Horse Forage and Forage Management

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Agricultural Division
The Samuel Roberts Noble Foundation

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Cover illustration: Dillard’s horses grazing a paddock of high-quality crabgrass
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Preface

There is not much easily accessible pasture and forage information available for the everyday horse person. In this publication, we use the terms pasture and forage somewhat interchangeably. We wrote the bulletin with a wide range of people in mind, from the youngest, who may also be in 4-H or FFA, to the neophyte adult willing to read and learn or the more sophisticated horse owner. We believe there is something in the bulletin for all, but it does not contain all the answers about pastures and hay. You can secure detailed forage management information from the Noble Foundation and other specialists.

The geographic area of interest is the Southern Plains and some of the surrounding area. Some information in the writing is applicable anywhere.

We did a relatively aggressive literature review. In an effort to make the publication more easily readable, we didn’t quote most references in the text. An extensive reference list in the back credits authors and their work and provides sources for more extensive reading by those interested in doing so.

We thank the Noble Foundation for supporting the writing and final publication. Jim Pumphrey is credited with encouraging us to write the publication, since he perceived in his equine work the need for the information. We thank the manuscript reviewers who provided excellent input: Billy Cook, Dr. David Freeman, Dr. Sandra Morgan, and Ryan Reuter. Thanks to Cara Wallace who makes our “Okie English” more universally readable and to our Communications Department for all their great support.
When we think *horse pasture*, we tend to visualize special forages and techniques. The fact is, we use the same forages with cattle and other livestock. The management, too, is usually much the same, but a few more cautions and inputs for special uses may be in order.

Good pasture can be one of the best-quality and least-expensive means of feeding a horse. Our goal is for horsemen to actively produce and more properly use pastures for horses.

The need for horse pasture depends on the nutritional demands of the horse and the horse’s value. A horse has high value because of both emotional and financial considerations. Sometimes it is unrealistic to use pasture for the nutritional needs of those special animals because the risks are too high.

This report is a combination of our experiences, the experience of horsemen we know, and information gleaned from horse-forage writings. The geographic area we are most concerned with is southern Kansas, Oklahoma, north and central Texas, Arkansas, and Louisiana. The forage discussions also apply somewhat to the vast area that includes all the surrounding states and other areas.

This report cannot be the whole answer. Detailed complete pasture management is not possible here, but this information can serve as a launching point.

Other literature also discusses general horse forage management. This writing does not indicate all references in a specific location, because of our goal of writing for the horseman small and large, but a listing of references at the back may be of interest.

**The Mystery of Horse Pasture**

The horse pasture subject, perhaps more than most agricultural areas, has been characterized by many erroneous ideas and a lack of information. Misinformation, misinterpretation, old fables, myths, old wives’ tales, trade secrets, and guessing have been common because of a lack of well-controlled precisely interpreted data and the forage inexperience of many horse producers. One says rye will kill a horse; another says it’s the best horse pasture there is. We want this report to contribute to more proper interpretations of pastures and better horse pasture management.

**Physical Characteristics of a Good Horse Pasture**

Numerous physical characteristics need to be considered in developing and managing good, safe horse pasture:

1. a dense, relatively smooth turf or surface
2. absence of harmful or risky objects such as old wire, stumps, rocks, junk, and garbage dumps
3. safe, noncutting fences
4. absence or very low incidence of poisonous plants and absence of thorny brush that can cause physical damage and mane or tail entanglement
5. yearlong forage availability, as feasible
6. nutritious and palatable forage
7. area large enough to provide the pasture quantity and quality needed, and therefore generally large enough for normal exercise needs and grazing management such as rotational grazing paddocks
8. area with fresh, clean water
9. area with shade for summer
10. area with shelter from adverse weather such as storms and cold
11. area relatively free of parasites; control procedures as necessary
12. area free of marshes and swamps
Pasture Usage, Stocking Considerations, and Costs

Pasture may be in a small holding paddock, a run, or a large paddock. You must decide whether to use the area for exercise, forage, or both. Small, congested exercise areas and runs are not usually feasible to manage for forage production. Don’t waste time or money on them, but do manage them to maintain a vegetation cover for soil conservation.

Horses require at least 2 acres per animal for a good exercise and forage area in good forage country. The stocking rate in southern Oklahoma probably varies from 2 to 5 acres per horse on improved pasture that is well managed.

A well-nourished horse will consume about 2 percent of its body weight per day on a dry-weight basis. Thus, a 1,000-pound horse will require approximately 20 pounds of forage or feed per day, or almost 4 tons of dry matter yearly per horse.

A pasture can supply at least some of that forage, depending on the pasture and the horse needs. Bermudagrass and winter pasture in southern Oklahoma will produce 3,000 to 8,000 pounds of forage per acre with recommended minimum to moderate fertilization and adequate forage management. The 3,000-pound yield is enough bermudagrass for a 1,000-pound horse for the equivalent of 150 days. Therefore, about 2.5 acres would be needed to carry the horse on pasture and hay alone at a moderate level of agronomic management. The 8,000-pound yield could provide grazing for about 1.5 horses per acre for an eight-month equivalent, but the stocking rate is not even throughout the time.

Stocking density is the number and weight of the stock (horses) on a given paddock (pasture) while the herd is in that paddock. Stocking rate is the number and weight of stock (horses) on the whole pasture unit. Stock density rates vary extremely. One guide is that small groups of about ten mature horses in small rotational pastures tend to be better for pasture management than larger groups in larger pastures. Larger groups tend to divide into smaller groups and cause problems such as stampeding through fences. Sometimes the figure is much higher and the stocking rate still successful, especially in larger paddocks.

Direct cost of producing bermudagrass might be about fifty dollars per acre yearly. Thus, pasture cost per grazing day would be about thirty cents. This figure is highly variable. It represents a direct pasture cost for fertilizer and weed control of about twenty-five to thirty dollars per ton of forage produced.

The direct cost of producing an acre of good, small-grains-based, winter pasture ranges from about seventy-five to one hundred twenty-five dollars per acre. These forages, or mixtures, usually produce 2 to 3 tons of dry weight forage per acre yearly. Forage cost per ton varies from twenty-five to sixty dollars. The daily cost per 1,000-pound horse feed-day ranges from about twenty-five to sixty cents, which is economical compared with a fully hand-fed ration. These forages are very high quality.

Pasture Quality

Pasture quality is influenced by plant species and age, soil fertility, seasons, and drought, among other factors. Every forage we mention can be good quality. Soil fertility can be managed easily to enhance forage quality. An overabundance of forage can cause problems for many managers.

The goal of pasture management should be to use fresh regrowth. Forage that has regrowth four to six weeks old and 4 to 10 inches tall is usually of excellent quality. Managing to graze at these stages is part of rotational grazing management discussed elsewhere.
These growth and recovery periods are worthy goals, but there will be much variation. Remember, the better the quality, the better the cost offset from fully hand-fed rations.

A so-called green pasture is not necessarily good. Horses can be malnourished in deep, green forage. Extremely lush pastures containing over 85 percent water can be too wet and too low in fiber for good nutritional intake or high dry-matter intake. The horse simply has to intake too much water to get needed nutrition. Plentiful low-quality pasture can result in hay gut and horse digestive tract impaction. Thus, supplemental feeding on pastures is sometimes needed.

It is helpful to have a basic knowledge of the horse digestive system when interpreting feeding, grazing, and animal health relationships of the horse. It may be helpful to compare horses with cattle in this regard. Horses are cecal fermenters. The majority of the digestion of roughage is accomplished in the cecum, or large intestine. Forage enters the stomach first, is broken down, and passes on to the small intestine, where most nutrients such as protein, simple sugars, and fats are absorbed. Then the forage passes into the large intestine, where specialized bacteria break down cellulose into a usable form of energy. Cattle are ruminants, meaning that forage enters the rumen, a pre-stomach, first. In the rumen, specialized bacteria break down most components of the forage into simpler molecules. The bacteria use some of these nutrients in the feed. The digestive system of the horse requires high-quality forages, whereas that of cattle uses very low-quality forage the best. Digestive anatomy is why horses are driven to eat small meals of high quality forage and are such notorious spot grazers. The long, folded large intestine is also the reason horses are so susceptible to impaction colic when fed low-quality roughage. In general, horses make efficient use of forage as long as it is high quality. If it isn’t, horses cannot perform to their potential unless they receive supplemental feed. A different digestive system is required if efficient use of low-quality forage is desired. Freeman (1996) provides additional information.

Summer Pasture Grass Choices

Oklahoma, Texas, and the surrounding region offer a wide choice of summer forages for horses. Forages can vary from the perennials for long-term forage to annuals for special, short-term pastures. All need to be managed, and each has a unique requirement. The forages can make good hay, and most of them respond readily to fertilization and irrigation. All of the summer grasses have adequate long stem fiber for horses.

These forages must be selected for climatic adaptation, soil site, terrain, management to be imposed, amount of expected abuse, and overall intended use.

Establishment and detailed management procedures can be obtained from other publications. Additional information on warm-season forages and horse performance is in the section on horse research on forages.

Bermudagrass

Bermudagrass is probably the best overall warm-season perennial horse pasture for this region. Its quality is acceptable, and it forms almost a solid turf, sustains stands under abuse, allows companion cropping, and responds to modern rotational grazing and other modern management. It is one of the best all-around horse pastures for Oklahoma, Texas, and regions in the southeastern United States.

For Oklahoma, sprigged hybrid bermudagrass is available as ‘Coastal’ (for southern Oklahoma and Texas), ‘Hardie’, ‘Midland’, ‘Midland 99’, and ‘Tifton 44’. Common types may also be sprigged. Winter-hardy seeded varieties of ‘Cheyenne’ and ‘Wrangler’ are good. ‘Midland 99’ and ‘Tifton 44’ are higher quality than ‘Midland’ or ‘Coastal’. Any of these varieties are suitable. Other
less cold-tolerant varieties can be used to the south and southeast of Oklahoma. An older type, ‘Greenfield’, is shorter, thicker, and suited to horse pastures. All of these varieties are productive when properly managed. They should be fertilized and sprayed or mowed for weed control, and use should be deferred to allow recovery, especially in late summer.

