ISSN 1920-9037

Quality of western Canadian lentils 2023

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Introduction

This report presents harvest quality data for western Canadian green and red lentils grown in 2023. Lentil 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 in the Grain Research Laboratory.

Growing and harvesting conditions

Figures 1 and 2 show the monthly mean temperature differences from normal in the Prairie region during the 2023 growing season (June and July). Figure 3 displays the total precipitation in the Prairie region from April 1 to October 31, 2023.

Figure 1 Mean temperature difference from normal in the Prairie region from June 1 to June 30, 2023

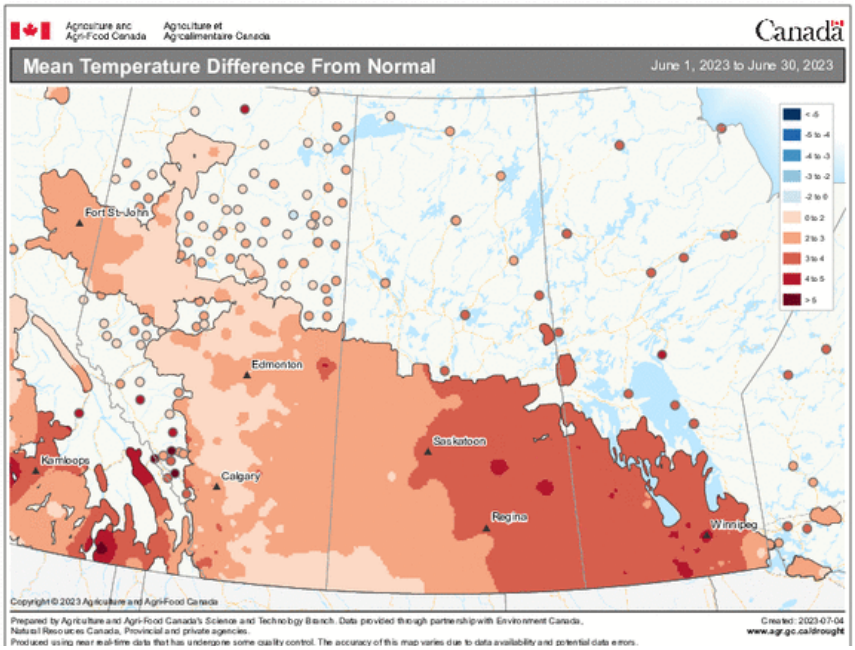


Figure 2 Mean temperature difference from normal in the Prairie region from July 1 to July 31, 2023

