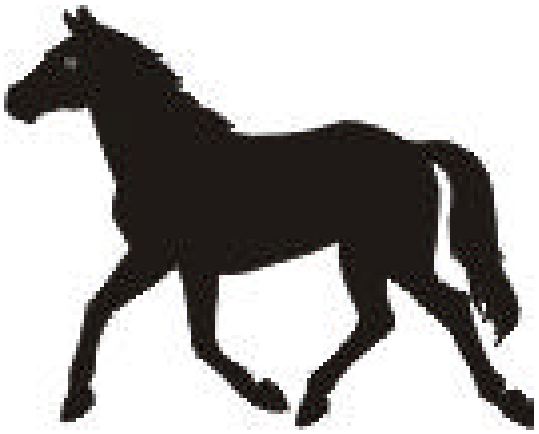
AS-953 (Revised)

Feeding Management for Horse Owners



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Recommended feeding management of horses differs from that of other domestic livestock, primarily because of differences in digestive anatomy and physiology. The digestive anatomy of the horse is classified as a monogastric (simple stomach) animal with extensive post-gastric fermentation of undigested feed residue. Pigs are an example of a monogastric animal that does not have extensive hindgut fermentation capabilities, while ruminants (cattle and sheep) have extensive fermentation in the rumen prior to gastric digestion. The combination of a simple stomach and post-gastric fermentation gives horses the ability to efficiently utilize both forages and concentrates. Nonetheless, this combination can present some unique challenges that need to be addressed with feeding management.

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Digestive Tract of the Equine

For domestic livestock, horses have a peculiar digestive tract (Figure 1). Functionally, the digestive tract can be divided into two components (foregut and hindgut). Components of the foregut include the mouth, esophagus, stomach, and small intestine; while the hindgut includes the cecum, large colon, small colon, and rectum. The foregut of the horse accounts for approximately 35 to 40 percent of the relative capacity of the digestive tract. When compared to the relative capacity of the foregut in pigs (60 to 65 percent) and cattle (85 to 90 percent; Figure 2); the uniqueness of the horses' digestive anatomy becomes apparent.

Horses have a small stomach in terms of relative size compared to other classes of livestock. This makes the rate of passage of ingesta (feed) through the stomach relatively fast. Horses are physically unable to vomit or belch. Consequently, overfeeding and rapid rates of intake are a potential problem.

Meal size and physical form of the diet influence rate of passage of ingesta through the foregut. Larger meals pass more quickly than smaller meals since stomach emptying is controlled by meal volume. Smaller feed particles (finely ground or pelleted grains) and liquids pass rather quickly to the hindgut. Excessively fast rates of passage can reduce the extent of digestion in the foregut since the feed passes through too quickly for the digestive processes to occur.

One of the unique features of the horse digestive tract is the presence of a large microbial population in the cecum and colon. These microorganisms are responsible for extensive fermentation of residues remaining following digestion and absorption in the foregut. The microbes have the ability to utilize the cellulose present in forages. Consequently, even though horses are monogastrics, they do have the ability to utilize forages. The anatomy of the colon (several flexures or folds which turn back onto itself) greatly reduces the rate of ingesta passage. Although this is an advantage in utilizing roughages, it can predispose the horse to digestive upsets when nutrient flow is abnormal.