These common types of bermudagrasses, such as ‘Greenfield’ and ‘Wrangler’, tend to be shorter and denser and may have a denser rhizome system than many other varieties. There are also many naturalized common bermudagrasses that tend to be denser, shorter types than the improved hybrid varieties. They have survived the tests of time and situation.

Under poor horse pasture management, these common types persist and produce where the improved varieties succumb. If you will not rotationally graze, fertilize well, or otherwise manage your pasture, then these usually inferior bermudagrasses may be the best for you.

Bermudagrass is the toughest grass we have, but *horses can still kill it*. It must be managed and allowed to have a suitable recovery period. Horses have the biting ability to clip grass completely to the soil surface and destroy its vigor, therefore contributing to its death.

If bermudagrass is adapted to your horse production area, you probably should have it as a major forage base, especially in abuse areas. Other forages can be added to bermudagrass or integrated into the total pastures to add production, quality, and length of green season.

**Crabgrass**

Crabgrass is an annual high-quality forage that produces well on well-drained soils with a medium to coarse texture. It is easy to establish and can be managed for a planned volunteer stand that can last decades as a pasture or meadow without being reseeded, but it takes planning and management. It can form a sod whose quality nears that of bermudagrass and is certainly better than that of bunchgrasses. There are no known toxicity problems with crabgrass forage.

Crabgrass is a good addition to a horse pasture, primarily in the precipitation zones that receive at least 25 inches of rain or in irrigated areas. It is good horse pasture and horse hay that can rival the quality of the very best summer grasses.

Crabgrass pasture can be managed to have almost the same green season as bermudagrass, but single-crop crabgrass usually greens about two weeks later in the spring. Its quality is better than that of bermudagrass. The high digestibility of crabgrass makes it excellent pasture forage or hay for many horses (see cover illustration). Horse graziers have used good crabgrass pasture at 1 acre per horse during the full summer season.

Crabgrass can be grazed off in the fall and sod-seeded to rye at least as easily as rye can be sod-seeded into bermudagrass. Crabgrass can be used successfully as a tilled double-cropping forage: crabgrass during summer, winter pasture during winter, and crabgrass again the next summer, which fits well with demands of many horse forage needs. To make crabgrass most successful, give it winter-season tillage, summer fertilization, and rotational grazing. Management information is available from the Noble Foundation on request.

Crabgrass is considered part of the horse pasture family because

1. the necessary tillage management should help control parasites and allow better winter pasture management;
2. crabgrass allows better double-cropped winter pasture than other approaches;
3. when perennials are killed by overgrazing and other problems, crabgrass could be reestablished annually;
4. it could partly replace the summer annual void left by sudangrass or other forages;
5. it is an exceptionally high-quality summer forage;
6. It responds well to irrigation and is useful in small traps, runs, and paddocks around a horse headquarters facility where small-scale irrigation is available.

Several publications on crabgrass pasture management are available from the Noble Foundation (Dalrymple, 1999a).

**Johnsongrass**
Refer to “Sorghum Grasses, Sudangrasses, and Millets” for johnsongrass information.

**Native Grasses**
The native range grasses are good horse forages. They are usually managed without fertilization, but weed control is recommended. Native grasses are considerably lower in production than well-managed introduced grasses. They are more susceptible to overgrazing and trampling, and because of their consistently medium to low quality, supplemental feed is often needed. That consistency may be one of the greatest advantages for horses because wide swings in quality are unusual. These grasses require three to ten times more acreage per horse unit for the same forage equivalent than properly managed improved grasses that are well fertilized.

**Old World Bluestems**
These grasses are introduced from various parts of the Old World. They are well adapted to Oklahoma and the surrounding regions and produce good high-quality pasture that is better suited to tight land than bermudagrass.

Varieties include ‘Caucasian’, ‘Ganada’, ‘King Ranch’, ‘Plains’, ‘WW-Spar’ bluestem, ‘WW-Ironmaster’, ‘WW-B Dahl’, and ‘PMT-587’. ‘King Ranch’ and ‘Plains’ bluestem have been used successfully for horse pasture, and there is no reason why the others can’t be used. ‘Caucasian’ bluestem is the most productive perennial tight-land grass available in our region. ‘Plains’ bluestem is widely adapted and has proven its forage use. ‘Ganada’ bluestem is a very dense, low-growing, Old World bluestem. It is more of a conservation bunchgrass because of its density and is expected to be more resistant to horse trampling and short grazing than other Old World bluestems because of its shortness.

These grasses are bunch grasses and, therefore, are more sensitive to overuse, trampling, and mudding-in (pugging) than bermudagrass. Grazing management is definitely more important with these grasses than with bermudagrass because they do not recover as well as bermudagrass after short-grazing and trampling.

These grasses can get ergot. Refer to “Poisonous Plant Considerations.”

**Bahiagrass**
Bahiagrass is a sod-forming bunchgrass useful in southeastern Oklahoma, southwestern and southern Arkansas, and eastern Texas. It can be used like bermudagrass. Varieties available include primarily ‘Pensacola’ and ‘Tifleaf 9’.

**Sorghum Grasses, Sudangrasses, and Millets**
The sorghum grasses and sudangrasses are not generally recommended for horses and include sudangrass, johnsongrass, sorghum hybrids, and sorghum-sudangrass hybrids. All of these grasses are excellent from a general forage quality viewpoint, however. They can produce massive amounts of forage. All of them require excellent rotational grazing, mowing for residue control, and fertilization for good yields.
If these forages are needed in emergencies, use caution when letting horses graze them. The sorghum-sudangrass can cause cystitis, or ataxia syndrome, a horse health problem. They also develop prussic acid. Refer to “Poisonous Plant Considerations.”

The millets include German and pearl. German millet, also called foxtail millet, can be used for short-season emergency grazing or hay. Regrowth is negligible afterward. Pearl and German millet can build up nitrate, which may affect horse health. Refer to “Poisonous Plant Considerations.”

All of these sorghums and millet crops require considerable farming, and production is erratic. Grazing management is difficult because of variations in growth, from extremely rapid to very slow or none.

**Weeping Lovegrass and Annual Lovegrass (Teff)**

Weeping lovegrass is the most productive upland sandy-land grass for our region. Its green season surpasses that of bermudagrass by one to two months per season. It can be integrated into the horse pastures to advantage.

Weeping lovegrass requires haying or definite rotational grazing for best results. It will not tolerate long-term short grazing, especially during fall. It is best to use it with other pasture types. Weeping lovegrass can make excellent-quality hay with higher fiber content.

Weeping lovegrass should be only a minor percentage of forage acreage because of its rapid growth and intensive use demands. One acre per ten to twenty horses may be sufficient when other forages are available.

*Teff* is the common name for an annual lovegrass that has been largely overlooked in the Southern Plains. It produces well in Oklahoma and has excellent seedling vigor and good production and quality. It is used for horse hay in South Africa and Europe, and its palatability and quality rival that of the best of the grass hays. The only known variety in the United States is ‘Dessie’ summer lovegrass. Seed sources are uncommon, but the variety is available from Geertsons Seed Farms, Adrian, Oregon.

**Other Grasses**

Dallisgrass offers some use in far southeastern Oklahoma and other similar areas. Numerous volunteer annual grasses, broadleaf signalgrass, barnyardgrass, and cupgrass can be used as crabgrass is used.

Dallisgrass can be infested with poisonous ergot fungus in the seed-head stage. Refer to “Poisonous Plant Considerations.”

**Grass Mixtures from a Summer Grass Base**

Several grass mixtures offer pasture advantages. A major point is that, to maintain them, grass mixtures require more control of grazing timing and intensity than pure stands do. The mixtures may require more haying and mowing management to eliminate uneven residue heights caused by lack of uniform grazing.

**Bermudagrass- Crabgrass Mixtures**

Crabgrass can be successfully overseeded in new bermudagrass plantings. It provides early, quick cover and high-quality pasture. The crabgrass should be used during the first summer as grazing or hay, which will control its growth and let bermudagrass establish.

The second year, crabgrass production is strongly reduced without winter tillage, so
Bermudagrass continues to grow and produce the second and successive years. This mixture often happens without planning, but it can be used by design. The mixtures perform better with soil disturbance, good nitrogen input, rotational grazing, and good moisture.

**Bermudagrass–Weeping Lovegrass Mixtures**

Weeping lovegrass offers earlier first-year forage, earlier and later green pasture after establishment, higher overall production, and better adaptation to some soil sites.

Bermudagrass offers better soil cover, higher-quality forage from mid to late summer, and better adaptation to fine textured, wet, alkaline, and shallow soils. Bermudagrass also is more tolerant of short grazing or frequent haying, and it will rapidly dominate under those conditions.

Should a severe winter weaken weeping lovegrass, bermudagrass rapidly covers the area via overwintered rhizomes. This mixture should be hayed or mowed periodically to about 4 to 5 inches tall to control growth of lovegrass and induce a more uniform residue height.

**Bermudagrass–Old World Bluestem Mixtures**

We were able to keep a good mixture of ‘Midland’ bermudagrass and ‘Plains’ bluestem for four years by managing for a tall overstory of ‘Plains’ bluestem. The area was either grazed or hayed two to three times per year after ‘Plains’ reached about knee high, and it reverted to pure bermudagrass in one season when its use was converted to a paddock grazed continually.

‘Plains’ bluestem offers the advantages of earlier development and rapid cover after planting. It has better forage quality and production after establishment and better adaptation to some fine-textured soils. Bermudagrass offers better soil cover and resistance to use.

**Bermudagrass-Fescue Mixtures**

Fescue, in fescue areas, is an excellent addition to a bermudagrass base. These mixtures can be maintained long term.

Fescue offers green fall, winter, and early spring pasture and the ability to grow better on wet soil, while bermudagrass offers good spring to fall pasture and better soil cover. Both grasses are adapted to slightly different soils, so they work well in mixed soils. The mixture will produce more total pasture annually than either grass alone and is among the best grass mixtures available where both species can grow well.

When fescue is planted for brood mares, the endophyte-free (fungus-free) or novell endophyte type should be selected over endophytic varieties. However, these varieties are less tolerant of bermudagrass competition, so the mixtures are sometimes rather short lived. Refer to the fescue information for more specifics.

