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CANOLA QUALITY IN ALASKA (2001 HARVEST)

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In 2001, approximately eight acres of canola (Brassica campestris/rapa) was planted on the Agricultural and Forestry Experiment Station's Delta Field Research Site. Three Polish varieties were planted, mainly Reward and Colt, with a small amount of Horizon. Approximately ten 1500-pound bags of canola were harvested, totalling a yield of 15,000 pounds, nearly a ton per acre. In July of 2003 a small oil press was set up at the AFES Farm and about 25 gallons of oil was pressed. The oil yield was about 25–30% of the weight of the seed. The products, oil and meal, along with five samples of the canola seed were sent to SunWest Food Laboratory in Saskatoon, Saskatchewan, for analysis. This report contains quality data from tests of the canola seed, oil, and meal from the 2001 canola grown on the Delta farm.

Canola press used to extract oil, located at the Agricultural and Forestry Experiment Station, Fairbanks Experiment Farm.

Oil Content

The most striking result of the analysis of canola seeds was the high oil content of the Alaska canola seed, of 52.65%. The mean for Western Canada during 1992-2001 was 42.9% (www.Grainscanada.gc.ca). In the words of the person performing the lab analysis in Saskatchewan, this was "exceptionally high."

Table 1. Quality of 2001 Alaska Grown Canola Seed vs. No. 1 Canada Canola 1992–2001 Mean Quality Parameter

	Alaska	Canada 1992-2001
Oil Content	52.65%(avg)	42.9%
Protein Content	17.68%(avg)	20.6%
Chlorophyll Content, Mg/Kg in seed	4.99%	14
Total Glucosinolates umol/g	15.3	12

Protein Content

Conversely, the protein content was significantly lower (17.68% vs. a mean of 20.6 in Western Canada for 1992–2001). As pointed out in (Geier 2001) the interest by Alaska livestock producers in a high protein concentrate feed source may be the main interest for canola research in Alaska. However, the test results for the 2001 canola crop indicates that the higher value will undoubtedly come from its other product, oil. Much of the difference between Alaska and Canadian canola protein content may be explained by the high oil content.

Chlorophyll Content

The chlorophyll content was a low 4.99 mg/kg, compared to a mean of 14 for Western Canada from 1992 to 2001. Chlorophyll is retained in mature canola seed as the result of an early frost or other environmental factors. Chlorophyll in seeds is extracted with the oil when it is processed. Oils from seeds with elevated chlorophyll content are less stable, and may become rancid faster. Production uses of the oil are limited due to the characteristics of chlorophyll. Chlorophyll can be removed from the oil during processing, although it does add to the cost of processing. Because of this, even a little chlorophyll can cause severe economic loss to farmers. For the samples of Alaska canola grown in 2001, chlorophyll content is very low. In the past, chlorophyll content in seeds has been seen as a very critical barrier to the production of canola in Alaska, under the belief that chlorophyll content in Alaska canola was high. There are many production practices that can be used to reduce chlorophyll content in seeds. In 2001 the fact that the canola was combined very late (about Sept. 24) may have contributed to the favorable analysis.

Glucosinolate Content

The Alaska-grown canola has a total glucosinolate level of 15.3 micromoles per gram, slightly higher than the Canadian canola average at 11 micromoles per gram in 2001. According to Canadian Feed Regulations, canola is defined as containing "Less than 30 micromoles of…glucosinolates." Thus, the Alaska-grown canola is well within the range for glucosinolates for canola. Glucosinolates have long been considered as the major anti-nutritive factor in rapeseed meal. Glucosinolates are responsible for the pungent odor and sharp flavor found in mustard, but its presence in canola is undesirable.

Canola Oil Analysis

Peroxide Value

The canola oil analysis results point out several very important characteristics of Alaska canola oil compared to U.S. and Canadian oil produced in 2001. While a peroxide value was not available from the publications consulted from Canada and the U.S., the SunWest Lab explained that the relatively high peroxide value was probably due to the age of the seeds tested (almost 2 years old). The value is correlated to spoilage that has already taken place in the oil, and thus time is the enemy. This is illustrated by the September 15 sample of oil tested from the same batch as the July 18 oil, in which the peroxide value was significantly higher after only 2 additional months in the bottle. Alaska canola oil will undoubtedly need to be stabilized after being pressed to be commercialy viable. According to USDA Commercial Item Description for Salad Oils, Vegetable, the maximum allowable peroxide value is 1.0 meq/kg, much lower than the 3.01 (July 18) and 4.43 (Sept. 15) meq/kg from the Alaska canola oil tested. This test illustrates that canola should be fresh when pressed, and the need for additional processing of the Alaska canola oil in the future.

