

A Biodiesel Byproduct May Substitute for Corn

Jim Linn and Mary Raeth-Knight
University of Minnesota, St. Paul

The biodiesel industry is producing a byproduct called glycerin. Glycerin, also known as glycerol or glycerine, is a colorless, odorless, water soluble, sweet-tasting viscous liquid. Glycerol in the purest form is used extensively in the food and pharmaceutical industry. Glycerin is similar in chemical formula ($\text{CH}_2\text{OH}-\text{CHOH}-\text{CH}_2\text{OH}$) to propylene glycol ($\text{CH}_3-\text{CHOH}-\text{CH}_2\text{OH}$) and has replaced propylene glycol as a glucose source in a few transition cow research studies. The current interest is to see whether larger quantities of glycerin can be fed as a replacement for starch in dairy diets.

Glycerin Production and Quality

For every gallon of biodiesel produced, approximately 0.6 lb of glycerin is produced. To produce the biodiesel, oilseeds or fats are reacted with alcohol, usually methanol, and a strong base like sodium hydroxide. The glycerin produced from the reaction will contain alcohol, possibly up to several percent, and other products produced from the reaction with sodium hydroxide. The glycerin also will be treated with an acid to neutralize the pH. These contaminants in the glycerin are a concern for feeding. Currently, the FDA considers food grade glycerin or glycerol safe for feeding but is concerned about the methanol content in crude glycerin. Purdue researchers reported a letter from the FDA suggested methanol content of glycerin be less than 150 ppm or 0.015% for safe feeding.

The quality and purity of glycerin will most likely vary among biodiesel production facilities. Idaho ag engineers have evaluated different oilseeds and cooking oils for biodiesel and found residual nutrient and mineral contents in glycerin to vary considerably depending on the initial oilseed used. Thus, if you are thinking of feeding glycerin, know your supplier and get guarantees on analysis.

Feeding Value

German researchers evaluated the feeding of glycerin in both high and low forage diets fed to sheep and steers. In general, they found no effects on digestibility of starch or organic matter. Cell wall digestibility of the high forage diet was unchanged with glycerin addition, but decreased in the low forage diet. They determined the net energy value of glycerin ranged from 0.90 to 1.05 Mcal/lb when fed in high and low starch diets, respectively.

In a transition cow study, South Dakota researchers fed either 0.0, 0.95 or 1.9 lb of glycerol per day for the first 21 days of lactation. Milk production was not affected by feeding glycerol, but cows fed diets with glycerol had lower dry matter intakes than cows fed the diet without glycerol.

The most recent glycerol lactating dairy cow feeding study is from Purdue University. In an 8-week lactation study, glycerol was fed at 0, 5, 10 or 15% of the total diet dry matter. Glycerol replaced corn grain in the diets. Corn was 20, 14.2, 8.4 and 2.8% of the diet dry matter in the 0, 5, 10, and 15% glycerol diets, respectively. Dry matter intake averaged 53.4 lb per day during the study and was not different across the 4 dietary treatments. Milk production averaged 81.2 lb per day and was not affected nor was milk composition changed by the substitution of glycerol for corn. The net energy feeding value of the pure glycerol used in this study was determined to be equal to corn, approximately 0.92 Mcal/lb of dry matter.

Rumen Fermentation

Rumen fermentation of glycerol is not well understood. German research indicated glycerol is rapidly degraded in the rumen; faster than wheat. Others have shown doses of about 0.5 lb disappear in the rumen in 1 to 2 hours. Feeding glycerol appears to shift volatile fatty acid production in the rumen away from acetate towards butyrate. There also is a slight increase in propionate and, therefore, a slight decrease in the ratio of acetate to propionate in the rumen.

There is potential for glycerin or glycerol to be a replacement for corn in dairy diets. However, the purity and quality of glycerin will have to be monitored closely. Pure glycerol will be best for feeding, but is likely to be the highest in cost also. Based on the lactation studies, the value of glycerol is about equal to corn on a pound for pound basis.