

Feeding sugar may sweeten your margins

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Feed palatability is important. Sugars generally have been used to improve palatability. But, sugars add more than good taste to rations. We have been realizing more lately that rumen microbes actually will respond to the addition of sugars in the diet by producing more microbial protein.

The microbes need both a protein source (protein, urea, or ammonia) and a carbohydrate source (sugar, starch, or fiber) in order to grow. With the appropriate amount of available protein, about one-third pound of microbial protein can be made from each pound of carbohydrate fermented in the rumen.

Steak and potatoes...

Rumen microbes make microbial protein by reproducing. Rumen microbes reproduce many times in one day. For this reason, they need access to protein and carbohydrate on a minute-by-minute basis. They don't want to eat steak (protein) at 6 a.m. and then have potatoes (carbohydrate) at noon. They want to be provided stew (protein plus carbohydrate) at noon. They want to be provided stew (protein plus carbohydrate) every minute of the day. If no carbohydrate is available when protein is available, the nitrogen found in the protein is wasted by the rumen microbes and by the cow.

Rumen microbes do not grow and reproduce well in acid conditions. When the rumen microbes ferment carbohydrates, volatile fatty acids (VFAs) are produced. These VFAs are absorbed from the rumen and are used by the cow as energy. The problem comes when too much carbohydrate is fermented at one time and acids accumulate in the rumen. In order to limit acid buildup, we must provide carbohydrate throughout the entire day, not all at one time.

What's typical...

The sugar content of typical dairy rations is only 1.5 to 3 percent of the dry matter. Molasses, sucrose, dextrose, lactose, citrus pulp, and whey are the most common supplemental sugar sources used. Molasses usually contains 35 to 50 percent sugar. Citrus pulp, about 25 percent.

Sugars are digested and used by the rumen microbes very rapidly. The Cornell Net Carbohydrate and Protein System assigns a digestion rate of 300 percent per hour to sugars. The rates of starch digestion vary from 6 to 60 percent per hour, depending on starch source.

Proteins also vary in their digestion rate. Nonprotein nitrogen (NPN) from feeds such as silage and urea is digested very rapidly (300 percent per hour), but insoluble true protein such as that found in soybean meal ferments more slowly (4 to 12 percent per hour).

Sugars help to provide the energy needed at the right time in relation to the fermentation of other carbohydrates in the ration. Studies show that adding sugars to diets almost always reduces the amount of ammonia in the rumen. This suggests that sugars help the rumen microbes capture and use more of the nitrogen in the diet, especially nitrogen coming from rapidly digestible sources such as urea and the soluble protein in ensiled forages. Thus, sugars generally boost microbial protein production.

Less corn in manure...

Addition of sugars to the ration also can reduce the amount of corn seen in the manure. Basically, the sugars give the rumen microbes a little bit of a "kick in the butt," and they then digest more of the slower degradable starch in the corn. By getting corn out of the manure, we also can reduce the total amount of grain in the diet because of greater efficiency of the rumen microbes.

The amount of milk resulting from added sugars will depend, in part, on the blend of starches in the diet. If the diet contains only slowly degradable starches from cornmeal and mature corn silage, and it contains a lot of rapidly digestible protein or NPN, you are more likely to see a milk response from the added sugars.

Faster fermenting starches, such as those in high-moisture corn, flour, and bakery product, provide rapidly available carbohydrate. So, if you already have a good portion of these fast-fermenting starches in the diet, expect a lesser (but maybe still significant) response from the addition of sugars.

There are two other factors to keep in mind when considering supplemental sugars. First, don't go wild with feeding sugars. Too much sugar will result in a big blast of acid in the rumen at once, and your cows will get acidosis. Responses to sugar addition have been greatest when buffers, such as sodium bicarbonate, also were present in the diet.

Second, in order to manufacture microbial protein, the rumen microbes require nitrogen, carbohydrate, and a source of isoacids, the backbones of amino acids, and they are only supplied from true protein. There are no isoacids in nonprotein nitrogen (NPN).

So, you must make sure that both soluble protein (30 to 32 percent of the CP) and degradable protein (60 to 65 percent of the CP) are not limiting in the diet. A common, easy method for meeting the isoacid needs is to have at least 2 pounds of soybean meal in the diet.

Evidence is sketchy...

Unfortunately, there are not many studies that document milk responses to sugars. Researchers at South Dakota State University found that milk production rose by 2 to 3 pounds per day when dried whey was fed in one study. But, in a second study with whey or molasses supplementation, they found no milk response to the added sugars. However, soluble protein may have been limiting in that study.

Researchers at the University of Illinois supplemented cows during their first 12 weeks of lactation with 1.5 percent sucrose in a diet composed of 10 percent corn silage, 30 percent alfalfa silage, 40 percent cornmeal, 12.5 percent soybean meal, and 6 percent other protein and mineral sources. Dry matter intake for the 12 weeks of the trial was not significantly different for the cows fed sucrose versus those fed the control diet. However, during the first two weeks after calving, cows fed sucrose ate more. Milk production rose by 2 pounds per cow on the sucrose diet, but that difference was not statistically significant.

Most scientists will agree that the addition of sugars to diets can improve microbial protein production. They also would agree that increasing microbial protein production should improve dry matter intake and milk production. Many progressive dairy producers feed supplemental sugars and like the results.

In the future, more work needs to be done to accurately balance rations for sugars, fast fermenting carbohydrates, and slow fermenting carbohydrates. But, as a general recommendation, 4 to 6 percent of the diet dry matter should be sugar. That would usually be equivalent to 2 to 4 percent supplemental sugars in typical rations for high-producing cows.