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# Quality of western Canadian lentils 2022

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Canada

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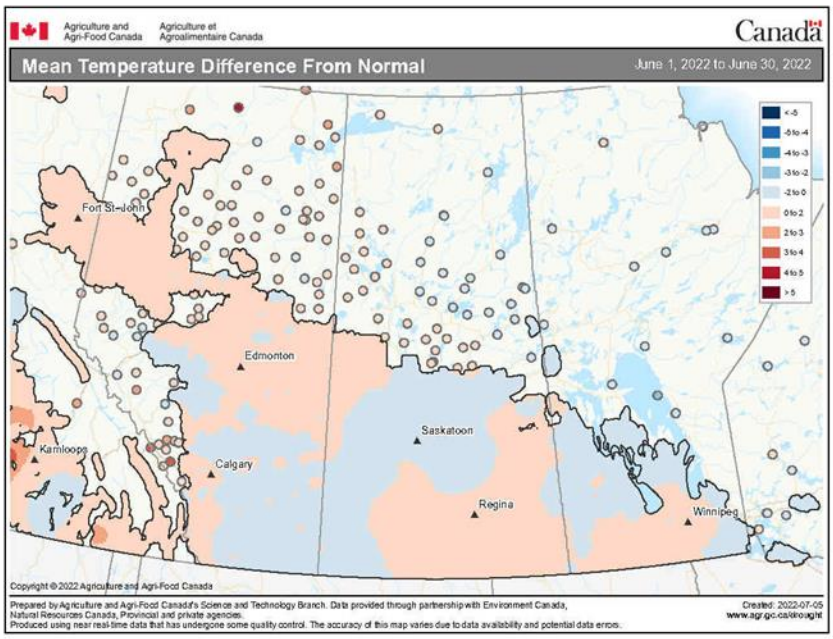
# Introduction

This report presents data on the quality of lentils grown in western Canada in 2022. Samples were submitted to the Harvest Sample Program by lentil producers and analysed by the Canadian Grain Commission.

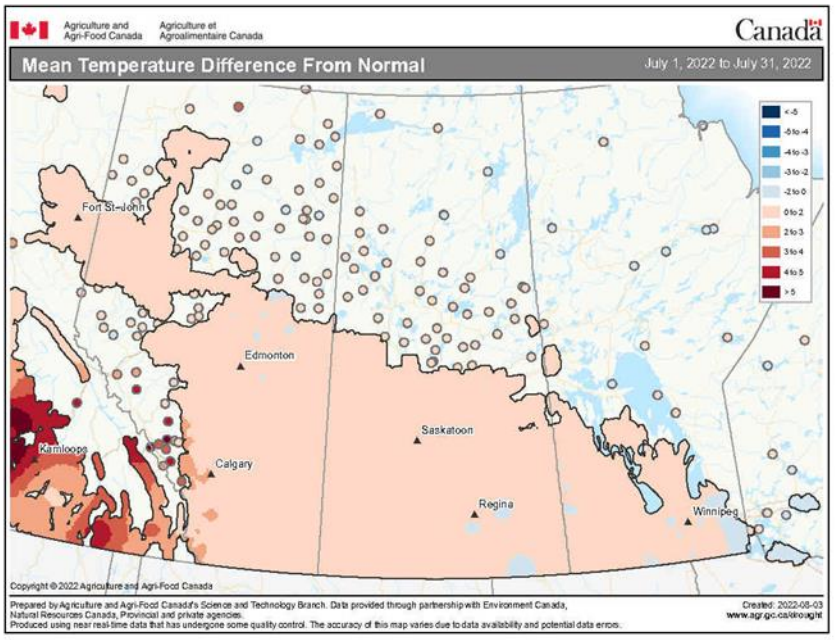
# Growing and harvesting conditions

Figures 1 and 2 show the monthly mean temperature differences from normal in the prairie region during the 2022 growing season (June and July). Figure 3 displays the total precipitation in the prairie region from April 1 to October 31, 2022.

