Forage News
Mississippi State University Extension Service

Incorporating Clovers into Your Pastures

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Fall is one of the most crucial periods for our cool season pastures. A goal of Mississippi cattle producers should be to provide the nutrients their cattle require as economically as possible through grazing. Due to rapidly increasing fertilizer prices, there has been a tremendous increase in interest in planting and grazing clovers with winter annual forages (ryegrass) and with perennial forages (bermudagrass and tall fescue). Forage legumes have the ability to remove or "fix" atmospheric nitrogen in a form that plants can utilize. The nitrogen is removed from the atmosphere by *Rizobium* bacteria which live in nodules on the legume roots and convert to ammonium to be utilized by the plant. Clover needs to be properly inoculated with live bacteria in order for it to grow properly. Proper inoculation will greatly increase forage production and quality.

Table 1. Characteristics of clovers commonly grown in Mississippi.

				Tolerance to[1]				
Clovers	**Seeding Rate**	**Seedling Vigor[1]**	**pH Range**	**Acidity**	**Poor Drainage**	**Drought**	**Grazing**	**Bloat Potential[2]**
Annual								
Arrowleaf	5 - 10	F	6.0-6.5	F	P	G	G	L
Ball	2 – 3	P	5.8-6.5	F	G	G	E	L
Berseem	10 – 20	G	6.5-7.5	P	E	F	F	L
Crimson	20 – 30	E	6.0-7.0	G	P	F	F	M
Vetch	20 – 25	E	5.0-8.0	G	P	F	F	L
Perennial								
Red	8 – 15	E	6.0-6.5	F	F	G	G	L
White	2 – 3	F	6.0-7.0	F	G	F	E	M

[1]E=Excellent; G=Good; F=Fair; P=Poor
[2]L=Low; M=Medium; H=High.
Source: Ball et al., 2002.

The characteristics of clover species differ. Some are more tolerant of certain climatic conditions, soil conditions, and/or management regimes than others (**Table 1 and 2**). All clovers are not created equal and adding clovers to a winter annual or a perennial grazing system requires that the producer knows his soil and has addressed three major management challenges. The first challenge is to ensure that the pH has been adjusted well before planting. Sample soils at least six months ahead of the planting date and apply recommended lime so that fields will be ready for planting in the fall. Legumes need a higher pH (5.8 to 7) than grasses do, in part so the bacteria that fix the nitrogen can function effectively. Most clovers do poorly in acidic soils. Liming the soil to a pH of at least 5.8 will help ensure a good stand of clover. It is not recommended to attempt legume establishment until the soil pH is within the prescribed range for a specific variety. The second challenge is to ensure that the soil contains adequate levels of potassium and phosphorus for successful establishment and persistence.

DO NOT APPLY NITROGEN. Nitrogen will not kill legumes, but it stimulates grass growth, which will increase the competition with the legume and the likelihood of legume loss due to shading. If the clover composition in the pasture is less than 25%, then apply 30 to 40 pounds of N per acre. Application of about 2 pounds of boron per acre might also be necessary. The third challenge is to control broadleaf weeds before seeding clover in pastures. Once clovers are seeded in pastures, control of broadleaf weeds ranges from very difficult to impossible. Before planting clover, time your herbicide applications to achieve good weed control while still allowing an adequate period for residual activity to disappear. Keep in mind that the length of residual activity depends upon the herbicide used, the rate applied, and the weather conditions following applications. Check the herbicide label to determine appropriate application rates and timing for various weeds. **Table 3** provides a general description of the time line that a producer needs to follow to establish clover after an herbicide application.

Table 2. Plant attributes of clovers commonly grown in Mississippi.

Clovers	Cold Tolerance[1]	Maturity	N Replacement (lb/ac)
Annual			
Arrowleaf	G	Late	50 – 110
Ball	G	Medium	60 – 100
Berseem	P	Late	90 – 110
Crimson	G	Early	70 – 125
Hairy Vetch	G	Late	50 – 150
Perennial			
Red	G	Late	75 – 200
White	G	Late	75 – 150

[1]E=Excellent; G=Good; F=Fair; P=Poor

Source: Twidwell, 2009; Ball et al., 2002; Lacefield, 2002; Killpack and Buchholz, 1993.