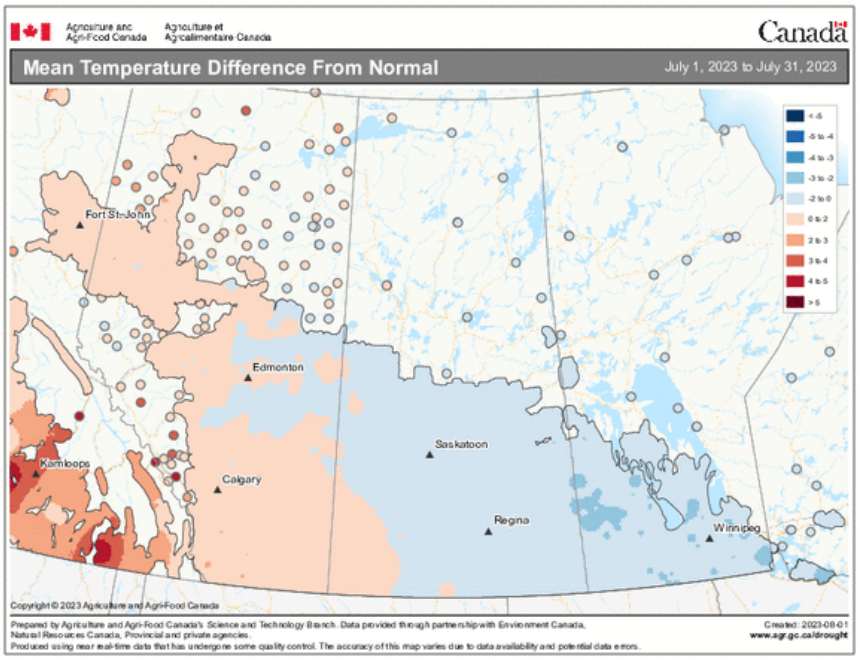
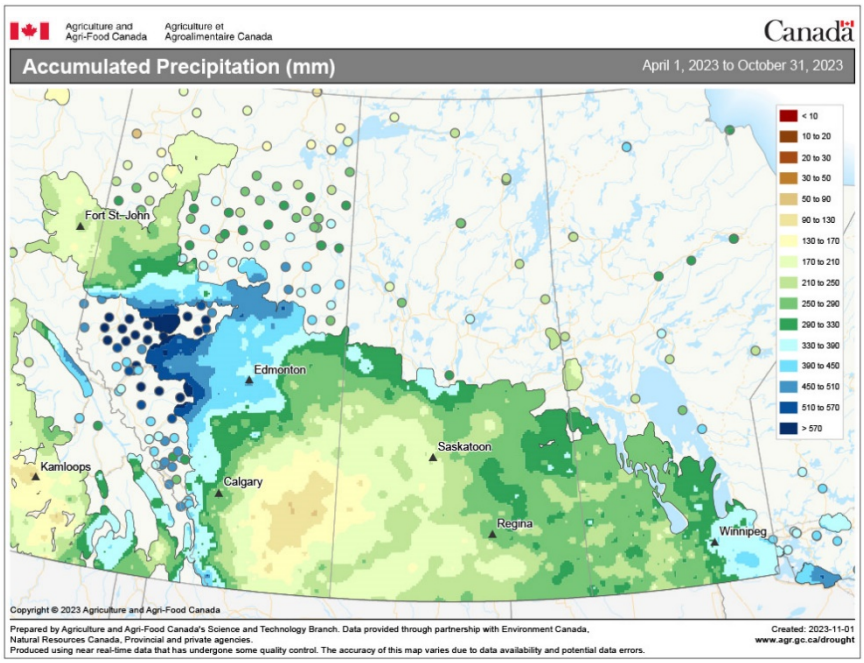


Figure 3 Total precipitation in the Prairie region from April 1 to October 31, 2023



In Manitoba, cold temperatures in early spring slowed the progress of seeding. Warmer than normal temperatures in May allowed seeding operations to advance and seeding was completed by early June. Warm conditions and inadequate moisture in June affected some crops in the central region of Manitoba (Figure 1). Rainfall was variable throughout the growing season (Figure 3). Growing conditions were good except for low topsoil moisture for crops seeded late. Cool temperatures in July helped crops in some areas thrive under dry conditions (Figure 2). By the end of July, crops started to ripen prematurely in some fields due to persistently warm and dry conditions. Harvest began in mid-August and was completed by mid-September. Lentil yields varied, depending on precipitation.

In Saskatchewan, seeding began in early May and was completed by early June. Warm temperatures and timely rain in the southeast, east-central, northeast and northwest regions were beneficial for plant growth (Figures 1, 2 and 3). Warm and persistently dry conditions in the southwest and west-central regions, however, caused crops to mature early and resulted in an early harvest (Figure 3). Harvest progressed smoothly and all of the lentils were in bins by mid-September. Lentil yields also varied throughout Saskatchewan, depending on precipitation.

In Alberta, unseasonably warm temperatures allowed seeding to begin in early May and be completed by early June. Hot, dry and windy weather depleted soil moisture in June and July, stressing and maturing plants more quickly than normal (Figures 1 and 2). Harvest began in early August in the south and central regions due to dry conditions but was delayed due to wet and cool conditions in the northern parts of the province (Figure 3). By mid-September the lentil harvest was near completion. Lentil yields were higher than the five-year provincial average in the northwest and northeast regions, but lower in other regions.

Production

Lentil production in 2023 was estimated to be 1.7 million tonnes, which is 27.3% lower than in 2022 and 30% lower than the 10-year average of 2.4 million tonnes (Table 1). The lower production is due to a 14.6% decrease in yield and a 14.8% decrease in harvested area compared to 2022. Saskatchewan continues to dominate lentil production in western Canada, accounting for 90.7% of production, while Alberta accounts for 9.3%.