**Old World Bluestem–Weeping Lovegrass Mixtures**

These mixtures have been used some by beef cattle and should be good for well-controlled grazing by horses. The advantages are much the same as for bermudagrass–weeping lovegrass mixtures, except for the lack of good soil cover attributed to bermudagrass. Weeping lovegrass usually dominates.

**Annual and Perennial Winter Pasture Grass Choices**

**Annual Winter Pasture Grasses**

These pastures include wheat and rye, with considerations for barley, annual ryegrass, oats, and triticale. Along with bermudagrass, the winter pastures rank high for horse forage.
The grasses can be planted on tilled land, sod-seeded into bermudagrass, or double-cropped with crabgrass and other summer annual grasses. Combinations of bermudagrass or crabgrass and well-managed winter pasture are an excellent nearly yearlong approach to horse pasture in Oklahoma.

Well-managed winter pastures can provide forage from November to late May or early June, depending on the forage combinations. Rye will usually provide earlier grazing, regrow better during cold, and produce excellent forage yield. Winter pastures can be greatly refined and fitted to individual needs.

These forages have to be established annually, which creates the disadvantage of being more troublesome and costly. However, because they have a high nutritional value, the cost can be easily offset when compared with the cost of purchased feeds. Additional information on cool-season forages and horse performance can be found in the section on horse research on forage.

Varieties. Cattle grazing studies show that oats are more palatable than wheat, wheat is more palatable than rye, and rye is more palatable than barley. Cattle consume all classes of small grains, and the same is true of horses. It is wise to plant these in pure stands for horses, since they tend to be more selective grazers. Intake of these lush forages will not likely decline if horses have access to only one type at a time.

Most varieties of small grains are bred and selected for grain production, with forage being a by-product. There are several good forage varieties of cereal rye: ‘Bates’, ‘Bone’, ‘Elbon’, ‘Oklon’, and ‘Maton’. These varieties can be expected to outproduce other small grains for fall and winter forage. They have the ability to grow at a lower temperature, which makes them dependable in a grazing program. Of these forages, rye terminates spring production the earliest.

Most oat varieties lack winter hardiness to always survive Oklahoma’s winter temperatures when planted early for fall-winter pasture. Oats are not generally recommended for fall planting, but they are dependable as spring planted pasture. Variety choices are limited.

Soft wheat grown in southern and southeastern Oklahoma and into Texas and Arkansas is usually more productive than hard red winter wheat when planted early for fall pasture. Most varieties of hard red winter wheat will produce stockpiled fall forage when planted early, but practically no winter forage regrowth occurs after mid-November. They produce abundant spring forage. Proven hard red winter wheats are trustworthy and can be planted throughout Oklahoma and Texas and adjoining regions. There are many acceptable varieties common in the seed trade.

Annual ryegrasses are an excellent choice for the southeastern two-thirds of Oklahoma, Arkansas, and Texas. They can be easily established as pure stands in clean tilled fields or in grazed-off bermudagrass or crabgrass. They provide excellent forage from March to June. There are several excellent varieties. ‘Marshall’ is a proven winter-hardy type with high production. Other good varieties are ‘Ribeye’ and ‘Jackson’.

Rescuegrass-type bromegrasses are available as ‘Stocker’ and ‘Matua’. These grasses are excellent horse pasture and hay. They can be managed for perpetual volunteer stands, as ryegrass and crabgrass are. Stocker bromegrass can be green into summer up to a month after annual ryegrass matures.

Clovers and vetch can be a part of the spring to midsummer forage. They are discussed elsewhere.

A good combination is a mixture of cereal rye or a variety of winter wheat and annual ryegrass or a winter legume. Under rotational grazing, this mixture will give a better distribution than a single kind of forage through fall, winter, and spring. A mixture can be devised for any part of the south central United States.
Establishment Techniques. The key to a successful clean-seedbed winter pasture is getting it established as early in the fall as feasible and developing the plants as fast as practical while fall weather is favorable for growth and fall stockpiling of forage. Moisture and plant nutrition are the limiting factors in getting good stands and rapid plant development.

The soil is a water reservoir for plant growth, so the management of the soil in relation to available soil water becomes very important. In the drier areas of Oklahoma, it is necessary to plant small grain for winter pasture as a single-season crop in either a tilled or chemical-fallow soil management regimen in order to have sufficient soil moisture for plant growth. Clean-till management of the soil would include a combination of tillage tools to control summer weeds, break up surface and subsoil compaction, and smooth and create a soil medium for excellent seed placement and early plant growth.

Chemical fallow involves relying on a combination of herbicides to conserve moisture by controlling vegetation. This method also depends on sufficient plant residue from the previous year to provide a protective soil cover. The cover intercepts rain droplets to stop erosion and conserves the moisture by reducing soil evaporation. Chemical fallow can be used on soils having more than a 3 percent slope if crop residue is maintained to control erosion.

The clean-till method of seedbed preparation has the disadvantage of depending on machinery. To prevent soil erosion, clean till should be done only on land that has less than a 3 percent slope. When using tilled pasture, remove (rotate) horses to be sure to allow pasture establishment and control excessive destruction of the stand and forage production caused by somewhat continual trailing, running, and overgrazing.

Overseeding winter forages into bermudagrass or crabgrass residue is a common practice for the eastern two-thirds of Oklahoma, among other places. Overseeded winter pasture coupled with proper fertilizer can produce economical winter and spring pasture. Research at the Noble Foundation has shown that overseeded rye can be produced for about fifty dollars per ton of forage. Many horse farms overseed pastures into bermudagrass because more extensive land area is unavailable for tilled pastures.

Overseeding any cool-season annual grass into bermudagrass is often done with special planting equipment that will place the seed in contact with the soil or into a furrow up to 1 inch deep. Broadcast planting or planting with a common drill can also be done successfully. Most no-till drills satisfactorily plant into a grass sod. The row opener of these drills should be placed behind a colter that cuts a slot through the grass sod. The disk row opener or narrow furrow opener will allow seed to be placed into the furrow. Press-wheel attachments following the row opener will press the soil against or over the seed to give it firm contact with the soil. Drills should have a fertilizer attachment so that a nitrogen-phosphorus starter fertilizer can be placed with the seed.

Row spacing is a consideration on some makes of drills. A 6- to 7-inch row spacing is better than an 8- to 10-inch or wider spacing. All narrow spacings are considerably better than row spacings wider than 10 inches.

Common grain drills and fertilizer spreaders can be used to effect a no-till drill planting, which is especially applicable when more precise no-till drills are unavailable. The common drill technique usually results in better stands than broadcast seeding does. Two bulletins available from the Noble Foundation provide detail about the common drill and broadcast procedures: Low-Input Overseeding, publication number NF-FO-99-17 (Dalrymple, 1999b), and Using Common Drills, Fertilizer Spreaders, and Carriers to Plant Difficult Seeds, publication number NF-FO-99-15 (Dalrymple, 1999c).

Broadcast planting can be successful where drills are unavailable. Good stands of winter pasture can be achieved by broadcasting seed into bermudagrass or other grass residues. Some kinds
of winter pasture perform better in this case than others. Among the best tend to be cereal rye, barley, annual ryegrass, rescuegrass, hairy vetch, and crimson clover. Second-order success tends to come from wheat, oats, and triticale. Although the efficiency of getting a stand from broadcast plantings is lower than that with a drilled stand, broadcast stands can be successful. Noble Foundation personnel have broadcast-planted rye, annual ryegrass, and other forages in over 250 paddocks of bermudagrass residue over ten years with a high rate of stand success. Good fertilization and rotational grazing allows good pasture production from these broadcast-planted stands. Clovers or ryegrass can be broadcast-planted on the soil surface of clean tilled lands before or after drilling. On a clean-till seedbed, it is best that clover or ryegrass seed be slightly covered with 1/4 to 1/2 inch of soil, which protects the inoculant that is attached to the clover from direct sunlight. One ideal planting method is to mount an electric-motor-driven broadcast spreader on the front of the tractor so that seed are dropped in front of the drill. The drill disk, or row opener, can slightly cover some seed.

**Planting Dates and Rates.** Small grains and annual ryegrass for pasture should be planted earlier and at higher seeding rates than is conventional for grain production. The following table gives guidelines on planting dates and rates for small grains, annual ryegrass, rescuegrass, some clovers and other legumes, and mixtures. The early fall planting date target is ideal, but plantings can continue to March 1 in southern Oklahoma. In very late plantings, certain kinds and varieties should be used. Planting rates and dates are not given for all forages because that information is available from the usual agricultural information sources.

<table>
<thead>
<tr>
<th>Plant</th>
<th>Early Fall Planting Date*</th>
<th>Planting Rate (Pounds of Good Seed per Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Grain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oats</td>
<td>Aug. 15 to Sept. 20</td>
<td>80 to 120</td>
</tr>
<tr>
<td>Rye</td>
<td>Sept. 1 to Sept. 20</td>
<td>80 to 120</td>
</tr>
<tr>
<td>Wheat</td>
<td>Sept. 1 to Sept. 20</td>
<td>80 to 120</td>
</tr>
<tr>
<td>Barley</td>
<td>Sept. 1 to Sept. 20</td>
<td>80 to 120</td>
</tr>
<tr>
<td>Triticale</td>
<td>Sept. 1 to Sept. 20</td>
<td>80 to 120</td>
</tr>
<tr>
<td>Annual ryegrass</td>
<td>Sept. 1 to Nov. 15</td>
<td>15 to 20</td>
</tr>
<tr>
<td>Rescuegrass (bromegrass)</td>
<td>Sept. 1 to Nov. 15</td>
<td>20 to 30</td>
</tr>
<tr>
<td>Arrowleaf clover</td>
<td>Sept. 1 to Oct. 15</td>
<td>5 to 10</td>
</tr>
<tr>
<td>Crimson clover</td>
<td>Sept. 1 to Oct. 15</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Hairy vetch</td>
<td>Sept. 1 to Oct. 15</td>
<td>10 to 20</td>
</tr>
<tr>
<td>Mixtures:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rye and wheat</td>
<td>Sept. 1 to Sept. 20</td>
<td>70 to 80 and 30 to 40</td>
</tr>
<tr>
<td>Rye or wheat and ryegrass</td>
<td>Sept. 1 to Sept. 20</td>
<td>80 to 120 and 10 to 20</td>
</tr>
<tr>
<td>Rye, crimson clover, and arrowleaf clover</td>
<td>Sept. 1 to Sept. 20</td>
<td>80, 10 to 15, 10 to 20, and 5 to 10</td>
</tr>
<tr>
<td>Overseeding in grass</td>
<td>Sept. 25 to March 1</td>
<td>As above</td>
</tr>
</tbody>
</table>

*Adjust dates about one day earlier for every 10 miles north of Ardmore, Oklahoma, and one day later for every 10 miles to the south. Later plantings cause late pasture availability, and total production will be lower.