The amount of nitrogen applied to pastures can be reduced or eliminated by planting clover or properly managing existing stands of clover in these pastures. There is a common misconception that nitrogen is released from the root of a growing clover plant and this nitrogen will supply the surrounding plants with nutrition. Research has shown that there is a small amount of nitrogen released or leaked from the nodules and roots of actively growing clover, but it is an insignificant amount and will not supplement the nitrogen requirement of the companion species. The primary method of nitrogen transfer from the clover to the soil is by decomposition of plant material. As clover plants mature and die the nodules, roots, stems, and leaves are decomposed by soil microbes and slowly release nitrogen into the soil. This slow release of nitrogen is beneficial to warm-season and cool-season grasses and will reduce or eliminate the need for nitrogen fertilization during this growing season.

Having 30 to 40% clover (based on a dry weight basis) in your pastures will help reduce your nitrogen needs. Clovers also favor profitability by lowering nitrogen fertilizer expense, which typically accounts for 20 to 50% of the cost of producing forage from grasses. Numerous studies have shown that annual clovers, ladino or white clover, and red clover often fix 60 to 150, 100 to 150, and 150 to 200 lb/ac/year, respectively (**Table 2**). At current nitrogen costs of around $0.50/lb (ammonium nitrate), this represents a value of $30 to over $100 per acre per year. The value of nitrogen fixed by a clover stand in a single year is often several times as much as the cost of planting the clover. Clover seed usually costs $10 to $25 per acre. Many factors such as overgrazing, length of the growing season, soil type and the amount of nitrogen

present in the soil will influence the amount of nitrogen that is fixed by clover from the atmosphere. Often the value of nitrogen fixed by clovers alone will more than offset the cost of their establishment. Other associated factors with establishing clovers depend on the site, situation and method of seeding, but are typically less than the seed costs.

Table 3. Replanting restrictions of legumes in Mississippi based on herbicide applications.

Herbicide Name/Brand	Legumes (Alfalfa, clover)
2,4-D	3 weeks
Arsenal Powerline	12 months + bioassay
Cimarron	4 months
Cimarron Max @ 0.25 oz/ac plus 1 pt/ac	4 months
Cimarron Plus @ 0.25 oz/ac	4 months
Clarity/Banvel (per pint applied/acre)	120 days
Crossbow	3 weeks
Diuron	2 years
Forefront	bioassay[1]
Glyphosate	1 week
Grazon P + D	I year
Lineage Clearstand	12 months + bioassay
Milestone	bioassay
Outrider	12 months + bioassay
Overdrive	30 days
Paraquat	0 days
Pasturegard	1 month
Redeem R&P	bioassay
Remedy	3 weeks
Surmount	bioassay
Telar	bioassay
Velpar	2 years
Weedmaster	120 days

[1]Bioassay is a procedure for determining the concentration of the active ingredients of the herbicide still present in the soil. A soil sample needs to be collected and sent to the lab for analysis.

Note: The herbicide names or brands mentioned in this newsletter are used as guidelines for establishing legumes. No direct endorsement of these products is intended. Other products providing similar weed control and approved for weed control in forage crops in Mississippi might be available. Contact your local County Extension Office for more information and pay close attention to application rates and hay and grazing restrictions.

Source: 2009 Weed Control Guidelines for Mississippi. Publication 1532.

Proper grazing management to avoid overgrazing is essential for the maximum transfer of nitrogen from clovers to the soil. Grazing clovers to a minimum stubble height (depending on species) of two to three inches and then rotating the animals to another pasture will allow the clover to produce more forage and fix more nitrogen. Do not allow the grass in the field to grow tall and get too mature. Not only will this result in poor quality pasture or hay, but will result in the shading of the legumes. **Table 4** provides a guide of clover/grass compatibility to help you properly choose the ideal species for your pastures. Research has shown that clovers improve animal gains and conception rates. High quality feed is important for a calf to gain well and for a cow to rebreed after calving. Clovers are more digestible and contain more nutrients than grasses. Their presence in a pasture improves the palatability of the forage, which will increase the amount and quality of the forage the animal consumes. In a pasture situation when clovers

are actively growing, most of the benefits come from increasing forage production and providing better forage quality since clovers have high percentages of crude protein (CP) and total digestible nutrients. A pasture that is composed of 70 percent grass and 30 percent clover will have 13 to 21 percent crude protein and as much as 60 percent total digestible nutrients during the vegetative stage.

