Selecting Hay for Your Horse

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Forage, in the form of hay or pasture, is the most important component of your horse's diet. Forage provides essential nutrients, including protein, minerals and vitamins. The fiber in forage provides a source of energy, helping to meet the horse's caloric needs. Fiber is also needed to maintain gut health and motility.

Because forage is the foundation of any feeding program, selection of a hay that is appropriate for your horse is very important.

This article will provide guidelines for visual appraisal of hay quality, tips on how to interpret a hay analysis report, and discussion on what types of hay work for specific types of horses. Determining value when buying hay will also be discussed.

Visual Appraisal of Hay Quality

The quality of any given hay can be influenced by many factors, including the type of hay, fertilization practices, stage of growth at which the hay was cut, how it was cured, and how it was stored. Many of these factors can be subjectively assessed by visual appraisal of the hay. The following is a description of visual criteria that can be used to evaluate hay quality.

1) Type of hay

Legumes, such as alfalfa or perennial peanut, generally produce higher quality forage than grasses, such as timothy, orchardgrass, and Coastal bermudagrass (Table 1). This is because legumes usually have less fiber, which results in greater energy (or calorie) content, as well as greater intake by the horse. Legumes also are typically higher in protein and calcium than grass hays.

Differences in nutrient content between different grass hay varieties are much smaller than differences between legumes and grasses (Table 1). Cool-season grasses (grown in temperate climates) include timothy, orchardgrass, fescue and annual ryegrass. Warm-season grasses (adapted to tropical and subtropical regions, like Florida) include Coastal bermudagrass, Tifton-85 bermudagrass, and bahiagrass. There are some minor differences between cool-season grasses and warm season grasses; but if cut at a similar stage of maturity, these differences are minimal.

Grass/legume mix hays, such as timothy/alfalfa or Coastal/peanut, have a nutrient composition intermediate between grass and legume hays (Table 1). Nutrient composition of these hays is highly dependent upon the proportion of grass versus legume forage present in the mix.

Table 1: Typical nutrient content of hays fed to horses (as-fed basis)*

Hay Variety	Digestible Energy (Mcal/lb)	Acid Detergent Fiber (%)	Crude Protein (%)	Calcium (%)	Phosphorus (%)
Alfalfa	0.8 to 1.1	24 to 34	15 to 22	0.9 to 1.5	0.2 to 0.3
Perennial peanut	0.8 to 1.0	28 to 38	10 to 15	0.9 to 1.5	0.2 to 0.3
Orchardgrass	0.7 to 1.0	30 to 40	7 to 11	0.3 to 0.5	0.2 to 0.3
Timothy	0.6 to 1.0	30 to 40	6 to 11	0.3 to 0.5	0.2 to 0.3
Bermudagrass	0.7 to 1.0	28 to 38	6 to 11	0.3 to 0.5	0.15 to 0.3
Grass/legume mix hay	0.8 to 1.0	27 to 36	12 to 18	0.8 to 1.2	0.2 to 0.3

**Source: Dairy One, Feed Composition Laboratory*

2) Stage of plant maturity when cut

One of the most important factors affecting hay quality is the plant's stage of maturity at the time the hay is cut. The life cycle of grasses and legumes is presented in Figure 1. Grasses begin as leafy young plants, enter the "boot" stage when seed heads begin to emerge and are in the "heading" stage when the seed heads have fully formed at the tip of the stem. When seed heads begin to shed their small seed, grasses are said to be in full "bloom" or flower. Legumes also begin as leafy young plants; however, instead of forming seed heads, legumes mature by forming flowers. Legume flowers begin as small buds that eventually mature into bright purple (alfalfa) or yellow (perennial peanut) flowers.

