

A Practical Guide to Horse Pasture Management in Virginia



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An Introduction to Horse Pasture Management

Horses are natural grazing animals and the importance of well managed pastures offering quality forage cannot be overstated. Quality pasture can meet the nutritional needs and exercise requirements of many classes of horses nearly year round in Virginia. These benefits for the horse and ultimately the horse owner can be realized through a combination of grazing management, forage selection, soil fertility management and knowledge of forage species and their effects. Astutely managed pasture can provide an economical and versatile home for your horses, often with minimal nutritional supplementation or facilities.

For most classes of horses, the goal for the horse owner should be to offer feed that meets the nutritional maintenance requirements for the horse or pony and allows them to maintain a healthy body condition. Quality pasture will meet these requirements for most of the year. The exception to this is when considering the nutritional requirements of lactating mares, growing and yearling foals and work or performance horses that require a higher caloric intake to meet daily energy demands. These horses will often require nutritional supplementation in the form of grain and minerals, but they are often the exception and not the rule. Many horses tend to be easy keepers and excessive caloric intake by over feeding and unnecessary supplementation will increase the chances of those horses developing metabolic disorders related to excessive body condition.

Poor quality pastures that are not meeting the nutritional requirements for the animal can cause a loss in body condition. Invasive and sometimes toxic plant species are opportunistic and thrive in poorly managed pastures when forages become thin and soil fertility becomes poor. Similarly, pastures that are too high in quality may require additional management for easy keeping horses such as dry lot and grazing muzzle use. Additionally, using sound pasture management techniques can lower or even eliminate internal parasite issues on horse farms.

This publication discusses basic nutritional needs of horses, proper pasture management, forage species and potentially toxic plant species commonly found in Virginia pastures. To develop a pasture management plan specific to your farm contact your local Extension Office (www.ext.vt.edu).

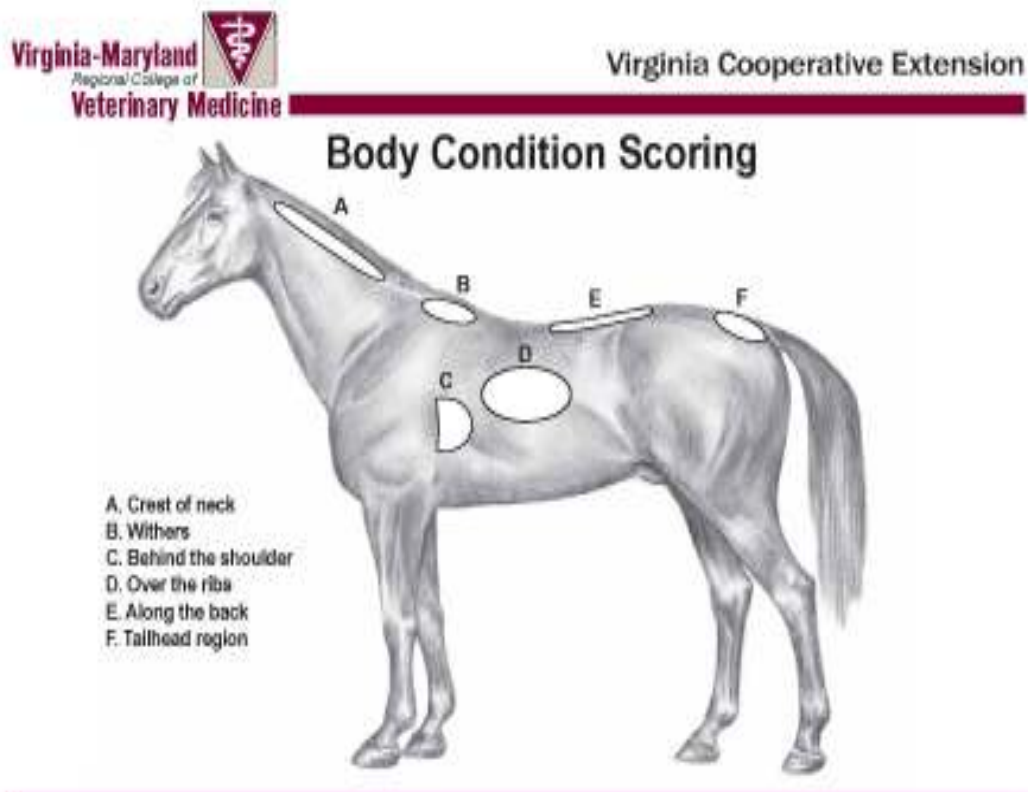
Basic Horse Nutrition and Feeding

Nutritional Needs of Horses

By and large, many horses are kept primarily as recreational animals and their work or performance nutritional requirements are quite minimal. Most pleasure horses in Virginia meet their energy, protein, vitamin and mineral needs on pasture and hay alone provided they have access to free-choice water and salt. The exceptions to this rule are horses in heavy work, growth or lactation that may require additional supplementation.

Horses require 1.5% to 3% of their body weight (BWT) intake per day to meet their nutritional needs. For a 1000 pound horse this equates to 15 to 30 pounds of intake on a dry matter basis. Remember that pasture is approximately 80% water and 20% dry matter; hay is 15% water and 85% dry matter. Horses are naturally grazing animals and the large majority of that intake should be forage based (pasture and/or hay) to provide the necessary fiber they need for good digestive health.

Unlike cattle and other production livestock species, a horse's nutritional needs vary tremendously by breed and activity level. For instance, a racing Thoroughbred will have much higher nutritional needs than a Quarter Horse used for weekend trail riding. So how do you know how much forage your horse needs? The easiest and most accurate way to make feeding decisions is to determine and monitor their body condition score. Then adjust feed intake to reach a body condition score of 4 to 6.





Description of Body Condition Scores (Scores 1-9)

1. **Poor:** Horse is extremely emaciated. Backbone, ribs, hipbones, and tailhead project prominently. Bone structure of the withers, shoulders, and neck are prominent. No fatty tissues can be felt.
2. **Very Thin:** Horse is emaciated. Slight fat covering over vertebrae. Backbone, ribs, tailhead, and hipbones are prominent. Withers, shoulders, and neck structures are discernible.
3. **Thin:** Fat built up about halfway on vertebrae. Slight fat layer can be felt over ribs, but ribs easily seen. The tailhead is prominent, but individual vertebrae cannot be seen. The hipbones, withers, shoulders, and neck structures are faintly discernable.
4. **Moderately Thin:** Slight ridge along back. Faint outline of ribs can be seen. Fat can be felt around tailhead. Hip bones not obviously discernable. Withers, neck, and shoulders not obviously thin.
5. **Moderate:** Back is level. Ribs can be easily felt, but not seen. Fat around tailhead beginning to feel spongy. Withers are rounded and shoulders and neck blend smoothly into the body.
6. **Moderately Fleishy:** May have a slight crease down the back. Fat around the tailhead feels soft. Fat over the ribs feels spongy. Fat beginning to be deposited along the sides of the withers, behind the shoulders, and in the crest of the neck.
7. **Fleishy:** May have a crease down the back. Individual ribs can be felt, but noticeable fat deposition over the ribs. Fat around tailhead is soft. Noticeable fat deposited along the withers, behind the shoulders, and in the crest of the neck.
8. **Fat:** Crease down the back is prominent. Ribs difficult to feel. Fat around tailhead prominent. Area along withers filled with fat. Area behind shoulders filled with fat. Prominent crest of neck. Fat deposited along the inner buttocks.
9. **Extremely Fat:** Obvious crease down back. Fat is in patches over rib area, with bulging fat over tailhead, withers, neck, and behind shoulders. Very prominent crest of neck. Fat along inner buttocks may rub together. Flank is filled in flush with the barrel of the body.



