Pasture Management and Grazing Guide for Livestock Producers

Management is the key to healthy, productive pastures. A well executed pasture management program can lead to improved soil fertility, an extended grazing season, and a more diverse, dense, and persistent pasture ecology. Beef producers should think of themselves as grass producers who are marketing their products to livestock. In other words, livestock producers want to produce high quality forages that can nourish livestock to provide a net return. Poor pasture management decreases animal gains and revenue. To sustain a livestock operation, a well managed forage system uses several different management techniques (**Figure 1**). These management practices promote a healthy grass supply and can reduce feeding costs. They also protect natural resources by reducing soil erosion and increasing soil organic matter.

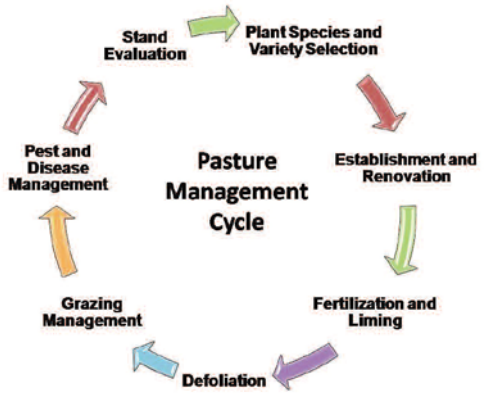

Figure 1. Pasture management plan.

Stand Evaluation

A successful livestock-based grazing system depends on good pasture condition. Pasture condition refers to the health of plants in an area and whether the soil's nutrients can sustain management practices. Pasture condition depends on species of the plants (legumes or grasses), biomass cover (weed pressure), soil conditions (nutrients, pH, and moisture), yield persistence (annual or perennial), and forage quality (taste, digestibility, and toxicity). Management practices that address these factors can improve pasture productivity.

Plant Species and Variety Selection

Selecting the appropriate forage for hay, pasture, or conservation is an important decision. There is a wide range of grasses and legumes available (cool- and warm-season). Each species can be used by itself or as part of a mixture. Some forbs such as brassicas and chicory can also be incorporated into a productive pasture system. Species selection depends on environmental conditions such as rainfall, soil drainage, soil nutrient supply, pH, and intended use (pasture vs. hay). **Tables 1 and 2** give descriptions and tolerance characteristics of species that are common to Mississippi.

When selecting forage species for seeding or renovating, consider your individual requirements (fertility, soil moisture requirements, and winter hardiness). Most producers prefer grasses for forage because grasses yield more per acre. They are also easier to maintain. On the other hand, legumes increase soil fertility, have higher protein levels, and extend the grazing season.

Based on the intended use and livestock needs, a mixture of grasses and legumes could increase yield and reduce maintenance. Forage mixtures with different maturities provide a high-quality, longer grazing season and longer stand survival. If you choose a forage mixture, make sure species have similar growth patterns and palatability (**Table 3**). Plan carefully for defoliation of grass/legume mixtures. Choose species that are compatible in height and have the same level of aggressiveness.

Because legumes can provide nitrogen (N), mixtures can reduce supplemental nitrogen needs. When legumes are incorporated into forage systems, they can provide 50 to 80 lb N/ac.

Contact your county Extension office to ask about forage varieties adapted to an area or specific site.

Establishment and Renovation

A good forage management program starts with establishing a healthy stand. Select grasses or legumes that are adapted to the climate and provide a high germination rate. Germination depends on a well prepared seedbed to establish good contact between seed and soil. A firm, well-packed seedbed will allow for a more precise seeding depth, allowing the seed to be in close contact with moist soil. Most producers plant in a clean seedbed or interseed forages (annual ryegrass or small grains) into existing pastures (bermudagrass or bahiagrass).

The correct seeding method and date and planting depth and rate are important factors in forage establishment. For example, planting too deep will force the seed to use its carbohydrate reserves before it can reach the soil surface and develop leaves for photosynthesis.

