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# Quality of western Canadian lentils 2021

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# Introduction

This report presents data on the quality of lentils grown in western Canada in 2021. 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 2021 growing season (June and July). Figure 3 displays the total precipitation in the prairie region from April 1 to October 31, 2021.

**Figure 1 Mean temperature difference from normal in the prairie region during the 2021 growing season (June)**

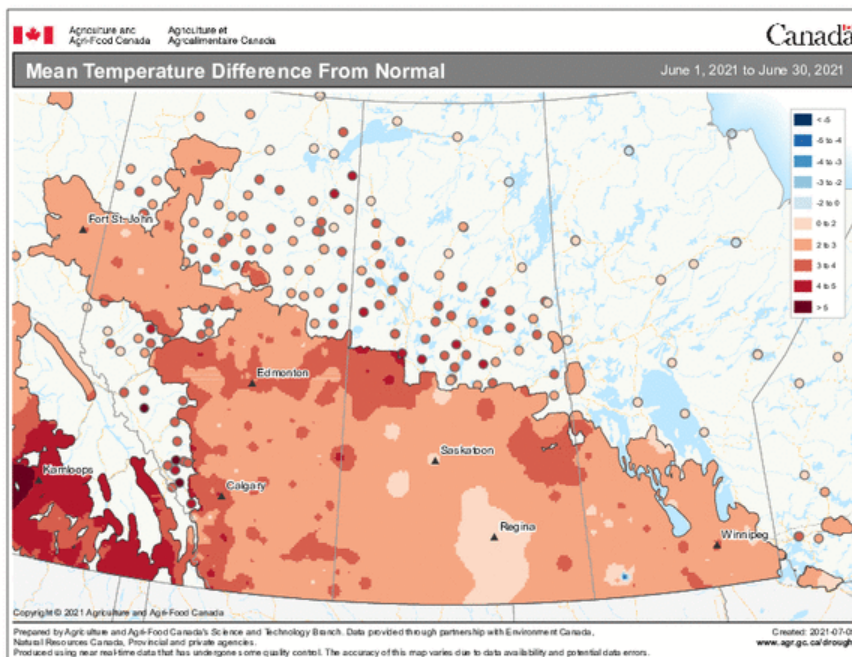


Figure 2 Mean temperature difference from normal in the prairie region during the 2021 growing season (July)

