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Energy from fiber key to optimal dairy cow, economic performance

Releasing energy from fiber may be a sustainable nutritional strategy for optimal dairy cow and economic performance.

By **SOPHIE PARKER NORMAN***

DAIRY producers face a constant challenge to produce a quality end product in the face of fluctuating milk prices that can put pressure on farm profitability.

Nutritionists and farmers alike are aware of the risks associated with compromising on the quality of the ration in order to improve margins due to potential negative effects on herd productivity and health over time. In order to ensure long-term success that is not driven by volatile external factors such as milk price alone, dairy farmers and nutritionists need to examine their underlying cost strategy to look for opportunities to maximize feed efficiency and meet the demands of the market while ensuring that they create and maintain a profitable business.

In light of this realization, recent attention has turned to the previously untapped energy potential of forage fiber as a means of creating additional nutritional and economic value, driving increased feed efficiency that does not compromise herd health or negatively affect milk production and creating a more sustainable operating model.

Fiber, concentrates

In ruminant nutrition, fiber is often thought about in terms of providing gut fill, causing stimulation of rumination and saliva production as well as providing a source of physically effective fiber that helps form the rumen mat. Inclusion of fiber in the dairy ration helps maintain healthy rumen function, leading to optimized rumen fermentation.

However, to meet ever-present demands for higher production, high-concentrate rations have traditionally been fed. While this can work in the short term to boost production, high-concentrate diets can be difficult to manage due to the longer-term effects on digestive health, milk quality and the associated higher feed cost.

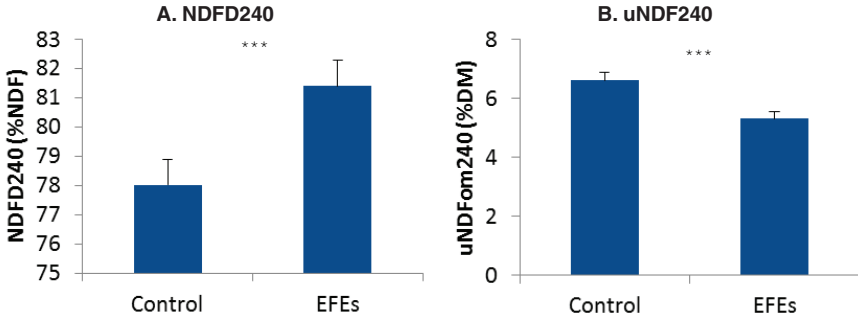
Ruminants have evolved to digest fiber and usually digest up to 65% of dietary fiber, meaning that almost one-third of valuable fiber energy still is unavailable, even when rumen function is optimized. Feeding a high-concentrate diet leads to a reduction in the number and activity of fibrolytic rumen bacteria and can result in fiber digestion being reduced to as low as 35%.

Reduced fiber digestion equates to greater losses in the available energy content of fibrous feeds. Feeding a high-concentrate diet can also lead to an imbalance in the supply of carbohydrates to the rumen.

The resulting accumulation of volatile fatty acids, coupled with the inability to produce sufficient saliva to act as a rumen buffer, can lead to the onset of subacute ruminal acidosis (SARA). This is marked by depressed rumen pH for several hours per day, which can have a negative effect on the fibrolytic rumen bacteria by reducing their numbers and activity (Plaizier et al., 2008).

