Interpreting Milk Urea Nitrogen (MUN) Values

Mike Hutjens
Extension Dairy Specialist
University of Illinois, Urbana
and
Larry E. Chase
Extension Dairy Nutritionist
Cornell University, Ithaca, NY

Disclaimer

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USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

Introduction

This fact sheet has been developed to support the implementation of the Natural Resources Conservation Service Feed Management 592 Practice Standard. The Feed Management 592 Practice Standard was adopted by NRCS in 2003 as another tool to assist with addressing resource concerns on livestock and poultry operations. Feed management can assist with reducing the import of nutrients to the farm and reduce the excretion of nutrients in manure.

The Natural Resources Conservation Service has adopted a practice standard called Feed Management (592) and is defined as “managing the quantity of available nutrients fed to livestock and poultry for their intended purpose”. The national version of the practice standard can be found in a companion fact sheet entitled “An Introduction to Natural Resources Feed Management Practice Standard 592”. Please check in your own state for a state-specific version of the standard.

Milk processing plants and DHI can provide dairy managers with milk urea nitrogen (MUN) values on bulk milk and individual cow milk samples. Milk Urea Nitrogen is a useful tool that can allow dairy managers to monitor changes in the feeding and management of their herds. The following points can allow you to interpret MUN test results from your herd.

Milk Urea Nitrogen (MUN)

Milk urea nitrogen is the fraction of milk protein that is derived from blood urea nitrogen (BUN). In Holstein’s, MUN normally represents about 0.19 percentage points of the normal 3.2% total milk protein.

Casein and/or whey proteins that contribute amino acids for human use or cheese production are not included in MUN values. Average MUN values will range from 10 to 14 milligrams per deciliter (usually reported as a whole number such as 12). When cows consume feed containing protein, If bacteria cannot capture the ammonia and convert it to microbial protein, the excess ammonia is absorbed part of the protein is degraded to ammonia by rumen microbes (rumen degraded protein or RDP). across the rumen wall. Because ammonia can shiftblood pH, the liver converts ammonia to urea to be excreted or recycled. Urea diffuses freely across cell membranes, therefore MUN concentrations represent blood urea concentrations. Thus, if BUN values are elevated, MUN will be elevated. If MUN values are high, your herd is possibly wasting feed protein along with excreting excess nitrogen into the environment. If MUN values are too low, the rumen bacteria yield can be reduced thereby limiting milk production and milk protein yield.

Feeding Factors That Impact MUN

The key factor is providing adequate rumen available carbohydrates to provide the energy for the rumen microbes to convert ammonia into microbial protein. The following feeding situations could lead to higher MUN values in your herd.

1. Feeding too much total crude protein in the ration may result in the excess protein being wasted.

2. Feeding too much rumen degraded protein (RDP) and/or soluble protein can raise MUN even if ration crude protein was normal.

3. If rumen acidosis occurs, microbial protein growth will be inhibited and ammonia is not captured.

4. Rations low in fermentable carbohydrate (such as starch, sugar, and/or digestible fiber) can reduce microbial growth leading to higher MUN values.

Target MUN values

Every herd can have a different optimal MUN depending on the time of feeding relative to milking time, total mixed rations (TMR) compared to component-fed herds, cow eating patterns, and other factors that affect BUN values. The power of a MUN tests is to monitor changes in feeding and management programs within a herd.

1. Develop a MUN baseline that is “normal” for your herd (values may range from 8 to 16).

2. When the farm baseline changes by more than 2 to 3 points (normal variation), look for changes in your herd that caused this MUN shift.

3. Look at weekly averages as large variations occur day to day.

4. DHI and milk plant MUN values will vary due to machine standards and sampling differences.

Feed and Management Changes Leading To Higher MUN Values

1. New crop corn silage may not have the same level of fermentable carbohydrate (less starch or starch is not available).

2. Putting cows on lush pasture can increase total and degradable protein intake.

3. Shifting to a different crop of hay silage that is wetter or higher in crude protein can elevate MUN.

4. Grinding your grain coarser may reduce the rate of fermentation in the rumen.

5. Shifting from processed corn silage to unprocessed or improperly processed corn silage means less fermentable starch is available.