The planting rate will depend on the planting method (drill, broadcast, or no-till drill). If you broadcast seeds, use higher seeding rates. Seeding rates are based on pounds of

Table 1. General legumes and forbs information.

Forage Crop	Forage Use			Grazing Management		Seeding Rate (lb/ac)[2]	Tolerance to		
	Pasture	Hay	Silage	Continuous	Controlled		Soil Acidity	Poor Drainage	Drought
Annual									
Arrowleaf Clover	G[1]	F	P	G	G	5-10	G	P	G
Berseem Clover	G	G	P	F	G	20-25	P	G	G
CaleyPea	G	P	P	G	G	50-55	G	G	G
Crimson Clover	E	E	P	G	E	20-30	F	P	G
Hairy Vetch	G	F	P	G	G	20-25	G	P	F
Annual Lespedeza	G	F	P	F	G	25-30	F	P	G
Rose Clover	E	P	P	G	G	8-12	G	F	E
Subterranean Clover	G	P	P	G	G	15-20	F	P	G
Sweetclover	G	P	P	P	F	12-15	P	P	G
Perennial									
Alfalfa	E	E	E	P	E	12-25	P	P	G
Birdsfoot Trefoil	G	G	E	G	G	4-6	G	G	F
Red Clover	E	G	E	P	G	12-15	F	F	F
White Clover	E	F	G	E	E	2-3	F	G	P
Perennial Peanut	G	G	P	F	G	12-15	F	P	G
Sericea Lespedeza	G	G	P	G	G	20-30	E	G	G
Forbs									
Rapes and Turnips	G	P	P	F	G	3-5	G	P	G
Chicory	G	P	P	G	G	3-4	E	G	E

[1]E= Excellent, G=Good, F=Fair, P=Poor
[2]Seeding rates are recommended for broadcast seeds. Reduce seeding rates by 20% if planting in a clean seed bed.
Sources: Ball et al. 2002; Banhart 1999.

Table 2. General grass information.

Forage Crop	Forage Use			Grazing Management		Seeding Rate (lb/ac)[2]	Tolerance to		
	Pasture	Hay	Silage	Continuous	Controlled		Soil Acidity	Poor Drainage	Drought
Annual									
Annual Ryegrass	E[1]	P	P	G	G	20-30	F	G	P
Crabgrass	G	G	P	F	G	4-6	G	G	G
Forage Sorghum	F	P	G	F	G	15-20	P	G	G
Pearl Millet	G	P	G	F	G	25-30	G	F	G
Small grains[3]	G	P	F	G	G	90-120	G	F	G
Soghum-Sudan Hybrids	G	P	G	F	G	30-40	F	P	E
Sudangrass	G	P	G	F	G	30-40	F	P	E
Perennial									
Bahiagrass	E	G	P	G	G	15-20	G	G	G
Bermudagrass	E	E	P	G	E	5-10 (25-40)[4]	G	G	E
Dallisgrass	G	F	P	F	G	10-15 (PLS)	G	G	G
Johnsongrass	F	G	P	F	G	20-30	G	G	E
Orchardgrass	E	E	G	E	E	15-20	F	F	F
Tall Fescue	E	G	G	G	G	15-20	E	G	G

[1]E= Excellent, G=Good, F=Fair, P=Poor
[2]Seeding rates are recommended for broadcast seeds. Reduce seeding rates by 20% if planting in a clean seed bed.
[3]Small grains (oats, rye, triticale, and wheat).
[4]Sprigging rate (bu/ac) for hybrid bermudagrass.
Sources: Ball et al. 2002; Banhart 1999.

Table 3. Compatibility of legumes and grasses for forage production.

Legume	Bahiagrass or bermudagrass	Dallisgrass	Johnsongrass	Tall fescue or orchardgrass	Small grain and/or annual ryegrass
Perennial peanut	X	.	.	.	X
Alfalfa	.	.	.	X	.
Red clover	.	X	X	X	X
White/ladino clover	.	X	.	X	.
Arrowleaf clover*	X	.	.	.	X
Berseem clover*	X	X	X	.	X
Crimson clover*	X	.	.	.	X
Hairy vetch*	X	.	.	.	X
Rose clover*	X	.	.	.	X
Subterranean clover*	X	.	.	.	X
Caley pea*	.	X	X	.	.

