Understanding a Hay Analysis

Interpreting a hay analysis and figuring out the amount of nutrients in hay is important for horse owners.

The importance of testing your hay

Horses are naturally meant to consume a diet based on forages. Pasture and hay should usually make up the majority of the average horse's diet. When it comes to selecting hay, many people know that good quality hay smells good, is soft, and has more leaves than stems. But how does this visual inspection match up with the actual amount of nutrients in the hay? How much crude protein or starch is in that bale of hay? To find out, you need to take a sample of hay and do a hay analysis.

A hay analysis will reveal the specific amount of various nutrients that are found in the hay. These days, it is relatively simple to obtain a hay analysis. Using a hay corer, collect samples from 10-20% of the bales in a single load. Do not combine loads of hay, even if they are different cuttings from the same field, or the same cutting from different years. Once a sample is collected and placed in a labeled bag, the sample is shipped off to a laboratory for analysis. The results are then sent back in a 1-2 page document.

Video: collecting a hay sample from a round bale.

Understanding the hay analysis can be tricky. The results are full of abbreviations and numbers and percents, and it can leave a person unsure what "good" and "bad" numbers are. So – let's go through what these abbreviations mean, and what typical values we find for these nutrients.

One important note before we begin: there are usually two different columns in a hay analysis that list values for the nutrients. One will be titled "as is" or "as fed", while the other will be titled "DM". The column titled "as is" means the values listed are for the hay without any alterations; basically, the hay as you would feed it to a horse. The column titled "DM", which stands for Dry Matter, means the values listed are for the hay without water. In other words, the sample has been dried completely and there is no water in the sample. The DM column allows for easy comparison between different feedstuffs, for example pasture and hay. It is far more accurate to compare the nutrients of pasture and hay once the water is removed. In the values listed for the nutrients below (with the exception of the moisture), the values are for DM.

Key nutrients and information listed on a hay analysis

Moisture and Protein

- **Moisture**: the ideal moisture for hay is around 15%. If the moisture is less than 10%, the hay will be very dry and lose a lot of nutritious leaves to shattering. The hay will also not be palatable if it is very dry. If the moisture is greater than 18%, there is a risk for mold forming in the hay, and if the moisture is greater than 20%, there is a risk for spontaneous combustion.

- **Crude Protein (CP)**: For adult horses, adequate protein should be provided by the hay if the CP value on the analysis is about 10–12%. If you have young horses, horses in high-intensity exercise, or broodmares that are lactating, you will want a higher CP
percent in your forage. Also note that the type of hay (grass versus legume) can impact the amount of CP; typically, legumes such as alfalfa will have higher CP as compared to grass hays. But – maturity of the plant when the hay was harvested will impact the CP. (This is why you are testing your hay – to know the true amount of nutrients in your hay!)

**Carbohydrates**

Carbohydrates fall into two categories: structural carbohydrates (fibers) and non-structural carbohydrates (sugars, starch, fructans, etc.). Both ADF and NDF give us an idea of the amount of fiber in the hay. Fiber is composed of structural carbohydrates found in plants (such as cellulose and hemicellulose). The more mature the plant, the higher amount of fiber it will contain. For horses that need to lose weight or are considered easy keepers, you may want ADF and NDF values to be on the higher end of the ideal ranges presented below. For horses that require more calories like young growing horses or horses that are working hard, you may want lower ADF and NDF values.

- **Acid detergent fiber (ADF):** This refers to cellulose and lignin. The ideal ADF for horses ranges from 30-45%. If you have values greater than 45%, your horse probably will not like it. ADF is negatively correlated with digestibility, so the higher the number, the less the hay will be broken down inside your horse's gastrointestinal tract.

- **Neutral detergent fiber (NDF):** This refers to cellulose, hemicellulose, and lignin. The ideal NDF ranges from 40-65%. If you have values greater than 65%, your horse probably will not eat it. NDF is negatively correlated with forage intake, so the higher the number, the less hay your horse will eat.

