



UTILIZATION OF FORAGE LEGUMES

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Nutritive Value

The greatest benefit forage legumes provide for livestock producers in the southeastern US is their high nutritive value. Warm-season perennial grasses form the basis of pasture systems in the Lower South. As a forage class, they have the lowest digestibility (**Fig. 1**) that results in only modest animal performance in comparison to cool-season forages. Legumes have some of the highest digestibility and protein levels of all forages. Protein is a major component of an animal's body. It is needed for growth and repair of tissues. Carbohydrates and the energy derived from them are, quantitatively, the most important item in an animal's diet. All the animal functions, such as growth and milk production and biological processes such as feed digestion, require energy.

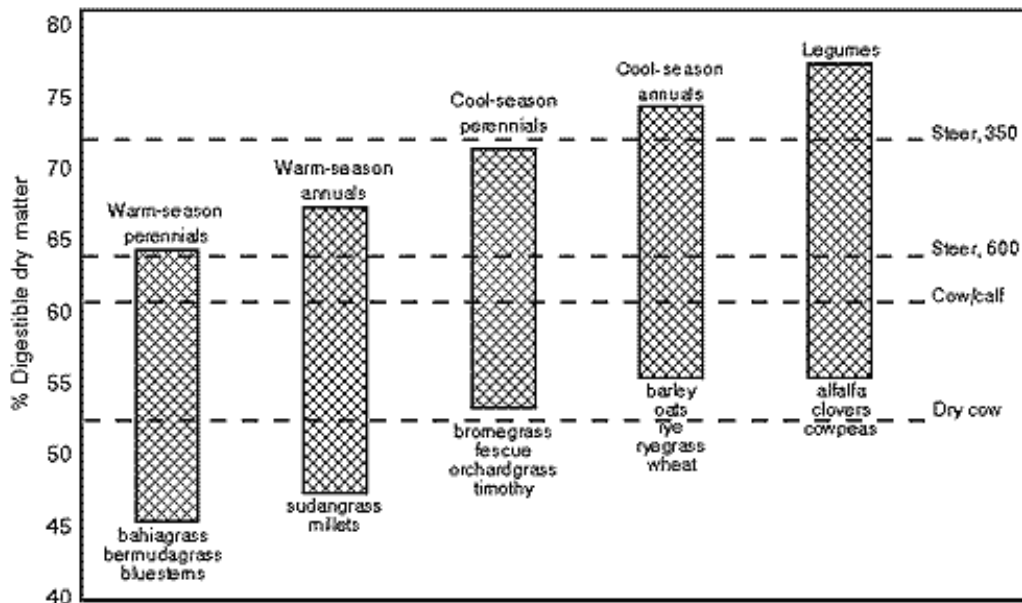


Figure 1. Digestibility percent ranges for several forage groups (H. Lippke, M. E. Riewe)

Legumes contain five times the calcium, 30 to 50% more phosphorus, and twice the magnesium of grasses. Calcium and phosphorus are critical for the formation and maintenance of bones and teeth. Calcium is involved in virtually every biochemical and physiological process in the body and is especially important for milk production. Phosphorus is critical for reproduction and is involved with more biological functions than any other mineral element. The primary function of magnesium in the animal is the activation of enzymes. Magnesium deficiency causes grass tetany that is associated with lactating cows grazing cool-season grasses in the spring. Milk production, growth, and reproduction are always higher on a pasture with a legume than one without a legume given the same amount of available forage.

Hay

The most commonly used forage legume for hay production is alfalfa. Although alfalfa is a perennial, stands usually persist for only three to five years. As with other forage legumes, alfalfa is soil specific and cannot be grown on all soils. In the southeastern US, alfalfa grows from late February through November with the first hay cutting sometime in April. Because of poor hay drying conditions in April, alternative uses in early spring are grazing, silage, or greenchop. With normal rainfall, about six hay cuttings per year are possible. Alfalfa should be cut at the 10% bloom stage. Later maturing, upright-growing legumes such as arrowleaf, red clover, and sweetclover can also be harvested as hay in late spring.



