Forage Systems for Horses in Georgia

Cooperative Extension Service/The University of Georgia College of Agricultural and Environmental Sciences

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Forage Programs for Horses in Georgia

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Georgia's horse population numbers approximately 250,000 and is steadily increasing. Although horses are found throughout the state, most are found on the fringes of major metropolitan areas. Horse operations range from one to a few pleasure horses to large commercial operations with substantial income from breeding, training or stabling horses.

A good pasture and forage program can provide quality feed and normally will be the most efficient and economical means of providing a substantial part of equine rations. In Georgia, we are fortunate to have a mild climate, soils suitable for producing forages and a good selection of highly productive forage species. With careful planning and good management, adequate grazing can be supplied for up to 10 months of the year in most areas of the state.

To many producers, the term "horse pasture" denotes grazing management and forage crops unique to horses. This is not the case at all. Because the horse is a herbivore, most forage crops commonly used for cattle can also be used to provide grazing for horses.

Forage as a Nutrient Source

Because the horse is a herbivore, the majority of its diet can consist of roughages. High quality pastures or hays are excellent sources of energy, protein and vitamins necessary for a balanced ration. Good quality pasture plus free choice trace mineralized salt and water can supply the nutrients needed by many classes of horses. Exceptions would be hard-working horses and young horses where a fast growth rate is desired.

Although not a nutrient, horses require a nominal amount of fiber for normal gastrointestinal function. Low fiber content in the diet of horses has been implicated in affecting behavior. Many cases of wood chewing, tail chewing and mane chewing may be due to low fiber content of the total diet. So formulate rations for horses based upon hay and/or pasture types and analysis. A rule of thumb is that a horse should consume at least 1 percent of its body weight in hay or an equivalent amount of pasture daily. For example, a "typical" quarter-horse weighs 1,150 pounds and would therefore require a minimum of 11.5 pounds of hay daily.

Required Acreage

The pasture acreage required for a mature horse will vary dramatically with pasture productivity, forage species and the horse's dry matter requirement (supplemental feed reduces pasture needs). The carrying capacity of the pasture also varies with seasons of the year. Warm-season grasses (bahiagrass or bermudagrass) provide grazing from May until October, while a cool-season grass such as tall fescue will be productive in spring (March-June) and fall (September-November). Supplemental feed will be necessary when pasture production is not adequate.

A good rule of thumb is to provide 2 acres of perennial pasture in non-cropping type land (north of fall line) and 1½ acres in cropping type land (south of fall line) for each mature horse. This is a general guideline and pasture productivity will vary greatly due to soil type, available moisture, forage species, fertility and many other variables. Base acreage allocated to your horses on the productivity of your pastures. A horse will consume from 1 to 2 percent of its body weight in forage dry matter per day (10-20 lbs). You can increase the number of horses in the pasture (stocking rate) if you are supplementing with hay or other feed. Annual pastures, such as rye or pearl millet, may provide higher stocking rates for brief periods.

Forage Crops for Horses

Georgia contains several geographic areas that differ in climate, topography and soil types. To establish and manage productive and sustainable forage programs, match forage species to climate. Plants that grow well on dry sandy

soils in south Georgia may not be productive in the heavier soils and cooler weather of north Georgia. Conversely, high quality cool season perennial plants that are productive in north Georgia may not survive in south Georgia for more than 1 or 2 years. Therefore, it is especially important to select forage crops for your operation with care. Be sure the forages are adapted to your area and are suited for the intended use.

Often when pasture forage programs are planned, only total forage production or plant persistence is considered. It is also important to consider species that complement the "base" forage in your pastures. For example, bermudagrass is a warm season species that produces large amounts of forage in the summer months. As the weather cools in the fall, little growth will occur until spring. If a cool-season forage like tall fescue or ryegrass were incorporated into the forage system, some forage could be produced during late fall and early spring months. This simple planning and selection of forage species can minimize and sometimes eliminate the need for hay in winter months.

Perennial Grasses

Base your forage program on a perennial pasture. Perennial forages reduce establishment costs over a period of several years and generally are more dependable than pastures that must establish from seed every year. Options for perennial pastures in north Georgia are tall fescue and/or bermudagrass. South Georgia options are bermudagrass or bahiagrass.

Bermudagrass

Bermudagrass is a sod-forming, perennial warm-season grass that can be grown statewide. Bermudagrass grows best on fertile, well-drained soils and is well suited for either grazing or hay production. Bermudagrass is productive from mid-spring until fall and can be overseeded in fall with winter annual crops like rye, wheat, oats or crimson clover. For the purposes of this bulletin we will discuss two general types of bermudagrass: hybrid types, which must be established vegetatively and seed-type bermudagrass.

The hybrid bermudagrasses produce sterile seed and must be established using vegetative material (sprigs or tops). These varieties are generally higher yielding than seeded varieties and produce better quality forage. Several hybrid varieties are available for establishment, and the proper variety for your forage program depends upon the environment in which the grass will be established and grown. 'Coastal' is a fine-stemmed variety adapted to the lower two-thirds of the state. 'Tifton 85,' a coarse stemmed variety released in 1993, is the highest yielding and most digestible hybrid. Tifton 85 is less cold tolerant than Coastal and is best adapted to areas south of Interstate 20. 'Russell' is a variety originating in Alabama that is similar to Coastal in yield and quality. It establishes more quickly than Coastal, is cold-hardy and performs well in central and northern areas of the state. 'Tifton 44' is a cold-hardy, fine-stemmed hybrid well suited to the northern third of the state. Tifton 44, however, is generally slow to establish and can take 2 years to achieve a full stand on clay soils. 'Alicia' is a fine-stemmed variety that establishes rapidly but produces lower quality hay and is highly susceptible to rust and fungal diseases.

Common bermudagrass is adapted throughout the state and, until recently, was the only persistent bermudagrass that could be established from seed. Common bermudagrass is easily established but yields only 60-70 percent of the forage that hybrids do. Generally, if hay production is a requirement, hybrid bermudagrasses are more productive and should probably be established. However, common bermudagrass can perform adequately in low input grazing situations or where land area is not a limitation. Common bermudagrass tends to produce a dense, wear-resistant sod that can make it a good choice for high traffic areas or areas where maximum production is not the primary objective.

During the past several years a number of improved bermudagrass varieties have been released that can be established from seed. Some of these varieties persist well in the Piedmont and Limestone Valley areas of Georgia and produce forage yields similar to Coastal bermudagrass. 'Cheyenne' is a seed-type variety that is productive and persistent in north Georgia. Some seeded varieties like 'Wrangler,' 'Vaquero' and 'Sundevil' appear promising but have not been tested in Georgia.

While establishing bermudagrass from seed is cheaper and easier than sprigging, some potential problems are associated with seed established varieties. Some commercial varieties do not persist well in Georgia's humid climate. 'Giant' is a seeded variety that yields well during the first few years of establishment but is sus-

ceptible to diseases and stands will eventually fail completely. Many seed-type brands are mixtures of "improved" bermudagrass seed and common bermudagrass seed. Use these seed blends cautiously as many benefits of the improved varieties are diluted with the establishment of common bermudagrass.

