

How to Feed a Horse: Understanding Basic Principles of Horse Nutrition¹

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Introduction

How do you properly feed a horse? With so many choices available in feeds, supplements, and hays, many people find themselves wondering exactly what their horse needs in regards to nutrition. The many opinions and myths related to feeding horses make the decision of what to feed even more difficult. Manufacturers of commercial horse feeds are required by law to put information concerning their feed on a “feed tag” which is either attached to or printed directly on the bag. This provides essential information on what the horse will be eating. However, most horse owners either don't understand or don't take the time to read this information. In this article, we will discuss the nutritional needs of your horse, common guidelines to observe when feeding your horse, and how to determine if your horse's requirements are being met.

The Basic Nutrients

When feeding horses, it is important to recognize that there are six basic nutrient categories that must be met: carbohydrate, protein, fat, vitamins, minerals, and water. Often times, feed companies

will balance the first five nutrients for us. However, it is critical not to forget about water. A normal, healthy horse will consume 5-15 or more gallons of water per day depending on temperature, humidity and activity. Clean water should be provided daily, and should ideally be available at all times for the horse to drink as it desires. If this is not an option, horses should be watered a minimum of twice daily and allowed several minutes to drink each time. If horses are not allowed to drink enough water, they are more susceptible to conditions such as dehydration, intestinal impactions and other forms of colic.

As for the other five nutrients, the horse's diet should be formulated based on its requirement for each. These requirements differ from individual to individual and are influenced by the horse's body mass, age, workload, and metabolic efficiency. It is a very useful skill to be able to look at a feed tag and determine if that feed is going to meet your horse's requirements. Let's look at each category of nutrients you will encounter when evaluating your feeding program.

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1. This document is AN236, one of a series of the Animal Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date March 2010. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.
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Overview of Basic Nutrients

Carbohydrates: This will most likely be the largest part of the horse's diet. They can be divided into two groups: **structural** (fiber) and **non-structural** (sugars and starches). Structural carbohydrates are found in the largest amounts in the roughage that the horse eats (hay, grass). These are able to be digested by the horse thanks to the design of its intestinal tract. Following digestion in the stomach and small intestine, the horse's digestive material enters the large intestine (hindgut), which in the horse consists of the cecum and colon. The cecum and colon contain microorganisms that are capable of breaking structural carbohydrates down into an energy source that the horse can absorb. This is the reason that a horse gets so much nutritional value from grass and hay.

It is important to feed good quality hay since hay that is overly mature when cut has little nutritive value to the horse due to an increase in a component called lignin. Lignin is completely indigestible to the horse or the microbes in the gut flora. There are many different types of hay that you can choose from and we will discuss hay in regards to other nutrients as well. It is important to feed hay which is free of mold and dust and is cut at an appropriate length and stage of maturity. Hay that has too coarse a stem or hay that is too fine can cause digestive problems such as impactions.

Nonstructural carbohydrates are easily digested by the horse's own digestive tract, primarily in the small intestine. These sugars and starches are primarily found in grains (i.e. corn, oats, barley, etc.) and provide a more concentrated form of energy to the horse than do structural carbohydrates (hence the term "concentrates" is often used when referring to grains and grain mixtures). However, it is important to recognize that the horse's digestive system evolved to process a roughage based diet. Therefore, a horse's diet should be based around forage consumed, and concentrates should be supplemented to meet energy requirements of the horse that cannot be met with forage alone. The horse should always be fed a minimum of 1% of its body weight in forage (on a dry matter basis) and ideally should be fed 1.5-2% of its body weight. Feeding less roughage

than this can lead to health issues such as colic and ulcers.

Protein: This nutrient is poorly understood by many horse owners. Protein is necessary for the growth and maintenance of many components of the body. Proteins are broken down in the small intestine into amino acids and these amino acids are recombined to make proteins in the body which make up components such as muscle, hair, hoof, etc. It is important to realize that the proteins that the body makes have a very specific sequence of amino acids. Therefore, the amount of protein that can be synthesized by the body is limited by the amino acid that basically runs out of supply first. For horses, this is generally lysine. Therefore, on many bags of horse feed, you will see a protein percentage listed and it might also say "added lysine". There will be an additional percentage listed for the lysine content. In essence, making the protein quality better without increasing the total amount of protein in the feed.

