



Selection and Use of Hay and Processed Roughage in Horse Feeding



Selection and Use of Hay and Processed Roughage in Horse Feeding

Pete G. Gibbs
Professor and Extension Horse Specialist
Department Of Animal Science
Equine Sciences Program
The Texas A&M University System

Contents

Introduction.....	5
Selecting High-Quality Roughage.....	5
Horses' Daily Roughage Intake.....	6
Legume Roughages.....	7
1. Alfalfa.....	7
2. Other Legumes	10
Grass Hays	11
1. Bermudagrass	12
2. Tifton	12
3. Timothy.....	12
4. Sorghum	12
5. Fescue.....	12
6. Bromegrass	14
7. Kentucky bluegrass	14
8. Prairiegrass	14
9. Matua Prairie Grass	14
10. Orchardgrass	14
11. Kleingrass	14
12. Bluestem.....	14
13. Wheatgrass	14
14. Bahiagrass.....	14
15. Ryegrass.....	15
16. Cereal Grasses	15
Other Roughage Sources.....	15
1. Straws	15
2. Hulls	15
3. Corn plants	15
4. Some "Super Fibers"	15
Summary	15



Many horseowners have limited grazing for horses, so good quality hay on a daily basis is important.

Selection and Use of Hay and Processed Roughage in Horse Feeding

Introduction

One of the biggest challenges facing horse owners is identifying top-quality roughage and using it properly. Because roughage is the foundation of safe and successful feeding programs, efforts to select the best available roughage are well worth the time spent.

Horses must be fed roughage regularly to keep their digestive systems functioning properly, to minimize vices such as wood chewing and to help meet some percentage of daily nutrient requirements.⁴⁰ A typical horse-owning household has 3.7 head of horses,²² many of which are kept on small acreages with no real access to roughage from grazing. Such horses must be fed hay daily. A performance horse, for example, needs from 1.6 to 2.3 tons of hay per year, representing about 20 percent of the total annual cost of keeping such a horse.

Selecting High-Quality Roughage

Carefully select roughage to ensure maximum nutrient supply per dollar spent and to avoid purchasing inferior feed. Characteristics of good-quality roughage include (1) high leaf-to-stem ratio, (2) fresh smell and appearance, (3) cleanliness (free of weeds, dirt, trash) and (4) natural color.^{11,39}

- **Nutritive value and digestibility is affected by maturity and harvest time**

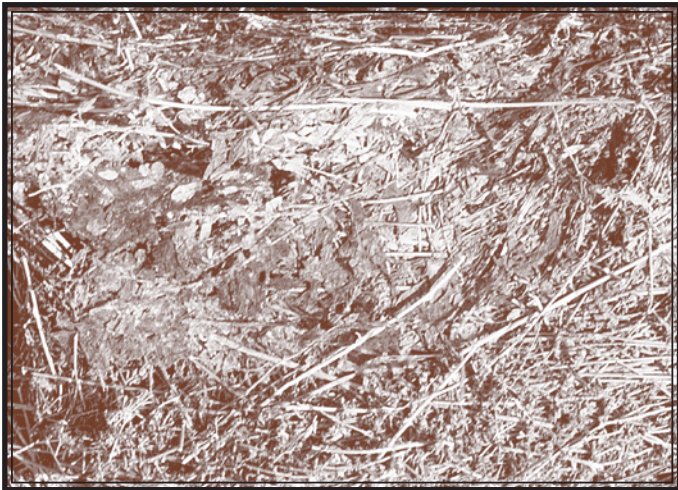
Roughage cut at a mature growth stage is very stemmy, making it significantly less digestible and nutritious. For example, overly-mature hay has higher levels of poorly-digestible crude fiber and lignin.^{13,25} Therefore, select fine-stemmed, soft, leafy hay rather than extremely stemmy, fibrous hay.² High-quality hay provides more nutrients and is less likely to cause the impaction colic sometimes associated with coarser,

lower-protein roughages.⁴⁶ Poor-quality hay increases chances for colic in horses.^{8,30}

The season in which hay is harvested also affects its quality. Forage harvested in the spring is more easily digested. Digestibility declines for hay harvested in mid-to-late summer, then rises slightly for autumn harvests.² So, all other factors being equal, hay cut in the spring will be of higher quality than hay cut in mid-or-late summer.

- **Analyze hay to determine its nutrient content.**

Although leafiness and softness are good indicators of quality, hay should be analyzed to determine its actual nutrient content. For hay purchased by weight (i.e., by the ton), a core sample should be analyzed for protein, fiber and moisture content. In most states, county Extension offices can help obtain samples and determine where to send them for quick analysis. Such analysis can verify hay quality and more accurately determine its value. Processed roughages need not be analyzed because many of them are sold with guaranteed nutrient content.



Hay quality is important. Never feed moldy hay to horses.

- **High-quality hay smells fresh, looks green, and is not moldy or dusty.**

Regardless of a particular hay's nutrient content, fresh smell and appearance are important in determining its quality. Avoid roughage with even a slight moldy or musty smell. A white or bluish, powdery appearance or excessive dust also may indicate mold. Mold easily can develop in the bottom row of stored hay bales, even those stored in barns. On round bales, the outer layer of spoiled or weathered hay may need to be removed before feeding it to horses.²⁹ If given a choice, horses that are not overly hungry often refuse to eat moldy roughage, but hungry horses will consume moldy hay, causing them health problems.

Dirt, dust and trash in roughage may indicate careless harvesting. Dirt and excessive dust can harm horses.²⁹ First-cutting hay sometimes contains higher percentages of weeds than do later cuttings but normally does not pose problems unless such hay is extremely weedy.

