Feeding distillers' grains?

Watch Sulfur Content

[PHOTO BY MICKY WILSON]

Experts say the risk of cattle developing PEM from eating distillers' grains is manageable, but it takes diligence and effort.

Story by
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As this country ramps up for energy independence there is no question that distillers' grains are destined to play an important role as a protein source for the beef industry.

It is projected that by 2012 30% of the corn produced in this country will be used in ethanol production. Each bushel of corn used in that process can be converted to 2.3 gallons (gal.) of ethanol and 18 pounds (lb.) of distillers' dried grains (DDG).

A single medium-sized ethanol plant that produces 40 million gal. a year also turns out more than 130,000 tons of DDG — enough byproduct to satisfy the protein needs of nearly 200,000 feedlot cattle.

While beef nutritionist Dewayne Siebrasse of Cattle Cents Consulting Inc., Aberdeen, S.D., sees distillers' grains as a feed source that could revolutionize the beef industry, his words regarding the subject are tempered with caution. "There are some real risks associated with overfeeding distillers' grains," he says. "It could result in sulfur toxicity and the death of the cattle being fed."

Siebrasse recommends no more than 15% of the total mixed ration [on a dry-matter (DM) basis] be distillers' grains.

Robbi Pritchard, South Dakota State University (SDSU) ruminant nutritionist, concurs with Siebrasse's recommendation. He says those feedlots that feed distillers' grains at levels higher than 15% DM are taking unnecessary risks with their cattle.

"I have seen sulfur toxicity in feedlots that are feeding anywhere from 22% up to 34% distillers' grains on a dry-matter basis," he says. "The best way to avoid the problem is to watch your inclusion rates."

Both men believe the likelihood of overfeeding distillers' grains and suffering the consequences of sulfur toxicity will increase as the number of ethanol plants in this country multiplies to meet projected market demand.

Ag economists predict that increased biofuel production and competing demands for corn from countries like China will drive up the cost of all raw protein sources. In contrast, the availability of ethanol byproducts such as distillers' grains will increase, further reducing their cost to beef producers.

The economics of this development could tempt producers to push the envelope.

Serious consequences

While sulfur is an essential component of the ruminant animal's diet, high concentrations of the mineral in the diet can prove fatal. The 1996 National Research Council (NRC) *Nutrient Requirements of Beef Cattle* recommends a sulfur concentration of 0.15%, which is needed for formation of certain amino acids and

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Feeds with moderate to high sulfur content

Feed	Int'l. Feed No.	Sulfur, %DM basis
Barley malt sprouts, dehydrated	5-00-545	0.85
Beet pulp, w/molasses, dehydrated	4-00-672	0.42
Brewers' grains, wet	5-02-142	0.32
Corn, distillers' grains, dehydrated	5-28-237	0.46
Corn gluten meal, 60%	5-28-242	0.72
Molasses, beet	4-00-668	0.60
Molasses, cane	4-04-696	0.47
Rapeseed meal	5-03-871	1.25
Whey, dehydrated	4-01-182	1.12
Turnip, root	4-05-067	0.43
Ammonium sulfate	6-09-339	24.10
Calcium sulfate	6-01-089	18.62
Copper sulfate	6-01-720	12.84
Potassium sulfate	6-06-098	17.35
Sodium sulfate	6-04-292	9.95

Source: Limin Kung, Department of Animal & Food Sciences, University of Delaware, 1998.

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the B vitamins thiamine and biotin, as well as for use in some detoxification reactions to maintain normal function of body cells.

A total DM intake from all sources (including water) above 0.4% is considered above the tolerable level by NRC standards and can lead to polioencephalomalacia (PEM). PEM is caused by production of excessive amounts of hydrogen sulfide, a gas derived from rumen fermentation, which is belched and then rebreathed into the lungs and carried to the brain, resulting in necrosis of the cerebrocotical region.

Limin Kung of the University of Delaware Department of Animal & Food Sciences has studied the effects of sulfur dioxide poisoning on ruminants. He warns that the mechanism by which the toxins are transmitted — belching and rebreathing sulfur dioxide — is responsible for generating a wide range of responses.

"You might have one or two animals that show clinical signs of PEM and others that appear perfectly fine," he explains.

Those animals that show clinical signs of PEM (brainers) will often push their heads against solid objects or stagger in circles. Others may look into the sky with their heads thrown back over their shoulders. Common symptoms are respiratory distress, reduced feed intake and reduced ruminal motility. Advanced signs of PEM include blindness, thrashing, kicking at the stomach and moaning, followed by death within two days.

