

Fiber Notes

Crude Fiber

The most commonly used descriptor of carbohydrates on feed tags is usually crude fiber. Crude fiber content of a feed is determined using proximate analysis or the Weende system. Crude fiber is the residue remaining after subtracting water, lipids, proteins and the nitrogen-free extract from the feed. Nitrogen-free extract is said to represent mainly sugars and starches. It uses a chemical method of solubilizing the feed using acids and bases. One of the problems in using crude fiber as a descriptor is that any lignin, cellulose or hemicellulose which is solubilized in the process is lost and appears in the nitrogen-free extract value for the feed. Thus, crude fiber values may actually underestimate the fiber value of the feed, and over estimate the nitrogen-free extract portion.

NDF and ADF

The Van Soest system of analysis improves on simple values of crude fiber, by separating out different fiber fractions into neutral detergent fiber and acid detergent fiber. These are the most common values which are reported if you have a forage analyzed. Unfortunately this method is most applicable to the value of feedstuffs for ruminants, rather than horses. Regardless, it still does offer the horse owner some important information. The neutral detergent fiber of a feed contains hemicelluloses, cellulose and lignin, although some soluble hemi-cellulose may escape into solution. It does not provide information about fructans, pectins, gums, or beta glucans which are quite readily fermented by the equine digestive tract. Acid detergent fiber represents the lignin and cellulose content of the feed, as the hemicelluloses have been removed. The amount of hemi-cellulose in a feed, which is easily fermented by horses as well, is represented by the difference in value of the NDF and ADF value for the feed.

Total Dietary Fiber

Total dietary fiber is more frequently used in human nutrition, but may actually offer better information for species which are hind gut fermentors, as is the horse. Total dietary fiber combines many plant values together, and essentially represents the portion of the plant that resists enzymatic digestion which takes place in the small intestine. This includes the traditional fiber components of hemi-cellulose, cellulose and lignin, but also includes pectins, oligosaccharides, mucilages, gums, etc. which are often referred to as soluble fibers in human nutrition. Thus this method recovers more of the true fiber portion of the feed which is susceptible to fermentation in the horse and contributes to their energy supply. Unfortunately this method is not commonly used in commercial feed testing laboratories which serve the animal industry.

Non-Fiber Carbohydrates (NFC)

Now the definitions are going to start getting a little trickier, and the horse owner may encounter many different acronyms. Non-fiber carbohydrates, or NFC, represent the carbohydrates which are not in the cell wall and are not recovered when doing an NDF feed analysis. The NFC is what remains after subtracting the NDF, protein, fat and ash. It represents the sugars, starches, fructans, galactans, pectins, beta glucans and organic acids. NFC is determined via a mathematical procedure and not a chemical analysis. You may also see values reported as NSC, which stands for non-structural carbohydrates. These values are actually determined chemically and differ from NFC in that NFC values may also include

pectins and gums which will not appear when analyzed for NSC.

WSC

Confused? Let's add some more letters. Water soluble carbohydrates are also used in equine nutrition to determine the most easily digested carbohydrate portion. The monosaccharides, disaccharides, oligosaccharides and some polysaccharides appear in this portion of feed separation. Compared to the NSC value for feeds, it would equal the WSC portion added to the starch content of the feed. Starch content of feed can also be analyzed separately as well.

Finally, some equine specialists have suggested that carbohydrates need to be redefined in terms of horse nutrition. As they are hind gut fermentors, they handle carbohydrates much differently than do ruminants. Certainly, they also get much more use of cell wall components than do simple monogastrics. Many of the particular disorders found related to carbohydrate digestion in the horse may require us to look differently at feeds than is needed in other species. One of the suggested systems created by Rhonda Hoffman (currently of Middle Tennessee State University) is to separate equine carbohydrates into hydrolysable carbohydrates (CHO-H) subject to enzymatic digestion, and fermentable carbohydrates (CHO-F) which undergo fermentation in the hind gut. The fermentable carbohydrate fraction can further be defined as either rapidly fermentable carbohydrates (CHO-F_R) or slowly fermentable (CHO-F_S). Slowly fermentable carbohydrates would include those seen in NDF values, with the indigestible lignin portion removed from the value. The rapidly fermentable carbohydrates, whose presence can increase the energy content of a feed, include the oligosaccharides, fructans, beta glucans and pectins. Feeds higher in rapidly fermentable carbohydrates can offer more calories to the horse. Alternatively, some horse owners may need to be aware of the fructan content of feeds or forages in horses more prone to developing laminitis.

So what values do you need to know and why should you care?

In general, crude fiber values are listed on most feed tags. Typically the lower the crude fiber value, the higher the energy density of the feed. This is not true of feeds which are designed to have higher fat values, and may include fibers to provide a healthier type of feed for the horse. Owners who have horses with insulin resistance or metabolic syndrome, as well as PSSM horses, should try and choose feeds which are lower in the soluble carbohydrates such as sugars and starches. However, these values are not always provided on feed tags. Owners may also select away from forages which may be higher in sugars and starches as well for these particular types of horses with demonstrated metabolic disorders.