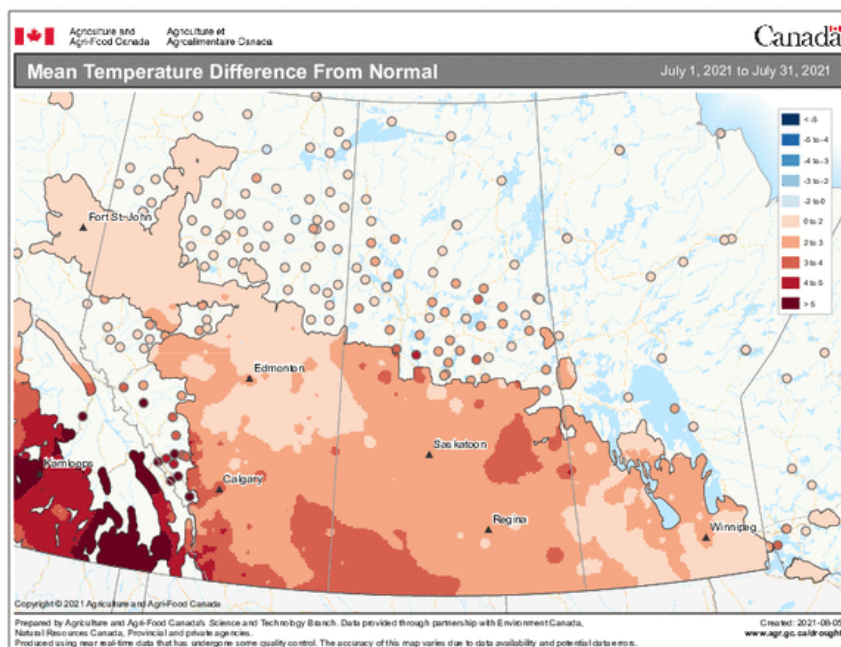
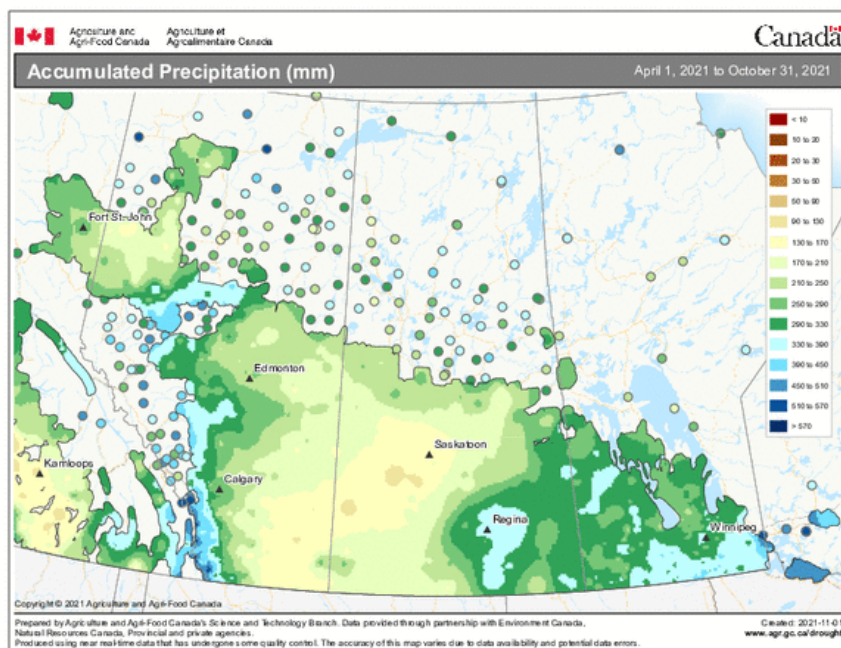


Figure 3 Total precipitation in the prairie region from April 1 to October 31, 2021



Extremely dry and hot conditions characterized the 2021 growing season in the Canadian prairies. A lack of snowmelt and dry soils allowed seeding operation to begin in early May in Alberta and Saskatchewan, and late April in Manitoba. Frost occurred in late May in Manitoba, causing injury to crops. Extreme heat in late June and July (Figure 1 and 2), as well as minimal rainfalls, affected crop development in the prairies. Crops were short, thin with dry lower leaves, and matured at a rapid pace. Rain and cooler conditions in August (Figure 3) helped replenish soil moisture across the prairies and benefited the growth of late season crops. Harvest started early across the prairies due to early seeding and the adverse affects of drought on plants. Yield varied depending on the moisture received. Overall, pulse crops had a lower than average yield.

# Production

Green and red lentil production in 2021 was estimated to be 1.6 million tonnes, which was 44.1% lower than in 2020 and 30.6% less than the 10-year average of 2.3 million tonnes (Table 1). Reduction of production was due to a 44.4% decrease in yield from 2020. Saskatchewan continues to dominate lentil production in western Canada, accounting for 89.4% of production, while Alberta accounts for 10.6%.