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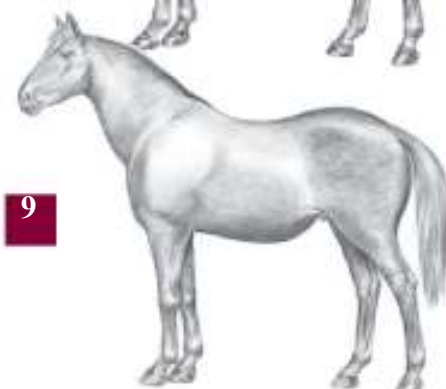
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Selecting Quality Hay for Horses

Text taken from

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Introduction

Many horse owners select hay for their horses based on what they think looks good or on what they have been told is good. Opinions vary all the way from believing that timothy is an essential part of every horse ration to that which insists on alfalfa for all horses. Forage should be the foundation of every horse ration. The quality of that forage, the composition of the hay, and the way the hay is delivered to the horse are all fundamental for good horse feeding.

Horses are herbivores, animals made to live primarily on plants (forages). About 65 percent of the digestive capacity of the horse is in the lower gut, or the cecum and colon. The cecum and colon contain large microbial populations which allow for the digestion of fibrous feeds, much like the digestive tracts of cattle and sheep (ruminants). Evidenced by the size of the lower gut and the presence of bacteria, the horse is designed to digest primarily forages. Horses have fewer digestive upsets and behavioral vices, such as wood chewing and cribbing, when hay is the main portion of the ration.

For proper digestive tract function, horses require a minimum of 1 percent of their body weight per day in long-stem dry matter. This can be done in any form that is convenient and economical. When the total ration particle size is below 1 inch in size, problems with rate of passage, digestibility, and behavioral vices occur.

Forages are most healthfully offered as pasture during the growing season. Conditions such as limited acreage, low productive pastures, seasonal rainfall variations, and the need to house horses separately or indoors restricts the ability to utilize pasture and necessitates the feeding of hay as the primary forage. In order for pasture to provide the majority of the nutrients for a horse, at least two acres should be allocated per horse.

Under most situations, rations are more economical when based primarily on hay rather than on concentrate mixtures to provide the bulk of the nutrients. The horse requires an absolute amount of specific nutrients per day, regardless of the feedstuff. The value of hay is determined by the composition of nutrients in the hay rather than the hay's appearance. The closer the nutrient composition of the hay matches the requirements of the horse being fed, the fewer supplements needed and the more economical the total ration.

Forage Quality

Forage quality is an expression of the characteristics affecting consumption, nutritive value, and resulting horse health and performance. Even though many factors affect forage quality, no single factor, including color, can be used to make predictions. Maturity stage at harvest, forage species and variety, leafiness, harvest and storage conditions, and the presence of foreign objects, weeds, and pests are all important factors affecting quality. A closer examination helps the horse manager economically select the best hay for their situation.

Color

The vitamin A precursor in plants is greater when hay is green. A beige color is an indication of sub-bleaching and leaching of nutrients by rainfall that occurred after harvest. Color is a poor indicator of forage quality as bright green weeds may have lower nutrient composition than brown alfalfa.

Maturity

Plant maturity is visually determined by the amount of seed heads of grasses or the flowers of legumes present at the time of harvest. Forages in the vegetative stage will not have visible seedheads or flowers. As plants progress through seedhead and flower bud emergence, pollination, and seed formation, the concentration of structural carbohydrates and lignin increases and crude protein decreases. The structural carbohydrates, cellulose, and hemicellulose are partially digested by the bacteria in the horse's lower gut, but lignin, another component of plant fiber, is not digested at all. As lignin increases one percent, the digestibility of the forage dry matter decreases three to four percent.

Forage digestibility is indirectly measured by determining the level of acid detergent fiber (ADF) in the hay. As the plant matures, ADF (cellulose and lignin) increases, and digestibility decreases. Neutral detergent fiber (NDF), a measure of cell wall content, increases as the plant matures and is an indirect measure of how readily a forage is consumed.

Immature hay is more easily digested by the horse (lower ADF percent) and more readily consumed (lower NDF percent), thus it is worth more to the horse owner. The maturity of the plant is not related to a particular cutting, but rather to the stage of maturity of the plant when cut.

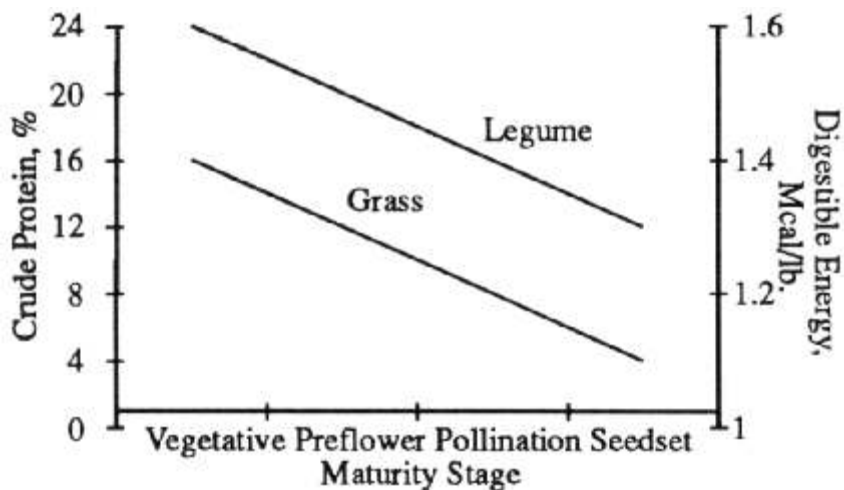


Figure 1. Maturity effect on the crude protein and digestible energy of legume and grass hays.

Species and Variety

Hay composition is highly affected by the species of forage present in the hay. Grass hays include the cool-season species of timothy, smooth brome grass, orchardgrass, tall fescue, and redtop. Commonly used legumes include alfalfa and red clover, and occasionally lespedeza and birdsfoot trefoil. Legumes are usually higher in protein and calcium than the grasses, but may not be much different in energy (Megacalories per pound) or phosphorus levels (see Table 1).

Table 1. Typical composition of mid-bloom legume and grass hays.

Forage type	Digestible Energy		% CP		%Ca	%P	Vit A
	Mcal/lb						IU/lb.*
Legume, mid-bloom	.94		17		1.24	.22	19,090
Grass, mid-bloom	.80	8.6	.43	.20	8,620		
Mixed-50/50	.87	12.8	.83	.21	13,855		

*International units per pound.

Some types of hay bring with them potential feeding problems. Moldy sweet clover hay can contain high levels of dicoumerol, an anticoagulant, produced by the action of molds on coumerol, a natural component of sweet clover. Dicoumerol ties up Vitamin K and causes the blood not to clot.

