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Milk Urea Nitrogen Testing

This NebGuide explains how to properly test for MUN and interpret the results.

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Milk urea nitrogen (MUN) analyses can be used as a signal, or "red flag", to point out potential problems in your feeding program. In particular, high MUN values reflect excessive dietary crude protein or low rumen degradable nonfiber carbohydrates (NFC). The NFC fraction, usually composed of starch and other sugars, can be low when insufficient grain is fed, or grain is improperly processed. Appropriate MUN testing over a period of several months to fine tune a feeding management program can result in:

- precisely meeting nutritional requirements,
- lower feed costs,
- increased reproductive performance,
- increased milk protein yield, and
- minimal nitrogen excretion into the environment.

Following are a series of steps to help you use MUN testing effectively and economically.

Step 1: Establish a Baseline MUN for Your Herd

For smaller herds, all cows can be tested. For larger herds, sample 10 percent of the herd or 10 percent of each cow group. Generally, milk sampling of individual cows will be more useful than a bulk tank sample. A good analogy would be sampling for somatic cell count (SCC). If a tank milk sample is high in SCC, you know you have a problem, but you don't know which cow(s) is the problem.

Step 2: When and How to Collect Milk Samples

Samples for MUN analyses should be collected at normal milking times. If your herd is on DHI test, the same sample can be used. The MUN levels reflect blood urea nitrogen (BUN) levels over the previous 12 hours (if milking is 2X daily) or 8 hours (if milking is 3X daily), when the milk was produced in the mammary gland (udder). Because of this, you can obtain a representative MUN value from milk samples collected at milking time. Remember that this is much different from BUN, where the blood sample should be taken 2 to 4 hours after a cow eats. To ensure the most comparable MUN values, sample all cows at approximately the same time after feeding.

Many scientists now agree that BUN and MUN values are equivalent if the sample has been taken, handled, and analyzed properly. Urea is thought to diffuse into and out of the mammary gland; and so urea in the milk equilibrates with blood urea very rapidly. This results in BUN and MUN values being very similar. Of course, taking a milk sample is much more convenient than drawing a blood sample.

Testing for MUN should be performed for 2 to 3 months to establish a good, reliable baseline value for the herd and for different cow groups. High producing cows will often have higher MUN levels than lower producing or late lactation cows. To monitor a herd or cow group, once a baseline has been established, test once every three months (or, about 4 times yearly). Remember to sample about 10 to 15 percent of the herd or cow group on larger dairies, or all of the cows on smaller dairies.

Step 3: Knowing When to Test for MUN

You can monitor your herd by testing for MUN every three to four months, or whenever one of the following situations occurs:

- *Major change in the rations.* This could occur when a nutrient concentration changes substantially (for example, crude protein increasing from 17 to 18%), or if feed ingredients change.
- *When cows are turned out to pasture.* You may need to reformulate the grain mix to avoid excessively high MUN levels.
- *New forage used.* This would be especially important for high protein silages and haylages such as alfalfa that are high in both crude protein and degradable protein.
- Forages and grains, reducing the particle size and increasing the moisture content, can alter use of protein and carbohydrates in the rumen, and consequently MUN levels. A common example would be switching from dry rolled to high-moisture rolled corn.

If you observe a decline in conception rate, if milk protein decreases, or if fecal consistency changes, you should consider MUN testing to aid in diagnosing the problem and causes. Conception rates have decreased by 15-20 percent or more with MUN levels greater than 18 to 19 mg/dl. Manure that is loose and runny, or a strong ammonia smell of the urine (noticeable in parlor or holding areas) can all be signs of improper protein and (or) carbohydrate feeding. Excessive dietary crude protein results in energy stress on the cow to excrete nitrogen as urea in the urine. This extra energy can actually worsen negative energy balance by 10 to 20 percent for cows in earlier stages of lactation. A MUN test can help you to zero in on the feeding factor causing the problem.

