# Nutrition & Forages:

## *Pasture Management - Oxymoron or New Opportunity?*

*Dr. David C. Ditsch*

Kentucky's soils and climate offer small ruminant producers the opportunity to graze their livestock on a wide variety of cool and warm-season grasses and legumes for an average of 8-9 months each year. However, the productivity, quality and sustainability of our pastures are highly dependent upon following grazing management practices that increase grazing efficiency and allow for a plant recovery period.

Many small ruminant pastures are either too large or overstocked to ensure uniform sustainable grazing. Grazing research conducted by numerous universities in the southeast US, have indicated that in the case of large pastures, only about one-third of the pasture forages produced are actually used by grazing animals. Ungrazed forage in these large pastures become over mature and low in quality resulting in low animal performance even if they are eventually consumed by small ruminants.

Rotational grazing is a commonly used term to describe a multi-paddock grazing management plan. The actual design of rotational grazing is specific to farm landscape, pasture acres, productivity, livestock numbers, and the availability of water resources. The most basic rotation grazing system is composed of 5 paddocks and one centrally located water source (Figure 1). The goal in this system is to establish a stocking rate that supports grazing in each paddock for 7 days. In theory, this would allow each paddock a 4 week rest period before grazing returns to the first paddock. On most farms, large pastures are simply subdivided into smaller paddocks with temporary electric fencing. Rotational grazing systems need to be designed to allow for easy movement of animals from paddock to paddock and access to water and shade. Paddock number and size is determined by the number of animals, the animals' estimated daily intake, estimated forage yield and the number of grazing days available. Unfortunately, there is not one standard rotational grazing system design that fits all operations. The best rotational grazing systems take time to perfect and even those require some adjustment from time to time due to changing weather conditions and animal numbers. In general, rotational grazing is a pasture management system that can help small ruminant producers increase forage productivity, quality, persistence and animal performance.

### PASTURE RE-GROWTH, QUALITY AND PERSISTENCE

For many of our forage species, the energy necessary for producing new leaves after grazing comes from carbohydrates stored in the plant's root system. In single or limited pasture systems, grazing animals tend to continually graze in the same areas on young tender plant re-growth. This frequent removal of leaves ultimately depletes root system carbohydrate reserves eventually resulting in plant death. In a rotational grazing system, the 4-5 week rest period built into the grazing cycle allows adequate time for plants to grow new leaves and capture sunlight so carbohydrate-cycling forage species can maintain proper energy reserves to fuel regrowth.

Within the pasture, forage quality varies greatly from the base of the plant to the uppermost leaves, especially with legumes and to a lesser extent with forage grasses. In general, forage quality is highest in the top half of the pasture canopy. This fact has practical implications for small ruminant grazing management that promotes the removal of the top half of the canopy to support maximum grains on growing weaned kids or lambs. Following kid or lamb grazing with dry does or ewes with lower nutritional requirements is known as leader/follower grazing or first-and-second grazing. This system allows for maximum forage utilization as well as high levels of animal output per acre. While a rotational grazing plan can improve the nutritional value of the forage for animal growth and development, a four to five week rest period is usually not long enough to significantly reduce the population of parasitic larva in the pasture. However, here are a few management tips that can reduce the consumption of larvae.

- Grazing after morning dew dries. Larvae move up the plant in water films.
- Cattle and small ruminants can be grazed together where each consumes the parasites of the other.

