by Steve Martin

Byproducts, sustainability, and the perfect ration.

When a dairy nutritionist sits down to formulate a diet, the goal is to combine a set of available ingredients into the most ideal blend that will best meet the needs of the animals being fed.

In my columns there is a frequent focus on the forage part of the formulation. But in most lactation diets the forages comprise only 40 to 60 percent of the ration. Since the goal of the lactating cow is to maximize milk production and have reproductive success, energy and protein from non-roughage feed ingredients are necessary. At many U.S. dairies most added energy comes from corn and most protein from soybean, canola and cotton by-products.

While it is true that dairy nutrition has become quite complex and most diets contain many ingredients, it is also true that a nice ration could be built with as few as four ingredients. Using only corn silage, soybean meal, a little wheat straw, and a vitamin/mineral supplement we can build a well-balanced diet.

So why complicate the process with the many ingredients that are in my computer ration model's feed library? The answer relates to cost control, along with increased and more detailed nutrient supply.

In agriculture's quest to feed the world's current population of over 7 billion people – and the need to ramp up production to soon feed 9+ billion – there will be more valuable by-products available to consider.

In most parts of the world the need for simple carbohydrates, including starch and sugar, results in enormous amounts of high fiber by-products. Some are left in the field and some are left at food processing facilities. When you add the by-products of ethanol production, the material that falls short of being valuable for the human kitchen or the gas tank is truly massive and valuable animal feed.

Many calories remain

Due to the ruminant's fantastic ability to digest and utilize these fiber-rich by-products, the calories that are left can still be converted to high quality nutrients for humans in the form of meat and milk.

In a similar fashion, much of the world's need for cooking oil comes from protein rich oilseeds like soybean, canola and cotton. Though there is human grade protein in the material remaining after oil extraction, it is filled with undigestible fiber for a human diet. The separation process to generate protein flour from these ingredients is also difficult.

If plant protein is the goal for a human diet, then lower-fat options like pinto beans may be a better crop choice. So in the production of cooking oil we are left with an enormous amount of fiber-rich protein meals that are tailor-made for ruminant-dairy nutrition formulation models, we should be able to have our cake and eat it too. It is true that a corn/soy-based dairy ration has less risk of nutrient variability than the by-products option. It is also true, though, that with a reasonable amount of formulation effort, ingredient sampling, and attention to detail we can supply the same nutrients to the cow using the cheaper by-product option.

Let's first look deeper at corn gluten feed. This material comes in great quantities due largely to America's love affair with soft drinks. Via the use of enzymes, the 70 percent starch content in corn is partially converted to fructose. This is the preferred sweetener by many soft drink and prepared food manufacturers.

The interesting thing about this process is that starch removal from the corn kernel is not complete. So the remaining material – corn gluten – still contains around 18 percent starch. Protein is also higher in the gluten than in the original corn kernel, simply due to the removal of the starch and resulting concentration of the protein in the kernel.

This protein is not fancy and is not altered due to high heat, but it is of sufficient quality to feed the microbial populations in cows' rumens. Since the fiber in corn is highly digestible, even the non-starch carbohydrates have a high energy value.

Thus, gluten feed is an able replacement for a blend of corn and SBM, but almost always at a lower cost. Two considerations when feeding gluten are the variability in starch and protein content between manufacturing facilities, and potentially problematic high sulfur levels.

Wheat midds are a very similar by-product ingredient to corn gluten from a nutrient content standpoint. When wheat flour is produced from raw wheat, the by-product produced is called wheat midds or wheat mill run. This is a very important feed ingredient in areas that are close to significant flour milling.

Like gluten feed, not all of the starch is removed from wheat when making flour. In addition, the original protein content of a wheat kernel (12 to 13 percent) is concentrated after removal of the starch and the final level in wheat midds is around 17 percent. So you have a moderate starch ingredient with 17 percent protein – which sounds very much like gluten!

The issue with midds relates to its particle size, low-density, and potential shrink due to wind. Thus, most wheat midds used in on-farm dairy mixing should be pelleted. The fiber in wheat is highly digestible, so when added to the highly digestible starch in midds the energy value is high.

What about DDG?

DDG can't be left out of this discussion, but it does differ from gluten and midds and there are three primary reasons.

First, since the production of ethanol from corn grain includes fermentation, the starch removal is more complete; nearly all carbons in the starch in a corn kernel are converted to carbons in ethanol. Thus, the concentration of fat, protein and fiber in DDG is more exaggerated than in other corn and wheat by-products.

Second, since fat is not removed from the kernel like it is in the corn gluten process, it is concentrated and results in a moderately high fat ingredient. This can be problematic in lactating cow rations due to potential reductions in milk fat synthesis, and thus lower butterfat levels. However, these higher fat levels are a great value in growing heifer diets.

The third reason is the protein portion is different. Heat in the ethanol process is high enough that it reduces rumen availability of the corn protein. This is good and bad. The good part relates to a higher "bypass" value for DDG protein. The bad part is a less-than-ideal amino acid content of corn protein.

DDG is more difficult to formulate and feed than the gluten and midds due to the higher levels of fat and bypass protein. Both factors limit its feed rate, but at more moderate inclusion levels DDG is a great option. As with the gluten, sulfur levels must be monitored.

This discussion exceeds the scope of one month's column and I will include information on brewing and oilseed by-products next month. It is true that a gold-standard dairy ration might not include these by-product type ingredients, but what about the cost savings potential? Simply being against them and thus leaving them out seems like a give-up.

We have all the tools necessary to source, analyze and formulate these cost-savers and still build a solid diet. It may take a larger commodity storage area and a few more lab samples, but the effort will be rewarded with as much as 10 to 20 cents per cow per day less feed cost. Taking the time and effort to participate in those savings while still feeding healthy diets will insure that you are truly feeding for the bottom line. *WEST*

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