**Table 1 Production statistics for 2021 western Canadian lentils (green and red combined) <sup>1</sup>**

Province	Harvested area (thousand hectares)		Production (thousand tonnes)		Yield (kg/ha) <sup>2</sup>		Mean production (thousand tonnes)
	2021	2020	2021	2020	2021	2020	2011 to 2020
Manitoba	-	-	-	-	-	-	-
Saskatchewan	1509	1535	1434	2497	951	1627	2112
Alberta <sup>3</sup>	205	170	170	371	825	2185	198
Western Canada	1714	1705	1604	2868	936	1682	2310

<sup>1</sup> Source: Statistics Canada

<sup>2</sup> kg/ha = kilograms per hectare

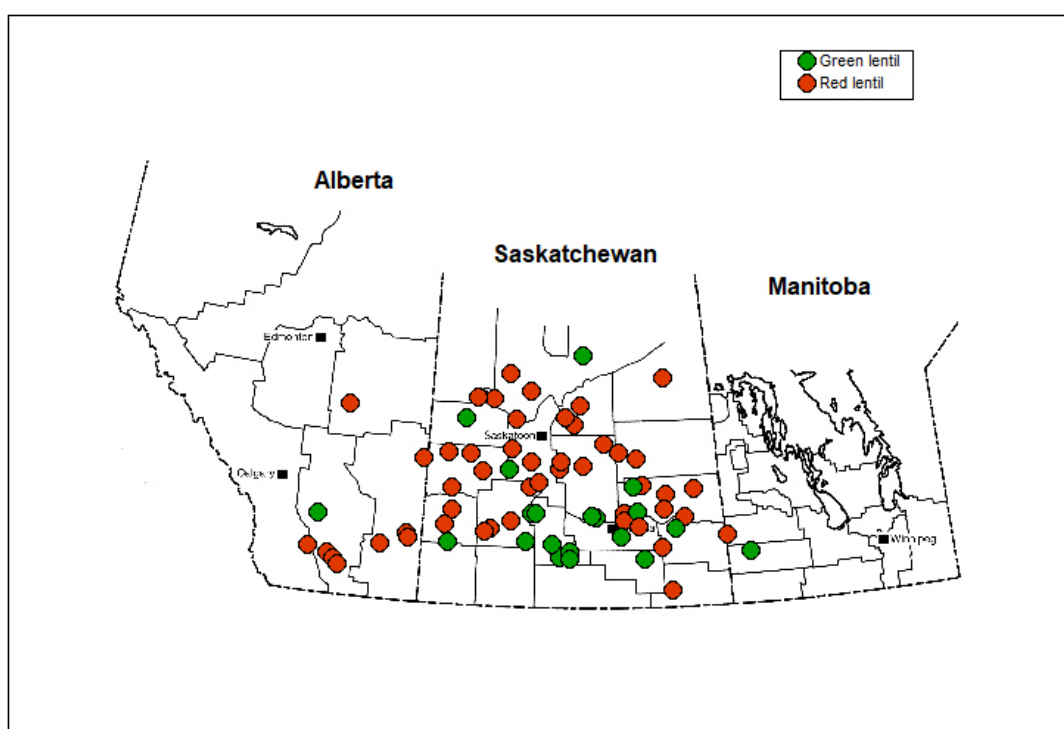
<sup>3</sup> Includes the Peace River area of British Columbia

# Western Canadian lentils in 2021

## Lentil samples

Samples were submitted to the Canadian Grain Commission's Harvest Sample Program by lentil producers across western Canada (Figure 4). The Canadian Grain Commission received 455 lentil samples for analysis, including 168 green and 287 red lentil samples.

**Figure 4** Origin of 2021 lentil samples submitted to the Canadian Grain Commission's Harvest Sample Program



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

The composite samples were tested for:

- moisture content
- protein content
- starch content
- total dietary fiber
- ash content



- mineral content
- 100-seed weight
- water absorption

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

## Quality of 2021 western Canadian lentils

In 2021, the protein content of green lentils ranged from 24.5% to 29.7% (Table 2) and ranged from 22.8% to 30.8% for red lentils (Table 3). The mean protein content was 27.3% for green lentils and 27.5% for red lentils. This is lower than the mean (green and red combined) in 2020 but is 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 the crop regions shown in Figure 6.