There can also be problems with weed competition during the establishment of seeded bermudagrass. No herbicides are available for weed control until seedlings are well established, and occasionally new plantings can be lost to weeds. Frequent mowing is often needed during the establishment year. For more information on establishing and managing bermudagrass, see Georgia Extension Service bulletin # 911 *Bermudagrasses in Georgia.*

Bahiagrass

Bahiagrass is a deep rooted, warm season perennial forage. It is common throughout the Coastal Plain and in the lower Piedmont. Bahiagrass forms a dense sod that resists weeds and treading damage. Bahiagrass is more tolerant of poorly drained soils and shade than bermudagrass and can be established in woodland pastures. It typically "greens up" about 2 weeks earlier in the spring than bermudagrass, so a slightly longer grazing season can be realized. Bahiagrass does not respond to fertilization as well as bermudagrass, and forage yields and quality are lower than bermudagrass. Although yields are lower, bahiagrass will normally persist in "low input" pastures where limited amounts of lime and fertilizer are applied.

'Pensacola' is the most widely planted variety of bahiagrass in the state. This is a persistent variety, but close grazing is necessary to obtain good forage utilization. It is not a good hay crop since most of the leaves are produced close to the soil surface. 'Tifton-9' is a bahiagrass variety developed in south Georgia that has produced forage yields that approach Coastal bermudagrass. Leaves are more erect than Pensacola, so hay production is more feasible with Tifton-9 bahiagrass. The 'Argentine' variety of bahiagrass is less cold-hardy than Pensacola and Tifton-9 and should only be established in extreme south Georgia. For more information on bahiagrass production, see Georgia Extension Service bulletin #1145 *Bahiagrass Production and Utilization.*

Tall Fescue

Tall fescue, a cool-season perennial grass, is well-adapted throughout north Georgia. Tall fescue is a bunch-type grass that forms a fairly open sod that can be interseeded with red or white clover for improved forage quality and distribution. Fescue normally provides grazing from mid-March until early June and from September to December. Forage growth during mid-summer is often limited by moisture stress and high temperatures except in the mountains. Winter production can be limited by cold temperatures.

Tall fescue generally has a poor reputation as an equine feedstuff. Reproductive problems with mares and reduced growth rate of young horses have been observed for many years when horses grazed toxic tall fescue pastures. The most common problems observed in brood mares grazing toxic tall fescue include agalactia (no milk production), abortions, retained placentas, weak foals, stillbirths and prolonged gestations. Research data have conclusively implicated a fungal endophyte (*Neotyphodium coenophialum*) as the cause of these symptoms. This fungus grows inside the plant and cannot be detected by the naked eye. The only way to conclusively verify that tall fescue plants are infected with the toxic endophyte is to have the pastures tested. The majority of Georgia tall fescue pastures are infected with this fungus, but fortunately several options are available to horse producers for minimizing or eliminating the fungal effects.

Option 1. Renovate infected pastures with endophyte-free tall fescue. Seed that does not contain the toxic endophyte is readily available. Horses grazing pastures free of toxic endophytes do not exhibit problems commonly associated with fescue toxicity. However, removal of the endophyte results in a less drought and grazing tolerant tall fescue plant. This frequently causes stand failures when endophyte-free fescue is subjected to harsh drought conditions or is grazed heavily in summer months. 'AU Triumph' is an endophyte-free variety that produces more forage in the late fall and early spring than other fescue varieties. This variety is less persistent than most other later maturing varieties. 'Jesup' is a variety developed in Georgia with good forage production potential. In addition, Jesup has better persistence than most other endophyte-free varieties, but it does not approach the persistence of endophyte-infected tall fescue. Many other endophyte-free tall fescue varieties are available in Georgia, most of which appear to have similar forage production characteristics among them.

Option 2. Renovate toxic pastures with tall fescue that contains a novel endophyte (*i.e.* 'MaxQ'). Recently a new solution has been developed that alleviates animal symptoms associated with fescue toxicity, but still allows plants to perform and persist as well as toxic tall fescue. Fungal endophytes have been discovered that do not produce compounds toxic to farm animals. These endophytes do, however, confer grazing persistence benefits to host plants. Limited data from Mississippi State University indicates that MaxQ tall fescue does not negatively affect gestating brood mares. If you wish to renovate existing toxic tall fescue pastures with novel endophyte-infected tall fescue, be careful during sod renovation to ensure that existing toxic plants are completely eliminated. This minimizes the chance that toxic tall fescue will reinfest the pasture.

For more information regarding testing tall fescue pastures for toxic endophytes, renovating existing tall fescue pastures, or grazing pastures containing non-toxic endophytes, please contact your local county extension agent.

If neither of the above pasture renovation options can be implemented, existing tall fescue pastures can be grazed if a few precautions are taken. The most effective method to prevent or alleviate fescue toxicosis is to remove brood mares from the pasture at least 30-45 days prior to foaling. If mares cannot be removed from the pasture the following suggestions may be beneficial:

1. Overseed the pasture with white clover (see page 7. Including clovers helps dilute the toxins present in the forage and can at least partially offset toxic effects. Overseeding with clovers will help only if the animal eats the clovers.
2. Use hay from other forage species like bermudagrass, bahiagrass, alfalfa, orchardgrass or perennial peanut during late gestation to help dilute tall fescue endophyte toxins.
3. Monitor udder development. If the udder does not develop normally as foaling approaches, provide additional energy from hay or grain. If mares have been grazing tall fescue and no udder development has occurred 1 week prior to foaling, domperidone (EquiTox) can help alleviate some symptoms of fescue toxicosis. Domperidone must be obtained from a licensed veterinarian. In studies, domperidone treated mares have been shown to have shorter gestation lengths, have live foals born closer to their expected delivery dates, have more mammary development, are not agalactic and have higher prolactin and progesterone levels. The daily oral domperidone paste is started 20 days prior to the expected foaling date if mares remain on toxic fescue up to parturition. If mares are removed from fescue, start the domperidone treatment 10 to 14 days prior to the expected foaling date, depending on the condition of the mare's udder. With normal udder development, the mare would probably not need treatment.
4. Be present at foaling. Increased dystocia is frequently observed when toxic tall fescue is grazed and assistance may be needed to ensure the foal and mare's safety.
5. Be sure the foal nurses and the mare has milk. All newborn foals need colostrums to help develop their immune systems. Provide colostrum from other sources if necessary.
6. If the mare foals and is agalactic, domperidone can be used daily for 5 days to help bring the mare into milk production.

