

# Soybean gums change digestion of protein

## Research

with  
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**D**OES the application of soy gums matter when using soybean meal in dairy cow rations? Do soy gums change the site of protein digestion in dairy cows?

These were some of the questions Soy Best asked two years ago when it changed its manufacturing process and began degumming soybean oil and adding the gums back into the meal (in a proprietary process).

According to Dr. Charlie Macgregor, marketing and sales manager for Soy Best, in an interview with *Feedstuffs*, nutritionists using the gummed soybean meal began noticing an increase in bypass protein compared to other soybean meals without added gums.

To confirm this, Soy Best sponsored ongoing research that has shown that bypass protein is not a fixed number. The next step is to look at amino acids, which Macgregor said showed some improvement, but the data are part of a patent application and a journal publication.

Research into the effects of soy gum application on protein degradation and intestinal protein digestion was presented by M.D. Stern and M. Ruiz Moreno of the University of Minnesota, T.K. Miller-Webster and W.H. Hoover of the Rumen Fermentation Profiling Laboratory at West Virginia University and Macgregor (abstract 86) at the 2005 joint annual meeting of the American Dairy Science Assn., American Society for Animal Science and Canadian Society for Animal Science.

According to Stern et al., in a preliminary *in situ* study, mechanical-extracted (ME) soybean meal 1 with fresh soy gums (MEC1G) was incubated for 16 hours in the rumen of a cow that was 50 days in milk (DIM) and producing 36 kg of milk. Rumen-undegraded protein (RUP) was 73.3%.

In a second *in situ* study, Stern et al. incubated ME soybean meal 1 (MEC1) and MEC1G for 16 hours in the rumen of a cow that was 200 DIM



### 1. Effect of processing on RUP, ID and IADP of seven soybean meals

Product	RUP, %	ID, %	IADP, %
SOL	30.9	67.5	15.7
MEC1G	37.6	83.8	41.3
MEC2	32.1	78.9	33.2
MEC3	30.1	75.7	25.2
MECE	34.3	76.5	29.3
SOLH	32.0	65.4	34.2
SOLNEB	31.5	57.7	39.4

### 2. U.S. Dairy Forage Research Center storage system study, DM losses

Silo	Alfalfa ensiled, lb. DM	Silage fed, lb. DM	Spoilage, lb. DM	Total silage removed, lb. DM	Spoilage loss, %	Gaseous loss, %	Total loss, %
Oxygen-limiting	77,088	71,581	101	71,682	0.1	7.0	7.1
Bag	88,172	77,459	2,378	79,837	2.7	9.5	12.2
Bunker	234,078	197,540	15,120	212,660	6.5	9.1	15.6

and producing 27.2 kg of milk. In this study, RUP was 58.0% for MEC1 and 62.1% for MEC1G, which they said indicated that the application of fresh soy gums to ME soybean meal increased RUP.

Two subsequent experiments were conducted. In experiment 1, eight diets containing 17% crude protein were examined in continuous culture fermenters to determine RUP.

In each diet, Stern et al. reported that 28% of the crude protein was provided by one of the following products: solvent-extracted (SE) soybean meal (SOL), MEC1, MEC1G, ME soybean meal 2 (MEC2), ME soybean meal 3 (MEC3), ME soybean meal extruded (MECE), SE soybean meal heat treated (SOLH) or SE soybean meal non-enzymatically browned (SOLNEB).

The researchers said RUP ranged from 30.9 to 37.6% for the diets, respectively (Table 1). They added that MEC1G had the numerically highest RUP and was different ( $P < 0.10$ ) from the SOL, MEC2, MEC3, SOLH and SOLNEB diets.

In experiment 2, Stern et al. said a three-step *in situ/in vitro* procedure was used to estimate intestinal crude protein digestion (ID) for the seven soybean meal products examined in experiment 1. ID values are also shown in Table 1 and ranged from 57.7 (SOLNEB) to 83.8% (MEC1G), indicating that processing can overprotect protein from digestion in the intestine.

They also calculated intestinally absorbable dietary protein (IADP) as RUP x ID (Table 1).

In an interview with *Feedstuffs*, Stern pointed out that overprocessing can be harmful to protein degradation due to the Maillard reaction, which may affect lysine digestion.