Table 6 shows the quality characteristics of green lentil composites according to seed size. Small-sized green lentil composites were comprised of 4 varieties (CDC Invincible, CDC Kermit, CDC Milestone and Eston) and large-sized green lentil composites were comprised of 8 varieties (CDC Greenstar, CDC Greenland, CDC Impower, CDC Improve, CDC Lima, CDC Glamis, CDC Grandora and Laird).

In 2021, mean protein content was lower for small green (27.9%) and large green (26.3%) lentils than in 2020 (Table 6). On the other hand, total starch and total dietary fiber of the 2021 small green (45.2%, 14.4%) and large green (47.2%, 12.3%) lentils were higher compared to 2020. Ash content of small green (2.5%) and large green (2.6%) lentils was lower in 2021 than in 2020.

In 2021, potassium (K) was the most abundant macroelement present in green lentils, followed by phosphorus (P), magnesium (Mg) and calcium (Ca) (Table 6). Among the microelements, iron (Fe) was the highest, followed by zinc (Zn), manganese (Mn) and copper (Cu). Small and large green lentils contained a higher Ca level (71.2 and 66.1 mg per 100 g sample) in 2021 than in 2020. Levels of P (374.2 mg per 100 g sample), K (1020.7 mg per 100 g sample) and Fe (7.1 mg per 100 g sample) were also lower in small green lentils in 2021 than in 2020.

Seed weights of small green lentils (3.1 grams per 100 seeds) and large green lentils (6.5 grams per 100 seeds) were higher in 2021 than in 2020 (Table 6). Water absorption per gram of seeds was similar in 2021 and 2020 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. Small green lentils had 66.8% seeds that were greater than 4.5 mm in diameter in 2021 compared to 22.5% in 2020. Large green lentils had 76.5% seeds that were larger than 6.0 mm in diameter in 2021 compared to 65.1% in 2020. Results indicate that green lentils had a higher proportion of large seed size in 2021 than in 2020.

Table 8 shows the 2021 quality data for the red lentil composites which included 10 cultivars:

- CDC Dazil
- CDC Imax
- CDC Impulse
- CDC King Red



- CDC Maxim
- CDC Proclaim
- CDC Redmoon
- CDC Rouleau
- CDC Simmie
- Crimson

In 2021, mean protein content (27.1%) and ash content (2.5%) were lower, while total starch content (46.1%) and total dietary fiber (14.0%) were higher than in 2020 red lentils. A higher amount of Ca (76.2 mg per 100 g sample) was detected in red lentils in 2021 compared to 2020 (Table 8). Overall, red lentils had a higher mean seed weight (4.2 grams per 100 seeds) and lower mean water absorption (0.95 grams water per gram of seeds) in 2021 than in 2020.

The mean dehulling efficiency for red lentils (74.4%) was lower with higher percentages of powders and broken seeds in 2021 than in 2020. The percentage of un-dehulled whole seeds was similar in 2021 and 2020 (Table 8). The colour of dehulled lentils was measured using a Hunterlab LabScan XE spectrophotometer with the CIE L\*, a\* and b\* colour scale. Dehulled whole red lentils exhibited more brightness (L\*) and less yellowness (b\*), and the dehulled splits had more redness (a\*) and less yellowness (b\*) in 2021 than in 2020 (Table 8). A higher proportion of large red lentils was detected in 2021, with 83.9% seeds being larger than 4.5 mm in diameter compared to 62.5% in 2020 (Table 9).

