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Maximizing energy release from fiber in beef rations

EFEs have the potential to make more use of fibrous co-products and, thus, could be a means to improve performance and feed efficiency in feedlot animals, especially in the receiving phase.

By **NICOLA WALKER***

RUMINANTS evolved to eat and digest plant material. As a result, roughage, or dietary fiber, can make up a large and important proportion of their diet.

With a rapidly growing world population leading to increasing demand for cereal grains for the human and monogastric livestock segments, the need to be able to produce meat by ruminants — either as efficiently as possible or through the use of alternative feeds or energy sources to cereal grains — becomes a key requisite.

Coupled with the fact that ruminants can more efficiently use fiber and fibrous co-products than monogastric animals, the potential to make more use of the fiber in the ration as a valuable energy source is an interesting proposition, with potential benefits including increased feed efficiency, improved daily gain and fewer days on feed.

Importance of fiber

Depending on the stage of growth in the beef production cycle, fiber can make up either nearly all of the ration or only a small percentage.

Typically, one would think that cow/calf and backgrounding operations would be dependent on rations high in fiber, with either fresh pasture or forages supplying nearly all of the animal's nutrient requirements through grazing or supplemental forage feeding, e.g., high-quality corn silage, haylage or hay. In these instances, little or no concentrate is fed.

As these young animals fresh from the backgrounding environment enter the feedlot, in order to maximize intakes and minimize stress during the receiving period, they are effectively transitioned from a very-high-fiber, hay-based receiving diet through a series of step-up diets. Introducing step-up rations over several days helps the rumen microflora adapt and stabilize in response to the change in diet and subsequent decrease in fiber content from, on average, 60% forage to less than 10% forage.

The benefits of using this approach occur in terms of lowering the incidence of secondary infections, such as bovine respiratory disease, that are exacerbated by stress, plus animals have greater feed acceptance and more stable dry matter intake.

In finishing rations, limited roughage is fed, and forage may account for an average of only 8-9% of the ration, with a range of 0-13% (Vasconcelos and Galyean, 2007). In this case, forage primarily is used more for gut fill, stimulation of rumination and saliva production to help with rumen buffering to reduce the risk of acidosis and as a source of physically effective fiber to help form the rumen mat, rather than being thought of as a potential valuable energy source.

In these more acidotic diets, fiber digestion can be reduced due to a decrease in the number and activity of fiber-degrading microorganisms; thus, anything that may help either increase these organisms or improve fiber digestion at this point is of interest.

Improving fiber digestion

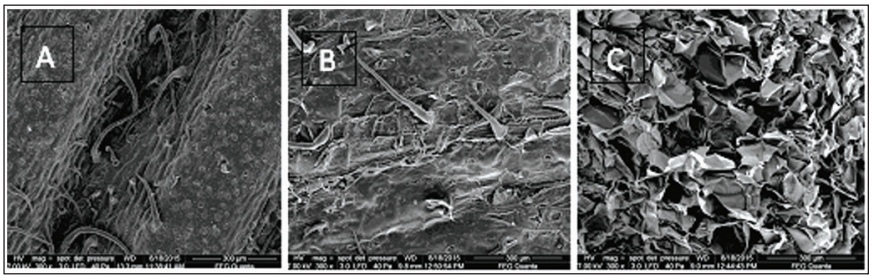
Alternative approaches to improve fiber digestion, feed utilization and feed efficiency in the beef industry have been investigated. These include the use of feed additives like ionophores, bacterial direct-fed microbials, probiotic live yeasts or buffers to help alter intake behavior and manipulate rumen microflora and ruminal fermentation to reduce the risk of acidosis.

Crude fermentation extracts from *Trichoderma* (EFEs) have been used extensively in monogastric production for the last 20 years. Because of their high levels of xylanase and cellulase activities that break down neutral detergent fiber (NDF) and acid detergent fiber (ADF), they have also recently been evaluated in ruminant production — even in finishing rations, where dietary fiber may be limited.

Previous research with EFEs in ruminant diets has demonstrated that these products start to work immediately once applied on the ration to make holes or pits in the surface of the fiber (Photo).

When the animal consumes the feed and it enters the rumen, disruption of the fiber's surface increases the surface area for colonization by the rumen microbes and leads to a reduction in the lag time to digestion (Morgavi et al., 2000). More energy is liberated as a consequence of the improved digestibility, with greater effects observed on roughages or fibrous co-products containing high levels of NDF and ADF.

In vitro digestibility measures on a variety of different fibrous co-products, such as soybean hulls, cottonseed hulls, corn stalks, dried distillers grains and sorghum grain treated with EFEs, have demonstrated that ADF may be improved an average of 13%, resulting in increased energy availability (Barbosa Kondratovitch et al., 2017).



