United States Department of Agriculture

Natural Resources Conservation Service

Prescribed Grazing: Design, Layout and Management of a Rotational Grazing System

Alabama Guide Sheet No. AL528

Description

Rotational grazing is a method to Prescribe Graze forages within the Prescribed Grazing (528) Conservation Practice Standard. It is used to effectively graze forages, while protecting natural resources. When properly implemented soil, water, plants animals and humans are benefitted:

- Soil erosion is reduced, soil quality and soil compaction are improved
- Water infiltration into soil is increased, surface water runoff is reduced, downstream water quality is improved
- Forage quality and production is improved
- Livestock health is improved and total livestock gains are improved
- Wildlife habitat (shelter, feeding, nesting and brood rearing) is improved
- Wildlife health is improved because of better food sources (seed, insects and invertebrates)

In the planning of a grazing system, one of the early steps is to evaluate the resource base. The forage types, soils, topography, water, shade, environmental sensitive areas, and physical facility should be carefully inventoried before a management plan is developed. It is essential to know what limitations are imposed upon the planned system by the natural resources base as well as limitations of capital, labor, and management expertise. Production and economic goals should be set within the context of the resource base. In developing the grazing system, both short term and long term goals should be identified. The guidelines that follow can help make a grazing system more effective, efficient and work smoother.

Keep Paddocks as Near Square as Possible

Uniform sized paddocks with parallel sides, where land allows, are the most desirable for rotational grazing systems. They better facilitate grazing distribution, additional subdivisions, as well as mechanical harvest of forage when appropriate. Observations and research indicates that shape of the paddock will influence grazing behavior. Paddocks which are nearly square tend to be grazed more uniformly than long, narrow paddocks. Long narrow paddocks are frequently grazed heavier in the portion of the paddock where the water is located as compared to the rest of the paddock. As travel distance from water increases, length to width ratio becomes more significant. On small grazing systems where animals are never more than several hundred feet from the water source, shape is less critical. Also, the shorter the grazing period the less critical shape becomes. Cattle take about three days to establish a strong grazing pattern within an individual paddock. If allowed to remain in a paddock beyond three days, spot grazing and pronounced cattle trails will begin to develop. When the cattle return to this paddock in future grazing cycles, the grazing pattern will be established and they will begin to follow the previous pattern.

The amount of fence required to subdivide a large pasture into paddocks can vary depending on the shape and layout of the paddocks. Frequently, fencing can be reduced 10 to 30 percent by considering different layout options. In most situations, a design based on a uniform paddock of low length to width ratio (block design) with water in every paddock will be the most efficient fence layout. Wheels and hub designs with one central water location do not work as well in Alabama because of mud and related problems.

Keep Animals within 800 Feet of Drinking Water

Grazing animals need to drink on a regular basis. To do this they must stay within a certain traveling distance of the water source. Consumption of water

by cattle is greater when water is made available in every paddock and the travel distance are kept less than 800 feet. When water is closer than 800 feet, cattle will often go to water as individuals instead of a herd. This allows a producer to use a smaller trough because there can be more time for the trough to refill after usage. In addition, pasture utilization becomes less uniform as cattle travel more than 800 feet to water. The nutrient gradient created by animal concentration and manure deposition around watering sites is lessened when animals do not have to travel a great distance to water.

Paddocks should be of Similar Production, Not Size

It is important to keep the animal's diet as uniform as possible to ensure consistent performance. Variance in diet from day to day will result in inconsistent animal performance. The nearer to constant that the diet can be kept, the more predictable animal performance will be. Using paddocks of all the same size in acres, but with varying forage production, can cause nutritional stress in the animals.
For this reason, the size of paddocks should be based on carrying capacity. Paddocks on the most productive part of the pasture management unit are likely to be smaller than average while paddocks on the least productive soils will be larger than average. Paddock boundaries which follow approximate contours and changes in soil type allow for uniform production and grazing. Livestock grazing patterns will often follow the forage species composition of the pasture. If several soil types, productivity levels, and forage species are located in the same paddock, uneven grazing can occur. This is why it is important to place each fence with the stocking rate and animal production in mind, not simply to divide the pasture management unit into equal sized units.