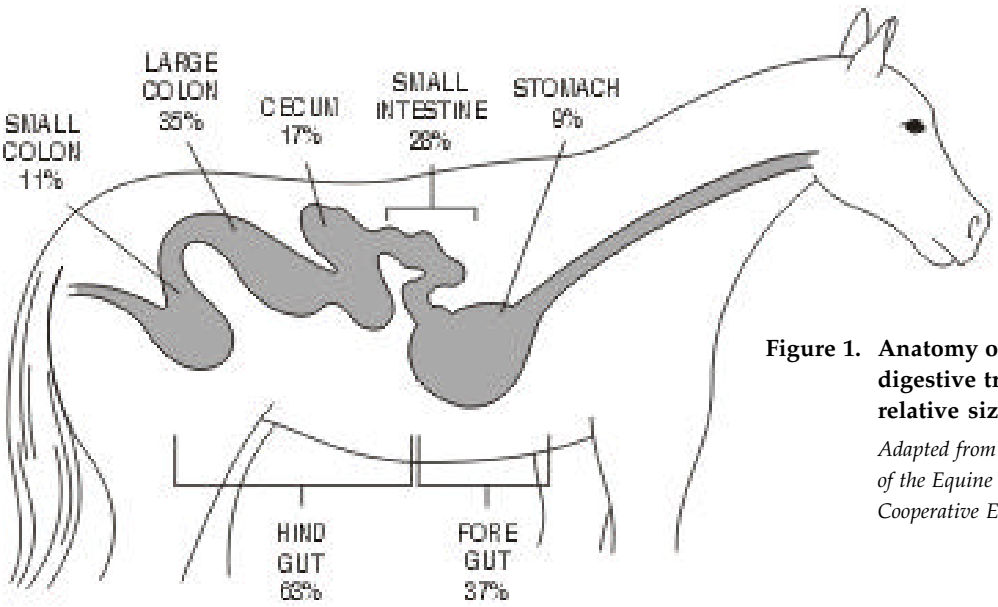

Figure 1. Anatomy of the horse digestive tract with relative sizes.

Adapted from Feeding Management of the Equine (F-3973). Oklahoma Cooperative Extension Service).

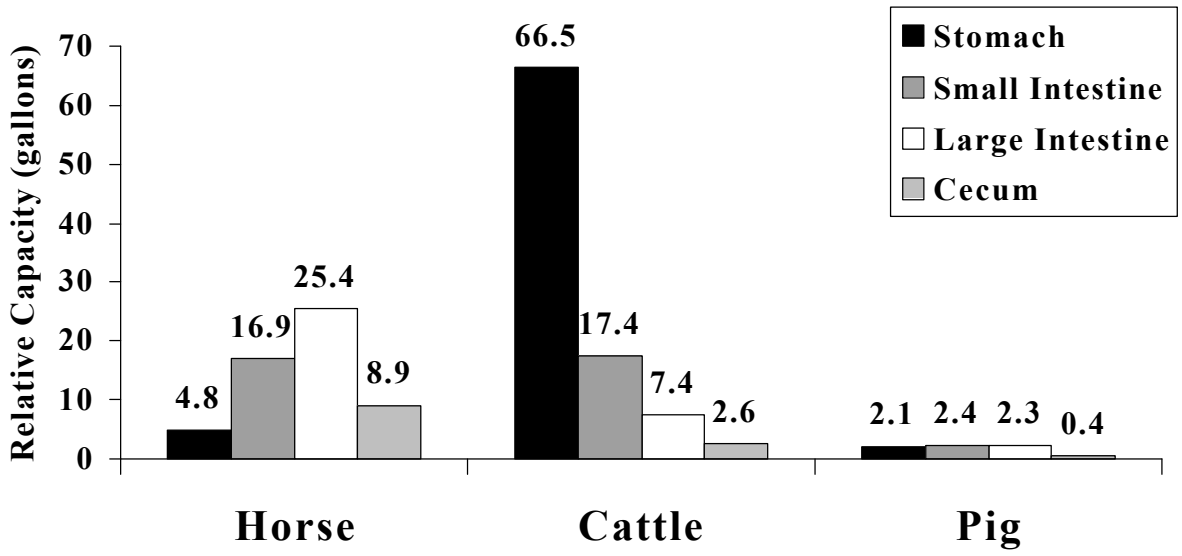

Figure 2. Relative capacities and proportional sizes of the digestive tracts of the pig, horse, and bovine. Numbers give size of various compartments in gallons.

Adapted from Ensminger and Olentine, 1978.

Feeding Management

The basic feed requirements of the horse are relatively simple. As a general rule of thumb, a horse will typically consume 10 to12 gallons of water, greater than or equal to 1.0 percent of body weight in forage, and less than or equal to 1.0 percent of body weight in concentrate per day. Horses should also be given free choice salt.

Water

Clean water should be available at all times. A mature horse may drink 12 gallons of water a day. Water consumption has a positive correlation to feed intake. If water intake is restricted, dry matter intake will also be reduced. Inadequate water consumption can result from having snow as the only water source, faulty watering equipment, or unpalatable water sources. Inadequate water consumption also increases the risk of impaction colic.

