



Canadian Grain
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Effect of free fatty acid content on the shelf-life of overwintered canola seeds

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Canadian Grain Commission – Grain Research Laboratory

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2019 Growing season highlights

- May
 - Cool nights and dry – germination issues
- June
 - Mix of very dry and very wet weather
- July and August
 - Dry weather (lack of rain)
- September
 - Cold and rainy: very slow and delayed harvest
 - Last week: snow in part of Alberta & Saskatchewan
- October
 - Cold and wet in Manitoba plus snow on Thanksgiving
 - Harvest over in most of the prairies



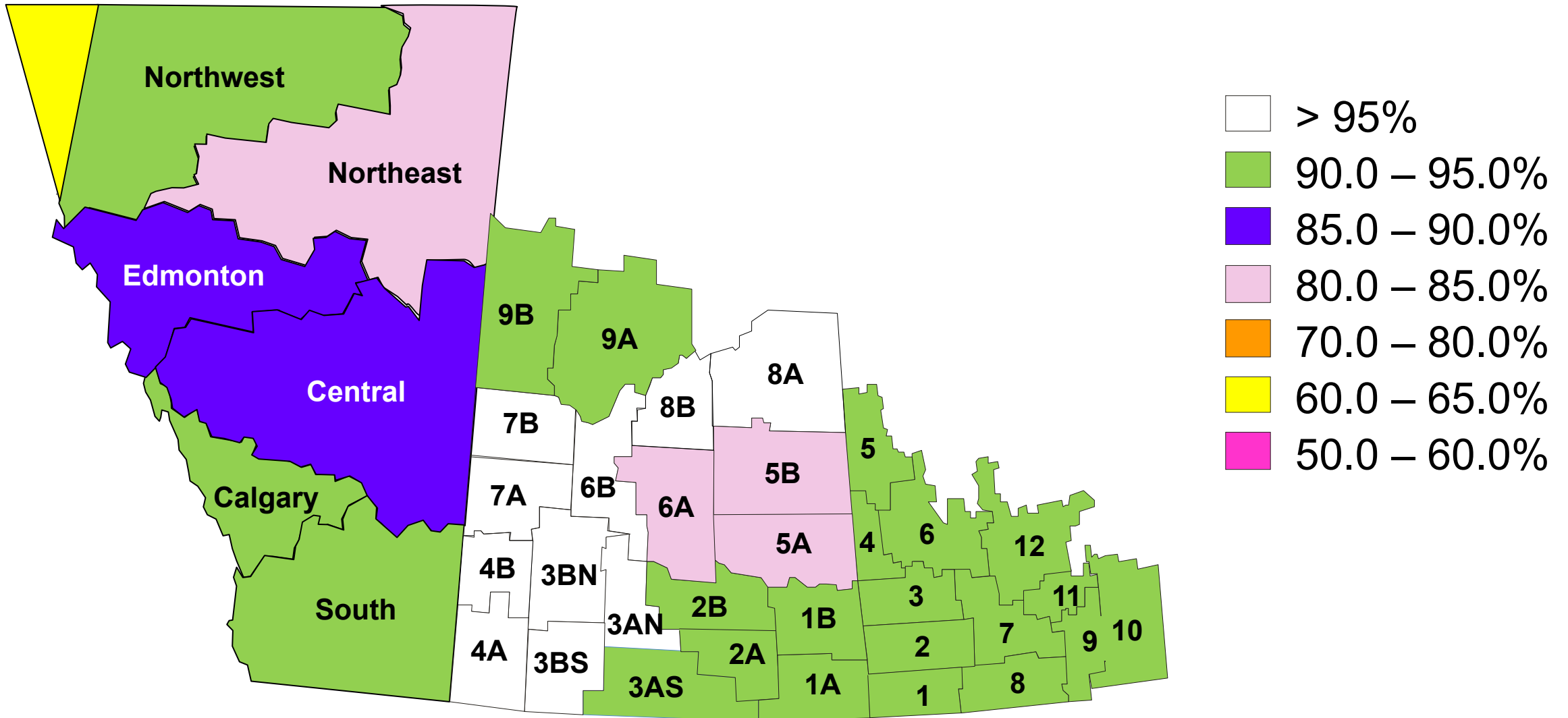
Canola Council of Canada



Calgary Zoo – CTV News



Percent of canola harvested in Western Canada



Western Canadian canola sample description

All samples are cleaned and graded upon receiving by grain inspectors according to the [Official Grain Grading Guide](#)

2019 Fall individual canola samples:

Seeded spring 2019 and harvested fall 2019

Analyzed for quality by NIR spectroscopy upon receiving

2019 Fall aggregate canola samples:

2019 fall samples aggregated by location and grade

Analyzed for quality by NIR spectroscopy and reference methods

Stored at 4°C until further analyses are needed

2019 Overwintered canola samples:

Seeded spring 2019 and harvested spring 2020 (May)

