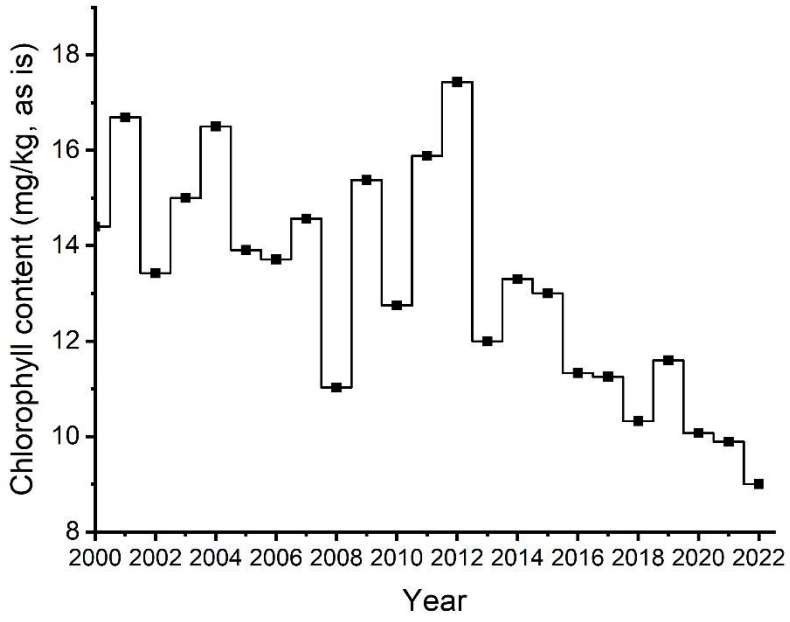
The calculated meal protein content, on an oil-free basis, is the maximum protein content of a theoretical meal that would be obtained if a crushing plant was able to extract 100% of the oil from the seeds. In 2022, the protein content calculated on an oil-free meal at 12% moisture was 39.9%. This is significantly lower than the 2021 value of 42.0% but higher than the 5-year mean of 39.2% (Table 1 and Figure 10b). The calculated protein content of the oil-free meal at 12% moisture was highest for samples from Alberta-Peace River (40.4%), followed by Saskatchewan (39.8%) and Manitoba (38.9%). CC exports of No. 1 canola had a calculated mean meal protein content (oil-free, 12% moisture) of 40.7% and 39.9% for August to November 2022 and December 2022, respectively. These results are lower than the value of 42.8% determined for the last shipping season (August 2021 to July 2022) for CC exports of No. 1 canola (Table 4).

Chlorophyll content

In 2022, the mean chlorophyll content for harvest samples graded No. 1 was 9 milligrams per kilogram (mg/kg), and 9 mg/kg in Manitoba, Saskatchewan and Alberta-Peace River (Table 2). This is lower than the mean for the 2021 harvest (10 mg/kg), lower than the 5-year mean (11 mg/kg, Table 1) and the lowest mean chlorophyll content observed in the last 10 years (Figure 11). Individual samples of No. 1 canola showed variations in chlorophyll content due to variable growing conditions. Chlorophyll content values of No. 1 canola samples ranged from 4 mg/kg to 43 mg/kg, 4 mg/kg to 42 mg/kg and 4 mg/kg to 43 mg/kg in Manitoba, Saskatchewan and Alberta, respectively (Table 2). Historical means of chlorophyll content vary greatly from year to year (Figure

11) due to the variability in growing conditions. High chlorophyll content is usually related to delays in seeding due to cold temperatures and rain, poor growing conditions due to lack of heat units or an early frost. These conditions did not occur in Saskatchewan and Alberta in 2022. There was a delay in seeding in Manitoba due to flooded fields but warmer than normal temperatures until the end of October allowed the crop to mature without issues. No crop district in Manitoba and Alberta or CAR in Saskatchewan showed a mean chlorophyll higher than 15 mg/kg.