# Acknowledgements

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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 for the assistance of the Industry Services Division of the Canadian Grain Commission with grading the samples. Furthermore, we would like to extend our thanks to the Pulse Research Program staff for technical assistance, to 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 2021 western Canadian green lentils by grade <sup>1</sup>

Province	Grade	Number of samples	2021			2020
			Mean	Minimum	Maximum	Mean
Saskatchewan	Lentils, No. 1 Canada	33	27.6	25.5	29.6	28.0
	Lentils, No. 2 Canada	81	27.2	24.5	29.7	27.3
	Lentils, Extra No. 3 Canada	22	27.3	25.6	28.8	27.2
	Lentils, No. 3 Canada	16	27.5	26.2	28.5	NS <sup>2</sup>
	All grades	152	27.3	25.4	29.7	27.6
Alberta	Lentils, No. 1 Canada	NS	NS	NS	NS	NS
	Lentils, No. 2 Canada	11	26.5	25.5	28.4	28.0
	Lentils, Extra No. 3 Canada	NS	NS	NS	NS	NS
	Lentils, No. 3 Canada	NS	NS	NS	NS	NS
	All grades	11	26.5	25.5	28.4	28.0
Western Canada	Lentils, No. 1 Canada	33	27.6	25.5	29.6	28.0
	Lentils, No. 2 Canada	92	27.1	24.5	29.7	27.4
	Lentils, Extra No. 3 Canada	22	27.3	25.6	28.8	27.2
	Lentils, No. 3 Canada	16	27.5	26.2	28.5	NS
	All grades	163	27.3	24.5	29.7	27.7

<sup>1</sup> Protein content (N x 6.25) is determined by near infrared measurement calibrated against the combustion nitrogen analysis reference method

<sup>2</sup> NS = non-sufficient number of samples to generate a representative value

Table 3 Protein content (% dry basis) for 2021 western Canadian red lentils by grade <sup>1</sup>

Province	Grade	Number of samples	2021			2020
			Mean	Minimum	Maximum	Mean
Saskatchewan	Lentils, No. 1 Canada	181	27.6	26.0	30.8	27.7
	Lentils, No. 2 Canada	35	27.4	25.9	29.5	27.4
	Lentils, Extra No. 3 Canada	20	27.8	26.6	29.1	27.1
	Lentils, No. 3 Canada	12	27.6	25.7	29.2	27.0
	All grades	248	27.6	25.7	30.8	27.6
Alberta	Lentils, No. 1 Canada	24	27.2	22.8	28.6	28.5
	Lentils, No. 2 Canada	7	26.8	26.1	27.5	NS <sup>2</sup>
	Lentils, Extra No. 3 Canada	NS	NS	NS	NS	NS
	Lentils, No. 3 Canada	NS	NS	NS	NS	NS
	All grades	31	27.1	22.8	28.6	28.5
Western Canada	Lentils, No. 1 Canada	205	27.6	22.8	30.8	27.7
	Lentils, No. 2 Canada	42	27.3	25.9	29.5	27.5
	Lentils, Extra No. 3 Canada	20	27.8	26.6	29.1	27.1
	Lentils, No. 3 Canada	12	27.6	25.7	29.2	27.0
	All grades	279	27.5	22.8	30.8	27.7

<sup>1</sup> Protein content (N x 6.25) is determined by near infrared measurement calibrated against the combustion nitrogen analysis reference method

<sup>2</sup> NS = non-sufficient number of samples to generate a representative value

Figure 5 Mean protein content of western Canadian lentils (green and red combined) from 2011 to 2021