Hay that is bright green usually is rich in vitamins, particularly carotene (converted by horses to Vitamin A). Color also indicates harvesting conditions and length of time stored.³⁹ However, don't turn down hay simply because it is not bright green on the outside. The inside of such bales often will have good color.

Remember, after carefully selecting a load of hay, check each bale as it is fed for mold or foreign objects.

- **Watch baled hay for signs of spontaneous combustion.**

Roughage harvested at too high a moisture content not only may mold but also can produce heat. While freshly baled hay normally feels slightly warm inside the bales, those reaching 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 packed against older, dry hay.⁹

Horses' Daily Roughage Intake

Although average guidelines exist for how much roughage to feed, actual amounts needed depend on a horse's status and on the quality and type of roughage being fed. Horses without access to a good grazing source should receive roughage daily in amounts equal to about 1 percent of body weight. This amount of roughage usually will satisfy a horse's need for adequate gut fill and chewing, helping to minimize wood chewing or cribbing. To feed hay based on percentage of body weight, estimate the horse's weight. If a set of scales is not available, use the formula below to accurately estimate weight for mature horses.^{7,13}

$$\text{Weight (lbs.)} = \frac{(\text{heart girth} \times \text{heart girth}) \times \text{body length}}{330}$$

Heart girth is the distance around the horse's 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. Both measurements are taken using a cloth and are recorded in inches. Contact the Equine Science section in the Department of Animal Science for more information about this formula, as well as for formulas to be used to estimate weights for weanling and yearling horses.⁵²

Horse owners should make sure daily roughage intake does not fall below .75 percent of a horse's body weight, because inadequate roughage can make horses more susceptible to digestive problems. When no other supplemental feed is provided, daily roughage intake may need to be as high as 2.5 percent of body weight for some horses. For horses receiving supplemental feed, roughage still makes up a significant portion of daily diet.⁴⁰

Roughage can go a long way toward maintaining some classes of horses. When grazing is not available, baled or processed roughage normally represents at least 50 percent of the daily diet for broodmares, horses doing light or moderate work, and two-year-old horses (Table 1). Mature, idle horses and mares in early pregnancy but already in suitable body condition often can be maintained on daily roughage alone at 1.5 to 2.0 percent of body weight, with no supplemental concentrate needed.

Some old horses eventually reach the point where their hay consumption begins to decline, as they simply eat less hay or take much longer to consume normal quantities of hay. Condition of older horses' teeth plays a role in reduced hay consumption. Such horses may chew hay, then spit it back out, referred to as "quidding." Such conditions of old horses have prompted feed companies to develop "senior feeds,"

often in pellet or extruded form. Senior feeds contain more fiber than traditional horse feeds. Senior feeds normally contain about 16 percent crude fiber; they can be fed without hay, as part of horses' daily diet. Still, if possible, try to keep older horses eating some hay on a regular basis.

Legume Roughages

1. Alfalfa

- **Nutrient Content and Quality**

Alfalfa is the type of legume roughage most used for horse feeding. Available in many different forms, including square baled, round baled, chopped and bagged, cubed, wafered and pelleted, alfalfa can (1) meet or help meet a horses' 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.

Remember, however, that alfalfa's nutrient quality depends on its maturity at harvest (Table 2).^{39,40} Highest-quality alfalfa is that cut before it becomes overly mature.

Some horse owners like to feed alfalfa because horses usually readily eat it. Alfalfa can help promote

Table 1. Types of horses and corresponding diet proportions and expected daily feed consumption⁴⁰

Type of horse	Percent of total diet		Intake as percent of body weight		
	Roughage (%)	Concentrate (%)	Roughage	Concentrate	Total
Mature, idle horses	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	50-60	35-50	1.0-1.5	1.0-1.5	1.75-2.5

Table 2. Nutrient content of alfalfa hay and alfalfa products (as-fed basis)⁴⁰

Form or stage of maturity	Digestible energy (mcal/lb.)	Crude protein (%)	Calcium (%)	Phosphorus (%)
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

the intake of feeds that horses otherwise eat only reluctantly.⁶ Thus, alfalfa often is the preferred roughage for finicky young horses, as well as for broodmares nursing foals. In one study, yearling horses primarily selected alfalfa instead of grass hay.³⁴ Richer in nutrients than some other roughages, alfalfa is an especially good source of crude protein, fiber and calcium.¹⁹ Many farms feed a combination of grass and alfalfa hay to young, growing horses and broodmares; this is good management practice.

Although not considered protein supplements, alfalfa and processed alfalfa products contain relatively high crude protein content, on average 30 percent or more than many grass hays. Alfalfa products normally cost more than grasses on a per-pound-of-dry matter basis, but they actually may cost from 15 percent to 35 percent less than grasses on a per-pound-of-crude-protein basis.¹⁸ Thus, alfalfa actually can be a more economical source of protein than other roughages. Such economic considerations become important when planning feeding programs for young, growing horses and for broodmares, both of which need more protein than do idle or performance horses.

Alfalfa has an almost 6:1 calcium-to-phosphorus ratio; use alfalfa to adjust the inverted calcium-to-phosphorus ratios of unbalanced cereal grains and to decrease the amounts of mineral supplements needed in grain mixtures. Furthermore, because alfalfa normally contains between 20 and 28 percent crude fiber, it can be an important source of bulk.

Although none of the roughage routinely fed to horses is considered to be rich in energy, alfalfa contains more energy than most grasses. This extra energy, along with alfalfa's higher protein content, helps cause the added "bloom" many horse owners recognize when they feed alfalfa hay daily.

