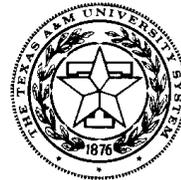


**TEXAS A&M UNIVERSITY  
DEPARTMENT OF ANIMAL SCIENCE  
EQUINE SCIENCES PROGRAM**



## **Selection and Use of Roughage in Horse Feeding**

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One of the biggest challenges facing the horse owner is identifying and properly using top quality roughage. Roughage must be fed regularly to keep the horse's digestive system functioning properly, to minimize vices such as wood chewing and to help meet some percentage of the horse's daily nutrient requirements<sup>29</sup>. Since roughage is the foundation of a safe and successful feeding program, the effort given to selecting the best roughage available is well worth the time involved.

### **Roughage Selection**

Careful selection of roughage is important to ensure maximum nutrient supply per dollar spent and to avoid purchasing inferior quality feedstuffs. Characteristics of good quality roughage include 1) a high leaf to stem ratio, 2) fresh smell and appearance, 3) cleanliness (free of weeds, dirt, trash) and 4) color<sup>8,28</sup>.

When roughage is cut at a mature growth stage it is very stemmy which makes it significantly less nutritious and digestible. Overly mature hay has higher levels of crude fiber and lignin, which decrease its feeding value, and are not digested as well by the horse<sup>10,19</sup>. Therefore, fine stemmed, soft, leafy hay should be selected over extremely stemmy, fibrous hay<sup>2</sup>. High quality hay provides more nutrients and is less apt to cause the impaction type colic that is sometimes associated with coarser, lower protein roughages<sup>34</sup>.

In addition to maturity, the season in

which hay is harvested also affects its quality. Digestibility is highest for forage harvested in the spring. It declines in mid to late summer and then rises slightly in autumn<sup>2</sup>. Therefore, if all other factors are the same, hay cut in the spring will be of higher quality than hay cut in mid or late summer.

Although leafiness and softness are good indicators of quality, hay should be analyzed for actual nutrient content. When hay is being purchased on a weight basis (by the ton), a core sample should be analyzed for protein, fiber and moisture. In most states, the County Extension office can provide assistance in obtaining samples and determining where to send the hay for quick analysis. This will help verify hay quality and more accurately determine its value. It is not necessary to analyze processed roughages because many of them are sold with a guaranteed analysis of some nutrients.

A fresh smell and appearance are important, regardless of nutrient content. Roughage that smells the least bit moldy or musty should always be avoided. A white or bluish, powdery appearance and excessive dust may also indicate mold. Horses that are not overly hungry often refuse to eat moldy roughage if given a choice. However, hungry horses will consume moldy hay, which can cause health problems. Mold can easily develop in the bottom row of stored bales, even in a barn. On round bales, the outer layer of spoiled or weathered hay may need to be removed before feeding<sup>23</sup>.

In addition to the risk of becoming moldy, roughage that is harvested at too high a moisture content will produce heat. While it is normal for freshly baled hay to feel slightly warm down inside the bale, bales that reach temperatures from 120 to 140 degrees F are at risk for spontaneous combustion. Because of the possibility of fire, fresh, green hay should never be stored tightly against older, dry hay<sup>2</sup>.

The presence of dirt, dust and trash in roughage may indicate that it was harvested carelessly. Dirt and excessive dust can be harmful to the horse<sup>2,6</sup>. First cutting hay sometimes contains a higher percentage of weeds than later cuttings, but this normally does not pose a problem unless the hay is extremely weedy.

A bright green color usually indicates that the hay is rich in vitamins, particularly carotene which is converted to Vitamin A by the horse. Color also indicates what the harvesting conditions were and how long the hay has been stored<sup>28</sup>. However, hay should not be turned down simply because it is not bright green on the outside. The inside of a bale often has good color.

Even after a load of hay has been carefully selected, each bale should be checked for mold or foreign objects as it is fed.