Broodmares consuming tall fescue that is infected with the endophytic (within plant) fungus can result in prolonged gestations, thickened placentas at birth, aglactia (lack of milk production), and dystocia (difficult birth). The endophyte is in the seed, stem, and leaf sheath but not leaf blades. Thus, second and third cuttings of hay should be of less concern (less than 5 percent infection). Low-endophyte varieties of tall fescue are available. For gestating mares, it is best to use low-endophyte varieties of fescue mixed with a legume.

When selecting hay, compare the needs of the horse with the nutrient content of the hay. Horses being maintained, mares in the first two-thirds of gestation, and mature horses working at light or moderate levels can do nicely on immature grass hay. Young foals and mares in the first three months of lactation can benefit by the best legume hay available. A grass/legume hay is recommended for most horses; however, hay can vary widely in nutrient compositions.

Leafiness

Leaves contain more nonstructural (digestible) carbohydrates and protein than stems. Nonstructural carbohydrates, which include plant sugars and starches, are highly digestible. When forage plants mature, the leaf to stem ratio decreases. Hay baled at ideal moisture levels (17 to 20 percent) has more leaves because fewer shattered and fell off when the forage was too dry or became moldy if the forage was too wet. Leaf diseases can cause premature leaf drop and reduce the leaf to stem ratio. Alfalfa weevil, an insect that feeds upon alfalfa leaves, lowers the leaf content. Forages with greater amounts of leaves are higher in quality.

Presence of Pests or Foreign Matter

Insects and some weeds are responsible for reduced forage quality. The insects most responsible for problems to horses are blister beetles. These beetles contain a toxin called cantharidin that is severely irritating to the gastrointestinal and urinary tracts. Usually this is only a problem in arid, droughty conditions and in years following heavy grasshopper infestations. Use of a mower-conditioner has made the blister beetle a greater concern because the crushed beetles are retained in the windrow. Be sure to examine hay carefully, especially if it is from an area with dry climatic conditions. Ideally, walk the fields of hay that you intend to use for horses before you harvest the hay or commit to purchase.

Some weeds present no problem to the horse, but other weeds when present in significant quantity can be very toxic or can reduce forage quality. Hay also should be inspected for the presence of other foreign matter such as wire or nails and the presence of dust or molds. A musty odor indicates that the hay was put up too moist which allowed molds to grow. Horses are especially sensitive to dust and molds as they can result in respiratory health problems.

Forms of Harvested Forage

Forage is an important part of a horse's diet, not only as an economical source of nutrients, but to maintain normal digestive health in the horse. The presence of material of one inch in particle size is important to minimize colic and digestive upsets, and abnormal behavior. Forage can be safely provided in a wide variety of forms.

Square bales. Small (40-80 lb.), square bales of hay are most commonly used in the horse industry. Horse owners can easily handle these bales, and storage is flexible. Bales should be stored under a cover in a way to minimize heat generation and weather damage.

Big round bales. These 800-1200 lb. rolled bales of hay can save great amounts of labor and can efficiently be used in drylots with large numbers of horses. Indoor storage or keeping the bales on a well-drained base, such as crushed rock, and wrapped with plastic is the key to success with big bales. Use a feeder that keeps the hay contained and controls wastage. Make certain there are enough horses to consume the entire bale so waste does not occur.

Hay cubes. Normally, hay cubes are 2 inch by 2 inch cubes and made from coarsely chopped hay. Cubes can be made from a variety of hay types and can be bagged and purchased with a composition guarantee on the bag. Storage and handling ease, and decreased wastage are advantages that may offset the increase in purchase price. Cubes made from coarsely chopped (>.5 in.) hay appear to provide adequate particle size to eliminate wood chewing. Caution should be used when adapting horses to cubes. They may gulp, or bolt, hay cubes quickly and choke.

Pellets. When fed as the sole feedstuff, pellets do not provide adequate particle size to maintain normal digestive health and behavior in horses. When hay or hay and concentrate are ground and then pelleted, horses chew wood, trees, and tails. Horses have an increased rate of passage; consequently, they feel less full, and eat more total pounds of feed. These negative effects can be overcome by feeding 1 percent of the horse's body weight per day in long-stem hay along with any pelleted concentrate mixture or complete feed.

Methods of Forage Testing

Near Infrared Reflectance Spectroscopy (NIRS) is a quicker and less expensive method to determine the major chemical constituents in forages. The major organic components of forage have specific absorption characteristics in the near-infrared region of the spectrum that make their identification and measurement possible through mathematical relationships. The forage can be analyzed in less than ten minutes. NIRS is the method of estimating composition that is accurate and has the shortest turn-around time.

Taking a Representative Sample

Taking a representative sample is essential if forage testing is to be of value. The samples must be taken at the right time and from locations representing the hay being analyzed. The proper time to sample forages is as near as possible to the planned time of feeding. One week for NIRS analysis and three weeks for chemical analysis should be allowed.

A bale probe or core should be used to collect samples in square bales or big round bales. The probe should be 12 to 18 inches long, hollow and at least 3/8 inch in diameter. Most probes attach to an electric drill or brace. Many feed companies and Cooperative Extension Service Offices can help locate probes, assist in preparing the sample, and provide a list of labs. A minimum of 20 average looking conventional square bales or ten big round bales should be used. Take one core drilling from the end of each square bale, place drillings in a clean plastic bucket, thoroughly mix drillings from all 20 bales together, put one quart in a plastic bag and send to a laboratory. If a bale probe is not available, reach into each bale and carefully remove a handful of forage. Cut up with shears and send to a lab. If there are several lots of hay from different fields, cuttings, or sources, then each lot should be sampled and submitted separately.

Interpreting the Analysis Report

The type of analysis will vary depending on what specific nutrient compositions are needed. Often horse managers need to know the levels of trace minerals or vitamins and only a chemical analysis provides that information.

The report will provide the horse owner with the percent Crude Protein (CP), Dry Matter (DM), Calcium (Ca), Potassium (K), and Phosphorus (P), Acid Detergent Fiber (ADF), Neutral Detergent Fiber (NDF), and Relative Feeding Value (RFV). Dry matter measures the amount of water in a sample and is subtracted from 100. Most hays will be about 90 percent dry matter.

Crude protein indicates only the level of amino acids and total nitrogen in the forage. It is not a good predictor of energy availability in the hay. Crude protein is not likely to be limiting except in lactating mares and growing foals. Levels of Ca, P, and K indicate the percent of these minerals in the forage. These can vary greatly and levels in the forage should determine the minerals needed in the concentrate mixture.

ADF is composed of cellulose, lignin, and other poorly digested components. The lower the ADF value, the more digestible the nutrients in the hay. Levels above 45 percent are of little nutritional value and samples with less than 31 percent ADF are excellent. The higher the percent NDF, the less the horses will consume. NDF levels below 40 are excellent and those above 65 will likely not be eaten by most horses. A high relative feeding value (RFV) reflects higher quality, greater intake, higher digestibility, and fewer concentrates needed to supplement the diet. When buying horse hay, RFV should be a prime consideration.

Table 2. Quality standards from Hay Market Task Force of American Forage and Grassland Council for hay.