*Annual legumes such as arrowleaf clover, crimson clover, subterranean clover, and hairy vetch may be grown with tall fescue but are less desirable than perennial clovers.
Source: Ball et al. 2002

pure live seed (PLS). Pure live seed assumes every seed is viable and capable of producing an established plant. To determine the adjusted seeding rate of a forage species, use the germination and purity percentage given on the seed tag. Note that seeding rates of legumes are not usually adjusted if PLS is greater than 90%.

The following two calculations are necessary to determine adjusted rates:

(1) Determine your PLS index:

$$\text{PLS Index} = \frac{(\%\ \text{germination} \times \%\ \text{purity})}{10{,}000}$$

(2) Determine the amount of seed needed per acre:

$$\text{Amount of bagged seed needed (lb/ac)} = \frac{\text{PLS seeding rate for forage}}{\text{PLS index}}$$

One of the best ways to improve forage yield and animal performance on low-producing grass pastures is to renovate them periodically. Pastures that need renovation usually have narrow leaves, thin stems, short seed heads, weak root systems, and low forage production. Poor soil quality is also reflected by low soil organic matter, poor nutrient cycling, and bare soil spots. To begin restoration, do a soil test. Seed a persistent forage species (grass, legume, mixture). If you broadcast seeds, overgraze the pasture to allow a better seed contact. If soil pH is low, apply lime. Fertilize according to soil test recommendations. If legumes are used as the renovating species, do not apply nitrogen. Apply nitrogen (20-30 lb/ac) only if the legume species composition is less than 30%. When planting legumes into an established pasture, magnesium and potassium levels may need to be adjusted for optimal plant growth and development.

Weeds are more aggressive under poor conditions. Therefore, weed control is important for forage establishment. Chemical control might be necessary. However, legume establishment is very susceptible to herbicide applications. See replanting restrictions in the table below.

Soil Testing and Liming

Adequate soil fertility is essential in pasture management. A soil test tells you the soil nutrient levels. Knowing the soil nutrient levels will help you decide how much fertilizer and/or lime you need to improve productivity.

Forage crops should be sampled for testing at least 6 months before planting and afterwards every 2 to 3 years, depending on the forage species. It is important to take a soil sample that is representative of the area. A good soil sample includes 15 to 20 subsamples taken within the sampling area at 6 inches depth. Avoid sampling in slopes or poorly drained areas. Different soil types have different chemical and physical properties and should be sampled separately. Contact the county Extension office to determine the soil types in a specific area and proper soil sampling documentation. Give information about the field history and intended use to ensure proper nutrient soil test recommendations.

Forages used for grazing usually require less fertilizer than those used for hay because most nutrients are returned in animal wastes as part of the natural cycle. Phosphorus is excreted primarily in manure, and nitrogen and potassium return in urine and manure. In the case of hay production, do a tissue analysis to determine how much of each nutrient is being removed so you can account for those losses when adjusting fertilizer applications. Adjusting the soil pH by liming could increase mineral availability. Lime (calcitic or dolomitic) is also a good source of calcium or magnesium. Lime usually takes months to adjust soil pH, but it makes added nutrients available instantly. Legumes are very sensitive to low pH. They are best adapted to pH ranging from 6 to 7. If pH is less than 5.5, lime application is recommended based on the soil test analysis. The types and locations of weeds

Table 4. Replanting restrictions for forages after herbicide application.