Reduced water consumption can be a sign of unpalatable or low quality water. Horses do not readily consume stale or dirty water. High salinity (total dissolved salts) or high sodium concentrations can also reduce water consumption. For more information regarding water quality, see Livestock and Water (NDSU Extension Service Circular AS-954).

Water that is supplied manually should be changed at least twice a day to avoid becoming stale or contaminated. Automatic water sources should be cleaned frequently. Clean and disinfect community water sources if a sick horse is detected in a group. Sick horses should have access to a separate water source until they are considered healthy again.

Horses that are hot from strenuous exercise should not have free access to water. They should be allowed only a few sips every three to five minutes until they have adequately cooled down. Working horses and horses in strenuous exercise programs require more water than inactive horses since large amounts of water are lost as sweat.

How much to feed

It is beneficial to know the actual weight of a horse when developing rations. This allows a more accurate estimate of the nutrient requirements and expected intake of the horse being fed. Normally, horses will eat the equivalent of 1.5 to 2.5 percent of their body weight as dry matter per day (this includes forage and grain). Heavily lactating mares, intensively worked mature horses and younger weaned horses (4 to18 months of age) can consume up to 3 percent of their body weight as dry matter daily. Producers can assume horses grazing on adequate pasture, supplemented with grain, will consume at least half of their daily dry matter intake from grazing.

It is also important to know the weight of the feeds when feeding horses. A volume of feed (scoops of concentrate or flakes of square-baled hay) is fine for instructing others how to feed your horses. However, you must know the weight per unit volume of each feedstuff to provide the proper proportions. Table 1 lists the weight of various feeds per unit volume. The true value for a specified feed may vary as much as 35% from average values. A more accurate estimate of weight per unit volume can be obtained by weighing a known volume of the actual feed being fed. This logic can be used to estimate the weight of concentrates, grains or roughages (bales or flakes).

Table 1. Weight per unit volume of selected feedstuffs.

Feed (as fed)	lbs/qt
Alfalfa Meal	0.60
Barley, whole	1.50
Barley, ground	1.20
Beet Pulp, dried	0.60
Corn, grain, whole	1.75
Corn, grain, cracked	1.60
Distillers grains, dried	0.60
Gluten feed, dried	1.30
Linseed meal	1.00
Milo, whole (grain sorghum)	1.70
Molasses	3.00
Oats, regular, whole	0.85
Oats, heavy, whole	1.00
Oats, dehulled, whole	1.40
Soybean, whole	1.60
Soybean meal	1.80
Soybean hulls, ground	0.90
Wheat, whole	1.80
Wheat, ground	1.55
Wheat midds	0.70
Forages	**cu ft/ton**
Hay, baled	200-360
Hay, cubed	60-70
Hay, loose	450-600
Straw, baled	400-500
Straw, chopped	250-350
Straw, loose	675-1000

The true value for a listed feed may vary by as much as 35% above or below the value given. An accurate value is only obtained by weighing a volume of the actual feed.

Adapted from Feeding and Care of the Horse, 1995. Lon D. Lewis.

Long-stemmed forages

Horses evolved in a grazing environment and their digestive systems can accommodate large quantities of roughage. Although horses can consume large quantities of concentrates, including long-stemmed forage in the diet slows the overall rate of passage and increases dry matter and water intake. A minimum of 1.0 percent body weight of roughage (pasture, hay, or other forage) should be offered daily to ensure adequate intake and digestive health. The use of long-stemmed forage in the diet may also help prevent or curtail other management problems such as tail chewing, wood chewing, and coprophagy (feeding on fecal material).

Nutritional quality of forages reflects the relative concentrations of energy, protein and fiber. Forages which are higher in quality (higher in energy and protein) require less concentrate supplementation to meet the nutrient needs of the horse. Lower quality forages (those with higher amounts of indigestible fiber) tend to require extensive (and expensive) concentrate supplementation to meet the nutrient requirements of certain types of horses.

It is generally recommended that horses be fed long-stemmed rather than processed (pelleted, ground, wafered, cubed) forages. Feeding long-stemmed forages tends to reduce the rate of consumption, stabilize ingesta flow and maintain digestive health. If forages are processed, particle size should be kept quite coarse to prevent digestive upset. Providing long-stemmed forages increases the amount of time spent eating, increases saliva flow, and reduces the level of boredom and associated behavioral problems. Processed forage has been used successfully in horse diets with minimal problems when appropriate feeding management and adequate exercise is provided.