Scanning electron micrographs show the effect of EFEs on corn silage versus a buffer control: (A) time, 0 hour; (B) sprayed with buffer, effect after one hour of incubation at room temperature; (C) sprayed with EFEs, effect after one hour of incubation at room temperature.

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A recent trial conducted in Texas investigated the potential of using these same EFEs as a pretreatment process to improve the digestibility of the ration and subsequent performance of receiving, starting and finishing cattle (AlZahal et al., 2017).

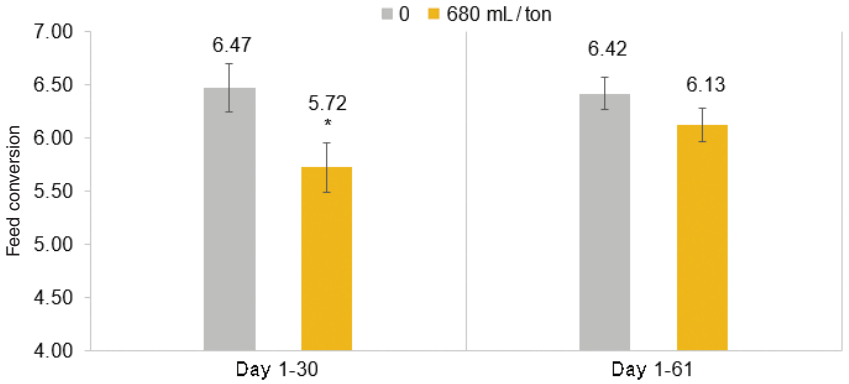
In the trial, 180 Aberdeen Angus crossbred heifers with an initial bodyweight of 248 ± 18 kg were allowed to adapt to the feedlot over a 30-day period and then were blocked by initial bodyweight and assigned to either the control or treatment group, giving 10 pens of nine animals per treatment. The EFEs were applied to the ration as follows: days 1-30 = 58% flaked corn, 8.5% corn gluten feed, 23% alfalfa hay, 5% molasses, 1% fat and 4.5% supplement; days 31-180 = 72.5% flaked corn, 8.5% corn gluten feed, 8.5% alfalfa hay, 4% molasses, 2% fat and 4.5% supplement; they were immediately fed out.

Animals were individually weighed every 30 days, and pen intake and refusals were monitored daily and averaged every 30 days. The trial lasted for a total of 180 days.

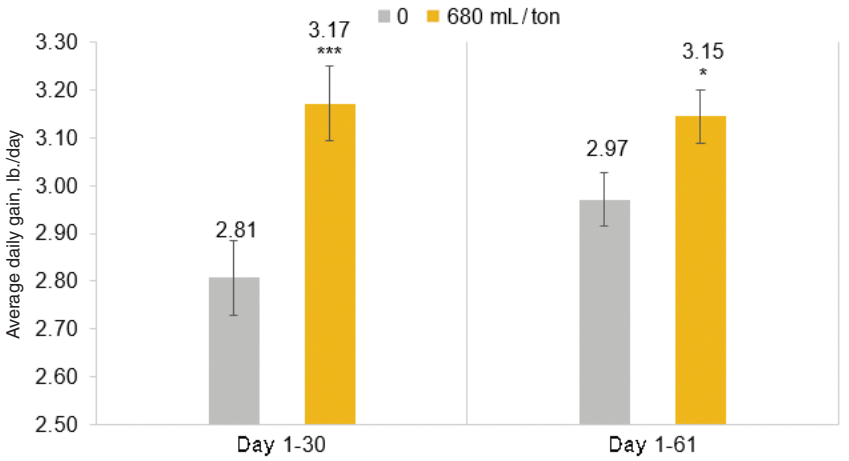
The greatest effects on average daily gain (ADG) and feed conversion ratio (Figure) were observed in the receiving and initial step-up diets, which contained higher proportions of NDF and ADF. Treatment with EFEs resulted in a 13.6% increase in ADG and feed:gain during days 1-30. These positive effects carried through until the end of the study, resulting in overall increases in ADG and feed:gain of 3.6% and 4.2%, respectively. Carcass characteristics tended to be improved, with treatment resulting in a tendency towards higher hot carcass weight and greater fat cover.

These data show the potential of using EFEs as a means to improve performance and feed efficiency in feedlot animals, especially in the receiving phase, and the potential to make more use of fibrous co-products.

Effect of EFEs on performance of growing cattle



*P < 0.05 compared with control. **P < 0.01 compared with control. ***P < 0.001 compared with control.



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