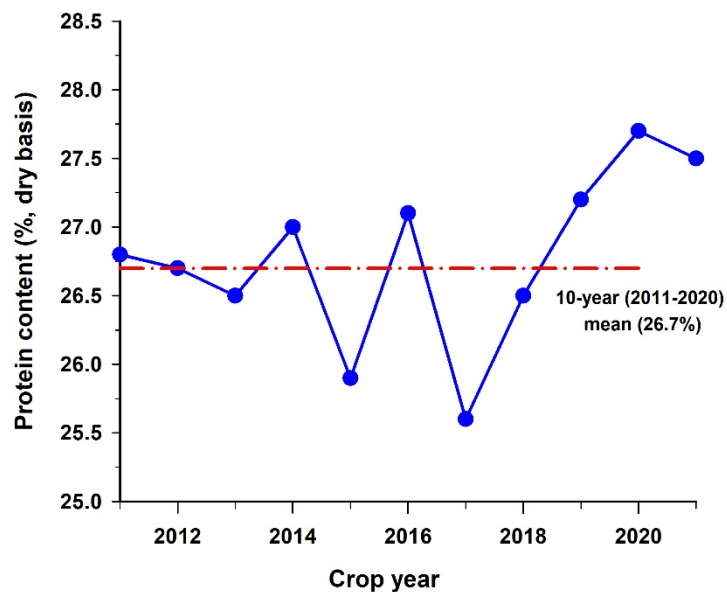


Figure 6 Crop regions in western Canada

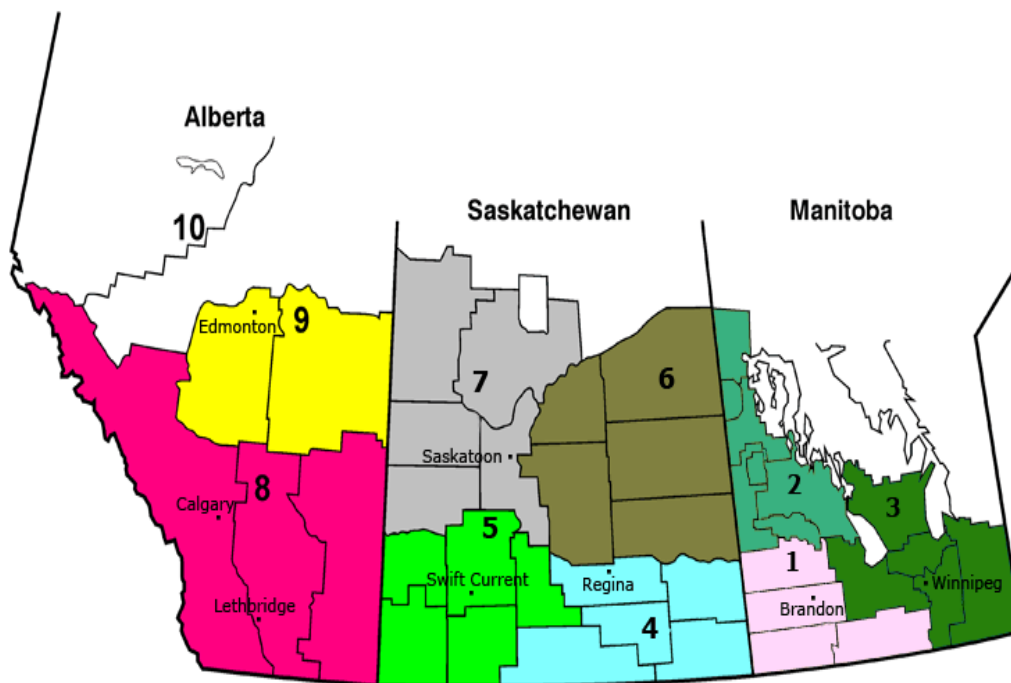


Table 4 Mean protein and starch content (% , dry basis) for 2021western Canadian green lentils by crop region

Crop region	Mean protein content		Mean starch content	
	2021	2020	2021	2020
4	27.2	27.3	46.0	46.0
5	26.7	27.9	47.0	44.9
6	NS <sup>1</sup>	NS	NS	NS
7	25.9	NS	46.7	NS
8	26.0	28.3	48.0	45.3

<sup>1</sup> NS = non-sufficient number of samples to generate a representative value

Table 5 Mean protein and starch content (% , dry basis) for 2021 western Canadian red lentils by crop region

Crop region	Mean protein content		Mean starch content	
	2021	2020	2021	2020
4	27.2	26.7	44.6	44.9
5	27.2	27.6	46.3	44.8
6	27.4	26.8	46.5	45.4
7	26.7	27.2	47.0	45.9
8	26.6	28.1	46.7	44.7