Oats, barley, annual ryegrass, and rescuegrass can all be successfully spring planted. Seeding rates are the same or up to 50 percent greater than that of fall planting if a thick stand is wanted. Spring planting dates in southern Oklahoma are about February 1 to March 10.
**Fertilization.** To produce optimum forage, winter forages require added plant nutrients. Small grain yields may range from 1 to 3 tons or more per acre. One ton of forage will contain 60 pounds of nitrogen (N), 12 to 15 pounds of phosphorus (P), and 60 pounds of potassium (K). These nutrients cannot all be supplied by the soil.

The nutrient base in the soil can be determined from a soil test. Supplemental fertilization can be determined according to the soil test analysis and other factors such as soil moisture and type, yield goals, and plant variety.

A typical fertilization program would consist in applying a starter fertilizer containing phosphorus and nitrogen by banding it with the seed at planting. Then a nitrogen fertilizer would be applied during both fall and spring. The first application should be made soon after plants emerge; the second, in mid-February.

For a winter pasture mix of small grain and clover or vetch, delay the first top-dressing of nitrogen two to three weeks so that the clover can become fully established. Nitrogen fertilizers can be toxic to the rhizobium attached to the clover seed, and excessive nitrogen will cause too much small grain production, which increases competition, and that can kill the small legume plants.

Total nitrogen top-dressing rates vary from 50 pounds of actual nitrogen per acre for low production goals to 250 pounds of actual nitrogen per acre for upper-level production goals.

Overseeded winter pasture in bermudagrass or crabgrass residue should be fertilized much the same way. However, it is important to make the first nitrogen top-dressing soon after hard freezes to reduce the summer grass uptake of the nitrogen and encourage early production of the winter pasture component. It is also important to use a minimum of 100 pounds of actual nitrogen per acre.

Soil acidity can be a limiting factor in forage production. A soil pH below 5.5 will limit growth on some varieties of small grains, and a pH below 6.0 will limit growth of clover plants. Soil acidity can be corrected with an application of lime, the amount to use determined by a soil analysis.

**Pasture and Grazing Management.** After the stand of small grain emerges and is growing, the need for management is just beginning. If the profit potential is to be realized, the plants must make good production and then be properly used.

Small grains planted early are susceptible to insect infestation. From the fall until cold weather hits, observe plants every one to three days for possible infestations of armyworms, cutworms, and other damaging insects. Look for leaf damage or discoloration. Watch for areas within the field that have a different color and growth pattern from adjacent areas. Control insects with insecticides as necessary.

Use plant height and density as a guideline to determine the beginning grazing date. A plant must have time to develop an adequate root system before forage is removed, because a shallow, weak root-crown system will cause the regrowth process to be slow and limited. Plants grazed too soon will regrow very slowly and produce much less. When plant leaves are removed, energy to grow new leaves must come from the root-crown lower-stem system. A minimum of 8 inches of growth is the normal guide for the beginning grazing date for rye in southern Oklahoma. Less growth may be acceptable for wheat. Plants should not be grazed to a residue height shorter than 3 inches. Leaf area is needed for the plants to continue growth to make a rapid recovery after being grazed. There will be a few fall seasons that are too dry to produce adequate growth for fall grazing, and grazing should not be done until spring when growth is better. If there is a limited amount of properly grazeable pasture by somewhere between November 15 and December 1, it can be grazed to about a 3-inch residue.

Information on the performance of horses grazing winter pasture is somewhat limited. There are research results that indicate that winter forages can provide 100 percent of the diet for the horse
that is being maintained, used only lightly, or grown at a moderate level. If you want a maximum daily gain for horses that are growing or have a medium to heavy work load, you will need to provide supplemental feed high in energy.

Stocking rate depends on the availability of forage, the size of the animals, and the number of days needed for grazing. A horse will consume about 2 percent of its body weight in dry matter per day. The average grazing period for rye is from about November 15 to May 1, or 150 days. Rye grown on a sandy loam soil that has low to moderate fertility and is in a 35-inch rainfall area will produce an average of 1.5 to 2.5 tons of dry matter during this period. Assuming that 80 percent would be available for grazing, it would then take about 1 to 1.6 acres to provide forage for one horse weighing 1,000 pounds. However, that number will actually be about 2.0 acres per horse from the fall to March 1 and 1 acre during March and April because of the difference in pasture volume in fall and spring. These projections are for excellent, very productive pasture.

Avoid using winter pasture areas for horse exercise. Small-grain plants are tender and can be damaged severely by trampling effects. A separate area containing water, minerals, hay, and shelter should be provided for the horse to loiter and exercise in.

**Perennial Winter Pasture Grasses**

*Fescue.* Fescue is a winter perennial forage adapted to the eastern half of Oklahoma, much of the eastern half of the United States, and some irrigated areas. Old-style fescue has a bad reputation as both a cattle and horse forage because of toxic disorders the animals develop when grazing endophyte (fungus) infested plants. Don’t let expectant mares graze endophytic fescue. Refer to “Fescue Toxicity.”

The new endophyte-free fescues have proven excellent for cattle, and the same appears true with horses. These fescues are better quality but they do not persist as well as endophyte-containing fescue. Using rotational grazing and leaving 3 to 6 inches of residue is imperative for stand persistence.

Fescue can be a useful forage from October to March and from March to late May. Fertilization is much the same as that suggested for annual winter pastures.

There are novell (friendly) endophytic fescue varieties. These fescues have a nontoxic fungus, infused into the physiological system, that gives them stress hardiness similar to that of toxic endophyte-containing fescue. The novell endophyte fescue has superb quality characteristics. The variety presently available is ‘Max Q’.

If you plant fescue, be certain to use endophyte-free varieties or novell endophyte varieties for brood mares.

*Smooth Bromegrass.* Smooth bromegrass can be a useful winter forage in far northeastern Oklahoma, southeastern Kansas, and western Missouri. It has the same growth season as fescue. Fertilization management is much the same as that suggested for annual winter pastures. Smooth bromegrass is good horse hay. Good varieties include ‘Achenbach’, which is persistent, and ‘Lincoln’.

*Rescuegrass (Bromegrass).* Rescuegrass is a high-quality bromegrass that is a short-lived or weak perennial compared with the hardiest cool-season perennials. To be volunteer reseeders, these grasses can also be managed as annual ryegrass and crabgrass. They volunteer better than other cool-season perennial grasses. ‘Stocker’ and ‘Matua’ bromegrasses are two available varieties.

*Wheatgrasses.* These grasses have limited adaptation to most of Oklahoma: tall wheatgrass, pubescent wheatgrass, and western wheatgrass. Persistence and production under dry land is better than that of fescue in central and western Oklahoma. They have a season similar to that of fescue, and
they offer more use than fescue in the western half of Oklahoma. Well-managed wheatgrass is good horse hay. Several varieties are available and include ‘Jose’ tall wheatgrass, ‘Luna’ pubescent wheatgrass, and ‘Manska’ pubescent wheatgrass.

**Orchardgrass.** Orchardgrass is excellent horse pasture and hay. It is a relatively stable perennial in the northeastern and east central area of Oklahoma. Stands can last several years, but persistence is not as good as that of fescue where fescue can grow well. ‘Paiute’ orchardgrass is among the most persistent.

**Perennial Ryegrass.** Perennial ryegrass is an excellent forage with a green season similar to that of fescue. It has limited adaptation because summer drought and heat usually kill it. At best, it is a short-lived perennial with lower production than that of fescue and bromegrass. Perennial ryegrass is very winter hardy compared with annual ryegrass, and it may be used as an annual with lower forage production potential in northern areas.

**Legumes**

Legumes are used as a forage primarily to improve quality and alter the green season. There is only a minor benefit to nitrogen supply when the legume is totally grazed. For upper-level benefit from legume nitrogen, these legumes must produce massive top growth, which is then returned to the soil surface as decomposed organic matter or manure and urine.

Legumes can be grown separately or added to grass pastures, in which case the grass cannot be highly fertilized or managed for upper production because it will dominate and diminish the legume. Legumes require higher levels of phosphorus, potassium, and lime than grasses.

Legumes tend to encourage spot grazing in a grass-legume pasture. Horses will graze legumes, but they often strongly prefer good grass pasture. This tendency enhances the need for rotational grazing management, since in a grass-legume mixture, horses may eat grass and leave legumes to mature. In this case, the legume residue should be mowed to allow it to decompose and release nitrogen for grass production. Horses may leave excellent vetch and clover and graze grasses almost exclusively in a low-stocking-rate syndrome, which characterizes the grazing response.

**Summer Legumes**

*Alfalfa.* Alfalfa can be used for both hay and green grazing, but it must be grown on good soil to be very effective. Horses have a good tolerance to it in the grazing stages. Refer to figure 1 and the section on horse research on forage for more information.

*Lespedeza.* Annual and perennial lespedezas have limited adaptation in Oklahoma. They can be produced in northeastern Oklahoma, Arkansas, and other more humid areas and can be produced poorly in thin grass pastures throughout the eastern half of Oklahoma and into Arkansas, Kansas, and Missouri. They tolerate very little grass competition. The annual lespedezas are good quality and may be considerably beneficial in extensive rather than intensive pastures.

*Sericea lespedeza* is a perennial that can be produced in the eastern half of Oklahoma and the eastern United States. It is relatively unpalatable to horses and difficult to manage for grazing. It does not offer much as a good horse forage.