Quality Standard ¹	Analysis					
	CP	ADF	NDF	DDM ² %	DMI ³ % of BW	RFV
Prime	>19	<31	<40	>65	>3.0	>151
1	17-19	31-35	40-46	62-65	3.0-2.6	151-125
2	14-16	36-40	47-53	58-61	2.5-2.3	124-103
3	11-13	41-42	54-60	56-57	2.2-2.0	102-87
4	8-10	43-45	61-65	53-55	1.9-1.8	86-75
5	<8	>45	>65	<53	<1.8	<75

¹ Dry matter digestibility (DDM, %) = 88.9 - 0.779 ADF (% of DM).

² Dry matter intake (DMI, % of body weight) = 120/NDF (% of DM).

³ Relative feed value (RFV) = (DDM x DMI)/1.29

Storage Conditions

Hay should be kept out of the weather and on a dry surface. Do not store hay directly on concrete indefinitely as moisture can be absorbed through the floor. The sun can bleach the outer edges, and the hay will lose color and some Vitamin A (carotene) but can be stored indoors under good conditions indefinitely without losing significant nutrient content. Hay takes a lot of space to store (about 200 cubic feet per ton). If an 1100-pound riding horse is going to eat two percent of its body weight per day as forage for nine months, it will eat three tons of hay which will take up 600 cubic feet of storage space. This is about the same as a 10 foot by 10 foot stall that is 7 feet high. If hay with excessive moisture is packaged and stored, mold may develop. Mold producing organisms generate heat through respiration and reduce hay quality dry matter digestibility. The mold spores can certainly create a respiratory problem or aggravate existing heave problems. Another problem is spontaneous combustion which can occur when storing hay at moisture levels greater than 20 percent. The heat created from hay being put into a stack can get hot enough to cause spontaneous combustion and burn the hay and/or barn.

Conclusion

Meeting the requirements and maintaining the horse's health as economically as possible are the primary objectives on which horses feeding programs should be based. Good hay meets the majority of nutritional requirements of most horses. In fact, horses are healthier when fed predominantly forage. Usually forages are cheaper sources of nutrients than concentrates. If additional assistance is desired to select hay, to sample hay for composition analysis, or to balance a horse's ration, contact the Cooperative Extension Agricultural agent in your area.

Sample Hay Analysis

CUMBERLAND VALLEY ANALYTICAL SERVICES, INC.
 PO Box 669 Maugansville, MD 21767 301-790-1980

November 13, 2006
 Sample No : 6451190

N I R A N A L Y S I S R E S U L T S				
MMG	As Sampled	Dry Matter	Unit	Range
Moisture	13.8		%	
Dry Matter	86.2		%	82.2 - 87.0
Crude Protein	7.1	8.3	% DM	12.8 - 16.2
Available Protein	6.3	7.3	% DM	
Unavailable Protein	0.9	1.0	% DM	1.2 - 1.7
Neutral Det. Crude Protein	4.0	4.6	% DM	3.5 - 4.7
Adjusted Protein	7.0	8.1	% DM	
Soluble Protein		32.4	% CP	
Degradable Protein (calc.)		66.2	% CP	
TDN	59.3	68.8	% DM	57.8 - 62.3
Net Energy Lactation	0.61	0.71	Mcal/lb	0.55 - 0.62
Net Energy Maintenance	0.62	0.72	Mcal/lb	0.56 - 0.63
Net Energy Gain	0.39	0.45	Mcal/lb	0.30 - 0.37
Acid Detergent Fiber	26.1	30.3	% DM	35.3 - 40.2
Neutral Detergent Fiber	44.7	51.9	% DM	55.9 - 61.4
Lignin	3.5	4.0	% DM	5.3 - 6.6
Lignin / NDF Ratio		7.7		
Crude Fat	2.7	3.2	% DM	2.1 - 2.7
Ash	4.8	5.6	% DM	7.0 - 10.0
Starch	5.2	6.1	% DM	7.9 - 17.9
Sugar	9.3	10.8	% DM	
NFC	30.7	35.6	% DM	12.9 - 18.0
Calcium	0.34	0.40	% DM	0.69 - 0.92
Phosphorus	0.22	0.26	% DM	0.26 - 0.33
Magnesium	0.15	0.17	% DM	0.20 - 0.26
Potassium	1.31	1.52	% DM	2.10 - 2.69
Relative Feed Value (RFV)	117			87 - 106

Moisture (%): Moisture is the amount of water in the hay.

Dry Matter (%): Dry matter is the percentage of the hay that is not water.

Crude Protein (%CP): An estimation of the total protein in the hay based on nitrogen content (N x 6.25 = %CP).

Acid Detergent Fiber (ADF): Consists primarily of cellulose and lignin and is closely related to indigestibility. The greater the ADF, the less digestible the hay will be.

Neutral Detergent Fiber (NDF): The total fiber content of the hay. The greater the NDF, the less hay it will take to fill the animal up.

Total Digestible Nutrients (TDN): Represents the sum of digestible crude protein, carbohydrates and fat. TDN represents energy in the hay.

Relative Feed Value (RFV): Ranks the hay comparatively for overall digestible quality. A value of 100 is average.

Many hay analyses do not express energy as Digestible Energy (DE) as needed for horses. To figure DE you can utilize %CP and %ADF in the following formula,

$$DE \text{ (Mcal/lb)} = \underline{[4.22 - 0.11 \times \%ADF] + [0.03632 \times \%CP] + [0.00112 \times \%ADF^2]}$$

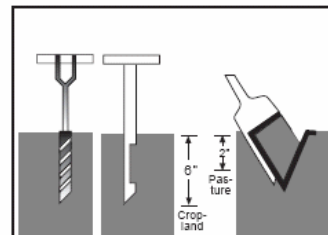
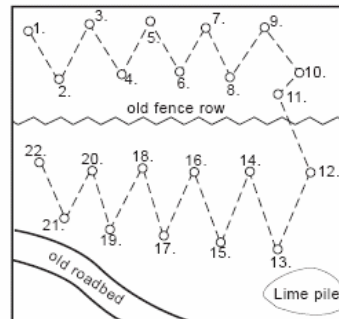
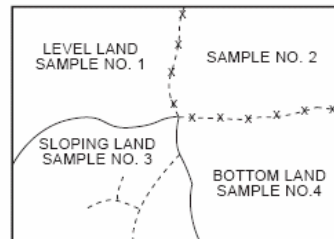
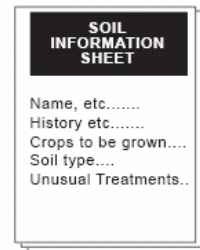
Agronomic Management of Pastures

Soil Testing the Right Way

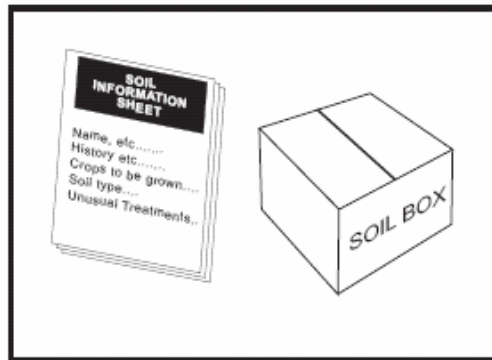
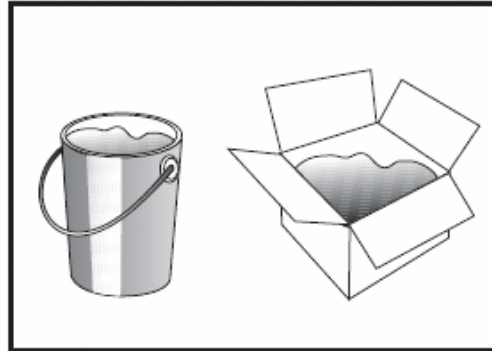
Soil testing is the fundamental agronomic tool for determining pasture and forage nutrient needs. Soil testing evaluates the fertility of the soil to determine the basic amounts of fertilizer and lime to apply. Plant analysis, on the other hand, is used as a monitoring tool to determine if the fertilization and liming program, as determined by the soil test, is providing the nutrients at the necessary levels for top yields. For more information on plant analysis procedures, please see the Virginia Tech Agronomy Handbook.

