NUTRITION NOTES
Innovation + Research from Kent Nutrition Group
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IMPROVING DAIRY RATION BALANCING SOFTWARE

Today, as we develop dairy diets we have a choice of using computer software that balances against National Research Council (NRC) standards or one that makes use of a dynamic rumen model. NRC standards have been developed over time based on many research trials. From these, the 1989 and 2001 NRC nutrient requirements for dairy cows and heifers for energy, minerals, and vitamins were set. The problem with comparing to NRC standards has been that these largely ignore the dynamics of the rumen. It is well documented that rumen microbes play an important role in ruminant nutrition. They not only assist in the breakdown of feedstuffs but also contribute essential nutrients to the cow. When using ration software in which there is a dynamic rumen model, non-linear math equations are used to calculate the contribution of the microbes. As a result, these are able to better predict animal response to a diet. In addition, their accuracy is improved by accounting for environmental factors including temperature, wind, housing, stocking rate, activity, etcetera.

Much of the research that has been done in developing models has been done by researchers at Cornell University, University of Pennsylvania, and Miner Institute in Northern New York. Their work has been made available to dairy nutritionists through the Cornell Penn Miner dairy model (CPM) and later as the Cornell Net Carbohydrate and Protein System (CNCPS). In recent years, a great deal of work has been done on CNCPS. To make it more accessible to the dairy industry, its technology is now licensed to be included in commercially available ration-balancing software. To keep the software abreast with current research, Cornell also provides software and database updates. Recently these programs were updated from CNCPS version 6.2 to 6.5 and already there is talk of what version 7.0 will provide. These advances address a challenge in ration balancing software, how to keep the software up to date. This has been particularly helpful relative to the database. Many of the model nutrients are not tested by commercial forage/ingredient testing labs. As a result, the software must get these from its database. An inaccurate or out-of-date database may significantly impact the effectiveness of a feeding program.

Since models attempt to account for the rumen microbe's contribution, they focus on different nutrients. Primary among these is metabolizable protein (MP). This is the total of that portion of the protein that bypasses the rumen and that which the rumen microbes provide. Beneficial rumen bacteria use nitrogen and carbohydrate sources that the cow consumes to grow and produce more bacteria. Further down the digestive tract, these bacteria are broken down into their nitrogen and carbohydrate components which are absorbed and become part of milk and or meat. Therefore, it is not a coincidence that the amino acid composition of milk is nearly identical to the composition of the rumen bacteria. It is the goal of a model diet to maximize the microbial output of the rumen and feed as little as possible of the expensive dietary bypass protein sources. Also, since MP rather than crude protein is balanced for, most diets will be balanced for less protein than NRC diets. That means that less nitrogen will be wasted and excreted back into the environment making diets more environmentally friendly.

Rumen models look at more than the chemical fractions reported by labs. Research has shown that the rate at which a nutrient is digested (Kd) and the rate that it passes through the animal (Kp) impact how much will be absorbed. An example of this is the measurement of the digestibility of the Neutral Detergent Fiber (NDF) fraction. The amounts digested after 30, 120, and 240 hours are measured and entered into the program. Also starch digestibility is measured. Entering a feed's digestibility greatly improves the estimate of the metabolizable energy (ME) it supplies. Within the last few months a measure of Undigestible NDF (uNDF240) has been added. This represents that part of the NDF that is unavailable to the cow. It simply takes up space in the gut. Knowing this is useful in determining if the projected dry matter intake is actually greater than can be consumed.

Using a rumen model greatly improves the software's ability to predict the production capacity of a diet. When coupled with a "best-cost optimizer," it is possible to also make more milk at lower cost. With continued research, models will improve but making use of this valuable technology is currently the best way for KNG to provide the advanced dairy nutrition that our customers demand.

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