Milk Urea Nitrogen What is it and how is it used?

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Recently DHIA centers have begun offering milk urea nitrogen (MUN) analysis along with the familiar SCC, fat and protein measurements of milk. However, many producers and veterinarians are unfamiliar with the theory behind and application of MUN measurement. Furthermore, there is controversy among nutritionist and dairy scientists concerning the validity of the measurements and the usefulness of the data. This article will provide a basic background for the concept behind MUN measurements, an explanation of the method of measurement and the use of MUN data to optimize dairy cattle rations.

Protein Metabolism in Dairy Cows.

Rumen degradable feed proteins are metabolized by microbes in the rumen into ammonia and volatile fatty acids (VFAs). Ammonia is in turn used by the microbes for growth (microbial protein synthesis). The extent to which ammonia is used is largely determined by the availability of energy provided by readily fermentable carbohydrates. An improper balance between rumen degradable protein and fermentable carbohydrate (energy) results in inefficient rumen microbial growth. Ammonia not used by rumen microbes is absorbed into the bloodstream and is toxic to body tissues in high concentrations. If the amount of rumen degradable protein is too high relative to rapidly fermentable carbohydrate (energy) more ammonia enters the bloodstream since there is insufficient energy available to rumen microbes for its incorporation into microbial protein. The body deals with ammonia primarily in the liver by converting it to urea, a small, non-toxic molecule, composed of nitrogen, oxygen and carbon. This process requires energy. Urea enters the blood stream and is cycled back into the rumen and removed from the body through the urine. As a small, water soluble molecule it freely diffuses into other body fluids such as saliva and milk. Therefore milk urea nitrogen (MUN) reflects blood urea nitrogen (BUN) which is an indication of the efficiency of protein metabolism in the rumen.

Blood urea nitrogen (BUN) concentration is variable and is effected by rumen degradable protein intake, undegradable protein intake, energy intake, water intake liver function and elimination in the urine. BUN varies throughout the day with levels highest 4-6 hours after feeding and lowest just before feeding. The level of urea in the milk (MUN) reflects (BUN), but is less variable since milk is produced and stored in the mammary gland between milking. MUN is a convenient way to estimate blood urea nitrogen levels and may be useful in monitoring protein nutrition in the dairy herd.

MUN Measurement Methodology, Testing Protocol and Interpretation

Organic molecules such as protein, fat and urea nitrogen each have a unique infrared spectrum when heated. An automated, infrared instrument can measure fat, protein and MUN in the same test day milk sample. The machine is calibrated to measure MUN in normal milk, therefore, may not give accurate measurements in milk with abnormal levels or fat, protein or somatic cells. Samples submitted through Colorado DHI can be tested at the laboratory in Zumbrota, MN for $0.10 per sample.

University of Pennsylvania and Northeast DHIA researchers have measured MUN in over a million milk samples. Herd MUN values should average 11-14 milligrams per deciliter for Holsteins. Because MUN concentrations vary between cows and within cows in the same herd, they recommend testing at least 8 cows at a time. A larger group such as a pen or the entire herd would, of course, be preferable. High MUN average values suggests that more protein is being fed relative to the level of rumen fermentable carbohydrate.

Problems with MUN Testing

Concerns about the use of MUN values are based on the lack of standardization of measurement methodology and interpretation of these results. Currently, there are no official quality control standards applied to MUN measurement to guarantee results generated by one laboratory are equivalent to results from another. DHIA laboratories in major dairy states have established an informal quality control program and National DHI is working to establish uniform calibration standards like those established for fat and protein.

Impact on Individual Dairy Producers

High levels of MUN indicate inefficient protein use as a result of an imbalance between protein and energy which may impact fertility, feed costs, production efficiency and the environment.

1)Research has demonstrated reduced conception rate in cattle associated with high blood levels of urea nitrogen.

2)Protein is the most expensive component of the ration. Any parameter (ie MUN) that provides information to fine tune dietary protein requirements will reduce feed costs.

3)Excess rumen degradable protein relative to fermentable carbohydrates results in excessive ammonia production in the rumen. The conversion of excess ammonia to urea reduces energy available to the cow for production.

4)Finally, overfeeding protein increases levels of nitrogen in animal waste. A University of Maryland study of dairy production in the Chesapeake Bay drainage region used MUN as a nutritional tool to indenfy excessive protein feeding, decrease nitrogen loading to the bay and increase farm profitability.