Figure 11 Chlorophyll content of seed (mg/kg, as is moisture) for Canola, No. 1 Canada



Mean chlorophyll levels for canola samples graded No. 2 (Table 2) was 22 mg/kg, which is slightly higher than that observed in 2021 harvest samples (19 mg/kg). Canola samples graded No. 3 and Sample had an average chlorophyll content of 35 mg/kg and 17 mg/kg, respectively, which is similar to what was observed in 2021 (37 mg/kg and 12 mg/kg).

Canola graded No. 1, must contain no more than 2.00% distinctly green (DGR) seeds. The mean DGR content in No. 1 canola samples in 2022 was 0.80% (0.61% in 2021), 0.48% (0.50% in 2021) and 0.59% (0.74% in 2021) for Manitoba, Saskatchewan and Alberta-Peace River, respectively.

The chlorophyll content of Canadian canola exports is affected by DGR and dockage content. The mean DGR content was 0.6%, 0.8% and 0.8% for December 2022 CC canola exports, August to November 2022 CC canola exports, and August to December 2022 NCC canola exports, respectively (Table 4). The mean chlorophyll content was slightly higher for the NCC export samples with similar DGR content (0.8%) and higher dockage content (2.94%) than the CC export and the harvest samples (Table 4).

Glucosinolate content

The mean total glucosinolate content of canola seeds at 8.5% moisture and the calculated mean total glucosinolate content of canola meal (after oil removal) at 8.5% moisture from 2000 to 2022 are presented in Figure 12a and Figure 12b, respectively.

In 2022, canola No. 1 seeds (Table 2) had a mean glucosinolate content of 12 micromoles per gram of seeds (µmol/g), higher than the 2021 mean of 11 µmol/g of seeds and the 5-year mean of 10 µmol/g of seeds. This is the highest mean glucosinolate content since 2015 (Figure 12a). Saskatchewan CAR No. 12 (Saskatchewan S012) and Alberta crop district No. 1 (Alberta 1) had the highest total glucosinolate content at 18 µmol/g of seeds.

The December 2022 and the August to November 2022 CC canola exports had a mean total glucosinolate content of 12 µmol/g of seed, which is slightly higher than last year's shipping season (10 µmol/g; Table 4).

In 2022, 12 µmol/g of total glucosinolates in seed corresponded to 21 µmol/g total glucosinolates in oil-free meal on an 8.5% moisture basis (Table 1). This is higher than both the 5-year mean (19 µmol/g) and the 2021 harvest mean (20 µmol/g) (Figure 12b and Table 1). Total glucosinolates in Canadian canola meal obtained from conventional crushing plants (expeller press followed by solvent extraction) is much lower than this calculated value. The calculated values assume that 100% of the oil is recovered from the seed during crushing and that no glucosinolates are destroyed during processing, which is never the case.

Research done in Australia showed that for canola, the total glucosinolate content for a given variety can be affected by environmental conditions. It was found that hot and dry conditions post flowering led to an increase in glucosinolate content in the seeds. In 2022, both Alberta 1 and Saskatchewan S012 experienced severe to extreme drought at the beginning of the growing season and severe drought at the end of the growing season (Figure 4). Figure 5 also shows that there were a significant number of days with temperatures over 30°C in August in Alberta and parts of Saskatchewan. It is likely that heat and lack of moisture were responsible for the increase in total glucosinolates observed this year.

Figure 12a Total glucosinolate content of seed (µmol/g, 8.5% moisture) for Canola, No. 1 Canada