Poor quality forages should not be used in horse diets. Low digestibility, excessive dust, molds, weeds, foreign material, and insect infestations are all factors that can dramatically reduce the overall suitability of a forage. These types of quality detractors can lead to a multitude of problems that range from low consumption of feed to irreversible respiratory disease and/or toxicity.

Blister beetles (*Epicauta* species) are of particular concern when feeding horses. If blister beetles are present in a hay, it should not be fed to horses. Blister beetles contain a compound called cantharidin, which is toxic to horses. The amount of cantharidin present per beetle varies by sex and species, but as few as 100 beetles can kill a 1200-pound horse. Symptoms of blister beetle poisoning include blisters on the tongue and in the mouth, colic, diarrhea, blood or intestinal lining discharge in stools, and problems with urination or bloody discharge in urine. If blister beetle poisoning is suspected, contact a veterinarian immediately. In areas where blister beetles are a problem, poisoning potential can be reduced by using first cutting hay or by using hay harvested after first frost. Beetles are not typically active at these times. Hay conditioning at cutting increases the risk of beetles being present in the hay, since the beetles can be crushed during the conditioning process and directly incorporated into the bale. Cutting hay with a straight mower may reduce the risk of incorporating beetles into the hay by allowing the beetles time to move out of the windrow prior to baling.

Processing feed grains for horses

A number of factors should be considered before deciding whether or not to feed processed grains to horses. Since grain processing tends to increase the overall cost of the concentrate, costs of processing need to be offset by feeding advantages. Processing feed grains with relatively hard seed coats (barley, corn, sorghum) or small kernel size (wheat) will aid in their digestion and increase their ultimate utilization. Fine grinding, however, is not recommended for any feed grain. Fine particle size can lead to decreased overall palatability, increased dust associated with the ration, and increased incidence of digestive problems. Processing of larger, soft-seeded grains (oats) is generally not necessary. The soft kernel and larger kernel size allow ample processing during normal mastication (chewing).

Dental soundness should be considered in deciding whether or not to process feed grains. Horses with poor dental soundness (a particular problem in older horses) tend to benefit more from processing than younger horses with sounder mouths and teeth. Horses fed high amounts of grain for maximum performance may also benefit from processed feed grains.

Many different methods of processing grain are acceptable. Some examples include pelleting, rolling, flaking, cracking, wafering, and extruding. Desirable pellet size varies, but most recommendations range from 0.2 to 0.75 inches in diameter.

Commercially prepared horse feeds, complete feeds, textured feeds, or total mixed rations offer some benefits and are especially popular among part-time horse owners due to the ease of feeding. The convenience and quality control of commercially available feeds needs to be balanced against their relative cost. The general recommendation of maintaining at least 1.0 percent body weight in long-stemmed forage is still applicable.

Frequency of feeding

The digestive health of the horse is enhanced with frequent feedings, particularly with respect to concentrates. When concentrates exceed 0.5 percent of body weight in the ration (5 pounds of grain for a 1000 pound horse) it is generally best to feed the grain in two or more feedings per day to reduce the risk of digestive upset. These meals should be fed 10 to 14 hours apart. Idle, mature horses can be fed up to 5 pounds of grain once a day, if they have continuous access to pasture. Young, growing horses consuming significant quantities of grain need to be fed concentrates at least twice a day. Stabled (non-pastured) horses should also be fed at least twice a day. High performance horses are often fed three times a day or more.

Feeding should occur during quiet times of the day so the horse will not be distracted and bolt (rapidly consume) its feed. A horse will learn to anticipate mealtime, so feeding at the same times each day is encouraged. Irregular feeding schedules can lead to feed bolting and digestive problems. It may also cause undue psychological stress.

Equal amounts of concentrate should be provided with each feeding. Hay should be provided when offering concentrates to stabled horses, with the bulk of the hay given in the evening, providing night time activity.

Changing the ration

To prevent digestive upset, be sure to gradually adapt horses to any ration change over several days. It takes time for the digestive tract to adapt to significant ration changes, especially when switching from an all forage diet to one with a large amount of concentrate. If grain or concentrate levels need to be increased substantially, do so incrementally over a period of several days. For example, increase the amount of grain by 0.5 pounds per day every two to three days until the desired level of grain is reached.