The hay analysis will have measures of different types of non-structural carbohydrates (NSC). This will include any of the following: starch, water soluble carbohydrates (WSC), and ethanol soluble carbohydrates (ESC). Each of these will measure slightly different combinations of carbohydrates; for example, ESC measures simple sugars, mainly monosaccharides and disaccharides (like glucose and sucrose), while WSC measures simple sugars and fructans. As the name suggests, WSC dissolve in water, so a portion of it can be leached out of hay by soaking it to reduce overall NSC.

There is not an ideal NSC number for all horses, but for horses who suffer from chronic laminitis or other metabolic disorders, it is recommended to keep NSC below 10-12% (on a DM basis). For horses that need to lose weight, you may also want to have lower NSC numbers. The hay analysis may not include NSC, but you can estimate it by adding together WSC + starch.

**Energy**

- **Digestible Energy (DE):** The amount of energy that is digested and used by the horse. You can think of this as being similar to a "calorie count" of the feed. Depending on the energy needs of your horse, an ideal number will vary. The DE for most hay ranges from 0.75-1.0 Mcal/lb.

**What else might be listed on a hay analysis?**

The list above is not everything that you might find on a hay analysis. You can find out the amounts of many vitamins and minerals in your forage, which would be useful if you are balancing your horse’s diet or if your horse is ill and you are trying to find out what the problem is. The analysis might also include values for ether extract fat, which is the amount of fat in a sample. Since forage is very low in fat, this number isn’t one we generally look closely at when analyzing hay. You might also see something called RFV, or relative feed value. This is generally used more for cattle nutrition but is an approximation of the quality of the hay. A value of 100 applies to good quality alfalfa hay. The higher the RFV, the better quality the hay for a ruminant’s digestive system. The forage testing lab may have several "levels" of analysis to choose from, and you can read what components are included in each package and select one based on your needs. To summarize, you can refer to this chart:

<table>
<thead>
<tr>
<th>Term</th>
<th>What it Means</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>Dry matter (forage minus water)</td>
<td>~85%</td>
</tr>
<tr>
<td>Moisture</td>
<td>How wet the hay is</td>
<td>11-16%</td>
</tr>
<tr>
<td>CP</td>
<td>Crude protein</td>
<td>8-20%</td>
</tr>
<tr>
<td>ADF</td>
<td>Acid detergent fiber (cellulose + lignin)</td>
<td>30-45%</td>
</tr>
<tr>
<td>NDF</td>
<td>Neutral detergent fiber (hemicellulose + cellulose + lignin)</td>
<td>40-65%</td>
</tr>
<tr>
<td>NSC</td>
<td>Non-structural carbohydrates (simple sugars/starch). Various measurements include WSC, ESC, and NFC.</td>
<td>5-25+%</td>
</tr>
</tbody>
</table>
Remember - the ideal amount of certain nutrients will vary for each horse, and is impacted by factors such as health, activity/exercise level, age, and body condition score. A young horse starting training will need hay that is higher in CP and DE, and lower in ADF and NDF. A middle-aged horse that is ridden once a week will probably need hay lower in CP and DE, and higher ADF and NFD, as compared to that younger horse. A horse suffering from laminitis will need NSC that are less than 10-12%, while a horse that is healthy and at an ideal body condition score does not need to have such a low percent of NSC.

Conclusions

A hay analysis provides a lot of useful information about your horse's forage. This information is important in making sure your horse has a well-balanced diet. Remember that you should select hay based on your horses' needs; not every horse needs premium hay with tons of energy and protein. For horses that suffer from diseases such as chronic laminitis, equine metabolic syndrome, or obesity, a hay analysis is critical to controlling the disease. If you are unsure how to balance your horse's diet, work with an equine nutritionist.

Refer to your forage testing laboratory for directions on correctly taking a hay sample. If you do not own a hay corer, contact your local extension office; they may have one you can borrow, or can send someone to your farm to help with sample collection. A list of certified forage testing laboratories is located at the National Forage Testing Association website.

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