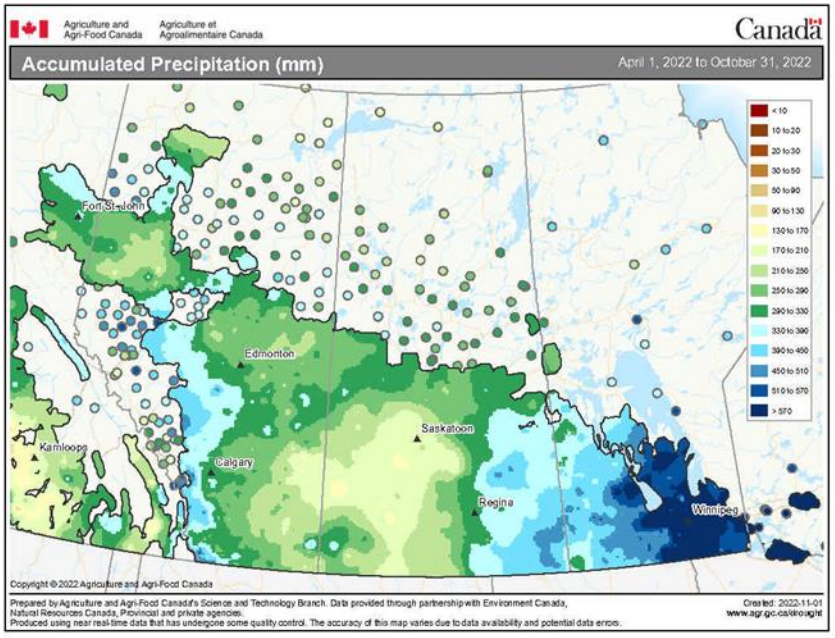
## Figure 1 Mean temperature difference from normal in the prairie region from June 1 to June 30, 2022



## Figure 2 Mean temperature difference from normal in the prairie region from July 1 to July 31, 2022




## Figure 3 Total precipitation in the prairie region from April 1 to October 31, 2022



In some areas of Manitoba, a cool and wet spring resulted in flooded fields that saturated soil and delayed seeding for up to 4 weeks. Some fields near Lake Manitoba and the northern Interlake region were left unseeded due to the wet conditions. A warm summer (Figures 1 and 2) allowed lentil crops to develop as expected for that time of year. In the northwest region, the harvesting of pulses such as lentils started by mid-August and was completed by mid-September with above average yields. For crops in other areas, the harvest period was extended to the end of October due to late seeding and late September rains (Figure 3).

In the southwest and west-central regions of Saskatchewan, seeding began in late April and continued until early May. Wet and cold conditions in the eastern part of the province (Figure 3) delayed seeding, which was not completed until early June. Warm temperatures and timely rainfalls during the summer resulted in good crop growth and helped fill seed pods, except in the southwest and west-central regions. Crops in these two regions ripened prematurely due to high temperatures and a lack of moisture (Figures 2 and 3) which resulted in an early lentil harvest with low yields. Harvesting of lentils in the rest of the province was completed in late September with above average yields. Due to high humidity, crops harvested at the end of September were damp and required aeration before storage.

In Alberta, the growing season started with cool and dry conditions except for the Peace region which had wet conditions (Figure 3). Most of the province was dry at the end of May, especially southern Alberta, but June was wetter than normal. Temperatures were above average throughout July (Figure 2). Precipitation during June and early July improved soil moisture but by mid-July soil moisture started to deteriorate. It was warm and dry during the harvest season and harvesting was completed two to three weeks earlier than normal. In general, the yields of lentil crops were above the 5-year provincial average.

# Production

Lentil production in 2022 was estimated to be 2.3 million tonnes, which was 43.3% higher than in 2021 and 0.6% less than the 10-year average of 2.3 million tonnes (Table 1). Production was higher in 2022 due to a 43.3% increase in yield from 2021. Saskatchewan continued to be the leader in lentil production in western Canada, accounting for 85.4% of production, while Alberta accounted for 14.6%.

