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Canola Quality in Alaska, 2004 and 2005 Harvests

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Introduction

About one acre of Polish canola (*Brassica rapa*) was planted on the Agricultural and Forestry Experiment Station (AFES) Delta Junction research site in 2004 and 2005. Reward, a Polish canola variety, was planted. The Reward seeds were from a local grower who bought it in Alberta. Approximately four 100-pound bags of canola were harvested in 2004, totaling a yield of 400 pounds per acre. The 2005 canola crop on the AFES farm yielded about 850 pounds per acre. Oil press equipment was set up at the AFES farm in University of Alaska Fairbanks (UAF) in June 2005, and seeds from the 2004 crop were pressed for oil. In previous years, the oil yield was about 25–30% of the seed weight. Shortly after harvest, two samples of oil (2004) and three samples of canola seeds (two from 2004, one from 2005) were sent to SunWest Food Laboratory in Saskatoon (Saskatchewan, Canada) for analysis. This report contains data on seed quality and oil test results from canola harvested in 2004 from AFES and from one cooperating grower in Delta. The 2005 canola was not pressed, but a seed sample from the UAF farm was sent to the SunWest Lab for analysis.

Oil Content

The most striking result of the analysis of canola seeds from previous tests was the high oil content of Alaska canola seed (Table 1). The mean for Western Canada for the 2005 crop was 43.7% (www.Grainscanada.gc.ca). The two samples of Alaska canola in 2004 had oil content of 45.9% for the UAF sample, and 50.7% for the cooperator's sample. In 2005, oil content in the UAF sample was 53.4%, nearly 10% higher than the Canadian average in 2005. There was also a clear difference in oil content between the Alaska samples. Even so, it is becoming apparent that Alaska canola consistently provides a comparatively high oil analysis when compared to canola grown elsewhere.

Protein Content

The protein content of the cooperator's canola was clearly lower (17.7% versus a mean of 21.2 in Western Canada for 2005 (Table 1). However, the UAF 2004 sample was higher at 25.3%. As illustrated by Geier, 2001, past interest by Alaska livestock producers in a high protein concentrate feed source may have been the main impetus for canola research in Alaska. The test results for all Alaska canola crops recently suggest that the oil content in the canola seeds produced in Alaska is probably of higher value than the protein. While the oil and protein content of the cooperator's sample was similar to the 2001 test results, the 2004 UAF sample exhibited a comparatively high protein content, and also a higher oil content than Canadian canola. In retrospect, the main difference between the UAF sample and that grown by the cooperator in 2004 was that the cooperator's use of nitrogen fertilizer was significantly lower (approximately 20 lbs/acre). The 2005 UAF sample had a protein content of 17.6, probably attributable to high oil content. Past results indicate that it is reasonable to expect Alaska canola will exhibit protein content in the range of 17 to 18%. However, after oil is removed from the seed, the resulting meal's protein content will be comparable to canola meal produced elsewhere.

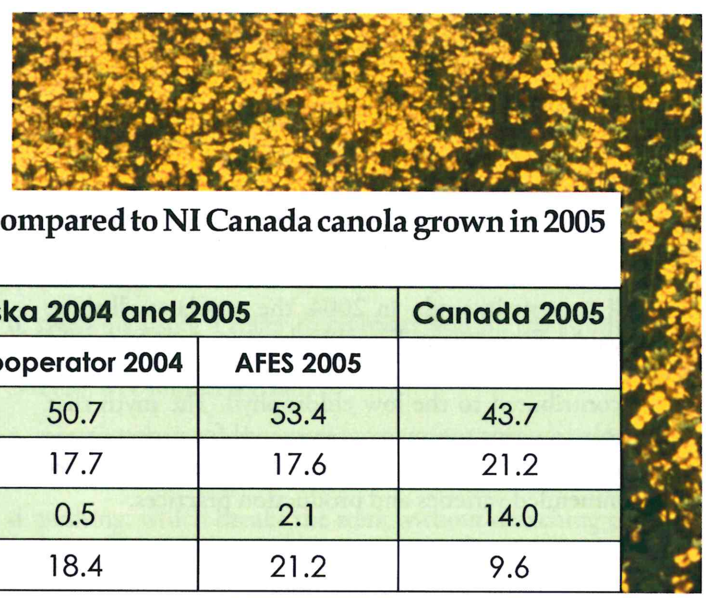

Table 1. Quality of 2004 Alaska-grown canola seed compared to NI Canada canola grown in 2005 (mean quality parameter).