Table 1 Production statistics for 2023 western Canadian lentils [1]

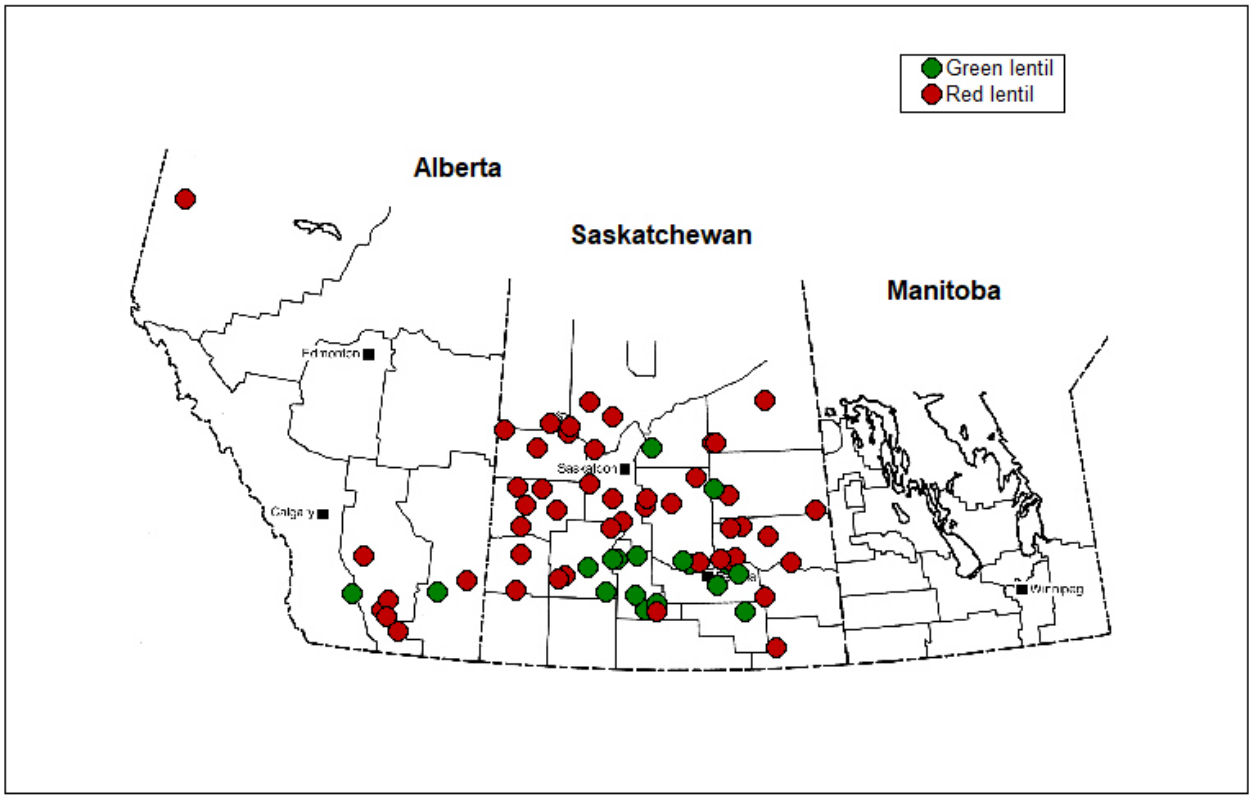
	Harvested area (thousand hectares)		Production (thousand tonnes)		Yield (kg/ha) [2]		Mean production (thousand tonnes)
Location	**2023**	**2022**	**2023**	**2022**	**2023**	**2022**	**2013 to 2022**
Manitoba	no data	no data	no data	no data	no data	no data	no data
Saskatchewan	1273	1491	1515	1964	1190	1317	2154
Alberta [3]	187	223	156	335	836	1504	233
Western Canada	1460	1714	1671	2299	1145	1341	2387

[1] Source: Statistics Canada.
[2] kg/ha = kilograms per hectare.
[3] 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 and grain companies across western Canada (Figure 4). The program received 343 lentil samples, consisting of 138 green lentil samples and 205 red lentil samples.

Figure 4 Origin of 2023 lentil samples received by the Canadian Grain Commission's Harvest Sample Program



All samples were graded and analyzed 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 content
- protein content
- starch content

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

The dehulling quality characteristics of red lentils were also evaluated.

The samples reported by grade do not necessarily represent the actual distribution of the grade across western Canada.

Quality of 2023 western Canadian lentils

Protein content

Protein content ranged from 24.7% to 30.6% for green lentils (Table 2) and from 23.4% to 30.2% for red lentils (Table 3). The mean protein content was higher for green lentils (27.5%) but lower for red lentils (27.4%) compared to 2022. The mean protein content of green and red lentils combined was higher than the 10-year mean of 26.7% (Figure 5). Tables 4 and 5 list the mean protein and starch content of green and red lentils, respectively, according to crop region (Figure 6).