## Table 1 Production statistics for 2022 western Canadian lentils (green and red combined) [1]

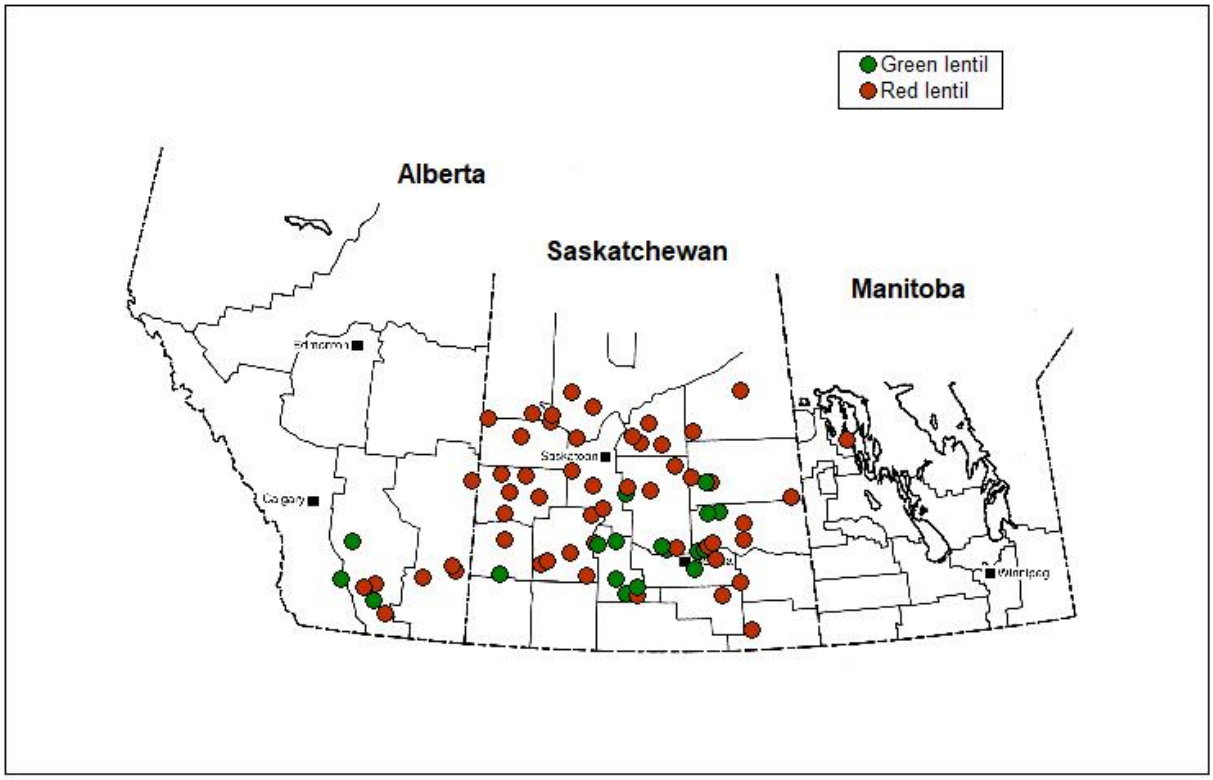
| | Harvested area (thousand hectares) | | Production (thousand tonnes) | | Yield (kg/ha) [2] | | Mean production (thousand tonnes) |
|---|---|---|---|---|---|---|---|
| **Province** | **2022** | **2021** | **2022** | **2021** | **2022** | **2021** | **2012 to 2021** |
| Manitoba | NA[3] | NA | NA | NA | NA | NA | NA |
| Saskatchewan | 1491 | 1509 | 1964 | 1434 | 1317 | 951 | 2106 |
| Alberta [4] | 223 | 205 | 335 | 170 | 1504 | 825 | 206 |
| Western Canada | 1714 | 1714 | 2299 | 1604 | 1341 | 936 | 2312 |

[1] Source: Statistics Canada
[2] kg/ha = kilograms per hectare
[3] NA = not available
[4] Includes the Peace River area of British Columbia

# Harvest samples

Samples were submitted to the Canadian Grain Commission's Harvest Sample Program by lentil producers across western Canada (Figure 4). The program received 455 lentil samples, consisting of 163 green lentil samples and 292 red lentil samples.

## Figure 4 Origin of 2022 lentil samples received by the Canadian Grain Commission's Harvest Sample Program




All samples were graded and analysed for protein content and seed size distribution. Seed size (small, medium and large) was determined using image analysis. Composites prepared for green lentils (No. 1 and No. 2 Canada combined) were based on seed size and crop region. Composites prepared for red lentils (No. 1 and No. 2 Canada combined) were based on crop region and variety.

The composite samples were tested for:

- moisture
- protein
- starch

- total dietary fiber
- fat
- ash
- mineral content
- 100-seed weight
- water absorption

The dehulling quality characteristics of red lentils were also evaluated. It should be noted that samples reported by grade do not necessarily represent the actual distribution of the grade across western Canada.

# Quality of 2022 western Canadian lentils

## Protein content

Protein content ranged from 21.6 to 30.4% for green lentils (Table 2) and from 24.3 to 30.7% for red lentils (Table 3). In 2022, the mean protein content was 27.2% for green lentils and 27.6% for red lentils, both of which were similar to 2021. Mean protein content of 2022 green and red lentils combined was 27.5%, higher than the 10-year mean (26.8%) (Figure 5). Tables 4 and 5 show the mean protein and mean starch content of green and red lentils from each crop region (Figure 6).