- **Treated Alfalfa**

To prevent mold and to increase storage life, alfalfa sometimes is treated with preservatives containing propionic and acetic acids. Although horses in one study preferred untreated hay,¹⁶ some current treatment methods produce hay that horses readily consume. Be safe when buying alfalfa, always making sure growers or suppliers know that the hay purchased will be used for feeding horses.

- **Chopped Alfalfa**

Studies indicate processed hays can be used effectively in horse feeding programs.^{12,24,32} One type of processed alfalfa, called "chopped hay," is made from long-stem hay usually chopped to ½ inch or ¾ 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 nutrient digestibility of high-quality chopped roughage to be significantly higher than that of average-quality chopped roughage.²⁰ Thus, high-quality chopped alfalfa can help provide the additional protein needed by young, growing horses and broodmares.

Horse owners with limited transportation and storage facilities find chopped and bagged alfalfa to be convenient. Some people also consider square bags of this type of alfalfa easier to haul and handle, and such bags protect feed from sunlight and from rain.

Chopped hay can be mixed with energy-dense grains such as corn or barley to regulate rate of feed intake and to add needed fiber. Horses eat grain feeds more slowly when such feeds are mixed with chopped hay,²⁷ so this feeding management practice helps feed rapid eaters more safely, possibly decreasing their chances of developing colic or founder.

Compared to oats, less than half as much processed alfalfa provides the same amount of bulkiness (fiber) to energy-dense feedstuffs like corn or barley. Chopped hay also may be mixed with cereal grains as a “total mixed ration” to be fed with no additional long-stem roughage.⁴²

Table 3 shows a total ration with 67 percent chopped alfalfa designed to be fed in wafered form. In a 30-day study, one group of horses received this ration, while another received a grain mix containing long-stem hay. The two rations yielded no differences in daily feed intake and produced no abnormal digestive behaviors. Although this study did not test for long-term changes in behavior such as wood chewing, it concluded that (1) such a chopped-alfalfa ration could be fed safely and (2) its nutritional value is comparable to that of a typical grain and hay diet.

Table 3. Total mixed ration fed in wafered form⁴²

Feedstuffs used	Percentage
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

- **Pelleted Alfalfa**

Opinions vary on using pelleted feedstuffs for horses. One limited survey indicated that a significant number of horse owners select pellets when purchasing commercial feed.²³ Pellets have several uses, provided they are composed of high-quality ingredients and are made properly. For example, pellets can be used to incorporate the fiber, protein and calcium from in alfalfa into a grain mix by using pellets (Table 4).

Feeding trials using 25 percent alfalfa in a pelleted-grain-mix have shown pellet density to be more important than pellet size.¹⁷ For example, hard, crunchy pellets are consumed more slowly than soft, crumbly pellets. Horse owners should know the exact weight of pellets fed instead of relying on coffee-can



Alfalfa pellets vary in size and usually have a guaranteed nutrient content.

Table 4. Example of herd ration (≈ 14 % crude protein) for mature horses using pelleted alfalfa (Ration may be fed to mature horses along with good-quality hay.)

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

(volume) measures. Remember that horses often consume pellets more rapidly than grain mixes.²⁸

Recent research has concluded that, compared to long-stem alfalfa, lesser amounts of alfalfa pellets can be fed, primarily because pellets usually contain higher percentages of rich leaves.⁴¹ Other research has shown pelleted alfalfa to have a nutritive-value index higher than that of long-stem hay.²⁴ Horse owners have observed that horses produce less manure when they eat pelleted alfalfa than when they eat long-stem hay; at least one feeding study has confirmed these observations.⁴¹

When feeding pellets, horse owners should evaluate their horses’ eating behaviors. 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.^{24,26,44} Horses are less likely to develop such problems when they have access to grazing or to long-stem hay.



Alfalfa cubes are one feedstuff that can be used to supplement horses on poor or limited pasture.

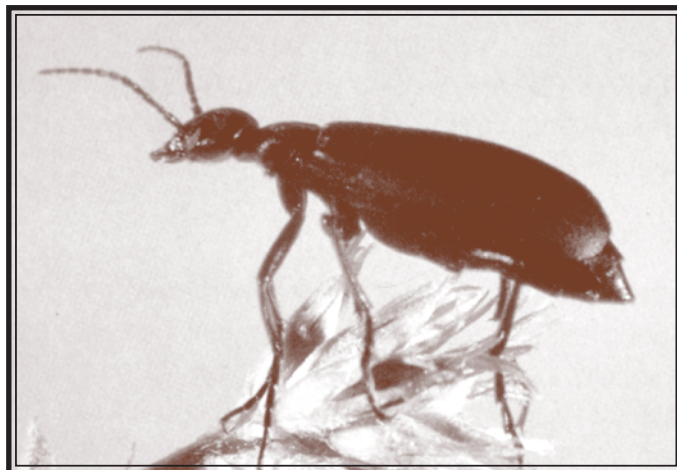
- **Alfalfa Cubes**

Cubed alfalfa can be used effectively when certain kinds of horses need supplemental feed or when conditions are less than ideal for feeding grain mixes (e.g., broodmares kept on native pasture where grass is dormant or covered with ice and snow). If fed daily at 1 percent of body weight, cubes will provide 55 percent of a pregnant mare's energy requirements (at late gestation) and 100 percent of her protein requirements. These cubes usually are large enough for mares to pick up without ingesting dirt or other foreign matter. Like pellets, cubes also can be mixed with grain-based feeds at 10 to 20 percent of the total ration to supply additional calcium and fiber. If fed at about 1.5 percent of body weight, cubes can provide all the energy and protein needed by mature, idle horses or by mares during early pregnancy.

