Equi-Analytical Laboratories

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How Are Sugar and Starch Measured in Hay?

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There are multiple numbers on your forage analysis report that are related to sugar and starch concentrations in your hay sample. In this newsletter, we will cover sugar and starch measurements, water soluble carbohydrates (WSC), ethanol soluble carbohydrates (ESC), starch, and non-fiber carbohydrates (NFC) and the ranges we have seen in samples analyzed by our lab over the last 10 years.

Water Soluble Carbohydrates (WSC)

These are extracted from the feed with water and can include simple sugars, disaccharides, oligosaccharides, and some polysaccharides, depending on the feed. Fructans are included in WSC. The roll of fructans in horse diets are not fully understood and WSC should be considered when looking at sample analysis. Interpreting and using this value depends on the proportions of sugars and fructans in the

sample; simple sugars are digested and absorbed in the small intestine and have a significant impact on blood sugar (glycemic response), while fructans are fermented in the large intestine and induce a much smaller response. However, when eaten in large amounts, some fructans have been shown to cause laminitis due to the production of lactic acid and the disruption of the bacterial population in the large intestine.
Alfalfa Hay Averages: % WSC 9.3 ± 1.9
Grass Hay Averages: % WSC 11.6 ± 4.6

Ethanol-Soluble Carbohydrates (ESC)

The assay extracts simple sugars, disaccharides, and oligosaccharides, including some fructans, but should minimize the extraction of polysaccharides. It is a subset of WSC. This fraction is generally used to evaluate one set of carbohydrates in a feed that will induce a high glycemic response.
Alfalfa Hay Averages: % ESC 7.1 ± 1.5
Grass Hay Averages: % ESC 7.6 ± 2.6

Starch

Starch is an alpha-linked glucose carbohydrate that is preferentially digested in the small intestine. If starch escapes digestion in the small intestine (which occurs when large amounts of starches are fed at once), it passes through the digestive tract and is fermented in the hind gut. This can lead to lactic acid production and the negative factors associated with it.
Alfalfa Hay Averages: % Starch 1.73 ± 0.94
Grass Hay Averages: % Starch 1.89 ± 1.4

Non Fiber Carbohydrates (NFC)

This is a calculated (as opposed to an analyzed or measured value) estimate of all carbohydrates not in neutral detergent fiber (NDF). NFC = 100 - crude protein% - NDF% - ash% - crude fat%. Prior to the routine availability of WSC, ESC and starch analyses, it was commonly reported as an estimate of feed carbohydrates. However, as a calculated value, it will carry all of the errors of the other measurements. Use WSC, ESC and starch when available to evaluate carbohydrate levels in the diet.
Alfalfa Hay Averages: % NFC 30.4 ± 3.6
Grass Hay Averages: % NFC 19.8 ± 5.1

Non Structural Carbohydrates (NSC)

An agronomic term to describe the carbohydrate content of plants defined as WSC + Starch. Confusion abounds in the reporting and interpretation of NSC and NFC. Although not set in stone, there is general agreement that NSC should be defined as the **measured** sum of WSC + Starch and NFC as a **calculated** value determined by difference as described above. In either case, using individual measured values of WSC, ESC and starch are better means of evaluating your horse's diet.
Alfalfa Hay Averages: % NSC 11.0 ± 2.3
Grass Hay Averages: % NSC 12.9 ± 4.8

Balancing sugars and starch in your horse's diet is important to your horse's health. Horses on high sugar and starch diets can develop laminitis, colic, and insulin resistance. Feeding hay and pasture as part of a horse's diet can help balance the sugars and starches in the

diet. Testing your hay and pasture for sugars and starches will help you balance your horse's diet and maintain health.

More information on feed composition is available in our Interactive Feed Composition Libraries.

Order the Dairy One and Agro-One Pasture Management Package for Next Spring

The Dairy One Forage Lab and the Agro-One Lab are offering a package to help you better understand your pasture. The package is designed for use in one pasture during a growing season. Testing your pasture from top to bottom (clippings and soil) will tell you what you are providing for your animals and what you might need to supply for your pasture.

Pasture Management Package Includes:

Forage Testing You will get 3 Forage testing kits and sample submission forms to be used throughout the grazing season.

Soil Testing One soil sample to determine the nutrient needs of the pasture (Phosphorus, Potassium, and pH)

Interpretation Each forage sample result will come with an interpretive sheet. The sheet will have the Dairy One Forage Lab sample ranges for comparison to your results and some management suggestions for changing your pasture.

Price $75.00
(includes all shipping costs and is a 15% savings over list price)

Dairy One Forage Laboratory Agro-One Agronomy Services

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