## Canadian green lentils

Table 6 contains the quality data for green lentil composites according to seed size. A small green lentil composite was composed of 4 varieties (CDC Imvincible, CDC Kermit, CDC Viceroy and Eston) and a large green lentil composite was composed of 6 varieties (CDC Greenstar, CDC Greenland, CDC Impower, CDC Lima, CDC Glamis and Laird). CDC Richlea was the only medium green lentil variety received by the Harvest Sample Program in 2022.

In 2022, small green lentils had a lower mean protein (27.6%) and total dietary fiber (14.2%) content than in 2021. Mean starch (45.7%) and ash (2.9%) content were higher than in 2021. Large green lentils grown in 2022 had a higher mean protein (26.9%), total dietary fiber (14.1%) and ash (2.9%) content but a lower mean starch (46.2%) content compared to 2021 (Table 6). Mean crude fat content for small, medium and large green lentils in 2022 was 0.92%, 0.83% and 0.86%, respectively.

Potassium (K) was the most abundant macroelement present in green lentils, followed by phosphorus (P), magnesium (Mg) and calcium (Ca) in 2022 (Table 6). Among the microelements, iron (Fe) was the most abundant, followed by zinc (Zn), manganese (Mn) and copper (Cu). In 2022, the level of Mn in both small and large green lentils was 1.6 milligrams (mg) per 100 grams (g) sample which was higher than in 2021. The level of P in small and large lentils (443.4 and 442.7 mg per 100 g sample, respectively) was also higher in 2022 compared to 2021. Levels of Fe (8.6 mg per 100 g sample), K (1130.7 mg per 100 g sample) and Zn (3.9 mg per 100 g sample) in small green lentils were higher than in 2021.

The seed weight of small green lentils (3.0 g per 100 seeds) in 2022 was similar to 2021. It was higher, however, for large lentils (6.7 g per 100 seeds) (Table 6). Water absorption per gram of seeds was similar in 2022 and 2021 for small and large green lentils.

Image analysis was used to determine the seed size distribution of green lentils (Table 7). The reported results may differ from those obtained by conventional sieving techniques. In 2022, 61.1% of small green lentils were smaller than 4.5 millimetres (mm) in diameter which was more than in 2021 (33.2%). In 2022, 26.2% of large green lentils were smaller than 6.0 mm in diameter, slightly more than in 2021 (23.5%). In general, green lentils grown in 2022 were reduced in size compared to 2021, especially green lentils classified as small.

## Canadian red lentils

Table 8 contains the quality data for the red lentil composite. Mean protein content (27.5%), total dietary fiber (15.2%) and ash content (2.7%) were higher in 2022 than in 2021, while mean starch content (45.2%) was lower. In 2022, red lentils had a mean crude fat content of 0.76%. Levels of Fe (8.0 mg per 100 g sample), Mn (1.6 mg per 100 g sample) and P (399.8 mg per 100 g sample) were higher in red lentils in 2022 compared to 2021. Mean seed weight (3.7 g per 100 seeds) was lower whereas mean water absorption (0.98 g water per g of seeds) was higher for red lentils in 2022 compared to 2021.

In 2022, the mean dehulling efficiency for red lentils (76.6%) was higher, with lower percentages of powders and broken seeds, compared to 2021. The percentage of un-dehulled whole seeds was higher in 2022 compared to 2021 (Table 8). The colour of dehulled lentils was measured using a Hunterlab LabScan XE spectrocolorimeter with the CIELAB L*, a* and b* colour scale. Brightness (L*) of whole seeds and splits was similar to 2021. Dehulled whole red lentils exhibited more redness (a*) and yellowness (b*), and the dehulled splits had less redness (a*) and more yellowness (b*) in 2022 than in 2021 (Table 8). There was a larger proportion of small red lentils in 2022, with 60.8% of lentils being less than 5.0 mm in diameter compared to 52.3% in 2021 (Table 9).

# Acknowledgements

The Grain Research Laboratory acknowledges the cooperation of western Canadian pulse processors, producers and grain handling facilities in supplying the samples of newly harvested lentils. We also are grateful to the following groups within the Canadian Grain Commission: Industry Services for assistance with grading samples; the Pulse Research Program staff for technical assistance; the staff of the trace elements unit for mineral analysis; and Multimedia services for their assistance in the publication of this document.