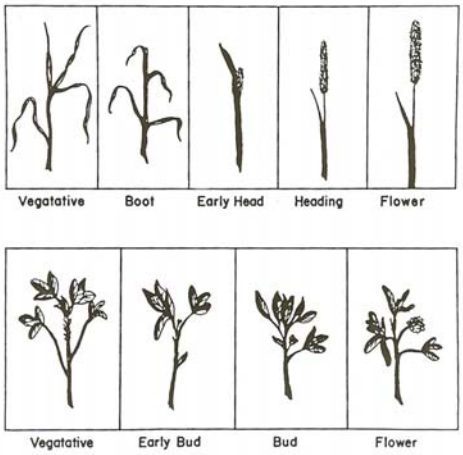


Figure 1: Identifying plant stage of maturity

Quality of any forage declines with advancing maturity. The amount of leaf material decreases, resulting in a drop in protein content; and the amount of stem material increases with maturity, resulting in an increase in fiber that becomes harder to digest (Figure 2). Along with a decline in nutrient content, voluntary intake by horses will decrease with stage of maturity.

The stage of maturity when the hay was cut can be evaluated by inspecting the emergence and condition of seed heads on grass hays and the appearance of flowers on legumes. The greater proportion of seed heads, particularly if they are large and crumble when rubbed (shedding their seeds), the more mature the grass hay. The more flowers you can detect in legume hay, the more mature the hay.

Stem diameter is also indicative of maturity. Plants typically develop thicker stems as they mature. Larger stems indicate more fiber, making them harder to digest and lowering the calorie content. Thick, twig-like stems also make the hay coarser, which decreases consumption.

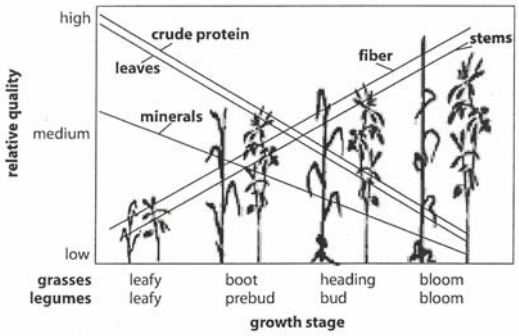


Figure 2: Nutrient content declines with plant maturity

3) Leaves and stems

Most of the protein, starch, and sugar are contained in the leaves of hay. As a result, hays that have a larger proportion of leaf material (ie, those cut at a younger stage of maturity) will contain higher nutrient content. Leaves also contain easily digested fibers, which increase the calorie content. In contrast, the stems are made up of fibers that are harder for the horse to digest. Although some fiber in the diet is necessary to maintain digestive health, hay that contains a large proportion of stems, or stems that are large in diameter (ie, hays cut at a late stage of maturity), will have a lower calorie and nutrient content.

Legumes hays, such as alfalfa and perennial peanut, have small, oval shaped leaves with fragile attachments to the stem. As a result, legume hays are more prone to leaf shatter compared to grass hays. Loss of leaves can occur as a result of baling the hay too dry, excessive handling of the hay while harvesting, and improper handling and storage after baling. Loss of leaf material, regardless of the type of hay, will reduce its nutritional value.

4) Texture

Horses base their feed choices on taste, as well as texture. Leaves tend to be softer and are typically more readily consumed than stems. The more stems, the coarser the hay.

Legume hays tend to be coarser than grass hays cut at the same stage of maturity. In addition, some grass hays tend to be more naturally "soft" than others—for example, orchardgrass hay has long, broad leaves that are more pliable than timothy or Coastal bermudagrass hays.

Texture can be evaluated by squeezing a handful of hay. If you feel sharp points that make you uncomfortable, it may also irritate your horse's muzzle and mouth and he may not readily eat it.

5) No mold, weeds & foreign material

Before purchasing hay, you should open a few bales and examine them closely for mold, weeds and foreign material. Horses should only be fed clean hay.

Mold can form on hay that has been baled too wet or hay that has been stored outdoors unprotected from wet weather. Some molds produce toxins that can cause colic, abortion and other complications. Mold spores that become airborne also irritate the horse's lungs, and may lead to respiratory infections and heaves.

Moldy hay has a musty smell and can be very dusty. Patches of black or grey mold may also be visible, but not always. Beware of hay that is high in moisture—a bale that seems heavier than others from the same batch may be indicative of excessive moisture, which could support mold growth. Also, avoid hays that feel hotter than the outdoor temperature (referred to as "heating"), which suggests mold formation.

Hay that contains weeds should also be avoided. Most weeds have little nutritional value and some could potentially be poisonous if eaten.

Hay should also be free from foreign material, such as trash, baling twine and pieces of wire or metal, which can cause impaction or possibly puncture the horse's gut if consumed.