### **Daily Roughage Intake**

Horses without access to a good source of grazing should receive roughage in amounts equal to about 1 percent of their body weight daily. This will usually satisfy a horse's need for adequate gut fill and chewing, helping to minimize wood chewing or cribbing. Horse owners should make sure daily roughage intake does not go below 0.75 percent of body weight, because inadequate roughage can make horses more susceptible to digestive problems. It is also important to realize that roughage can go far in maintaining some classes of horses. Mature, idle horses and mares in early pregnancy that are already in suitable body condition often can be maintained quite well on roughage alone at 1.5 to 2.0 percent of body weight daily. When no other supplemental feed is provided, roughage intake may need to be as high as 2.5 percent of body weight daily for some horses<sup>1</sup>. These are

average guidelines. Actual amounts depend a great deal on the status of the horse and the quality and type of roughage being fed. For those horses that do receive supplemental feed, roughage still makes up a significant portion of the daily diet<sup>29</sup>. When grazing is not available, baled or processed roughage normally represents at least 50 percent of the daily diet for brood mares, horses doing light or moderate work and 2-year-old horses (Table 1).

To feed hay on a percentage of body weight basis, the horse's weight must be estimated. If a set of scales is not available, the following formula may be used to get a fairly accurate estimate of weight<sup>5</sup>.

$$\frac{[\text{heart girth (in.)}]^2 \times \text{body length (in.)}}{330} = \text{body wt. (lbs.)}$$

Heart girth is the distance around the body at the highest point of the withers, and body length is measured from the point of the shoulder to the point of the buttock on the same side.

## **Legume Roughages**

### **Alfalfa**

The legume roughage used most for horse feeding is alfalfa. It is available in a variety of forms including square baled, round baled, chopped and bagged, cubed, wafered and pelleted. Each baled or processed form of alfalfa can be used in many ways to: 1) meet or help meet a horse's need for roughage; 2) provide supplemental nutrients; 3) provide added bulk to energy rich grain mixes; or 4) serve as the major source of nutrients for some horses.

Alfalfa products are popular with horsemen because horses usually consume such feedstuffs very readily. Alfalfa can even be used to promote the intake of feeds that horses are otherwise reluctant to eat<sup>4</sup>. Because of this, alfalfa is often the preferred roughage for young horses, who at times can be finicky eaters, as well as for brood mares nursing foals. Alfalfa also is richer in nutrients than some other roughages and is especially helpful in supplying crude protein, fiber and calcium<sup>15</sup>.

### **Alfalfa Quality**

The stage of maturity at which alfalfa is harvested greatly affects its nutrient content<sup>28,29</sup> (see Table 2). The highest quality alfalfa is that which is cut before becoming overly mature.

Alfalfa and processed alfalfa products are not actually considered protein supplements, but they are relatively high in crude protein content. On the average, they contain 30 percent or more protein than many grass hays and can actually be a more economical source of protein than other roughages. Alfalfa products normally cost more than grasses on a per pound of dry matter basis, but they may actually cost from 15 percent to 35 percent less than grasses on a per pound of crude protein basis<sup>14</sup>. This can be an important consideration when planning feeding programs for young, growing horses and brood mares that need more protein than idle horses or performance horses.

Alfalfa has an almost 6:1 ratio of calcium to phosphorus, so it can be used to adjust the inverted calcium:phosphorus ratios of cereal grains and decrease the amount of mineral supplement needed in a grain mixture. Furthermore, because alfalfa normally contains between 20 and 28 percent crude fiber, it can be

an important source of bulk in the horse's diet. Although roughages are not considered to be rich in energy, alfalfa does contain more energy than most grasses. This extra energy, along with the higher protein content, is partially responsible for the added "bloom" many horse owners recognize when alfalfa hay is part of the daily feeding program.

### Chopped Alfalfa

Roughage is being marketed in various physical forms, and studies have shown that processed hays can be used effectively in horse feeding programs<sup>9,18,25</sup>. One type of processed alfalfa is chopped hay, made from long stem hay usually chopped to 1/2 inch or 3/4 inch lengths. The nutrient content of most commercially chopped and bagged alfalfa is consistent with that shown for dehydrated alfalfa in Table 2. Research has shown that the nutrient digestibility of high quality chopped roughage is significantly higher than that of average quality chopped roughage<sup>16</sup>. Consequently, high quality chopped alfalfa can help provide the additional protein needed by young, growing horses and brood mares.

Chopped and bagged alfalfa is also convenient for horsemen with limited transportation and storage facilities. Some people consider the square bags easier to handle and haul, and the bags protect the feed from sunlight and rain.