Few cases of choking by horses fed cubed hay have been documented; studies suggest that choking usually is a problem only for horses that already have chewing problems.³² Although horses spend less time eating cubes than eating long-stem hay, habits such as wood chewing have not been observed in studies about feeding cubes.^{24,32}

- **Horse Hage**

Horse hage is a fairly new form of processed roughage developed in England and now being manufactured in the United States. It consists of chopped alfalfa vacuum-packed at a high moisture level.⁴⁰ Horse hage has a distinctive aroma and is processed to preserve its freshness over long periods. Research on horse hage is limited, but field observations indicate that horses take 2 or 3 days to adapt to this high-moisture roughage.³⁷



Blister beetles contain cantharidin, which is very toxic if horses eat dead beetles in alfalfa hay. Beetles can be black, grey, spotted or striped.

- **Insect Contamination of Alfalfa**

Blister beetles sometimes enter alfalfa fields and can end up in harvested products. The beetles contain the toxin cantharidin, which severely irritates a horse's digestive tract and often kills the animal. Although there are no guarantees, hay mowed and windrowed without conditioning rollers may be less likely to contain beetles than hay cut with a self-propelled-mower conditioner⁴. Furthermore, inspections of Midwest hay fields indicate that second, third and fourth cuttings are more likely to contain beetles than other cuttings.⁴ Many hay producers are now aware of the potential for blister beetle contamination and try to harvest alfalfa with horse owners in mind. Horse owners should talk with producers and suppliers to learn details about alfalfa offered for sale, including harvest date, method of harvest and other pertinent factors, such as field inspections throughout the harvesting process.

2. Other Legumes

Besides alfalfa, other legume hays used to feed horses include red clover, birdsfoot trefoil and lespedeza.⁴⁰



Round bales can be fed to horses if the hay is high quality. Expect some wastage due to weather and scattering.

Protein content of sun-cured red clover hay is intermediate between grasses and alfalfa, and energy level is about the same as many grasses, while its levels and ratios of both calcium and phosphorus are similar to that of alfalfa. Red clover hay often appears stemmy, and it does not possess the bright green color of other legumes. Limited studies indicate that horses are less susceptible than other livestock to problems caused by eating clover, such as slobbering. However, horses can be affected by dicoumarin present in moldy or improperly cured sweet clover.

Birdsfoot trefoil is similar to clover in protein content but higher in energy content. It often is less stemmy than red clover.^{27,40}

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

When feeding any legume roughage, horse owners should regularly monitor their horses' eating behaviors and other relevant signs. Since most legumes are higher in energy and protein than are grasses, horses eating legumes may show slight

differences in water and feed intake and in urination and defecation. Sometimes feces will be looser and greener when horses eat legumes, especially when this type of roughage is first introduced. Therefore, introducing new feedstuffs gradually over a period of several days is always a safe management practice.

Grass Hays

Grass hays and small-grain hays vary in nutritive value and palatability, depending on variety, growing area and stage of maturity at harvest. Grass hays generally provide less protein and energy than do good-quality legumes. Maximum protein content of excellent-quality grass hays may be as high as 15 percent, but it averages closer to 8 percent or less.⁴⁹ Because of their fiber content and relatively low nutrient content, grass hays usually may safely be fed "free choice" to horses. Such hays frequently are mixed with legume hays as part of daily feeding programs

Grass hays most commonly fed to horses include, among other varieties, coastal bermudagrass, timothy, prairiegrass, orchardgrass, smooth bromegrass, Kentucky bluegrass, oat hay, tall fescue and sudan-

grass. Regardless of 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.⁴⁰

1. Bermudagrass

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

Bermudagrass sometimes is blamed for impaction colic in horses¹¹; however, fertilized bermudagrass hay baled at 3- to 4-week intervals usually is easily digestible. Because a large number of horses are fed bermudagrass, many receive overly mature hay. Coastal bermudagrass hay intended for horses should be cut at a height of 15 inches for the first cutting and thereafter every 21 to 28 days for subsequent cuttings. Research has shown that good-quality bermudagrass hay is actually more digestible for horses than average-quality alfalfa hay.²⁰

2. Tifton

Tifton is a variety of bermudagrass, with Tifton 85 probably most commonly recognized. Tifton 85 has a larger leaf and a thicker stem than coastal bermudagrass.

Tifton has not been well-evaluated as a roughage source for horses, but one study showed Tifton 85's nutrient content and digestibility to be similar to that of coastal, although horses did not consume it as readily.³⁵ While Tifton maintained body weight in mature, idle horses, some horses were unable to gain any weight when fed only Tifton 85. Another study compared Tifton 44, 78 and 85 hays, all in the 10 to 11 percent crude protein range, to coastal of similar quality. When fed daily at 2 percent of body weight, digestibility was similar for all varieties.³⁸

Both consumption and digestibility are influenced by the stage of maturity at which Tifton is cut and cured for hay. If it is harvested before becoming too mature, Tifton 85 can be as good as coastal.³⁶ So, the ability of Tifton to meet a mature, idle horse's energy and protein requirements or to satisfy the daily roughage needs for other horses that also eat concentrate feeds depends on its acceptability. Note that overly mature hay will be coarse and lower in nutrient content, regardless of variety.

3. Timothy

The best quality timothy hay normally is grown in the northern United States. Relative to other grass hays, timothy has only 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 pre-bloom or early-bloom stages and frequently is grown along with a legume to increase total nutrient value of the harvested roughage.⁴⁹ As might be expected, horses seem to prefer timothy hay over native grass hays such as big bluestem or indiagrass hay.⁴³

4. Sorghum (not recommended for horses)

Sudangrass, johnsongrass and sorghum/sudan hybrids all are members of the sorghum family. Johnsongrass is a tall, rank-growing grass often regarded as a weed.¹⁰ Although Johnsongrass hay has more calcium (Table 5) than most other non-legume hays, it has little protein and is often coarse and largely unpalatable.