Table 2. 2001 Canola Oil Analysis

	Alaska		U.S.	Canada
	July 18	Sept 15		
Peroxide Value (meq/kg)	3.01	4.43		
Fatty Acid Profile (%)				
12:0 Lauric Acid		0.01	--	
14:0 Myristic Acid	0.04	0.04		
16:0 Palmitic Acid	3.50	3.35	4.1	4.0
16:1 Palmitoleic	0.19	0.18	0.26	0.3
18:0 Stearic Acid	1.51	1.46	2.53	2.0
18:1 Oleic Acid	57.13	57.45	64.1	61.0
18:2 Linoleic Acid	20.98	21.12	17.3	19.1
18.3 Alpha Linolenic Acid	14.02	14.40	8.00	9.3
20:0 Arachidic Acid	0.60	0.45	0.77	0.7
20:1 Eicosenoic Acid	1.02	0.93	1.34	1.3
20:2 Eicosadienoic Acid	0.08	0.08	0.07	0.1
22:0 Behenic Acid	0.32	0.23	0.35	0.3
22:1 Erucic Acid	0.07	0.06	0.11	0.1
24:0 Lignoceric Acid	0.16	0.06	0.22	0.2
24:1 Nervonic Acid	0.37	0.19	0.19	0.2

Fatty Acid Profile

In brief, although the oil content of the Alaska grown canola is significantly higher than Canadian and U.S., the oil composition is also significantly different. Specifically, the Oleic acid, which is seen as the "good" oil (stable, good for frying) is underrepresented in July 18 sample of AK canola (57.13% vs. 64.1 U.S. and 61.0 in Canada. Meanwhile, the oils with high and very high oxidation rates (Linoleic and Alpha Linolenic) are significantly higher. Erucic acid, which originally was the most toxic of compounds that was bred out of rape to produce canola, was the lowest in the Alaska sample (0.07% vs. 0.11% US and 0.1% Canada).

Another interesting point was that the Alaska canola fatty acid profile components were generally either higher or lower than the various fatty acids in both U.S. and Canadian fatty acid profiles. This would indicate another area of research interest, possibly correlating the latitudes at which the seed is produced with the differences.

The chemistry of Alaska grown canola oil is an area of research that is evident as needed information for potential growers, processors, and customers. What is the market for oil with the characteristics, which have been exhibited by this one-year canola trial in Alaska? Are the results replicable in future years? Is canola in Alaska a crop that is economical to grow, to process, and to sell?

The protein test of the Alaska canola meal shows 28.32% protein content. After the removal of oil, there 19.7% of oil remained, on a dry weight basis. Commercially available canola meal is approximately 36% protein with some oil content (usually 3–4%). The high remaining oil content in the meal from Alaska canola seeds was due to the extraction process used. The press used by UAF was a cold expeller press, which generally yields a much lower oil extraction rate than the solvent process used by most commercial canola oil extraction plants. Compared to the Australian canola meals from different extraction processes, the Alaska canola meal was comparable to the cold pressed sample. This illustrates that the process of oil extraction is very important to the characteristics of the canola meal. Thus, the oil content was significantly higher than in most commercially available meal, the protein content was lower (due to high oil content) and the glucosinolates were fairly high, although lower (22.67 umol/g) than the allowable maximum of 30%.

Alaska canola meal processed by a cold expeller press, though similar to the results from other latitudes and countries, contains enough differences in its general makeup to warrant further research into its chemical properties. In addition to the general characteristics of oil content, protein content, moisture, and glucosinolate in the canola meal, an amino acid analysis should also be performed in the future.

Conclusions

The characteristics of Alaska canola, canola oil, and canola meal all deserve further attention. This study has shown so far that there are very significant differences between the samples of Alaska canola and its products grown in 2001 and canola grown in other parts of the world. These differences highlight the need to further evaluate the chemical makeup of Alaska canola for human and animal consumption, and to determine economic viability for marketing products and supporting farming and processing industries in Alaska.

Table 3. Canola Meal Analysis with Comparisons

	Alaska	Avg AB	Trules	ColdP	Expell	Solvent
Oil Content	19.70%	2.8	NG	25.55	13.02	4.48
Protein Content	28.32%	40.0	34%min	26.54	32.51	33.31
Moisture Content	8.76%	8.0	12%max	8.67	4.87	11.79
Glucosinolate Total (umol/g)	22.67	NG	30 max	11.1	3.0	1.4

Avg AB = Average Alberta analysis
Trules = Trading rules for canola meal, Canadian Oilseed Processors Association and Canola Council of Canada.
NG = not given
ColdP = Australian cold-pressed canola meal
Expell = Australian expeller-pressed canola meal
Solvent = Australian solvent-extracted canola meal

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