**Table 1. Diet proportions for horses and expected daily feed consumption.\***

<u>Type of horse</u>	<u>% of total diet</u>		<u>% of body weight intake</u>		
	<u>Roughage (%)</u>	<u>Concentrate (%)</u>	<u>Roughage</u>	<u>Concentrate</u>	<u>Total</u>
Mature, idle	100	0	1.5-2.0	0	1.5-2.0
Pregnant mares	70-80	20-30	1.0-1.5	.5-1.0	1.5-2.0
Milking mares	50-65	35-50	1.0-2.0	.5-2.0	2.0-3.0
Performance horses					
light work	65	35	1.0-2.0	.5-1.0	1.5-2.5
moderate work	50	50	1.0-2.0	.75-1.5	1.75-2.5
intense work	35	65	.75-1.5	1.0-2.0	2.0-3.0

Growing horses					
weanling	30	70	.75-1.0	1.25-3.0	2.0-3.5
yearling	40	60	1.0-1.5	1.0-2.0	2.0-3.0
2-year-old	50-65	35-50	1.0-1.5	1.0-1.5	1.75-2.5

\* NRC, 1989.

**Table 2. Nutrient content of alfalfa hay and alfalfa products (as fed basis).\***

<u>Stage of maturity or form</u>	<u>Digestible energy (mcal/lb.)</u>	<u>Crude protein (%)</u>	<u>Calcium (%)</u>	<u>Phosphorus (%)</u>
Alfalfa hay				
early-bloom	1.02	18.0	1.28	.19
mid-bloom	.94	17.0	1.24	.22
full-bloom	.89	15.5	1.08	.22
Dehydrated alfalfa meal				
15% protein	.91	15.6	1.25	.23
17% protein	.98	17.4	1.38	.23

\* NRC, 1989

Chopped hay can be mixed with energy dense grains such as corn or barley to regulate the rate of feed intake and to add needed fiber. Horses eat grain feeds more slowly when they are mixed with chopped hay<sup>21</sup>. This feeding management practice can be helpful in feeding rapid eaters more safely and possibly decreasing their chances of developing colic or founder. Compared to oats, it takes less than half as much processed alfalfa to provide the same amount of bulkiness (fiber) to an energy dense feedstuff such as corn or barley. Chopped hay may be mixed with cereal grains as a "total mixed ration" that might be fed with no additional long stem roughage<sup>31</sup>. Table 3 shows a total ration containing 67 percent chopped alfalfa that is designed to be fed in wafered form.

**Table 3. Total mixed ration fed in wafered form.\***

<u>Feedstuffs used</u>	<u>Percentage</u>
Chopped alfalfa	67.0
Cracked corn	16.3
Crimped oats	10.0
Dried cane molasses	3.0
Salt	1.0
Trace mineral premix	0.1
Vitamin premix	0.1
Nutri-binder, gelatinized grain sorghum	2.5

\*From Pipkin et al. 1991.

This ration was fed to some horses in a 30 day study, while others received a grain mix fed with long stem hay. There were no differences between the rations in daily feed intake, and no abnormal digestive behavior was observed with either. Although long term changes in behavior such as wood chewing were not determined, the study concluded that such a ration can be safely fed, and that its nutritional value is comparable to that of a typical grain and hay diet.

### **Pelleted Alfalfa**

Opinions vary widely on the use of pelleted feedstuffs for horses. One limited survey indicated that 30 percent of horse owners select pellets when purchasing commercial feed<sup>17</sup>.

Pellets do have several uses, provided they are composed of high quality ingredients and are properly made. The fiber, protein and calcium in alfalfa often can be easily incorporated into a grain mix by using pellets (Table 4).

Feeding trials utilizing 25 percent alfalfa in a pelleted grain have shown that pellet density is more important than pellet size<sup>13</sup>. Hard, crunchy pellets are consumed more slowly than soft, crumbly pellets. Horse owners should know the exact weight of pellets fed rather than relying on coffee can (volume) measures, and should bear in mind that pellets often are consumed more rapidly than grain mixes<sup>22</sup>.