Orchardgrass

Orchardgrass, a cool-season perennial, is adapted to fertile soils in the Mountain and extreme upper Piedmont areas of Georgia. Orchardgrass is an open-sodded bunch grass that produces excellent quality forage for grazing or hay. This grass is not as persistent as tall fescue and stands will usually thin after a few years. It is also susceptible to leaf diseases and does not tolerate close continuous grazing; however, stands perform well with interseeded cool season legumes. Good orchardgrass varieties include 'Benchmark' and 'Hallmark.'

Timothy

Timothy is a cool-season perennial forage that is **not** adapted to any area of Georgia. Timothy can be established in northern areas of the state but will not persist for longer than 1 or 2 years. This makes timothy an expensive annual crop that offers no additional benefits than more economical cool season forages like orchardgrass, tall fescue or ryegrass.

Kentucky Bluegrass

Kentucky bluegrass is a cool-season perennial forage adapted only to the Mountain area of Georgia. Even though bluegrass will persist for a few years in the mountains of Georgia, production is low and other cool season forages probably offer better opportunities.

Perennial Legumes

Adding forage legumes like clover, alfalfa or birdsfoot trefoil to grass pastures offers several advantages to grass monocultures. Grass pastures that have been interseeded with legumes generally produce more total forage, have a longer productive season, and have improved forage quality. In addition, legumes can fix atmospheric nitrogen into plant proteins. This greatly decreases or eliminates nitrogen requirements in grass-legume swards. To ensure good nodulation for nitrogen fixation, inoculate legume seeds at planting with the proper *Rhizobium* bacteria and check soil fertility for proper pH, phosphate and potash levels.

Red Clover

Red clover, a deep rooted biennial, can be interseeded into tall fescue pastures in north Georgia. Red clover is an upright growing legume with better seedling vigor, drought tolerance and forage distribution than white clover. Red clover is not as tolerant of close grazing or poorly drained soils as white clover. Although red clover is technically a perennial, it will generally only persist for 1 or possibly 2 years in Georgia. Several good red clover cultivars are currently on the market. These include 'Cinnamon Plus,' 'Redland III,' 'RedlanGraze II,' 'Rudolph' and 'Royal.' 'Cherokee' is an excellent variety for south Georgia.

Horses grazing red clover occasionally salivate excessively, a condition commonly known as the "slobbers." This condition is due to the presence of a fungus (*Rhizoctonia leguminicola*) and is normally aesthetic, but pregnant mares have reportedly aborted after eating infected red clover for extended periods of time. The slobbers generally occur when more than half the dry matter present in a pasture is red clover. Grass-legume mixtures seldom contain this much red clover, so problems with horses grazing red clover are rare.

Red clover has also been reported to be less palatable than white clover for horses. This may be due to the higher tannin content of red clover. While some horses will consume red clover readily, some will completely avoid it. Red clover is also pubescent or 'hairy.' This lengthens the curing time needed to produce red clover hay and contributes to dustier hay.

White Clover

White clover is a more prostrate growing legume that spreads using short "runners" or stolons. These stolons grow close to the soil surface and enable white clover to tolerate close grazing. Most forage production occurs during the fall and spring months with some winter production in favorable years. White clover grows best on moist soils; however, in the upper Piedmont and mountains it can be productive on upland soils. It does not survive well on dry, upland soils in south Georgia.

White clover is susceptible to some diseases, but stands will generally persist for 2 to 3 years in the Piedmont and longer in the Mountain areas. Ladino varieties (*i.e.* 'Regal,' 'Osceola' and 'Will') produce the most forage but are the least grazing tolerant of the white clovers.

White clover varieties with improved grazing tolerance have been developed by the University of Georgia and were released in fall 2002. These clovers (named 'Durana' and 'Patriot') are derived from ecotypes collected from grazed pastures that had not been planted with clover for long periods of time. These clovers produce an abundance of stolons, which help them tolerate close continuous grazing. They have persisted far better than ladino clovers under heavy beef cattle grazing. Durana, in particular, should persist well in closely grazed horse pastures.

Research indicates that white clover is considered palatable by horses. In fact, white clover is commonly included in horse pastures in more northern states.

Alfalfa

Alfalfa is a perennial legume crop that can produce high yields of excellent quality forage. Alfalfa grows best on well-drained soils with good moisture holding capacity. The alfalfa plant will develop a deep root system if root growth is not restricted by hard-pans, high water tables or acid subsoil. This deep root system makes alfalfa an extremely drought tolerant forage that can be grown statewide in suitable, fertile soils. Stands generally persist for 3 to 5 years in south Georgia and for 4 to 7 years in north Georgia. The crop has a high lime requirement (pH 6.5-7.0) and must be well fertilized and properly managed to maintain productive and healthy stands.

Alfalfa is best known for its hay quality, but with the development of grazing tolerant varieties, it can now persist well in pastures with rotational grazing. 'Amerigraze 702' is well suited to the Coastal Plain for both grazing and

haying. 'Alfagraze' is more cold-hardy and can be grazed or cut for hay throughout north Georgia. Alfalfa is slow to establish and should be grazed lightly and infrequently during the spring after planting. For more information on alfalfa, see Georgia Extension Service bulletin # 898, *Alfalfa Production in Georgia.*

Perennial Peanut

Perennial peanut is a warm-season legume crop adapted to the lower Coastal Plain area. High yields of excellent quality forage can be produced. There is currently a large demand for high-quality perennial peanut hay, so this crop is almost exclusively used for hay production. Stands are extremely slow to establish (establishment time may be 2-3 years) and plants must be propagated vegetatively from sprigs. Few pesticides are labeled for perennial peanuts, so control of weeds, insects and diseases can be a problem.

Birdsfoot Trefoil

Birdsfoot trefoil, a cool-season perennial legume, can be a productive addition to cool season pastures in the mountain areas of Georgia. This legume is a good addition to orchardgrass and tall fescue pastures. Seedlings are weak, so establish pure stands before grasses are introduced. Established plants can reseed naturally. Stands will generally persist for 2 to 3 years in the mountains.

Annual Grasses and Legumes

In some areas of Georgia, it is difficult to maintain warm and cool season perennial mixtures. In this situation, annual forages can be used to help evenly distribute forage production and minimize hay needs during periods of slow plant growth or dormancy. Cool season annuals are particularly useful in areas of south Georgia where tall fescue and other cool season perennials will not survive for more than 1 or 2 years. Warm season annuals can be useful in north Georgia to provide summer grazing while fescue is being rested.

Annual pastures are typically a high yielding, high quality addition to a forage program for horses; however, their use is often limited by lack of land suitable for cultivation and availability of machinery for annually preparing and planting land. Use annual forages to complement the perennial forage species in your grazing system.

Rye, Wheat and Oats

These cool season annual species are often referred to as "small grains" and are planted for winter forage production in Georgia. Rye is the most cold-tolerant of the species and will produce forage earlier in the fall and spring than wheat or oats. Rye can be grown statewide but occasionally exhibits some disease problems and stands can be lost. Rye is the least palatable small grain for horses. If given a choice, horses will preferentially consume oat or wheat forage before rye. Oats are the least cold-tolerant small grain and stands can be damaged or lost to cold weather in north Georgia. Oat forage is highly palatable to horses and typically provides a longer spring grazing period than rye. Wheat is also a palatable, cold-tolerant winter annual that produces forage longer into the spring than rye.