In a recent 2006 case study reported in VetContact *(vetcontact.com)*, an online professional portal sponsored by the European School for Advanced Veterinary Studies (ESAVS), a 2,750-cow dairy and 2,300-head beef ranch in Turkey were struck with PEM, resulting in 256 cattle dying or having to be euthanized.

Symptoms of the disorder ranged from excessive salivation to impaired coordination, from hypersensitivity to blindness and death. The first animals to show signs of the disorder were 6- to 8-month-old beef calves. Those most severely affected by PEM were calves and lactating dairy cows.

It was concluded, after an investigation, that the PEM was caused by high levels of sulfur (0.45%) in barley malt sprouts being fed in the ration. Once the sprouts were identified as the cause and removed from the daily diet, PEM symptoms gradually disappeared.

Autopsies on the affected animals showed, in most, a histopathology of PEM. Highly elevated levels of sulfide in the rumen fluid of the affected animals pointed to sulfur toxicity as being the cause of the PEM.

While distillers' grains were not responsible for PEM in this case, the sulfur percentage in the barley sprouts responsible for the incident was slightly less than the sulfur percentage normally found in distillers' grains.

Why distillers' grains?

For Kung and other ruminant specialists who have witnessed the effects of overfeeding distillers' grains, the source of sulfur toxicity can be traced back to multiple entry points. "We are looking at an accumulation of sulfur that goes on throughout the ethanol production process," he says.

Sulfuric acid is initially added in the dry grind ethanol process to keep pH levels conducive to yeast cells and then to end the fermentation process. As well as adding sulfur-based products during the fermentation, both corn and yeast contain moderate amounts of sulfur, which are concentrated by a factor of three in the fermentation and distillation process into the mash and solubles to an average level of 0.33%. Sulfur is also produced by the yeasts during fermentation.

One of Pritchard's primary concerns regarding the presence of sulfur in distillers' grains is its content variability from batch to batch.

"A plant that may be running 0.6% sulfur on the average might have a bad

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>
> *— Dewayne Siebrasse*

day and the level jumps up to 1.1% sulfur," he says. "That is a substantial increase in sulfur."

He attributes this variability to the intermittent use of sulfuric acid as a flow-control agent. "Periodically the slurry from the fermentation process begins to stick to the inside walls of the equipment," Pritchard says. "Adding sulfuric acid is the most inexpensive way to remove the material."

While it is possible to adjust a ration for a specific percentage of sulfur, trying to deal with a moving target can be an impossible task, especially when the longevity of moist distillers' grains is shorter than the length of time it takes to get test results back from the laboratory. "What you will see is that the assay for the sulfur takes longer than that inventory sits around in the plant," Pritchard says. "It is gone and consumed before you know what is in it."

Evaluate total intake

Pritchard says the best way to deal with any potential sulfur problems is to first examine a herd's total intake. He adds that anything going into an animal's mouth should be tested for background sulfur content. That includes water and all other feed sources.

Kung agrees and notes that the sulfur in a water supply can be a real contributor to the overall percentage of the mineral consumed by an animal in a feedlot.

"For example, if you had water with a sulfur content of 1,000 parts per million (ppm) and you have a steer drinking 30 liters of water a day, that translates into 12 grams of sulfur," he says. "That is the equivalent of 0.1% in the diet."

Kung adds that water isn't the only potential contributor of sulfur. "You need to be looking at all your sources of feed, especially if you are putting in a lot of byproducts," he says, adding that some of the more common ration extenders contain relatively high levels of sulfur. For example, corn gluten meal can contain more than 0.7% sulfur, while rapeseed meal usually has 1.25% sulfur.

Both Kung and Pritchard recommend working directly with a nutritionist to determine exactly what the daily sulfur intake is per animal. "From there you just balance your diets so that you have enough safety room so when that hot batch does come through you don't get hurt," Pritchard says.

Finally, Pritchard cautions that the palatability of distillers' grains can work against a feeder's efforts to control his cattle's intake of sulfur.

"The cattle really like the taste of the stuff," he says. "So if it isn't well-mixed, there are some cattle that are going to eat a lot more than you meant them to eat."

Final tips to avoid sulfur toxicity

Learn as much as possible about your source for distillers' grains. Find out when and how much sulfur is introduced in that plant's particular process. Determine both the average percentage of sulfur in the distillers' grains and the percentage at its peak levels. Remember, an ethanol plant's primary product is ethanol, not distillers' grains. *Caveat emptor* — buyer beware.

Test your water for sulfur content and balance it against the sulfur content in your distillers' grains.

Pay attention to the sulfur content of other feed items. Remember, the maximum 0.4% of DM should be viewed as an accumulative 0.4% DM.

Make sure that your ration is well-mixed to reduce the likelihood of the more aggressive animals cherrypicking the distillers' grains.