AS94-015

FENCING FOR OPTIMUM GRAZING

By Larry W. Turner[1]

Controlled or rotational grazing can result in better utilization of forage resources. By better forage management through controlled grazing, producers may increase profitability of cattle/forage systems. To effectively develop a controlled grazing system, however, fencing must be used to subdivide the pasture into sub-fields or paddocks. The animals may then be rotated among the paddocks to optimize forage and beef or dairy production from the system. Planning the "best", or optimum, fencing strategy should be done with the overall goal in mind of improving profitability. Key factors that describe the optimal system will include the number of paddocks needed, type of fence construction, water supply plan, and overall layout of the system. Although the optimum will be different for each farm, there are some general principles that apply to all farms.

PADDOCK NUMBER

One of the key management questions asked by producers considering a controlled grazing system is "How many paddocks should I use?". Obviously, there are no simple answers to this question. The most profitable, or optimum, number will vary depending upon individual farm circumstances and resources. These include the forage base and land, the animal type and number, and the management time and capability of the producer. However, there are some general guidelines that should be applicable to most situations.

Forage resources/land base

The forages to be used should be selected to provide good quality and supply over the grazing season. Cattle may graze more effectively on certain forages according to season. For example, endophyte-contaminated fescue is better used in the spring and fall as opposed to during the summer-slump period. Therefore, separate paddocks will be needed for differing forage types. However, all fences used to develop a controlled grazing system need not be permanent. Portable, or temporary, fences may sub-divide fields which may later be used for cropping. Temporary fencing may provide economic advantages when small paddocks are required.

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The farm's soil types and land characteristics will influence the number and layout of paddocks. Almost all land classes are suitable for some form of grazing, while Class V and better land is suitable for intensive grazing.

The land's slope and orientation with respect to north (aspect) greatly influence plant environment and forage growth. Animals will tend to alter their grazing behavior depending upon the forage production of an area and its environment. If a paddock is non-homogeneous (that is, it contains areas of differing slope, soil and forage type), animals will tend to overgraze and undergraze in the same field. This fact makes the number of paddocks with respect to slope and aspect of the land very important.

Animal type/number

The type of animal used for grazing will influence the number of paddocks required. For example, stocker vs. cow-calf, dry versus lactating dairy cows, or multiple groups of similar animals may dictate that added paddocks be used to manage groups with differing needs.

How many paddocks?

Cattle should be concentrated into paddocks they can use in 3 to 7 days, according to most agronomists. Pastures generally need 25 to 30 days of rest. Therefore, 5 to 10 paddocks are recommended for a controlled grazing program.

In most cases, four paddocks are the minimum number that should be considered in a controlled grazing system. In some systems, three paddocks may be enough, but a system with four or more paddocks will generally be easier to manage and will provide more uniform grazing. Contrary to intuition, a two-field rotation is probably the most difficult system to manage properly. The forage growth tends to be more uneven, and one field tends to "get ahead" of the other in this kind of rotation. Further subdivisions allow management of the controlled grazing system to be more effective and consistent.

Systems with as many as 40 or more paddocks have been used in New Zealand and tested in some degree in the U.S. However, for most operations, the added benefits above approximately 8-10 paddocks are not worth the added costs of additional fencing, water, labor and management.

Comparisons of paddock numbers

Computer simulation programs can be used to test various options for fencing under identical conditions of weather, animal type, forage type and stocking rate. The results can help in choosing the optimum number of paddocks for given situations. A computer simulation program originally developed at the University of Kentucky, GRAZE 2.33, was used to

analyze various stocking rates for steers grazing low-endophyte tall fescue on a Maury silt loam pasture. The results help to compare performance for different paddock numbers under otherwise identical conditions.

To compare beef production for varying paddock numbers, a computer study was done simulating four different stragegies: continuous, 4 paddocks, 6 paddocks, or 8 paddocks. Angus steers were stocked on low-endophyte fescue pasture in each case. Previous work had been done to show that the GRAZE model was accurate as compared to research trials conducted on UK's Coldstream farm for such a situation with continuous grazing.

The GRAZE simulation used 1987 weather data, and was started on February 15. Nitrogen fertilizer was applied on February 28 and May 1, at a rate of 60 lb/acre for each application. On May 4, 500 lb. steers were placed on the pasture at a stocking rate of 6 head/acre. They remained on pasture until two early September dates (either Sep 4 or Sep 9), for a total grazing period of 124 or 129 days, respectively. However, on July 1, half of the animals were removed and sold so that the stocking rate was cut to 3 head per acre for the second half of the grazing period.