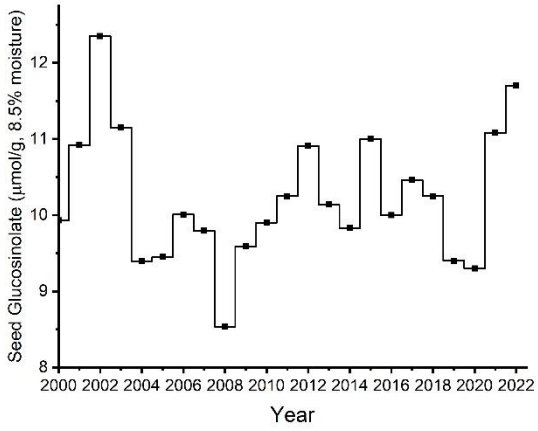
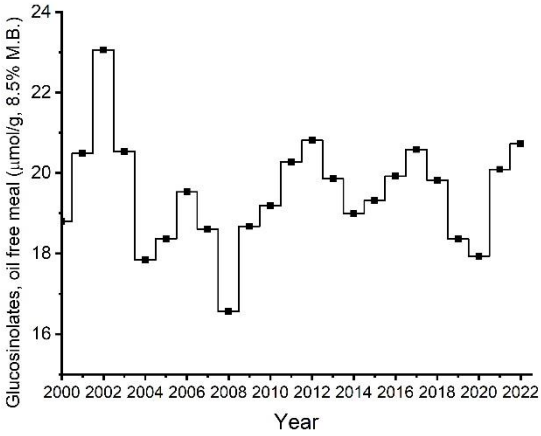


Figure 12b Total oil-free glucosinolate content of meal (µmol/g, 8.5% moisture) for Canola, No. 1 Canada



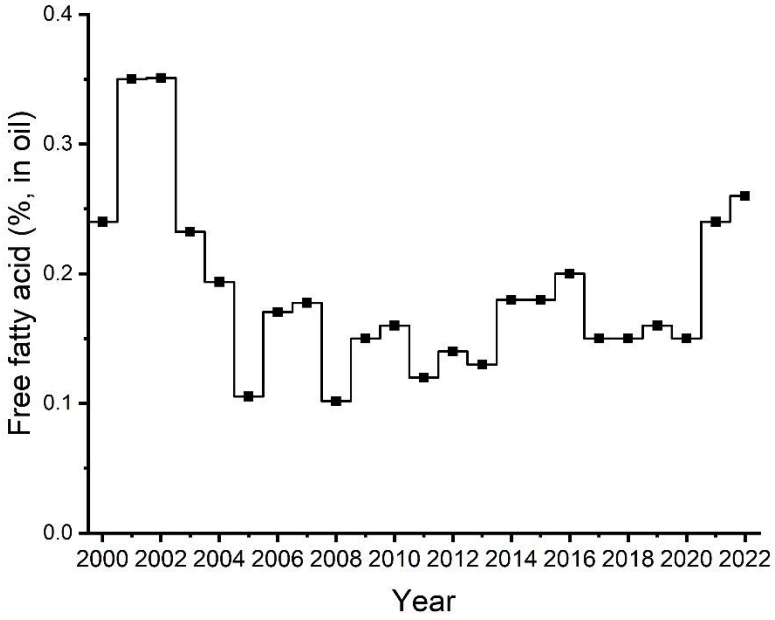
Free fatty acid content

In 2022, the mean free fatty acid (FFA) content of oil in canola graded No. 1 was 0.26%. This is similar to 2021 (0.24%) but much higher than the 5-year mean of 0.17% (Table 1 and Figure 13). The mean FFA content for No. 1 canola samples (Table 2) from Manitoba (0.47% in 2022 versus 0.31% in 2021) was higher than that for Alberta-Peace River (0.31% in 2022 versus 0.29% in 2021). Both were much higher than the Saskatchewan value of 0.16% (0.18% in 2021). All canola samples graded No. 1 from Manitoba had higher FFA content than the Canadian mean (0.26%). The FFA content ranged from 0.25% to 0.71%, which may pose a problem for local crushers.

Overall, canola samples graded No. 2 had a higher mean FFA content than those graded canola No. 1 (0.62% in 2022 versus 0.26% in 2021) as seen in Table 2. Samples from Manitoba had the highest mean (1.03%).

Plant stress and seed sprouting, due to hot and dry growing conditions and rain at harvest, can often lead to an increase in FFA content. In 2022, the Manitoba harvest stopped for about a week due to rain (Figure 6b). It is likely that the wet seeds started to germinate, but germination stopped when the seeds were harvested and dried, resulting in high FFA content. A low level of sprouting was observed in many canola samples from Manitoba.