Green lentils

Table 6 contains the 2023 quality data for green lentil composites according to seed size. Small green lentils had higher mean protein (28.3%) and starch (46.6%) content but lower total dietary fiber (13.4%), crude fat (0.82%) and ash (2.3%) content than in 2022. Large green lentils had higher protein (27.3%) and starch (46.8%) content but lower ash (2.5%) content than in 2022. Total dietary fiber (14.1%) and crude fat content (0.86%) of the large green lentils were similar between 2023 and 2022. Medium green lentils had lower protein (25.8%) and ash (2.3%) content but higher starch (47.6%), total dietary fiber (14.2%) and crude fat (0.87%) content compared to 2022.

Potassium (K) was the most abundant macroelement present in green lentils, followed by phosphorus (P), magnesium (Mg) and calcium (Ca). Among the microelements, iron (Fe) was the most abundant, followed by zinc (Zn), manganese (Mn) and copper (Cu). All three sizes of green lentils had lower levels of all elements compared to 2022.

In general, the 100-seed weight of small, medium and large green lentils was lower than in 2022. Water absorption per gram of seeds for large green lentils (1.02 grams water per gram of seeds) was the same as in 2022 but was higher for small and medium green lentils (0.98 and 0.99 grams water per gram of seeds).

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. Small green lentils had a similar size distribution in 2023 and 2022. Medium and large green lentils had a greater percentage of seeds with smaller sizes in 2023 than in 2022. For medium green lentils, the proportion of seeds with a diameter less than 5mm was

36.9%, greater than in 2022 (30.5%). For large green lentils, the proportion of seeds with a diameter less than 6.5 mm was 81.6%, greater than in 2022 (65.3%).

Red lentils

Table 8 contains the 2023 quality data for red lentils. The mean starch (46.0%) and crude fat content (0.95%) were higher compared to 2022, while the total dietary fiber (14.2%) and ash content (2.3%) were lower. The mean protein and copper content of red lentils did not differ much between 2023 and 2022. For all other elements, levels were lower in red lentils than in 2022. The mean seed weight (4.1 grams per 100 seeds) was higher and the mean water absorption (0.96 grams water per gram of seeds) was lower than in 2022.

The mean dehulling efficiency (77.0%) and the percentages of powders and broken seeds for red lentils were higher in 2023 than in 2022 (Table 8). The percentage of undehulled whole seeds was lower compared to 2022. The colour of dehulled lentils was measured using a Hunterlab LabScan XE spectrocolorimeter with the CIE L*, a* and b* colour scale. The brightness (L*) of whole lentils and splits was similar to 2022. Dehulled whole red lentils exhibited less redness (a*) and yellowness (b*), and the dehulled splits had more redness (a*) and less yellowness (b*) than in 2022. There was little difference in seed size between 2022 and 2023, with 60.7% of red lentils having a diameter less than 5.0 mm in both years (Table 9).

Acknowledgements

The Grain Research Laboratory acknowledges the cooperation of western Canadian pulse processors, producers and grain companies 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 Protein content (%, dry basis) for 2023 western Canadian green lentils by grade [1]

			2023			2022
Location	**Grade**	**Number of samples**	**Mean**	**Minimum**	**Maximum**	**Mean**
Saskatchewan	Lentils, No. 1 Canada	25	27.9	26.0	30.6	27.7
	Lentils, No. 2 Canada	98	27.4	24.8	30.0	27.1
	Lentils, Extra No. 3 Canada	4	27.8	26.7	29.1	27.8
	Lentils, No. 3 Canada	4	26.8	24.7	29.2	27.3
	All grades	131	27.5	24.7	30.6	27.2
Alberta	Lentils, No. 1 Canada	no data	no data	no data	no data	no data
	Lentils, No. 2 Canada	6	27.3	25.6	28.4	27.2
	Lentils, Extra No. 3 Canada	2	27.9	27.6	28.3	no data
	Lentils, No. 3 Canada	no data	no data	no data	no data	no data
	All grades	8	27.5	25.6	28.4	27.2
Western Canada	Lentils, No. 1 Canada	25	27.9	26.0	30.6	27.7
	Lentils, No. 2 Canada	104	27.4	24.8	30.0	27.1
	Lentils, Extra No. 3 Canada	6	27.9	26.7	29.1	27.8
	Lentils, No. 3 Canada	4	26.8	24.7	29.2	27.3
	All grades	139	27.5	24.7	30.6	27.2