6) Smell

Hay should have a pleasant, faintly sweet smell, similar to freshly mowed grass. As described above, hay that smells musty or moldy should be avoided.

7) Color

In general, hay should be green. However, the particular shade of green is not a good predictor of nutritional quality and can be misleading. For example, hay produced in the western U.S. is grown under irrigation, which generally yields a very bright green color, regardless if the plant is cut at early heading or more mature at full bloom. In contrast, hay cut in the eastern or southern U.S. will often be a lighter green with some yellowing, but it may still have excellent nutritional value. Therefore, emphasis should be placed on stage of growth when selecting hay, rather the relative shade of green.

Yellowing of hay may occur from rain damage or from storing hay where direct sunlight can cause fading. Sun bleaching has little effect on nutritional quality, whereas rain damage may result in loss of nutrients from leaching. Breaking open a few bales of hay and inspecting the inner flakes will help you determine the source of the yellowing. If the outer edges of the bale are yellow, but the inside is green, it most likely has been sun bleached. If the yellow coloration persists within the interior of the bale, then rain damage during harvest may have occurred.

Black, gray, or excessively brown hay should be avoided. As mentioned above, mold contamination may show itself in the form of black or grey patches within the bale. Brown discoloration results from excessive heating of the hay during or after baling, which reduces the protein and carbohydrate content.

8) Consistency

If you are buying several bales or a large load of hay, you should also look for consistency between bales.

Pick up several bales and compare their weight. Inconsistent weight between bales can result from faulty settings on farm machinery, but more importantly, can also indicate rain damage or excessive moisture during harvest or storage.

Do all the bales look similar? Differences between hay bales may be due to different hay types in the load, hay cut from different fields, sun bleaching or rain damage, or the length of storage since harvest. Before you buy, make sure you know what you are getting.

How tight are the strings? Hay bales that are tightly bound tend to discourage mold growth, assuming they were baled at the appropriate moisture. Loose bales are more difficult to handle and forage may sift out during storage resulting in wastage.

Which hay cutting is the best?

Many horse owners favor second or third cutting hay and believe first cutting to be inferior. However, a particular cutting does not always equate to quality.

Many factors, including weather and temperature, influence plant growth. These factors also control when a hay producer can cut hay. For example, rainy weather encourages growth, but postpones harvest, which allows the grass to become more mature. This can occur regardless of whether it is the first or the fifth cutting.

Rather than focusing on the cutting, evaluate hay based on stage of maturity at harvest. Stage of maturity has the biggest effect on nutrient quality.

Laboratory Analysis

Although you can discern much about hay quality with visual inspection, the only way to determine nutrient quantity is to submit a sample to a forage testing laboratory.

Many forage labs can be found in the Yellow Pages under "analytical laboratories." You can also find information on how to take a representative hay sample and locate a certified feed testing lab at www.foragetesting.com. The average cost for analysis starts at about $20.

A lot of information can be obtained with hay testing. Table 2 contains an example of a hay analysis report. Nutrient values are reported as a proportion of the total weight of the feed. For example, the percent of the feed that is crude protein or the number of mega-calories of digestible energy per pound of feed.

To facilitate your understanding of how to read a hay analysis report, the following is a description of some key nutrients:

Moisture—is the percent of water the feed contains. Hays typically contain 10% moisture. A moisture content less than 10% could indicate brittleness or excessive leaf loss. A moisture content greater than 14 to 18% indicates a high risk for mold.

Dry Matter—is the percent of the feed that does not include water. Nutrients are often reported on a "dry matter" basis and an "as-received" (or "as-fed") basis, the later including the water naturally contained in the feed. Because feeds differ in their moisture (water) content, which can dilute nutrient concentrations, comparisons between feeds are more accurately performed by using values on a dry matter basis.

Crude Protein—is the percent of the feed that is protein. Because of how crude protein is determined in the lab, the value also includes other nitrogen-containing compounds, such as urea or nitrate. If you suspect the feed you are testing may have high levels of these non-protein components, you should use caution when interpreting "true" protein content from crude protein. The crude protein content of hay can vary widely from 6 to 24%, and is highly dependent upon the type of hay being analyzed and its stage of maturity (see Table 1).