Lanes or Alleyways

Lanes or alleyways may or may not be needed. Often with rotational grazing systems for beef cattle, to move animals from one paddock to adjacent paddocks the producer will simply open a wire gap between the paddocks. However, if lanes are part of the grazing system, they should only be used to facilitate movement of cattle to fresh pastures or to corrals for working. This type of use causes very little stress on the lane vegetation without loss of cover. When lanes are used each day to access a fresh paddock, as with dairy cattle, or to access a common water source, loss of vegetation, erosion, and potential mud problems will occur. For this reason, it is best to develop water in each paddock if possible or special attention will be needed to maintain the lane. This may require establishing a gravel surface or making multiple lanes. When one lane is in use the others are resting. Normally each lane would be used only a day or two before the animals are routed to the adjacent lane. This rest will help maintain vegetation on the lanes and reduce problems associated with bare soil.

Number of Paddocks

The optimum number of paddocks will vary with both pasture species and animal type due to desired utilization and performance goals, resistance to grazing damage of the forage, regrowth habit of the forage, and the economic potential. The ideal system is to have grazing animals harvest the high quality leaf tips and leafiest forage leaving the lower quality basil leaves and steamy forage for photosynthesis to maintain the root systems and for rapid regrowth. **Also, the animals should be rotated to another paddock before new regrowth (new leaves and shoots) reaches grazing height. This is usually a three to seven day period**, depending on climate conditions. For forage species which have a high growing point, it is very important that a short grazing period be used to prevent regrazing of the new regrowth so production will not be effected. Another point to remember is with a shorter grazing period, the fluctuation in forage quality from the first grazing day to the last grazing day in each paddock is minimized.

The actual number of paddocks required for a particular grazing cycle is determined by the necessary rest interval required for the particular forage species under specific environmental conditions and the maximum number of days that animals should be left on a paddock to obtain performance goals.

Typically the growth cycle of forages in Alabama is 21 to 35 days. This will vary depending on the forage species, environmental conditions, and time of the year. Therefore, this is the rest interval (21 to 35 days) that should be considered in designing many rotational grazing systems. Under good growing conditions, a 21 day or less rest may be plenty for a cool season forage species. However, in midsummer during dry periods, warm season forages may require 36 or more days to recover. The implication is that fewer paddocks or more livestock are needed at certain times of the year. The paddocks not needed for grazing can be harvested as hay. Also, depending on the time of the year and forages species, it may be stockpiled for grazing at a later time. Tall fescue is a forage species which lends itself to stockpiling for fall and early winter use. Sometimes bermudagrass may be stockpiled as well. Supplements may be needed when feeding stockpiled bermudagrass.

With the regrowth period of three to seven days, and the forage growth cycle of 21 to 35 days, six to eight paddocks should be sufficient. The number of paddocks is determined by the following equation.

$$\textbf{Number of Paddocks} = \frac{\textbf{Days of Rest (Forage Growth Cycle) + 1}}{\textbf{Days of Grazing (Limited by Shoot and Leaf Regrowth)}}$$

With this in mind for slow growing forages or forages with low growing points such as bahiagrass or bermudagrass, six paddocks (35 divided by 7 plus 1 equals 6) should be sufficient to meet the rest or recovery period needed to maintain good production. With fast growing cool-season forages eight paddocks should be sufficient. With the forages available in Alabama, 8 to 10 paddocks should be sufficient.
Also, consider the increased input cost, along with increased management needed to make the grazing system work when increasing paddock numbers. A reasonable approach is to start with four to five permanent paddocks with water located near the center of each and then use temporary fencing to further divide into 8 to 10 paddocks.

Improved Forage Utilization

Rotational grazing systems have been proven to improve forage utilization compared to continuous stocking systems. Forage utilization improves from 35% to 50% by using 3 to 4 pastures in rotation compared to continuous grazing (Table 1). Utilization continues to improve with more intensive rotational grazing management systems.