Teeth and dental soundness

Symptoms of improper chewing include feed falling from the horse's mouth during chewing, wasted feed, excessive slobbering, indigestion, and large amounts of whole grain in the feces. A horse's teeth may need to be checked if it is taking longer than normal to clean up its feed. Conversely, sore spots in the mouth may

cause horses to bolt their feed to reduce the amount of time the sore is irritated. Strong, sour odors from the mouth can be indications of tooth cavities or food particles lodged in the mouth. Floating (filing) the teeth may be necessary to remove sharp edges produced from excessively worn teeth. A good management practice to follow is to check teeth once per year in adult horses and twice per year in aged horses.

Vitamin and mineral supplements

There are a variety of good quality mineral and vitamin supplements on the market. Horse owners may be tempted to fall into the 'if some is good, more is better' trap. This is not the case with vitamin and mineral supplements. Excess levels of most vitamins and minerals can cause problems for horses. Using commercially prepared mineral and vitamin supplements at the recommended levels will take the guesswork out of proper mineral and vitamin supplementation. In many cases, commercially prepared concentrate supplements will provide all the necessary vitamins and minerals, so no additional supplementation is necessary except in special cases.

Special concerns

The amount of hay fed to heavy working horses should be restricted immediately prior to exercise. Horses will normally consume a regular meal within an hour. Allow one hour between the time the horse finishes a meal and heavy work. Also, remember to reduce the nutrient intake of a working horse during periods of reduced activity. Tying-up, ('Monday morning disease' or 'azoturia') can occur in working horses that are being fed high grain diets and given one or more days of complete rest with no change in diet. Although the exact cause of the problem is not known, it is likely that the condition results from exercise that exceeds the state of training. The condition was common in draft horses that were worked hard six days a week and given rest on Sunday. Tying-up occurred following the resumption of work on Monday. Reducing grain intake during periods of inactivity and beginning exercise programs slowly following extended periods of inactivity are recommended.

Reducing the rate of grain intake may be necessary if horses bolt their feed or if competition between horses for the same feed becomes a problem (pen- or group-fed horses). Several methods can be used to slow rate of intake. Grain can be spread out in shallow troughs or feeders, or large stones can be placed in grain feeders so that horses are required to eat around them. If a pelleted feed is used, harder pellets will tend to increase the amount of time spent chewing and decrease the overall rate of intake.

Individual feeding is the best way to assure each horse receives the necessary amount of feed to meet its individual nutrient requirements. Competition among horses in group-feeding situations can result in aggressive horses consuming more than their share of feed while more timid horses are not given the opportunity to receive adequate amounts of feed. In these types of situations, it may be better to feed less aggressive horses separately or to place feeding stations 50 to 75 feet apart to reduce competition during feeding. When feeding groups of horses, you may also wish to use one more feed bucket or trough than the number of horses. This will give the submissive horse a chance to eat next to an unoccupied bucket or trough.

Inherent nervousness caused by unfamiliar surroundings can often be reduced by offering the horse many small meals of hay during the day. Providing mineral blocks to the traveling horse may also help dispel nervous activity.

Horses are also susceptible to nitrate poisoning and prussic acid poisoning. For more information on these problems refer to Nitrate Poisoning of Livestock (NDSU Extension Service Circular V-839) or Prussic Acid Poisoning (NDSU Extension Service Circular V-1150).

Summary

Horses have a unique digestive tract in comparison to other species of livestock. Horses are monogastrics but can use forages effectively due to the presence of the microbial population in the hindgut. Because of the unique nature of the digestive tract, proper feeding management is important to ensure that the nutritional needs of the horse are met.

Long-stemmed forages such as hays or pasture are necessary in the diet to ensure normal digestive function. When concentrates are fed, consideration should be given to grain processing, frequency of feeding, the amount of concentrate necessary, and dental soundness. Ration changes should always be made gradually.

Nutritional quality of hays and other forages intended for horses is important. To ensure optimum health and performance of your horse do not feed hays that are excessively dusty, moldy, weedy or have blister beetles present. As with any species of livestock, access to good quality water is also important to ensure optimum health and performance.

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