Sudangrass hay is similar in many respects to johnsongrass hay 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.¹⁰ 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 such problems.

Because of the potential for health problems, johnsongrass, sudangrass and sorghum/sudan hybrids are not recommended for horses.

5. Fescue (not recommended for mares in late pregnancy or during lactation)

Grown extensively in the Midwest and the Southeast, fescue hay has a reputation of being fairly unpalatable to horses, regardless of the stage at which it is harvested. Most of the fescue in Texas is found on the east side of highway I-35.

Endophyte-infected fescue can pose serious reproductive problems for broodmares, including prolonged gestations, abortions, thickened placentas and agalactia (no milk).²¹¹ Therefore, during the last 90 days of pregnancy or during lactation, mares should not be given fescue hay or allowed to graze fescue. Fescue can be tested to determine whether or not this fungus is present, and endophyte-free seed is available for reseeding new stands.

Table 5. Nutrient content of some varieties of grass hays (as fed basis)⁴⁰

Type/Harvest stage	CP (%)	DE (mcal./lb.)	Ca (%)	P (%)
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-grass 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

6. Bromegrass

Smooth bromegrass, the most common type of bromegrass fed to horses, grows extensively in the Great Plains but does not do well in the southern U.S. Best when harvested in mid-bloom stage, bromegrass is highly palatable, with a feeding value comparable to that of bermudagrass. Consequently, bromegrass is reasonably desirable as a roughage choice.²

7. Kentucky bluegrass

Popular in mideastern states, particularly Kentucky, bluegrass can provide good-quality roughage. Bluegrass hay cut prior to heading out can have protein content similar to that of good-quality alfalfa. However, because of a low yield-potential, it often is not harvested until quite mature, resulting in much lower feeding value.^{2,11} Much of the bluegrass found in pastures actually is a mixture of bluegrass and fescue.

8. Prairiegrass

Prairie hays, used mainly in the midwestern and western United States, are a mixture of native wild grasses. When these grasses are cut in early growth stages, they can provide protein in the 6 to 8 percent range. However, quality varies because of the many different types of grasses that comprise prairiegrass hay.⁴⁹ In some states, prairiegrass along road ditches and medians sometimes is baled and sold. This hay routinely contains various kinds of trash and foreign matter and is coarse and low in nutrients.

9. Matua Prairie Grass

Matua is a variety of bromegrass found in the Texas panhandle and high plains. When harvested correctly, matua appears to make hay suitable for horses. One study suggests that it may be economically feasible to grow and harvest matua hay, making it a possible roughage source in west and northwest Texas.⁴⁸

In one study, yearling horses consumed matua at dry matter levels comparable to alfalfa hay,³⁴ and they voluntarily ate more matua than coastal bermudagrass, perhaps partially because of slight differences between the two in nutrient quality and maturity. Mature geldings may use matua hay satisfactorily.⁴⁷ When round bales of matua were chopped and fed to broodmares, no adverse effects were seen.³

Like that of any other hay, nutrient content of matua will be influenced by maturity, time of harvest and other factors. Not surprisingly, matua quality is related to nutrient digestibility.⁵

10. Orchardgrass

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

11. Kleingrass (do not feed to horses)

Kleingrass has become popular along the Gulf Coast; it is the third most-widely-grown forage on improved pastures in Texas.⁵⁰ However, it is not suitable for horses.

Cattle grazing kleingrass may gain as much or more weight than cattle grazing bermudagrass,⁹ but horses grazing kleingrass do not appear to perform as well. In one study, horses offered free-choice kleingrass hay consumed only 0.29 percent of their body weight; the same horses ate 1.49 percent of their body weight when offered coastal bermudagrass hay.⁵⁰ Also, there have been indications of potential liver damage in horses eating kleingrass hay, even when hay quality is good.¹⁵

12. Bluestem

This grass grows throughout the U.S. Central Plains. The most common types of this variety 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.⁴⁹

13. Wheatgrass

Crested wheatgrass, normally grown for pasture, sometimes is used for hay in the Northern Plains. 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 rapidly decrease, and it becomes tough and fibrous.⁴⁹

14. Bahiagrass

Bahiagrass is grown widely over much of the southern Coastal Plain, primarily for grass and secondarily for hay.¹⁰ Therefore, hay usually is made only from surplus pasture growth, resulting in overly mature, poor-quality hay often unsuitable for horses. Such mature hay also can cause ergot poisoning.¹⁴ However, good-quality bahiagrass hay, cut before heading out, may be comparable in feeding value to good coastal bermudagrass hay.¹⁰ Even though it is not a preferred hay for horses, bahia has performed well in areas where erosion is a problem or in areas with frequent foot traffic.

15. Ryegrass

Ryegrass commonly is planted to provide winter grazing in the southern and southeastern United States. Ryegrass pastures have high nutrient value and produce excellent animal gains.² Excess pasture growth sometimes is cut for hay. Ryegrass can make good hay (Table 5) if it is allowed sufficient time to dry before being baled. Rye hay, however, generally is considered to be low in quality and palatability. Introduce horses gradually to ryegrass pastures, providing some dry hay as well.