Soil samples can only provide good information if they were collected properly. Collecting the sample is one of the most important steps in the soil testing program. When one considers that a 2-lb soil sample must adequately represent 10 million or more lbs of soil in the area being sampled, the importance of doing a good job of sampling becomes apparent. Here are instructions for collecting a good representative soil sample:

- Get soil sample information sheets and soil boxes from your local Virginia Cooperative Extension office or from the Virginia Tech Soil Testing Lab. Follow the directions they provide.
- Divide the farm into areas or fields. If the field is uniform, one sample will do. But most fields will have been treated differently, or the slope, drainage or soil type will make it desirable to divide the field into small areas of 5 to 10 acres each.
- Obtain a good sample of soil. The soil test can be no better than the sample. Take the sample from 20 or more places in the field. Zig-Zag across the field or area as shown in the diagram. When taking the sample, avoid unusual places such as old fence rows, roadbeds, eroded spots, where lime or manure have been piled, or where you have fed hay.
- Use the proper equipment. Sampling may be made with a soil auger, soil tube, or spade. The desired depth is 2-4" for pasture land. Place the sample in a clean plastic bucket.



- Mix well in a clean plastic bucket. From the 20 or more stops you have made, you now have one gallon or more of soil. Mix it thoroughly, then fill the soil box and send to the lab for analysis.
- Fill out the soil sample information sheet for each sample. It is essential that your name, address, and sample number be plainly written on the sheet you send with each sample.
- Mail to soil testing laboratory. Place the soil sample information sheet inside the top flap of the soil box and mail to the Soil Testing Laboratory, Department of Crop and Soil Environmental Sciences (0465), Virginia Tech, Blacksburg, VA 24061.



Six Keys to Successful Pasture Maintenance

(Adapted by an article from Matt Mattox of the Noble Foundation)

1. Stocking rate
 - a. This is one of the most critical and most often overlooked elements to pasture maintenance, especially when thinking about horse pastures. Overstocking will encourage weed growth and will lead to poor animal performance. Match the stocking rate to the expected long-term carrying capacity of the property. Adjust the stocking rate as necessary and avoid both overgrazing and under utilizing high quality pastures.
2. Soil test
 - a. This cannot be emphasized enough. It is unreasonable to expect your pastures to perform to the genetic potential of the forage species if soil nutrients or pH is out of balance. Soil test at least every three years to maintain sufficient plant nutrient availability. Don't guess, soil test!
3. Correct pH
 - a. If your soil test recommends adjusting the pH with either calcitic or dolomitic limestone make sure to do so before applying fertilizer. Soils with a less than optimal pH range for your pasture or forage species will actually prevent uptake of the nutrients you have purchased and applied.
4. Fertilize or manure
 - a. Apply nutrient sources either as organic forms (composted manure, poultry litter, biosolids) or as inorganic forms (chemical fertilizer) as recommended by a soil test. Fertilizers are an expensive investment and applying more than your forage or pasture needs not only costs you more money, it may have undesirable effects on water quality. For more information on manure land application see [VCE Pub 406-208 Horse Manure Management](#).
5. Weed and brush management
 - a. Practically every pasture will need some weed control management at times to maintain the health and diversity of the forage species. Weed control may be chemical or biological. Timely clipping of pastures, and carefully managed grazing will often be enough to keep weeds in check. Always read the herbicide label and use appropriate safety equipment as required. If in doubt, hire one of the local farm supply stores.
6. Monitor grazing patterns and pressure
 - a. Horses are notorious spot grazers, and will continually return to graze on young forage species that are growing back after already having been grazed. Utilize rotational grazing to get the most out of your available forage base.

Frequently Asked Questions About Manure and Fertilizers

1. How much fertilizer do I need to apply?

This will of course depend on your soil test analysis. Most soil test reports indicate the proper application rates to reach a realistic yield goal for your soil type and condition. Follow these rates closely.

2. How can I apply my fertilizer?

This depends on the size of your grazing operation and how much time you want to invest. If your fields are relatively level, you have more than 5 acres, and you have a midsize tractor, consider renting a bulk fertilizer spreader (dry buggy) from your local farm supply store. If you have smaller acreage with steep or wooded pastures, you may want to rent or purchase a small spin type spreader that attaches to the three point hitch on your tractor or some may be attached to the back of an ATV or garden tractor. You also might consider working with a custom applicator.

3. Do I need to wait after applying fertilizer before grazing?

When applying commercial chemical fertilizers, it is recommended to wait for at least ¼-1/2 inch of rainfall or 1 week after application before grazing. Horses are close grazers, and the possibility exists that they may ingest particles of the fertilizer. A moderate rainfall will quickly incorporate these materials into the soil rendering them harmless.

4. Can I use a turf type (weed and feed) fertilizer?

Generally this is not recommended. Data from South Dakota State University indicates that many of these products are engineered to break down very slowly. Thus, the rainfall amounts indicated earlier would not apply. This could increase the risk of ingestion by your horses.

5. Where can I get manure tested for nutrient content?

Virginia works closely with Clemson University for manure testing. If you are interested in a test, bring a bottled or bagged sample of the manure in question to your local extension office and fill out the form.

6. Is poultry litter safe for my horses?

There is no documented evidence indicating that horses grazing around poultry litter can be harmful. One potential issue would be if a horse ingested undecomposed dead birds in the material increasing the risk of botulism. However, most litter is well decomposed by the time of application. Remove your horses for a week after spreading if you feel especially concerned.

7. Where can I get some poultry litter?

Call the poultry litter hotline at 1-800-418-0768 to get connected with a local broker.

An Overview of Sound Pasture & Grazing Management

1. Test your soils at least every 2 - 3 years to benchmark soil fertility and follow fertilization recommendations.
2. Do not allow newly planted seedlings to be grazed until the plants have become well established. This may take anywhere from a year to eighteen months.
3. In most cases a pasture forage mixture of at least two grasses and a legume will provide the diversity needed to help combat drought, weeds, foot traffic and maximize the grazing season.
4. Herbicide application will encourage quality forage development and eliminate invasive weeds and other plant species. Follow herbicide label direction for effective application and observe any withdrawal times the treated pasture.
5. Allow 2 – 3 acres per horse for adequate grazing and exercise. Keeping horses stalled for 12 hours a day does not mean you can have twice as many horses.
6. Because forage grasses store their energy reserves in the stem never allow horses to graze grasses below 2 inches in height.
7. Divide and rotate the pasture to prevent selective overgrazing and dedicate a sacrifice area for exercise, wet weather and hay feeding.
8. Have access to water and salt in all pastures.
9. Scatter manure after rotating horses off the pasture to avoid spot grazing and distribute nutrients across the soil.
10. Horses can be grazed with other species (such as cattle or sheep) or the species can be rotated one after the other to maximize production.
11. Horses can easily founder on lush early spring and fall grasses that have low dry matter content and are high in moisture. Monitor body condition scoring to determine if your horse is at risk and decide which management strategy to use to limit grazing.
12. Internal parasites should be controlled by working with your veterinarian to develop a deworming program for your farm. Avoid overstocking pastures and utilize rotational grazing to decrease your parasite load.
13. Remove pregnant mares from endophyte infected tall fescue pastures 60 – 90 days prior to foaling to avoid potential issues with fetal development, dystocia, thickened or retained placentas and/or lactation.

