



## **Your Hay Test and your Horse – How to Decipher That Lab Report and What Does it Mean?**

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Buying hay for your horse can be a challenge whether you buy it a few bales at a time or buy a year's supply as soon as it becomes available in the summer. Supply, price and quality have always been important parameters to consider when buying hay for horses but now more than ever before, horse owners are becoming aware of the importance of the nutritional components of the hay they feed. Many hay dealers will provide you with a lab analysis for the hay they have for sale but if not or if you grow your own hay, you will need to sample it yourself for laboratory analysis.

### **How Do I Sample My Hay?**

The first challenge in getting hay analyzed for nutrient content is obtaining a representative sample. Ideally sampling hay involves the use of a hay drill suitable for "coring" sufficient bales to get a representative sample. Generally sampling at least 6-12 bales off the stack is recommended to get an accurate sample. While coring bales with a proper hay drill is always recommended to get a representative sample from your stack it is possible to take grab samples (handfuls) of a number of bales (at least 10-12 different bales) if you don't have a drill. Whether you have cored bales or taken grab samples, the hay you have collected off the stack needs to be well mixed in a large pail and then "sub-sampled". The sub sample should be of a sufficient amount to fill a large zip lock bag.

When you have your hay sample ready it should be packed in water proof packaging and either personally delivered or sent via postal service, bus or courier to the lab of your choice. Make sure you have included your name, and phone number or email address so you can be advised when your hay analysis is completed. Analysis options can include wet chemistry or NIRS (Near Infrared Spectroscopy) and either would be suitable for the analysis of horse hay for the basic nutrients such as Moisture, Dry Matter, Crude Protein, NSC and sugars.

Analyzing hay for trace minerals should always be done using wet chemistry methods. While NIRS can be highly accurate for determining most nutrients in a hay sample, it isn't recognized as being sufficiently accurate for trace mineral analysis.

# How do I Read the Lab Report?

## As Fed versus Dry Matter Basis

Your first look at your hay analysis report may be intimidating. You will see a large collection of numbers, usually arrayed in two columns labeled as 'As Fed" and "Dry Matter Basis". For the purposes of evaluating the hay for your horse you will most often consult the "Dry Matter Basis" column. Both sets of numbers represent the actual amount of the specific nutrient in the hay but the As Fed column is reported with the values expressed as a percentage of the feed including the weight of the moisture in it. The Dry Matter Basis column is reporting the nutrients expressed as a percentage of the feed without the moisture included. Every feedstuff has moisture...some have more than others. In order to accurately compare the inputs into your horse's diet of one feedstuff relative to another it is important to compare them on a "dry matter basis" so that the nutrients they contribute are not being "diluted" in percentage by the moisture present in the feed. Grass or alfalfa hay should ideally be 90% dry matter or over, indicating the presence of 10% moisture or less. More than 10% moisture in a hay sample could indicate a higher risk for mould or heating in the bales.

## Crude Protein

Crude protein is an estimation of the total protein content of a feed. It is determined by analyzing the nitrogen content of the feed and multiplying the result by 6.25. Crude Protein values give no indication as to the amino acid profile of the feed protein. Protein in some feedstuffs such as grass silage or haylage can be further differentiated by criteria such as protein digestibility and protein quality including amino acid profile. Generally grass or alfalfa hays that are 90% dry matter or above and harvested at a pre-boot or pre-bloom stage contain a high quality protein of superior digestibility.

The requirement for protein in the hay by a horse will vary according to what other feeds are being offered, the work level of the horses and the metabolic state, for example, growing, mature, breeding stallion, lactating mare etc. The protein requirements of horses are well documented in the National Research Council Nutrient Guidelines for Horses available on line at:

<http://nrc88.nas.edu/nrh/>

The hay you should buy for your horse should be high enough in CP% to ensure that maintenance protein requirements for your horse are being met. Ideally this means finding hay with crude protein in the range of 10%-14% on a dry matter basis (DM). Hay that is lower in CP than 10% could possibly have high NSC (nonstructural carbohydrate) values so use caution in buying low protein "maintenance" hays.

## **ADF and NDF and Lignin**

The terms ADF and NDF stand for Acid Detergent Fibre and Neutral Detergent Fibre respectively. These terms refer to the cell wall portions of the forage that are made up of hemicellulose, cellulose and lignin. These values are important because they give an indication to the ability of the horse to digest your hay to its component nutrients. As forage matures the ADF, NDF and Lignin values tend to increase. As ADF, NDF and Lignin increase, digestibility of hay usually decreases. The energy measurements such as DE (Digestible Energy) reported on your hay analysis are calculated using the ADF, NDF and Lignin values.

## **ESC, WSC, Starch and NSC**

The terms ADF, NDF and lignin are all used to help quantify the cell walls in your hay test. The terms ESC, WSC, Starch and NSC are all used to describe the cell content portions of the hay. The terms ESC and WSC stand for ethanol soluble carbohydrate and water soluble carbohydrate respectively. ESC is a measure of the very simple sugars and WSC is a measure of the ESC plus the more complex sugars present in the hay sample. The difference between WSC and ESC is roughly calculated, the complex storage sugar called fructan. Forage testing labs are not yet testing specifically for this sugar but it is possible to get an idea of the fructan content of your grass hay by subtracting the ESC value from the WSC value. The difference is the approximate percentage of the fructan in your hay sample. There is increasing evidence from on going research that fructan is a carbohydrate compound that may be causing significant health issues for our metabolically challenged horses.