Figure 13 Free fatty acid content (% in oil, as oleic acid) for Canola, No. 1 Canada



The mean FFA level of CC canola No. 1 was 0.27% for the December 2022 exports and 0.30% for the August to November 2022 exports (Table 4). FFA levels of individual CC canola No. 1 export samples ranged from 0.14% to 0.53%.

It has been observed that FFA levels can increase during the shipping season. Storage conditions can activate hydrolytic enzymes in seeds which leads to an increase in FFA production. FFA content could vary considerably from each load throughout the entire shipping season.

Fatty acid composition

The mean erucic acid (C22:1) content of the 2022 canola crop was below the limit of quantification. Over the last several years, the mean erucic acid content in canola samples graded No. 1 ranged from below the limit of detection to 0.01% (Tables 1 and 3, Figure 14a). These low values are a direct result of breeding efforts by the Canadian canola industry.

In 2022. the mean α-linolenic acid (C18:3) content of No. 1 canola was 8.2%, lower than the 2021 mean (8.6%) and much lower than the 5-year mean (9.2%; Table 1 and Figure 14b). Samples from Saskatchewan had the lowest mean α-linolenic acid content (8.1%). Manitoba samples had a slightly higher α-linolenic acid content (8.3%,) and samples from Alberta-Peace River had the highest average (8.6%; Table 3). This year, location had little effect on the mean α-linolenic acid content, which ranged from 7.3% to 9.0%.

In 2022, the mean oleic acid (C18:1) content of canola samples graded No. 1 was 64.6%, higher than the 2021 mean (64.2%) and the 5-year mean (63.5%; Table 1 and Figure 14c). The lowest mean oleic acid content was found in samples from Manitoba (64.2% in 2022 versus 64.3% in 2021) and the highest mean was from Alberta-Peace River (65.1% in 2022 versus 63.8% in 2021, Table 3).

The total monounsaturated fatty acid (MUFA) content in 2022 was 65.8% in Manitoba (65.9% in 2021), 66.2% in Saskatchewan (66.0% in 2021) and 66.4% in Alberta-Peace River (65.4% in 2021). The mean for western Canada was 66.0% (66.0% in 2021; Table 3).

In 2022, linoleic acid (C18:2) content (Figure 14d) followed a similar pattern to α-linolenic acid content (Figure 14b) in response to breeding and the hot and dry growing conditions, which are known to reduce the linoleic acid content in canola seeds. This year's mean was the lowest from the last 10 years at 18.1% (Figure 14d).

In 2022, the mean total polyunsaturated fatty acid (PUFA) content was 26.6% in Manitoba (26.9% in 2021), 26.2% in Saskatchewan (26.9% in 2021) and 26.2% in Alberta-Peace River (27.4% in 2021). This resulted in an overall mean of 26.3% for western Canada (27.0% in 2021; Table 1 and Table 3). In canola, PUFA content is directly related to α-linolenic acid (C18:3) and linoleic acid (C18:2) content. After flowering, the hot temperatures in August 2022 combined with drought like conditions, especially in Alberta and Saskatchewan (Figure 5), led directly to a PUFA content in canola that was even lower than in 2021. In 2022, we did not observe a difference in PUFA content between northern and southern areas as temperatures were higher than normal over the entire canola growing region, especially in the Peace River area (Figure 2).