Small grain species are frequently mixed at planting to provide more uniform forage production and to help ensure against disease and winter-kill losses. Establishment is usually in prepared clean-tilled seedbeds; however, small grains can be no-till seeded into dormant bermudagrass or bahiagrass sod. Small grain varieties also have different potential for forage production. For an up-to-date list of well adapted and productive small grain varieties, contact your local county extension agent.

Annual Ryegrass

Ryegrass is an easily established and productive winter annual forage that is less cold-hardy than oats or wheat, but it produces large amounts of high quality forage in the spring. Ryegrass has a longer spring grazing season than the small grains and, in favorable years, can produce forage until early May in south Georgia and early June in north Georgia. Annual ryegrass can be planted in prepared seedbeds, or it is easily established in dormant sods using broadcast or no-till planting methods. Annual ryegrass is highly palatable to equines and is normally a good addition to a warm season based forage program. Perennial ryegrass is a different species than annual ryegrass and usually will not persist for more than 2 years. Perennial ryegrass is not recommended for planting in Georgia. As with small grain varieties, consult your county extension agent for the most appropriate annual ryegrass cultivar for your area.

Crabgrass

Crabgrass is an annual warm-season forage that frequently invades bermudagrass and fescue pastures. Contrary to popular belief, crabgrass produces extremely palatable, high-quality forage that is generally preferred by horses over other perennial grasses like bermudagrass and bahiagrass. Interest in crabgrass has risen in recent years due to the commercial seed release of 'Red River' crabgrass. Do not use crabgrass as the primary species in forage programs because production is highly dependent on rainfall, which can be unpredictable in summer months. Crabgrass is a good complement to tall fescue pastures because summer production occurs at a time when fescue growth has slowed. The crabgrass also dilutes toxins present in endo-phyte-infected toxic tall fescue. Crabgrass is a vigorous plant and can outcompete tall fescue in some circumstances.

Sorghum, Sudangrass and Sorghum-Sudan Hybrids

These forages, along with Johnsongrass, are **not** recommended for horse pastures. These species have been implicated in cases of cystitis (urinary bladder infection) and abortion. Mares affected by cystitis may have urethral irritation. Yellowish, sticky, granular fluid accumulates in the bladder and death may result from subsequent kidney infections. These grasses may also develop toxic levels of prussic acid under growth conditions that involve drought or frosts. Hay from these species is generally safe to feed.

Millets

Pearl millet is a high-yielding warm season annual grass that can be grown statewide on well-drained soils. Pearl millet is tolerant of drought conditions and low soil pH. Production is similar to sorghum and sorghum hybrids; however, there are no cystitis or prussic acid problems in either pearl or browntop millet. Forage production occurs from June through August. Millet planted in warm soil should be ready for grazing 30-40 days after planting. Growth is rapid and rotational grazing systems usually enable good forage use without over-grazing the pastures. Begin grazing when forage is approximately 20-24 inches tall and graze to a stubble height of 8 to 10 inches.

Several hybrid pearl millets are available. Recently there has been an effort at the USDA-ARS station in Tifton, Georgia, to develop extremely leafy pearl millet hybrids that produce high quality forage for grazing and hay production. 'Tifleaf-3' is the latest hybrid release from this program and is generally the variety recommended for Georgia.

Browntop millet is a lower growing and lower yielding summer annual than pearl millet. Browntop millet has smaller stems and cures much more rapidly and easily than pearl millet for hay. Both browntop and pearl millet can accumulate nitrates when over-fertilized or during droughts. If conditions are right for high nitrate concentrations, test pastures or hay.

Winter Annual Clovers

Several winter annual clovers are well adapted to areas of Georgia. These clovers are most often used to complement warm season perennial forages and are usually broadcast seeded when warm season forage becomes dormant in the fall. Consumption of annual clovers by horses is frequently quite low. Equines typically prefer to graze grass species, so they sometimes avoid the winter annual clovers in mixtures.

Crimson, rose and arrowleaf are the most commonly planted winter annual clovers and are best suited to well-drained fertile soils in the Coastal Plain and lower Piedmont areas of the state. Crimson and rose clovers flower early in the spring and have the shortest grazing season of the listed winter annuals. Crimson has relatively soft seeds and, depending on grazing management, may not reseed dependably. Rose clover has hard seeds but poor seedling vigor, and it may also need to be replanted frequently. While crimson and rose clover are the most palatable of the winter annual clovers, they are still normally less palatable than companion species and many horses may refuse to consume them.

Arrowleaf clover is a highly productive clover but contains high levels of tannin. These tannins greatly decrease arrowleaf clover palatability for horses. Horses will avoid consuming arrowleaf clover, so do not establish it in equine pastures.

Establishing Pastures

Seedbed Preparation

In many situations (*i.e.* sloping or other erosion-prone areas) no-till planting of forages into existing sods is the only option. However,

pasture plants are most easily established on well-prepared, clean-tilled seedbeds when a choice between seedbed type is possible. The amount of tillage necessary to prepare a good seedbed depends upon what crop was last grown on the site. When converting cropland into pasture, less tillage is needed than if establishing new pastures on soils formerly in brush or native grasses. When tilling pasture sites, consider the erosion potential and minimize erosion in new pastures. On sloped sites you may want to suppress or kill existing forage with herbicides and no-till into the existing dead sod to minimize or prevent soil erosion. Most grass and legume seeds are small, so a firm, moist seedbed is essential in all situations to obtain a good stand. Seedbeds of this type provide good seed-soil contact and conditions favorable for seed germination and plant emergence.

Liming and Fertilization

A good liming and fertilization program is necessary for establishing and maintaining productive pastures. Soil pH and fertility vary widely due to past fertilization and liming practices. Always test soils several months prior to planting to determine lime and fertilizer needs for your particular situation.

Lime is used to supply calcium and magnesium and neutralize soil acidity (increase soil pH). Maintaining proper soil acidity will make some nutrients needed by the plant (*i.e.* phosphorus) more available and some elements toxic to plants less available (*i.e.* aluminum). This, in turn, allows plants to use fertilizer more efficiently.

Liming also promotes desirable bacterial activity in the soil and improves organic matter decomposition. Most crop plants grow well at pH of about 5.8 to 6.2; however, some legumes require a higher soil pH for optimal nitrogen fixation and forage production. If possible, apply limestone at least 2 to 3 months in advance of planting and incorporate with tillage into the top 6 inches of soil. In no-till situations, surface application of lime is also an effective (but slower acting) method of alleviating soil acidity.

Proper fertilization is necessary to promote rapid, early growth of forage plants and ensure good stands. Apply the needed quantities of phosphorus and potassium before planting and incorporate into the soil. Application rates of phosphorus and potassium will vary and are dependent upon field history and forage crop needs.

