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DAIRY RESEARCH RESULTS
from the Agriculture and Agri-Food Canada Research Centre, Lethbridge

Micronization of Full-fat Canola Seed

In many areas of North America, full-fat whole soybeans and whole cottonseed are economical sources of both protein and fat for lactating cows. Since these feeds are not readily available in Western Canada, there has been some interest in exploiting the protein and fat in whole canola seed (see article **1F3**).

Both soy and canola proteins are quite degradable in the rumen and several methods of heating have been used to improve their 'bypass' values. In the US and Eastern Canada, intact soybeans are commonly roasted and included in dairy rations with no further processing. But the small size and hard hull of canola seed make it almost completely indigestible unless the hull is fractured, normally by rolling or grinding.

Micronization

Another method of processing grains has recently become available in Western Canada with the importation of a technology commonly used in Europe. Micronization is a dry-heat process in which infrared gas generators heat the grain to approximately 110-115 °C. The grain is cooked from the inside out and rapid internal expansion causes the hull to rupture. We became interested in determining whether micronization could be used to process whole canola seed, both increasing its bypass protein value by heating and increasing its digestibility by fracturing the hull. Here are the results of our trials:

Effects on whole canola seed

Although micronization did not affect the chemical composition of whole canola seed, it did produce some significant physical changes. Figure 1a is a photograph of unprocessed whole canola seeds taken with an electron microscope. Figure 1b shows how micronization ruptures the seed coat, exposing internal material.

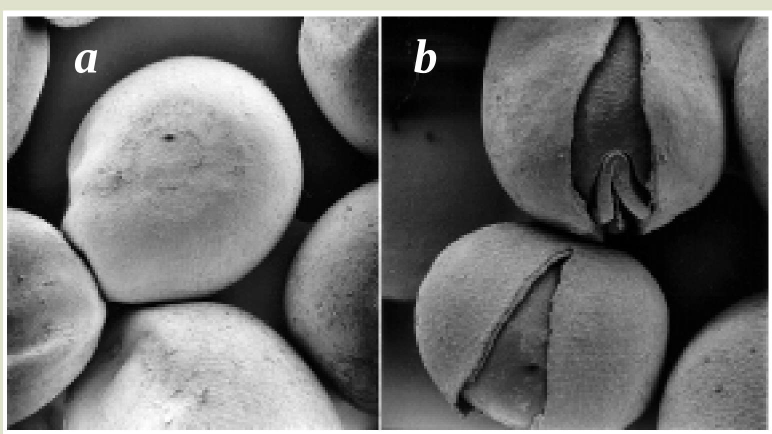

Figure 1 : Electron microscope photos of whole canola seed - (a) untreated and (b) after micronization for 1.5 minutes.

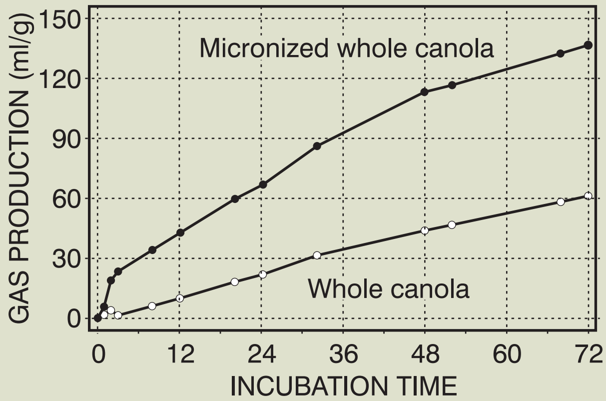

Figure 2 : Micronization increased the rate of fermentation of canola seed by rumen microbes.

In a preliminary trial, samples of unprocessed or micronized whole seed were incubated with microbes extracted from the rumen of a lactating cow. Fermentability of the seed was estimated as the amount of gas produced during the incubation. As shown in figure 2, micronization significantly increased fermentability although, for both samples, gas production was quite low. When studied under the electron microscope, it was apparent that the intact seed coat of unprocessed canola was extremely resistant to microbial colonization and digestion. Rupture of the seed coat by micronization allowed microbes to gain access to the more readily digestible interior.

Since digestion of unprocessed seed was so low in our preliminary gas production study, for our further trials we decided to compare micronized whole seed with unmicronized seed in which the seed coat was hand-cracked by pressing seed under a steel plate, to simulate rolling.

Figure 3 compares dry matter (DM) and crude protein (CP) disappearance rates when samples of these were incubated in the rumen. Notice the very low rates of disappearance for the micronized seed, reflecting low microbial digestibility.Whole tract disappearance of the micronized seed was also very low, amounting to 26.4% of DM and 33.5% of CP compared with 62.4% of DM and 79.3% of CP for hand-cracked, unmicronized seed. Most of the difference in whole tract disappearance between micronized and hand-cracked whole seed was due to differences in rumen DM and CP disappearance rates.