**Winter Legumes**

*Clovers.* Clovers have always been popular in combination with grasses for a horse pasture. They are usually higher in phosphorus, calcium, and protein, providing a more nutritious and balanced diet for the horse.
Arrowleaf and crimson clover are the two main winter annual clovers best adapted to southeastern Oklahoma. These clovers in combination will produce some fall forage and then become dormant from December to March. Then they will be available as spring pasture from late March to June. Arrowleaf alone will remain dormant until late March or early April and then begin rapid growth in late April, with production lasting until early June. Arrowleaf clover is not very palatable to horses, but it is useful.

Red, white, yellow hop, subterranean, sweet, and berseem clovers are adapted to various regions in the eastern half of Oklahoma. All can be used for horse pasture. Crimson clover is among the easiest to establish. Red clover and white clover may cause profuse slobbering, and the horses should be removed from the pasture if that happens. The pasture may be regrazed later.

In the southern and eastern sections of Oklahoma, winter annual clover and annual ryegrass can be grown successfully. These forages need good rainfall, and even though they are planted in the fall, they produce forage primarily in the spring. Ryegrass can be very productive in the fall when wet mild growing conditions prevail. Most cattle producers will use one or more of these legume forages in combination with rye or wheat.

Vetch. Hairy vetch grows well in Oklahoma and is the choice for annual legumes for the western half of Oklahoma. It can be sod-seeded into bermudagrass, mixed with winter pasture, or planted alone. Hairy vetch is one of the easiest legumes to establish. It will add about one to two months to early pasture during spring.

**Pasture Production Management**

Pasture production management involves site selection, variety selection, and production inputs, among other things. Pasture management can vary from a casual approach to intensive long-range planning. Planning is needed. Experience, skill, and common-sense judgment are important.

Many horsemen tend to be content to feed processed feeds and ignore pasture potential. Sometimes with high-value animals, that is wise. It is also wise to consider that good pasture can be nutritional and more economical than processed feeds.

Pastures can be unproductive, weedy, low quality, and barely nutritional. They can also be the opposite.

All horsemen cannot be forage production experts. However, to realize the benefits, they must use basic production requirements, know the science of pasture management, and apply acceptable use techniques.

There are many aspects of good pasture management. The scope of this writing does not allow thorough coverage of them, but you can obtain additional management information from the Noble Foundation, Oklahoma State University extension and research personnel, and other agricultural information services.

If you already have a pasture base, seek information on how to manage it. Use it partly according to horse nutritional requirements. Manage it for good cost-effectiveness per unit of forage or per day of horse feed. Plan and manage it for the long term.

If you are fortunate enough to choose what pasture to develop, study your lesson well. Seek professional advice, decide what is best for your region, soil, capabilities, and horses, and then establish and manage the pasture well.

Some important pasture management considerations are

1. kind and variety of forages adapted to soils and climate of your area
2. establishment procedures for good, early, useful pasture
3. resistance and tolerance to horse grazing and trampling in your area
4. need for fertilization and response to fertilization
5. methods of weed control
6. need for rotational grazing approaches
7. response to use and needed recovery periods
8. palatability of the forages for horses

Forage Fertilization for Production

Forage fertilization is almost always crucial for good production and successful horse pasture management. No forages produce well without good soil fertility, and few soils have enough inherent fertility for upper-level production. Most soils in the central United States must be fertilized to produce improved forages well.

Grasses need primarily nitrogen, but also phosphorus, potassium, and lime in many cases, as do legumes. Fertilization recommendations should be made on the basis of soil test results, objectives, and experience.

Fertilization must be done with some goal in mind:

1. You can apply fertilizer at a minimal rate just to maintain grass stands. Some operators might wish this rate to be the minimal effective rate, or just enough to carry light stocking.
2. You can apply fertilizer to get the most effective forage production per pound of fertilizer applied, that is, apply it at a rate at which pounds of forage produced per pound of fertilizer would be judged cost effective at an upper level of forage production. There are many ranges of fertilization applications that are acceptable for the land, the forage, and the operator’s goals. Seek professional advice to determine the amount to apply.
3. You can fertilize at a maximum effective rate. This application would yield the greatest forage volume over the years.

Objectives vary, and what one considers well fertilized may not always be so. What is suitable for one horse pasture may not be for another. What is good for another livestock operation may be too good for a casual horse pasture, or vice versa.

Native range grasses are generally not fertilized. If it is judged wise to fertilize them, use low amounts of actual nitrogen per acre at 30 to 75 pounds, and phosphorus and potassium according to soil test results. Fertilize only once per season. This recommendation also applies to ‘King Ranch’ bluestem pastures.

Other grasses that respond well to fertilization include bermudagrass, Old World bluestems, crabgrass, weeping lovegrass, and winter pastures from small grains, ryegrass, rescuegrass, fescue, and other cool-season perennials. The following is a fertilizer guide for producing forages for a moderate-quality horse pasture or meadow in southern Oklahoma and surrounding areas. This summary is presented for either warm- or cool-season forages; read carefully.

Early Season—Top-dress with nitrogen to apply 50 to 100 pounds of actual nitrogen per acre. The date of this application would be about April 15 to May 15 for the summer grasses and just before or immediately after stand emergence for the annual winter pastures, usually about September 1 to October 15. An application of 30 to 50 pounds of actual nitrogen per acre could be considered a minimal application for simple stand survival, stand maintenance, and low production if it were the only application.
Midseason—Top-dress with nitrogen to apply an additional 50 to 100 pounds of actual nitrogen per acre about June 1 to 15 for the summer grasses and about January 1 to February 15 for winter pastures. Spring applications during April should be considered for late winter pasture or early summer grasses.

Legume pastures should be fertilized according to soil test results for phosphorus, potassium, and lime. Grass and legume mixture pastures can be fertilized relatively lightly with nitrogen, at 30 to 50 pounds of actual nitrogen per acre, to allow maintenance of the legume and get some added grass production. Legume pastures in southern Oklahoma and surrounding areas almost always need phosphorus, and they often need potassium and lime.

The above information is only a guide and is far from the upper limit possible or the individual accuracy desired. The scope of this writing does not allow adequate discussion of fertilization methods or the rate variations and type of fertilizer. That information must be acquired elsewhere.

High nitrate content in forage may present potential animal health problems. For horse pasture, it is wise to top-dress several times at a lower acceptable rate than to top-dress once at an extremely high rate.

The most efficient forage production is from a higher-rate, one-time application coinciding with the warm moist seasons. Part of the reason for using lower rates of nitrogen is due to uncertainty in some horse situations. The nitrogen fertilization rates discussed above, however, are not considered high.

Visits to several veterinary schools and diagnostic labs have failed to verify any serious or common problems with nitrates or our suggested nitrogen rates. There has been little problem with nitrates in horse nutrition.

Precautions in pasture fertilization and liming should be observed:

1. Do not spill fertilizer or lime in horse areas.
2. If any is spilled, thoroughly clean it up and till the soil if necessary. Take no chances! If there is any doubt, remove horses until after a rain and new forage growth.
3. Do liming without horses on the area, and keep them off limed pasture until after a rain. Lime dust inhalation may cause respiratory problems.
4. In a single application, do not use excessively high nitrogen rates, generally over 100 pounds of actual nitrogen per acre in southern Oklahoma and the surrounding regions.
5. If fertilizer adheres to wet forage, it is wise to withhold horses until after a rain. The best choice is not to fertilize when forage is wet.

**Weed and Brush Control with Herbicides or Mowing**

Weeds include numerous broad-leaved plants, woody plants, and certain grasses. Weed control improves the overall quality of the herbage, increases the quantity of the forage, and minimizes plant toxicity potential.

Overall herbage quality improves when undesirable broad-leaved plants and their associated coarse stems are reduced or eliminated. Rid the area of potentially toxic plants and insects, and reduce or eliminate undesirable grasses such as annual three-awn and some of the volunteer naturalized winter annual grasses. The quantity of the desirable forage will increase because it produces more efficiently without weedy plant competition.
Blister beetle control is another reason to reduce broad-leaved weeds in horse-grazed areas because the beetles can congregate on some weeds. Blister beetles are a problem in alfalfa, and they also feed on pigweed, kochia, and other broad-leaved weeds. They also tend to congregate on some broad-leaved plants without feeding.

Pastures, runs, paddocks, and meadows can all be sprayed with herbicides for weedy plant control. *Always read the container label for all the application information.* Observe all precautions and grazing or haying restrictions. The herbicide choices are many, and the use of a given herbicide depends on the problem and objective.

The more common postemergence herbicide choices for forage grasses include the following trade names:

1. Ally
2. Amber
3. Banvel
4. Grazon P+D (2, 4-D and picloram)
5. Rave
6. Remedy
7. Roundup
8. 2, 4-D
9. Weedmaster (2, 4-D and Banvel)

These herbicides and mixtures are used for special cases. Where there is a unique weedy plant problem, it is wise to consult a weed control specialist for a recommendation and precise recipe. *Always follow the label guidelines.* Be certain to have the proper permits and licenses to buy and use herbicides.

All of the herbicides above are used to control broad-leaved weeds after they emerge and begin growing. Numbers 3, 4, 6, and 9 are generally used to control weeds that are resistant to 2, 4-D alone or broad-leaved weeds stressed by something such as drought or maturity. Rates can be somewhat fitted to the need and objective. Remedy, Banvel, and Grazon P+D are also used for woody plant control.

If a pasture contains alfalfa or clovers, broad-leaved weeds can be controlled with 2, 4-DB. This chemical is not 2, 4-D, but 2, 4-DB. It has limited effect on alfalfa and many clovers, but it will kill vetch.

There are not any specific herbicide data relative to horse forage readily available. Guidelines must be the restrictions on the label.

Some of the postemergence herbicides have a grazing restriction of seven or more days. To simplify matters and ease uncertainty, consider as a guide that all pastures sprayed postemergence need a ten-day use deferment for horse pasture. It is wise to keep horses off sprayed pastures until the spray has dried to avoid chance of eye or skin irritation.

Some weeds accumulate higher nitrate content for a short time after being sprayed with 2, 4-D and possibly other postemergence herbicides. If these weeds are palatable and in good supply, it is conceivable a nitrate reaction in horses is possible, but the weed spraying itself is considered non-toxic. The regular deferment periods recommended should take care of the potential problem.