	Legumes		Grasses			
Product	**Alfalfa**	**Clover**	**Bahia**	**Bermuda**	**Fescue**	**Rye**
Cimmaron	4 m[1]	4 m	–	4 m	4 m	4 m
Crossbow	3 w	3 w	3 w	3 w	3 w	3 w
Diuron	2 y	2 y	2 y	2 y	2 y	2 y
Glyphosate	1 w	1 w	1 w	1 w	1 w	1 w
Grazon P+D	1 y	1 y	3 w	3 w	3 w	3 w
Paraquat	0 d	0 d	0 d	0 d	0 d	0 d
Remedy	3 w	3 w	3 w	3 w	3 w	3 w
Velpar	2 y	2 y	2 y	2 y	2 y	2 y

[1]d, m, w, and y following the numbers indicates days, months, weeks, and years, respectively.
Source: Mississippi State Univ. Ext. Serv. 2007

could indicate fertility and help identify special situations such as low pH.

Defoliation

Defoliation of forage species is affected by grazing pressure, frequency, duration, and resting period interval. Control the degree of defoliation during the growing season. Allow enough remaining leaf area to provide new carbohydrates for regrowth so the plant is not forced to use stored carbohydrates. Do not graze a forage species below 3 inches. In grasses, the bottom 2-3 inches is where the sugars and proteins are stored for regrowth. Once plants begin to use stored nutrients, forage quality is reduced. A good rule of thumb is the "take half, leave half" rule, which allows plants to retain that important energy reservoir.

Severe defoliation late in the growing season is more harmful than early in the season because it reduces crown tissue and carbohydrate storage capacity. Avoid grazing a forage species for the 4 weeks before the growing season ends. This resting period allows carbohydrate to rebuild.

Grazing Systems

Pasture management also depends on grazing schemes that increase forage utilization. Many livestock producers use rotational grazing plans instead of continuous grazing to increase forage use and profits. Under continuous grazing, animals have free choice of forage. They become more selective, creating bare spots that can lead to weed invasion and erosion. Erosion can lead to runoff, which may affect water quality.

The rotational stocking method uses two or more grazing units or paddocks that are alternately grazed and rested. Animals can rotate as often as once every two hours or as seldom as once every two weeks. These rotations are usually based on the amount of forage available, forage growth rate, paddock size, and stocking rates.

Animals tend to eat more forage in a rotational stocking system because they can't be as selective as in a continuous grazing system. Rotational stocking systems also improve the composition and distribution of forage. Therefore, this method reduces the need for supplemental feeding. To make a rotational grazing system work, you must coordinate the rotations with the growth stage of the target forage species. You may have some start-up costs if the rotational system requires new fencing or water systems. Rotational grazing can help improve pasture quality and fertility by allowing an even manure distribution and increasing biomass yields (1000 to 2000 lb DM/ac more than continuous grazing). In a well managed rotational grazing system, the forage supply should be monitored closely and adjusted to the appropriate stocking rate by increasing or decreasing the amount of acres grazed during a specific time period (**Table 5**).

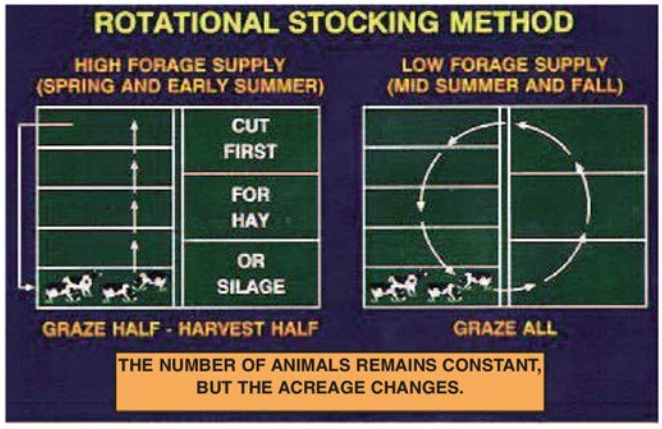

Figure 2. Scheme of a rotational grazing method.
Source: Emmick and Fox 1993.

Weed Control

Weed control is a very important part of forage management. Healthy, well established forage plants are better able to resist invasion by weeds. Weeds compete with forage species for space, nutrients, and water, reducing forage yield and stand persistence. Weeds that are present in small quantities can be controlled by digging them out or using spot spray herbicides. To combat aggressive weed growth, you may need to use herbicides or tilling practices. This should be done only when necessary. In some cases, chemical control is not be

Table 5. Calculating stocking rates.