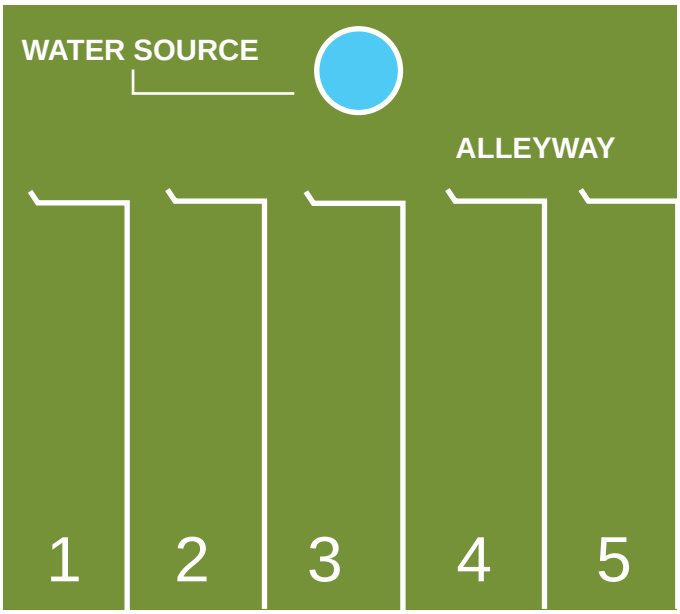


**Figure 1.** A basic 5 paddock rotational grazing design with one permanent water source.

## NUTRIENT RECYCLING

Sustainable pasture fertility represents a real opportunity for Kentucky small ruminant producers. Kentucky surveys show that soil testing is done on only about 10 percent of pastures. Of the pastures that are tested, 40% are below a pH of 6.0, 45% are low in phosphorus (P) and 35% are low in potassium (K). Grazing animals excrete in their feces and urine, between 70 and 90 percent of the nitrogen, P and K they consume from forage. Therefore manure can be a valuable source of plant nutrients in a pasture, provided they are distributed uniformly.

Rotational grazing can provide better manure (fertility) distribution than typical continuous grazing in which most of the manure and urine is deposited close to shade and water. Research has shown that soil-test P and K values are often three to five times higher within 50 ft of shade than are average levels in the general pasture. Therefore, smaller paddocks and shorter distances to water in a rotational grazing system should improve manure distribution. Unfortunately, alleyway paths to water and other areas where animals congregate, such as feed troughs, shade and shelters are perfect environments for high populations of parasitic larva to thrive.

## GRAZING SYSTEM PHYSICAL COMPONENTS

A good rotational grazing plan will include four main physical components: forage supply, fencing system, water supply and shade.

**Forage Supply.** Forages can be divided into two main categories : *cool-season* and *warm-season* species which differ in their seasonal ability to produce grazable yield. *Cool-season species* (tall fescue, orchardgrass, white clover and red clover) perform best in spring and fall. *Warm-season species* (bermudagrass, indiangrass switchgrass, sericia lespedeza) perform better in mid-summer. Forage species should also be matched to soils that maximize their growth. So fencing paddocks to minimize soil (landscape) and forage species variation will encourage more uniform forage growth and grazing. In short, producers should fence slopes separately from bottoms and ridge tops.

**Fencing System.** Rotational grazing usually relies on an electrified fencing system to subdivide larger pastures into smaller grazing paddocks. In Kentucky, the most functional and economic small ruminant fencing system for rotational grazing often includes a combination of permanent (woven wire) perimeter fencing and a variety of temporary interior electric fencing options (i.e. high-tensile wire, poly-tape, and electric netting). Often times, fencing materials are chosen based on the amount of predator protection needed and the proximity of the pasture to property boundaries and roads. In general, kids and lambs exposed to electric fencing at an early age learn to respect it and rarely challenge it as they mature. Temporary poly-net fencing materials that include a built-in post are extremely user-friendly especially when fencing on steep terrain.

**Water Supply.** Providing access to a reliable, clean source of water for each grazing paddock can be the most challenging part of designing a rotational grazing system. This is especially true on steep terrain where public water supplies are usually not available. Although there is a monthly cost involved, public water supplies are often the best solution to livestock water needs when development, maintenance and reliability are considered. Where available, consider developing natural springs and ponds for livestock water. Gravity flowing water from ponds to livestock tanks is strongly preferred to watering directly out of the pond. Location of water in the grazing system will greatly influence grazing distribution. During hot weather, livestock tend to concentrate their grazing near the water source resulting in less use of the pasture and increased exposure to parasitic larvae.

***Photo:*** *A six-strand high tensil electric fence.*

**Shade.** Livestock access to natural or artificial shade in each grazing paddock should also be considered in the grazing system design. Shade is necessary to minimize heat stress and maximize performance. Portable shade structures that can easily be moved to new locations within a grazing paddock improves the distribution of manure which decreases the population of parasitic larvae. Moving shade structures within a paddock following grazing exposes accumulated manure to ultraviolet light that kills these larvae.