## Table 2 Mean protein content (%, dry basis) for 2022 western Canadian green lentils by grade [1]

| | | | 2022 | | | 2021 |
|---|---|---|---|---|---|---|
| **Province** | **Grade** | **Number of samples** | **Mean** | **Minimum** | **Maximum** | **Mean** |
| Saskatchewan | Lentils, No. 1 Canada | 32 | 27.7 | 21.6 | 29.3 | 27.6 |
| | Lentils, No. 2 Canada | 103 | 27.1 | 25.1 | 30.4 | 27.2 |
| | Lentils, Extra No. 3 Canada | 5 | 27.8 | 26.4 | 28.9 | 27.3 |
| | Lentils, No. 3 Canada | 6 | 27.3 | 25.8 | 28.9 | 27.5 |
| | All grades | 146 | 27.2 | 21.6 | 30.4 | 27.3 |
| Alberta | Lentils, No. 1 Canada | NS[2] | NS | NS | NS | NS |
| | Lentils, No. 2 Canada | 4 | 27.2 | 26.2 | 28.3 | 26.5 |
| | Lentils, Extra No. 3 Canada | NS | NS | NS | NS | NS |
| | Lentils, No. 3 Canada | NS | NS | NS | NS | NS |
| | All grades | 4 | 27.2 | 26.2 | 28.3 | 26.5 |
| Western Canada | Lentils, No. 1 Canada | 32 | 27.7 | 21.6 | 29.3 | 27.6 |
| | Lentils, No. 2 Canada | 107 | 27.1 | 25.1 | 30.4 | 27.1 |
| | Lentils, Extra No. 3 Canada | 5 | 27.8 | 26.4 | 28.9 | 27.3 |
| | Lentils, No. 3 Canada | 6 | 27.3 | 25.8 | 28.9 | 27.5 |
| | All grades | 150 | 27.2 | 21.6 | 30.4 | 27.3 |

[1] Protein content (Nitrogen x 6.25) is determined by near infrared measurement calibrated against the Combustion Nitrogen Analysis reference method.
[2] NS = non-sufficient (insufficient number of samples to generate a representative value).

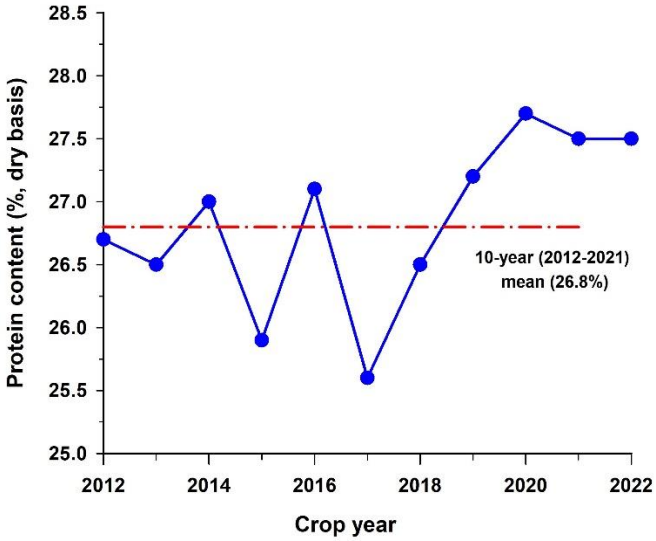
## Table 3 Mean protein content (%, dry basis) for 2022 western Canadian red lentils by grade [1]

| | | | 2022 | | | 2021 |
|---|---|---|---|---|---|---|
| **Province** | **Grade** | **Number of samples** | **Mean** | **Minimum** | **Maximum** | **Mean** |
| Saskatchewan | Lentils, No. 1 Canada | 228 | 27.4 | 24.3 | 30.7 | 27.6 |
| | Lentils, No. 2 Canada | 17 | 28.2 | 26.0 | 30.6 | 27.4 |
| | Lentils, Extra No. 3 Canada | 5 | 27.5 | 25.9 | 28.7 | 27.8 |
| | Lentils, No. 3 Canada | 4 | 28.3 | 27.4 | 29.7 | 27.6 |
| | All grades | 254 | 27.5 | 24.3 | 30.7 | 27.6 |
| Alberta | Lentils, No. 1 Canada | 24 | 28.4 | 27.0 | 30.5 | 27.2 |
| | Lentils, No. 2 Canada | 2 | 28.8 | 28.6 | 29.1 | 26.8 |
| | Lentils, Extra No. 3 Canada | NS[2] | NS | NS | NS | NS |
| | Lentils, No. 3 Canada | NS | NS | NS | NS | NS |
| | All grades | 26 | 28.5 | 27.0 | 30.5 | 27.1 |
| Western Canada | Lentils, No. 1 Canada | 252 | 27.5 | 24.3 | 30.7 | 27.6 |
| | Lentils, No. 2 Canada | 19 | 28.3 | 26.0 | 30.6 | 27.3 |
| | Lentils, Extra No. 3 Canada | 5 | 27.5 | 25.9 | 28.7 | 27.8 |
| | Lentils, No. 3 Canada | 4 | 28.3 | 27.4 | 29.7 | 27.6 |
| | All grades | 280 | 27.6 | 24.3 | 30.7 | 27.5 |