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

Table 3 Protein content (%, dry basis) for 2023 western Canadian red lentils by grade [1]

			2023			2022
Location	**Grade**	**Number of samples**	**Mean**	**Minimum**	**Maximum**	**Mean**
Saskatchewan	Lentils, No. 1 Canada	148	27.3	23.4	30.2	27.4
	Lentils, No. 2 Canada	28	27.5	25.7	29.5	28.2
	Lentils, Extra No. 3 Canada	6	27.8	26.5	29.4	27.5
	Lentils, No. 3 Canada	3	27.1	26.7	27.5	28.3
	All grades	185	27.4	23.4	30.2	27.5
Alberta	Lentils, No. 1 Canada	13	28.2	26.1	29.5	28.4
	Lentils, No. 2 Canada	5	27.6	26.3	28.8	28.8
	Lentils, Extra No. 3 Canada	no data	no data	no data	no data	no data
	Lentils, No. 3 Canada	no data	no data	no data	no data	no data
	All grades	18	28.1	26.1	29.5	28.5
Western Canada	Lentils, No. 1 Canada	161	27.4	23.4	30.2	27.5
	Lentils, No. 2 Canada	33	27.5	25.7	29.5	28.3
	Lentils, Extra No. 3 Canada	6	27.8	26.5	29.4	27.5
	Lentils, No. 3 Canada	3	27.1	26.7	27.5	28.3
	All grades	203	27.4	23.4	30.2	27.6

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

Figure 5 Mean protein content (%, dry basis) of western Canadian lentils from 2013 to 2023