The results are summarized in Figure 1. For the case where the animals grazed until September 4, increases in number of paddocks gave increases in total beef produced per acre. Total seasonal beef production ranged from 812 to 835 lb/acre for the rotational strategies, while the continuous system produced a total of 772 lb/acre. This translates to added production of 40 lb/acre for the four-paddock stragegy to 63 lb/acre for the eight- paddock arrangement. When the pasture was grazed longer, to Sep. 9, the rotational strategies produced 795 to 810 lb/acre, while the continuous system produced 683 lb/acre. The differences were more dramatic, ranging from a positive benefit of 112 lb/acre for the four-paddock system to 127 lb/acre for the eight-paddock strategy, as compared to the continuous system. The six-paddock system did not perform as well for the Sep. 9 results, but was still well above the continuous system performance (+95 lb/acre). These results point out the extra carrying capacity obtained by using rotational grazing. As expected, the rotational strategies maintained more available forage and also improved quality of the forage that was available.

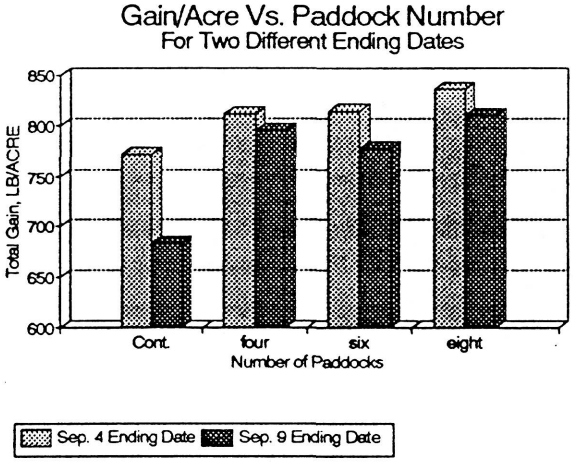

Figure 1. Gain per acre versus number of paddocks.

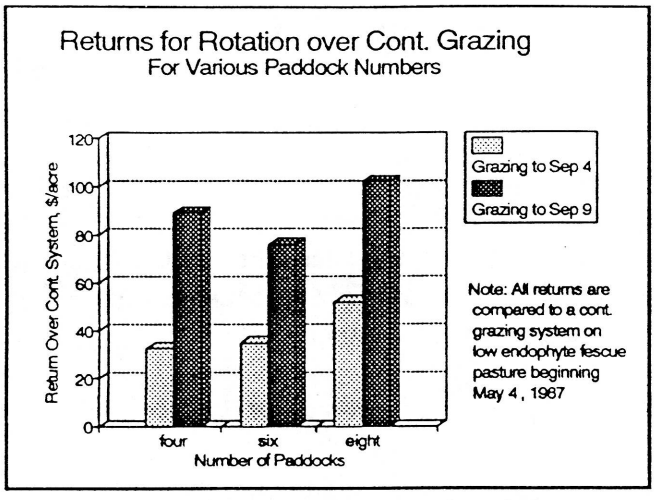

Figure 2. Returns for rotational over continuous grazing.

In terms of added returns, the rotational strategies increased returns by $33-53/acre for the Sep. 4 ending date, and $77-103/acre for the Sep. 9 grazing trial (see Figure 2), as compared to the continuous system. As shown in Figure 3, the larger increase observed on Sep. 9 was because the animals lost more weight in the continuous system during the Sep. 4-9 period compared to the rotational system. Forage availability was dropping in all cases, but the rotational systems maintained the forage longer.

The added returns are available to pay back the costs of fencing and water supply, and added management and overhead. On lower quality land, the trends would be similar, but a lower stocking rate would be needed. Less total return would be available for the rotational systems, but the benefits would still be positive.