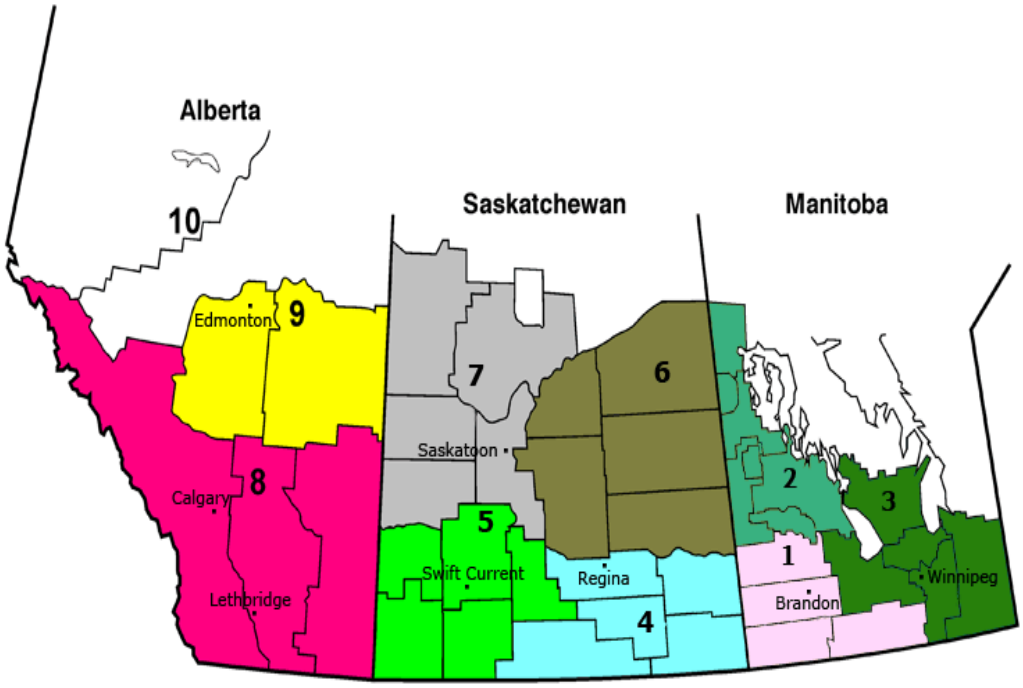
[1] Protein content (Nitrogen x 6.25) is determined by near infrared measurement calibrated against the Combustion Nitrogen Analysis reference method

[2] NS = non-sufficient (insufficient number of samples to generate a representative value)

## Figure 5 Mean protein content of western Canadian lentils (green and red combined) from 2012 to 2022




## Figure 6 Crop regions in western Canada



## Table 4 Mean protein and starch content (%, dry basis) of western Canadian green lentils in 2022 by crop region

| | Protein content | | Starch content | |
|---|---|---|---|---|
| **Crop region** | **2022** | **2021** | **2022** | **2021** |
| 4 | 27.0 | 27.2 | 45.9 | 46.0 |
| 5 | 27.1 | 26.7 | 46.2 | 47.0 |
| 7 | 24.3 | 25.9 | 47.4 | 46.7 |
| 8 | 27.6 | 26.0 | 46.4 | 48.0 |

## Table 5 Mean protein and starch content (%, dry basis) of western Canadian red lentils in 2022 by crop region

| | Protein content | | Starch content | |
|---|---|---|---|---|
| **Crop region** | **2022** | **2021** | **2022** | **2021** |
| 4 | 27.0 | 27.2 | 45.2 | 44.6 |
| 5 | 27.7 | 27.2 | 45.5 | 46.3 |
| 6 | 27.1 | 27.4 | 45.3 | 46.5 |
| 7 | 27.1 | 26.7 | 44.8 | 47.0 |
| 8 | 28.5 | 26.6 | 44.0 | 46.7 |