	Alaska 2004 and 2005			Canada 2005
	AFES 2004	Cooperator 2004	AFES 2005	
Oil content (%)	45.9	50.7	53.4	43.7
Protein content (%)	25.3	17.7	17.6	21.2
Chlorophyll content (mg/kg seed)	2.1	0.5	2.1	14.0
Total glucosinolates (µmol/g)	31.5	18.4	21.2	9.6

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Table 2. Peroxide value (meq/kg) and 2004 fatty acid content of canola seeds.

Alaska Peroxide Value (meq/kg): AFES .85 Cooperator .63

	Fatty Acid Profile			
	Alaska		U.S.	Canada
	AFES	Cooperator		
14:0 Myristic Acid		0.06		
16:0 Palmitic Acid	3.46	3.99	4.1	4.0
16:1 Palmitoleic	0.17	0.19	0.26	0.3
18:0 Stearic Acid	1.56	1.85	2.53	2.0
18:1 Oleic Acid	59.2	59.78	64.1	61.0
18:2 Linoleic Acid	19.84	19.26	17.3	19.1
18.3 Alpha Linolenic Acid	13.28	12.23	8.00	9.3
20:0 Arachidic Acid	0.48	0.65	0.77	0.7
20:1 Eicosenoic Acid	1.09	1.00	1.34	1.3
20:2 Eicosadienoic Acid	0.08	0.07	0.07	0.1
22:0 Behenic Acid	0.24	0.38	0.35	0.3
22:1 Erucic Acid	0.22	0.20	0.11	0.1
24:0 Lignoceric Acid	0.16	0.22	0.2	
24:1 Nervonic Acid	0.11	0.20	0.2	
Others	0.07	0.01	0.17	0.19

Chlorophyll Content

Low chlorophyll content in canola seed is desirable. 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 during processing. Oil from seeds with elevated chlorophyll content are less stable, and their oxidation results in rancidity, which limits how the oil can be used. Chlorophyll can be removed from the oil during processing, but this increases production costs. Because of this, even a little chlorophyll can cause severe economic loss to farmers in the cooking and salad oil market.

The chlorophyll content in the Alaska samples grown in 2004 and 2005 was a very low (2.1 mg/kg seed for UAF in 2004, 2.08 in 2005, and 0.5 for the cooperator's sample) compared to a mean of 14 for Western Canada sampled from 1994 to 2003 (Table 1).

In the past, chlorophyll content in seeds has been seen as a very critical barrier to the production of canola in Alaska. There are many field production practices that can be used to reduce chlorophyll content in seeds. In 2004, the canola at all three sites (Fairbanks Experiment Farm, Delta Research Site, and cooperator's field) was combined last, late in the season, which may have contributed to the low chlorophyll. The myth that Alaska canola contains too many green seeds for processing is unsupported by any recent data from AFES or its cooperators using recommended varieties and production practices.

Glucosinolate Content

Glucosinolates have long been considered as the major anti-nutritive factor in canola seed meal. Glucosinolates are responsible for the pungent odor and sharp flavor found in mustard, but its presence in canola is undesirable.

The Alaska-grown canola has a total glucosinolate level of 31.84 micromoles per gram (µmol /g) for the UAF sample, and 18.43 µmol /g for the cooperator sample in 2004, and 21.2 in 2005, which was higher than the Canadian canola average of 9.6 µmol /g from 1994 to 2003 (Table 1). According to Canadian Feed Regulations, canola is defined as containing "Less than 30 micromoles of glucosinolates." Thus, the 2004 UAF Alaska-grown canola is slightly above the range for glucosinolates for canola. The 2004 Alaska cooperator's sample and the 2005 UAF sample were within the range but above the Canadian average.

Peroxide Value

A peroxide value is correlated to spoilage that has already taken place in the oil. According to USDA Commercial Item Description for Salad Oils, Vegetable (ref.), the maximum allowable peroxide value is 1.0 meq/kg. Peroxide values were tested in oil from the 2004 samples and seeds from 2005 The peroxide value of Alaska canola that was tested in oil for the 2004 samples, and in the seed for 2005. Results show a value lower than the 1.0 meq/kg maximum allowable for USDA Vegetable Salad Oil (Table 2). Peroxide values of 0.85 and 0.63

were recorded for the 2004 UAF and cooperator samples; the 2005 UAF sample had a 0.39 peroxide value.

To be commercially viable as cooking or salad oil, despite these low peroxide values in 2004 and 2005, Alaska canola oil will require stabilization after pressing. Otherwise, the oil will continue to deteriorate and in time peroxide values will be a problem. This test shows that canola should be fresh when pressed, and that Alaska canola oil will require additional processing.