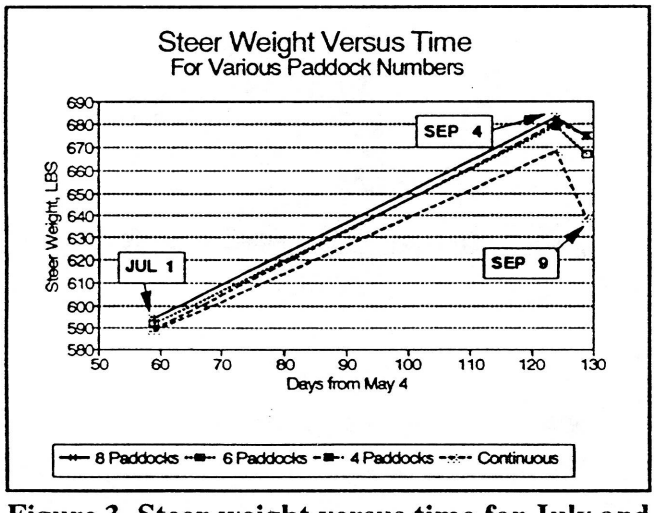

Figure 3. Steer weight versus time for July and September periods.

FENCE CONSTRUCTION

Fence type

The most economical fence type for controlled grazing fencing systems has been found to be a combination of permanent electric smooth high-tensile wire fence and temporary portable polyethylene and steel braided fence (available on reels). An advantage of the reel is that it allows rapid set-up and take-down of fence for temporary arrangements or for strip grazing. Portable fiberglass fence posts are often used with the portable braided wire, using one strand of wire for large animals and two strands for calves. The high tensile wire for the permanent fence can often be installed using a "low-tension" technique, since it is electrified.

Fence construction

The type of wire suggested for permanent boundary fence installations is New

Zealand-type high tensile wire. This is 12 1/2 ga. high tensile smooth wire which is heavily galvanized (Class III). Also, smaller diameter high tensile wires are now being used, particularly on interior division or paddock fences. These include 14 1/2 ga. and 16 ga. thicknesses. The use of such wire has implications in energizer selection (since smaller wires have a greater resistance to current flow) and in allowable length of fencing to be energized.

For interior and temporary fences, a more flexible, low-tension wire is becoming more popular. The smaller diameter, high tensile wire can be used, but many producers prefer a slightly softer grade of wire since it is somewhat easier to work with in moving and handling the fence. An excellent alternative for very temporary installations is braided wire containing very fine gage steel wires braided with polyethylene strands into a wire, ribbon or tape. These wires work quite well for installations of up to 1200 ft. Because of the lower cross sectional area of the steel, energizer requirements differ from that of smooth high tensile wire.

Wire spacing. As discussed previously, wire spacing depends upon the type of livestock being fenced. Table 1 presents suggested wire spacings for permanent or temporary electric fences.

Table 1. Suggested wire spacings for permanent and temporary electric fences.

Cattle type	Wire Spacing Above Ground (for wire numbers)				
	1	2	3	4	5
Cows	30"				
Cows & calves	17"	38"			
Hard-to-hold	17"	27"	38"		
Boundary	5"	10"	17"	27"	38"

Energizer selection

No standard exists for rating energizers in the United States. In practice, many producers are purchasing energizers which are larger than may be necessary to attempt to ensure an adequate current level on the fence and to provide for expansion. Therefore, the major factors influencing energizer selection (aside from length of fence and number of wires) should be personal preference, price, warranty and availability of service. Hopefully, in the future, new standards will make it easier to compare energizers according to performance.

WATER SUPPLY

Requirements and Sources

Water requirements vary depending upon the type and size of the animal, and on the

time of year. Table 2 summarizes the requirments for beef cattle. Table 3 indicates the space requirements for waterers. Note that tank or water space requirements are higher for animals on pasture as opposed to dry lot conditions.

Table 2. Water requirements for beef cattle, gallons/day.

Animal Type	50° F	90° F
400 pound calves	4-7	8-15
800 pound feeders	8	15-18
1000 pound feeders	9-10	18-20
Cows and bulls	9-14	18-27

Source: MWPS-6 Beef Housing and Equipment Handbook

Table 3. Waterer space requirements for beef cattle.

Animal Weight	Water cup/bowl (hd/space)		Tank (hd/ft. of perimeter)	
	on pasture	in lot	on pasture	in lot
400-800 lb	18	25	10	16
1000 lb	15	20	10	16
1300 lb	14	18	10	16

Source: MWPS-6 Beef Housing and Equipment Handbook

Sources of water for grazing include municipal systems, springs, ponds, wells or other farm sources. The use of streams as water supplies can potentially cause problems both in terms of health of the animals, and by increasing stream bank erosion and water pollution.