Basic Rules to Remember

Use the higher quality parts of the forage plants for grazing, rotating the animals to next paddock before they begin to graze the new regrowth. Forcing animals to eat low quality leaves and stems will reduce their performance.
Maintain sufficient leaf area for photosynthesis to keep a healthy root system and maximize forage production. A rule of thumb for keeping sufficient leaf area is maintain 50 percent of the forage growth (dry matter) for photosynthesis or not to graze closer than the recommended minimum grazing height. Recommended minimum grazing heights are contained in Table 2. The target height to stop grazing is the most critical one to observe since it has significant impact on how long it takes most plants to regrow and recover to a sufficient height to be re-grazed or harvested again. Plants regrow faster when more foliage if left after a period of defoliation.
Match the rotation time to the forage growth. The rotation among paddocks **must not be** based on a fixed time schedule, but rather on available forage and rate of forage growth. During periods of rapid forage growth, the grazing time in each paddock should be short. When forage growth is slow, the rotation can be slowed down. **Maintaining a rigid rotation schedule is a recipe for failure. Consider how fast forages regrow and how long it takes for them to reach the grazing height. Rotating livestock before they can graze the regrowth is important to minimize spot grazing and promote forage uniformity during the next grazing period.**

An *estimate of the number of days it will take to recover following grazing is found in Table 2.*
The number of days to rest a pasture following grazing depends on many things, including the “stop” grazing height, the height of growth before grazing, the level of moisture or temperature stress, landscape position, soil type, soil fertility, and amount of hoof damage. The days for the forage to recover after grazing will vary throughout the year.

Remember, the lack of plant persistence is highly influenced by short resting periods and close grazing of forages. This situation causes root growth and plant health to decline; promotes influxes of weed problems in the pastures; and, ultimately leads to stand failures.

The manager should observe pastures often and set priorities on the sequence of regrazing. Because of the wide variation in resources found on most farms, it is not wise to systematically rotate from pasture to pasture on a set time or sequence. Some pastures simply grow faster and are suitable for grazing more frequently than others. Developing a forage inventory, by field, will indicate which fields have the potential for highest yields and therefore are likely to regrow quickest under reasonable grazing management.

Keep grazing records to help:

- document implementation of grazing management strategies and their effectiveness
- determine an estimate of forage production in each pasture, post-grazing recovery, proper stocking densities, fertility needs, and financial inputs.

Keep the grazing periods short for each pasture to:
reduce the trampling and waste of forage

- minimize spot grazing,
- improve distribution of animal waste over the pasture
- reduce feed quality variation
- deduce the trails and lounging areas
- increase the consumption of “weedy” species

Table 1. Forage Utilization Under Different Stocking Methods.

Stocking Method	% Utilization
Continuous	35
3 – 4 Pastures in Rotation	50
5 – 7 Pastures in Rotation	55
8 – 12 Pastures in Rotation	60
Daily rotation	65
Strip Grazing	70

These values represent estimated utilization based on proper grazing height for the forage species. They should be used only as a guide. Considerable variation can exist within and among the categories.

Table 2. NRCS Forage Grazing Heights, Productivity and Recovery Guides.						
Common Forage Species	Begin Grazing	Graze To	Usual Days of Rest	Average Annual Production Dry Matter lbs./ac	Approximate Dry Matter Production lb./ac-in	Dry Matter Production Range lb./ac-in
Grasses						
Bahiagrass	6	2	10 - 20	8000	225	100 - 350
Bermudagrass, Common	5	2	7 - 15	8000	260	150 - 500
Bermudagrass, Improved	6	3	7 - 15	12000	260	150 - 500
Bluestem, Big and Little	18	10	30 - 45	8500	100	50 - 250
Crabgrass	5	3	10 - 20	6000	120	75 - 200
Dallisgrass	6	3	7 - 15	6000	250	150 - 350
Eastern Gamagrass	24	12	30 - 45	8000	100	50 - 250
Fescue, Tall	6	3	15 30	7000	210	100 - 350
Johnsongrass	18	10	30 -40	7000	150	100 - 250
Indiangrass	12	6	30 -40	9000	100	50 - 250
Orchardgrass	8	3	15 - 30	7000	180	75 - 300
Pearl Millet	24	10	10 - 20	7200	150	150 - 250
Ryegrass	6	3	7 - 15	6600	250	75 - 400
Small Grains	8	4	7 - 15	6000	150	75 - 250
Sorghum-Sudan Hybrids	24	10	10 - 20	8000	150	100 - 250
Legumes						
Alfalfa, Grazing Types	10	4	35 - 40	9000	225	75 - 40
Clover, Arrowleaf or Crimson	6	2	7 - 15	5000	200	100 - 300
Clover, White	5	2	10 - 20	5000	200	100 - 300
Clover, Red	6	2	10 - 20	6000	220	100 - 300
Lespedeza, Annual	5	2	20 - 30	3000	150	50 - 250
Lespedeza, Sericea	8	4	20 - 30	4000	200	150 - 250
Mixtures						
Bahiagrass + Crimson Clover	6	3	7 - 20	9000	225	100 - 350
Bahiagrass + Ryegrass	6	3	7 - 15	9500	240	100 - 380
Bahiagrass + Rye, Ryegrass, Clover	6	3	7 - 20	10000	250	100 - 400
Common Bermudagrass + Crimson Clover	6	3	15 - 30	9000	225	100 - 350
Common Bermudagrass + Ryegrass	6	3	7 - 15	10000	240	100 - 380
Common Bermudagrass + Rye, Ryegrass, Clover	6	3	7 - 20	10500	250	100 - 400
Tall Fescue + White Clover	6	3	15 - 30	8000	200	100 - 325
Common Bermudagrass (50%)+ Tall Fescue (50%)	6	3	15 - 30	9000	250	150 - 350