Acid Detergent Fiber (ADF)—is one measure of the fiber content of the feed and is a good marker of hay quality. ADF includes cellulose, a type of fiber that is hard for the horse to digest. ADF also includes lignin, which is essentially indigestible. Therefore, ADF content is a good indicator of the overall digestibility of the hay. The higher the ADF content, the lower the quality of the hay. Hays with less than 32% ADF tend to be very leafy with high nutritional value. Hays with greater than 37% ADF tend to be very mature and stemmy.

Because horses obtain calories (or energy) from fiber, the higher the ADF content, the lower the digestible energy value of the hay. In fact, ADF is used to help calculate digestible energy, which will be described next.

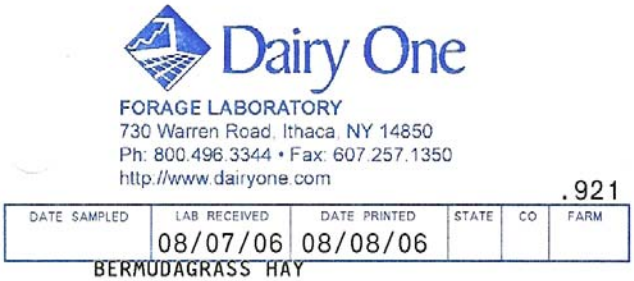
Digestible Energy (DE)—is the amount of mega-calories per pound (or per kilogram) of feed. One mega-calorie (Mcal) is equivalent to 1000 human calories. An accurate DE value can only be determined with a lengthy research trial. However, a reasonable estimate of DE can be calculated from the crude protein and ADF content of the hay. Many forage testing labs provide you with this calculated DE value. The DE content of hays varies from 0.7 to 1.2 Mcal/lb of hay (see Table 1). The more mature the hay, the higher the ADF content, and the lower the caloric (DE) value.

Minerals and Vitamins—a basic hay analysis usually includes the macro-minerals: calcium, phosphorus, magnesium, potassium, and sulfur. Analysis of other macro-minerals, as well as micro- (or trace) minerals, such as copper, zinc, and selenium, can usually be requested for an additional fee. Similarly, many forage testing labs also offer vitamin analysis for an additional fee.

Other Nutritional Components—most forage testing labs can provide additional analyses to help you better evaluate feeds for your specific situation. For example, if you are concerned with mold contamination, some labs can perform mycotoxin analyses. If you have a horse that is sensitive to starch and sugar, you can request these components be measured (please note, however, there is still some debate on the most accurate way to measure starch and sugar in feeds). Many forage testing labs also perform analysis on other types of feeds, such as supplements and grain products.

If you purchase small quantities of hay, having your hay tested each time may be impractical. Although analysis only takes one or two days, you may not receive your results for 1 to 2 weeks. Many hay producers submit their own samples for analysis before marketing their hay. Therefore, when you buy your hay, you should ask if an analysis has already been performed.

Table 2: Example of a Hay Analysis Report



Dairy One
FORAGE LABORATORY
730 Warren Road, Ithaca, NY 14850
Ph: 800.496.3344 • Fax: 607.257.1350
http://www.dairyone.com

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DATE SAMPLED	LAB RECEIVED	DATE PRINTED	STATE	CO	FARM
	08/07/06	08/08/06			

BERMUDAGRASS HAY

LORI K WARREN
ANI SCI BLD 459 RM 108
SHEALY DR
GAINESVILLE, FL 32608

ENERGY TABLE - NRC 2001
Body Wt = 1350 Fat % = 3.7 Tprot % = 3.1

Milk, Lb	NEL Mcal/Lb	NEL Mcal/Kg	Milk, Kg
Dry	0.59	1.29	Dry
40	0.56	1.23	18
60	0.54	1.18	27
80	0.51	1.12	36
100	0.47	1.05	45
120+	0.44	0.96	54+
NEM3X	0.56	1.23	
NEG3X	0.30	0.66	
ME1X	0.96	2.12	
DE1X	1.15	2.54	
TDN1X,%	56		

COMMENTS:
1.NRC ENERGIES - SMALL BREEDS - DO NOT USE ENERGIES BEYOND 80 LBS. MILK. LARGE BREEDS - USE 120 LB. ENERGY WITH EXTREME CAUTION.