16. Cereal Grasses

Cereal-grass hays are made from common cereal-grain crops. Oat hay is cut while still green, usually in the dough stage, and the oat grain remains part of the hay.¹⁰ When cut at the appropriate stage of maturity, oat hay can provide satisfactory roughage (Table 5). Field observations indicate that horses may prefer small-grain hays in this order: oats, barley, wheat and rye.²

Other Roughage Sources

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

1. Straws

Grain straws (oat, wheat or ryegrass straws) are low in palatability and feeding value for horses. Grain straws have 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 at 68 percent of total diet, it is recommended that straws comprise no more than 10 percent of the diet so that they don't severely reduce its energy content and fiber digestibility.¹¹ Research has shown that straw treated with ammonia, sodium hydroxide or acid followed by yeast inoculation is more digestible for horses than is untreated straw.³¹

2. Hulls

Both oat hulls and rice hulls are poor-quality feeds but may be used to add bulk to completely-pelleted horse diets. Like straws, hulls should be limited to 10 percent of total diet and only high-quality hulls free from dust, mold and foreign materials should be used.¹¹

Sunflower hulls have a negative feeding value for horses but will provide bulk and satisfy appetite.³³ 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.³³

Cottonseed hulls have relatively little nutritive value for horses but may be used to add fiber or bulk to the diet.¹¹ Peanut hulls are easily contaminated by aflatoxin; therefore, they are rarely fed to horses. If free of aflatoxin and dust, peanut hulls can be used as a fiber source.

3. Corn plants

Whole corn plants can be pelleted and fed to horses as an energy source, but supplemental protein, vitamins and minerals may be needed.³³ Unless they receive added protein, horses fed whole corn plants will have reduced appetites and will practice coprophagy (eating of feces).^{11,40} 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.

4. Some "Super Fibers"

The term "super fibers" refers to fiber sources that contain more energy than typical hays but less than grains. Two examples are rice bran and beet pulp. Such fiber sources are not considered as hays nor as process forms of roughage and should not be fed by themselves. They are often included in manufactured horse feeds to add fiber or, in the case of rice bran, fat. Their inclusion in horse diets should be calculated and balanced.

Summary

Careful roughage selection is critical for successful horse-feeding programs; owners can choose from a variety of roughages. Owners must consider several factors when deciding whether to use a legume, a grass or a mixture of both. These factors include availability, cost and quality of different roughages; methods used to haul and handle roughage; storage capacity available; nutrient requirements of horses; and type of concentrate or grain mix being fed. In addition, horse owners should be aware of potential health hazards related to some roughages (Table 6).

Taking time to select top-quality roughage and continually monitoring horses' consumption patterns can assure owners that their horses are receiving the best diets possible.

Table 6. Forage-related disorders and poisonous plants

Forage-Related Disorders			
Forage	Agent or compound	Cause	Manifestation
Fescue	endophyte fungus	present in seed	thickened placenta, prolonged gestation, foal death, agalactia
Kleingrass	unknown	photosensitization	liver damage
Alfalfa	cantharidin	blister beetle	digestive tract
Sweet Clover	dicoumarin	improper curing of hay	reduced palatability, reduced intake, reduced performance
Foxtail Millet Russian Millet German 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

Some Poisonous Plants		
Ornamental shrubs	Black locust	Perilla mint
Night shades	Braken fern	Pokeweed
Locoweed	Castorbean	Jimsonweed
Pearine	Oleander	Horsechestnut

For detailed information on poisonous plants, see *Toxic Plants of Texas*, available for purchase from Texas Cooperative Extension.

Acknowledgements.....

Special thanks to Dr. Karen Davison, former Extension associate, for her assistance in developing much of this information for the first edition of this publication.

References.....

1. Aiken, G.E., G.D. Potter, B.E. Conrad and J.W. Evans. 1987. Voluntary intake and digestion of coastal bermudagrass hay in yearling and mature horses. In: *Proceedings of the 10th Equine Nutrition and Physiology Society*. pp. 73-76.
2. Ball, D.M., C.S. Hoveland and G.D. Lacefield. 1991. *Southern forages*. Potash and phosphate Institute and Foundation for Agronomic Research. Norcross, Georgia.
3. Ball, K.A., H.A. Brady, V.G. Allen, K.R. Pond, M.L. Galyean, L.A. Janeka and N.L. Henniger. 1999. Matua hay for mares in gestation and lactation. In: *Proceedings of the 16th Equine Nutrition and Physiology Society*. p. 9.
4. Bauernfeind, R.J., R.A. Higgins, S.L. Blodgett and L.D. Breeden. 1990. *Blister beetles in alfalfa*. MF959. Kansas Cooperative Extension Service.
5. Box, A.C., L.A. Baker, J.L. Pipkin and J.C. Halliburton. 2001. The digestibility and mineral availability of matua grass hay in mature horse. In: *Proceedings of the 17th Equine Nutrition and Physiology Society*. p. 53.
6. Burton, J.H., D.J. Price and J. Aspinall. 1983. The ability of feed flavors to mask anthelmintic drugs in horse diets. In: *Proceedings of the 8th Equine Nutrition and Physiology Society*. pp. 27-32.
7. Carroll, C.L. and P.J. Huntington. 1988. Body condition scoring and weight estimation of horses. *Equine Veterinary Journal*. 20:41-45.
8. Cohen, H.D., P.G. Gibbs and A.M. Woods. 1999. Dietary and other management factors associated with colic in horses. *Journal of Veterinary Medical Association*. 215:1. p. 53.
9. Conrad, B.E. 1976. *Forages and animal production systems for south Texas*. No. RM-GC. Texas Agricultural Experiment Station.