There are advantages to improving protein quality without increasing total protein amount. It is a commonly held misconception in the horse industry that higher protein is associated with higher energy. In reality, proteins are the most difficult energy source for the horse to digest and convert to usable energy. Therefore, they are a very limited energy source for horses. Protein requirements for growth and maintenance vary depending on age and workload. In general, growing horses need a higher percentage of protein in comparison to mature horses. A growing horse generally needs between 12-18% crude protein in its diet for proper growth and development. Horses need more protein when tissue is being laid down for growth (i.e. young horses in rapid growth phases, gestating mares in their last trimester, and lactating mares that need to produce large quantities of milk). Mature horses will most likely do fine on a lower protein percentage (8-12%) depending on their workload. Horses that are in intense training need more protein than maintenance horses because they are developing muscle tissue. However, most will still do well on a 12% protein feed. Feeding horses higher levels of protein than they need simply means that the horse breaks down the excess protein and excretes it as urea in its urine which is rapidly converted to ammonia. This is not

desirable since the excess ammonia can lead to respiratory problems in stabled horses.

It is also important to recognize that the concentrate is not the only place in the horse's diet where he receives protein. Forage is also a source of protein. When choosing hay, consideration should be given to the horse's protein requirement, and hay should be selected to help meet this requirement. Hays can be categorized as either grass hays (bermudagrass, timothy, etc.) or legume hays (alfalfa, peanut, clover, etc.). In general, legume hays are higher in protein than grass hays. Good quality legume hay can have roughly 18-22% crude protein while good quality grass hay can have 10-16% crude protein. Again, quality and growth stage at harvest determine how digestible the hay is and influence how much protein the horse receives from it.

Fats: The practice of feeding high fat diets is a relatively new trend in the horse industry. It has been demonstrated that horses can tolerate a fairly high level of fat in their diet. Fat is an excellent and easily digestible source of energy for the horse. Commercial feeds that are not supplemented with additional fats contain approximately 2-4% fat. Many commercial feeds are now supplemented with fat in the form of some type of stabilized oil. These feeds can contain anywhere from 6-12% fat. When adding fat to a diet, it is important to make sure that all other requirements (i.e. protein, vitamins, minerals) are being met as well. Adding fat to a feed increases the energy density of that feed so the horse will require less of it. It is important to be sure that all other nutrients are also high enough to meet your horse's requirements. Typically, commercial feeds will be balanced to meet the horse's requirements of each nutrient. However, if you are increasing the fat in your horse's diet by simply pouring some type of oil or fat supplement on the feed, it is important to be sure that you are meeting its requirements for other nutrients and not just its requirement for energy.

Vitamins: Vitamins are critically important organic compounds. They must be present in the body to enable important reactions to take place which in turn allow the animal to live. Vitamins are divided into two categories. The water soluble group consists of the B-complex vitamins (B₁, B₂, etc.) and

the fat soluble group is comprised of vitamins A, E, D, and K. Vitamins also have proper chemical names; for example, B₁ is thiamine. It is important to check your feed and be sure that all of your horse's vitamin requirements are being met. Deficiencies in these vitamins can lead to various health problems in horses. However, it is also important to realize that extreme excesses in these vitamins are not desirable either, particularly regarding fat soluble vitamins. Water soluble vitamins are not generally stored in the body, and excesses are excreted in the urine. However, fat soluble vitamins are stored readily in the animal's fat tissue and therefore can build up to high levels if fed in excessive amounts. Excessively high levels of vitamins can lead to toxicity. Therefore, it is important to use good judgement when feeding nutritional supplements that are high in particular vitamins. In most cases, a good forage program combined with a well-formulated concentrate will provide adequate vitamins to meet the horse's requirements.

Minerals: Minerals are inorganic materials that must be present in adequate amounts for the body to function properly. Minerals are another item that can be found in supplements on the shelves of feed and tack stores. It is important to understand that mineral needs will change depending on the age and status of the horse (i.e. if the horse is working, gestating, or lactating). Most commercial horse feed companies will balance their feed to meet the mineral requirements of different classifications of horses. Forage will also provide minerals. In some cases, additional supplementation of some minerals may provide desirable results. For example, in some cases, biotin, zinc, and copper supplemented above requirements have been shown to improve hoof strength. However, excessive amounts of the minerals may also cause toxicities leading to serious health conditions. In addition, excessive supplementation of some minerals may interfere with absorption of others. Therefore, care should be taken when supplementing excessive additional minerals to commercial feeds.

If your horse does not receive a commercial concentrate or eats very little of it, it may be important to supplement additional vitamins/minerals to his forage diet. This may be done by feeding a

product called a ration balancer. Ration balancers are manufactured by many feed companies and are designed to be fed at a low level (approximately one pound per day) that contains the vitamins, minerals and protein that a horse needs. It is also possible to meet vitamin and mineral requirements by providing a free-choice loose salt-vitamin-mineral mix. Horses are not efficient lickers and therefore salt blocks do not work as well for horses as a loose mixture. Mineral blocks are generally less than 5% mineral and over 95% salt so they do little to provide for the vitamin/mineral requirements of the horse. A loose vitamin/mineral premix or a ration balancer is a good option for horses maintained on pasture. If providing a loose mixture, a general rule of thumb is to expect horses to consume 1 1/2 to 3 oz. per day. These are important to make available to horses that are primarily adapted to eating all-forage diets.