Fencing of streambanks is becoming a topic of greater interest not only by agricultural producers, but by the general population concerned with non-point source pollution. Several states have or are considering regulations to require stream bank fencing. In those instances, pumps and a distribution system will be required to supply water to grazing animals. Ponds should also be fenced with a water tank placed below the pond to keep animals out of the pond.

Water location

The most desirable arrangement for water supply is to provide water within each paddock, so that animals do not have to travel back and forth between the forage and water. A separate water supply may be provided to individual paddocks by using above-ground plastic pipe to deliver water to portable troughs for summer grazing. Buried water lines may also be

installed to individual paddocks, but the expense is much greater and payback will be much longer. If permanent water lines are installed, the paddock locations should be well defined prior to installation.

Costs for supplying a distributed portable water system generally range from $10-25/acre. An alternative is to use a lane for access to water. Lanes of up to 1/4 mile to a central water source may be used instead of providing remote water tanks or building additional ponds. When such lanes are used, however, animal performance will be reduced since the animals will use extra energy travelling to the water source, and may tend to congregate there rather than go back out to the paddock to eat.

OVERALL SYSTEM LAYOUT

Once the boundary fence has been established, further subdivisions may be created with a combination of permanent and temporary fencing to create four or more paddocks. The fences should follow the main contour of the land to provide fields of similar soil type and slope.

Two or three-wire electric fences are adequate for major divisions and lanes, with 5-wire electric fence used for a barn lot or "training" lot. Smaller paddock subdivisions may be developed with single wire construction, or two wires for a cow-calf situation. Creep fences or gates can be used to allow grazing of high-quality forage by calves ahead of the cows.

The fence need not be straight. Although a straight fence will be shorter, it is better to follow the contours of the land rather than maintain a straight line. All paddocks can be arranged to have access to a central lot so that stock have a source of water and can be handled easily.

Pie-shaped fencing systems are sometimes planned so that animals may have access to a central water source. However, there are problems with such arrangements, and they are **not recommended**. The area around the water source often becomes a mud hole from cattle congregating to such a small area. Research shows that 6% or more of the pasture in such an arrangement becomes a sacrifice area because of cattle trails converging to one central location. Also, creating paddocks that follow land contours is often more difficult with the pie-shape, depending upon the terrain of the particular farm. In terms of fence requirements, research indicates that a rectangular paddock system with a central lane to water required 17% less fence than the "pie" design, and the lane would contain less than 1% of the pasture.

Additional Temporary Subdivisions

Although a four-paddock fencing system gives a workable rotation system, slope, orientation and forage type differences within paddocks could still cause uneven grazing. A

combination of portable and permanent fencing could be used to give the more uniform paddocks desired. Temporary fences also allow for larger areas to be cropped, or for making hay, while still creating the smaller paddocks that give better control for grazing.

Gate Placement

Gate placement is important in a controlled grazing system because animals are moved frequently. A gate should be in a corner of the paddock. It should be located with ease of animal movement in mind so that when the lead animal moves out of the paddock down the lane, others will follow out the gate rather than along the inside of the paddock fence.

SUMMARY

Some general guidelines for planning controlled grazing fencing systems, developed from experience and demonstrations, can be summarized as follows:

1) Concentrate cattle into paddocks they can use in 3 to 7 days. Pastures generally need 25 to 30 days of rest. Therefore, at least 4 or 5 paddocks are recommended to begin a controlled grazing program. Three paddocks are the minimum which should be considered.
2) Use only a portion of a farm the first year to gain experience managing the system before expanding to a larger part of the farm.
3) The initial four or more paddocks may be laid out with permanent, low-tension fences and then subdivided using temporary fences.
4) Provide paddocks to enclose areas as similar possible in terms of soil, forage and slope/aspect characteristics.
5) Distributed water supplies using temporary surface pipe or permanent systems will promote increased forage intake and reduce the problems with cattle standing idle in a central water area. Initially, lanes of up to 1/4 mile miles to a central water source are less costly than providing water to each paddock, but performance may be reduced.
6) Avoid the pie-shaped design unless it is particularly suited to a farm's resources.

Fencing systems for controlled grazing must be tailored to each individual farm. There are common principles, though, which should be used for every farm. Producer experiences in Kentucky indicate that a wide diversity of types of installations can be successfully implemented, from a single wire, low investment system to a multi-wire permanent installation.

For more information on fencing system planning, consult the following references, available through your County Extension Office:

"Planning fencing systems for intensive grazing management". ID-74, University of Kentucky Cooperative Extension Service.