## GRAZING SYSTEM DESIGN

The most frequently asked question by producers who want to start a rotational grazing program is “How many paddocks do I need?” In general, one should consider starting with five to 10 paddocks which will allow a paddock to be grazed 3 to 7 days and rested for 25 to 30 days. For more information on how to calculate 1) number of paddocks, 2) acres per paddock, 3) total acres required per grazing cycle, 4) stocking rate and 5) stocking density, refer to UK Extension publications ID-143 and ID-74. Although rarely considered, the shape of an individual paddock is important. Within practical limits, square paddocks are the most efficient. Studies have shown that square paddocks are more economical to construct than rectangular or triangle shaped paddocks. Obviously, having exactly square paddocks is rarely an option, but avoid long, narrow paddocks and always fence across slopes rather than up and down slopes when possible.

Goats are known as top-down grazers, meaning they prefer to graze vegetation above their shoulders and work their way down the plant.

Other livestock species including cattle, sheep and horses prefer to graze much shorter vegetation than goats. In theory, goats and sheep managed in a rotational grazing system should realize greater average daily gains or at least maintain their weight compared to those grazed in a continuous grazing system. Rotational grazing should also allow small ruminants to graze higher in the forage canopy, reducing their exposure to larvae of gastrointestinal parasites. Unfortunately, few research studies have been conducted in Kentucky to measure the benefits of managing small ruminants in a rotational grazing system.

In 2006 and 2007, a study was conducted in Greenup County, Kentucky to compare rotational grazing vs. continuous grazing in a meat goat production system. Based on the results of this study, rotational grazing did not result in improved animal weight gain or a significant reduction in exposure to internal parasites (based on FAMACHA scores) compared to the continuous grazing treatment. However, forage availability was significantly greater in all rotational grazed paddocks during extremely dry summers in both study years.

In summary, good pasture management requires the right balance between standing forage available, forage utilization and animal performance. Good pasture managers should start by establishing forage species that match the physical and chemical characteristic of their soils and meet the nutritional requirements of their livestock. Next, good pasture managers should stock pastures heavily enough to graze available forage to a target height (3-4 inches for cool-season grasses and 8-10 inches for warm-season grasses) that will allow rapid and maximum re-growth without compromising nutritional needs. Finally, a good pasture manager will frequently observe pastures for overgrazing and undergrazing and periodically adjust the stocking rate or movement of livestock as needed.

*Dr. David C. Ditsch, UK Extension Professor in Agronomy. Dr. David C. Ditsch is an extension agronomy professor in the Plant and Soil Sciences Department at the University of Kentucky. He is also the Director of the UK Robinson Center for Appalachian Resource Sustainability located in Breathitt County, Kentucky.*

***Photo:*** *Boer goats being grazed in a rotational grazing system.*

***Photo:*** *A rotational grazing system using poly-net to subdivide a larger pasture into smaller paddocks.*

# Nutrition & Forages:

## *Rotational Grazing - Why, Where, and How?*

*By Mr. Sid Brantly*

***Photo:*** *With rotational grazing, a more nutritious "cocktail" of forage choices can be offered to livestock, such as the Forage chicory, Perennial ryegrass, Orchardgrass, Tall fescue, Clover and Dandelion on this dairy farm in Ohio.*

### WHY IMPLEMENT ROTATIONAL GRAZING?

**More forage!** A multi-agency effort by the Natural Resources Conservation Service, the National Institute of Food and Agriculture, the Agricultural Research Service and the National Resources Inventory reviewed 27 research papers that included both rotational and continuous grazing systems. Eighty-five percent of the research papers reported greater forage quantity resulting from the rotational grazing. The average forage production advantage was thirty percent! This increase in forage produced is then coupled with an increase in grazing efficiency. Rotational grazing in small research paddocks generally increases utilization rates by five to fifteen percent over continuous grazing. However, the actual improvement in utilization may be much more in larger-sized, production operations.

