Extend Feed Inventories with Alkali-Treated Corn Stover

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High grain prices and shortages of alfalfa due to winter kill are challenging many Midwestern beef and dairy producers to look for alternative sources of feed. Alkali-treated corn stover can be an alternative to stretch corn and forage inventories. There are several alkali treatment processes that will improve the digestibility of corn stover. Treatment processes with ammonia, sodium hydroxide (lye), calcium oxide (quicklime), or calcium hydroxide (hydrated lime) could be applied on most farms that have access to a forage chopper or tub grinder, adequate water, and bunker or bag silos. Alkali treatments break cross-linkages in the fiber matrix of corn stover, which in turn makes the fiber more accessible to rumen bacteria. The chemical reaction takes 5-7 days for sodium hydroxide or lime treatments and a month to six weeks for anhydrous ammonia treatment of forages. Corn stover must be treated and stored to allow the chemical reaction to occur before the material is fed.

Fiber digestibility is typically improved by about 50% when corn stover is treated with alkali. In beef feedlot diets, alkali-treated stover has been used with modified corn distillers grains to make a 'corn replacement feed.' Iowa State researchers (Russell et al. 2011) reported a 2:1 ratio of modified corn distillers grains and calcium oxide-treated corn stover could replace half the corn grain in feedlot diets without affecting average daily gain of steers. They reported that in a 183 day trial each steer fed the corn replacement feed diet ate 30 bushels less corn grain than steers fed a 70% corn grain diet. When corn was priced at $4 per bushel, the total cost per 100 lbs of gain was $5.77 less for the steers on the diet containing treated stover. When corn grain was valued at $6 per bushel, the total cost advantage for the steers on the stover diets rose to $11.24 per 100 lbs of gain. University of Nebraska researchers (Shreck et al., 2012) also found that a 2:1 ratio of corn distillers grains and calcium oxide-treated stover could replace 10% units of corn without affecting average daily gain, feed to gain ratio, carcass weight, or percentage of carcasses grading choice.

Table 1. Response of intake and milk production in early lactation cows as corn grain is replaced with alkali-treated corn stover (Cook et al. 2013).

	-------added CaO-treated corn stover (%)-------			
	0	**4**	**8**	**12**
Dry Matter Intake (lb)	59.0[a]	56.8[b]	53.5[c]	51.7[d]
3.5% FCM[2] Yield (lb)	105.6[a]	101.3[b]	95.5[c]	90.8[d]

[abcd]means in row with different superscripts differ (p<0.05)
[2]Fat corrected milk

Purdue researchers (Donkin et al., 2012) reported alkali-treated corn stover could potentially replace up to ⅔ of the corn silage in diets for dairy cows in mid to late lactation. In this study, however, intake declined when treated stover replaced corn silage (the study was only 21 days, so long term implications of the reduction in feed intake could not be assessed). Feed intake and milk production declined linearly when Wisconsin researchers (Cook et al., 2013) replaced corn grain with calcium oxide-treated stover. In this study, 63 early-lactation dairy cows were fed diets containing 0, 4, 8, or 12% treated stover for six weeks. To accommodate the treated stover, the amount of corn grain was reduced from 19% of ration DM to 15, 11, and 7% as the amount of stover increased. Fiber digestibility of the diets were similar which indicates that the alkali treatment improved the quality of the stover, but the gut fill effects of the added fiber limited the ability of cows to consume enough TMR to sustain milk yield. For dairy cattle, alkali-treated stover may be a viable substitute for a portion of the corn silage in rations of lower producing cows. It appears, however, that alkali-treated stover may not work well in diets for high producing cows because added gut fill from adding more fiber will limit feed intake.

The lime treatments are the most popular approaches because of cost and safety. Costs for treating corn stover with calcium oxide are approximately $20-30 per ton of treated forage. The lime treatments are safer to work with than sodium hydroxide or ammonia, but still must be handled carefully. Calcium oxide is not as caustic as sodium hydroxide or ammonia, but can still cause severe burns and irritation if the dust is inhaled or comes in contact with exposed moist skin. Safety goggles must be used and contact lenses must not be worn when working with calcium oxide. Mixing calcium oxide with water eliminates the dust, but calcium oxide reacts violently with water. Calcium oxide must be added slowly to a large volume of water in an open container to avoid boiling or possible rupture of containers. Hydrated lime (calcium hydroxide) is more expensive than calcium oxide, but the dust is less irritating and hydrated lime does not react violently with water.

References:
Russell, J et. al. 2011. Potential of chemically treated corn stover and modified distillers grains as partial replacement for corn grain in feedlot diets. Iowa State University Animal Industry Report. A. S. Leaflet R2586

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