Fiber Digestibility - Removing the Mystery

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In the last few years the way we talk about and report fiber and fiber digestibility in forages has seen some changes. In this article, I will cover the changes in terminology and how the newer measures of fiber digestibility relate to the terms that we are all familiar with.

aNDF and aNDFom

Starting in January all of the Forage Lab reports had NDF reported as aNDF or aNDFom. The addition of the "a" to NDF is to clarify for customers the procedure used on their samples. In the 1990's amylase and sodium sulfite were added to the ND (neutral detergent) solution to further clean up the residue and give a more accurate representation of fiber in the sample. Amylase was added to help breakdown the starch. Likewise, sodium sulfite was added to help remove protein. The use of amylase is the official procedure and the Dairy One Forage Lab has always used amylase and sodium sulfite in our analysis. So, your NDF and aNDF results are the same thing, just a new name.

Next, aNDFom - it is being advocated that NDF be reported on an "organic matter" or "ash free" basis. Samples high in ash can overwhelm the ND solution and the remaining ash is included in the fiber residue resulting in an overvaluation of the NDF. The measure of aNDFom is determined by the traditional NDF extraction, then the fiber residue is ashed at 550°C for 2 hours to burn off the organic matter. The residual ash is subtracted from the fiber residue to determine and express NDF on an ash free or organic matter basis (aNDFom).

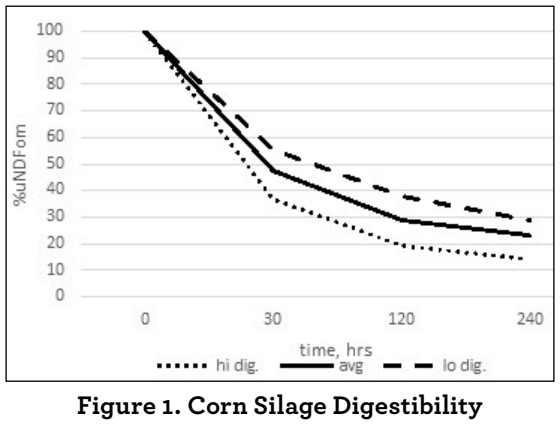

Figure 1. Corn Silage Digestibility

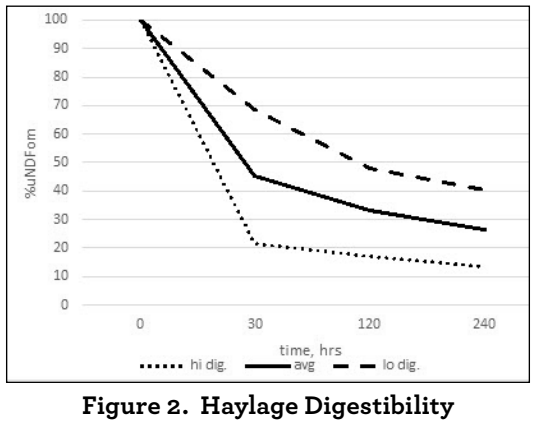

Figure 2. Haylage Digestibility

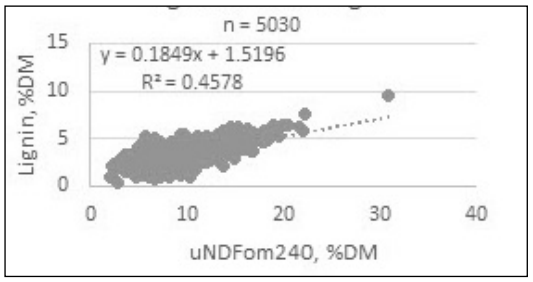

Figure 3. Corn Silage

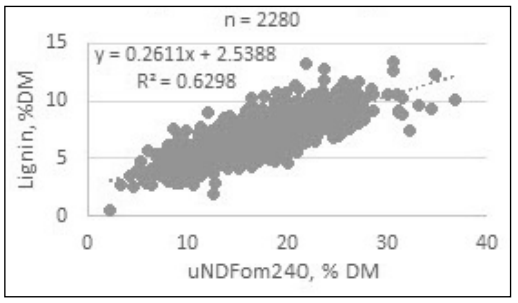

Figure 4. Legume Silage

uNDFom and NDFDom

Work done at Cornell University has determined that using three digestibility time points (30, 120, and 240 hours) will result in a better estimation of the rate of fiber digestion known as "kd". Values from these analyses are undigested NDF (uNDFom) and NDF digestibility (NDFDom) on an organic matter basis. In the rate calculation, it is important to know the end point. In this case, the end point is the total undigestible fiber at 240 hours (uNDFom240). In the Dairy One Forage Lab we have seen that there is greater variability the digestibility rate of haylages than corn silages (Figure 1 and 2). This is largely attributed to the wide range in species and maturity that contribute to the makeup of a haylage.

