Milk Urea Nitrogen (MUN) – Use it to Your Advantage

More and more farmers are monitoring MUN's. They do so because over time, they realize its value as an inexpensive measure of protein efficiency. By keeping their herd MUN's in a desirable range, 10 to 14 milligrams per deciliter, they reduce the chance of under or overfeeding protein. Both practices can be costly. Underfeeding protein is seldom a profitable move, even when protein costs are high, because it lowers milk production and sometimes decreases milk protein concentrations. Overfeeding protein is costly...it increases feed costs, it may lower milk production, it may reduce reproductive efficiency, and it may lower milk protein concentrations.

What is it?
Urea is a small water soluble organic compound. It is produced in the liver when the body uses protein for energy. It is the chief nitrogenous component of urine.

All protein contains nitrogen (N). Protein is comprised of amino acids, and all amino acids contain N. When protein (i.e., amino acids) is used for energy, the N must be released. In an energy-requiring process called the urea cycle, the N is captured as urea. Urea is a potent source of N; by weight, it contains 45% N.

What does MUN measure?
It’s a measure of protein efficiency. It allows you to see how efficiently your cows use the crude protein (CP) they consume. The more efficiently the CP is used for milk protein production, the lower the MUN values. If MUN values are high, your herd is wasting feed protein. Urine will have elevated levels of urea. Research has also shown that urine volume may increase.

Because urea is water soluble, it is found in all body fluids, including blood and milk. The more urea the body makes, the higher its concentrations in body fluids.

Interpreting MUN levels
An important initial point that needs to be emphasized is that a lot of cow variation exits. Wisconsin dairy specialists have observed that when well balanced diets are fed, 95% of all values range from 5.0 to 20.0 mg/dl for Holstein cows. Their experience is that a well-balanced diet results in MUN in the range of 10 to 12 mg/dl.

Individual cow sample MUN’s are the most useful. They give producers and their nutritionists the opportunity to look at MUN averages and ranges by and within pens or groups of cows. Bulk tank samples have their best application in one-group TMR herds. If you are feeding a one-group TMR, then it’s important that you track the average concentrations for the herd.

The reason for tracking MUN values is not only to see if you are too high or too low, so you can take corrective action, but also for you to relate the changes that you will see to the changes you have made in your feeding program. In the first case, you are using MUN as a signal, or a “red flag”, to point out a problem. In the second case, you are using the values to help you be more certain as to what factors on your farm make your cows more or less efficient in how they are using feed protein.

Causes of high MUN
Values become elevated when: (1) excess rumen degradable protein (RDP) is fed, (2) excess rumen undegradable protein (RUP) is fed, or (3) RDP is not balanced with non-fiber carbohydrates (NFC) because of less than assumed levels of fermentable carbohydrates. In these cases, the underutilized portion of dietary CP is converted to urea by the liver, which ends up in blood, urine and milk.
You will probably encounter several times over the course of a year or two where MUN’s will be higher than you want. Some reasons for feeding too much CP include:

- Turning cows out on lush pasture without other dietary changes (too much RDP)
- Switching to higher protein forages without other dietary changes (too much RDP)
- Replacing conventional protein supplements with too much urea (too much RDP)
- Switching from heat-treated soybeans to raw soybeans (too much RDP)
- Overfeeding “bypass protein” supplements (too much RUP)

Some reasons that result in feeding less fermentable carbohydrates include:

- Switching from processed corn silage to unprocessed (or poorly processed) corn silage
- Switching from high moisture or steam flaked corn to dry rolled corn
- Switching from finely ground corn to coarsely ground corn

**Causes of low MUN**

While this is less common, it does occur. If MUN values become too low (below 8-10 mg/dl), it is usually because the diet does not contain enough RDP. And when that happens, feed intake and milk yield decreases. Protein and butterfat concentrations may also decrease.

These observations occur because the rumen bacteria are not getting enough N (ammonia and amino acids) to support maximal rates of carbohydrate digestion and synthesis of microbial protein. When bacteria are short-changed on N, they become less active and their growth rates are suppressed. The result is decreased synthesis of volatile fatty acids and microbial protein…the precursors (building blocks) for milk components (lactose, fat and protein).

Some reasons for low MUN include:

- Shifting from higher legume silages to more corn silage
- Forage quality has decreased
- Not feeding enough supplemental protein
- Not feeding enough urea (sometimes rumen ammonia is more limiting than soluble protein)

**Correcting out-of-range MUN levels**

It is important to remember that most singular dietary changes will lead to changes in MUN if the rest of the diet is not re-formulated. For example, if more corn silage and less alfalfa silage are fed, then the grain mix needs to be reformulated with more protein supplements that provide for higher intakes of RDP (e.g., soybean meal and urea).

If your herd MUN is high, consider feeding less supplemental protein or less urea. If it is still too high, because of high protein forages, consider feeding more corn silage if you have it, or substituting less fermentable grains with more fermentable grains. Of course, do not over-feed grain because of acidosis.

If your herd MUN is low, and you have reason to believe that milk production is being impaired, then consider ration changes that will increase RDP supply. However, MUN values less than 10 mg/dl don’t always mean that the diet is too low in protein. It may be the result of excellent feeds and an exceptionally well-balanced diet! If feed intake and milk and milk component yields are high, and fecal consistency is good, then don’t mess with a perfect diet!

**Other factors**

It is important to understand that there are factors other than dietary factors that affect MUN levels. These include things such as season (usually higher in the summer), breed (Holstein usually lower than other breeds), milking frequency (herds milked 3x usually have higher concentrations), sampling time (values are usually the highest 3-5 hours after feeding), and a.m. vs. p.m. sampling (a.m. samples are usually lower).

**Balancing diets for protein**

It is apparent from the above discussion that balancing diets for RDP and RUP is important. Amino acid balancing is another strategic tool that allows for more efficient use of RUP. The result can be reduced feeding of RUP without a change in milk and milk components, or more milk and milk components with the same amount of RUP. A collection of observations by field nutritionists and research studies indicate a very favorable return on investment of this practice, as well as reduced N in urine and feces.
Economics of MUN Testing
Underfeeding protein obviously reduces milk income. Overfeeding protein usually increases feed costs, it may decrease reproductive performance, and it will certainly increase N excretion into the environment. Research has shown decreases in conception rates by 15 to 20% or more when MUN levels are greater than 18 to 19 mg/dl.

Overfeeding protein is hard to quantify, but Cornell research has shown a 10 to one return on the cost of MUN testing. (Editor’s note: Agri-Mark does not charge its members for MUN testing.) According to the researchers, this reflects savings in feed costs and reduced days open if MUN testing leads to a reduction in MUN as a result of diet changes. Overfeeding protein can be expensive!

MUN testing over a period of several months and making the dietary changes needed to keep it the normal range can result in: lower feed costs, increased milk and milk component yields, increased reproductive performance and minimal N excretion.

Caution
MUN values should not be used by themselves to evaluate your feeding program. They are useful, however, when used in conjunction with evaluating milk production records, feed intake, ration composition (e.g., DM, RDP, RUP and NSC), and feeding management practices.