Fatty acid composition (oleic acid, linoleic acid and α-linolenic acid) in the 2022 crop differed from that in 2021. There was a 0.4% increase in oleic acid and a 0.3% and 0.5% decrease in linoleic acid and α-linolenic acid, respectively. As a result, the iodine value, which represents the degree of unsaturation in oil, was lower in 2022 (109.5 units) compared to 2021 (110.9 units) (Table 1). The 2022 iodine value was 2.5 units lower than the 5-year mean of 112.0 units (Table 1). It was the lowest iodine value observed since 2000 (Figure 14e).). For No. 1 canola, the mean iodine value in units was 109.8 (110.6 in 2021), 109.3 (110.5 in 2021) and 110.2 (111.7 in 2021) for Manitoba, Saskatchewan and Alberta-Peace River, respectively (Table 3). This year, the iodine value of individual canola samples graded No. 1 ranged from 104.2 to 117.8 units while in 2021 they ranged from 104.5 to 119.1 units. Canola samples graded No. 2 had a slightly higher iodine value, higher linoleic and α-linolenic acid content, and lower oleic acid content than samples of canola No. 1 (Table 3).

The mean saturated fatty acid (SFA) content was 6.9% in 2022, which is higher than the 2021 mean of 6.6% and the 5-year mean of 6.6% (Tables 1 and 3, Figure 14f). Since 2009, the mean SFA content varied from 6.6% to 6.9% (Figure 14f). In 2022, the mean SFA content was 6.9% in samples from both Manitoba and Saskatchewan but lower (6.5%) in Alberta-Peace River samples (Table 3).

The fatty acid composition of the 2022 harvest corresponded well with the fatty acid composition from the August to December 2022 exports compared to last year's shipping season (Table 4). Oleic acid was higher and α-linolenic acid and iodine value were lower when compared to the 2021 to 2022 shipping season.