Some horse managers are petrified of using any herbicide because they lack chemical understanding and fear horse health problems with a high-value horse. There is no known serious problem with spraying a pasture properly, using approved herbicides, employing the stated deferment, and continuing the forage use. The advantages of spraying are great. Those who are extremely cautious should use the grazing-restriction guidelines above but also consider that, if it rained, the forage
would be even cleaner. Some horse managers use herbicides regularly and have no reservations, because experience has proven the practice. Managers should be cautious of roadside spraying or such things as oil-field-site spraying where herbicides not approved for pasture are used.

Mowing can be done for weed control and aesthetic purposes. It is inferior to herbicides for weed control, but it does help. It should be considered a last resort, but sometimes it is the best choice if there is risk of herbicide damage to neighboring areas. Ideally, mowing should be done after the weeds have grown at least 12 inches and budding has started. Weeds will usually need to be mowed several times per season. Mowing is expensive, but it may have more real value when used in conjunction with aesthetic needs, weed control, and balance of forage use in the grazing approach.

Cattle can also be used as a partial aid in weed control because they graze certain broad-leaved weeds differently than horses. We discuss cattle and horse combination grazing more in grazing management. Sheep and goat flocks are a great biological method of weed and brush control.

Perhaps the most important thing to consider regarding weeds is that all weeds are not undesirable. If a plant that is not the base forage for a pasture is present, consider its usefulness. If it is palatable, nutritious, and relatively nontoxic, use it—don’t kill it. Use with good recovery periods often removes those plants and allows the base forage to dominate, especially if cattle or other stock can be used in conjunction with horses.

Brush control is a more variable management input than usual weed control, and we cannot cover the subject here. If brush control is needed, there are many methods, varying from hand controls to aerial application. Analyze the brush problems and seek advice from specialists to determine the best way to treat the problem.

**Dragging and Sweeping**

Horses tend to defecate and paw in certain areas and not distribute these behaviors over the whole pasture as readily as cattle, goats, and sheep, so regardless of other pasture management, horse pastures need to be dragged to scatter animal wastes and smooth pawed areas. Dragging can be done with many tools such as a spike tooth harrow, flexible chain harrow, homemade iron drag, or just a wad of brush. Dragging is best done after a rain shower or under very high humidity.

Work by Herd (1986) may be cause to reevaluate dragging. The author has developed a technique of sweeping horse pastures to physically remove manure. For simplicity, just consider the sweeper a street sweeping machine. The sweeping can remove manure before there is time for parasite eggs to hatch and migrate to the forage, where the parasites would be ingested. The manure can be stockpiled, composted, and used as organic fertilizer. Sweeping to remove manure and parasite load can reduce pasture larval counts up to 95 percent. Sweeping also increases pasture area by up to 50 percent by cleaning areas that were avoided because of horse manure. This technique is useful only on short pasture and a few small paddocks. Commercial sweepers, such as the Jacobson brand, are available.

Removing manure is somewhat counterproductive if nutrient recycling in a rotational grazing approach is desired. However, the manure can be piled, composted, returned to the horse pastures, or used elsewhere.

The horse pastures apparently have to be very short, if pictures in the sweeper reports are accurate, which may mean a considerable sacrifice in forage management for our region. The operator must weigh the pros and cons—is sweeping and removing manure and potential parasite load worth the sacrifice in forage management, nutrient recycling, and expense?
Grazing or Use Management

Grazing or haying management is where potential benefits can be won or lost.

Horse Grazing Characteristics, Spot Grazing, and Trampling

The horse is a biting top-grazer. The cow is a tongue-lapping, tearing side-feeder. Horses graze off the tops until the pasture in that spot is short. Then they tend to continue grazing resprouts on that spot and avoid what appears to be good, taller pasture. Other grazers do this, too, but the horse is notorious for it.

The spot grazing effect can be so intense and extensive that large spots, and finally whole pastures, are almost completely destroyed by grazing too short, too often, and too much over an extended time and by all the associated trampling effects. The hog is probably the only domestic animal that can do more damage to a pasture than a horse can.

Spot grazing ranges from short-grazed areas associated with tall spots to completely bare ground. Spot grazing and short grazing also increase pasture dust, which can lead to respiratory, digestive tract, and parasite problems. This syndrome also apparently increases parasite levels and soil erosion.

The natural traveling characteristic and flipping hoof action of the horse cause much trampling damage by cutting off forage or uprooting whole plants. This problem is most severe with tender forages such as legumes and cool-season annual winter pastures. It is less severe in permanent forages or sod forage such as bermudagrass, bunchgrasses, crabgrass, and fescue.

There is only one way to avoid spot grazing and trampling damage—don’t graze. Since such a course is unacceptable, use rotational grazing and controlled stocking rates along with good production practices to control both damaging characteristics.

Changing Pastures and Introducing Horses to Pasture

A crucial factor in managing horses on pasture is to avoid abrupt changes from a fed ration to pasture and from extremes of pasture quality or type. Changes are especially a problem when horses are moved from a lower-quality pasture, or no pasture, to a high-quality pasture. Many, if not most, horses must adapt to great changes. Horses unaccustomed to very lush pastures can colic, founder, or have other digestive tract problems associated with overeating and the sudden change in diet. These reactions can kill the animals. Lush pasture might be excellent and abundant winter pasture, early bermudagrass, early crabgrass, and legumes. Many horses tend to eat too much too fast in these cases. The problem is generally nonexistent when horses go from a high-quality to lower-quality pasture.

A good procedure is to gradually increase the exposure to lush pasture over a period of days, which works well when horses go from a dry feed program to lush winter pastures. The actual approach will vary, depending upon the horse characteristics and value. A guide for such changes would be to

1. feed a ration of hay before the first grazing;
2. graze on lush pasture thirty minutes every morning and evening the first day;
3. increase time to one hour in the morning and evening the second day and preferably continue this program several days (watch the horses and make a judgment);
4. gradually increase the time to full-time grazing, if that is the goal.
Creep Grazing

Using creep grazing for foal nutrition is uncommon but should work, if properly implemented. Creep grazing is simply allowing the colt to creep graze into an adjoining paddock that can be managed for better quality than the one where the mare is.

Rotational Grazing Approaches

Horse pastures should be used in a rotational grazing approach, if at all possible. This style of grazing, properly done, enhances forage production and quality, betters stand sustainability, and controls some problems mentioned before. There are no exceptions to rotational grazing if you are interested in good pasture production, quality control, uniform use (reduced spot grazing), pasture recovery after grazing or mowing, and pasture life span. Without an acceptable rotational grazing approach, the reverse of all the above will happen to some degree, even causing the pasture to die.

The drier the region and the lower the quality of soil, the worse the negative responses of uncontrolled grazing. Recovery periods are crucial to the success of a rotational grazing approach. Multipaddock arrangements are excellent for rotational grazing. In limited-control situations, recovery periods may have to be done while horses are lotted, stalled, or in special runs not associated with the main paddocks.

What is rotational grazing? It is the science and art of a planned sequence of grazings during which each paddock is both grazed and deferred several times by one congregated herd during the same production year. Rotational grazing is (1) using the forage in one paddock a short time, (2) deferring use and allowing regrowth and recovery, and (3) regrazing the area.

It is important to repeat some things from above. Horses are destructive to pasture by

1. grazing nature
2. spot grazing tendencies
3. spot excreting
4. trampling, trailing, and loitering in the same areas
5. bogging and hoof action on pastures

Rotational grazing can control or eliminate the harmful effects of these characteristics.

Using a pasture rotationally is vital to stand longevity and production, and neglecting to do so is possibly the worst horse pasture problem, closely followed by a lack of adequate production practices. Bermudagrass is tough, but horses can kill it in an intensive nonrotational situation. Anybody can use his pastures in a rotational approach, but effectiveness is a matter of degree. Two paddocks are better than one, and several are better than two.

Rotational grazing can be accomplished many ways in multiple paddocks or single pastures. Probably the best way is to have two to four paddocks for one group and graze one area at a time, but eight to twelve paddocks would be better. When the pasture being grazed is used, or spot grazed, rotate horses to another pasture and graze it. The pasture just grazed by horses may need to be clipped, mowed, shredded, or grazed off by other livestock. Many horse producers don’t have facilities to do the best rotational grazing, so it becomes a matter of doing the best possible. Sometimes there is only a single pasture and herd. The management choices in this case are few. The approach that seems best is to graze the area, lot or stall the horses and feed them until the pasture has regrown, and then regraze it. In this case, we are talking about maintaining pasture in a bad situation, not destroying it by continual overuse. Sometimes horses are congregated heavily on an area and then moved out after breeding, foaling, or something similar. This use, in effect, constitutes a form of rotational grazing because it allows regrowth during the fallow period.
In all cases of rotational grazing with horses, the dominant horse influence, or *pecking-order effect*, must be considered. Although horses can be congregated into high-density herds more than under wide-open continual grazing circumstances, they cannot be placed into an extremely high stock density like cattle, sheep, and goats. When forced into such a situation, territorial behavior increases, as do fighting and other aggressive behavior, and horse injury can result. The behavior can damage fence and other facilities. There is not a definite rule of how many horses can be in one herd: it depends on the herd involved, their temperament, and conditioning to the circumstance, so it is somewhat a trial and error method to find the acceptable number for a given herd under rotational grazing. Small horse operations may successfully congregate at least a dozen horses. Large operations may be able to congregate thirty to fifty head in paddocks. Regardless of the operation, the more constant the case, the less the trouble. Extreme troublemakers need to be removed and isolated.

Figure 1 illustrates many things about rotational grazing and electric interior fences. The one-strand, high-powered, electrified, white, very visible polytape performs well for interior paddock fences. The one-strand visible electric gate is adequate, and it will break at about 200 pounds of tension, thus limiting horse injury. Some types of polystrands have a higher breaking strength. A strand height of 36 inches at the line post is excellent for these horses. The fiberglass posts are flexible and will give in the event that a horse hits the fence. Always use a high-powered, high-quality, electric unit.

