Feed and Forage Testing:
The Whys and Hows for Dairy Producers

Why is it important to get feed/forages tested?

Testing feeds and forages consistently allows producers to more closely meet the nutrient requirements of dairy cows and replacement heifers. Also, testing for concentrations of nutrients in feeds improves consistency in nutrient supply and helps cows maintain milk production.

Overfeeding nutrients to cattle (above their true requirement) results in a net loss of those nutrients to the environment and a net loss to the producer's bottom line. Exceeding the crude protein (CP) requirement for lactating dairy cows, for example, results in increased nitrogen excretion in feces and urine and is unnecessary, especially considering that protein is often the most expensive ingredient in most lactating cow rations. Overfeeding or underfeeding energy to dairy cows can negatively impact body condition scores, reproductive rates, and milk production.

Without testing feeds and forages to find the true concentration of nutrients, producers may over- or underestimate the amount of CP and energy available. For example, if concentrations of CP in grains or forages are underestimated even by 1 to 2 percent, then producers are likely to feed too much supplemental protein, which increases feed costs and increases the amount of nitrogen excreted to the environment.

Table 1 illustrates the monetary losses of over- or underfeeding CP. Overfeeding cows by 1.6 percent CP would result in an extra $0.50/head/day spent on the ration, which means an extra $50/day for a herd of 100 cows. It is unlikely that milk production would increase enough to offset the added costs. Underfeeding cows by 1.8 percent CP results in a ration that is $1.60/head/day less expensive; however, milk production would decrease substantially. At 13.8 percent CP, it would be difficult for cows to put on any weight through their lactation cycle. This could lead to metabolic disorders such as ketosis or fatty liver.

Table 1. Comparison of rations with different amounts of crude protein (CP) fed to lactating Holstein cows (680 kg/body weight, 36 kg/d milk production, 23.9 kg/d dry matter intake, 15% CP required).

Ration[1]	CP, % diet dry matter	Cost, $/head/day[2]
Meets CP requirement	15.6	$4.95
High CP	17.2	$5.45
Low CP	13.8	$3.35
Compared to ration that meets CP requirement		
Exceeds CP requirement	+1.6%	$0.50
Below CP requirement	-1.8%	-$1.60

[1]Ration is corn silage based and formulated in NRC for Dairy Cattle (2001). All values are estimated from NRC for Dairy Cattle (2001).

[2] Prices based on published prices on July 5, 2010.

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While meeting CP and energy requirements improves animal health and production, it is also important to know the mineral content, particularly phosphorus (P) and potassium (K), of the feeds. In areas where water and air quality are sensitive environmental issues, overloading the soil with P or K increases the potential for runoff into surface water. In most states, this results in hefty fines for the producer. Calcium (Ca) is a mineral of concern as well. Having the proper amount of Ca and a cation/anion (+/- ions) balance in the ration is imperative to prevent disorders such as milk fever (hypocalcemia).

Mycotoxins are another reason to test feeds, particularly grains. Mycotoxins are toxic substances produced by mold spores found in grain feed. Several mycotoxins have been found in feeds common in dairy cattle rations. These toxins can cause reduced feed intake, milk production, and heat tolerance in dairy cows.

In addition, Aflatoxin B1 is a known carcinogen and can be translated from cattle feed to the milk (Aflatoxin M1). For this reason, the U.S. Food and Drug Administration has published a maximum concentration of 20 ppm AflatoxinB1 in dairy cattle rations. Aflatoxin residues found in milk have the same consequences as antibiotic residues: if found, the producer is responsible for the disposal of the milk. Thus, it is very important to have feeds and forages tested not only for nutrient content, but also for mycotoxins or other factors that may negatively impact the herd.

What affects quality of feed/forages?

Weather, storage, and processing are three broad categories that can have a tremendous impact on feed quality. Both weather and storage can affect dry matter concentration in feeds. In particularly rainy climates, the chance for mold growth and, in turn, mycotoxin production increases. Also, increased rainfall can subsequently increase the amount of nutrient leaching from cut hay and other stored feeds.

If feeds are stored or ensiled at too high of a moisture content, mold growth would be promoted and proper fermentation of ensiled feeds may not occur. The opposite is true as well, and particularly dry climates or drought events can reduce moisture content. This also negatively impacts fermentation of ensiled feed and may reduce the ability to properly mix and deliver a total mixed ration, without the addition of water.