A four-year study conducted at Texas A&M in the 1980s showed the advantage of incorporating clovers into the pasture when three systems were compared: (1) a high input system on dallisgrass pastures using 150 lbs/acre of nitrogen and herbicides for weed control, (2) a medium input dallisgrass system where white clover was over-seeded, and (3) a no input pasture system using dallisgrass with no nitrogen, no herbicide, and no clover. It was reported that average daily gains for the calves were 1.57, 1.82 and 1.66 lbs/day for the high, medium, and no input systems. By using 2008 costs for pasture and animal inputs, production costs per pound of calf gain were $1.12, $0.58 and $0.81 for the high, medium, and no input pasture systems, respectively.

Table 4. Compatibility of clovers with warm- and cool-season grasses for forage production.

	Warm-season			Cool-season	
Clovers	**Bahia/Bermuda**	**Dallis**	**Johnsongrass**	**Tall Fescue[1]**	**Small Grain/Annual Ryegrass**
Annual					
Arrowleaf	✓				✓
Ball	✓				✓
Berseem	✓	✓	✓		✓
Crimson	✓				✓
Hairy Vetch	✓				✓
Perennial					
Red		✓	✓	✓	✓
White	✓	✓		✓	✓

[1]Annual legumes such as arrowleaf, crimson, and hairy vetch may be grown with tall fescue but they are less desirable than perennial clovers.

Source: Ball et al., 2002.

The occurrence of bloat is a major limitation to a more effective use of clovers. Bloat is a form of indigestion marked by an abnormal distention of the rumen caused by accumulated gas. Bloating is an animal disorder linked to clover utilization when the clover composition in the pasture is too high (>50%) or when animals are allowed to graze on clovers for extended period of time when they have not been preconditioned to this type of grazing management. Many methods have been used over the years to reduce the incidence of pasture bloat, but the most effective method uses Poloxalene. Poloxalene is an antifoaming agent that prevents frothy bloat for 12 hours, if fed in adequate amounts. Poloxalene can be fed as a top dressing on feed, in a grain mixture fed free choice, or in molasses-salt blocks. The effectiveness of an anti-bloating agent depends on required daily intake; therefore mixing with daily supplement is more effective than feeding in blocks on pasture. There are a number of standard management options to reduce bloat on pastures that contain a high percentage of clover: (1) do not turn

hungry animals onto a fresh legume pasture, (2) maintain at least 50% grass, (3) do not start grazing when the pastures are wet from dew or rain, (4) gradually introduce cattle to legume containing pastures, (5) pre-fill with coarse hay before turning onto a new pasture, (6) Feed the bloat preventative poloxalene mixed with a mineral or grain supplement or as a pasture block; and (7) check animals frequently for bloat when beginning grazing. On the other hand, clovers also have an important role in improving animal health. Grass tetany is animal disorder reduced or eliminated by the presence of clovers in the pastures.

Pasture management is the basis of a sustainable grass farm. Pastures serve as the main source of nutrition for the cow herd, dry cows, steers, and developing heifers on the farm. To accomplish this, it is very important to first establish a baseline of information by conducting a systematic assessment of the grazing resource. A grazing plan can then be implemented and periodically assessed with a pasture monitoring program. Clovers are a valuable component of a pasture or hay field because they result in improved animal performance and a decreased need for nitrogen. Either of these benefits alone is enough to make the legumes profitable. Having both makes legumes a component of the pasture that we should focus on constantly. With selection of the right clover and proper management, improved pastures represent one of the best and most affordable sources of feed for your animals. The use of clovers in forage programs has numerous potential benefits: reduce nitrogen use, increase forage yield, provide better yield distribution, and provide better forage quality. These benefits are usually associated with better animal performance which means a reduction in the cost of production. Renovating or planting a new pasture is a commitment to maximizing the productivity of your land, and clovers will help you achieve that goal.