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"Constructing high-tensile wire fencing" (12:50 minute videotape). Tape No. V11-AE-0432. Agricultural Communications Services, University of Kentucky Cooperative Extension Service.

EXPLORING NEW SPECIES FOR GRAZING

Dr. Monroe Rasnake
Extension Agronomist
University of Kentucky

Let me begin by telling about two introduced grass species. Both are warm season grasses — one is an annual, the other perennial. The annual is a good seed producer, quick and easy to establish, produces high quality forage and can withstand hot and dry weather. It tolerates grazing well.

The perennial also is a good seed producer, quick and easy to establish, produces high quality forage and can withstand hot and dry weather. It produces high yields and with good management will maintain a stand for many years.

Does this sound too good to be true? You've probably guessed the rest of the story by now. The grasses I have described are crabgrass and johnsongrass. This illustrates one of the risks involved in exploring new species.

We have been looking at different forage species primarily at our Research and Education Center in Princeton. Most of these are not new to the U.S. or even Kentucky, but have not been used to any extent by farmers. Most are being studied in small experimental plots or observation plots. Some have been planted on a few farms for grazing demonstrations. Following are brief descriptions of the ones we have been working with.

Old World Bluestems

These are warm season perennial grasses that originated in Asia and have been used some in the plains states for about forty years. We have had plains and caucasian bluestem in small plots at Princeton since 1987. They have small, fluffy seeds that are difficult to handle and slow to establish. Weed control during establishment is a major problem. They are low growing and tolerate grazing well. They also tolerate a low pH and low fertility, but respond to moderate fertility and up to 150 pounds of nitrogen per acre. They are capable of producing high yields, averaging over five tons hay equivalent in our tests. Laboratory analysis of forage indicates low quality, but grazing tests in other states have shown good liveweight gains.

Native Warm Season Perennial Grasses

Many native grass species almost became extinct in Kentucky due to tillage, overgrazing and competition from introduced species. There has been a great deal of

DESIGNING WATER AND SHADE ACCESS THAT MAKES SENSE (AND $)

Larry W. Turner [1]

Controlled or rotational grazing can result in better utilization of forage resources. By better forage management through controlled grazing, producers may increase profitability of cattle/forage systems. To effectively develop a controlled grazing system, however, fencing must be used to subdivide the pasture into sub-fields or paddocks. The animals may then be rotated among the paddocks to optimize forage and beef or dairy production from the system. Water and shade are recognized as being important factors in efficiency of production on rotational grazing systems. Water and shade are not often present in the right locations to meet animal needs. Therefore, to improve animal performance, and profit, from grazing systems, portable water and shade systems may be needed.

WATER SUPPLY

Requirements and Sources

Water requirements vary depending upon the type and size of the animal, and on the time of year. Table 1 summarizes the requirements for beef cattle. Table 2 indicates the space requirements for waterers. Note that tank or water space requirements are higher for animals on pasture as opposed to dry lot conditions.

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Source: MWPS-6 Beef Housing and Equipment Handbook

[1] Extension Agricultural Engineer, Agricultural Engineering Department, University of Kentucky, Lexington, KY 40546-0276

Table 2. Waterer space requirements for beef cattle.

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Sources of water for grazing include municipal systems, springs, ponds, wells or other farm sources. The use of streams as water supplies can potentially cause problems both in terms of health of the animals, and by increasing stream bank erosion and water pollution.

Fencing of streambanks is becoming a topic of greater interest not only by agricultural producers, but by the general population concerned with non-point source pollution. Several states have or are considering regulations to require stream bank fencing. In those instances, pumps and a distribution system will be required to supply water to grazing animals. Ponds should also be fenced with a water tank placed below the pond to keep animals out of the pond.

Water system location/layout

The most desirable arrangement for water supply is to provide water within each paddock, so that animals do not have to travel back and forth between the forage and water. A separate water supply may be provided to individual paddocks by using above-ground plastic pipe to deliver water to portable troughs for summer grazing. Buried water lines may also be installed to individual paddocks, but the expense is much greater and payback will be much longer. If permanent water lines are installed, the paddock locations should be well defined prior to installation.

Costs for supplying a distributed portable water system generally range from $10-25/acre. An alternative is to use a lane for access to water. Lanes of up to 1/4 mile to a central water source may be used instead of providing remote water tanks or building additional ponds. When such lanes are used, however, animal performance will be reduced since the animals will use extra energy travelling to the water source, and may tend to congregate there rather than go back out to the paddock to eat.