**Additional Resources on Pasture Management
from Virginia Cooperative Extension**

[Options for Clearing Land: Pasture Establishment for Horses](#)

[Virginia's Horse Pastures: Forage Establishment](#)

[Virginia's Horse Pastures: Forage Species for Horse Pastures](#)

[Virginia's Horse Pastures: Grazing Management](#)

[Virginia's Horse Pastures: Renovating Old Pastures](#)

[Maintaining Healthy Horse Pastures](#)

**Additional Resources on Feeding and Nutrition
From Virginia Cooperative Extension**

[Nutritional Supplementation of Horses on Pasture in Virginia](#)

[Easy Keepers: Managing Horses Prone to Obesity](#)

[Feeding and Management of Weanlings for Healthy Skeletal Development](#)

Common Pasture Species

(Photos courtesy of <http://www.agry.purdue.edu>)

Annual Ryegrass – Cool Season Annual Pasture

Lolium multiflorum



Description:

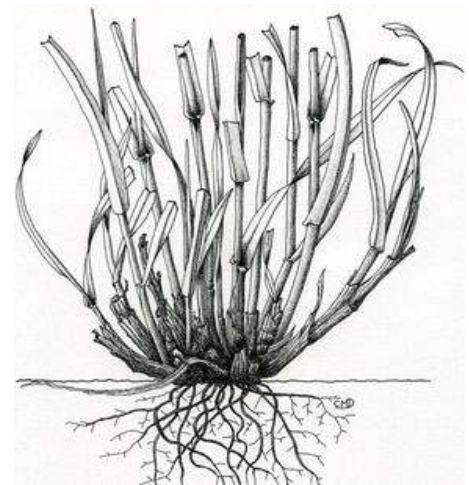
Shiny, dark green leaves that are smooth, grows in bunches, reaches around 3 feet tall when in head stage.

Advantages:

Highly palatable and digestible, has good erosion control properties, adapts well to moderately drained and fertile soils, tolerates close grazing, reseeds itself well, vigorous, can be grazed in 60 days after planting.

Disadvantages:

Not well suited for hay production, can be highly competitive if allowed to reseed



Kentucky Bluegrass – Cool Season Perennial Pasture

Poa pratensis



Description:

Perennial, dark green, sod forming grass with rhizomes, can grow 12 – 20 inches in height. Leaves are narrow and fine with a boat's bow shaped tip.

Advantages:

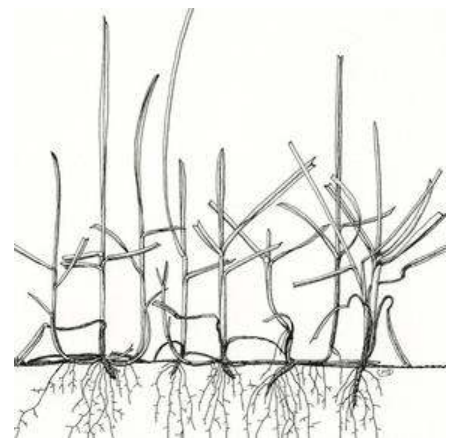
Covers well and forms a dense sod, highly palatable to horses, high in digestible protein, tolerates close and frequent grazing, tolerates freezing.

Disadvantages:

Low summer production, goes dormant in times of drought or extreme heat, slow to establish, requires good soil fertility to flourish, susceptible to grubs and insects.



Kentucky Bluegrass has leaves with a boat shaped tip.



Orchardgrass – Cool Season Perennial Pasture/Hay

Dactylis glomerata



Description:

Tall bunchgrass growing in clumps, bluish green color, grows up to 4 feet in height in head stage, stems are flattened at bottom.

Advantages:

High quality and high yielding grazing and hay type forage, palatable to horses, well suited for rotational grazing.

Disadvantages:

Requires fertile, well drained soil to thrive, does not tolerate close grazing, not deep rooted, more management intensive.



Pearl Millet – Warm Season Annual Pasture/Hay

Pennisetum glaucum



Description:

Grows to a height of 3 – 8 feet, leafy, seasonally productive from June to August, thick stems, produces a seed head similar to a cat tail at the end of the stems, seeds are large and develop around 30 days after flowering.



Advantages:

High nutritional value, tolerant of drought and acidic soil, excellent recovery after grazing, erosion control for pasture reclamation.

Disadvantages:

Thick stems do not allow for close grazing, grazing below 5 inches will limit re-growth, thick stems make curing for hay difficult.



Tall Fescue – Cool Season Perennial Pasture/Hay

Festuca arundinacea



Description:

Bunchgrass with short rhizomes, shiny, dark green leaves and prominent veins. Grows up to 4 feet tall in the head stage. Most older stands have a variety that lives in a symbiotic relationship with two types of Ergot fungus. *Claviceps pupurea* in the seed head and *Acremonium coenophalium* inside the stalk. Seasonally productive from March to November.

Advantages:

Long lived, forms dense sod that withstands close grazing and heavy traffic, tolerant of soil acidity, low fertility, poor drainage and drought. Very palatable after frost.

Disadvantages:

Endophyte fungus infected varieties can hinder animal performance. The *Acremonium coenophalium* fungus in the stalk produces a peptide called Ergovaline that can lead to neuroendocrine and reproductive disorders in livestock and horses.



Timothy – Cool Season Perennial Pasture/Hay

Phelum pretense



Description:

Tall, relatively short lived bunchgrass that has a dense and spike like seed head.

Will grow up to 5 feet tall in the head stage. Has a swollen bulb like structure at the base of the stem. Leaves are a bluish green color, flat, erect and taper to a point with a slight twist. Seasonally productive from April to November.

Advantages:

Primarily a hay forage, it has typically high first cutting yields, good nutritional value as hay when harvested in early boot to early head stage.

Disadvantages:

Does not tolerate close or frequent grazing, heat or drought. Has a shallow root system with little regrowth typically after first hay cutting. Tends to grow clumpy and has limited pasture potential. Does not reseed well and should be replanted every 2 – 3 years to maintain stand vigor and population.



First cutting Timothy hay

Birdsfoot Trefoil – Cool Season Perennial Pasture

Lotus corniculatus



Description:

Similar to alfalfa in appearance with smaller and less rigid stems, grows to a height of 18 – 20 inches, produces 4 – 8 yellow flowers per stem with seed pods located at right angles to the flowers, has a large tap root with many lateral branches.



Advantages:

Palatable and non-bloating legume, tolerates low soil pH and fertility.