Figure 14a Erucic acid content (% in oil) for Canola, No. 1 Canada

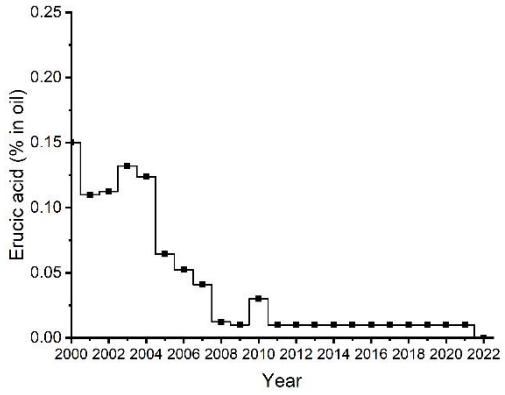


Figure 14b Alpha-linolenic acid content (% in oil) for Canola, No. 1 Canada

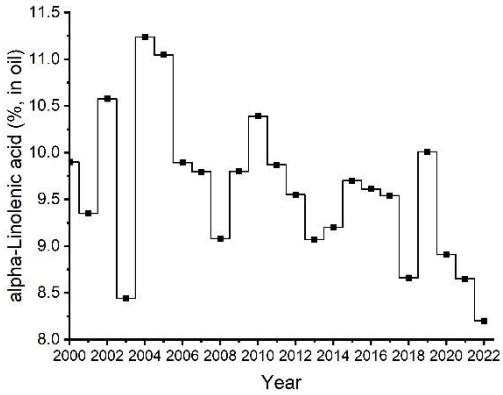


Figure 14c Oleic acid content (% in oil) for Canola, No. 1 Canada

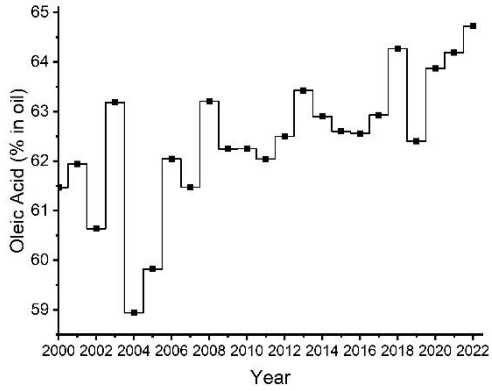


Figure 14d Linoleic acid content (% in oil) for Canola, No. 1 Canada

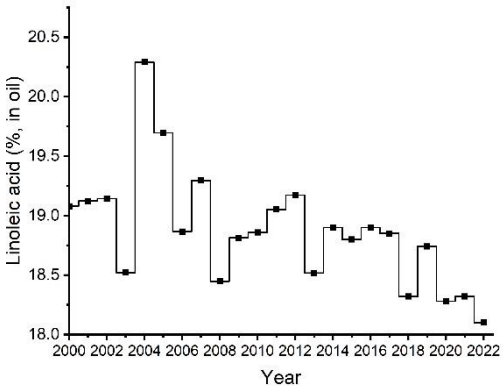


Figure 14e Iodine value (units in oil) for Canola, No. 1 Canada

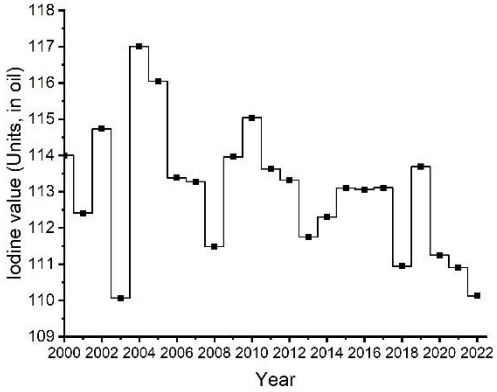


Figure 14f Saturated fatty acid content (% in oil) for Canola, No. 1 Canada

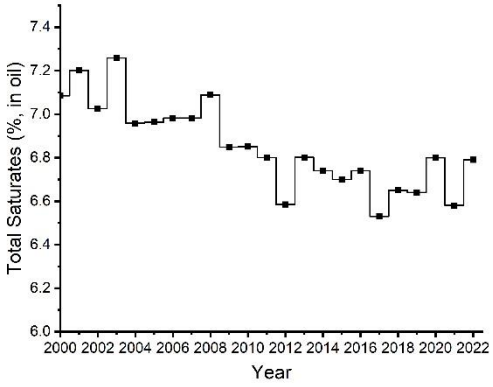


Table 2 Oil, protein, chlorophyll and total glucosinolate content of seeds and free fatty acid content of oil in 2022 canola harvest samples according to grade and province

Grade	Province	Number of samples	Oil content[1] %			Protein content[2] %			Chlorophyll content[3] mg/kg[4]			Glucosinolates µmol/g[5]			Free fatty acids (%)
			Mean	Min[6]	Max[6]	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Canola, No. 1 Canada	Manitoba	335	42.0	39.3	49.2	21.8	16.4	26.3	9	4	43	11	3	27	0.47
	Saskatchewan	757	41.9	34.9	48.2	22.4	16.1	29.7	9	4	42	12	4	26	0.16
	Alberta-Peace River[7]	650	42.6	35.5	48.7	22.5	16.7	29.3	9	4	43	12	4	22	0.31
	Western Canada[8]	**1,742**	**42.1**	**34.9**	**49.2**	**22.4**	**16.1**	**29.7**	**9**	**4**	**43**	**12**	**3**	**27**	**0.26**
Canola, No. 2 Canada	Manitoba	33	41.7	39.6	45.8	22.3	20.1	25.0	20	6	46	10	5	14	1.03
	Saskatchewan	25	41.6	35.4	46.5	22.7	17.9	28.1	22	5	56	10	6	20	0.28
	Alberta-Peace River	43	41.8	37.0	47.2	23.6	19.8	29.3	24	4	48	14	6	26	0.65
	Western Canada	**101**	**41.7**	**35.4**	**47.2**	**22.9**	**17.9**	**29.3**	**22**	**4**	**56**	**13**	**5**	**26**	**0.62**
Canola, No. 3 Canada	Manitoba	6	40.6	40.0	44.4	23.0	21.8	23.8	37	27	51	9	9	11	0.46
	Saskatchewan	3	45.5	43.7	46.3	20.3	18.9	22.6	30	4	58	11	8	11	0.12
	Alberta-Peace River	4	41.6	40.1	44.7	23.5	21.5	28.2	41	18	69	12	10	13	0.43
	Western Canada	**13**	**42.7**	**40.0**	**46.3**	**22.1**	**18.9**	**28.2**	**35**	**4**	**69**	**11**	**8**	**13**	**0.32**
Canola, Sample Canada	**Western Canada**	**14**	**42.3**	**40.8**	**45.6**	**22.0**	**20.0**	**25.0**	**17**	**7**	**36**	**10**	**4**	**14**	**0.44**