Table 6 Quality data for 2021 western Canadian green lentil composites by size <sup>1</sup>

Quality category	Quality parameter	2021			2020		
		SL <sup>2</sup>	ML <sup>3</sup>	LL <sup>4</sup>	SL <sup>2</sup>	ML <sup>3</sup>	LL <sup>5</sup> Error! Bookmark not defined.
Chemical composition	Moisture content, %	10.1	NS <sup>5</sup>	10.2	9.6	10.1	9.6
	Protein content, % (dry basis)	27.9	NS	26.3	28.3	26.2	27.5
	Starch content, % (dry basis)	45.2	NS	47.2	44.3	46.8	45.7
	Total dietary fiber, % (dry basis)	14.4	NS	12.3	12.6	12.2	11.9
	Ash content, % (dry basis)	2.5	NS	2.6	2.9	2.9	2.8
Mineral (mg/100 g sample <sup>6</sup> , dry basis)	Calcium (Ca)	71.2	NS	66.1	58.3	78.3	58.0
	Copper (Cu)	1.1	NS	1.0	1.2	1.0	1.0
	Iron (Fe)	7.1	NS	7.0	8.4	7.6	7.7
	Potassium (K)	1020.7	NS	1087.0	1135.9	1094.7	1077.1
	Magnesium (Mg)	113.1	NS	122.3	116.1	127.9	118.7
	Manganese (Mn)	1.4	NS	1.4	1.4	1.6	1.5
	Phosphorus (P)	374.2	NS	393.9	443.7	409.4	412.7
Physical characteristic	Zinc (Zn)	3.5	NS	4.0	3.4	4.5	3.9
	100-seed weight, g/100 seeds <sup>7</sup>	3.1	NS	6.5	2.7	4.8	6.1
	Water absorption, g H <sub>2</sub> O/g seeds <sup>8</sup>	0.94	NS	1.00	0.94	1.01	1.05

<sup>1</sup> Lentils, No. 1 Canada and Lentils, No. 2 Canada combined

<sup>2</sup> SL = small lentils including CDC Invincible, CDC Kermit, CDC Milestone and Eston

<sup>3</sup> ML = medium lentils, including CDC Richlea

<sup>4</sup> LL = large lentils including CDC Grandora, CDC Greenstar, CDC Greenland, CDC Impower, CDC Improve, CDC Lima, CDC Glamis and Laird

<sup>5</sup> NS = non-sufficient number of samples to generate a representative value

<sup>6</sup> mg/100g = milligrams per 100 grams

<sup>7</sup> g/100 seeds = grams per 100 seeds

<sup>8</sup> H<sub>2</sub>O/g seeds = grams of water per gram of seeds



Table 7 Seed size distribution of 2021 western Canadian green lentils <sup>1</sup>

Seed size distribution	2021			2020		
	SL <sup>2</sup>	ML <sup>3</sup>	LL <sup>4</sup>	SL <sup>2</sup>	ML <sup>3</sup>	LL <sup>4</sup>
<3.5 mm, %	0.7	NS <sup>5</sup>	0.0	3.6	0.8	0.0
3.5 to 4.0 mm, %	5.8	NS	0.0	22.0	0.8	0.1
4.0 to 4.5 mm, %	26.7	NS	0.1	51.8	4.2	0.3
4.5 to 5.0 mm, %	52.0	NS	1.3	21.3	10.7	1.4
5.0 to 5.5 mm, %	14.2	NS	4.6	1.2	40.3	7.1
5.5 to 6.0 mm, %	0.6	NS	17.5	0.0	39.6	25.9
6.0 to 6.5 mm, %	0.0	NS	38.7	0.0	3.5	49.5
6.5 to 7.0 mm, %	0.0	NS	33.2	0.0	0.0	15.2
7.0 to 7.5 mm, %	0.0	NS	4.6	0.0	0.0	0.4
>7.5 mm, %	0.0	NS	0.0	0.0	0.0	0.0