Nitrogen is also necessary for rapid early growth of seedlings. Apply 30-60 pounds of nitrogen per acre before seeding or soon after seedling emergence. Additional nitrogen may be needed later in the growing season. Legume seedlings do not require nitrogen fertilizer.

Seed

With the exception of hybrid bermudagrasses and perennial peanuts, most forage plants are established from seed. If possible, purchase certified seed. Certified seed is normally more expensive, but it has guaranteed germination and will list the amount of noxious weed seed present. **Cheap seed are seldom a bargain.**

Planting Methods

Crops established from seed can be planted using several methods. Plant at the proper time of year using enough seed to produce a vigorous and productive pasture. Recommended seeding rates and planting dates for the Coastal Plain, Piedmont and Mountain areas of Georgia are listed in Table 1 (page 11). Deliver seed into the soil at a uniform depth and firm soil around the seed. Planting seed too deeply will cause establishment failure. Large-seeded crops like wheat can be planted 1 to 1½ inches deep. Small seeded crops like ryegrass and clovers should not be planted more than ¼ to ½ inch deep.

On prepared seedbeds, plant seed with grain drills or cultipack seeders. If small seeded crops are planted, the grain drill should be equipped with a small seed attachment to ensure accurate seeding rates. Cultipack seeders are ideal for small seeded crops like alfalfa and seed-type bermudagrass varieties because the seed is placed at the proper depth and soil is firmed in one operation.

Seed can also be no-tilled into established perennial sods. Use a sod-seeding drill with disk coulters that slice through sod and allow good seed-soil contact. Grain drills can occasionally be used for sod-seeding in thin bermudagrass stands but poor stands frequently result from using this method.

Some plant species can also be established by broadcasting seed on the soil surface. Seed are then incorporated by lightly disking, dragging, treading or frost depending on plant species and environmental conditions. Since this method is

Table 1. Adaptation, Planting Date and Seeding Rates for Forage Crops in Georgia

	Adaptation			Planting Date			Seeding
	Coastal Plain	Piedmont	Mountains	Coastal Plain	Piedmont	Mountains	Rate/Acre
PERENNIAL WARM SEASON GRASSES							
Coastal, Russell, Tifton 44 bermuda	Excellent	Excellent	Poor	Feb - Aug	Feb - July	Mar - June	20-30 bu
Tifton 85 bermuda	Excellent	Fair	Poor				
Common bermuda	Excellent	Excellent	Good	Mar - July	Apr - June	May - June	5-8 lbs
Pensacola, Tifton 9 bahia	Excellent	Fair	Poor	Mar - June			10-15 lbs
Argentine bahia	Good	Poor	Poor	Mar - June			10-15 lbs
PERENNIAL COOL SEASON GRASSES							
Tall Fescue	Poor	Excellent	Excellent		Sept - Oct	Aug - Sept	20-25 lbs
Orchardgrass	Poor	Fair	Excellent		Sept - Oct	Aug - Sept	20-25 lbs
PERENNIAL WARM SEASON LEGUMES							
Alfalfa	Good	Excellent	Excellent	Oct	Sept - Oct	Aug - Sept	20-25 lbs
Birdsfoot Trefoil	Poor	Fair	Good		Sept - Oct	Aug - Sept	5-6 lbs
PERENNIAL COOL SEASON LEGUMES							
White Clover							
Ladino	Poor	Good	Excellent		Oct	Sept	2-3 lbs
La types	Good	Good	Good	Oct	Oct	Sept	2-3 lbs
Red Clover	Poor	Fair	Good		Oct	Sept	10-12 lbs
ANNUAL WARM SEASON GRASSES							
Pearl Millet	Excellent	Excellent	Good	Apr - July	Apr - June	May - June	10-15 lbs
Browntop Millet	Excellent	Excellent	Good	Apr - July	Apr - June	May - June	20-25 lbs
ANNUAL COOL SEASON GRASSES							
Rye	Excellent	Excellent	Good	Oct	Sept - Oct	Aug - Sept	2-2½ bu
Wheat	Excellent	Excellent	Good	Oct	Sept - Oct	Aug - Sept	2-2½ bu
Oats	Excellent	Fair	Poor	Oct	Sept - Oct	Aug - Sept	3-4 bu
Ryegrass	Excellent	Excellent	Good	Oct	Sept - Oct	Aug - Sept	25-40 lbs
ANNUAL COOL SEASON LEGUMES							
Crimson Clover	Excellent	Excellent	Good	Oct	Sept - Oct	Aug - Sept	10-20 lbs

less precise, increase the seeding rate by 25 percent when broadcasting.

When establishing hybrid bermudagrass or perennial peanuts, good quality sprigs are important. Dig sprigs from fields that are pure and have few weeds or common bermudagrass plants. Remember that sprigs are live plant material and plant them as soon after digging as possible. Keep sprigs cool and moist between digging and sprigging to help maintain viability. Many custom spriggers are available throughout the state and can be contracted for professional and timely vegetative establishment.

Pasture Fertilization

A good fertilization program is necessary to produce high yields of quality forage and to maintain healthy stands of grasses and legumes. The rates and types of fertilizer required vary with different forage crops, management intensity and soil type. Soil testing is a valuable tool when developing a pasture fertilization program. Sample hay fields annually and sample grazed pastures at least every other year. For more information on soil testing, see Georgia Extension Service leaflet #99 *Soil Testing*.

Soil pH and Lime

Soil pH is a measure of soil acidity. Most Georgia soils are acidic and require periodic liming to increase soil pH and supply calcium and magnesium. Availability of many nutrients necessary for plants decrease with low soil pH. Lime soils to maintain availability of these beneficial nutrients and decrease availability of other toxic elements like aluminum. Apply lime according to soil test recommendations.

Fertilizer Materials

When you purchase fertilizer materials, the analysis tag shows the quantity of nitrogen (N), phosphate (P_2O_5) and potash (K_20) the bag contains. These values are given on a percentage basis. For example, a 5-10-15 fertilizer contains 5 percent nitrogen, 10 percent phosphate and 15 percent potash. If the fertilizer contains all three elements (N, P, and K), then it is considered a "complete" fertilizer. A pasture soil test will determine if a complete fertilizer application is needed.

Frequently, you will need to apply N to your pasture, but you may not need potash or phosphate. This is especially true in grazed pastures where little potassium and phosphorous are removed by animals. In these cases, apply simple nitrogen fertilizers. Again, testing your soil is the only way you can be sure what level and type of fertilization is necessary.

Fertilizing Grass Pastures

Hybrid Bermudagrasses

These crops will produce high forage yields under good fertility and moisture conditions. For hay fields, apply 75 to 100 pounds of nitrogen per acre in spring before growth starts and after each cutting except for the last fall cutting. Rates of P and K needed will vary with current soil fertility and N rate. Follow soil test recommendations for these nutrients. Phosphate can generally be applied in one spring application; however, K may need to be applied in split applications on sandy soils because of leaching.