[1] 8.5% moisture basis
[2] calculated from nitrogen (N) content using N x 6.25, 8.5% moisture basis
[3] as-is moisture basis
[4] mg/kg = milligrams per kilogram
[5] µmole/g = micromoles per gram
[6] Min = minimum, Max = maximum
[7] includes part of the Peace River area that is in British Columbia
[8] values are weighted averages based on production by province as estimated by Statistics Canada

Table 3 Main fatty acid composition, total SFA[1], PUFA[2] and MUFA[3] content and iodine value of oil in 2022 canola harvest samples according to grade and province

		Relative fatty acid composition of oil (%)															
		Oleic acid (C18:1)			Linolenic acid (C18:2)			Alpha-linolenic acid (C18:3)			Erucic acid (C22:1)	SFA[1]	PUFA[2]	MUFA[3]	Iodine value[4] (units)		
Grade	Province	Mean	Min[5]	Max[5]	Mean	Min	Max	Mean	Min	Max	Mean	Mean	Mean	Mean	Mean	Min	Max
Canola, No. 1 Canada	Manitoba	64.2	58.5	67.5	18.1	16.0	21.3	8.3	6.8	11.3	0.00	6.9	26.5	65.8	109.8	105.9	117.7
	Saskatchewan	64.6	59.8	68.7	18.0	15.9	20.6	8.1	5.7	12.1	0.00	6.9	26.2	66.2	109.3	104.2	117.4
	Alberta- Peace River[6]	65.1	59.6	68.6	17.6	15.7	20.4	8.6	5.9	11.8	0.02	6.4	26.2	66.6	110.2	104.4	117.8
	Western Canada[7]	**64.6**	**58.5**	**68.7**	**18.1**	**15.7**	**21.3**	**8.2**	**5.9**	**12.1**	**0.00**	**6.9**	**26.3**	**66.1**	**109.5**	**104.2**	**117.8**
Canola, No. 2 Canada	Manitoba	62.7	57.7	67.0	18.8	16.4	20.4	8.9	7.4	11.6	0.03	6.8	27.8	64.4	111.3	107.3	118.4
	Saskatchewan	63.5	58.4	67.5	18.6	16.2	20.3	8.7	7.3	11.4	0.03	6.8	27.3	65.1	110.9	106.7	117.0
	Alberta- Peace River	64.0	59.7	67.9	18.0	16.5	20.5	8.7	6.8	11.4	0.04	6.7	26.7	65.6	110.2	106.3	117.7
	Western Canada	**63.5**	**57.7**	**67.9**	**18.4**	**16.2**	**20.5**	**8.7**	**6.8**	**11.6**	**0.03**	**6.8**	**27.2**	**65.1**	**110.7**	**106.3**	**118.4**
Canola, No. 3 Canada	Manitoba	61.7	60.0	64.5	18.8	17.3	19.3	10.1	8.7	12.0	0.02	6.8	28.9	63.5	113.5	110.1	118.1
	Saskatchewan	64.5	63.3	64.5	17.9	18.2	18.6	8.6	8.7	9.6	0.00	6.8	26.5	66.0	110.3	110.3	112.6
	Alberta-Peace River	63.0	60.6	65.2	18.1	17.2	20.0	9.6	8.6	10.7	0.00	6.8	27.8	64.7	112.0	109.9	115.5
	Western Canada	63.1	**60.0**	**65.2**	**18.2**	**17.2**	**20.0**	**9.4**	**8.6**	**12.0**	**0.01**	**6.8**	**27.7**	**64.8**	**111.9**	**109.9**	**118.1**
Canola, Sample Canada	**Western Canada**	**63.9**	**61.7**	**66.7**	**18.3**	**16.0**	**19.2**	**8.7**	**7.9**	**12.0**	**0.01**	**6.7**	**27.0**	**65.4**	**110.6**	**108.1**	**114.5**

