Using MUN to Monitor your Dairy Feeding and Management Program

Cooperative Extension Service

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Milk urea nitrogen, commonly called MUN, can be used to monitor the protein nutritional status of dairy cows. MUN concentration can be determined in milk sampled from the bulk tank or collected from individual cows as part of DHI sampling and analysis. Bulk tank MUN values reflect the average concentration for the entire herd and multiple milkings within a milk pickup. They can be reported, along with somatic cell count, butterfat, and protein, by a milk company on each tank of milk picked up and delivered to the processing plant. Some milk companies may only report the MUN content in an electronic format and not on the pay stub. In addition, milk samples from individual cows can be collected (i.e. DHI sampling), analyzed, and averaged for groups of cows to evaluate nutrition programs for groups of cows (i.e. high, low groups) within a herd. When MUN concentrations deviate from the expected values, a review of the feeding and management program should be undertaken.

What Do MUNs Measure?

MUNs reflect the concentration of urea in the blood. They ultimately reflects what occurs during the digestion of feeds within the dairy cow's rumen, the cow's large fermentation vat. The rumen microbes or bugs use ammonia, peptides, and fermentable carbohydrates to make microbial protein. Between 60 to 75% of a cow's protein needs are met by digestion of this microbial protein in the cow's small intestine. This process is very important to the cow in order for her to synthesize milk in the mammary gland. When inadequate or excessive amounts of certain types of protein, known as rumen degradable proteins (RDP) or inadequate amounts of carbohydrates are present in the rumen, the concentration of MUN's in milk changes. These changes in MUN content can be used to pinpoint areas within a feeding and management program to critically review.

Where Does the Urea Found in Milk Urea Nitrogen Come From?

When cows consume a diet, the microbes within the rumen degrade some of the protein to ammonia. The microbes, in turn, use ammonia and fermentable carbohydrates to make microbial protein. Microbial protein flows to the small intestines where it is degraded to amino acids and absorbed into the blood stream of the cow. These amino acids can then be used by the mammary gland to make milk protein.

The amount and rate of carbohydrate digestion in the rumen are the primary regulators of microbial protein synthesis. In order to capture the ammonia, the bacteria require an energy source, fermentable carbohydrates. Dietary fats are not used as an energy source by the bacteria. Thus, sufficient, but not excessive, amounts of fermentable carbohydrates (nonstructural carbohydrates) must be provided for optimum rumen function and microbial protein synthesis.

Excess ammonia is absorbed across the rumen wall and passes to the liver via the portal vein where it is converted to urea. Urea can either be recycled back to the rumen through saliva or be excreted in the urine. Cows have to expend 2 Mcal (equal to the amount of energy to synthesize 5-6 lbs of milk) or more of energy to excrete the excess urea through the urine. Thus, excretion of excess urea is an energy requiring and wasteful process. Excess concentrations of urea in the blood are believed to have detrimental effects on milk production, reproductive efficiency, embryo survivability, and immune function. In addition, excess urea excreted in the urine has environmental implications.

Urea also is an end product from tissue metabolism. When the cow's tissues are energy deficient, proteins are broken down within the cow's body to supply an energy source. Increasing the amount of energy supplied by digestion in relation to the cow's needs will decrease protein breakdown (protein catabolism) and result in lower concentrations of urea in the blood.

Urea readily diffuses from the blood into the milk. Shortly after milking, the concentration of urea in milk found in the mammary gland closely parallels the concentration of urea found in the blood. As the interval after milking increases, slight differences will be seen in the concentration of urea found in milk and the urea concentration found in the blood since milk is "pooled" over time in the mammary gland. Since the concentration of urea in milk reflects that in the blood, MUNs can be used to reflect concentrations in blood.

What Are Expected Values for MUNs?

Generally, MUN concentration should be between 10 and 14 mg MUN/dl. Outside of these ranges, an evaluation of the feeding and management program usually is advised. . The concentration of MUNs does vary between cows, season of the year, and breed (Jerseys are higher than Holsteins).The following table summarizes some of the common problems attributed to lower or higher MUN values than expected.

MUN value	Ration parameters to evaluate
Less than 9	Rumen bacteria do not have enough ammonia for optimum synthesis of microbial protein. • Inadequate amounts of RDP (ruminally degradable protein) • Protein content of diet lower than expected- Check protein content of corn, other byproducts and forages to make sure current feedstuffs being fed reflect the nutrient composition used to balance rations. • Check the composition of the diets actually consumed by the cows. Do they contain the dry matter amount of each forage and grain ingredients specified within the balanced ration?
Greater than 15	Rumen bacteria cannot utilize the ammonia produced in the rumen—the excess is absorbed across the rumen wall, converted to urea in the liver and transported in the blood which is detected in milk • Too much RDP in the diet • Not enough carbohydrates present or not present at the correct time in the rumen • Usually seen on pasture diets, high alfalfa haylage/baleage diets • High MUN concentrations may decrease reproductive performance