**More pasture plant diversity!** A better diet offered by a mixture of grasses, forbs, and woody species can improve sheep, goat, and cattle performance. Providing appropriate "graze" and "rest" periods through rotational grazing, and stocking at or below the farm's carrying capacity (not overgrazing) allows many of the preferred forages to recover between grazing cycles. When leguminous forbs and/or woody species are not grazed out from continuous overgrazing, the plant community benefits from nitrogen that is "fixed" by the plants; and the animals benefit from the increased protein and digestibility of the legumes.

**Superior persistence of desirable forage plants!** Rotational grazing allows the desirable plants to grow more "above ground" vegetation. The chlorophyll in the additional leaf tissue produces additional roots for a healthier plant. The more robust root system can, in turn, provide the water and nutrients from deeper in the soil profile, resulting in a more "drought-proofed" pasture. In this way, the desirable plants can persist while the invading weeds cannot easily gain a foothold.

***Photo:*** *– The Tall fescue plant on the left was not grazed or clipped. The plant in the center was clipped once per month at three inches height, simulating rotational grazing. The plant on the right was clipped once per week at one inch height, simulating continuous overgrazing.*

**Opportunities to extend the grazing season through stockpiling of forage!** Stockpiling is allowing forage to grow in order to use at a later date, or when pasture plants have stopped growing. Almost any grass or leguminous forb can be stockpiled. Tall fescue is often the "standard" for stockpiling because it grows well into the late fall and holds forage value well. It is also important to note that the anti-quality alkaloid in the most-common "fungus-infected" strains of Tall fescue declines rapidly during late fall and winter. Rotational grazing gives managers the opportunity to stockpile forage, which helps extend the grazing season and reduce feed purchases.

**Greater control of grazing and browsing heights!** Gastrointestinal parasite loading is highest near the ground. The increased growth and performance of the plants result in higher sward heights for the grass, and increased woody understory recovery for browsing. Small ruminants will then be consuming forage at a higher level, thus ingesting less numbers of parasites.

### WHERE

**Rotational grazing can be implemented wherever forages are grazed!** It can be used on farms with flocks of sheep, herds of goats, a brace of ducks, a herd of cattle, or even a flerd. A flerd is a group of mixed livestock species (grammatically FLock-hERD contraction) in which the small ungulates (sheep, goats) are bonded to the larger ones (typically cattle) in such a way that they consistently remain together. Rotational grazing with more than one species of livestock usually increases the efficiency of forage utilization and reduces the intensity of "landscape maintenance" practices such as mowing, chopping, or herbicide application. This is because cattle have a higher level of preference for grass, goats for woody plants, and sheep for forbs. Manipulating the percentages of different grazing animal species can also be used to change pasture composition to have more grass, more forbs, more woody plants, or any combination of these plant types.

### HOW

**Begin by creating multiple pastures and grouping livestock into a flock, herd, or flerd that can be rotated from one pasture to the next so that you build "forage recovery periods" into your management.** Fortunately, technological advances in livestock water system design and fence materials have helped to create a feasible working environment where rotating livestock from one paddock to another can be both convenient and affordable.

***Photo:*** *(BEFORE) Goats were used where the author wanted to change this weedy pasture (foreground) and brushy woodland (background) into a grass dominated silvopasture for use by beef cattle (AFTER).*

The table below illustrates the wide range of water intake needed by different types of livestock. Water use also varies considerably depending upon the animal's health, air temperature, water temperature, stage of lactation, and additional environmental factors. Traveling long distances to water can limit animal performance (the less they drink, the less they eat) and tends to promote overgrazing in areas closest to water and underutilization of forages located at greater distances. Portable water systems using high-density polyethylene, freeze-resistant portable pipe and quick-connectors offer a "quick" solution to the problem of "water short" pastures.