One common mineral ratio you will see when looking at a bag of feed is the calcium:phosphorus ratio. As a rule of thumb, this ratio should be between 1:1 and 2:1. If the phosphorus levels are high in relation to calcium, calcium will be pulled from the bone into the blood stream to balance the calcium:phosphorus ratio. This is not typically a problem for grazing animals since phosphorus is fairly low in grasses. However, grains are very high in phosphorus and therefore, commercial feeds are generally supplemented with some form of calcium. It is important to check that commercial feeds, as well as vitamin/mineral premixes, have a calcium:phosphorus ratio between 1:1 and 2:1. Feeding single grains, such as oats, can cause an inverse calcium:phosphorus ratio if calcium is not supplemented in some form. Another important mineral consideration is the sweat loss of your horse. Horses that are in moderate to intense work and are sweating heavily are losing electrolytes in their sweat. For these horses, it may be necessary to supplement salt as well as additional electrolytes (such as potassium). A balanced electrolyte mix can be added to the horse's grain mixture as needed.

Simple Calculations to Determine Nutrient Intake

We have now discussed the five main nutritional categories you will find addressed on feed tags and

some practical suggestions to consider when examining your feeding program. Nutritional requirements vary from horse to horse and it is important to be able to examine a feed tag and assess whether or not that feed will meet your horse's needs. Manufacturers typically put feeding instructions on the tag to assist buyers in determining if the feed is appropriate for their horses and how much of it should be fed to each individual. However, it is beneficial to be able to look at a particular feed and understand why it is or is not a good choice for your horse.

For those who want to examine their feeding program more closely, the most in depth listing of requirements can be found in the National Research Council (NRC) recommendations for horses (*Nutrient Requirements for Horses 6th Edition* 2006). Approximate requirements of a horse's nutritional needs based on age, work load, and status are listed as well as the nutritional value of different grains and hays. This is a resource based on scientific research and updated periodically to be current with recent findings. To access this database of information on-line, use the following website: <http://nrc88.nas.edu/nrh/>. This website allows you to select the age, weight, status, and workload of a particular horse (under "Animal Specifications") and determine its specific nutritional needs for macronutrients (given in the table at the bottom of the webpage) as well as vitamin and mineral needs (under "Other Nutrients"). This program also allows you to select certain forages and other feedstuffs (under "Dietary Supply"—click on "New" to change feedstuff) to determine how much of your horse's requirements are being met by that particular feed or combination of feeds (you must input the weight of each feedstuff being consumed).

Sample Calculation

As a brief example of how to do calculations by hand, if a mature horse weighs 400 kg, to maintain its weight and body condition if it is not exercising will require approximately 504 g of protein (according to recent NRC guidelines). If the horse is eating 1.5% of its body weight in coastal bermudagrass hay, it is eating approximately 6 kg of hay each day (400 X

0.015). An average coastal bermudagrass hay has a crude protein percent of approximately 10.4%. If you multiply 6 kg by 0.104, you get 0.624 kg or 624 g. Therefore, in this instance, the horse's protein requirement is being met through the forage it is consuming. As another example, if that same 400 kg horse is working at a very intense level, it will require approximately 804 g of crude protein. Therefore, if the horse is eating the same 1.5% of its body weight in coastal bermudagrass hay, it will be short 180 g of protein (804-624) to meet its needs. Therefore, a concentrate (grain) must be provided to make up the difference, and/or hay with higher protein content (i.e. alfalfa) can be fed instead of coastal bermudagrass. (Special note: When allowing the NRC computer program to calculate the dietary supply a certain foodstuff is providing, often times it will calculate slightly lower than when calculating by hand. This accounts for losses that are difficult to determine by hand calculations. However, hand calculations will still give a fairly accurate estimate as to whether your feeding program is meeting your horse's requirements).

Conclusion

This process of calculating whether a feeding system meets a horse's nutrient requirements can be done on virtually every nutrient (including digestible energy which is provided primarily by carbohydrates and fats). This process helps determine if the horse's needs are being met. Commercial feeds typically provide recommendations based on weight, age, and activity of the horse. These recommendations are based on NRC recommendations as well as the composition of their feed. It is important to understand your horse's nutritional requirements and be able to apply this knowledge in a practical manner. Many myths surrounding the practice of feeding horses have very little to no truth. It is critical to be informed and understand exactly how your horse's needs are being met.