Recent research has concluded that alfalfa pellets can be fed in lesser amounts than long stem alfalfa, primarily because the pellets usually contain a higher percentage of nutrient

**Table 4. Example herd ration (~14% crude protein) for mature horses using pelleted alfalfa.\***

<u>Ingredients</u>	<u>Percent</u>	<u>Lbs./ton</u>
	45.0	900
Alfalfa pellets	47.5	950
Cracked corn	4.0	80
Soybean meal	2.5	50
Molasses	.5	10
Dicalcium-phosphate	.5	10
Trace mineral salt	100.0	2000

\*Ration may be fed with good quality grass hay to mature horses.

rich leaves<sup>30</sup>. Other research has shown that pelleted alfalfa has a higher nutritive value index than long stem hay<sup>18</sup>. Horsemen have observed that less manure is produced when horses eat pelleted alfalfa versus long stem hay and at least one feeding study has confirmed this<sup>30</sup>.

It is important to evaluate the eating behavior of horses when pellets are being fed. Horses kept in confinement and fed pellets may need additional long stem roughage to discourage bad habits such as wood chewing, cribbing or mane and tail chewing<sup>18,20,32</sup>. Such problems are certainly less likely when horses have some access to long stem hay or grazing.

## Alfalfa Cubes

Horse owners sometimes need to give supplemental feed to certain horses. And sometimes conditions are less than ideal for feeding grain mixes, as when brood mares are being kept on native pasture and grass is fairly dormant or covered with ice and snow. Cubed alfalfa is one feedstuff that can be used effectively in such situations. Fed at 1 percent of body weight daily, cubes will provide 55 percent and 100 percent of the pregnant mare's (late gestation) requirements for energy and protein, respectively. The cubes are large enough that mares can usually pick them up without ingesting dirt or other foreign materials. Like pellets, cubes can also be mixed with grain based feeds at 10 to 20 percent of the total ration to supply additional calcium and fiber. And, when fed at about 1.5 percent of body weight, cubes can provide all of the energy and protein needed by mature, idle horses and mares during early pregnancy. Cases of choking in horses fed cubed hay appear to be very limited and studies suggest that choking is usually a problem only in horses that already have chewing problems<sup>25</sup>. Horses spend less time eating cubes compared to long stem hay, but habits such as wood chewing have not been observed in feeding studies with cubes<sup>18,25</sup>.

## Horse Hage

A fairly new form of processed roughage developed in England is now being manufactured in the United States. Horse hage consists of chopped alfalfa that is vacuum packed at a high moisture level<sup>29</sup>. It has a distinctive aroma and is processed to preserve freshness for a long time. Research on this high moisture roughage is limited, but field observations indicate that horses take 2 or 3 days to adapt to the feed<sup>27</sup>.

## Potential Problems with Alfalfa

Blister beetles sometimes enter alfalfa fields and can end up in the harvested product. The beetles contain the toxin cantharidin, which severely irritates the horse's digestive tract and often causes death. Although there are no guarantees, hay that is mowed and windrowed without conditioning rollers may be less likely to contain beetles than hay that is cut with a

self-propelled mower conditioner<sup>3</sup>.

Furthermore, inspections of hay fields in the Midwest indicate that second, third and fourth cuttings are more apt to contain striped beetles than other cuttings<sup>3</sup>. Many hay producers are now aware of the potential for blister beetle contamination and try to harvest alfalfa with the horse owner in mind. Horse owners should talk with alfalfa producers and suppliers to learn the details of harvest date, method of harvest and other factors.

### **Other Legumes**

Other legume hays used in horse feeding are red clover, birdsfoot trefoil and lespedeza<sup>29</sup>. Sun-cured red clover hay is intermediate in protein content compared to grasses and alfalfa, and contains about the same energy as many grasses. It is very similar to alfalfa in both its level and ratio of calcium and phosphorus. Red clover hay often appears somewhat stemmy and does not possess the bright green color of other legumes. Limited studies indicate that horses are less susceptible than other livestock to problems such as slobbering caused by consuming clover. However, horses can be affected by dicoumarin, which is present in moldy or improperly cured sweet clover.

Birdsfoot trefoil is similar in protein content but higher in energy content than clover. It is often less stemmy than red clover<sup>21,29</sup>.

Lespedeza grows well in certain areas of the U.S. and can be used as a source of roughage. It often contains less protein and energy than alfalfa, red clover or other legumes, but is somewhat comparable to alfalfa in calcium and phosphorus content.