SAMPLE DESCRIPTION	FARM	CODE	LAB SAMPLE
BERMUDAGRASS HAY		115	10155740

ANALYSIS RESULTS

COMPONENTS	AS SAMPLED BASIS	DRY MATTER BASIS
% Moisture	8.0	
% Dry Matter	92.1	
% Crude Protein	12.5	13.6
% Available Protein	11.9	12.9
% ADICP	.6	.7
% Adjusted Crude Protein	12.5	13.6
Soluble Protein % CP		33
Degradable Protein %CP		63
% NDICP	5.0	5.5
% Acid Detergent Fiber	32.0	34.8
% Neutral Detergent Fiber	65.4	71.1
% Lignin	5.7	6.2
% NFC	12.1	13.2
% NSC	7.1	7.7
% Starch	1.4	1.5
% Sugar	5.8	6.3
% Crude Fat	1.9	2.1
% Ash	5.16	5.61
% TDN	52	56
NEL, Mcal/Lb	.39	.42
NEM, Mcal/Lb	.44	.48
NEG, Mcal/Lb	.21	.23
Relative Feed Value		81
% Calcium	.34	.37
% Phosphorus	.20	.22
% Magnesium	.18	.19
% Potassium	1.30	1.42
% Sodium	.021	.023
PPM Iron	68	74
PPM Zinc	18	19
PPM Copper	5	5
PPM Manganese	62	67
PPM Molybdenum	.2	.2
% Sulfur	.35	.38
% Chloride Ion	.27	.29
Horse TDN, %	46	50
Horse DE, Mcal/lb	.91	.99
% Lysine	.44	.47
% Methionine	.16	.18

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Match the Hay to the Horse

One of the most important criteria that should be considered when selecting hay is the needs of the horse you intend to feed it to. Not all horses have the same nutrient needs, so naturally, not all horses have the same hay needs.

There are two big reasons for matching hay to the horse:

1) You can meet more of the horse's nutritional needs with hay, which requires the feeding of less grain (or no grain at all). The feeding of large amounts of grain has been associated with an increased risk of digestive disturbances, such as colic, gastric ulcers and laminitis.

2) You can satisfy your horse's appetite. Horses have evolved to spend large amounts of time eating, normally grazing for 9 – 16 hrs per day. If a horse with low nutrient requirements is fed a very high quality, nutrient-rich hay, he will have to be fed less or he may become overweight. This means he will spend less time eating and could potentially develop vices such as wood chewing to occupy his time. If, however, this same horse was fed a mature hay with lower nutritional value, he will be able to eat more hay, thus providing more "chew time" and satisfying his appetite.

Weanlings and lactating mares have the highest nutrient requirements of all horses. Early- to mid-maturity alfalfa or perennial peanut, as well as grass/legume hay mixes with at least 30% legume, can contribute a lot of nutrition to the diet of these high-need horses. These types of hay are also useful for horses with poor appetites or those that need to gain weight. Hays with high nutritional value will be very leafy, fine-stemmed, and will contain very few seed heads (grasses) or flowers (legumes).

Performance horses, yearlings and 2-year-olds have moderately-high nutritional needs. Grass or legume hays cut at mid-maturity work well for these horses. Grass/legume mixes are also useful. Hays of moderate to good quality are leafy and pliable. If seed heads are present, they should be small and soft, not large and crumbly.

Barren mares and horses used for light recreational riding have relatively low nutrient requirements. Mid- to late-maturity grass hays or late maturity grass/legume hays are often suitable for these types of horses. These types of hays will have obvious seed heads (grasses) or dried flowers (alfalfa). Stems will be more obvious and thicker compared to higher quality hays, but the hay should still be relatively soft to the touch.

Grass hays that are cut at late-maturity may also have use in some feeding programs. Such hays may be useful for ponies and other "easy keepers" that seem to "stay fat on air." Mature grass hays provide fewer calories, helping the horse to maintain (or lose) weight, while still providing lots of chew time. These "stemmy" hays have coarse, thick stems and almost every stem will have a large seed head. Even though these hays are lower quality, they should <u>not</u> be moldy or full of weeds. The color may be faded green, but avoid severely rain damaged hay.