Processing of feeds can impact nutrient concentration. For example, chop length too long (greater than 1 to 1.5 inches) in corn silage may encourage cows to sort their feed and would eventually reduce the amount of fiber (and energy) consumed. Chop length too fine (less than 0.5 to 0.75 inch) could cause a reduction in the time the cow spends chewing her feed and thus producing saliva to buffer the rumen, resulting in decreased pH or rumen acidosis.

Asking for a particle size test along with a nutrient analysis at the feed analysis lab helps identify problems ahead of time and reduces the incidence of both of these situations. If the laboratory currently used does not offer particle size analysis, it can be done on the farm using the Penn State Particle Separator.

What is the proper way to sample feeds and forages?

When sampling feeds for analysis, it is important to obtain a sample that is representative of all that particular feed. Do not sample just off the top or the bottom of the stored feed, as nutrient concentrations can change within the feed.

Grains/Dry Feed

Grain or concentrate feeds are typically more consistent than forages such as hays. However, it is still important to take samples from several locations within the stored area. Taking several small samples during the loading of a commodity bay or grain bin allows for a better representation of the total amount of feed stored. Once the small samples are taken, they can be combined, mixed well in a bin or large trash can, and then a smaller subsample taken and packaged to send to the laboratory for analysis.

Depending on the laboratory selected, directions vary for mailing the samples. Call the lab or check the lab's website to be sure you are sending the proper amounts in the preferred containers.

Forages

Loose hay and silages

The "4 corners" method can be used to properly sample loose forages. While silos are being loaded/unloaded, take several samples from within the feed. Compile this feed on a large trash bag or other surface. Split the pile of feed in half horizontally and then again vertically, until there are four small, separate piles or corners. Take small handfuls of each corner for the sample. Repeat this process two times.

Baled hay

The proper way to sample baled feeds (or silage from a trench or bunker) is to use a hay corer. The corer will penetrate the bale, trench, or bunker and collect a sample that represents the total amount of feed. Also be sure to take samples from each field where the feed is harvested. Silages should be tested, at the minimum, when they are first put up and then every time a new silo is opened for feeding.

Pasture

Taking samples from pasture is similar to taking samples from baled feeds. It is important to take samples from each field or paddock that cattle will be able to access. It is also important to take samples throughout the grazing period, as the quality of the pasture is likely to change as the number of cows and length of pasture changes.

To sample pasture for analysis, take a 36-by-36-inch square frame to the pasture. Often an old window screen with the mesh removed will work. Toss the screen in the pasture, then clip the forage found in the center of the frame. Repeat this three times in each paddock. The pasture collected in each paddock can then be mixed and a smaller sample sent for analysis.

Where can forage and feed samples be sent for laboratory analysis?

Many different laboratories are available for forage and feed testing across the United States. A few in the Southeast are listed below. A more comprehensive list can be found at ***http://msucares.com/livestock/dairy/index.html***.

LSU Ag Center Southeast Research Station
P.O. Drawer 569
Franklinton, LA 70438
Laura Zeringue
(985) 839-3740

Auburn University Feed & Forage Laboratory
961 S. Donahue Drive, Room 113
Auburn University, AL 36849
Dr. Gobena Huluka
(334) 844-3958

Agricultural Diagnostic Lab
1366 W. Altheimer Drive
Fayetteville, AR 72704
Nancy Wolf
(479) 575-3908

Cumberland Valley Analytical Services
14515 Industry Drive
Hagerstown, MD 21742
Sharon Weaver
(301) 790-1980

Dairy One Forage Lab
730 Warren Road
Ithaca, NY 14850
Paul Sirois
(607) 257-1272

Mississippi State Chemical Lab
1145 Hand Lab
Mailstop 9572
Mississippi State, MS 39762
(662) 325-3428

How should laboratory results be interpreted and used?

Results from a feed analysis should be used to properly balance a ration for cows and replacement heifers. Share these results with a nutritionist, who also can assist in the testing process. If you are not using a nutrition service and are relying on someone else to do a ration, read Extension Publication 2620 *Interpreting Forage and Feed Analysis Reports*, available at MSUCares.com or through the county Extension office. This report gives detailed information about each result encountered on a laboratory analysis report and how it applies to balancing rations for a herd.

References

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National Research Council. 2001. Nutrient Requirements for Dairy Cattle. 7th rev edition. National Academy Press, Washington, DC.

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