When bermudagrasses are grazed, use lower N rates (150 to 200 pounds per acre) during the grazing season. This is the total amount of nitrogen to be applied during the grazing season and should be split into two or more applications to improve nutrient utilization efficiency and provide more even forage distribution.

Bahiagrass and Common Bermudagrass

These species produce lower yields than hybrid bermudagrass and are usually grazed rather than cut for hay. Apply 100-150 pounds of N in split applications during the grazing season. Base the N rate on the quantity of forage needed. Apply P and K as indicated by soil test results.

Tall Fescue and Orchardgrass

Tall fescue and orchardgrass grown in pure stands can use up to 120 pounds of N per acre. When producing hay, apply 60 to 80 pounds of N in late winter (February to early March). With favorable summer rains, a second cutting of tall fescue can sometimes be obtained in the summer months. If a summer cutting is attempted, apply 70 pounds of N after the spring cut-ting of fescue hay. Tall fescue can also be fertilized with 40 to 60 pounds of N in early September with the resulting forage stockpiled or deferred for early winter grazing. Orchardgrass will produce less fall forage than tall fescue. Again, apply P and K as indicated by soil test results.

Winter Annual Grasses (Rye, Ryegrass, Wheat, Oats)

These grasses can use up to 150 pounds of N per acre. Apply 40 to 60 pounds of N at fall planting or when seedlings have emerged and are actively growing. If fall and early winter weather was favorable for growth, a second N application of 60 to 80 pounds per acre in early winter will often stimulate late winter and spring growth. Ryegrass grows longer into the spring and may also benefit from a third N application of 40 to 60 pounds of N in late March or early April.

Fertilizing Legume Monocultures And Mixtures

Legume (clover) plants can fix N from the atmosphere and in pure stands do not need additional N. Legumes, however, require higher rates of P and K than grasses and must be supplied these nutrients for good persistence and production.

Although legumes fix their own N, grasses growing in association with the clover may benefit from low N rates. If N is used in grass-legume mixes, rates should be (1) timed to minimize grass-legume competition and (2) applied at rates that consider legume proportion of the sward (see below).

Tall Fescue-Clover and Orchardgrass-Clover Mixtures

When tall fescue stands contain a good proportion of white or red clover, little or no nitrogen is needed. A general rule of thumb is not to apply nitrogen if the clover constitutes greater than 15 percent of the stand. If 5 to 15 percent clover is present, apply 30 to 40 pounds of N per acre; if less than 5 percent clover is present, fertilize the pasture as a fescue or orchardgrass grass stand or plant additional clover. It may also be desirable to fertilize with moderate rates of N in early fall or late winter. This will stimulate early grass growth and, if grazed properly, will not negatively impact clover stands. Be sure to supply adequate P and K for best clover productivity and survival.

Winter Annual Clovers (Arrowleaf, Crimson, Ball) in Dormant Warm Season Pastures

Like other legumes these clovers do not require N fertilization, but they do require favorable soil pH and adequate P and K levels.

Alfalfa and Perennial Peanut Monocultures

These perennial legumes need well-fertilized soils and proper management for good yields and persistence. Because these species are normally used for hay production in Georgia, the following recommendations are for hay programs. Base fertilization programs on soil test results and amount of nutrients removed in hay. A typical fertilization program for high yielding alfalfa consists of Phosphorus (P_2O_5), 70 to 100 pounds per acre; Potassium (K_2O), 200 to 300 pounds per acre; Sulfur, 10 to 30 pounds per acre; and Boron, 3 pounds per acre. One-half pound of molybdenum per acre applied every other year may also improve nodulation and nitrogen fixation. Because potassium is subject to leaching, it will be used more efficiently when split applications are made. This is especially true on sandy soils typical of south Georgia. In sandy soils, apply potash in three to four applications during the growing season. Two to three applications are sufficient in heavier soils.

Grazing Management

Animal performance improves when pastures are closely and uniformly grazed. The forage in these pastures is younger and has a higher leaf content and protein level. It is also more digestible than forage in under-grazed pastures where excess forage accumulates and matures.

There is a major difference between close grazing and overgrazing. When pastures are overgrazed and forage availability is limited (not enough feed available), animal performance declines due to reduced intake. A closely grazed pasture can become overgrazed very quickly if forage growth slows and the stocking rate is not reduced. Overgrazing can weaken pasture plants, causing stands to thin and allowing invasion of undesirable weedy plants. Most managers operate on the safe side by allowing some forage to accumulate as a buffer against periods of reduced forage growth.

How close pastures can and should be grazed varies with species. Perennial pasture grasses such as bermudagrass, bahiagrass and tall fescue will tolerate close grazing (2- to 4-inch stubble height) and maintain good stands. When white clover is grown in association with tall fescue, periodically grazing to a 2- to 3-inch stubble height is necessary to maintain clover in the stand.

Pastures may be grazed continuously or rotationally. With continuous grazing, horses graze the

same pasture for extended periods of time, perhaps for the entire season. With rotational grazing, horses move from pasture to pasture during the grazing season.

Continuous Grazing

A continuous grazing program requires less fencing to subdivide large pastures and less time and labor to handle horses; however, the major disadvantage is matching the stocking rate to the forage growth rate.

During periods of rapid forage growth, the supply of forage exceeds demand and excess forage accumulates. Since young forage is more digestible and palatable than older forage, the horses start to "spot graze." Some areas of the pasture will be grazed heavily while the forage in ungrazed areas grows and matures. When pastures are spot grazed, it may be beneficial to mow to promote more uniform grazing.

When conditions are unfavorable for forage growth, the pasture may be unable to supply enough forage for the horses, causing over-grazing. Under these conditions, supplemental feed is needed.

Rotational Grazing

Large pastures are fenced into smaller units for rotational grazing. Horses are confined in one area until the forage has been grazed down to the desired stubble height and they are then moved into the next area and the process repeated. The length of the grazing period in each area depends on stocking rate and forage growth rate. When conditions are favorable for rapid growth of forage crops, it may be unnecessary to graze each grazing area or paddock. The forage in areas not needed for grazing can be harvested as hay and stored for feeding during the winter or stockpiled for later grazing.

When forage growth is slowed by dry weather or other growth-limiting conditions, all of the grazing areas may be needed to meet the demand for forage. A rotational grazing program provides flexibility and allows more efficient use of the forage produced. Several new fencing options available reduce the costs of cross fencing and make rotational grazing a viable alternative. Georgia Extension Service bulletin 1192, *Fences for Horses*, discusses types of temporary fencing that are available.

Horses seldom graze pastures to a uniform height unless the stocking rate is very high. After rotating the horses out of a pasture, it may be useful to mow the pasture to a uniform height. Mowing helps control weeds and other undesirable plants, promotes uniform regrowth of forage for the next grazing cycle, and helps break up dung piles.