Step 4: How to Interpret MUN Values

Research at Cornell University and the University of Illinois indicates the following guidelines:

- Herd average MUN: 12 to 18 mg/dl of milk

- Individual cow MUN: 8 to 25 mg/dl of milk

Table I. Feeding management changes which alter milk solids production.

Management Factor	Milk fat percent	Milk protein percent
Maximum intake	increase	increase .2 to .3 units
Increased feeding frequency of grain	increased .2 to .3 units	may increase slightly
Underfeeding energy	little effect	decrease .1 to .4 units
High NFC ¹ (>45%)	decrease by 1% or more	increase .1 to .2 units
Normal NFC (25-40%)	increase	maintain normal level
Excessively high fiber	marginal increase	decrease .1 to .4 units
Low fiber ² (<26% NDF)	decrease by 1% or more	increase .2 to .3 units
Small particle length ³	decrease by 1% or more	increase .2 to .3 units
High crude protein	no effect	increase if previous diet was deficient
Low crude protein	no effect	decrease if diet is deficient
Escape protein (33 to 40% of CP)	no effect	increase if previous diet was deficient
Added fat (>7 to 8%)	variable	decrease by .1 to .2 units
¹ NFC = nonfiber carbohydrates. ² Low dietary fiber, high NFC, small forage particle length and low forage levels all may increase milk protein percent and greatly reduce milk fat test. These are not desirable ways to improve milk solids-not-fat. These feeding practices cause acidosis, lameness, and feed intake fluctuations. The cow is not healthy. ³ Less than 25% of particles greater than 2 inches indicates inadequate particle length.		

The variation (standard deviation) for individual cow samples in a given herd averages about 4 mg/dl. This means that variation in MUN values of 4 mg/dl for an individual cow is to be expected if she is sampled multiple times.

When interpreting MUN values, focus first on herd levels to decide if feeding changes are needed, and then on individual cow problems if they exist. If an individual cow MUN is high, make certain that the milk sample didn't have high SCC or changes in milk components that could cause the MUN test to be unreliable. Since the same sample can be used for MUN testing as the DHIA test day sample it is easy to monitor any component changes. Retesting during the following month is often a good idea.

A high MUN (greater than 16 to 18 mg/dl) indicates:

- crude protein is too high,
- rumen fermentable NFC is too low, and(or)
- protein and NFC aren't properly combined in the diet.

A low MUN (less than 12 mg/dl) indicates:

- low crude protein in the rations.
- improper mix of undegradable and degradable protein, and(or)
- high rumen fermentable NFC.

Low crude protein is easy to correct and is often a simple matter of supplying more rumen degradable protein. A low MUN can be associated with decreased milk and milk protein production. *Table I* lists feeding management factors that can be fine tuned to improve production of milk solids, and keep MUN levels in the desired range.

Step 5: Where to Send Sample for MUN Testing

Most Dairy Herd Improvement Association labs offer MUN testing. You should contact your lab for specific information; however, here are some basic guidelines.

Use the same samples that you or your field technician submits for butterfat and protein testing, and handle them in the same manner as usual. The cost will vary, but is usually less than one dollar per sample. You should expect your results back in about two to five days.

The Heart of America DHIA offers MUN testing. You can contact the lab by calling 800-698-2634 or simply ask your Field Technician for details.

Economics of MUN Testing

Cornell University research indicates a ten to one return on the cost of MUN testing. This reflects potential savings in feed costs, and reduced days open if MUN testing leads to a reduction in MUN or BUN as a result of feeding program changes.

Conclusions

Testing for MUN can be a useful, economical, and easy tool to flag potential feeding problems. The test must be used properly. Remember that any increases in herd profitability will be a result of improving the feeding practices in your herd to lower, or increase, MUN levels so that they fall within the acceptable range (12 to 18 mg/dl). In the future, MUN may be useful to allow dairy producers to better manage their feeding programs and to minimize nitrogen excretion into the environment.

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