CUMBERLAND VALLEY ANALYTICAL SERVICES

Tech Notes

Dry Matter Determinations: On-farm versus laboratory

Why are they different?

Most nutritionists and dairy producers would agree that cows will milk better with a consistent diet. Diet consistency problems often are related to changes in forage dry matter. Frequently, cows experience rumen health issues, run out of feed, or receive inadequate nutrition when the forage weights are not adjusted for dry matter changes. In a USDA research study where the as-fed amount of TMR was not increased with wet silage, there was a significant decrease in milk yield of up to 6 pounds/cow/day.

A constant frustration for those involved in developing and feeding diets is the inconsistency between reported laboratory dry matter values and those determined on the farm. Often it is observed by those performing on-farm dry matter determinations on silage that the on-farm result is 1% to 4% higher (or 1% to 4% less moisture) than what is reported by the laboratory. The nutritionist and dairyman are left to wonder which dry matter value is "correct".

"Dry matter", or conversely "moisture" is generally not defined as a chemical entity but as a portion or weight of a sample that is driven off through a drying process. The amount of weight that is lost is very much dependent on the conditions of the dry-down process, particularly time and temperature. The definition of the method is critical for what we understand as "dry matter". It would be much less complicated if everyone used the same approach or definition. As this is not practical, understanding the differences between methods is important.

If we look to an industry definition of "dry matter" in wet feed samples, the primary definition is provided by the National Forage Testing Association (foragetesting.org). It recommends that a forage sample that is less than 85% dry matter be dried down initially by oven or microwave (at less than 55° centigrade) to a moisture level that allows for grinding (usually 3% to 8% moisture). This ground sample is then assayed for moisture by drying at 105° centigrade for 3 hours. The weight loss from the two steps is combined for a total moisture definition. This is known as a "two-step" dry matter determination.

A farm-based approach to dry matter determination often uses a device such as a Koster Tester which forces heated air through a sample. This is a "one-step" approach to driving off moisture which leaves a variable amount of moisture in the sample that is unaccounted for. Even if the person running the dry matter determination weighs a sample back multiple times to arrive at a constant weight, there will still be residual moisture in the sample. This residual moisture will result in the farm determination to yield a "higher" dry matter than the lab using a two-step process. Let's consider two examples in the data table below determined at CVAS using a Koster Tester and our standard lab drying oven:

	Haylage			Corn silage		
	DM (initial dry-down)	Residual Moisture	Final DM	DM (initial dry-down)	Residual Moisture	Final DM
Koster Tester 30 Minutes	42.4%	Not determined on farm	42.4%	35.5%	Not determined on farm	35.5%
Koster Tester 45 Minutes	41.7%	Not determined on farm	41.7%	34.7%	Not determined on farm	34.7%
NFTA Two Step Dry-down at the Lab	42.4%	4.10%	**40.7%**	35.3%	4.80%	33.6%

As evidenced by the data summary above, the initial dry matter from the initial dry-down by the Koster Tester and oven method are comparable. The difference in the final dry matter value between methods is that the residual moisture in the sample has been accounted for in the lab by grinding the initially dried sample and heating at 105° centigrade for three hours.

On farm methods of dry-down typically leave 3% to 5% moisture in a sample. A practical approach to bringing the farm-based one-step determination in line with the laboratory two-step approach would be to multiply the one-step dry matter by a factor of 0.96 (assuming 4% residual moisture):

Koster dry matter (haylage, 30 min) = 42.4% x 0.96 = **40.7%**

It is also helpful to know that error can play a role in perceived values. A 1 gram weighing error in a 100-gram wet sample can mean 1 point of perceived moisture. This can be due to scale errors, airflow across the scale, temperature and humidity or losing material at some point in the process. It is recommended to run samples in duplicate to account for possible errors as we do in the laboratory.

The definition of dry matter, as well as the accuracy and repeatability of determination, is important for developing and executing nutrition on the farm. Not only does the definition of dry matter impact the quantity of dry matter fed, but also the quantity of all nutrients in the ration. Understanding the differences between farm and laboratory dry matter methods is important for the nutritionist and dairyman.

References:
Forage Analysis Procedures, D. Undersander, 1993, National Forage Testing Association, www.foragetesting.org/lab-procedures.

NFTA Method 2.1.4 - Dry Matter by Oven Drying for 3 hr at 105° C, B. Shreve, 2006, National Forage Testing Association, www.foragetesting.org/reference-methods.

Goering, H.K. and P.J. Van Soest. 1970. Forage fiber analyses (apparatus, reagents, procedures, and some applications). ARS/USDA Handbook No. 379, Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402