

Milk Urea Nitrogen (MUN)

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What is it? What does it measure?

Milk Urea Nitrogen (MUN), the concentration of urea nitrogen in milk, gives a look at how cows utilize the crude protein (CP) they consumed. MUN is expressed in milligrams per deciliter (mg/dl) with 95% of all values ranging from 5.0 to 20.0 mg/dl for Holstein cows. A well-balanced diet results in MUN in the range of 10 to 12 mg/dl, but values become elevated when (a) excess Rumen Degradable Protein (RDP) is fed, or (b) excess Rumen Undegradable Protein (RUP) is fed, or (c) RDP is not balanced with dietary Non-fiber Carbohydrates (NFC). In these cases, the unutilized portion of dietary CP is converted to urea (by the liver), which ends up in the blood, urine, and milk. Interpretation must be done carefully, however, because in addition to diet composition, MUN is influenced also by season, breed, parity, milking frequency, days in milk (DIM), level of production, and sample type (a.m. -vs- p.m.).

How is it measured? How do we use it?

MUN can be measured on individual cows (DHI testing), on a group of cows (milk line drip sampler), or by bulk tank samples taken when the milk is picked up on the farm. The cost of monthly individual samples range from 10 to 25 cents per cow. Many processing plants now provide bulk tank MUN tests free of charge at the producer's request, or at a modest charge of \$1.25 per sample. Individual cow samples can be summarized to give producers and their consultants the opportunity to monitor MUN averages and ranges by and within pens or groups of cows that exist within the herd associated with parity, DIM, diet, breeding, etc. Bulk tank samples have their best application in one-group TMR herds, while a drip sampler or flowmeter could be used to evaluate multiple groups within a herd. Bulk tank or drip sampler MUN test results provide information about herd or group average MUN, but do not provide information about cow variation that exists within a herd or group. Knowing cow-to-cow variation might be useful because a "normal" average MUN with high variability could suggest problems with feed mixing or delivery by the feeder and/or sorting in the feed bunk by the cows.

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What are the numbers telling you?

In research conducted at the U.S. Dairy Forage Research Center by Glen Broderick, cows receiving 16.7% CP diet optimized milk, fat and protein yields, however lower CP concentrations showed more efficient use of nitrogen. This and other work suggest that the most desirable MUN values range from 10 to 12 mg/dl for Holstein cows, but may be somewhat higher for other breeds (Table 1). Concentrations that are high (>14 mg/dl) may come from feeding high levels of immature alfalfa silage as the sole forage in the diet, feeding too large an amount of raw beans, or feeding excess urea, for example. Concentrations that are low (<10 mg/dl) suggest that protein-limited diets are being fed or that the forage has changed (e.g., lower protein haylage).

Why do you care?

Overfeeding protein is expensive, may reduce reproductive performance, and increases nitrogen excretion into the environment. Underfeeding protein may reduce milk income. Current guidelines recommend 17% CP diets for most lactating dairy cows. Besides being costly, excess protein is excreted as urinary nitrogen that is highly unstable, thus creating an environmental concern. Using MUN in combination with TMR analysis can help fine tune rations by looking for changes in the MUN levels before we notice changes in silage or other feedstuffs. Many nutritionists have become more sophisticated with their formulations for RDP, RUP, and NFC. Yet, measuring and using MUN is a way to let the cow tell you how you are doing with diet formulation and the feeding program.

Stage of Lactation	MUN (mg/dl)			
	< 10	10-12	13-14	> 14
Early (0-30 days)	Lack Dietary Protein	OK		Excess Dietary Protein
Peak & Post-peak (31-150 d)		Most desirable	May be acceptable	
Mid to Late (>151 d)	Intake & milk yield may be sub-optimal	Most desirable	RDP, RUP and / or adjust NFC	

¹ For Jerseys and Brown Swiss herds, add 1.5 units to all MUN value