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Added lysine can fortify soybean meal

The lysine content of mechanical extracted soybean meal can be improved through the use of gums technology.

By **CHARLES MACGREGOR, KENNETH KALSCHEUR** and **DON SAPIENZA***

INCREASED milk production requires adequate levels of amino acids delivered to the duodenum in a digestible form.

In many rations for lactating dairy cows, the first limiting amino acid is lysine. A process for fortifying mechanically extracted, high-bypass soybean meal with rumen-protected lysine has been developed. This new product can help lactating dairy cows meet their dietary lysine requirement.

Why is this important?

There is no single source of rumen undegradable protein (RUP) that provides an ideal balance of amino acids to match the amino acids required for milk production.

Some feedstuffs that are low in both crude protein and in lysine are commonly included in rations, such as corn silage, corn grain and corn byproducts (National Research Council, 2001). Other feedstuffs, such as the various blood meals, have higher crude protein and lysine concentrations but are variable in rumen degradability and intestinal digestibility (Stern, 2007).

In order to meet the lysine requirement and, at the same time, accommodate the drawbacks of these ingredients, rations are often formulated to contain higher crude protein levels than necessary.

This leads to two other problems. First, ration cost increases and income over feed cost falls because higher protein ingredients tend to be more expensive than lower protein ingredients. Second, excess crude protein is associated with elevated plasma urea nitrogen and milk urea nitrogen. Those, in turn, are associated with increased breedings per conception, increased incidence of mastitis and increased cost of reproduction.

*Dr. Charles Macgregor is with Soy Best. Dr. Kenneth Kalscheur is with South Dakota State University. Dr. Don Sapienza is with Sapienza Analytica LLC.

Rectified

As with other vegetable protein sources, mechanical extracted, high-bypass soybean meal supplies RUP that is low in lysine relative to the lysine requirement for milk production. When that ingredient is fortified with rumen-protected lysine, it supplies RUP that is a better match with the cow's amino acid requirements. That makes it possible to formulate a ration to meet the lysine requirement at a lower crude protein level.

The new process is based on patented technology (U.S. Patent No. 7,297,356) for applying fresh soy gums onto a feedstuff. In this case, the feedstuff is mechanical extracted soybean meal (MESG). A rumen-protected lysine product is inserted into fresh soy gums. The gums/lysine mix is then applied onto the mechanical extracted soybean meal (MESG+L).

Context

Dairy nutritionists of today have programs capable of formulating rations to meet amino acid requirements. These ration balancing models include LRNS from Texas A&M University, CNCPS from Cornell University and CPM from the University of Pennsylvania. The Ohio State University offers a program called Sesame that evaluates feedstuffs in terms of the value of their nutrients.

These technologies can help improve efficiency of nitrogen utilization, dairy cow health, milk production and income over feed cost in dairy rations.

These technologies benefit milk producers and milk consumers. They make it possible to formulate rations that meet cow's amino acid requirements at a lower crude protein content. That results in the likelihood of improved efficiency of nitrogen utilization, reduced milk urea nitrogen, improved health and reproduction and increased income over feed cost.

Plasma lysine

Gums technology is known to increase RUP. In a study at West Virginia University, a total mixed ration containing MESG had more RUP than diets with mechanical extracted high bypass soybean meal without gums.

A recent study at South Dakota State University measured plasma lysine in lactating dairy cows fed either MESG or MESG+L. Eight lactating Holsteins were fed a base ration that was adequate in lysine and protein during a pre-trial phase. During the seven-day plasma trial, four of the cows were fed the base ration top-dressed with MESG. The other four cows were fed the base ration top-dressed with MESG+L. Blood samples were drawn on the last day of the trial.

MESG+L increased plasma lysine levels in lactating Holsteins significantly ($P < 0.03$) compared with MESG (Figures 1 and 2).

Rumen kinetics

Two *in vitro* studies at Sapienza Analytica LLC evaluated the rumen kinetics of MESG and MESG+L.

In the first study, both products were incubated for 8 hours ruminally and 8 hours post-ruminally. At 8 hours, rumen undegraded lysine was not different between MESG and MESG+L, indicating that added rumen-protected lysine in MESG+L behaves in the rumen similarly to the native lysine in MESG (Figure 3).

(Note: This bag procedure does not allow for particles to exit the rumen with the liquid fraction. In actual rumen conditions, soybean meal particles do exit the rumen with the liquid fraction, in addition to being digested, and the average rumen residence time of soybean meal particles is 8 hours. That means the actual rumen bypass values are higher than the rumen undegraded values as measured in this study.)

The RUP from MESG was measured in a live cow at 73.3% of crude protein at the University of West Virginia, as reported in the *Journal of Dairy Science*. Intestinal digestibility of rumen undegraded lysine at 8 hours was 83.0% for MESG and 89.9% for MESG+L (Figure 4).

Rumen undegraded dry matter at 8

hours was also not different for MESG and MESG+L and averaged 74.5%.

In the second study, both products were incubated for 50 hours in dacron bags. Dry matter disappearance curves were fitted using the JMP statistical software program. RUP was calculated based on the A and B fractions and kd determined using the nonlinear modeling function of JMP. RUP was calculated at an assumed passage rate of 6% per hour.

Rumen undegraded dry matter at 8 hours for MESG and MESG+L was not different and averaged 73.6% at 8 hours (Figure 5). This was similar to the value of 74.9% in the first Sapienza study.

These three studies showed:

(1) The added lysine and the native lysine have similar rates of rumen bypass and intestinal digestibility, and

(2) The added lysine is absorbed into the plasma of lactating dairy cows.