Rotational grazing helps maintain quality pastures and is important for the health of the horse. Internal parasite infective larvae and/or eggs are not as likely to survive when horses are periodically removed from the pasture. The deworming schedule can also be planned so a horse is passing very few parasite eggs when it goes into a new pasture. Grazing cattle following horses also helps to control horse internal parasites, since the stomach worm (*Trichostrongylus axei*) is the only internal parasite common to horses and cattle.

Hays

Hay is an important part of the feeding program on most Georgia horse farms. Hay is frequently fed to supplement horses on pasture and is the primary source of fiber for horses that have no access to quality pasture.

What kind of hay should you feed horses? Contrary to popular opinion, horses can use virtually any good quality grass or legume hay. The hay should be palatable and free of toxic weeds; it should not be moldy or dusty. Forage tests will provide the information needed to determine the feeding value of the hay so the ration can be balanced for protein, energy and minerals with supplemental feed if necessary.

Hay Quality

The term "quality" refers to the nutritive or feeding value of a forage. Two widely used indicators of forage quality are digestible energy (DE) and crude protein (CP). High quality hay is more readily consumed and is used more efficiently than low-quality forage.

Forage species and age when harvested are major factors affecting quality. Forage crops differ significantly in quality. Legume forage crops generally produce forage that is more digestible and has a higher protein content than the grasses. Annual forages are usually more digestible than perennial crops.

The feeding value of a forage is largely determined by its stage of maturity when harvested. Young, leafy vegetative growth has a higher level of total digestible nutrients and protein. Both protein and digestible energy levels decline as plants pro-

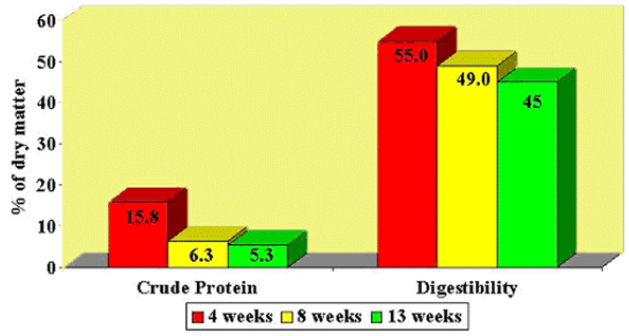

Figure 1. Effect of bermudagrass age on hay quality. For quality hay and good yields, bermudagrass should be harvested at 4- to 5-week intervals. Data from McCollough and Burton (1962).

gress toward maturity. Older forage has fewer leaves, more stems and a higher fiber content. Presence of mature seedheads or flowers in hay indicates advanced maturity and lower quality. For high quality and good yields, harvest bermudagrass hay at 4-5 week intervals (Figure 1). Harvest tall fescue and orchardgrass at the boot to early bloom stage for good quality.

Cutting good quality forage does not guarantee good quality hay. Properly cured hay will have a sweet aroma when the bale is opened and will not be moldy or dusty. Moldy hay was probably baled too wet and should be avoided. Horses are particularly susceptible to colic after consuming moldy hay. Hay should not contain foreign material, such as excessive weeds, which may be toxic. Contrary to popular belief some "weed" species can improve hay quality. For example, crabgrass and ryegrass are high quality forages that are frequently labeled as undesirable. Properly cured bermudagrass that contains these species can be highly palatable and more nutritious than pure bermudagrass hay.

A bright green color usually indicates proper curing and a high carotene content (pro-vitamin A). Young immature forage will normally be greener than more mature forage. The color of hay alone, however, does not imply that it is high quality. While properly cured hay is green when baled, some color changes occur during storage. Under the high humidity conditions common in Georgia, hay on the outside surface of the bale will turn brown while hay inside the bale remains green. It is also often true that brown hay harvested at an immature growth stage has much higher nutritive quality than green hay harvested at a mature stage of growth. Although hay color gives some clues to the quality of hay, it should not be considered a primary indicator of nutrient content.

Forage Testing

Visual observations are useful but should not be the only criteria on which rations are based. A forage analysis conducted by the University of Georgia Forage Testing Laboratory or a reputable private laboratory provides an accurate determination of quality so properly balanced rations can be formulated. The forage analysis should include (1) percent moisture, (2) percent crude protein, (3) percent fiber (ADF-acid detergent fiber and NDF-neutral detergent fiber) and (4) percent calcium and phosphorus.

Your county extension agent can provide information on sampling hay for analysis and help with ration formulation.

Legume Hay

Legume hay generally contains higher levels of energy and protein than grass hays (Table 2, page 17). Calcium, vitamin A and vitamin B content is also usually higher for legume hay.

Alfalfa and perennial peanut are the most common legumes used for hay production in Georgia. Other clovers have nutrient characteristics similar to alfalfa. Alfalfa is a good roughage source particularly for young horses and lactating mares. When incorporating alfalfa into rations, make a gradual change from grass to alfalfa hay since an abrupt change may cause digestive upsets. Alfalfa-fed horses may urinate more frequently because alfalfa usually contains more nitrogen (crude protein) than grass hay. The urine will also contain more sediment because of the higher calcium content. Contrary to popular belief, alfalfa does not harm the kidneys.

Blister beetle contamination is a concern with alfalfa hay. Blister beetle poisonings have been reported throughout the country and are most common with hay produced in the Midwest and southwestern sections of the country. The toxic material from the blister beetle is believed to be a cantharide. Symptoms include colic, fever, increased pulse, increased respiration, sweating and soft feces. Poisoned horses repeatedly splash their muzzles in water without drinking. Once symptoms appear, death occurs in a high percentage of horses within two days. No satisfactory treatment for blister beetle poisoning has been found. The beetle is about ¼ to ¾ inch long and may be entirely black, black with orange stripes, gray or yellowish-tan with or without black spots.

Perennial peanut is a high quality tropical forage legume produced in Florida, southern Georgia, and southern portions of the Gulf States. Limited equine research has been conducted investigating perennial peanut hay value. Perennial peanut hay is readily consumed by horses and generally has slightly lower crude protein and digestible energy content than alfalfa. For example an excellent quality alfalfa hay will contain about 1.1 megacalories of digestible energy per pound, while an excellent quality perennial peanut hay will contain 1.0 megacalories per pound when fed to horses. Perennial peanut is closer to alfalfa in nutrient content than the grass hays and appears to be an excellent hay for horses.

Grass Hay

Bermudagrass, bahiagrass and tall fescue are the most abundant and commonly fed grass hays in Georgia, although orchardgrass hay is frequently found in northern areas of the state. The hybrid bermudagrasses (*i.e.* Coastal, Russell, Tifton 44 and Tifton 85) typically produce higher quality forage than common bermudagrass and are available throughout Georgia. Bahiagrass hay is normally slightly lower quality than bermudagrass due to advanced maturity and increased stem material at harvest.