**Estimated Water Intake Table**

***(Source: D.M.Ball, C.S.Hoveland, and G.D.Lacefield)***

| Livestock Class | Daily needs in gallons per head | |
|---|---|---|
| | 50° F | 90° F |
| *Sheep and Goats* | *1.5* | *3.5* |
| *Beef Cow* | *8* | *20* |
| *400 lb. Calf* | *4* | *10* |
| *Dairy Cow* | *15* | *30* |
| *Horses and Mules* | *8* | *12* |

**Fencing is the second facilitating practice you will need to install in order to begin rotational grazing management.** Fences should be constructed with the idea of containing all of the livestock classes (ewes, lambs, does, kids, bucks, rams, and/or cattle) that will be in the grazing system.

**Properly designed and constructed boundary fences can also help deter many predators.** Keep in mind that most predators go under or through boundary fences as opposed to over them. Interior cross-fences are typically three to four strand permanent electrified steel wire, polywire/polytape, or electric netting. Protecting livestock from predators usually presents itself as a challenge in a grazing management system, and is normally addressed with guardian dogs, donkeys, or llamas. Each type of guardian has its own, unique set of issues to deal with and needs to be studied in depth before selecting a guardian for your particular conditions. Combining small ruminants and cattle into a flerd also conceives the need to consider the phrase "research before reliance." Sheep and cattle, goats and cattle, or sheep, goats and cattle haphazardly thrown together will not be bonded. Bonding is a necessary part of flerd management, and needs to be done correctly in order to have a more "predator resistant" group of animals. Animal observation and health is also necessary in order to implement successful grazing management. Certainly gastrointestinal parasite management through "FAMACHA" type diagnosis, culling highly-susceptible animals, judicial treatment, and managing grazing/browsing heights through rotational grazing and proper feeding techniques is an absolute necessity.

**When the fences and water facilities are correctly installed, predator control issues are addressed, and the animal health planning is behind you, it's time to begin rotational grazing!** Start by resting the best pastures first. The best pastures will respond the fastest to a grazing deferment, giving you the most forage return for your time, labor, and investment. When the flock, herd, or flerd has grazed the vegetation to the proper degree, move them to the next pasture. The proper degree of grazing/browsing can be best assessed by local extension agents, natural resource conservationists, or other practitioners, professionals, and researchers in your local area. But as a rule of thumb, do not graze introduced grass plants (fescue, orchardgrass, bermudagrass, bahiagrass, dallisgrass) any shorter than 2-4 inches and do not graze native grass (big bluestem, indiangrass, switchgrass, gamagrass) any shorter than 8-10 inches, nor remove more than about 50% of the leaves and twigs of desirable woody species. In fast-growing, introduced pastures, grazing periods should not exceed 3 to 7 days. The concept here, is that plants should not be grazed twice during the same grazing period. The rest periods should be 2 to 6 weeks, depending on how fast the vegetation is growing back. As you rotate the flock/herd/flerd through the pastures, if the pasture ahead of the rotation is seeding out, then shorten the grazing periods in order to keep the pastures from becoming over-mature. If the pasture ahead of the rotation has not recovered to some level above the proper degree of grazing, then lengthen the grazing periods in order to provide longer rest periods. If this issue persists, then consider reducing the numbers in your flock/herd/flerd in order to match your forage requirements with the available forage.

*Sid Brantly, Mr. Brantly is the State Grazing Land Specialist for the Natural Resources Conservation Service in Kentucky. Brantly grew up on an angora goat and beef cattle ranch in Wise County, Texas. He attended Texas A&M University and received a B.S. in Range Science.*

## To Note:

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Conservationists with the Natural Resources Conservation Service work with land users (owners, operators, producers, farmers…), assisting them to develop and implement grazing management systems that are tailored for the unique landform, soils, and circumstances enveloping their farm or ranch. Often, there are programs offered by the local, county, state, or federal government to share the financial burden of installing the "facilitating practices" such as pipelines, watering facilities, and fences. The Environmental Quality Incentives Program (EQIP) available through the USDA Natural Resources Conservation Service also provides initial "start-up" cost share for the management expenses involved in rotational grazing in some situations. Visit **www.ky.nrcs.usda.gov/programs/2012EQIP/** to learn more about this program. To contact your local Natural Resources Conservation Service Office, visit **www.nrcs.usda.gov/wps/portal/nrcs/sitenav/national/states/**.

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