Conclusion

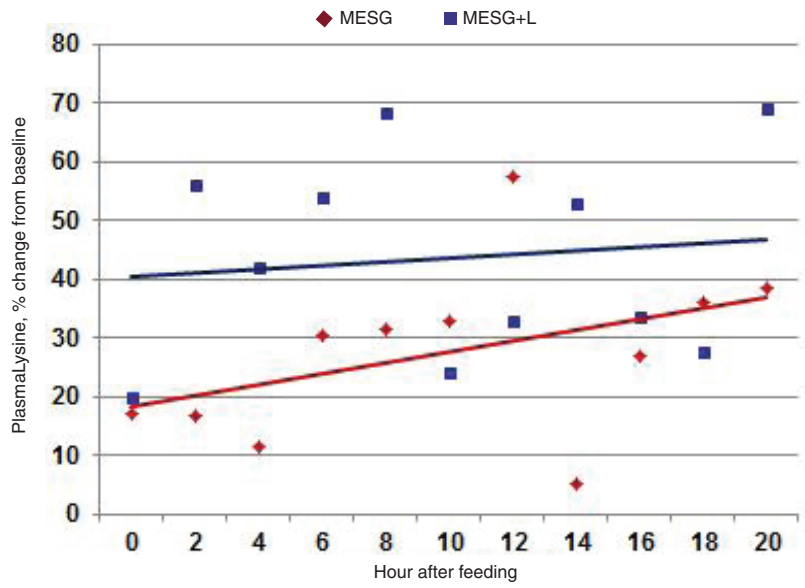
New technology makes it possible to fortify MESG with rumen-protected lysine. The rumen-protected lysine is inserted into fresh soy gums. The gums and lysine mix are applied onto the soybean meal using patented technology. The process results in improved nutritional value of the RUP in this product. That can lead to ration formulation, cow health and milk production benefits.

References

National Research Council. 2001. Nutrient Requirements of Dairy Cattle. 7th revised edition. National Academies of Science, Washington, D.C.

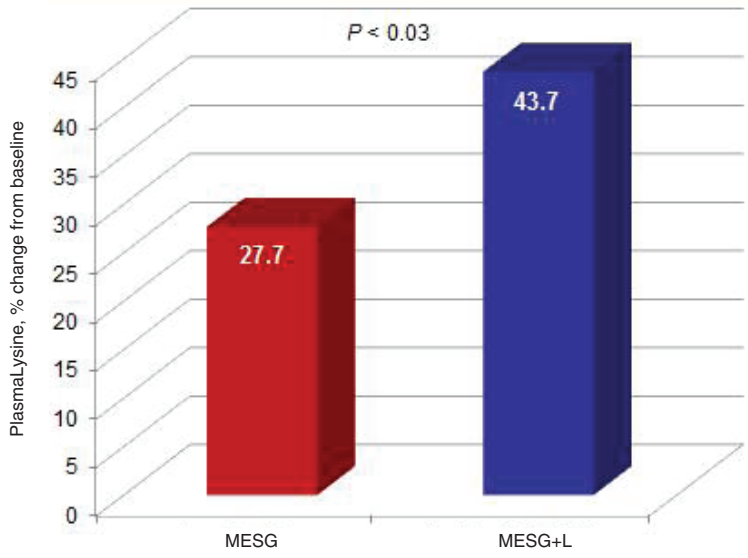
Stern, M.D. 2007. Significance of Intestinal Digestion of Dietary Protein. 18th annual Colorado Dairy Nutrition Conference. ■

1. Plasma lysine by hours after feeding



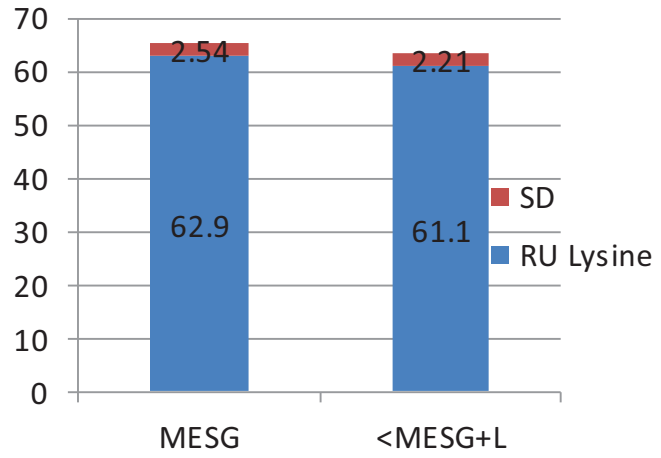
Source: **SDSU, 2012, Publication in Progress**

2. Plasma lysine by product type

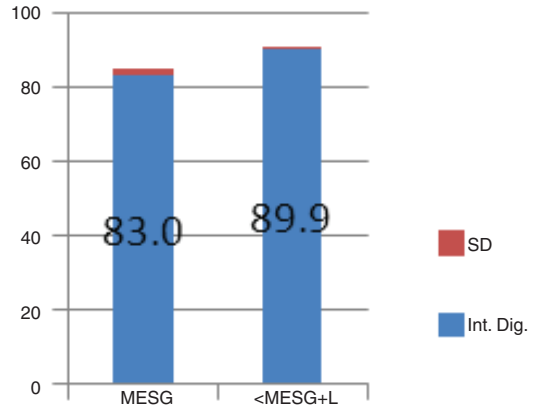


Source: **SDSU, 2012, Publication in Progress**

3. Rumen undegraded lysine in MESG and MESG fortified with rumen-protected lysine



4. Intestinal digestibility of rumen undegraded lysine in MESG and MESG+L



5. Rumen undegraded dry matter