[1] SFA = saturated fatty acids (total SFA are the sum of lauric (C12:0), myristic (C14:0), palmitic (C16:0), stearic (C18:0), arachidic (C20:0), behenic (C22:0) and lignoceric (C24:0) acids

[2] PUFA = polyunsaturated fatty acids (total PUFA are the sum of linoleic (C18:2), α-linolenic (C18:3) and eicosadienoic (C20:2) acids)

[3] MUFA = monounsaturated fatty acids (total MUFA are the sum of palmitoleic (C16:1), oleic (C18:1), eicosenoic (C20:1), erucic (C22:1) and nervonic (C24:1) acids)

[4] calculated from fatty acid composition

[5] Min = minimum, Max = maximum

[6] includes part of the Peace River area that is in British Columbia

[7] values are weighted averages based on production by province as estimated by Statistics Canada

Table 4 Comparison of quality data from 2022 harvest samples and recent export shipments for Canola, No. 1 Canada

Quality parameter	2022 Harvest Sample Program	Commercially clean exports			Not commercially clean exports
		December 2022	August to November 2022	Previous shipping season 2021-2022	August to December 2022
Oil content[1] (%)	42.1	41.1	41.0	41.3	40.1
Protein content[2] (%)	22.4	22.9	22.9	23.6	22.4
Oil-free protein content[3] (%)	39.9	39.9	40.7	42.8	39.7
Chlorophyll[4] (mg/kg[5] seed)	9	10	10	13	16
Total glucosinolates[6] of seeds (µmol/g seed[7])	12	10	10	11	9
Free fatty acids (% in oil, as oleic acid)	0.26	0.27	0.30	0.33	0.50
Erucic acid (% in oil)	0.00	0.01	0.02	0.04	0.02
Oleic acid (% in oil)	64.6	65.0	64.9	63.8	63.8
α-Linolenic acid (% in oil)	8.2	8.1	8.1	9.1	8.2
Total saturates[8] (% in oil)	6.9	6.9	6.8	6.6	6.9
Iodine value[9] (units in oil)	109.5	109.1	109.4	111.6	109.6
MUFA[10] (% in oil)	66.1	66.6	66.5	65.5	66.1
PUFA[11] (% in oil)	26.3	25.8	26.0	27.3	26.3
Distinctly green seed (DGR, %)	0.6	0.6	0.8	0.8	0.8
Dockage (%)	NA[12]	1.31	1.41	1.64	2.94
Loading moisture (%)	NA	7.32	7.52	7.8	8.0
Number of export samples	NA	15	70	113	14
Tonnage (tonnes)	NA	580,065	2,330,169	3,847,609	360,118

[1] 8.5% moisture basis
[2] calculated from nitrogen (N) content using N x 6.25, 8.5% moisture basis
[3] calculated nitrogen (N) content using N x 6.25, 12% moisture basis
[4] as-is moisture basis
[5] mg/kg = milligram per kilogram
[6] 8.5% moisture basis
[7] µmol/g seed = micromoles per gram of seed
[8] total saturated fatty acids are the sum of lauric (C12:0), myristic (C14:0), palmitic (C16:0), stearic (C18:0), arachidic (C20:0), behenic (C22:0) and lignoceric (C24:0) acids
[9] calculated from fatty acid composition
[10] MUFA = monounsaturated fatty acids (total MUFA are the sum of palmitoleic (C16:1), oleic (C18:1), eicosenoic (C20:1), erucic (C22:1) and nervonic (C24:1) acids)
[11] PUFA = polyunsaturated fatty acids (total PUFA are the sum of linoleic (C18:2), α-linolenic (C18:3) and eicosadienoic (C20:2) acids)
[12] NA = Not applicable

Acknowledgments

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