10. Cullison, A. 1975. *Feeds and Feeding*. Reston, Virginia: Reston Publishing Co., Inc.
11. Cunha, J.J. 1991. *Horse Feeding and Nutrition. 2nd Edition*. San Diego: Academic Press, Inc.
12. Cymbaluk, N.F. and D.A. Christensen. 1986. Nutrient utilization of pelleted and unpelleted forages by ponies. *Canadian Journal of Animal Science*. 66:237.
13. Darlington, J.M. and T.V. Hershberger. 1968. Effect of maturity on digestibility, intake and nutritive value of alfalfa, timothy and orchardgrass by equines. *Journal of Animal Science*. 27:1572.
14. Dorsett, D.J. 1986. *Forage species for Texas*. L-2205. Texas Agricultural Extension Service.
15. Dorsett, D.J. and D. D. Householder. 1986. *Horse pastures for Texas*. B-1542. Texas Agricultural Extension Service.
16. Dunn, E.L., C.V. Freitas, M.L. Norris, T.L. Saunders and C.A. Walker. 1993. Acceptable of hay treated with buffered proponic and preservative for horses. In: *Proceedings of the 13th Equine Nutrition and Physiology Society*. p. 103
17. Freeman, D.W., D.L. Wall and D.R. Topliff. 1990. Intake response of horses consuming a concentrate varying in pellet size. *The Professional Animal Scientist*. 6:3. pp. 10-12.
18. Freeman, D.W. and L. Rommann. 1989. *Use of forages for horses*. No. 3980. Oklahoma Cooperative Extension Service.
19. Fonnesbeck, P.V., R.K. Lydman, G.W. VanderNoot and L.D. Symons. 1967. Digestibility of the proximate nutrients of forage by horses. *Journal of Animal Science*. 26:1039.
20. Gibbs, P.G., G.D. Potter, G.T. Schelling, J.L. Kreider and C.L. Boyd. 1988. Digestion of hay protein in different segments of the equine digestive tract. *Journal of Animal Science*. 66:400-406.
21. Gibbs, P.G. and N.D. Cohen. 2001. Early management of race-bred weanlings and yearlings on farms. *Journal of Equine Veterinary Science*. p. 279.
22. Gibbs, P.G., G.D. Potter, C.L. Jones, M.R. Benefield, J.W. McNeill, B.H. Johnson and B. Moyer. 1998. *Report on the Texas Horse Industry*. Department of Animal Science. Texas A&M University.
23. Gibbs, P.G. 1990. *A Texas Grain Sorghum Producers' Association survey of horse owner feeding practices*. College Station, Texas.
24. Haenlein, C.F., R.D. Holdren and Y.M. Yoon. 1966. Comparative response of horses and sheep to different physical forms of alfalfa hay. *Journal of Animal Science*. 25:740.

25. Harbers, L.H. and W.H. Smith. 1981. Digestibility of three grass hays by the horse and scanning electron microscopy of undigested leaf remnants. *Journal of Animal Science*. 53:1671.
26. Hintz, H.F. and R.G. Loy. 1966. Effects of pelleting on the nutritive value of horse rations. *Journal of Animal Science*. 25:1059.
27. Hintz, H.F. 1983. *Horse Nutrition-A Practical Guide*. New York: Arco Publishing.
28. Hintz, H.F., J. Scott, L.V. Soderholm and J. Williams. 1985. Extruded feeds for horses. In: *Proceedings of the 9th Equine Nutrition and Physiology Society*. pp. 174-176.
29. Horne, C.W. et al. 1989. *Mycotoxins in feed and food-producing crops*. B-1279. Texas Agricultural Extension Service.
30. Hudson, J.M., N.D. Cohen, P.G. Gibbs and J.A. Thompson. 2001. Feeding practices associated with colic in horses. *Journal of American Veterinary Medical Association*. 219:10. p. 1419
31. Israilides, C.J., A.W. Anderson and D.W. Holtar. 1981. Microbial enhancement of acid treated and fermented ryegrass straw for ponies. In: *Proceedings of the 7th Equine Nutrition and Physiology Society*. pp. 10-12.
32. Jackson, S.A., V.A. Rich, S.L. Ralston and E.W. Anderson. 1985. Feeding behavior and feed efficiency of horses as affected by feeding frequency and physical form of hay. In: *Proceedings of the 9th Equine Nutrition and Physiology Society*. pp. 78-83.
33. Jordon, R.M. and G. Kosmo. 1979. Relative value of sunflower hulls, pelleted corn plant and soybean hulls for ponies. In: *Proceedings of the 6th Equine Nutrition and Physiology Society*. pp. 77-83.
34. LaCasha, P.A., H.A. Brady, V.G. Allen, C.R. Richardson and K.R. Pond. 1997. Voluntary intake, digestibility and selection of matua prairie grass, coastal bermuda grass and alfalfa hay by yearling horses. In: *Proceedings of the 15th Equine Nutrition and Physiology Society*. p. 9.
35. Lieb, S. and P. Mislevy. 2001. Comparative intake and nutrient digestibility of three grass forages: Florakirk and Tifton 85 bermudagrass and florona stargrass to coastal bermudagrass fed to horses. In: *Proceedings of the 17th Equine Nutrition and Physiology Society*. p. 390.
36. Lieb, S. and P. Mislevy. 2003. Comparative nutrient digestibility of the grass forages: Florakirk and Tifton 85 bermudagrass and florona stargrass to coastal bermudagrass fed to horses, trial 2. In: *Proceedings of the 18th Equine Nutrition and Physiology Society*. p. 324.
37. Masters, D. 1991. (personal communication) The Great Hage Texas, Inc.
38. McCann, J.S., G.L. Heusner and G. Burton. 1995. Digestibility comparison of four bermudagrass cultivars in mature horses. In: *Proceedings of the 14th Equine Nutrition and Physiology Society*. p. 84.