Disadvantages:

Not suitable for hay, must be allowed to reseed each year to remain long lived, slow to establish



Red Clover – Cool Season Perennial Legume Pasture/Hay

Trifolium pretense



Description:

Hairy stems, pinkish red flower, erect and leafy, grows 2 – 3 feet tall, leaves are large with V-shaped marking, has a taproot with many off shoots.

Advantages:

Fairly drought tolerant, excellent pasture complementing legume, easily adaptable, establishes early in the spring, high yielding.

Disadvantages:

Must be re-seeded every 2 – 3 years for longevity, difficult to cure for hay when not grazed, dusty when dried, contains a fungus that can cause slobbering in horses.



White/Ladino Clover – Cool Season Perennial Legume Pasture

Trifolium repens



Description:

Long lived legumes that are differentiated primarily by height with white clover being a low growing variety and ladino clover being a taller variety. Spread by stolons, height ranges from 8 inches to over 1 foot. Stems are smooth with heart shaped leaves born in clusters of three. Seasonally productive from April through October, does best in fertile and moist soils. White clover seeds are hard and can lay dormant for years until soil moisture improves.



Advantages:

Tolerates close grazing and works well blended with pasture grasses. White works well with Kentucky bluegrass and Ladino with fescue or orchardgrass.

Disadvantages:

Not tolerant of dry and shallow soils, Ladino needs to be reseeded every 3 – 4 years to maintain vigor and population.



White Clover seed

Common Plants Causing Toxicity to Horses in Virginia

Prepared by Crystal Smith, Extension Agent, Animal Science
and Allison Steele, VCE Summer Intern

Common Pasture Weeds Causing Toxicity in Horses

Brackenfern (*Pteridium aquilinum*)



Toxin(s) involved: Thiaminase.

Potential for Toxicity: Moderate.

Toxic when dry? Yes.

Clinical Signs: Thiamin deficiency resulting in neurologic symptoms including incoordination and severe tremors. Requires significant intake over 1-2 months.

Treatment: Daily thiamin injections for up to two weeks. If not treated, death may occur within 2-10 days.

Buckwheat (*Fagopyrum esculentum*)



Toxin(s) involved: Fagopyrin.

Potential for Toxicity: Low.

Toxic when dry? Yes.

Clinical signs: Photosensitization after a moderate-large intake. Most common when horses fed hay contaminated with the weed.

Treatment: Remove horse from the source. Protect from sunlight. Recovery is generally quick.

Buttercup (*Ranunculus* spp)



Toxin(s) involved: Protoanemonin.

Potential for Toxicity: Low.

Toxic when dry? No.

Clinical Signs: Oral and gastrointestinal irritation and blistering.

Treatment: Recovery is uneventful when animals removed from source.

Curly Dock (*Rumex crispus*)



Toxin(s) involved: Soluble Oxalates.

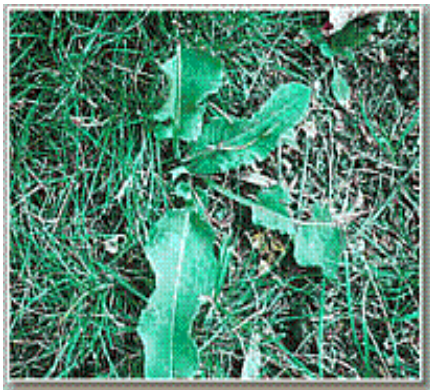
Potential for Toxicity: Moderate.

Toxic when dry? N/A

Clinical Signs: Oxalates bind to calcium and magnesium in the blood leading to muscle tremors, weakness, depression, and recumbency.

Treatment: Intravenous Ca, Mg, glucose, electrolytes. Oral limewater to decrease further oxalation.

Groundsel/ ragwort (*Senecio vulgaris*)



Toxin(s) involved: Pyrrolizidine alkaloids.

Potential for Toxicity: Extremely high.

Toxic when dry? Yes.

Clinical Signs: 15 mg/kg BW over 2 weeks induces irreversible liver disease. May also cause photo-sensitization, weight loss, and jaundice.

Treatment: Once liver damage is done, treatment is unsuccessful. Humane euthanasia recommended.

Hemp Dogbane (*Apocynum cannabinum*)



Toxin(s) involved: Cynarin and apocynin.

Potential for Toxicity: Low-moderate.

Toxic when dry? Yes.

Clinical Signs: Diarrhea, colic, hemorrhagic, gastroenteritis, abnormal heartbeat. 15-30 grams of leaves can be lethal.

Treatment: Symptomatic treatment.

Horse Nettle (*Solanum carolinense*)



Toxin(s) involved: Solanine.

Potential for Toxicity: Moderate.

Toxic when dry? Yes.

Clinical Signs: Toxic effects more common when plant is in processed feed. Symptoms include Salivation, colic, diarrhea, muscle tremors, and weakness.

Treatment: Fluid therapy, activated charcoal, via stomach tube. Physostigmine may be used cautiously in severely poisoned animals.

Jimsonweed (*Datura stramonium*)



Toxin(s) involved: Hyoscyamine, Hyoscine, and Atropine.

Potential for Toxicity: High.

Toxic when dry? N/a.

Clinical Signs: Within minutes to hours of ingestion, symptoms such as behavioral changes, colic or diarrhea appear.

Treatment: Symptomatic therapy and activated charcoal to prevent further absorption. Severely affected animals may benefit from treatment with Physostigmine.

Milkweed (Asclepias species)



Toxin(s) involved: Cardenolides.

Potential for Toxicity: Moderate.

Toxic when dry? Yes.

Clinical Signs: Colic, incoordination, tremors, heart problems, respiratory difficulty.

Treatment: Supportive therapy.

Onions and Garlic (Allium spp)



Toxin(s) involved: N-propyl disulphide.

Potential for Toxicity: Low.

Toxic when dry? Yes.

Clinical Signs: More than 25% of the diet as onions will result in fast, weak pulse; staggering and collapse as a result of anemia.

Treatment: Reduce stress, whole blood transfusions in severely anemic animals.

Poison Hemlock (Conium maculatum)



Toxin(s) involved: Coniine, gamma-coniceine.

Potential for Toxicity: High.

Toxic when dry? Less toxic when dry.

Clinical Signs: Toxins block spinal cord reflexes leading to muscle tremors, incoordination, paralysis, frequent urination, and sudden death. 4-5 pounds of leaves are lethal to a horse.

Treatment: Supportive Therapy.

Pokeweed (*Phytolacca Americana*)



Toxin(s) involved: Phytolaccatoxin and Phytolaccigenin.

Potential for Toxicity: Low.

Toxic when dry? Yes.

Clinical Signs: Colic and diarrhea.

Treatment: Supportive Therapy.

Water Hemlock (*Cicuta maculate*)



Toxin(s) involved: Cicutoxin, and cicutol.

Potential for Toxicity: Extremely High.

Toxic when dry? Yes.

Clinical Signs: The most toxic poisonous plant known. 0.05%BW intake is lethal. Signs include convulsions and death due to respiratory failure.

Treatment: Due to rapid 15 minute - 8 hours following ingestion, veterinary intervention is unlikely. In some cases sodium Phenobarbital may help.

Yellow and White Sweet Clover (*Melilotus spp*)



Toxin(s) involved: Coumarin.

Potential for Toxicity: Moderate.

Toxic when dry? Yes *fresh undamaged sweet clover is safe for consumption.

