

## First-lactation cows benefit from exogenous enzymes

by Alvaro Garcia

**G**ENETIC selection for improved production in dairy cows also has resulted in parallel growth in body frame over the years. The average body weight of Holstein cows at a Wisconsin dairy show in 1917 was 1,225 pounds, according to University of Nebraska researchers who recorded the weights. The average cow weight nowadays is close to 1,500 pounds, with some cows well above that scale measurement.

Milk production for these 1917-version cows averaged 14,712 pounds. Meanwhile, it is not unusual to find well-managed farms with a rolling herd average of 36,000 pounds today. While body weight has climbed by 22.4%, milk production has leapfrogged by 146%! These large volumes of milk require higher nutrient uptake which cows can accomplish by better feed selection, greater intakes, and improved digestibility.

In confinement dairy systems, feed selection is limited, with nutrient uptake being determined by diet digestibility and individual intake. There is an upper limit to which nutritionists and feeders can improve diet digestibility before digestive upsets occur; any additional nutrient demands need to occur through increased feed intake.

The paradigm, though, is that as feed intake climbs, so does passage rate. That, in turn, reduces digestibility. One approach that has been used to improve the digestibility

of the forages fed is the addition of exogenous enzymes.

### Results in the cow

Research results using these enzymes, however, have not always been consistent. Depending on the substrate, the terms include amylases, cellulases,  $\beta$ -glucanases, hemicellulases, xylanases, pectinases, and proteases. Some of these enzymes are synthesized by fungus of the genus *Aspergillus*. *Aspergillus oryzae* alone, or in combination with *A. niger*, produce cellulases, pectinases, and amylases. The means of action is by a synergism between these fungus and rumen microbes enhancing the release of plant cell nutrients in the rumen.

Not many studies have compared the effects of exogenous enzymes on the lactation performance between first-calf heifers and older cows. This is important since first-lactation cows have smaller meal sizes and reduced intake rates. In addition, cows in their first and second lactation have higher nutrient requirements to account for growth.

Pennsylvania State University researchers looked at the effects of enzyme extracts from *A. oryzae* and *A. niger* on milk production, nutrient digestibility, and nitrogen use in lactating dairy cows. They also evaluated if the response varied between primiparous and multiparous cows in the study published in 2022.

The commercial enzyme prep-

aration contained enzymes that degraded starch, hemicellulose, cellulose,  $\beta$ -glucans, and pectin. To administer it to the cows, they used a premix of 4 ounces of the enzyme preparation in 1.1 pounds of the total mixed ration (TMR) and then topdressed it on the ration.

Supplementing the feed with the enzymes tended to raise feed intake by 2 pounds per day in all cows with an increase of 5 pounds during first lactation. Concentrations of milk true protein and lactose were greater for both first lactation as well as multiparous cows. First-lactation cows had more milk true protein and lactose, as well as other solids content in milk and unexpectedly experienced a reduction in milk SCC. The results showed that first-lactation cows benefited more, which makes sense considering their intake restriction as well as greater nutrient demands for growth.

### Put into practice

There are many products on the market that contain exogenous enzymes. To expect similar responses to those detailed above, we need to answer the following questions:

Are the right enzymes present?

Are they present at a high enough concentration?

Are we feeding the recommended amounts and are they properly administered to the cows?

Because of the complex, multi-ingredient dairy cow rations, the

product needs to contain a combination of enzymes that help degrade the main carbohydrate groups: starch, cellulose, and hemicellulose. In other words, these are amylases, cellulases, and hemicellulases, respectively. Other enzymes that are sometimes included are those that help degrade  $\beta$ -glucans and pectin, which are important in the degradation of corn silage and alfalfa hay and silage.

With that in mind, the suggested minimum content of the main exogenous enzymes are amylase  $1.2 \times 10^6$  units per kilogram, cellulase  $1.1 \times 10^4$  units per kilogram, and hemicellulase  $1.9 \times 10^5$  units per kilogram.

For good results, follow the manufacturer's specifications as to the amounts to feed. Make a premix of approximately 1.1 pounds of the TMR or one of its components (for example, ground grain) and topdress it to the cows. If fed mixed in the TMR, it is advisable to first make a premix of at least 5% of the TMR and then add that to the mixer during mixing.

Remember, exogenous enzymes are an additional tool that can be used and will deliver an impact when all other things are under control. First and foremost, adequately balanced diets and good feed management must be achieved. 🐄

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