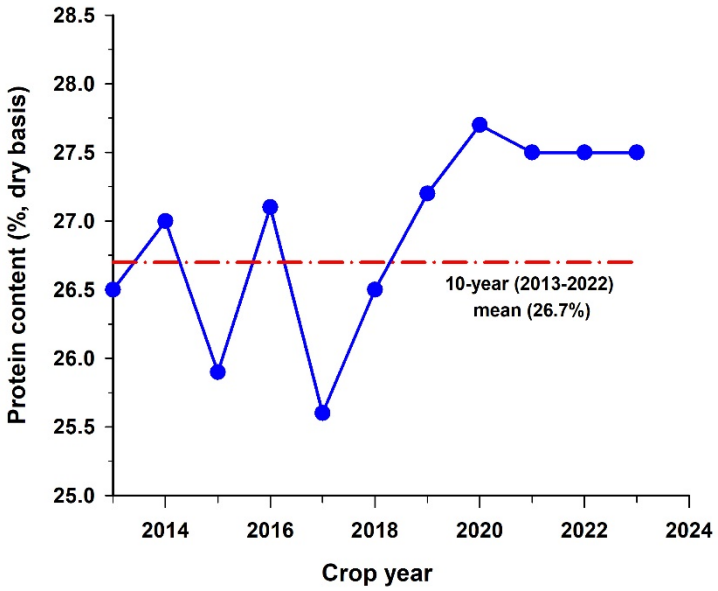


Figure 6 Crop regions in western Canada

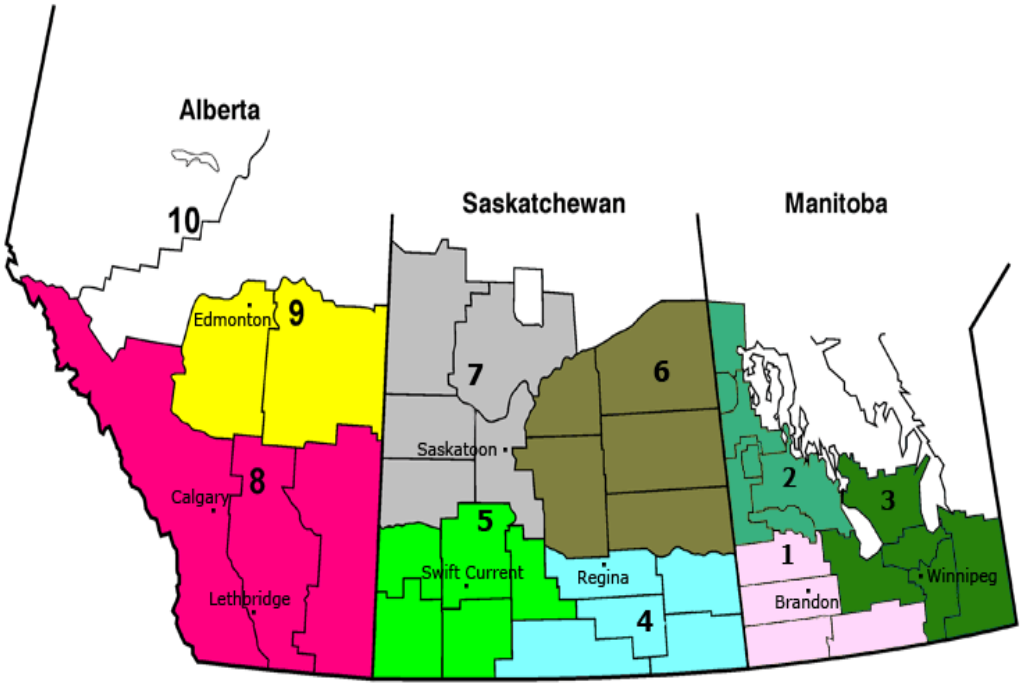


Table 4 Mean protein and starch content (%, dry basis) for 2023 western Canadian green lentils by crop region

	Protein content		Starch content	
Crop region	**2023**	**2022**	**2023**	**2022**
4	27.3	27.0	46.0	45.9
5	27.5	27.1	47.4	46.2
6	27.2	no data	46.9	no data
8	26.9	27.6	47.0	46.4

Table 5 Mean protein and starch content (%, dry basis) for 2023 western Canadian red lentils by crop region

	Protein content		Starch content	
Crop region	**2023**	**2022**	**2023**	**2022**
4	27.5	27.0	45.5	45.2
5	27.5	27.7	46.1	45.5
6	26.7	27.1	46.2	45.3
7	26.9	27.1	46.1	44.8
8	28.3	28.5	46.0	44.0

Table 6 Quality data for 2023 western Canadian green lentil composites by size [1]

		2023			2022		
Category	**Quality parameter**	**SL [2]**	**ML [3]**	**LL [4]**	**SL**	**ML**	**LL**
Chemical composition	Moisture, %	10.4	10.8	10.7	9.7	9.4	9.9
	Protein, %, dry basis	28.3	25.8	27.3	27.6	26.0	26.9
	Starch, %, dry basis	46.6	47.6	46.8	45.7	47.1	46.2
	Total dietary fiber, %, dry basis	13.4	14.2	14.1	14.2	13.4	14.1
	Crude fat, %, dry basis	0.82	0.87	0.86	0.92	0.83	0.86
	Ash, %, dry basis	2.3	2.3	2.5	2.9	2.6	2.9
Mineral content[5]	Calcium, mg/100 g sample[6]	66.0	69.1	63.5	67.0	79.6	70.9
	Copper, mg/100 g sample	1.0	0.8	0.9	1.2	0.9	1.0
	Iron, mg/100 g sample	7.5	6.1	7.0	8.6	6.8	7.4
	Potassium, mg/100 g sample	921.6	951.0	1004.3	1130.7	1072.7	1145.5
	Magnesium, mg/100 g sample	107.2	113.8	115.0	119.0	124.7	125.2
	Manganese, mg/100 g sample	1.1	1.3	1.2	1.6	1.8	1.6
	Phosphorus, mg/100 g sample	317.3	298.9	357.7	443.4	345.4	442.7
	Zinc, mg/100 g sample	3.0	3.7	3.5	3.9	4.4	4.1
Physical characteristics	100-seed weight, g/100 seeds[7]	2.9	5.1	6.4	3.0	5.3	6.7
	Water absorption, g H_2O/g seeds[8]	0.98	0.99	1.02	0.93	0.97	1.02

[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 Impress and CDC Richlea.
[4] LL = large lentils, includes CDC Greenstar, CDC Greenland, CDC Impower, CDC Imporove, CDC Lima, CDC Grimm and Laird.
[5] dry matter basis.
[6] mg/g 100 g sample = milligrams per 100 grams of sample.
[7] g/100 seeds = grams per 100 seeds.
[8] g H_2O/g seeds = grams of water per gram of seed.