Wildlife Benefits

All species of wildlife have certain basic requirements. These include food, water, cover, space, and arrangement of these items compared to each other. Prescribed grazing promotes cover and food for many wildlife species. Combining pastures of native warm season grasses and prescribed grazing significantly improve the benefits to wildlife. Properly managed pastures will follow grazing height guidelines, stocking rates and rotational schedules. Rotational grazing of native warm season grasses allows plenty of residual grass height to provide structure for nesting and foraging even as cattle are being rotated out of a paddock. Native grasses provide quality habitat for grassland nesting birds including bobwhite quail, eastern wild turkey, Bachman's sparrow, eastern meadowlark, grasshopper sparrow, loggerhead shrike and many other birds. White-tailed deer utilize native grasses for bedding cover. Native grasses provide both shelter and food for cottontail rabbit and wild turkey. Many species of birds use these grasslands for nesting, as well as for brood rearing areas. Young birds consume insects such as grasshoppers and leaf bugs for much needed protein. These insects, which are abundant in native grasslands, are consumed at a high rate the first several weeks after bird hatching.

When wildlife is a primary focus for a landowner, native warm season grasses should be utilized in the grazing system as previously described.

Summary

Grazing systems should be designed with ready access to water, preferably with the animals always being within 600 to 800 feet of the water source. Excess forage should be used as hay or haylage. Paddocks of rotational stocking systems should be laid out nearly square following landscape changes so that each paddock has as little soil variation within it as possible. Also, permanent paddocks should be sized to provide similar forage production. They can be further subdivided if needed with temporary fencing.

Table 3. **Grazing Management Records**

Keeping accurate records helps to track pasture conditions and aids in effectively managing each pasture in the grazing system.

Pasture ID		Pasture acres		Forage type			
Soil test date		Lime/ Fertilizer rate		Lime/ Fertilizer type		Date applied	

Livestock		Date in	Forage height	Date out	Forage height	Notes (fertilizer applied)
Type	Number					

Pasture ID		Pasture acres		Forage type			
Soil test date		Lime/ Fertilizer rate		Lime/ Fertilizer type		Date applied	

Livestock		Date in	Forage height	Date out	Forage height	Notes (fertilizer applied)
Type	Number					

References

A Guide for Planning and Analyzing a Year Round Forage Program, Nebraska **Cooperative** Extension Service, EC 86-113

Getting More Value From Your Pastures, UK Special Publication, KFGC-97-1

Management Intensive Grazing in the Ozarks, A Project of Top of the Ozarks RC&D and Southwest Missouri RC&D

Managing **Johnsongrass** *for Dairy Cows,* Auburn University Agricultural Experiment Station Bulletin 389, *Missouri Grazing Manual*, 1997, Edited by Jim Gerrish and Craig Roberts

Nebraska **Handbook** *of Range Management,* Nebraska Cooperative Extension Service, EC 92124-E

Wisconsin Pastures for Profit: A hands on guide to rotational grazing, University of **Wisconsin** Extension Publication A3529.

Southern Forages, Ball, D., Hoveland, C., and Lacefield, G. 2007.

Forestland Grazing: A Guide for Service Foresters in the South. Forestry Report SA-FR10. Rev. August 1980. *Missouri Grazing Manual*. Edited by Jim Gerrish and Craig Roberts. 1997.

The United States Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact the USDA's TARGET Center at (202) 720-2600 (voice and TDD).To file a complaint of discrimination, write the USDA, Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer. *01/15*