Grazing

Forage legumes make their greatest contribution towards reducing input costs of livestock production systems when they are grazed. As discussed earlier, legumes have a higher nutritive value than grasses that result in better animal performance. Grazing livestock enhance the transfer of nitrogen from the legume to the soil. Letting the animal harvest most of the forage is less costly than mechanical harvesting as hay, silage, or greenchop. The rapid growth period of cool-season annual legumes is relatively short, from about March 1 to plant maturity that ranges from mid-April until June depending on species. However, this growing period fills a gap in most grazing systems. When legumes are overseeded on warm-season perennial grasses, grazing can begin 6 to 8 weeks earlier than the warm-season grass alone. When mixed with small grains, the legume extends the grazing season 6 to 8 weeks.

The legume-summer grass system is the most efficient at using fixed nitrogen. The grass-growing period follows the legume-growing period so that the grass can utilize the nitrogen provided by the legume the first year. In the small grain/ryegrass-legume system on prepared seedbed, the grass-growing period precedes the peak legume-growing period. In this scenario, nitrogen from the legume would not be available to the cool-season grass until the following year. This would be contingent on any summer grass or weeds being disked back into the soil before planting the next fall.



Cows make the most efficient use of the cool-season legume and warm-season perennial grass mixtures when they calve in the winter. Production of the high nutritive value legume forage in the spring coincides with the highest nutrient requirements of the cow when she is producing milk and trying to rebreed. The cool-season legume and small grain and/or ryegrass mixture is best utilized by replacement heifers or fall calving cows. Fall and winter grass production will be limited because only modest rates of nitrogen fertilizer can be used so the legume stand is not reduced by shading. Average daily gains (ADG) of replacement heifers during the winter would only be 1 to 1.5 lb/day because of limited forage. With increased forage production in the spring, their ADG should increase to 2.5 to 3.0 lb/day and result in excellent conception rates for winter calving. Fall calving cows should be limit-grazed (2 hr/day, 4 hr every other day) during the winter when pasture growth is slow and allowed to graze full time during the rapid growing period in the spring.

Bloat

Bloat in ruminants such as cattle, sheep, and goats is not completely understood although bloat was reported by an ancient Roman author as early as 60 A.D. Bloat occurs when the rumen (paunch) swells as gases (methane, carbon dioxide), that are formed during normal fermentation of feedstuffs that produce a stable foam that cannot escape. Swelling occurs first and is most noticeable in the left flank. Free gas is normally removed through belching by the animal but the foam inhibits the belching response. Drylot or feedlot bloat is experienced mainly in beef cattle raised on high grain diets and is chronic in nature. Legume, or frothy bloat, occurs when susceptible livestock graze lush, rapid growing, cool-season forages that are high in soluble proteins. Cattle can bloat on ryegrass and small grains as well as legumes. A common misconception is that animal death from bloat is caused by an increase in gas production. The problem is the result of the formation of stable foam on top of the rumen fluid which covers the esophagus opening and prevents gas expulsion. The rumen expands as the gas increases causing pressure against the lungs and certain blood vessels. This causes the animal to suffocate.

The mechanism of legume bloat is complex because of the interaction of plants, animals, and microbes in the rumen. There is no specific set of conditions (legume species, time of the year, animal type) where bloat always does or does not occur. Since bloat is not predictable, we can only discuss situations which increase or decrease the chance for bloat. The following discussion will be limited to legume bloat.

Plant Aspects of Bloat

The compound in legumes which causes the foam build up is not known for certain. Many feel it is some type of soluble leaf protein but differ on which protein fraction is responsible. Other plant compounds which have been reported to influence bloat are saponins and pectins. Legume species vary in their ability to cause bloat. Alfalfa, ball clover, annual medics, white clover, and Persian clover are considered to have high bloat potential; red, crimson, and subterranean clovers have medium potential; and berseem clover and arrowleaf clover have low bloat incidence. A high tannin level in arrowleaf clover is thought to be responsible for its low incidence of low bloat. However, all can cause bloat and should be managed properly. Birdsfoot trefoil, sainfoin, crownvetch, and most tropical legumes are non-bloating legume species.