Table 7 Seed size distribution of 2023 western Canadian green lentils [1]

Seed size distribution	2023			2022		
	SL [2]	ML [3]	LL [4]	SL	ML	LL
<3.5 mm, %	1.9	0.0	0.0	2.4	0.0	0.0
3.5 to 4.0 mm, %	15.1	0.0	0.1	14.9	0.4	0.1
4.0 to 4.5 mm, %	42.6	0.0	0.0	43.8	0.8	0.1
4.5 to 5.0 mm, %	37.8	7.1	1.5	36.0	6.5	1.3
5.0 to 5.5 mm, %	2.6	29.7	7.4	2.8	22.8	5.2
5.5 to 6.0 mm, %	0.0	43.8	25.8	0.0	53.0	19.5
6.0 to 6.5 mm, %	0.0	19.2	46.9	0.0	16.3	39.2
6.5 to 7.0 mm, %	0.0	0.0	17.4	0.0	0.2	31.1
7.0 to 7.5 mm, %	0.0	0.0	1.0	0.0	0.0	3.6
>7.5 mm, %	0.0	0.0	0.0	0.0	0.0	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 Impress and CDC Richlea.
[4] LL = large lentils, includes CDC Greenstar, CDC Greenland, CDC Impower, CDC Improve, CDC Lima, CDC Grimm and Laird.

Table 8 Quality data for 2023 western Canadian red lentils [1, 2]

Category	Quality parameter	2023		2022	
Chemical composition	Moisture, %		10.4		9.5
	Protein, %, dry basis		27.4		27.5
	Starch, %, dry basis		46.0		45.2
	Total dietary fiber, %,dry basis		14.2		15.2
	Crude fat, %, dry basis		0.95		0.76
	Ash, %, dry basis		2.3		2.7
Mineral content[3]	Calcium, mg/100 g sample[4]		68.0		72.6
	Copper, mg/100 g sample		0.9		0.9
	Iron, mg/100 g sample		6.9		8.0
	Potassium, mg/100 g sample		926.4		1034.1
	Magnesium, mg/100 g sample		107.5		116.2
	Manganese , mg/100 g sample		1.3		1.6
	Phosphorus, mg/100 g sample		326.0		399.8
	Zinc, mg/100 g sample		3.6		4.0
Physical characteristics	100-seed weight, g/100 seeds[5]		4.1		3.7
	Water absorption, g H_2O/g seeds[6]		0.96		0.98
Dehulling quality	Dehulling efficiency, %		77.0		76.6
	Powder, %		4.7		3.9
	Broken seeds, %		4.0		3.2
	Un-dehulled whole seeds, %		1.4		2.4
Colour of dehulled seeds [7]		**Whole**	**Splits**	**Whole**	**Splits**
	Brightness, L*	61.0	62.9	60.9	62.9
	Redness, a*	29.8	31.2	30.2	30.8
	Yellowness, b*	37.2	39.6	38.7	40.2

[1] Lentils, No.1 Canada and Lentils, No.2 Canada combined.
[2] Red lentils include CDC Dazil, CDC Impact, CDC Impulse, CDC King Red, CDC Maxim, CDC Proclaim, CDC Redmoon, CDC Simmie and Crimson.
[3] dry matter basis.
[4] mg/100 g sample= milligrams per 100 grams sample.
[5] g/100 seeds = grams per 100 seeds.
[6] g H_2O/g seeds = grams of water per gram of seeds.
[7] L* = darkness (0) to brightness (+); a* = greenness (-) to redness (+); b* = blueness (-) to yellowness (+).

Table 9 Seed size distribution of 2023 western Canadian red lentils [1,2]

Seed size distribution	2023	2022
<3.5 mm, %	0.4	0.7
3.5 to 4.0 mm, %	3.2	4.5
4.0 to 4.5 mm, %	16.5	18.2
4.5 to 5.0 mm, %	40.7	37.4
5.0 to 5.5 mm, %	28.2	26.6
5.5 to 6.0 mm, %	10.0	11.3
6.0 to 6.5 mm, %	1.0	1.4
6.5 to 7.0 mm, %	0.2	0.0
>7.0 mm, %	0.0	0.0

[1] Seed size includes all grades and is determined using image analysis.
[2] Red lentils include CDC Dazil, CDC Impact, CDC Impulse, CDC King Red, CDC Maxim, CDC Proclaim, CDC Redmoon, CDC Simmie and Crimson.