Getting Canola Meal Values Right in Your Formulation

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Introduction

Feeding studies conducted at the U.S. Dairy Forage Research Center as well as elsewhere in the USA and Canada have repeatedly shown that dairy cows produce about 2 pounds more milk than would be expected from the formulation (Table 1 and Table 2). About 6 years ago, with the assistance of programs sponsored by Agriculture and Agri-Food Canada the Canola Council of Canada invested in numerous studies to determine the nutritional worth of canola meal for lactating dairy cows, and to provide updated nutrient values for this ingredient. The purpose of this extensive research was to provide fair and accurate feeding values for canola meal so that the ingredient can be used in diets with confidence of results. lso important to remember that the composition of drinking water is not only under natural influence but septic tanks, milk-house wastes and industrial drainage or drilling practices (Vidic et al., 2013) may also contribute to these composition problems. It is generally recommended that the water supply for cattle should be evaluated several times a year for coliforms, pH, minerals, nitrate and nitrites, and total bacteria. Expected levels and potential benchmarks of concerns for common water quality tests are given in Table 2.

Updated nutrient values for canola meal

Canola meal is a fairly new protein source. Developed in the 1970s from rapeseed meal, it had undergone continuous improvements, moving from a somewhat difficult to use protein to a premium product. Many existing databases rely on values from early studies, and these do not really relate to the meal at hand. The NRC (2001) publication Nutrient Requirements of Dairy Cattle, lists older values for expeller canola meal, and no values for solvent extracted meal. This key publication lacks representation of a feed ingredient that is predominantly available as solvent extracted canola meal. Furthermore, the methodologies used to assess nutritional values have likewise been improved as time passed. In situ disappearance of protein was the gold standard, and is now recognized as providing misleading values for rumen undegraded protein (RUP) and rumen degraded protein (RDP). Commercial laboratories currently provide an amazing selection of low cost assays to determine these values along with rates of digestion and digestibility.

The project to determine accurate feeding values was multifaceted. A survey was conducted that involved 12 canola processing facilities in Canada. Three samples of canola meal were obtained annually for 4 consecutive years. These samples were then analyzed by several laboratories. The complete set of samples was analyzed by Dr. Bogdan Slominski and his team at University of Manitoba (Adewole et al., 2016). This group of researchers tabulated proximate analyses as well as fiber sub-fractions, amino acids, and total tract digestibility in monogastric animals (Adewole et al., 2017a,b). The Manitoba group also assessed the presence of antinutritional factors. The complete sample set was furthermore analyzed by scientists at the U.S. Dairy Forage Research Center, under the guidance of Dr. Glen Broderick (Broderick et al., 2016). This laboratory used the Inhibitor Method (Colombini et al., 2011) to assess protein degradation in the rumen and determined digestibility of protein fractions. Protein and fiber digestion was determined in continuous culture at the University of Nevada under the supervision of Dr. Antonio Faciola. In addition, a portion of the samples were submitted to Dr. Debbie Ross, at Cornell University for evaluation of protein and amino acids using the Multi-Step Protein Evaluation System (Ross et al., 2013).

Results

The results of the analysis were eye-opening, and helpful in explaining the results found in past studies when canola meal was compared to other vegetable proteins. In a nutshell, the results showed that a high proportion of the protein in canola meal escaped fermentation in the rumen. In addition, the amino acid profile of the escape protein was found to be quite similar to the amino acid profile of rumen microbes, and well suited to efficient use for milk protein synthesis.

The meal contains a high proportion of lignin. However, this does not appear to interfere with fiber digestion, and the digestibility of the fiber fraction was determined to be considerably greater than in older tables. As a result the metabolizable energy value of the meal was determined to be greater as well.

An interesting observation on Table 1 and 2 is that the urea N is lower in diets that contain canola meal. The reason for this is because there is less rumen degraded protein, which ultimately gets absorbed and must be disposed by the cow. This also means that there is more RUP that can be efficiently used by the cow.

Why rule of thumb estimations are not reliable- and what can be done

Ingredient buyers must make decisions regarding ingredient procurement with the goal of remaining as competitive as possible. Purchasers have a variety of rules or systems for assessing the value of an ingredient. It is not unusual for purchasing departments in mills and on dairies to rely on an intuitive dollar value spread between various protein ingredients. For example, canola meal might only be considered when the price is $75 less than soybean meal. How do such methods compare to the actual feeding value of the ingredient?