Livestock are most likely to bloat on clover pastures in the early spring. One theory is that the warmer day temperatures increase photosynthesis or the synthesis of carbohydrates and proteins. However, the night temperatures at that time are still cold which slows the breakdown process of some of the carbohydrates and proteins which occurs at night. The net result is the build up of carbohydrates and proteins, one of which is the soluble leaf protein which is believed to cause bloat.

Animal Aspects of Bloat

Cattle may bloat after grazing clovers for only 2 hours or for as long as 2 weeks. Within a given herd, some animals will bloat and some will not. Selecting against bloat susceptibility is possible because of bloat prone families of dairy and beef cattle, differences in the bloating potential of cattle breeds, and transmittal of bloating tendencies to offspring. Many producers feel that Brahman cross cattle are less likely to bloat than non-Brahman cattle. Some individuals are chronic bloaters and should be culled. Possible reasons cited are differences in (1) salivary flow and composition, (2) grazing behavior, (3) feed intake, (4) lower rates of gas production in the rumen, (5) conditions in the rumen unfavorable to persistent foaming, (6) physiological responses to tactile stimulation or stretch of the reticulorumen walls, and (7) anatomy. Grazing studies in Louisiana have shown wide variations in bloat severity for the same animals from morning to afternoon grazing periods of the same day, as well as variations in bloat severity of the same animals after corresponding grazing periods from day to day. This further demonstrates that the cause of legume bloat is quite complex.

Bloat Prevention

Care must be taken when first turning cattle on to lush legume pastures in the early spring. The drastic change in diet from a dry hay with 6 to 10% protein to young clover with over 25% protein (dry weight basis) and a moisture content of about 85% is a shock to the microflora and protozoa in the rumen. A transition period of 1 to 2 weeks where livestock have access to both hay and legume is helpful. This can be accomplished by allowing the animals to graze clover for an hour or two a day while receiving hay or providing hay on the clover pastures. In any case, animals should never be placed on lush legume pasture with an empty rumen.

Pasture management practices for reducing the incidence of bloat center on not allowing young succulent legumes to constitute the total diet of livestock. Utilization of grass-legume mixtures instead of pure legume pastures is the most desirable option in terms of cost and labor to reduce frothy bloat. Bloat is very rare on grass-legume pastures when legumes constitute 50% or less of the available forage. The most economical grass-legume mixtures are seeding from 15 to 20 pounds of ryegrass per acre with the legume in the late fall. Cost will be from \$5 to \$7 per acre for seed plus planting expenses. Besides preventing bloat, adding a grass will provide earlier grazing that will further reduce overwintering costs of the cow herd.

If clover constitutes the major portion of the available forage in a pasture, hay can be fed. An alternative is to limit graze the pasture several hours a day or use a portable electric fence to strip graze a small portion of the pasture each day. Here again, hay should be fed free choice. This is also an excellent way to get maximum return from winter pasture for a cow-calf operation.

Another approach to preventing bloat is the feeding of antifoaming agents. The most effective one is poloxolene which is available in a molasses block, in granular form that can be mixed with a mineral or grain supplement, and in a liquid molasses supplement. Directions must be followed carefully for poloxolene to be effective. Allow livestock access to poloxolene blocks 2 to 5 days before turning in on legume pastures so they become accustomed to them. One block should be provided for every five head. Never allow livestock to run out of poloxolene since it must be consumed daily to prevent bloat.

Legume pastures should always be managed to reduce the incidence of bloat since its occurrence is unpredictable. Check livestock frequently for two weeks when they begin grazing lush legume pastures to identify chronic bloaters and to be sure bloat prevention methods are working. Slight swelling or puffiness of the left side of the animal is not uncommon. Even though precautions are followed, an animal may still be lost to bloat. Consensus of most livestock grazers

is that the benefits of grazing legumes outweigh the risks of bloat.

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