With any legume roughage, horse owners should always monitor eating behavior and other signs on a regular basis. Since most legumes are higher in energy and protein than grasses, it is not uncommon to see slight differences in water consumption, feed intake, urination and defecation. Sometimes the feces will be looser and greener when horses eat legumes, especially when the roughage is first introduced. Therefore, it is always a safe management practice to introduce new feedstuffs gradually over a period of several

days.

### **Grass Hays**

There are many grass and small grain hays. They vary greatly in nutritive value and palatability, depending on the particular variety, where it is grown and its stage of maturity at harvest. The grass hays generally provide less protein and energy than good quality legumes. The protein content of excellent quality grass hays may be as high as 15 percent, but the average is closer to 8 percent or less<sup>35</sup>. Because of their fiber content and relatively low nutrient content, grass hays may be safely fed free choice to horses. Grass hays are frequently mixed with legume hays to provide roughage that is very palatable, moderate in nutrient content and safe to feed ad libitum. Grass hays most commonly fed to horses include coastal bermudagrass, timothy, prairiegrass, orchardgrass, smooth brome grass, Kentucky bluegrass, oat hay, tall fescue and sudangrass, although other varieties may be fed. Regardless of the variety, good quality grass hay should be leafy, soft and pliable to the touch, have no or comparatively few seed heads and be free of mold, dust and weeds<sup>29</sup>.

### **Bermudagrass**

Bermudagrass is very popular in the southern United States. Coastal bermudagrass is more often grown for hay because it grows taller than common bermuda, which is generally too short for good hay yields. The nutrient content of bermudagrass is almost the same as that of early bloom timothy (Table 5). Horses that are being shipped to different regions of the country are often given bermuda as a substitute for timothy because of the similarities. The protein in both is higher than in typical cereal grain hays such as oats or barley (Table 5).

Bermudagrass is sometimes blamed for impaction colic in horses<sup>8</sup>; however, fertilized bermudagrass hay baled at 3- to 4-week intervals is usually high in protein and easily digestible. Because a large number of horses are fed bermudagrass, many may receive hay that is overly mature. Coastal bermudagrass hay intended for horses should be cut at a 15-inch height for the first cutting and every 21 to 28 days thereafter for subsequent cuttings. Research

with horses has shown that good quality bermudagrass hay is actually more digestible than average quality alfalfa hay<sup>16</sup>.

### Timothy

The best quality timothy hay is normally grown in the northern part of the country. Relative to other grass hays timothy has an average nutrient content (Table 5), but it tends to remain free from dust and mold . Timothy is highest in nutrient content and palatability when cut in the pre-bloom or early-bloom stages, and is frequently grown with a legume to increase the total nutrient value of the harvested roughage<sup>35</sup>.

**Table 5. Nutrient content of some varieties of grass hays (as fed basis).\***

	<u>CP (%)</u>	<u>DE (mcal./lb.)</u>	<u>Ca (%)</u>	<u>P (%)</u>
Bahiagrass				
sun-cured, late vegetative	8.9	.77	.25	.19
Coastal bermudagrass				
15-28 days	10.6	.87	.35	.24
29-42 days	10.9	.89	.30	.19
43-56 days	7.3	.79	.24	.17
Kentucky bluegrass				
full-bloom	8.2	.72	.24	.25
Smooth brome				
mid-bloom	12.6	.85	.25	.25
mature	5.6	.71	.24	.20
Kentucky fescue				
full-bloom	11.8	.86	.40	.29
mature	9.8	.80	.37	.27
Oat hay	8.6	.79	.29	.23
Orchardgrass				
early-bloom	11.4	.88	.24	.30
late-bloom	7.6	.78	.24	.27
Italian ryegrass				
late vegetative	8.8	.71	.53	.29
Sorghum, johnsongrass				
hay	6.7	.68	.80	.27

Timothy				
early-bloom	9.6	.83	.45	.25
mid-bloom	8.6	.80	.43	.20
late-bloom	6.9	.72	.34	.13
Wheat hay	7.7	.76	.13	.18

\* NRC 1989

### **Sorghum**

Sudangrass, johnsongrass and sorghum/sudan hybrids are all members of the sorghum family. Johnsongrass is a tall, rank growing grass often regarded as a weed<sup>7</sup>. Johnsongrass hay has more calcium (Table 5) than most other non-legume hays, but has little protein and is often coarse and largely unpalatable. Sudangrass hay is similar to johnsongrass hay in many respects and, if cut too early, may contain toxic levels of prussic acid. Some newer varieties have low levels of prussic acid, but these hays probably should be tested before feeding<sup>7</sup>. A recent report indicates that sudangrass hay and sorghum/sudan hybrids may cause the urinary tract inflammation known as cystitis in horses. Careful management and harvesting are necessary to avoid these problems.