Dr. John Shirley, professor emeritus and applied dairy nutritionist for Kansas State University, noted in an interview that when feeding for high milk production, bypass protein and intestinal digestibility of the bypass protein are important considerations when formulating rations.

He said using dietary components

that are consistent in their quality and digestibility can lead to reduced sorting, which means the cow gets the nutrition she needs for her level of milk production, which, in turn, allows dairies and nutritionists to start solving other issues on dairies.

He added that Soy Best's process by which soy gums are added back to soybean meal makes for a consistent dietary component.

### Stored alfalfa

Alfalfa stored in an oxygen-limiting storage system had less spoilage and gaseous loss than alfalfa stored over the same period in a plastic bag silo or a covered concrete storage bunker, according to an ongoing study by the U.S. Dairy Forage Research Center.

Ensiled in 2004, alfalfa stored in an oxygen-limiting Harvestore silo lost a total of only 7.1% of the dry matter (DM) ensiled, compared to a 12.2% total loss for a bag silo and a 15.6% total loss for a concrete bunker silo (Table 2), said Dr. Neal Martin, director of the research center.

"The two-year study will determine how storage structure affects silage DM losses and quality and the subsequent effect each has on feed intake and milk production by lactating dairy cows," Martin said.

Initial results of the study — which showed that cows fed from the oxygen-limiting silo produced 5.7 lb. more fat-corrected milk than cows fed from the other two systems — were announced at the World Dairy Expo in October. DM losses, which took longer to analyze, were released in February.

Alfalfa DM ensiled in an oxygen-limiting storage system, bag silo and

concrete bunker was monitored as it was removed and fed to determine the percentages lost to gaseous release and spoilage, Martin said, which together comprise the "total percentage lost" during storage.

Silage fed from each silo was sampled daily for moisture and quality analysis; spoiled silage was weighed and kept for analysis.

Silage from a second harvest season (2005) will be fed in an animal trial this spring and summer. Final results of the study will be released this year.

### Listeriosis

Dairy farmers should be on the lookout for poor-quality silage, which animal health experts say can lead to listeriosis.

"It is also sometimes called 'circling disease' since affected animals sometimes walk in circles," said Jeffrey LeJeune, a veterinarian and microbiologist with Ohio State University Extension and the Ohio Agricultural Research & Development Center.

Listeriosis is caused by the bacterium *Listeria monocytogenes*, which is often found on plants, in the soil, in natural waterways and also is frequently isolated from the manure of cows, pigs, sheep, goats, chickens, horses, dogs, cats and people.

"For the most part, exposure to a small number of the organism doesn't appear to be dangerous to animals," LeJeune said. "However, using feed that has been inadequately ensiled and does not reach an acidic pH of less than five can pose a problem. Under these conditions, listeria naturally present on the feedstuffs can slowly multiply during storage, resulting in a large number of

organisms accumulating in feed by late winter and early spring." Most outbreaks of listeriosis in animals occur during this time of year.

Animals most at risk of becoming ill from exposure to listeria are those that are stressed due to other conditions, such as pregnancy, other infections or mouth injuries from rough feeds or lost or cutting teeth, LeJeune said.

Wide temperature fluctuations also put animals at risk of actually becoming sick as opposed to remaining healthy and simply shedding the organism in their feces, LeJeune said.

Listeria infection can result in the classic circling disease, but more often than not, it presents itself as the cause of a late-term abortion outbreak in a herd of cattle, affecting 5-10% of the herd over a two-month period. Listeria also sometimes causes mastitis, "but that's not very common," LeJeune said.

Veterinarians usually diagnose listeria by testing a dead animal's diseased tissues or examining the brain and placenta for listeria-related changes. "If you suspect listeriosis in your herd, it is important to save samples from dead animals for veterinary inspection and confirmation," LeJeune said. "Antibiotics are usually effective during the early stages of disease."

If the veterinarian identifies animal feed as the source of the problem, the contaminated silage must stop being used, "but prevention is by far the best medicine," LeJeune added. "Take precautions when silage is chopped and packed, and make sure it reaches the appropriate pH conditions. That will limit the likelihood of listeria growing in the feed."