In brief, although the oil content of the Alaska-grown canola is clearly higher than that of Canadian and other states in the U.S., the oil composition is also clearly different. Specifically, the oleic acid, which is seen as the "good" oil (stable, good for frying) is underrepresented in the 2004 samples of Alaska canola (59.2% and 59.8% versus 64.1% U.S. and 61.0% in Canada. Meanwhile, the oils with high and very high oxidation rates (linoleic and alpha linolenic) are clearly higher. Erucic acid, which originally was the most toxic of compounds that was bred out of rape to produce canola, was higher in the Alaska samples (0.22% and 0.20% 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 canola's fatty acid profiles. Determining whether these differences correlate with the latitudes at which the seed is produced is another potential area of research.

Conclusions

The characteristics of Alaska canola and canola oil deserve further attention. This study has shown so far that there are very significant differences between the samples of Alaska canola from 2004 and 2005, and canola grown in Canada. 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.

Basic information on the chemistry of Alaska grown canola oil is needed by potential growers, processors, and ultimately customers. Another question that should be answered in the future is: why is there such a difference in Alaska canola oil content and composition versus canola grown elsewhere?

Recommendations for Growing Canola

Canola grows well in the Interior of Alaska. However, if a producer is interested in growing this crop, it is imperative that they take into consideration several facts that are supported by UAF research. Recommendations for canola growers:

1. There are several Polish varieties that do well in interior Alaska. UAF has found no Argentine varieties that consistently do well. If you are interested in planting Canola, please contact UAF for varietal recommendations.
2. It is very important to PLANT EARLY. Canola has a very small seed—if it is planted early (early May), it will have enough moisture to sprout. If you plant it later, it may not have moisture and will sprout later in the growing season (probably in late June when summer rains start), leading to immature seeds at harvest. Canola seed is relatively cheap, and seeding rates are low, so if you do have significant frost damage, you can simply plant your field again. Canola is resistant to frost in the cotyledon stage, and may show amazing recovery after what may appear to be a killing frost.

Robert Kocsis in a canola field that will be ready for harvest in about two weeks. Kocisis plans to buy canola for making biodiesel fuel.
—Photo by Hans Geier

3. Plant shallowly. Set your drill at 1 inch deep, or use a seeder that deposits the seed very shallowly. Direct seeders are preferable to conventional tillage and drills for seeding canola, both for accuracy and seed placement.
4. Insure your canola crop. Provisions for replanting and payment for crop failure will ensure that you will minimize income loss while growing this crop (as well as other Alaska crops like hay and barley). Like crop insurance, participation in USDA production subsidy programs will allow you to compete with growers elsewhere.
5. Plant early to help minimize weed problems. Canola can out compete most weeds in interior Alaska, given an adequate head start. The photo above shows a 36-acre field in 2006 near Delta Junction with no obvious infestations, although the field was not been sprayed with herbicides. Most canola weed control includes proprietary (genetically modified) seed as well as chemicals like glyphosphate. Currently, AFES cannot recommend any proprietary canola varieties that perform well in Alaska, because most are Argentine varieties.

As with any crop, harvesting presents a new set of challenges. First is the choice of harvest method itself, including pre-harvest treatments. Because of canola's status as a new crop for Alaska's farmers, it is difficult to advise on what may be expensive equipment choices. Several pre-harvest techniques are known, including:

a. swathing without a way to fix the swath, which may result in wind damage,

b. swathing using a roller to compact and fix the swath in the stubble which may result in drying problems from Alaska's cold, wet soils in the fall,

c. spraying the standing crop late in the growing season with glyphosphate or a dessicant,

d. pushing, which breaks the stem without detaching the root by means of an implement specifically designed for the purpose, or with a smooth roller to simply crush the plant.

Spraying and pushing expedite straight combining, the harvest method of choice for most Alaska producers.

Combining canola brings additional challenges. If a pre-harvest technique has been used and is successful in desiccating the stem especially, harvest problems will be minimized. Without desiccation, it is still possible to achieve high quality canola seed. However, canola is a comparatively very difficult crop to harvest, especially using older combines. Twenty to thirty-year-old combines that have been transported here from the Midwest may have been designed mainly to harvest corn and soybeans. Even with an experienced operator, canola (especially green and wet canola) will plug combines in ways that barley will not.

After the canola has been combined, post harvest handling is of utmost importance. To date AFES has not conducted significant research in this area. It is possible to simply store the canola in flat storage (including trucks) if it is evenly piled less than two feet thick. Make sure that you smooth the top (no peaks or valleys), and check regularly for heating in the first few weeks. If it does heat, simply shovel it around to expose the heated area to air. Of course this will only work with small amounts of canola. Drying and storage issues will become critical with increased production. Specific drying instructions cannot be made using AFES research. However, much information is available from manufacturers of drying and storage equipment for those interested in commercial production.

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