# Alternative Energy

## Alkaline treatment of low-quality forages can provide alternative energy source for finishing diets.

*by* ***Troy Smith***

Much has been said and written about grain-milling byproducts, particularly distillers' grains, for use in cattle diets. For many cattle feeders, distillers' grains have become a relied-upon feedstuff. Replacing a portion of the grain included in rations, distillers' grains serve as a source of non-starch energy, as well as protein. Generally, ration palatability increases and cost of gain decreases. But what if even more of the grain could be replaced with lower-cost ingredients?

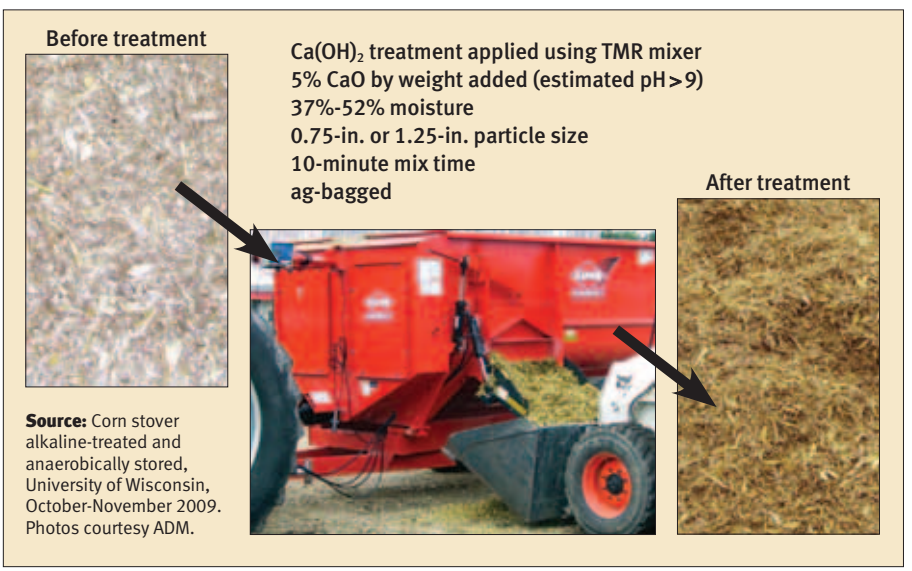
Feeding & Feedstuffs

With that in mind, animal scientists have been evaluating methods for increasing the use of low-quality forages — mainly crop residues like corn stover or wheat straw — in cattle finishing diets. Funded in part by Archer Daniels Midland Co. (ADM), researchers at Iowa State University (ISU) and the University of Nebraska (NU) have looked at an alkaline treatment to render such forages more digestible by rumen microbes.

Wait a minute. That's not a new concept. It's long been known that treating forages with alkaline substances will break down lignin, the tough stuff that lends strength to plant cell walls. According to ISU's Dan Loy, alkaline treatment to make low-quality forages more digestible dates back to the 1970s. Application of anhydrous ammonia to wheat straw is something familiar to many producers. But most of the early work involved treatment of forages fed to cows or growing calves. The idea didn't make much sense for finishing rations containing mostly grain.

"For most of my 29-year career, corn was the lowest-cost source of energy. That's not the case anymore," Loy states. "For many cattle feeders, distillers' grains is now the ingredient with the lowest cost per unit of energy. It has replaced a considerable portion of the grain used in traditional finishing diets."

**Fig. 1: Field chopped stover treated in feed wagon**




**Source:** Corn stover alkaline-treated and anaerobically stored, University of Wisconsin, October-November 2009. Photos courtesy ADM.

### A feedlot option

At today's prices, cattle feeders could appreciate another alternative energy source — something that could replace a little more corn in finishing rations. So researchers have taken a new look at low-quality forages treated with another alkaline substance. This time around, the focus is on a product commonly called quicklime. Chemically, it's calcium oxide. When added with water to the forage, the calcium oxide and water combine to form calcium hydroxide. That's what does the trick, breaking down the chemical bonds within the forage's cell walls and making it more digestible by rumen microbes.

In an ISU trial, the treatment enabled scientists to reduce the percentage of grain in a finishing ration by half, from 70% to 35%, without affecting animal performance. Feeding the treated stover and distillers' grains resulted in lower ration costs and lower cost of gain. The University of Nebraska conducted a similar trial yielding similar results for corn stover and ground wheat straw.

In these trials, the stover or straw was field-chopped or ground and treated with calcium oxide powder added in an amount equal to 5% of the dry weight of the forage. Water was added to achieve 50% moisture content. After mixing, the treated forage was stored in a silage bag. After sealing the bag, the treatment was allowed to "work" for a minimum of seven days. Then, treated forage was fed, out of the bag, as 20% of the finishing diet on a dry-matter basis.

"Some producers will think it's a bit of a hassle, and it is," admits NU animal scientist Galen Erickson. "You have to weigh out the correct amount of calcium oxide and add the right amount of water. And there is some heating from the chemical reaction. Add too little water, and there can be too much heating and some risk of fire. And it must be stored anaerobically. It has to be done right."

### Streamlining the process

Applying this forage treatment may be most challenging for operations handling large volumes of feedstuffs. ADM's director of feed technology, Mike Cecava, says the company is seeking ways to streamline the process for large-scale treatment and storage.

"We are still working on improving the process for continuous treatment of residues during tub grinding," Cecava explains.

"We're in contact with companies that have equipment expertise and know-how for coloring wood mulch. This industry has figured out how to uniformly apply dyes and pigments to wood while it is being ground, and what we are trying to accomplish by chemically treating stover or straw is not too different. We hope to develop a standardized process that could be used by commercial tub grinders when they are supplying ground residues to feedlots."

Cecava says another goal is to shorten the length of time treated forage must be stored. Hopefully, treatment methods can be fine-tuned so that only a 24-hour "cure" time is required. If so, a feeder may be able to treat the stover, straw or other low-quality forage on the day prior to use, and just run it back into a bunker or commodity bay until it is fed.

"We are also trying to reduce the application rate of the calcium oxide, by using a finer grade of product or using other technology, such as enzymes in combination with the calcium oxide. I think we can work toward a lower rate of chemical treatment and have similar benefits to what we've seen with 5% lime," Cecava adds.

Additionally, ADM is investigating more aggressive treatment processes applicable at

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**Fig. 2: The process of treating low-quality forage with calcium oxide to increase digestibility**


►Field-chopped or ground stover or straw is treated with calcium oxide powder.


►Water is added to achieve 50% moisture content.

►After mixing, the treated forage is stored in a silage bag.

►After sealing the bag, the treatment is allowed to cure for a minimum of seven days.

centralized locations, such as a feed plant, grain elevator or feed dealership. Cecava says these processes hold potential for extracting more energy value from low-quality forages.

"The treatment works, and our data suggest treated forage can replace an additional 15% of corn in finishing diets without sacrificing animal performance or carcass merit," Erickson says. "Economically, it hinges on high-priced corn and cheap stover, relative to corn."

There's another benefit for feeders who want to use more distillers' grains in cattle rations with less worry over increased sulfur levels that may accompany high inclusion rates of distillers' grains. Loy says replacing more corn with treated forage, making the ration 15% to 20% forage, will compensate for sulfur levels up to 0.5%.

"It does work," Loy adds. "It can benefit feeders trying to get better utilization out of low-quality forages and distillers' grains."

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***— Dan Loy***