## Table 6 Quality data for 2022 western Canadian green lentil composites by size [1]

| | | 2022 | | | 2021 | | |
|---|---|---|---|---|---|---|---|
| **Category** | **Quality parameter** | **SL [2]** | **ML [3]** | **LL [4]** | **SL** | **ML** | **LL** |
| Chemical composition | Moisture content, % | 9.7 | 9.4 | 9.9 | 10.1 | NS[5] | 10.2 |
| | Protein content, % (dry basis) | 27.6 | 26.0 | 26.9 | 27.9 | NS | 26.3 |
| | Starch content, % (dry basis) | 45.7 | 47.1 | 46.2 | 45.2 | NS | 47.2 |
| | Total dietary fiber, % (dry basis) | 14.2 | 13.4 | 14.1 | 14.4 | NS | 12.3 |
| | Fat content, % (dry basis) | 0.92 | 0.83 | 0.86 | NA[6] | NA | NA |
| | Ash content, % (dry basis) | 2.9 | 2.6 | 2.9 | 2.5 | NS | 2.6 |
| Mineral (mg/100 g sample[7], dry basis) | Calcium (Ca) | 67.0 | 79.6 | 70.9 | 71.2 | NS | 66.1 |
| | Copper (Cu) | 1.2 | 0.9 | 1.0 | 1.1 | NS | 1.0 |
| | Iron (Fe) | 8.6 | 6.8 | 7.4 | 7.1 | NS | 7.0 |
| | Potassium (K) | 1130.7 | 1072.7 | 1145.5 | 1020.7 | NS | 1087.0 |
| | Magnesium (Mg) | 119.0 | 124.7 | 125.2 | 113.1 | NS | 122.3 |
| | Manganese (Mn) | 1.6 | 1.8 | 1.6 | 1.4 | NS | 1.4 |
| | Phosphorus (P) | 443.4 | 345.4 | 442.7 | 374.2 | NS | 393.9 |
| | Zinc (Zn) | 3.9 | 4.4 | 4.1 | 3.5 | NS | 4.0 |
| Physical characteristic | 100-seed weight, g/100 seeds[8] | 3.0 | 5.3 | 6.7 | 3.1 | NS | 6.5 |
| | Water absorption, g $H_2O$/g seeds[9] | 0.93 | 0.97 | 1.02 | 0.94 | NS | 1.00 |

[1] Lentils, No. 1 Canada and Lentils, No. 2 Canada combined
[2] SL = small lentils, includes CDC Imvincible, CDC Kermit and Eston
[3] ML = medium lentils, includes CDC Richlea
[4] LL = large lentils, includes CDC Greenstar, CDC Greenland, CDC Impower, CDC Lima, CDC Glamis and Laird
[5] NS = non-sufficient (insufficient number of samples to generate a representative value)
[6] NA = not available
[7] mg/g/100 g sample = milligrams per 100 grams of sample
[8] g/100 seeds = grams per 100 seeds
[9] g $H_2O$/g seeds = grams of water per grams of seed

## Table 7 Seed size distribution of 2022 western Canadian green lentils [1]

| Seed size distribution | 2022 | | | 2021 | | |
|---|---|---|---|---|---|---|
| | SL [2] | ML [3] | LL [4] | SL | ML | LL |
| <3.5 mm, % | 2.4 | 0.0 | 0.0 | 0.7 | NS [5] | 0.0 |
| 3.5 to 4.0 mm, % | 14.9 | 0.4 | 0.1 | 5.8 | NS | 0.0 |
| 4.0 to 4.5 mm, % | 43.8 | 0.8 | 0.1 | 26.7 | NS | 0.1 |
| 4.5 to 5.0 mm, % | 36.0 | 6.5 | 1.3 | 52.0 | NS | 1.3 |
| 5.0 to 5.5 mm, % | 2.8 | 22.8 | 5.2 | 14.2 | NS | 4.6 |
| 5.5 to 6.0 mm, % | 0.0 | 53.0 | 19.5 | 0.6 | NS | 17.5 |
| 6.0 to 6.5 mm, % | 0.0 | 16.3 | 39.2 | 0.0 | NS | 38.7 |
| 6.5 to 7.0 mm, % | 0.0 | 0.2 | 31.1 | 0.0 | NS | 33.2 |
| 7.0 to 7.5 mm, % | 0.0 | 0.0 | 3.6 | 0.0 | NS | 4.6 |
| >7.5 mm, % | 0.0 | 0.0 | 0.0 | 0.0 | NS | 0.0 |

