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Forage Producers Tech Guide:

Understanding Wet Chemistry Forage Analysis

Laboratory analysis provides an inexpensive means of measuring forage digestibility. The standard method used by the analytical laboratory industry is known as wet chemistry analysis. In this process standardized chemical solutions are used to separate out the various forage components. Energy projections are then calculated from these analytical results. How accurate are the projections based on these calculations? In other words, do the energy projections yielded by wet chemistry analysis correlate closely with actual animal performance?

Forage researchers have questioned if wet chemistry analysis of brown midrib or BMR forages are yielding accurate energy projections. This question is based upon an understanding of this analytical method which is described below:

Forage energy projections are described as the percent total digestible nutrients (%TDN) or percent in vitro (laboratory) total digestible nutrients(% IVTDN). TDN or IVTDN is calculated from the percent acid detergent fiber (ADF) as determined by chemical analysis. High ADF percentages result in low TDN percentages, low ADF percentages result in high TDN percentages. Following are two formulas currently in use by analytical labs to determine TDN. As you can see, ADF is the only variable which is entered into either of these formulas.

$$\% \text{ TDN} = 88.90 - (0.790 \times \% \text{ ADF})$$

$$\% \text{ TDN} = 95.88 - (0.911 \times \% \text{ ADF})$$

Acid detergent fiber or ADF consists of the cellulose and lignin in the forage (It also contains trace amounts of silica, a mineral). Lignin contributes no energy and lowers overall digestive efficiency. Cellulose is an excellent energy source for ruminants. Yet these two components are lumped together as if they were of the same value when calculating energy levels. Please refer to the two hypothetical forage analysis below:

#1	28.5% cellulose	#2	35.0% cellulose
	9.5% lignin		3.0% lignin
	<u>+0.2% silica</u>		<u>+ 0.2% silica</u>
	38.2% ADF		38.2% ADF

In the example above, ADF levels are identical and TDN levels as calculated by any standard method are identical also. However, it is obvious that sample #2 with the higher cellulose and lower lignin level has significantly more energy available for animal use than sample #1. Forage researchers have questioned if brown midrib forages, with a lower lignin level, are assigned inaccurate TDN percentages similar to that of example #2.

One other point should be clarified in this discussion of forage analytical methods. As stated earlier, % TDN or % IVTDN is derived from wet chemistry analysis. Another energy projection with a similar abbreviation, percent in vitro total digestibility or % IVTD is derived from in vitro or laboratory analysis using rumen fluid collected from an actual animal's rumen. Since % IVTD is based upon the activity of rumen microbes this analytical method is considered to be a more accurate projection of energy levels in in forages, particularly BMR forages.