Clinical Signs: Toxin, coumarin, can be converted to dicoumarol in moldy hay containing sweet clover. Signs include weakness, visible bleeding, and pale mucous membranes.

Treatment: Vitamin K administration.

Common Forage Plants Causing Toxicity in Horses

Alsike Clover (*Trifolium hybridum*)



Toxin(s) involved: Unknown.

Potential for Toxicity: Low-moderate.

Toxic when dry? Yes.

Clinical Signs: Primary sign is photosensitization especially in non-pigmented areas. May advance to chronic liver damage with prolonged intake.

Treatment: Remove horse from the source. Prognosis is good if photosensitivity is only sign, poor when liver damage is involved.

Tall fescue (*Festuca arundinacea*)



Toxin(s) involved: Acremonium coenophialum.

Potential for Toxicity: Moderate.

Toxic when dry? Yes.

Clinical Signs: Toxic effects in broodmares only including prolonged gestation, retained placenta and agalactia.

Treatment: Remove the mare from fescue for the last 30-90 days prior to expected foaling date. Treatment with oral Domperidone at least 15 days prior to expected foaling date.

Common Trees Causing Toxicity in Horses

Black Locust (*Robinia pseudoacacia*, and *neomexicana*)



Toxic(s) involved: Robin.

Potential for Toxicity: Moderate.

Toxic when dry? Unknown.

Clinical Signs: Colic, constipation, diarrhea, muscle weakness, laminitis and irregular heartbeat may occur within one hour of eating; Fatalities are rare.

Treatment: Prevent further ingestion and treat clinic signs.

Black Walnut (*Juglans nigra*)



Toxin(s) involved: Unknown.

Potential for Toxicity: Moderate.

Toxic when dry? Yes.

Clinical Signs: Horses bedded on shavings containing 20% more black walnut develop severe laminitis, limb edema and colic within 12/18 hours.

Treatment: Remove the bedding, treat the clinical signs.

Buckeye/ Horse Chestnut (*Aesculus* spp.)



Toxin(s) involved: Aesculin, fraxin and possibly narcotic alkaloid.

Potential for Toxicity: Moderate.

Toxic when dry? Unknown.

Clinical Signs: Toxin is found in leaves and young sprouts. Clinical signs include colic and neurologic signs such as trembling, staggering, and difficulty in breathing.

Treatment: Supportive Therapy.

Wild Cherry (*Prunus* spp.)



Toxin(s) Involved: Cyanide

Potential for Toxicity: High

Toxic when dry? Probably not

Clinical Signs: Breathing difficulties, anxiety, staggering, convulsions, collapse, and death, within minutes of ingestion

Treatment: If horse is alive after 2-3 hours, chances are good it will recover. Veterinary treatment includes intravenous administration of sodium thiosulfate and sodium uirite

Oak (*Quercus* spp.)



Toxin(s) Involved: Gallotoxins.

Potential for Toxicity: Moderate.

Toxic when dry? Unknown.

Clinical Signs: New young leaves and green acorns most toxic leading to poor appetite, weight loss, diarrhea or constipation, increased drinking, increased urination, edema, death is possible.

Treatment: Aggressive fluid therapy and low stress environment.

Red Maple and hybrids of red maple (*Acer rubrum*)



Toxin(s) involved: Unknown.

Potential for Toxicity: Extremely High.

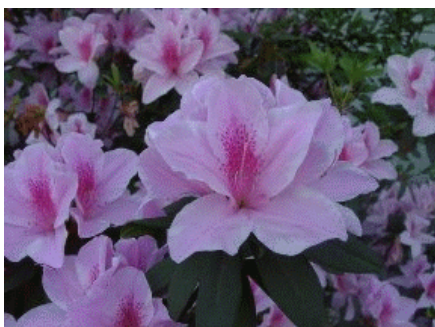
Toxic when dry? Yes.

Clinical signs: Massive destruction of red blood cells leading to breathing difficulties, jaundice, dark brown urine, and death.

Treatment: Supportive therapy, Ingestion of 1 ½ kg is toxic, 3 kg is lethal to horses (50-75% death/euthanasia rate).

Common Ornamentals causing toxicity in Horses

Rhododendron, Mountain Laurel, Azalea (Rhododendron spp.)



Toxin(s) involved: Grayanotoxins (glycosides)

Potential for Toxicity: Moderate.

Toxic when dry? No.

Clinical Signs: 0.2% BW green leaves will cause colic, abnormal heart rate and rhythm, convulsions, coma, and death.

Treatment: Supportive Therapy.

Spurge (Euphorbia spp.)



Toxin(s) involved: Diterpene esters.

Potential for Toxicity: Moderate.

Toxic when dry? Yes.

Clinical Signs: Blistering upon contact, colic and gastrointestinal irritation.

Treatment: Remove plants from animal's diet and they will recover uneventfully.

Yew, English or Japanese (Taxus spp.)



Toxin(s) involved: Taxine (alkaloid).

Potential for Toxicity: Extremely High.

Toxic when dry? Unknown.

Clinical Signs: Within one hour of ingestion: paresis, ataxia, trembling and death within 15 minutes of appearance of clinical signs.

Treatment: Supportive therapy including activated charcoal and saline cathartic. Atropine to counter depression.

Resources

- Equine Nutrition Problems: Toxic Plants in the Mid-Atlantic
 - Erin D. Pittman, Institute of Applied Agriculture, University of Maryland, College Park, MD 20742.
- Photos courtesy of Virginia Tech Weed ID Guide.

Other Potential Feeding Related Toxins

Botulism

Botulism results from clostridium bacteria contamination in soil, dead animals in feed or in ensiled feeds. Botulism is highly toxic to horses. Symptoms are paralysis that start in the back legs and move to the front. Avoid feeding baleage, silage or other fermented feeds to horses.

Ionophore Poisoning

Ionophores are feed additives that improve feed efficiency in ruminants (i.e. cattle, sheep and goats). They are deadly to horses. Ingestion by horses may lead to cardio, skeletal and GI problems and eventual death. Ionophores appear very similar to common mineral. Keep horses away from cattle minerals and feeds containing ionophore supplements.

Mycotoxins

There are hundreds of forms of mycotoxins found in many types of feed and forage, including pastures. Some common mycotoxins affecting horses are:

1. Fumonisin B1 and B2
 - a. Found in moldy corn
 - b. Prolonged consumption will lead to disease
 - c. Affects central nervous system
 - d. Causes leucoencephalomalacia in horses in cold weather
2. Slaframine
 - a. Grows on legume leaves, particularly red clover
 - b. Appears as black patches on leaves normally in hot/humid weather
 - c. Causes “slobbers”
 - d. Not typically a problem, but excessive slobbers may cause dehydration. Allow plenty of water when grazing clover.
3. Endotoxins
 - a. Common in areas where food is disposed or in very dusty hay
 - b. Will grow anywhere bacteria can thrive

Pesticides

Poisoning from herbicides (pesticides that kill plants) is rare. However, insecticides (pesticides that kill insects) may be harmful. Each year many livestock are killed from consumption of pesticide granules, powders and dusts accidentally spilled or left on trucks and wagons. Clean up spills carefully and store pesticides safely in locked facilities away from feed and forage. The best defense against pesticide poisoning, for both humans and livestock, is to carefully read and follow the label. The label is the law!