6. Shifting to a more degradable protein source (shifting from heat-treated soybeans to raw soybeans for example) results in more rumen ammonia.

Feed and Management Changes With Low MUN Values (< 8-9)

If the rumen does not maintain a minimum level of ammonia, milk yield and milk protein yield may drop because of reduced microbial protein synthesis. If your herd MUN is low, consider adding supplemental protein, different protein sources and/or other ration change and then monitor your herd for changes in MUN concentrations.

Herd vs. Individual MUN Values

Herd MUN values are similar to herd somatic cell counts when interpreting results. DHI processing centers may provide MUN group averages summarized by lactation number, days in milk, and milk production. Pennsylvania workers recommend a minimum of 8 to 10 cows per group in order to calculate an unbiased group MUN value. There are a number of factors that can influence your MUN values. These include:

a. Breed – Holsteins usually have a lower MUN value than other dairy breeds. However, this may be due to body weight rather than a breed difference.

b. Season – MUN values tend to be higher in the summer months.

c. Sampling time – MUN values usually peak 3-5 hours after feeding.

d. Milking frequency – Herds milked 3x tend to have higher MUN values than herds milked 2x.

AM-PM samples – The AM MUN value is usually lower than PM samples taken from the same herd. When comparing MUN values in your herd between months, be sure to account for differences in sampling times.

Fine Tuning MUN Values

MUN is one tool to evaluate ration protein and energy status. Remember that MUN's can be impacted by heat stress (MUN values are higher in the summer). Evaluate the following management factors along with herd or group MUN values.

1. Check rations to determine if the crude protein is too low (less than 15 percent for example) or too high (over 18 percent crude protein).
   Review the level of RDP (60-65% of the total crude protein), RUP (35-40 percent of total crude protein), and SP (50% of RDP).

2. Check ration starch levels (24 to 28 percent of the ration dry matter) and ration sugar levels (4 to 6 percent of total ration dry matter).

3. Evaluate the ratio of true milk protein to milk fat. For Holsteins, the ratio of milk true protein to milk fat is 82 percent (for example 3.0 percent true milk protein and 3.7 percent milk fat). A low MUN could result in a value of less than 75 percent.

4. Evaluate manure consistency. Cows with low MUN could have firm manure compared to cows with looser manure and higher MUN's. However, there are a number of others factors that can contribute to manure consistency differences in a herd.

Applying MUN Values to Calculate Nitrogen Losses

Wisconsin workers have developed an equation to predict the loss of nitrogen based on body weight and MUN values. Other equations are also available and could be used.

Urinary excretion of nitrogen = Body weight x 0.0129 x MUN (mg/dl)

Two examples are calculated below using a low (10 mg/dl) and average (14 mg/dl) MUN's.

1500 lb Holstein cow x 14 MUN x 0.0129 = 271 grams of urinary nitrogen
1500 lb Holstein cow x 10 MUN x 0.0129 = 194 grams of urinary nitrogen

The difference of 77 grams represents a loss of one pound of dietary protein or 2.2 lb of soybean meal plus the added environmental risks of disposing of the urinary nitrogen. This is equal to about 52 lbs. of N excreted per cow during a 305-day lactation.

Take Home Message

- MUN values can be used to the efficiency of microbial protein synthesis there by reducing nitrogen excretion into the environmental
- MUN values will vary from herd to herd, so the key benefit is to make comparisons within a herd or groups of cows in a herd
- If MUN levels (10-14 mg/dl) are outside normal ranges, look at ration balancing results, milk components, feeding management and nutrient balance.

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Project Information

Detailed information about training and certification in Feed Management can be obtained from Joe Harrison, Project Leader, jhharrison@wsu.edu, or Becca White, Project Manager, rawhite@wsu.edu

Author Information

Mike Hutjens
Extension Dairy Specialist
University of Illinois, Urbana
and
Cornell Larry E. Chase
Extension Dairy Nutritionist
University, Ithaca, NY

Reviewers

Dave Casper – Agri-King, Inc.

Jim Drackley – University of Illinois