Number of paddocks = $\frac{\text{days of rest}}{\text{days of grazing}}$ + 1 *Example:* Number of Paddocks = $\frac{\text{28 days of rest}}{\text{4 days of grazing}}$ + 1 = 8 paddocks	**days of rest**: Number can range from 10 or lower for rapidly growing grasses to 30 for legumes to more than 30 for slow growth periods. **days of grazing**: Varies from 1 to 7 and up. Shorter times on a paddock yield greater season-long usefulness and less waste, selectivity, and regrowth grazing.
Acres required per paddock = $\frac{\text{weight x \%DMI x animal number x days per paddock}}{\text{DM per acre x \%utilization}}$ *Example:* Acres required per paddock = $\frac{\text{500 lb x 3\% x 100 heads x 4 days}}{\text{2000 lb/ac x 60\%}}$ = 5 acres per paddock	**weight**: weight per head, in pounds. **percent DMI**: percent dry matter intake, ranging from 2 to 4%. **animal number**: number of head to be grazed. **days per paddock**: amount of time that animals are to be allowed to graze in a given paddock. Values can range from 1 to 7 and up. To keep animals from grazing regrowth, keep days per paddock at 7 or fewer. **DM per acre**: estimate of the total forage dry matter available per acre as the animals enter a paddock. **percent utilization**: portion of the available forage per acre that animals will consume during a grazing period. Utilization is the proportion forage production that is consumed or destroyed by animals (including insects). Utilization may refer either to a single plant species, a group of species, or the vegetation as a whole. Improved grazing systems can result in utilization of 60% for grasses and 75% for legumes.
Total acres required per grazing cycle = Number of paddocks x acres required per paddock *Example:* Total acres required per grazing cycle = 8 paddocks x 5 acres per paddock = 40 acres	**number of paddocks**: determined by the length of the rest and grazing periods. **acres required per paddock**: determined by the amount of forage needed each day by the grazing herd divided by the grazable forage dry matter per acre. The number of acres needed per grazing cycle will vary with the growth rate of the forage. As the growth rate slows, the number of acres required to supply 3% DM and maintain 4 days on and 28 days off a paddock will increase.
Stocking rate = $\frac{\text{number of animals to be grazed}}{\text{total acres grazed}}$ *Example:* Stocking rate = $\frac{\text{100 head}}{\text{40 acres}}$ = 2.5 head per acre	Stocking rate and stocking density are often confused. Stocking rates applies to the entire grazing period (in this example, 32 days) or can be thought of as a season-long or whole-farming statistic.
Stocking density = $\frac{\text{number of animals grazing on a paddock}}{\text{paddock size}}$ *Example:* Stocking density = $\frac{\text{100 head}}{\text{5 acres}}$ = 20 head per acre	Stocking density is the stocking rate at a given point in time. In this example, 100 steers are grazing in a 5-acre paddock, which is a stocking density of 20 head per acre. Stocking density can be expressed as the number of pounds of grazing animals per acre at a given point in time (in this case, 10,000 pounds per acre).
Adapted from Henning et al. 2004	

an option because of livestock requirements, herbicide restrictions, or environmental concerns. In these cases, changes in grazing methods, fertilization, forage species, and water management might help to shift the competitive balance in favor of the forage rather than the weeds. For example, not applying fertilizer when weeds are actively growing can reduce their competitive edge.

Rotational grazing systems can help control weeds because livestock are less selective in small areas and more likely to eat weeds before they reach a seeding stage. Mowing before weeds flower could reduce weed competition as well, but at higher costs in terms of equipment, fuel, and labor. Letting different livestock species (sheep, goat, and horses) graze the same land may help with weed control. Some of these animals, like sheep and goats, consume more broadleaf species, forbs, and brush. Most broadleaf weeds can be controlled by utilizing a broad-spectrum herbicide such as 2,4-D. It is important to read the label, follow recommended rates, and adhere to restrictions (**Table 6**).