Past research at the University of Georgia has indicated that mature horses tend to prefer bermudagrass with smaller diameter stems, narrow leaf blades and shorter leaf blade widths. While this data is interesting, these factors indicate nothing about actual nutrient quality of hay. In fact, coarse-stemmed bermudagrass hays are readily consumed if horses are not allowed a choice. It is important to note that if a sudden change is made in forages offered to horses, they may be slow to begin consuming the new forage. For example, if a diet is rapidly changed from Coastal (fine stemmed) to Tifton 85 (coarse stemmed) bermudagrass, horses may refuse Tifton 85 for a short period of time. Diet changes should be made gradually to allow equines to adapt.

Tall fescue hay may range from slightly lower to slightly higher quality than the bermudagrasses. Fescue hay quality is also directly related to maturity at harvest. Hay that contains a high percentage of mature seedheads is generally low in quality. Exercise caution when feeding wild-type endophyte infected fescue hay because of the toxicity problem (see page 5). Endophyte-free tall fescue hay is safe to feed.

The quality of grass hays may vary significantly. The protein content may range from 6 to 16 percent, while digestible energy value ranges from .70-.95 Mcal/pound. Because of such wide ranges in nutrient content, a laboratory analysis is necessary to determine the feeding value of hay so rations can be properly balanced. Ration formulation for horses should be based on the forages they are consuming. If a horse requires supplemental energy or protein, formulate rations to complement the forage, not vice versa.

Hay Purchasing

Supply and demand dictate hay prices, which vary from year to year and between seasons of the same year. Hay is more expensive when supplies are low so is generally worth more in winter than in spring or summer when forage crops are being harvested.

When purchasing hay for horses, energy content is the most important factor for most classes of horses. Alfalfa and perennial peanut hay have a high protein content and can be fed to reduce the supplemental protein needs of some classes of horses, particularly young growing horses; however, a supplemental protein source, such as soybean meal generally is a cheaper satisfactory source of additional protein for most classes of horses.

Price should be based on quality. Alfalfa and perennial peanut hay should contain about 1.0-1.1 megacalories of digestible energy per pound, while grass hays typically contain about 0.8 megacalories of digestible energy per pound. Since grass hay contains only 70-80 percent as much digestible energy as alfalfa, it is less valuable. Based on these figures, when grass hay sells for $100 per ton, alfalfa is worth $125-$143 per ton.

Storing Hay

Purchasing an entire year's supply of hay from one or two hay harvests is a good way to assure consistent quality throughout the year. To do this, you should know how much hay you will need and have adequate storage facilities.

Good pastures will significantly reduce annual hay needs. However, if hay is to be the primary forage source, some simple calculations can help in determining how much hay to purchase. An average horse consumes one to 2 percent of his body weight in hay each day. For example, a 1,200 pound horse will consume 12-24 pounds of hay daily. A good average figure to use is 1½ percent or 18

Table 2. Approximate digestible energy and relative feed values of hays for horses (100% Dry Matter Basis)

Hay	Crude Protein (%)	Neutral Detergent Fiber (%)	Crude Fiber (%)	Digestible Energy Mcal/1 lb	Relative Feed Value
	>20	<30	<23	1.2	100
Alfalfa	16-18	30-47	24-28	1.1	92
	<15	>47	>28	1.0	83
	>12	<65	<30	0.9	75
Coastal Bermudagrass	8-12	66-72	31-35	0.8	67
	<7	>72	>35	0.7	58
	>9.5	<68	<32	0.75	63
Bahiagrass	7-9.5	68-75	32-36	0.7	58
	<7	>76	>36	0.6	50
	>12	<65	<26	0.95	79
Tall Fescue	7-12	66-70	27-30	0.83	69
	<7	>70	>30	0.75	63
	>12	<60	<26	0.99	83
Orchardgrass	7-12	60-65	26-30	0.85	71
	<7	>65	>30	0.75	63

pounds of daily hay. Calculate: 18 lbs/day x 365 days= 6,570 lbs/ 2,000 lbs per ton = 3.3 tons. This translates into approximately 135 bales of hay that weigh about 50 pounds each. Smaller horses require less total hay and the hay required also varies if supplemental grain is fed.

Hay is generally packaged in rectangular bales that weigh from 40-60 lbs. Place bales in sheltered storage convenient to the barn. Ventilate the hay storage area well. Barn designers generally recommend a separate hay storage area away from the horse barn to reduce dust levels in the barn and decrease the possibility of a hay fire.

Large round bales (750-1200 lbs) can be used. These bales can be stored outside; however, nutrient and dry matter losses will be higher than for sheltered storage. When storing round bales outside, locate the stackyard on a sloping area with a firm surface. Maintain space between the rolls to allow air circulation. Most of the hay loss associated with outside storage occurs at the point where the bales contact the soil. Research data shows that losses from large stemmed grasses, such as ryegrass stored on the ground, can exceed 65 percent. Recent data from Georgia demonstrates that more than 30 percent losses of the bale weight can be lost from improper storage alone (Figure 2). This does not include the amount of moldy hay that will be refused by animals (Figure 3), which can total an additional 20 percent. Losses can be significantly reduced by storing rolls on a rack or crushed rock to raise them

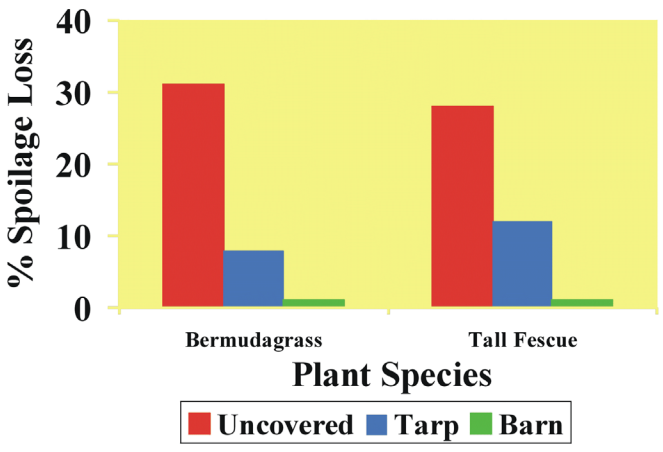

Figure 2. Spoilage loss (% dry matter) of bermudagrass and tall fescue stored for 7 months (1) outside and uncovered, (2) outside under a tarp, and (3) under a hay barn. Data from Hoveland *et al.,* 1997.

Figure 3. Horses often refuse to eat the outer areas of weathered round hay bales. The outer area of this bale was moldy, so only a limited amount of the bale was consumed.

off the ground and by covering them with a tarp to shed rainfall. Round bales can be an economical forage source, but like small square bales, must be stored properly.

Summary

Efficient and economical forage production and utilization provides an excellent source of nutrients for equines. In addition, animal health and well being is generally improved when horses are allowed pasture. Hopefully the information contained in this bulletin will provide information needed to plan, manage and maintain a productive forage program for horses.

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