Analyzed for quality by NIR spectroscopy and reference methods upon receiving



Methods

NIR reflectance spectroscopy (NIRSystems 6500): triplicate analyses (24 spectra, 2 nm intervals, 400 to 2500 nm). NIR models developed and tested using whole seed Canadian canola analyzed according to:

AOCS Ba 4e-93:2017 (Dumas, N x 6.25) for crude protein (% , 8.5% moisture basis)

AOCS Ak 2-92:2017 for chlorophyll content (mg/kg, as is)

CGC method for moisture (%): 2 g ground seeds, 3 h, forced air oven at 103°C

ISO TS 12788:2022 (glucose release) and ISO 9167:2019 (HPLC) for total glucosinolates content ($\mu\text{mol/g}$ of seed, 8.5% moisture basis)

ISO 10565:1992 (pulse NMR spectroscopy) for oil (% , 8.5% moisture basis) and moisture (%) contents

Fatty acid composition and iodine value: ISO 12966-2:2017 (derivatization of oil) followed by ISO 12966-1:2014 (gas chromatography) and iodine value calculated from fatty acid composition using AOCS 1c-85:2017

Free fatty acids: Ke *et al.* (1978) for free fatty acids (% as oleic acid)

Accelerated oxidative test: modified ISO 6886 method (893 Professional Biodiesel Rancimat instrument) at 110, 120, 130, and 140°C with 0.5 g of ground seeds

Sample description: oil, protein & chlorophyll

			NIR Oil (%, 8.5% moisture)			NIR Protein (%, 8.5% moisture)			NIR Chlorophyll (mg/kg, as is)		
Sample	Grade	N	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Fall individual	No. 1	2,233	44.8	36.0	51.9	20.3	14.4	27.8	11	4	62
Fall aggregate		36	44.2	41.5	45.8	20.8	19.2	23.1	11	4	22
Overwintered		33	45.7	41.7	49.9	19.0	16.2	22.6	19	4	53
Non parametric ANOVA Kruskal-Wallis Test			p = 0.009			p = 0.0224			p < 0.0001		
Fall individual	No. 2	232	44.5	37.8	50.6	20.3	15.8	28.1	37	4	91
Fall aggregate		4	43.9	42.6	44.6	20.6	19.9	21.7	26	7	47
Overwintered		37	45.9	42.6	50.7	19.8	16.4	22.6	29	4	49
Fall individual	No. 3	135	44.9	38.1	50.0	20.2	15.7	27.1	73	4	165
Fall aggregate		3	44.8	44.5	45.1	20.2	19.7	20.6	49	6	77
Overwintered		22	45.7	40.2	51.1	19.8	17.7	21.6	48	7	88
Fall individual	Sple	51	44.4	35.4	48.0	19.7	17.0	24.6	54	4	204
Fall aggregate		4	43.7	42.1	44.7	20.4	19.9	21.1	33	8	75
Overwintered		21	44.2	39.7	49.5	20.2	15.7	27.4	53	4	161

Free fatty acid content of the oil

Harvest segregation	Grade	N	FFA 1 upon arrival (% as oleic acid)				FFA 2 after storage (% as oleic acid)			
			Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Fall individual	No. 1	28	0.17	0.10	0.05	0.43				
Fall aggregate		36	0.19	0.08	0.08	0.34	0.33	0.14	0.14	0.64
Overwintered		31	0.50	0.33	0.12	1.45	0.63	0.32	0.17	1.66
Non parametric ANOVA, Kruskal-Wallis Test			p < 0.0001				p = 0.0001			
Fall aggregate	No. 2	4	0.41	0.25	0.22	0.76	0.61	0.54	0.23	1.23
Overwintered		37	0.98	0.75	0.17	4.62	1.21	0.99	0.26	6.09
Fall aggregate	No. 3	3	0.28	0.03	0.25	0.30	0.51		0.50	0.51
Overwintered		22	1.50	1.52	0.32	7.64	1.78	1.80	0.41	8.99
Fall aggregate	Sple	4	0.44	0.20	0.26	0.72	0.71	0.22	0.57	0.96
Overwintered		17	1.78	1.60	0.53	7.13	2.32	2.38	0.65	10.00