The alfalfa and grass forage mixture in the paddock to the right in figure 1 is well grazed with adequately uniform residue (stubble) for horses. The residue in the paddock should be trimmed when the horses are rotated. The forage on the left is regrown (recovered) to 6 to 12 inches and in an excellent stage for regrazing. This example of rotational grazing management could represent grazing of bermudagrass, winter pastures, crabgrass, Old World bluestems, and many other forages used for horse pasture.

In this case, the horse producer has a small operation with six paddocks in the pasture system and eight horses on one 0.9-acre paddock. This stock density is about eight horses per acre, an illustration of many things done right.

Figure 1. An example of a good, visible, interior, high-powered electric fence and good rotational grazing on an alfalfa and grass mixture.
Sometimes rotational grazing may not be practical, in which case the pasture should be occasionally trimmed, hayed, or grazed with cattle. Recovery and regrowth should still be allowed. Rotational grazing has secondary reasons. Good rotational use tends to aid internal parasite control. Treatment with dewormers is still necessary, but infestations can be reduced.

**Fencing**

Horse managers tend to have limited options for rotational use of their pastures or paddocks because of a lack of fencing to subdivide the areas. Besides, many horse managers want one pasture for one horse or herd of horses. It is difficult or impossible to manage pastures and implement any form of rotational use under these circumstances.

Part of managing a rotational-grazing horse pasture approach is having pastures divided into smaller paddocks because rotational use of pastures is vital for stand maintenance, production, and overall degree of pasture success. More subdivision is needed in most cases, but traditional horse fencing is costly. Managers may consider cheaper, more convenient means of interior fencing to allow necessary subdivisions for better forage management. Some alternatives might be as follows:

1. various good-quality electric fences, such as ribbon, and other polywire or polyrope made by high-powered electric fencing supply companies (but use only white-colored wires for visibility against a green or brown pasture background, and use an alternating dark- and white-striped polytape for visibility where snow is common)
2. smooth multiwire high tensile fencing (high breaking strength), 12-gauge
3. smooth conventional hardware store wire (low breaking strength), 12-gauge
4. smooth conventional wire topped with an electric wire, 12-gauge
5. PVC fencing, which is expensive compared with the other choices

Some of these fences can be managed very well for strip grazing or breaking up paddocks. Some electric fences cost only about four hundred dollars per mile for materials and are very effective if properly installed and managed. Using one to three lines of electric temporary or permanent fencing is suggested only for interior fences. Exterior fencing should be good conventional non-electric fence or multiwired (four to eight wires) electric high-tensile smooth wire fence.

Stock, including horses, need to be trained to the electric fence under controlled circumstances before being turned out to paddocks made of these fences. All electric fences should be made visible by using white polytape, white polyrope, and white signal strips as necessary. These fences should be constructed to break easily to prevent injury if a running horse encounters the fence.

**Horse Research on Forages**

Practical use and common-sense judgment has shown that horses can survive and do well on forages alone. There are ranges of survival and ranges of just how well horses do on various forages. It has only been recently that research and demonstration work has set out to define these ranges and how they can fit into the nutritional needs of the horse, which vary enormously. The following comments are based primarily on winter forages and bermudagrass, with additional information on other forages.
Performance on Bermudagrass, Winter Pastures, Kliengrass, and Alfalfa

The quantity of forage available influences gain of livestock, including horses. Grazing that allowed 60 to 100 pounds or more of dry matter pasture per 100 pounds of body weight resulted in maximum individual performance, according to Aiken et al. (1985) and Roquette (1985). In our experience, good thick bermudagrass for one 1,000-pound horse per acre meant only 4 to 6 inches of growth above the soil line. For our good small-grains-based winter pasture, we would need 6 to 12 inches for one 1,000-pound horse per acre for upper-level gain. If the pasture is shorter and the quantity lower, the horse must have more area to get 60 to 100 pounds of forage per 100 pounds of body weight and reach top gains. At least two more acres are required in some cases. If the forage is extremely short, that expanded acreage still will not allow convenient intake for upper-level gains.

In a 201-day trial, yearling horses produced 1.12 and 1.46 pounds of ADG from pasture only versus pasture and 8.3 pounds of 14 percent crude protein feed per head per day (Roquette, 1985). The pasture was sod-seeded winter pasture of rye-ryegrass-clovers in bermudagrass and then pure bermudagrass during summer. The winter pasture phase lasted two to three months in early spring, with the bermudagrass continuing to October. The horses on pasture and feed gained their advantage during the high-quality winter-pasture phase, with ADG the same on pasture only versus bermudagrass pasture and feed during the summer. Horses on winter pasture only may not have reached their forage gain potential because of the high moisture content of the winter forage, which is often 80 percent or higher. Horse growth, other than pounds of gain, was essentially the same in both treatments. Horses had body condition scores of 4.2 versus 5.9 from pasture only versus pasture and feed.

With advances in age and stage of bermudagrass growth, there was increased selective and spot grazing. This phenomenon is often seen in pastures, and although it was not quantitatively measured, forage managers understand that plant selection and spot grazing results in reduced quantity and quality intake and therefore lowered performance. Spot grazing can be defined as overgrazing and reduced quantity available per body weight unit. Stock, including horses, tend to try to get their fill on that short spot, cannot, and to an extent then go hungry. They will not eat the taller, less preferred areas. One reason for rotational grazing and management is to limit selective and spot grazing, thereby creating more uniform grazing, better forage quantity and quality control, and better stock performance.

Figure 2. Relative horse average daily gain (ADG) on bermudagrass at various stocking rates (Aiken et al., 1985)
Horses on pasture and feed tended to wait for feed and not graze actively, a common characteristic of forage and feed situations. Unfortunately, it likely limits performance from the pasture itself.

Aiken et al. (1985) compared horse performance from stocking rates on bermudagrass. The data showed that, in general, the heavier the stocking rate, the lower the horse gains. Daily gains ranged from a loss at heavy stocking rates to 0.95 pounds of ADG at light stocking rates. Frame growth was the same from all stocking rates. At a certain point, lighter stocking rates induced selective or spot grazing and then lower gains, apparently because of lower forage quality (figure 2). The greater the forage volume per acre, the greater the spot grazing.

Some related information by D. E. Johnson et al. (1982) and B. L. Koller et al. (1978) showed that digestibility of hay was 12 percent less in horses than cattle and that horses consumed 40 percent more dry matter per unit of body weight than cattle. This restresses that both quantity and quality have an important influence on horse performance from forages.

Webb et al. (n.d.) reported that yearling horses grazing bermudagrass gained 0.92 pounds per day, while those on kleingrass lost 1.56 pounds per day. The apparent reason for the negative performance was kleingrass’s low palatability for horses, which resulted in an intake only 19 percent that of bermudagrass. Horses do not like mature switchgrass.

Evaluation of alfalfa for yearling horse pasture by the Noble Foundation and Oklahoma State University illustrates some of its potential. In the twenty-five-day test, horses in continual grazing gained an average of 0.52 pound per day, whereas horses in a six-paddock rotational grazing unit gained 1.30 pounds per day (Freeman et al., 1987). Other growth characteristics were satisfactory, and there were not any forage-related horse problems.

Whether any of these gains and other performances are acceptable depends primarily on the goal for the young horse. Some goals may be met from pasture only, with adequate frame growth and an ADG of 1 pound per day, while other goals requiring a higher gain and condition performance mean some feeding is necessary.

**Palatability**

Palatability in this case is how horses relish and consume various forages. Given a choice and time, all stock will choose one forage over others, and observations show that the order of palatability changes as plants are grazed down and stage of growth or season proceeds. Palatability is important in that grossly unpalatable forages may present a problem through insufficient forage intake. The reverse is that very palatable forages increase dry matter and nutrient intake and enhance horse maintenance or gain performance. To some extent, you should consider palatability when planning horse pastures.

It is common for medium- to low-palatability beef cattle forages to be consumed like more palatable forage if the pasture is a monoculture or close to it, or if good rotational grazing is practiced where stock densities are relatively high.

A key to managing forages with variable but acceptable palatability is to use rotational grazing methods because the animals are only briefly on a paddock whose stock density does not allow extensive picking and choosing. Therefore, in a relatively short time, they eat what is reasonably acceptable to them.

Beef cattle rotations have been managed on grass mixtures when graze-off of forage in a given paddock was accomplished in one-half to three days with no obvious signs of undesirable selective grazing caused by palatability differences. However, extremely short grazing periods of one-half to one day to use all forage may not be realistic for horses. The cattle didn’t have time to sort out palatable plants. They ate what was there in a hurry. Also keep in mind that horses are not
(1) intelligent enough or (2) intuitive enough to balance a diet on the basis of forage palatability. A cafeteria of forages may not be totally helpful in balancing horse forage rations.

Most horsemen and others who have observed pasturing horses know that small-grain pastures, ryegrass, lush bermudagrass, crabgrass, certain Old World bluestems, and other grasses are all well used by horses. Research illustrates the relative palatability of southern forages to horses (Ball, 1985; table 2).

Palatability will change with different horses, season, and stage of pasture growth. Arrowleaf clover rated low in palatability in this study, but it can be used some in a grass-clover mixture in rotational grazing situations. Palatability is important, but not the last word.

Archer (1973) of the United Kingdom has researched horse forage palatability. Many of the forages he tested are not important here, but results for some forages we also have in the United States are presented in table 3.

Table 2. General Relative Palatability of Some Forages to Horses (Ball, 1985)

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Medium Palatability</th>
<th>Low Palatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Browntop millet</td>
<td>Pearl millet</td>
<td>None rated</td>
</tr>
<tr>
<td>Crabgrass</td>
<td>Texas panicum</td>
<td></td>
</tr>
<tr>
<td>Fescue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foxtail millet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryegrass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small grains</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Broad-leaved plants |                     |                  |
| Alyce clover (summer)| Alyce clover (spring)| Aeschynomene    |
| Annual lespedeza   | Crimson clover      | Cowpeas          |
| Subterranean clover|                     | Hairy vetch      |

Table 3. General Relative Palatability of Forages to Horses in England (Archer, 1973)

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Medium Palatability</th>
<th>Low Palatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creeping red fescue</td>
<td>Bluegrass</td>
<td>Orchardgrass</td>
</tr>
<tr>
<td>Hybrid ryegrass</td>
<td>Browntop</td>
<td>Perennial ryegrass</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>Perennial ryegrass</td>
<td>Tall fescue</td>
</tr>
</tbody>
</table>

| Broad-leaved plants |                     |                  |
| Chicory (young)     | Sanfoin             | Chicory (old)    |
| Dandelion           |                     | Red clover       |
| White clover        |                     |                  |
| Yarrow              |                     |                  |

Poisonous Plant Considerations

One of the considerations for chemical and other weed control in horse pasture is the control or elimination of poisonous plants. There are few forage areas devoid of all toxic plants.