[1] Seed size includes all grades and is determined using image analysis
[2] SL = small lentils, includes CDC Imvincible, CDC Kermit and Eston
[3] ML = medium lentils, includes CDC Richlea
[4] LL = large lentils, includes CDC Greenstar, CDC Greenland, CDC Impower, CDC Improve, CDC Lima, CDC Glamis and Laird
[5] NS = non-sufficient (insufficient number of samples to generate a representative value)

## Table 8 Quality data for 2022 western Canadian red lentil composite [1]

| Category | Quality parameter | 2022 | | 2021 | |
|---|---|---|---|---|---|
| Chemical composition | Moisture content, % | | 9.5 | | 10.1 |
| | Protein content, % (dry basis) | | 27.5 | | 27.1 |
| | Starch content, % (dry basis) | | 45.2 | | 46.1 |
| | Total dietary fiber, % (dry basis) | | 15.2 | | 14.0 |
| | Fat content, % (dry basis) | | 0.76 | | NA[2] |
| | Ash content, % (dry basis) | | 2.7 | | 2.5 |
| Mineral (mg/100 g[3] sample, dry basis) | Calcium (Ca) | | 72.6 | | 76.2 |
| | Copper (Cu) | | 0.9 | | 1.0 |
| | Iron (Fe) | | 8.0 | | 7.3 |
| | Potassium (K) | | 1034.1 | | 988.5 |
| | Magnesium (Mg) | | 116.2 | | 115.6 |
| | Manganese (Mn) | | 1.6 | | 1.4 |
| | Phosphorus (P) | | 399.8 | | 364.9 |
| | Zinc (Zn) | | 4.0 | | 4.0 |
| Physical characteristic | 100-seed weight, g/100 seeds[4] | | 3.7 | | 4.2 |
| | Water absorption, g $H_2O$/g seeds[5] | | 0.98 | | 0.95 |
| Dehulling quality | Dehulling efficiency, % | | 76.6 | | 74.4 |
| | Powder, % | | 3.9 | | 4.2 |
| | Broken seeds, % | | 3.2 | | 5.7 |
| | Un-dehulled whole seeds, % | | 2.4 | | 2.0 |
| Colour of dehulled seeds [6] | | **Whole** | **Splits** | **Whole** | **Splits** |
| | Brightness, L* | 60.9 | 62.9 | 61.0 | 62.7 |
| | Redness, a* | 30.2 | 30.8 | 30.0 | 31.0 |
| | Yellowness, b* | 38.7 | 40.2 | 37.9 | 40.0 |

[1] Lentils, No.1 Canada and Lentils, No.2 Canada combined. Red lentils include CDC Dazil, CDC Impact, CDC Impulse, CDC King Red, CDC Maxim, CDC Nimble, CDC Proclaim, CDC Redberry, CDC Redmoon, CDC Rouleau, CDC Simmie and Crimson.
[2] NA = not available
[3] mg/100 g = milligrams per 100 grams
[4] g/100 seeds = grams per 100 seeds
[5] g $H_2O$/g seeds = grams of water per gram of seeds
[6] L* = darkness (0) to brightness (+); a* = greenness (-) to redness (+); b* = blueness (-) to yellowness (+)

## Table 9 Seed size distribution of 2022 western Canadian red lentils [1,2]

| Seed size distribution | 2022 | 2021 |
|---|---|---|
| <3.5 mm, % | 0.7 | 0.4 |
| 3.5 to 4.0 mm, % | 4.5 | 2.7 |
| 4.0 to 4.5 mm, % | 18.2 | 13.0 |
| 4.5 to 5.0 mm, % | 37.4 | 36.2 |
| 5.0 to 5.5 mm, % | 26.6 | 32.9 |
| 5.5 to 6.0 mm, % | 11.3 | 12.8 |
| 6.0 to 6.5 mm, % | 1.4 | 1.9 |
| 6.5 to 7.0 mm, % | 0.0 | 0.1 |
| >7.0 mm, % | 0.0 | 0.0 |

[1] Seed size determined using image analysis

[2] Red lentils include CDC Dazil, CDC Impact, CDC Impulse, CDC King Red, CDC Maxim, CDC Nimble, CDC Proclaim, CDC Redberry, CDC Redmoon, CDC Rouleau, CDC Simmie and Crimson