Dairy One News from Dairy One - Where Information Creates Opportunity. September 1996, No. 22 Forage Laboratory

NEW ENERGY EQUATION

A major challenge of analysis is predicting the energy content of feeds and forages. Traditionally, we have taken advantage of the inverse relationship between fiber and digestibility to estimate energy. This system has served us well over the years, but improvements are needed in several areas:

1. Prediction equations existed for common forages but not for grains or byproducts. This forced us to print average tabular values for these types of feeds regardless of nutrient composition.

2. Energy prediction equations varied across the US. The same alfalfa sample analyzed in NY, PA, WI or CA would receive different energy values.

3. The negative impact of lignin and positive impact of fat were not taken into account. The unusual weather patterns we have experienced over the last few years and its affect on lignin will affect total plant digestibility. The increased use of fat in dairy rations through the inclusion of high fat byproducts and supplemental fat contribute to higher energy values. Neither of these factors were taken into account.

In our efforts to continue providing top quality feed information, starting 9/26/96, Northeast DHIA began using a new equation for predicting the energies of all forages and concentrates. The equation is based on a review of multiple digestibility trials by Bill Weiss at Ohio State University. Total Digestible Nutrients (TDN) was chosen as the term for available energy because of the large availability of digestion trial data and the ease of conversion of TDN to other expressions of feed energy using standard equations (NRC, 1988). In the equation, feeds are fractionated into potentially available fiber, fat, protein and carbohydrates. These factors are multiplied by their true digestibilities and summed. A metabolic fecal energy factor is then subtracted from the total resulting in an estimate of TDN.

The equation was tested by Weiss on a combination of 248 feeds and forages. The predicted TDN value fell within +/- 6% of the measured TDN. In a digestibility trial, the error of measuring TDN is about 3-5%. Therefore, the equation will estimate energy with precision similar to experimental animal measurements.

More information about the equation can be found in the references listed at the end of the article.

Facts and effects of utilizing the new equations.

1. In the past we used several different ADF based equations to predict forage energy. Under the new system, a single equation will be used for all forages, grains and byproducts based on multiple feed components (CP, NDF, ADICP, NDICP, Lignin, Fat, and Ash).

2. Energy prediction for ingredients and byproducts of plant origin will now be possible. Given the popularity and increasing number of byproducts available, this new system will provide the power to generate more precise energy estimates.

3. Energy values of ingredients and byproducts will vary from average tabular values. Some values will increase, others will decrease in comparison to tabular values. The new energies will be more reflective of the sample itself rather than a composite average.

4. The equation is not applicable to animal byproducts.

5. Average tabular energy values will be reported where the equation is not applicable.

6. In the absence of analytical values, average values for the missing components will be used in the calculation.

7. The energy values of grain mixes and TMR's will now reflect the impact of added fat when a fat analysis is requested.

In summary, the new energy prediction system will enable us to generate energy values for the majority of feeds. The ability to provide energy estimates for ingredients and byproducts will result in more accurate ration formulation.

REFERENCES

National Research Council. 1988. Nutrient Requirements of Dairy Cattle. National Academy Press, Washington, D.C., p.9.

Weiss, W. P., H.R. Conrad and N.R. St. Pierre. 1992. A theoretically-based model for predicting total digestible nutrient values of forages and concentrates. Anim. Feed Sci. and Tech. 39:95.

Weiss, W.P., 1993. Predicting the energy values of feeds. J. Dairy Sci. 76:1802.

Weiss, W.P., April 1995. Theoretical models for estimating available energy concentrations in ruminant feeds. Conseil des Productions Animales du Quebec (C.P.A.Q., Inc.) p.96.

NEW NIR SERVICES AVAILABLE

New NIR calibrations have been developed and are available for the following feed types:

Barley grain
Oat grain
Wheat grain
Triticale grain
Mixtures of the above small grains. *
Brewers grains
Corn silage and haylage mixtures.

*** IMPORTANT** – Mixtures containing corn, soybean meal or any other grains, ingredients, byproducts or minerals are not applicable. The calibration is only suitable for the 4 small grains listed either individually or in combination.

The high power of the new NIR software has finally enabled us to develop the long sought after corn silage/haylage calibration.

NEW FIBER TECHNOLOGY

This September, we adopted the ANKOM Filter Bag Technique (FBT) for determining ADF and NDF. Traditionally, fiber analyses ran as follows:

1. Samples digested individually in boiling solution.

2. After 1 hour digestion, solution was filtered through crucibles or filter paper upon which the fibrous residue was collected.

3. The residue was washed with hot water and acetone, then allowed to dry.

4. The residue was then weighed and divided into the original sample weight to determine the percent fiber.

With the FBT, samples are weighed into individual nylon bags and heat sealed. The best analogy that applies is that the samples are all in their own individual “tea bag”. Twenty four bags are then placed into a single digestion vessel and boiled under pressure for one hour. Upon completion, the bags are rinsed as a group in hot water followed by an acetone rinse, dried and weighed as before.

The FBT offers the advantages of multi-sample processing and eliminates the tedious step of individual sample filtering. This will result in increased sample thoughput and increased precision.

Research conducted by Northeast DHIA, Cornell University and other institutions led to the development of this process which will soon be going through the AOAC approval process. More information about the procedure can be found in the following:

J.Dairy Sci. 76: Suppl. 1, p.250, P309.

J. Animal Sci. 72: Suppl. 1, p.114, P436.

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Anyone who does a large quantity of faxing has probably run into these problems before. If you have, you know how frustrating they can be. It’s also frustrating for you, the customer, because it delays receiving your results.

In order to insure the successful transmission of your results, we need your help and cooperation. Avoiding the pitfalls listed above will get your results in your hands sooner. Thanks for your help.