Prices for vegetable proteins vary, and some ingredients may be better buys some years than other years. In the above example, if soybean meal is priced at $300/ton, then canola meal would appear on the radar screen when the price is $225 or below. Basically one would be assessing the value of canola meal at 75% of the value of soybean meal. However, with the price of soybean meal at $500/ton, canola meal would be purchased if the price were below $425. Canola meal would be worth 85% of the value of soybean meal. However, the nutritional worth to the cow does not change.

Another approach is to compare on the basis of protein content. Canola meal has 77% of the protein of high protein soybean meal so therefore the price should be 77% of the current price of soybean meal. However, most nutritionists do not formulate diets on the basis of crude protein, and the RDP and RUP are of greater importance. As Table 3 shows, canola meal provides as much RUP as soybean meal on a pound/pound basis. If this metric were used than the price paid for CM should be equal to that of SBM!

There are other differences as well. The RUP in canola meal provides 40% more methionine than soybean meal, but it also has 10% less lysine. If methionine is limiting, then canola meal might be a good choice, while perhaps not so if ingredients at hand are marginal in lysine.

Rule of thumb type valuations can either over or under value the comparative worth of canola meal or any other protein ingredient in feeding circumstances. It is possible to make a wrong choice and not buy canola meal, as well as make a wrong choice by buying canola meal, or any other protein being substituted. For more on the topic see the article "Comparison of feed proteins for dairy cows takes careful thought", in Feedstuffs, July 5th 2017 issue (Broderick et al., 2017).

Handy tools

To try and remove some of the guesswork when comparing protein ingredients, the Canola Council of Canada developed the Dairy Feed Calculator. This calculator assigns comparative values to feed proteins. Values are assigned based on costs for RUP, RDP, energy. This tool can be accessed at http://canolamazing.com/feed-calculator/. Use is not restricted to canola meal.

Another important tool is the Feed Val program developed by University of Wisconsin and maintained by Dr. Victor Cabrera (http://dairymgt.uwex.edu/tools.php#feeding). This program takes advantage of up to date nutrient values that have been determined for canola meal. There are other similar programs, but the user needs to be aware of the values that are being used in the matrix. Those that rely on NRC (2001) data for nutrient values will be out of date for many ingredients.

But probably the most important method of assessing the value of a protein is to evaluate it in a feed formulation program. Feed formulation programs assess the value in relationship to other ingredients available in each unique situation. For example, the value of more methionine in the RUP fraction may or may not be important, based on other ingredients available: grains, forages and byproducts. Or, methionine might be more valuable than predicted by other methods. The tools provide relative values based on a few nutrients. In actual fact, any nutrient can cause ingredients to gain or lose in importance in feed formulation.

Are your values up to date?

Every effort has been made to supply platforms with up-to date values. If there remain doubts about a particular platform, nutrient profiles can be compared to values found at canolamazing.com, where a spreadsheet is available for downloading. Should this be inadequate, either of the authors can be contacted for additional support.

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Table 1. Comparison of feeding results from the U.S. Dairy Forage Research Center (Faciola and Broderick, 2013)

	Canola Meal	**Soybean Meal**
Dry-matter intake, lbs.	52.4	51.7
Milk yield, lbs.	82.1	80.1
Fat Yield, lbs.	3.21	3.19
Protein yield, lbs.	2.46	2.42
Milk urea nitrogen, mg/dL	12.9	14.0

Table 2. Comparison of feeding results from the U.S. Dairy Forage Research Center (Broderick et al., 2015)

	Canola Meal	Soybean Meal
Dry-matter intake, lbs.	55.9	55.0
Milk yield, lbs.	89.4	87.4
Fat Yield, lbs.	3.56	3.47
Protein yield, lbs.	2.70	2.63
Milk urea nitrogen, mg/dL	10.4	11.5

Table 3. Comparison of rumen undegraded protein values for soybean meal and canola meal (canolamazing.com)

Variable	**Soybean Meal**	**Canola Meal**
Crude protein, %	48.0	37.0
Degraded (RDP), %	53.6	40.0
Not degraded (RUP), %	47.4	60.0
Not degraded (RUP), % of meal	22.8	22.2
Digestibility, %	93.0	85.0
Available RUP, % of meal	21.2	18.9

Table 4. Amino Acids in the RUP fraction of protein as compared to milk (canolamazing.com)

	Milk	Canola meal	Blood meal	Soybean meal	Corn Gluten meal
Methionine	2.5	2.1	0.8	1.5	2.0
Lysine	7.5	5.7	9.2	6.3	1.5