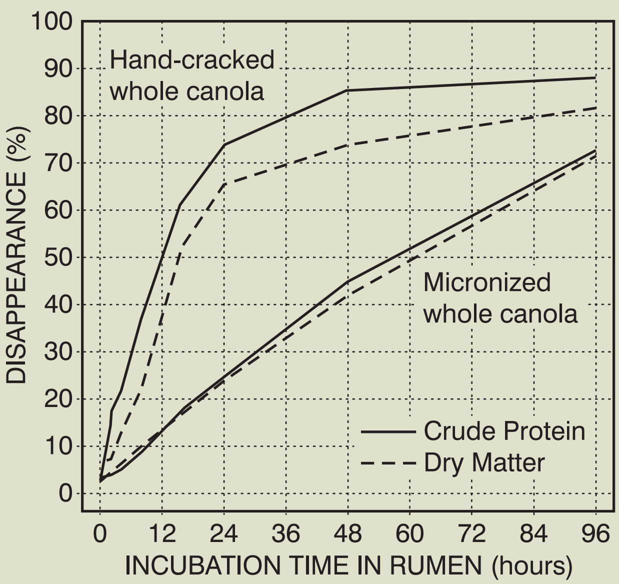

Figure 3 : Disappearance of dry matter and crude protein from samples of cracked or micronized whole canola incubated in the rumen in porous nylon bags.

These experiments demonstrated that micronization was effective in fracturing the seed coat of whole canola and in decreasing its rumen DM and CP degradability. Although the overall digestibility of the micronized whole canola was too low to be economically practical, the reduction in rumen degradability suggested that micronization might be used to improve the feeding value of ground seed.

	GROUND UNTREATED	GROUND MICRONIZED
Dry Matter Disappearance, %		
Rumen	86.6^{a}	80.4^{b}
Whole tract	89.1	89.9
Crude Protein Disappearance, %		
Rumen	91.3^{a}	84.8^{b}
Whole tract	93.6	93.4
Effective Rumen Crude Protein Degradability, %	55.6^{a}	45.4^{b}

Table 1 : Rumen disappearance is the % of DM or CP lost from samples incubated in the rumen in porous nylon bags for 16 hours. Whole tract disappearance is the total amount lost from the bags after rumen incubation followed by passage through the lower digestive tract. Effective degradability is an estimate of the amount which would be degraded in the rumen under typical feeding conditions. Values in the same row with different superscripts are significantly different from one another.

Effects on ground canola seed

Table 1 compares DM and CP disappearances of ground micronized canola seed with those of ground unmicronized seed. Micronization significantly decreased the rumen disappearance of both DM and CP (figure 4) while whole tract disappearances were unaffected. Of particular relevance was the reduction in effective CP degradability – from 55.6% for the untreated canola down to 45.4% for the micronized product. In practical terms, this reduction in rumen CP degradability suggests that micronization could be used to improve the 'bypass' protein value of rolled, full-fat canola seed.

researchers: Yuxi Wang, Tim McAllister, Dale ZoBell, Lyle Rode, Mark Pickard, Zahir Mir and K.-J. Cheng

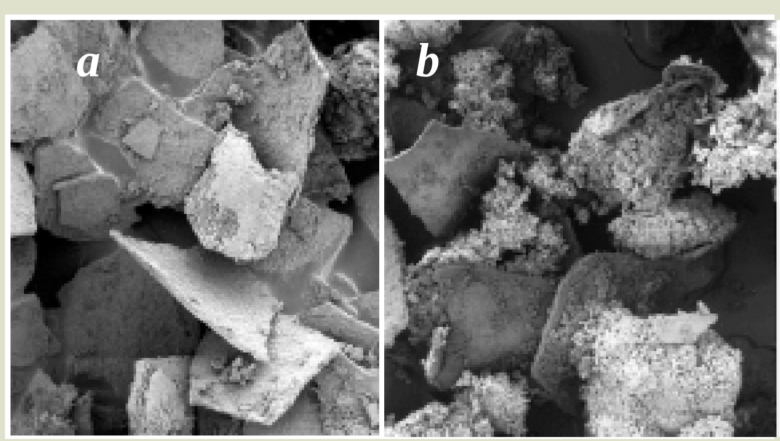

Figure 4 : Electron microscope photos of (a) ground unmicronized, and (b) ground micronized canola seed after 16 hours of incubation in the rumen. Notice the greater loss of internal material in (a).