### **Fescue**

This grass is grown extensively in the Midwestern and southeastern United States. Fescue hay has the reputation of being fairly unpalatable to horses, regardless of the stage at which it is harvested. Endophyte-infected fescue can pose serious reproductive problems for brood mares, including prolonged gestations, abortions, thickened placentas and agalactia (no milk)<sup>2,8</sup>. Therefore, it is commonly recommended that mares not be given fescue hay or allowed to graze fescue during the last 90 days of pregnancy or during lactation. Fescue can be tested to determine whether or not the fungus is present, and endophyte-free seed is available for reseeding new stands.

### **Bromegrass**

Smooth bromegrass is the most common type of bromegrass fed to horses. This grass grows extensively in the Great Plains but does not do well in the southern U.S. It is best

when harvested in the mid-bloom stage. Bromegrass is highly palatable and can have a feeding value comparable to bermudagrass. Consequently, it is a reasonably desirable choice of roughage<sup>2</sup>.

### **Kentucky bluegrass**

Popular in mideastern states, particularly Kentucky, bluegrass can provide good quality roughage. Bluegrass hay that is cut prior to heading out can have a protein content similar to that of good quality alfalfa. However, because of its low yield potential, it is often not harvested until it is quite mature, resulting in a much lower feeding value<sup>2,8</sup>.

### **Prairiegrass**

Prairie hays, used mainly in the mid and western United States, are a mixture of wild, native grasses. When these grasses are cut in the early stages of growth, they can provide protein in the range of 6 to 8 percent. However, the quality is variable because of the many different types of grasses that comprise prairiegrass hay<sup>35</sup>.

### **Orchardgrass**

Produced in many areas of the country, orchardgrass can be of fairly good quality if cut in the early bloom stage. If cut later it can be unpalatable and of little nutritive value. Good quality orchardgrass hay will average about 9 percent crude protein<sup>2</sup>.

### **Kleingrass**

Kleingrass has become popular in the Gulf Coast area and is the third most widely grown forage on improved pastures in Texas<sup>36</sup>. While cattle grazing kleingrass have been shown to gain as much or more weight than cattle grazing bermudagrass<sup>6</sup>, horses do not

appear to perform as well. In one study, horses offered free choice kleingrass hay would consume only 0.29 percent of their body weight, whereas these same horses ate 1.49 percent of their body weight when offered coastal bermudagrass hay<sup>36</sup>. There is some indication of potential liver damage in horses eating kleingrass hay, even when hay quality is good<sup>12</sup>.

### **Bluestem**

This grass variety grows throughout the Central Plains region of the United States. The most common types used for hay are big and little bluestem. Both make highly palatable horse hays of acceptable quality (about 8 percent crude protein), but contain slightly more fiber than comparable quality timothy or bermudagrass<sup>35</sup>.

### **Wheatgrass**

Crested wheatgrass, normally grown for pasture, is used some for hay in the Northern Plains states. Wheatgrass is hardy and, if cut pre-bloom, produces good quality roughage averaging 9 percent crude protein. As this grass matures, its quality and digestibility decrease rapidly and it becomes tough and fibrous<sup>35</sup>.

### **Bahiagrass**

Bahiagrass is grown widely over much of the southern Coastal Plain, primarily for grass and secondarily for hay<sup>7</sup>. Therefore, hay is often made only from surplus pasture growth, which results in overly mature, poor quality hay. This mature hay also can cause Ergot poisoning<sup>11</sup>. However, good quality bahiagrass hay, cut before heading out, can be somewhat comparable to good coastal bermudagrass hay in feeding value<sup>7</sup>.

### **Ryegrass**

Ryegrass is commonly planted in the south and southeastern United States to provide winter grazing. Ryegrass pastures have high nutrient value and produce excellent animal gains<sup>2</sup>. Excess pasture growth is sometimes cut for hay. Ryegrass can make good hay (Table 5) if it is allowed sufficient drying time before

baling.