uNDFom240 and Lignin

When uNDFom240 was introduced, some of the discussion was to use it replace lignin. So what is the relationship of uNDFom240 and lignin? In general, as lignin increased, uNDFom240 also increased for corn silage, legume silages, and grass silages (Figure 3, 4, and 5). However, these mild positive relationships indicate that, in addition to lignin, other factors are affecting forage digestibility.

Further investigation into what uNDFom240 represents found that corn silage had the narrowest distribution for lignin and uNDFom240 (Figure 6), followed by legume silage (Figure 7), and then grass silage (Figure 8). Corn silage has a narrower range for lignin and uNDFom240 because of harvest management practices. Corn silage is much closer in maturity across farms when harvested compared to the range in maturity of grass and legume silages. The timing and number of the cutting, (1st, 2nd, or 3rd) will also change the digestibility of the fiber and contributes to the wider range of values observed for these forage types (Figure 7 and 8). The narrow range

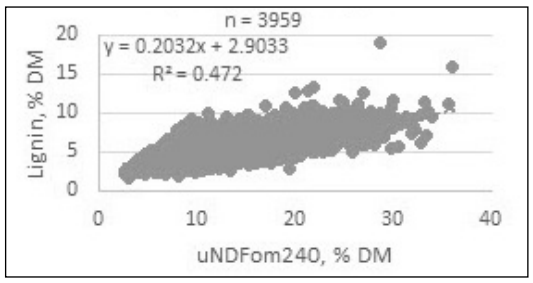

Figure 5. Grass Silage

of lignin observed indicates that it represents a portion of the fiber digestibility puzzle. The wider distribution of uNDFom240 is likely a more accurate indicator of the variability in digestibility of the plant population.

Overall, these results are helpful in explaining why feeds with the same or similar lignin values do not perform the same when fed. In the case of grass silages, forages with the same lignin can have as much as a 20% difference in uNDFom240 (Figure 8). As uNDFom240 increases intake decreases and the amount of energy the animal gets from the feed decreases.

As we measure more components of fiber in forages, we improve our understanding of fiber, fiber digestibility, and the factors that influence fiber digestibility.

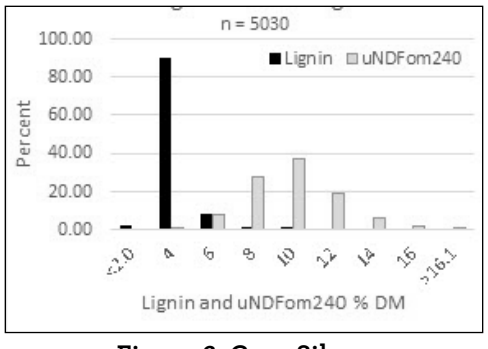

Figure 6. Corn Silage

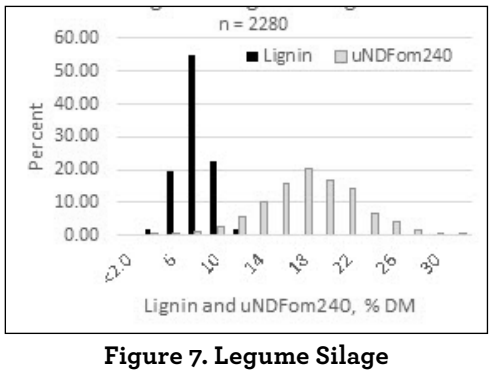

Figure 7. Legume Silage

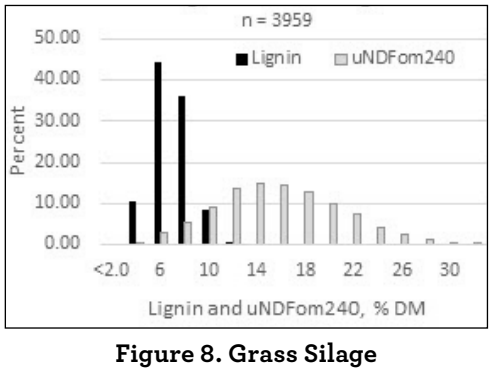

Figure 8. Grass Silage