<sup>1</sup> seed size including all grades determined by the image analysis technique

<sup>2</sup> SL = small lentils including CDC Invincible, CDC Kermit, CDC Milestoone and Eston

<sup>3</sup> ML = medium lentils including CDC Richlea

<sup>4</sup> LL = large lentils including CDC Grandora, CDC Greenstar, CDC Greenland, CDC Impower, CDC Improve, CDC Lima, CDC Glamis and Laird

<sup>5</sup> NS = non-sufficient number of samples to generate a representative value

**Table 8 Quality data for 2021 western Canadian red lentil composites <sup>1</sup>**

Quality category	Quality parameter	2021	2020		
Chemical composition	Moisture content, %	10.1	9.6		
	Protein content, % (dry basis)	27.1	27.3		
	Starch content, % (dry basis)	46.1	45.0		
	Total dietary fiber, % (dry basis)	14.0	12.4		
	Ash content, % (dry basis)	2.5	2.7		
Mineral (mg/100 g <sup>2</sup> sample, dry basis)	Calcium (Ca)	76.2	61.0		
	Copper (Cu)	1.0	1.0		
	Iron (Fe)	7. 3	7.9		
	Potassium (K)	988.5	1032.6		
	Magnesium (Mg)	115.6	112.5		
	Manganese (Mn)	1.4	1.4		
	Phosphorus (P)	364.9	395.2		
	Zinc (Zn)	4.0	3.8		
Physical characteristic	100-seed weight, g/100 seeds <sup>3</sup>	4.2	3.4		
	Water absorption, g H <sub>2</sub> O/g seeds <sup>4</sup>	0.95	0.99		
Dehulling quality	Dehulling efficiency, %	74.4	85.1		
	Powder, %	4.2	2.7		
	Broken seeds, %	5.7	0.30		
	Un-dehulled whole seeds, %	2.0	1.9		
Colour of dehulled seeds <sup>5</sup>		Whole	Splits	Whole	Splits
	Brightness, L*	61.0	62.7	60.7	62.7
	Redness, a*	30.0	31.0	30.0	30.5
	Yellowness, b*	37.9	40.0	38.2	40.5

<sup>1</sup> Lentils, No.1 Canada and Lentils, No.2 Canada combined. Red lentils including CDC Dazil, CDC Imax, CDC Impulse, CDC King Red, CDC Maxim, CDC Proclaim, CDC Redmoon, CDC Rouleau, CDC Simmie and Crimson

<sup>2</sup> mg/100 g = milligrams per 100 grams

<sup>3</sup> g/100 seeds = grams per 100 seeds

<sup>4</sup> g H<sub>2</sub>O/g seeds = grams of water per gram of seeds

<sup>5</sup> L\* = darkness (0) to brightness (+); a\* = greenness (-) to redness (+); b\* = blueness (-) to yellowness (+)

**Table 9 Seed size distribution of 2021 western Canadian red lentils <sup>1,2</sup>**

<b>Seed size distribution</b>	<b>2021</b>	<b>2020</b>
<3.5 mm, %	0.4	0.9
3.5 to 4.0 mm, %	2.7	6.8
4.0 to 4.5 mm, %	13.0	29.8
4.5 to 5.0 mm, %	36.2	40.8
5.0 to 5.5 mm, %	32.9	16.8
5.5 to 6.0 mm, %	12.8	4.6
6.0 to 6.5 mm, %	1.9	0.3
6.5 to 7.0 mm, %	0.1	0.0
>7.0 mm, %	0.0	0.0

<sup>1</sup> Seed size determined by the image analysis technique

<sup>2</sup> Red lentils including CDC Dazil, CDC Imaxl, CDC Impulse, CDC King Red, CDC Maxim, CDC Proclaim, CDC Redmoon, CDC Rouleau, CDC Simmie and Crimson