Table 3 summarizes the type and characteristics of hay suitable for different classes of horses.

Table 3: Guidelines for Matching Hay to the Horse

Horse	Type of Hay	Visual Characteristics*	Laboratory Characteristics	
			Crude Protein	ADF
Weanlings Lactating mares	Early- to Mid- Maturity Legume hays or Grass/legume Mix hays	Leafy Fine stemmed Few seed heads/flowers	> 14%	< 34%
Performance Yearlings 2-year-olds	Mid- Maturity Grass or Legume hays or Grass/legume Mix hays	Leafy Medium-fine stems Small, soft seed heads, small flowers on legumes	12 – 16 %	30 – 36%
Recreation use or idle horses	Mid- to Late-Maturity Grass hays Late- Maturity Grass/legume Mix	Medium stems Large, soft seed heads, flowers on legumes	8 – 12%	37 – 40 %
Overweight	Late- Maturity Grass hays	Thick, coarse stems Large, brittle seed heads	7 – 10%	> 40%

**All hay should be clean-smelling and free from molds, weeds and trash; avoid excessive rain damaged hay.*

Value Buying

To maintain good health, forages should be the largest component of any horse's diet. Most horses will need to be fed 1.5 to 2% of their body weight as forage per day. This amount of hay can quickly turn into a large feed bill.

While it is better to invest money on good forage than pay for an expensive colic surgery, it also behooves you to calculate the value of what you are buying. Knowing how to calculate the cost of nutrients will also help you to evaluate best buy when you come across two hays that have similar quality, but different price.

Two of the nutrients that will help you gauge the best hay price are crude protein (CP) and digestible energy (DE). However, you can also perform the same calculations with any other nutrient of interest.

Information needed to perform calculations:

1) Cost per bale
2) Average individual weight of the bales
3) CP (%) or DE (Mcal/lb) concentration in hay

Calculating the amount of nutrients per $1 spent:

Equations:

$$\frac{\textbf{Weight of bale}}{\textbf{Price per bale}} = \textbf{Pounds of hay per \$1}$$

lbs of hay per $1 X nutrient concentration = amount of nutrient you get for $1

Example:

You are looking to buy a timothy/alfalfa hay for $10/bale. Each bale weighs 56 lbs. This hay contains 13.5% CP and 0.93 Mcal/lb DE.

$$\frac{56 \text{ lb bale}}{\$10/\text{bale}} = 5.6 \text{ lbs hay per \$1}$$

5.6 lbs hay per $1 X 0.135 CP
= **0.75 lbs Crude Protein per $1**

5.6 lbs hay per $1 X 0.93 Mcal/lb DE
= **5.2 Mcal Digestible Energy per $1**

Additional suggestions for minimizing hay costs:

- ✓ Learn to identify the different types of grasses and legumes, as well as the criteria to evaluate hay quality, so you can make better buying decisions.
- ✓ Buy the type of hay your horse needs. Spending large amounts of money on high-quality hay when your horse would perform just as well with something of lower quality is wasting money. All those un-needed nutrients will just end up in the manure.
- ✓ In addition to visual evaluation, have your hay tested so you know exactly what nutrients it is providing. Knowing what the hay provides will help you make better decisions about what supplements to purchase, or if they are even needed.
- ✓ Buy hay directly from the hay producer, rather than an intermediate, such as a feed store.
- ✓ Pick up and load the hay yourself or arrange your own delivery
- ✓ Consider using locally grown hay, rather than paying the higher costs of hay imported from northern states.
- ✓ Buy larger volumes of hay, rather than a few bales a week. If you do not have the storage space, make a long-term investment in a hay barn, store some at a neighbor's, or ask the hay producer if they can store it for you until it's needed. You might also team up with other horse owners in your area to buy a larger lot of hay that you can split with each other.
- ✓ Buy hay by the ton, rather than the bale. Not only might you save some money, you'll have a more accurate record of the amount of hay you have purchased, which allows you to better plan your feeding management.
- ✓ Anticipate your hay needs and purchase hay early in the season. Hay often becomes more expensive when there is large demand, such as occurs in the winter when more horses are consuming hay than pasture.