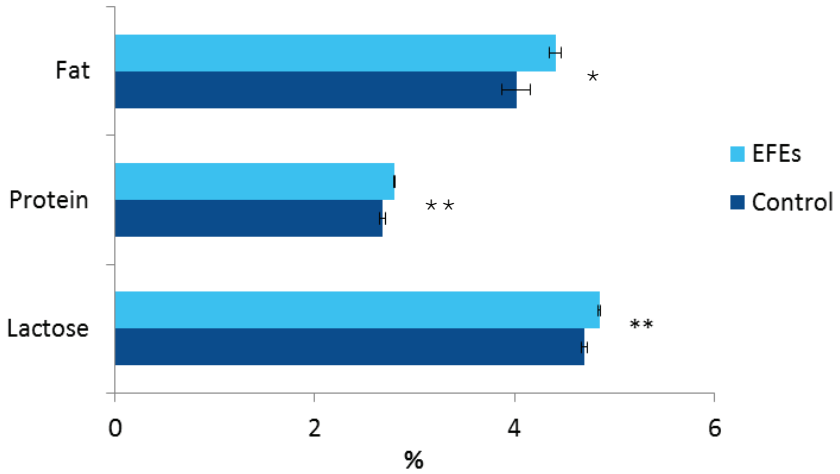
Production losses due to SARA have been reported to cost the U.S. dairy industry between $500 million and $1

1. Corn silage TMR samples treated with control buffer or fermentation extracts (EFEs)



***Significant difference of P < 0.001.

2. Cows fed TMR treated with fermentation extracts (EFEs) had increased milk fat, protein and lactose percentages



*Significant difference of P < 0.05. **Significant difference of P < 0.01.

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billion per annum (Krause and Oetzel, 2006).

More energy from fiber

While feeding adequate fiber is critical to maintaining effective rumen fermentation, increasing energy availability through improved fiber utilization can affect profitability by positively influencing the yield and quality of milk production (including milk fat yield) as well as wider herd management factors such as body condition and fertility, all of which influence economic success. Additionally, with feed typically accounting for more than 50% of the cost of producing milk, enhanced utilization of fiber represents a means of driving efficiency while also supporting herd health.

Ruminant nutritionists have considered alternative approaches to improve the digestibility of forage fiber — including the addition of additives such as ionophores, probiotic live yeasts, bacterial direct-fed microbials and buffers — with the aim of altering intake and improving rumen fermentation.

Recent innovations include the use of crude fermentation extracts from *Trichoderma* — also known as exogenous fibrolytic enzymes (EFEs) — as a means of pretreating the fibrous portion of the ration, releasing previously unavailable energy reserves by improving fiber digestibility and leading to a reduction in the lag time to digestion (Morgavi et al., 2000). Corn silage-based total mixed ration (TMR) samples treated with EFEs have shown a significant ($P < 0.001$) increase in neutral detergent fiber digestibility at 240 hours (NDFD240) and a significant ($P < 0.001$) decrease in undigestible neutral detergent fiber at 240 hours (uNDF240), reflecting improved digestibility (Figure 1).

EFEs also offer the opportunity to utilize alternative feeds — such as fibrous co-products — instead of cereal grains, as well as the ability to maximize the use of home-grown forage.

Responses

Responses to increased dietary energy will depend on a host of factors, including where the cow is in her lactation cycle and how she is coping with metabolic and other challenges.

In a recent U.S. study of 92 lactating cows fed a TMR treated with EFEs, feed efficiency was significantly improved: 2.96 for the control and 3.39 for the EFE treatment ($P < 0.01$). In addition to improved feed efficiency, milk fat, protein and lactose percentages were also significantly improved in cows fed the EFE-treated TMR (Figure 2).

Mid-lactation cows are able to partition nutrients towards body tissue replenishment rather than to milk production, which allows for compensation following the high metabolic stress of early lactation. In a recent U.S. study, mid-lactation cows had greater weight gain when fed a TMR treated with EFEs. An improvement in body condition score management throughout the lactation cycle mitigates the risk of metabolic disorders caused by a negative energy balance and can improve conception rates and management going into the dry period.

Summary

Innovations in fiber management can allow the previously untapped energy value to be extracted from the fibrous portion of the ration. This represents a means of driving greater feed efficiency and animal performance as a result of improved rumen function and supporting better body condition. Greater utilization of fiber, therefore, presents an economically viable method of improving management of underlying feed and farm costs, moving away from a reliance on milk price alone as a predictor of economic success.

References

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