

FORAGER



Agronomics with livestock in mind!



FIBER DIGESTIBILITY: BASIC CONCEPTS, COW RESPONSES & TAKING ADVANTAGE OF GREATER FIBER DIGESTIBILITY ON THE FARM

Neutral detergent fiber (NDF) digestibility is positively related to feed intake, milk production, and body weight gain in dairy cattle. We are learning what laboratory measurements best predict the NDF digestibility of forages and how to effectively use these NDF digestibility values in ration evaluation and formulation. This [article] provides a template for deciding how to use NDF digestibility on-farm, including the impact of cow management on response to improved fiber digestibility. To fully appreciate and properly interpret NDF digestibility values, we need to understand the relationships among cell wall structure, ruminal digestion, and dietary and management factors that all impact the animal's response to forage with a specific digestibility.

It is the complex series of interactions between these entities that ultimately determine the NDF digestibility of forage when fed to cattle. Chemical properties of the forage (primarily lignin) and three-dimensional structural attributes of the plant cell comprise the physiochemical matrix that the microbial population must interact with. While the process of fiber fermentation is occurring, dietary and management factors will influence fiber digestion and passage rates from the rumen and consequently the total time a forage particle will stay in the rumen. Ultimately, all of these factors determine cow response in terms of feed intake and milk yield. Given the complexity of this process, it is actually incredible that we can estimate the NDF digestibility of a forage sample as accurately as we sometimes do with only a 1-gram sample (usually dried and ground)! Remember this "big picture" of factors influencing NDF digestibility when interpreting NDF laboratory results and what to expect for any on-farm scenario.

From a nutritional perspective, acid detergent fiber (ADF) is correlated with digestibility of a forage or feed because it contains primarily lignocellulose, and lignin is the major plant compound that limits ruminal cell-wall carbohydrate digestion. Neutral detergent fiber (NDF) is correlated with feed intake because it measures the complete plant cell wall (cellulose, hemicellulose and lignin) that is typically bulky and takes up space in the rumen. The NDF content of forage is also positively related to chewing response during eating and rumination. Following are some general guidelines to assess the adequacy of dietary "chemical" and "physical" fiber in dairy rations.

Chemical NDF:

- 28-32% of ration, DM
- minimum ~25% (NRC, 2001)
- 1.2% pf BW as total NDF intake maximum
 - o $1350\text{-lb BW} \times 0.012 = 16.2\text{ lb NDF intake/day}$
 - o upper limit for NDF intake/day in many situations

Physical NDF:

- 550-600 minutes of rumination/day
- ~60% of resting cows should be ruminating
- Ruminal pH >5.8
- ~5-8% of particles >19mm sieve PSU Particle Separator
- peNDF >20% of DM

PLANT CELL ANATOMY & RUMEN DIGESTION

We usually envision plant cells as two-dimensional squares as illustrated in most textbooks. But, to fully understand how microbes interact with a forage fragment, we must think of the cell as being three-dimensional; in other words, the plant cells are boxes that bacteria must enter. And, entering and moving through these boxes, digesting NDF as they journey through the plant cell, takes time to accomplish. When we evaluate a NDF digestibility value like 30-hour NDF digestibility, we are really evaluating how much distance the bacteria traveled through the plant cells in 30 hours. The most important microbes for fiber digestion are bacteria and fungi.

RELATIONSHIP BETWEEN NDF DIGESTIBILITY & PERFORMANCE

Research clearly demonstrates the importance of high quality, high-NDF digestibility forages for optimal milk production. As NDF digestibility of forage increases, researchers have observed the following responses:

- greater dry matter intake
 - increased milk yield
 - higher peak milk yield and greater persistency
 - less body weight loss in early lactation
 - better body condition
 - improved reproductive performance
- The benefits of feeding diets with higher amounts of digestible NDF include:
- increased energy intake
 - higher ruminal pH
 - increased acetate: propionate and better milk components
 - minimal lactic acid and less acidosis risk
 - greater bacterial protein production and less need for expensive RUP supplements
 - indigestible NDF interferes with digestion and absorption of starch, protein and fat
 - constant supply of absorbed nutrients resulting in more milk production

Small increases in NDF digestibility can result in highly economical increases in milk yield, body condition and reproductive performance.

(from an article by Dr. Rick Grant, W.H. Miner Institute, NY)

**INVESTING IN QUALITY FORAGES & FEEDS is
...INVESTING IN RESULTS!**

~ RENAISSANCE NUTRITION ~