### **Cereal Grasses**

The cereal grass hays are made from the common cereal grain crops. Oat hay is cut while the crop is still green, usually in the dough stage, and the grain remains part of the hay<sup>7</sup>. When cut at the appropriate stage of maturity oat hay can be a very satisfactory roughage (Table 5). Field observations indicate that horses may prefer small grain hays in the order of oats, barley, wheat and rye<sup>2</sup>. Rye hay, however, is generally considered to be low in palatability and quality.

### **Other Roughage Sources**

Other fiber sources are used in livestock rations, but little information is available about their use in horse diets so it is difficult to make exact recommendations.

### **Straws**

Grain straws (oat, wheat or ryegrass straws) are low in palatability and feeding value for horses. They have a high fiber content and may be used to add bulk to a completely pelleted diet. Although mature ponies have been shown to maintain body weight when fed ryegrass straw as 68 percent of the total diet, it is recommended that straws comprise no more than 10 percent of the diet so that they don't severely reduce the energy content and fiber digestibility of the diet<sup>8</sup>. Research has shown that straw treated with ammonia, sodium hydroxide or acid followed by yeast inoculation is more digestible for horses than untreated straw<sup>24</sup>.

### **Hulls**

Both oat hulls and rice hulls are very poor quality feeds but may be used to add bulk to a completely pelleted horse diet. As with straws, hulls should be limited to 10 percent of the diet and only high quality hulls that are free from dust, mold and foreign materials should be used<sup>8</sup>. Sunflower hulls have a negative feeding value for horses but will provide bulk and satisfy the appetite<sup>26</sup>. Research has shown that weanlings fed a diet of 50 percent soybean hulls and 50 percent concentrate gained as much

weight as weanlings fed 50 percent alfalfa and 50 percent concentrate<sup>26</sup>. Cottonseed hulls have relatively little nutritive value for horses but may be used to add fiber or bulk to the diet<sup>8</sup>. Peanut hulls are easily contaminated by aflatoxin and are, therefore, rarely fed to horses. But if they are free of aflatoxin and dust they can be used as a fiber source in the diet.

**Corn plants**

Whole corn plants can be pelleted and fed to horses for an energy source, but supplemental protein, vitamins and minerals may be needed<sup>26</sup>. Without added protein, horses fed whole corn plants will have a reduced appetite and will practice coprophagy (eating of feces)<sup>8,29</sup>. Ground corn cobs contain 50 to 70 percent as much digestible energy as the average grass hay and can be used as a source of fiber and bulk.

**Summary**

Careful roughage selection is a critical component of a successful feeding program for horses, and owners have a variety of roughages to choose from. In deciding whether to use a legume, a grass or a mixture of both several factors must be considered. These include the availability, cost and quality of roughages, the method by which they will be handled and hauled, the storage capacity available, the nutrient requirements of horses and the type of concentrate or grain mix being fed. In addition, horsemen should be aware of the potential health hazards related to some roughages (Table 6).

By taking the time to carefully select top quality roughage and continually monitor horses consumption patterns, owners can be sure their horses are receiving the best possible diets.

**Table 6. Forage-related disorders and poisonous plants.**

<b><u>FORAGE-RELATED DISORDERS</u></b>			
<b><u>Forage</u></b>	<b><u>Agent or compound</u></b>	<b><u>Cause</u></b>	<b><u>Manifestation</u></b>
Fescue	endophyte fungus	present in seed	thickened placenta, prolonged gestation, foal death, agalactia

Kleingrass	unknown	photosensitization	liver damage
Alfalfa	cantharidin	blister beetle	digestive tract damage, death
Sweet Clover	dicoumarin	improper curing of hay	reduced palatability, reduced intake, reduced performance
Foxtail Millet	alkaloids	unknown	kidney and joint disorders
Lespedeza	tannins		reduced digestibility, reduced intake, reduced performance
Sorghums, sudans, sorghum/sudan hybrids	glycoside-prussic acid	hard frost, fast growth after drought	rapid breathing, suffocation
	nitrates	heavy nitrogen fertilization followed by drought	labored breathing, staggering, muscle spasms, death
<b><u>SOME POISONOUS PLANTS</u></b>			
	Ornamental shrubs	Black locust	Perilla mint
	Night shades	Braken fern	Pokeweed
	Locoweed	Castorbean	jimsonweed
	Pearine	Oleander	Horsechestnut

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