Most toxic plants are broad-leaved. Horses normally don’t relish broad-leaved weeds, but they do if grass forage is limited. Horses tend to browse weeds more when on a higher-concentrate, low-fiber ration. Having a few toxic plants available does not mean there is an acute problem.
Plant toxicities may be grouped in two categories:

1. definite poisonous plants
2. secondary toxicities or ailments associated with forage plants

We cannot discuss in detail horse poisoning symptoms and treatment here, but we mention a few pertinent items. The list includes primarily common potentially toxic plants but not absolute toxicity syndromes of the plants.

**Definite Poisonous Plants**

These plants have a definite toxicity syndrome. Some harm horses as well as other livestock, while others’ action is unknown. Some palatable weeds are nitrate accumulators. The point of the following listing is to increase awareness of the potential problems and stress the need for weed control. Grasses capable of having toxicity syndromes are discussed later. Refer to the Noble Foundation’s Web site, www.noble.org, and its plant gallery, created by Chuck Coffey and Russell Stevens, for pictorial identification of many of these and other plants.

1. Bitterweed (*Actinea* spp.)—broad-leaved
2. Black locust (*Robinia* sp.)—woody
3. Bladderpod (*Glottidium* sp.)—broad-leaved
4. Bracken fern (*Pteridium* sp.; very toxic to horses)—broad-leaved
5. Chinaberry (*Melia* sp.)—woody
6. Cocklebur (*Xanthium* spp.)—broad-leaved
7. Dogbane (*Apocynum* sp.)—broad-leaved
8. Goathead (*Tribulus* sp.)—broad-leaved
9. Groundsels (*Senecio* spp.)—broad-leaved
10. Horsenettle (*Solanum* spp.)—broad-leaved
11. Horsetail (*Equisetum* spp.)—broad-leaved (Granslike)
12. Kochia (*Kochia* sp.)—broad-leaved
13. Milkweed (*Asclepias* spp.)—broad-leaved
14. Pokeberry (*Phytolacca* sp.)—broad-leaved
15. Ornamental yew (*Taxus* spp.)—woody, very toxic to horses
16. Pigweed (*Amaranthus* spp.)—broad-leaved
17. Rattlebox (*Crotalaria* sp.)—broad-leaved
18. Scurfy pea (*Psoralea* spp.)—broad-leaved
19. Sesbania (*Sesbania* sp.)—broad-leaved
20. Smartweed (*Polygonum* spp.)—broad-leaved
21. Snakeroot (*Eupatorium* sp.)—broad-leaved
22. St. Johns wort (*Hypericum* spp.)—broad-leaved
23. Wild parsley or carrot (*Lomatium*, *Daucus*, and *Pastinaca* spp.)—broad-leaved
24. Yarrow (*Achillea* sp.)—broad-leaved
25. Landscaping and garden plants: castor bean, euonymus, gladiolus, ivy, pea vines, privet, nandena, boxwood, and tomato

**Fescue Toxicity**

The subject of potential plant toxicity reaction is a massive one that we cannot cover in total. There is an excellent reference book on plant toxicities to horses that all horse managers should have
for more extensive study: *Natural Poisons in Horses*, available from the National Animal Poison Control Center, College of Veterinary Medicine, University of Illinois, Champaign-Urbana, Illinois (Hall et al., 1995).

Fescue pasture may be the single most-studied forage specifically for horses primarily because it causes reproductive problems in mares. The toxicity syndrome is variable, with problems including poor performance on pasture, abortion, and reproductive tract malfunctions such as an overly thick placenta that colts cannot break out of. Problems also include sick colts, dead colts, and agalactia (mare does not lactate well), a major syndrome.

Summer slump, fescue foot, and fat necrosis problems with cattle grazing fescue have not been directly associated with horses. Fescue is a tremendous forage in acreage and production per acre in the eastern half of the United States. It contributes much to cattle and horse forage programs. Fescue toxicity may affect only 1 percent of horses, but 100 percent of the mares in a given herd may have the problem.

The effect of endophyte-free fescue on horses is not completely understood. However, indications are that endophyte-free fescue and novel endophyte fescue do not cause the toxicity problems.

The problem with horses grazing endophyte-containing fescue is almost entirely associated with foal-producing mares. Apparently other classes of horses can be grazed on well-managed fescue quite successfully when husbandry practices are good.

The following precautions should be applied when grazing horses on endophyte fescue:

1. In all fescue-associated pasture situations—full or part time
   a. Follow good pasture management approaches, including rotational grazing, soil fertility, weed control, and clipping to remove stems and even the residue height.
   b. Add acceptable legumes to the fescue pasture.
   c. Conduct good horse nutrition and health programs, regardless of forage uses.
   d. Monitor udder development. If udder development is not obvious two weeks before foaling, expect problems. Even if it is obvious, the manager cannot be certain of milk volume available to the foal. Mares may lactate enough to keep the foal alive, but it will be thin and slow growing because of malnutrition. Remember, one problem leads to another.
   e. Be present at births to help colts out of tough birth membranes.
   f. Be prepared to feed supplemental colostrum and milk replacer when mares foal.
   g. Increase grain feeding sharply when mares foal with agalactia.
2. If mares can be removed from fescue
   a. Remove them after the first fall freeze and feed them elsewhere during winter until after foaling.
   b. Alternatively, remove mares from fescue 60 to 120 days before foaling and supplement with high-quality, nonfescue hay and feed.
   c. Practice all the items under 1 regardless of whether mares can be removed from fescue.

**German Millet and Pearl Millet Toxicities**

Foxtail or German millet can be used, along with other roughages, for horse forage. They are an alternative to producing sudangrass or other sorghum forages.

Some pearl millet reportedly has an alkaloid buildup that can induce cattle toxicity. Horses may react to these alkaloids because they are susceptible to alkaloid toxicity syndromes.
All millets can accumulate nitrates, which in grazing or haying millets can reach toxic proportions. Nitrates can be controlled somewhat by reducing the amount of nitrogen per application and increasing the number of applications. German millet can cause oral mechanical lesions.

**Sorghum Grass Toxicities**

Sorghum grasses include sudangrass, johnsongrass, hybrid forage sorghums, and grain sorghums. Here we consider all classes of forage sudangrasses and associated hybrids the same. In reality, there may be some without the toxicity syndrome problems.

Sudangrass in the green growing stages can produce a horse urinary tract disease called cystitis syndrome or cystitis/ataxia (staggering). The disease is irreversible and believed to be associated with low levels of cyanide (prussic acid) in forage. Piper sudangrass is a low-prussic-acid variety and may be a good choice to minimize this problem.

Hay produced from sudangrasses will not likely cause cystitis/ataxia syndrome because prussic acid dissipates as hay cures. Sorghum pasture can also cause a problem for pregnant mares in the first three months of pregnancy, presumably because of prussic acid content. Foals can be born with contracted tendons, or mares can abort.

We must be cautious about high nitrate content in sorghum pasture and hay. The potential for it can be limited somewhat by cutting plants when they are growing under low stress conditions and on a sunny afternoon.

Sweet-stemmed sudangrasses and other sorghums that are relatively high in sugar also cause a laxative reaction in horses. If it is necessary to use sudangrasses, be sure to use a nonsweet starchy type and try to use other roughages as part of the ration.

Johnsongrass, which is a sorghum, and other sorghums can be high in prussic acid (cyanide), which can occur in any green plant and especially stressed ones. Rapid growth after a drought, drought or cold-stressed plants, and plants at and soon after frost are especially hazardous. Prussic acid does not occur in dangerous amounts in properly cured, dry hay. Prussic acid poisoning is not as severe a problem in horses as in cattle, but it can occur. Johnsongrass can also have a high nitrate content.

**Secondary Toxicities or Ailments Associated with Pasture Plants**

These potential toxicities and other horse reactions are associated with common horse forage. Probably no forage is absolutely safe. These common forages are relatively toxin free, but there are some things to be aware of:

1. Alfalfa needs to be used with special caution to avoid overeating syndromes and blister beetle ingestion, which can cause colic and death.
2. Bermudagrass fungus can cause some problems in cattle. Its effect on horses is unknown, but they have been known to develop colic on bermudagrass pastures and hay.
3. Clovers, particularly red clover, can develop a mold that causes some problems in horses, such as slobbering or diarrhea.
4. Ergot is a fungus that occasionally grows in the seed head of dallisgrass, wild rye, Old World bluestems, and other grasses. It can induce blood vessel constriction and other associated problems.
5. Fescue toxicity syndromes are detailed elsewhere in this report.
6. German millet is a nitrate accumulator and can cause oral lesions.
7. Horses sometimes relish johnsongrass rhizomes, which cause possible sand colic from ingestion of soil dug up with the rhizomes. Johnsongrass also contains prussic acid. The rhizomes can be more than 10 percent crude protein.
8. Some pearl millets can accumulate nitrates and alkaloids.

**Horse Ailments Associated with Pasture**

Several ailments are attributed to pasture management, and controlled management can control these ailments:

1. colic
2. founder and other intestinal disorders
3. diarrhea
4. sand colic from eating rhizomes from forage such as bermudagrass and johnsongrass
5. excessive slobbering attributed to legume grazing

**Potential Fence Toxicities**

Treated wood rails and posts create potential toxicity reactions to cribbing horses. The CCA-C treated wood commonly contains residue of chromate copper arsenate (CCA-C). Penta treated wood contains residue of pentachlorophenol. Both of these chemicals can potentially induce colic and other reactions. Caution prevails—if horses crib and then eat the treated wood, measures to prevent that behavior should be in force.
References