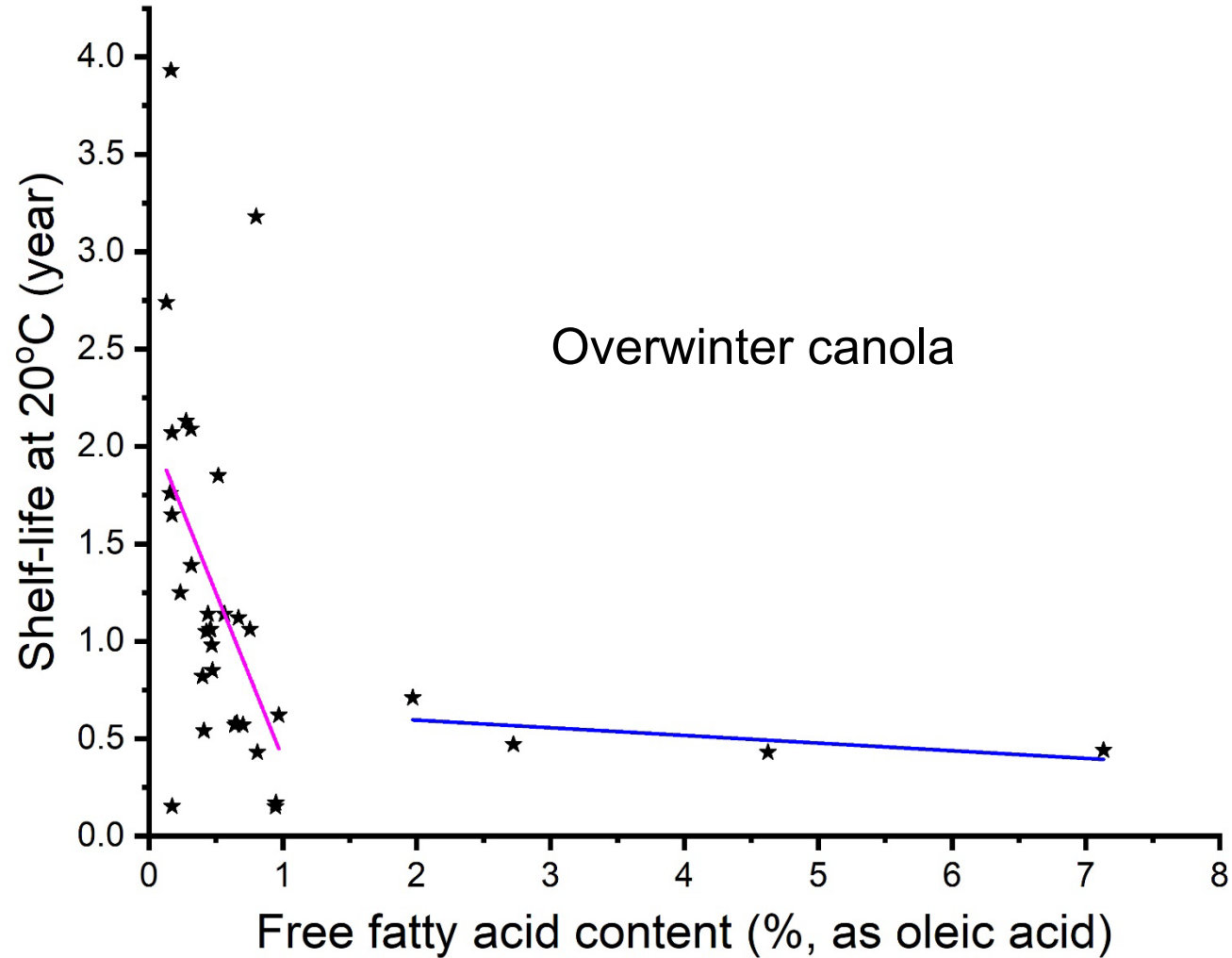
Accelerated oxidation test: Induction period

				Ip 110°C				Ip 140°C			
Harvest Type	Grade	Class	N	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Fall aggregate	No. 1	LEAR	13	72.4	8.6	63.8	90.3	10.5	2.1	8.2	13.9
Overwinter			16	42.6	11.4	25.6	64.3	6.2	1.1	4.2	8.8
Non parametric ANOVA Kruskal-Wallis Test				p < 0.0001				p < 0.0001			

Accelerated oxidation test: Q_{10} and shelf-life

				Q_{10} factor				Shelf-life at 20°C (SL ₂₀ , years)			
Harvest Type	Grade	N	Class	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Fall aggregate	No. 1	13	LEAR	1.91	0.06	1.80	1.98	2.66	0.58	1.78	3.36
Overwinter		16		1.89	0.07	1.78	2.04	1.61	0.97	0.54	3.93
Non parametric ANOVA, Kruskal-Wallis Test				p = 0.3237				p = 0.0025			
Fall aggregate	No. 2	3	LEAR	1.91	0.04	1.88	1.95	2.56	0.51	2.07	3.09
Overwinter		7		1.85	0.07	1.74	1.95	0.95	0.77	0.15	2.13
Fall aggregate	No. 3	2		1.88	0.02	1.86	1.89	1.82	0.19	1.68	1.95
Overwinter		4		1.86	0.03	1.83	1.91	1.16	0.16	0.44	1.39
Fall aggregate	Sple	3		1.88	0.04	1.83	1.91	1.86	0.34	1.51	2.19
Overwinter		3		1.87	0.06	1.82	1.94	0.54	0.15	0.44	0.71
Overwinter	No. 1	2	LowLin	1.81		1.77	1.85	0.85		0.57	1.12
Overwinter	No. 2	2		1.68		1.59	1.76	0.36		0.15	0.57
Overwinter	Sple	1		1.65				0.17			

Shelf-life as a function of free fatty acid content



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