Starch is a complex form of sugar that the plant may use to store carbohydrate. Most cool season grasses do not store plant carbohydrates as starch and so it isn't usually very significant component of hay.

The sum of WSC (equal to roughly the ESC and fructan content of the hay) and the starch is equal to the NSC or Non-Structural Carbohydrate. NSC is the number commonly used by equine nutritionists and horse owners as a parameter for "safe" hay for metabolically challenged horses. The rule of thumb for feeding a horse with health issues such as Insulin Resistance, Cushings Disease or Pre-Laminitic Syndrome is sourcing hay with an NSC value of 10% or less on a dry matter basis.

## **Nitrate**

Nitrate is a nitrogen containing compound that can be toxic to horses if ingested in large enough amounts. Hay can become high in nitrate if it is irrigated by high nitrate water, excessive applications of nitrogen containing fertilizers or if the hay field is infested with weeds that are high in nitrate. High nitrate can cause gastro- intestinal irritation, colic and/or diarrhea in your horse but the biggest risk from nitrate is that of nitrite toxicity.

Nitrate is converted to the more toxic nitrite in the hind gut of the horse by the fibre fermenting bacteria. Once converted, the nitrite travels through the gut wall into the blood stream where it interferes with the ability of the horse's red blood cells to carry oxygen. Clinical signs of nitrite toxicity are laboured breathing or panting, ataxia, convulsions, grey or bluish mucosa, abortions in pregnant animals and death. Ensure that nitrate levels on your hay test are low or negligible. Nitrate values on hays must be determined using wet chemistry analysis as NIR is not considered a reliable analysis method for an accurate determination.

## **DE – Digestible Energy**

Energy is frequently described as being a nutrient but in actual fact is a measure of the “fuel” provided for the horse by other nutrients. DE or digestible energy is a calculated value that is an attempt to quantify the amount of “fuel” provided by a feedstuff. On your lab report, DE is a computer derived calculation that has taken into consideration all the nutrients contained in the hay.

Digestible energy is quantified in terms of calories, or in horse nutrition, megacalories (MCAL), and a unit of measurement equal to 1 million calories. Calories are the units of energy that represent a standardized amount of heat released when organic compounds undergo combustion in the animal’s bodies.

Comparing feedstuffs for your horse on DE alone can be misleading. Although higher fibre, lower DE forages might be suitable for an overweight horse because of potential reduced intake, DE doesn’t always give us a good indication of the digestibility of the fibre of a feed . Fibre and fibre digestibility are important characteristics of good quality forage

## **What is a Good Hay Test?**

You now have your hay test in your hand but do you know what those numbers need to be for your horse? What constitutes a good hay test? That will depend on your horse and his age, amount of work, weather condition and whether he has any pre-existing metabolic conditions. We all know that insulin resistant horses have a low tolerance for high sugar hays but if your insulin resistant horse is a mature pasture ornament he may not require the higher protein level commonly found in low sugar hays. It is important to use some common sense in selecting hays and balance your horse’s diet for the hay in your barn by making it a part of a more varied diet including other safe fibre sources if it doesn’t exactly fit your horses unique set of requirements.

## **Guidelines**

The following is a table with some guidelines to follow when interpreting your grass hay analysis. Remember these are guideline only and a lab report with a nutrient that falls outside these guidelines is not necessarily a cause for major concern. One of the most important criteria in buying hay, regardless of the lab analysis is the quality. Is it clean, free from weeds and extraneous material like sticks etc. The best hay analysis in the world becomes of secondary importance if the hay is mouldy or hot to the touch when you open a bale. Remember that regardless of your hay test your horse will be healthier if you follow some basic feeding principles including small meals fed often and ample fresh water.

## Grass Hay

	Mature Horse Sedentary	Mature Horse Working	Metabolically Challenged Horse
Dry Matter / Moisture (%)	88-92 / 8-12	88-92 / 8-12	88-92 / 8-12
Crude Protein (%)	10-15	12-16	10-16
ADF (%)	30-40	30-40	30-40
NDF (%)	50-60	50-60	50-60
WSC (%)	14 or less	17 or less	10 or less
NSC (%)	<15	<18	<10
Nitrates (%)	<0.44	<0.44	<0.44
Digestible Energy / kg	2 Mcal ± 0.2	2 Mcal ± 0.2	2 Mcal ± 0.2

## Alfalfa Hay

	Mature Horse Sedentary	Mature Horse Working	Metabolically Challenged Horse
Dry Matter / Moisture (%)	88-92 / 8-12	88-92 / 8-12	88-92 / 8-12
Crude Protein (%)	12- 17	12-18	12-18
ADF (%)	30-40	30-40	30-40
NDF (%)	40-50	40-50	40-50
WSC (%)	12 or less	12 or less	10 or less
NSC (%)	<13	<13	<12
Nitrates (%)	<0.44	<0.44	<0.44
Digestible Energy / kg	2 Mcal ± 0.2	2 Mcal ± 0.2	2 Mcal ± 0.2

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