Fact Sheet - Milk Protein Testing - FAQ's

May 14, 1999

Changing from Crude Protein to True Protein

David M. Barbano and Joanna M. Lynch
Cornell University, Ithaca, NY

What is the difference between crude protein and true protein?

Crude protein, sometimes called total protein, is estimated from measuring the total nitrogen content of milk. Nitrogen is multiplied by 6.38 to express the results on a protein equivalent basis. The total amount of nitrogen in milk, however, comes from both protein and non-protein nitrogen sources. True protein reflects only the nitrogen associated with protein and does not include the nitrogen from non-protein sources.

What is non-protein nitrogen?

This is a normal part of milk. The non-protein nitrogen (NPN) fraction is composed of urea and other low molecular weight nitrogen containing compounds such as creatine and creatinine. About 50% of the NPN in milk is urea, and variation in NPN is attributed primarily to variation in urea content. Non-protein nitrogen has little nutritional value and does not contribute to cheese yield. Therefore, it does not have the same economic value as "true" milk protein to either the processor or the consumer.

How much of the crude protein is NPN?

The amount of NPN in milk varies naturally, just like any other milk component. On average NPN represents approximately 6% of the total nitrogen. On an absolute basis, NPN accounts for about 0.19% of the "protein" in a crude protein value, but may range at the extremes between 0.12-0.25%.

How are crude protein and true protein measured?

Kjeldahl nitrogen analysis forms the basis for the **reference tests** for both crude and true protein. In both cases, nitrogen is multiplied by 6.38 to express the results on a protein equivalent basis.

Milk infrared analyzers are the most common testing instruments used for determination of protein for **payment testing**. They are calibrated using results from Kjeldahl reference testing. These instruments detect a signal generated from the protein molecules. In simple terms, the machines "see" protein but cannot see NPN substances.

Why change the basis for measurement of the protein concentration in milk from crude protein to true protein?

In the past, most electronic milk testing equipment were calibrated on a crude protein basis. This created problems because, although the NPN varied, the machine could not measure this variation. By calibrating on crude protein, a certain amount of error was inevitable when the machine attempted to predict something it could not measure. The direction and magnitude of these errors are not easily predicted, as NPN is not well correlated with either crude or true protein level.

These errors are eliminated when true protein is used as the basis for calibration because the electronic testing instruments can directly detect the protein signal.

Are there differences in NPN between farms? Between breeds?

Milk NPN levels are influenced primarily by farm management and feeding practices. Feeding practices

account for much of the variation in NPN observed between farms, regions and seasons. Any differences in NPN between breeds will be small compared to the effects of diet.

Will expressing protein as true protein rather than crude protein decrease my protein test?

On an absolute basis, yes.

Will the lower protein test decrease the milk price?

No. The value of protein will be increased to compensate for the decrease in protein. The change in test level in the Federal Milk Markets will be revenue neutral.

How do I compare my true protein tests to my previous crude protein records?

Add 0.19% to the true protein values to get an approximate estimate of crude protein.

You say that NPN levels can vary. So is adding a constant correction of 0.19% to estimate crude protein from true protein accurate?

Estimates of crude protein based on electronic milk testing have never been accurate with respect to the actual amount of NPN in milk, since this is not a component that the machine can measure. Adding a constant factor contributes no greater error than previously occurred when instruments were calibrated on a crude protein basis.

How will changing from crude protein to true protein influence genetic selection for protein production?

Using true protein will reduce the amount of random error in milk protein production data and improve the data quality for genetic selection. This will be an advantage for genetic selection for improved protein production in all breeds within the US. The actual value of protein production can be adjusted to a crude protein basis by adding 0.19% to the true protein test to make data comparable to historic data and data from other countries that still express milk protein on a crude protein basis.

Will this change in payment testing affect nutritional labeling?

No. Crude protein is the basis for nutritional labeling on an international basis.

Do any other countries express milk protein content for payment testing on a true protein basis?

Yes. France and Australia.

Please summarize the advantages of using true protein instead of crude protein.

Using true protein instead of crude protein will better reflect the economic value of milk protein. Additionally, it will improve the accuracy of payment testing for protein by eliminating sources of random error. This will result in more equitable and accurate protein tests, and improve the quality of data used for genetic selection and farm management.