Table 6. Haying, grazing, and slaughter restrictions for livestock in herbicide treated pastures.

Product	Dairy Animals				Meat Animals		
	Lactating		Nonlactating				
	Grazing	Haying	Grazing	Haying	Grazing	Haying	Slaughter
	days						
2,4-D amnine	7	30	7	30	0	30	3
2, 4-Ester	7	30	7	30	0	30	3
Arsenal	0	7	0	7	0	7	–
Buctril							
spring treatment	30	30	30	30	30	30	–
fall/winter treatment	60	60	60	60	60	60	–
Butyrac							
established alfalfa	30	30	30	30	30	30	–
seeding alfalfa/clover	60	60	60	60	60	60	–
Cimmaron	0	0	0	0	0	0	–
Cimmaron Max	7	37	0	37	0	37	30
Clarity/Banvel							
1/2 qt/ac or less	7	37	0	0	0	0	30
2-4 gal/ac	40	70	0	0	0	0	30
Crossbow							
2 gal/ac or less	14	NS[1]	0	7	7	0	3
2-4 gal/ac	NS	NS	14[2]	14	14[2]	14	3
Diuron	70	70	70	70	70	70	–
Glyphosate							
legumes							
preplant, preemergence, at plant (< 44 oz/ac)	0	0	0	0	0	0	0
preplant, preemergence, at plant (> 44 oz/ac)	56	56	56	56	56	56	56
afalfa preharvest	1.5	1.5	1.5	1.5	1.5	1.5	1.5
spot treatment (<10% total acres)	14	14	14	14	14	14	14
renovation (< 44 oz/ac)	1.5	1.5	1.5	1.5	1.5	1.5	1.5
renovation (> 44 oz/ac)	56	56	56	56	56	56	56
grass pastures							
preplant, preemergence, renovation	56	56	56	56	56	56	56
spot or wiper treatment	14	14	14	14	14	14	14
Gramoxone							
alfalfa/clover							
dormant clover	–	60	–	60	–	60	–
between cuttings	30	30	30	30	30	30	–
bermudagrass, dormant	–	40	–	40	–	40	–
Gramoxone Max/Boa							
alfalfa	–	30	–	30	–	30	–
dormant bermudagrass	–	40	–	40	–	40	–
Grazon P+D	7	30	0	30	0	30	3
Journey	0	7	0	7	0	7	–
Metrilbuzin	28	28	28	28	28	28	–
Overdrive	0	0	0	0	0	0	0
PastureGard	NS	14	0	14	0	14	3
Poast	7	20	7	20	7	20	–
Redeem R+P	14	NS	0	7	0	7	3
Remedy							
2 qt/ac or less	14	NS	0	7	0	7	3
2-4 qt/ac	NS	NS	14[2]	14	14[2]	14	3
4-6 qt/ac	NS	NS	14[2]	NS	14[2]	NS	3
Surmount	14	7	0	7	0	7	3
Telar	0	0	0	0	0	0	–
Velpar	60	60	60	60	60	60	–
Weedmaster	7	37	0	37	0	37	30

[1]NS indicates next season.
[2]If the area treated is less than 25% of grazing area; there is no restriction for nonlactating or meat animals
Restricitions vary among manufactured product. Refer to particular product label for specific restrictions.
Source: Mississippi State Univ. Ext. Serv. 2007

Summary

Providing good forage quality throughout the year will greatly reduce feed costs. In Mississippi, year-round grazing is a realistic goal. Remember to strike a balance between forage species composition, nutrient availability, forage establishment, and grazing pressure (defoliation) to sustain plant and animal performance. Livestock species and breeds have different nutrient requirements and preferences. Forage production should be adjusted to meet those needs. Also take into consideration soil and environmental conditions to meet the needs of the selected forage species. Awareness of these concepts should help you assess your management practices. Remember that no single management practice will suit all operations.

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By **Dr. Rocky Lemus**, Associate Extension/Research Professor, Plant and Soil Sciences.

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