Milk urea (MU) is a nitrogen compound in milk that is related to the amount of urea circulating in the blood and affected by the amount of protein eaten by the animal.

In NZ pasture-based systems, MU levels are usually higher than in systems where cows are fed a total mixed ration (i.e. USA, Western Europe). This is due to the greater amount of crude protein (20-25 %) in good quality pasture.

High MU concentrations are not detrimental to cow health or fertility in NZ pasture-based cows. Depending on the stage of lactation, MU levels less than 20-25 mg/d can indicate insufficient protein in the cows’ diet; in these situations, dietary protein levels and amino acid composition should be checked against cow requirements.

For high-input systems (e.g. less than 60% of the diet is pasture), bulk milk MU levels can help decide when to check the diet for an excess or deficiency of protein. If protein is in excess of recommended levels, this can allow expensive protein supplements to be removed from the diet.

The main driver for processors to provide the MU value on the docket was an increasing demand from some suppliers and their nutritionists – some milk companies decided to simply add the information to the docket or website instead of supplying the information manually to individuals.

In low-input systems, it is not beneficial to the animal to try and reduce MU. In high-input systems, high MU can indicate that protein supplements could be reduced in the diet. For all systems, low MU can indicate dietary protein deficiency.

1. What is milk urea?

Milk urea (MU) is a by-product of the breakdown of dietary protein. It is formed from normal daily metabolism of nitrogen and protein.

The digestion of nitrogen and protein in the rumen releases ammonia. If a diet has excess rumen degradable protein, excess ammonia is produced. The excess ammonia is absorbed through the rumen wall into the blood stream and converted to urea in the liver. Excess protein digested in the small intestine goes through a similar fate, being converted in the liver to urea. Most of the urea is excreted in the cow’s urine (see point 5) although some passes into the milk.

The main factor affecting MU in pasture-based systems is the amount of protein in the diet although, there are other factors that also influence MU.

A high MU concentration in pasture-based dairy cows does not affect their health or reproductive performance.

2. The MU value on your milk docket

Be aware of what values you are looking at - milk companies, NZ labs, and universities may use different units for Milk Urea (MU) or Milk Urea Nitrogen (MUN). Information from the USA is generally expressed differently to what is on the milk docket (see Comparison between milk urea units). MUN is 47 % of MU. The conversion equations are:

- $\text{MU (mg/dl)} = \text{MUN (mg/dl)} \times 2.14$
- $\text{MUN (mg/dl)} = \text{MU (mg/dl)} \times 0.47$

3. Interpreting MU

Milk Urea is an approximate indicator of the dietary protein supply to the cow. Lower-input systems (where pasture makes up more than 60% of the diet) can often have MU greater than 30 mg/dl and, there is no benefit to the animal to try and lower MU concentrations.
Milk urea may be used as a tool to help identify when dietary crude protein levels should be checked.

Depending on the stage of lactation, MU concentrations below approximately 20 - 25 mg/dl can indicate that protein may be limiting milk production; however, if MU is greater than approximately 30 mg/dl the cow is not deficient in metabolisable protein, and high protein feeds are unlikely to increase milk production.

As there are other factors influencing MU, actual MU concentrations are less important than establishing the normal base-line MU for your farm and monitoring changes in association with feed changes (e.g. MU could help you to decide when to check dietary crude protein content and alter the use of protein supplements).

For information on milksolids response to additional dietary protein in summer, check out the DairyNZ Technical Series (Nov 2011).

4. Protein requirements (CP%) and associated milk urea values

The dietary protein requirements and the associated approximate MU values are in Table 1.

If the MU value on the milk docket is less than the indicated range, farmers should look at the protein and amino acid content of the diet offered to their cows, as total protein or a particular amino acid may be limiting production. If this is the case, options such as increasing the proportion of pasture in the diet or adding in appropriate protein supplements could be considered. Farm infrastructure should be an important consideration in this decision, as protein supplements tend to be very expensive, and it is important to minimise wastage.

If the MU values are greater than the indicated range, it could indicate excess protein in the diet. In pasture-based systems high MU values are not detrimental to animal health or reproduction; however, they can indicate when to check dietary protein levels and potentially reduce the use of expensive protein supplements.

Table 1: Protein requirements of lactating dairy cows (DairyNZ Facts and Figures) and estimated approximate MU values

<table>
<thead>
<tr>
<th></th>
<th>Early lactation</th>
<th>Mid lactation</th>
<th>Late lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum CP% in diet</td>
<td>18</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Estimated MU value (mg/dl)</td>
<td>25-40</td>
<td>25-30</td>
<td>20-25</td>
</tr>
</tbody>
</table>

5. Environment

Although MU values are associated with the concentration of urinary N, implications of small changes in the urinary N concentration on environmental N loading are minor compared with other management factors, such as stocking rate and/or days in milk. Numerous management and resource factors determine the environmental outcome on farm, and the impact of any change needs to be determined by taking into account the whole farm system. For example, the addition of supplements to increase stocking rate or days in milk, may reduce MU but could actually lead to increased N leaching.

References:


October 2013
This resource is designed to provide general guidance on particular topics in a timely manner. This DairyNZ information is prepared with due care and based on research to date.