39. Novasod, A.C. and K.L. Smith. 1979. *Hay judging guidelines*. D-1079. Texas Agricultural Extension Service.
40. N.R.C. 1989. Nutrient requirements of horses. *Nutrient Requirements of Domestic Animals. 5th Revised Edition*. Washington, D.C.: National Academy Press.
41. Pagan, J.D. and S.G. Jackson. 1991. Digestibility of longstem alfalfa, pelleted alfalfa or an alfalfa/bermuda straw blend pellet in horses. In: *Proceedings of the 12th Equine Nutrition and Physiology Society*. pp. 29-32.
42. Pipkin, J.L., L.J. Yoss, C.R. Richardson, C.F. Triplitt, D.E. Parr and J.V. Pipkin. 1991. Total mixed ration for horses. In: *Proceedings of the 12th Equine Nutrition and Physiology Society*. pp. 55-56.
43. Reinowski, A.R., R.J. Coleman, and L. White. 2003. Preference selection of big bluestem, indian grass and timothy grass hays by mature horses. In: *Proceedings of the 18th Equine Nutrition and Physiology Society*. p. 308.
44. Schurg, W.A., D.L. Frei, P.R. Cheeke and D.W. Holtan. 1977. Utilization of whole corn plant pellets by horses and rabbits. *Journal of Animal Science*. 45:1317.
45. Schurg, W.A. 1981. Alternative roughage utilization by horses. I. Evaluation of untreated and sodium hydroxide treated wheat straw in horse diets. In: *Proceedings of the 7th Equine Nutrition and Physiology Society*. pp. 8-9.
46. Scrutchfield, L. 1982. An overview of colic in the horse. In: *Proceedings of the Horse Production Short Course*. Texas A&M University. College Station, Tx.
47. Sturgeon, L.S., L.A. Baker, J.L. Pipkin, J.C. Halliburton and N.K. Chirase. 1999. The digestibility and mineral availability of matua, bermudagrass and alfalfa hay in mature horses. In: *Proceedings of the 16th Equine Nutrition and Physiology Society*. p. 1
48. Tyson, T.K., L.A. Baker, J.E. Mehlorn, J.L. Pipkin and R.C. Bachman. 2001. An economic evaluation of producing matua grass hay as an alternative forage for horses in the high plains of Texas. In: *Proceedings of the 17th Equine Nutrition and Physiology Society*. p. 101.
49. Wagoner, D.M. 1973. *Feeding to Win*. Grapevine, Texas: Equine Research Publications.
50. Webb, G.W., M.A. Hussey, B.E. Conrad and G.D. Potter. 1989. Growth of yearling horses grazing kleingrass or bermudagrass pastures. In: *Proceedings of the 11th Equine Nutrition and Physiology Society*. pp. 267-272.
51. Younglove, G.A., P.G. Gibbs, G.D. Potter, M. Murray-Gerzik and D.J. Dorsett. 1994. Comparative feeding value of a cubed alfalfa: corn plant product as an exclusive diet for exercising horses. *Journal of Equine Science*. p. 598
52. Wilson, K.R., P.G. Gibbs, D. D. Potter, E.M. Michael and B.D. Scott. 2003. Comparison of different body weight estimation methods to actual weight of horses. In: *Proceedings of 18th Equine Nutrition and Physiology Society*. p. 238.

Protect Your Horses

Horse Theft Awareness and Prevention

- Consider permanent identification with brands, microchips or lip tattoos.
- Record permanent marks or brands with the county clerk in the county where the horses live.
- Keep on hand current photographs or video footage of weanlings, yearlings and two-year-olds. Be sure photos or video include any unique marks, brands, color patterns or other distinguishing characteristics.
- Establish an organized proof-of-ownership file with photos, registration information, health papers and any other supporting information.
- Secure barns, corrals or pens from the road with a good perimeter fence.
- Use well-built gates that cannot be lifted off the hinges and that can be locked.
- Feed pastured horses well away from the gate or road, because horses will congregate around feeding areas and be easier to catch.
- Check on pastured horses regularly. Keep up activity levels and consider establishing a horse/facilities watch program with others in your area.
- Do not leave halters on pastured horses, particularly young, growing horses.
- Do not leave halters hanging where they can be used by somebody else, and lock up expensive tack.
- Secure hitches on horse trailers or hide trailers from public view, making them harder to see and even harder to steal.
- Post warning signs on pasture gates and fences where appropriate.

Contact Texas Cooperative Extension for the following information on horse theft awareness and prevention:

L-5210 – *Fifteen steps to minimize theft of horses and equipment*

L-5211 – *Permanent identification of horses*

L-5244 – *What to do if your horse is stolen*

Video Tape – *Horse Theft Protection*

All printed and video material related to horse theft awareness is free to horse owners in Texas. Contact your local county Extension office, or the Extension Horse Specialists, Kleberg 249, TAMU 2471, College Station, Texas 77843. Printed material also is available at <http://animalscience.tamu.edu>

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Texas AgriLife Extension Service is implied.

Produced by AgriLife Communications and Marketing, The Texas A&M University System
Extension publications can be found on the Web at: <http://AgriLifeBookstore.org>.
Visit Texas AgriLife Extension Service at <http://AgriLifeExtension.tamu.edu>.

Educational programs of the Texas AgriLife Extension Service are open to all people without regard to race, color, sex, disability, religion, age, or national origin.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Edward G. Smith, Director, Texas AgriLife Extension Service, The Texas A&M University System.

12M, New