Stream bank access may be a problem in supplying water to animals, and in some places in the U.S. is being restricted for animal access. Alternatives include low-volume pumps such as the hydraulic ram (using stream energy) and the pasture pump (using cow action). However, these are not practical in many situations.

Pie-shaped fencing systems are sometimes planned so that animals may have access to a central water source. However, there are problems with such arrangements, and they are **not recommended**. The area around the water source often becomes a mud hole from cattle congregating to such a small area. Research shows that 6% or more of the pasture in such an arrangement becomes a sacrifice area because of cattle trails converging to one central location.

Also, creating paddocks that follow land contours is often more difficult with the pie-shape, depending upon the terrain of the particular farm. In terms of fence requirements, research indicates that a rectangular paddock system with a central lane to water required 17% less fence than the "pie" design, and the lane would contain less than 1% of the pasture.

SHADE

Dairies in Kentucky lose more in milk production from heat stress as opposed to cold stress. Even beef herds can benefit from shade structures to reduce heat stress, thus improving feed efficiency and reproduction. Particularly on fescue-based pastures with high-endophyte fescue, shade is a must! In other situations, the need for shade must be balanced against the tendency for animals to congregate under the shade and thereby reduce feed intake.

Research data are limited as to the benefit of shade. In one study in Arizona, shade improved milk production by 7.5% when placed over the feed bunk as compared to control cows with no shade. Here in Kentucky, we should see even more benefit, since we have much higher humidities, and possibly less night cooling. For pasture situations, producers should definitely provide shade for dairy cows, and probably also breeding beef stock. For stocker animals, the value is questionable, except in the case of grazing on high-endophyte fescue.

Types of Shade for Pasture Situations

Shade is not often conveniently placed for rotational grazing systems. Often some paddocks have shade while others do not. The following alternatives can be used for shade in a rotational grazing system.

Natural Shade is the lowest cost alternative, but is not often in the proper location and care must be taken to avoid killing trees with too high a cow density.

Portable, low-cost shades can be built from 2.5" pipe, welded into a frame sturdy enough to take the abuse from cattle. For rotational grazing, the frames can be made portable and moved with the animals, or moved to different locations to avoid high manure build-up in a particular location. For covering, shade cloth will allow air movement while providing shade. Use 80% shadecloth for such structures. Figures 1 and 2 illustrate the attachment methods for securing the shadecloth to portable frames. Frames should have a skid-type bottom member to allow moving from paddock to paddock if necessary. Dimensions of 8'x16' are practical maximums for portable shade size.

Shade Requirements for Portable Shades

It is difficult to provide portable shades to meet the total desired shade amount. A practical compromise is to provide shade at 50-60% of the requirements of Table 3. Under such a provision, a 30-cow herd of beef cows would require 2-3 portable shades to approach an adequate shade requirement for those animals, using 8'x16' portable shades.

Table 3. Shade requirements for beef and dairy cattle.

Animal Type	Space Requirement (ft^2/hd)
400 pound calves	15
800 pound feeders	20
Beef cows	20
Dairy cows	25

Source: MWPS-6 Beef Housing and Equipment Handbook

SUMMARY

Some general guidelines for planning water and shade systems, developed from experience and demonstrations, can be summarized as follows:

1) Distributed water supplies using temporary surface pipe or permanent systems will promote increased forage intake and reduce the problems with cattle standing idle in a central water area. Initially, lanes of up to 1/4 mile miles to a central water source are less costly than providing water to each paddock, but performance may be reduced.
2) Avoid the pie-shaped design unless it is particularly suited to a farm's resources.
3) Shade should be provided for 50-60% of the herd in controlled grazing systems, particularly for dairy or beef cows, or animals grazing high-endophyte fescue. This can be accomplished with portable shade structures, which may be moved to alternate locations in the grazing system.

Fencing systems for controlled grazing must be tailored to each individual farm. There are common principles, though, which should be used for every farm. Producer experiences in Kentucky indicate that a wide diversity of types of installations can be successfully implemented. In many cases, portable shade and water systems can boost profits from such systems.

For more information on fencing system planning, consult the following references, available through your County Extension Office:

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"Creep grazing for beef calves". ID-76, University of Kentucky Cooperative Extension Service.

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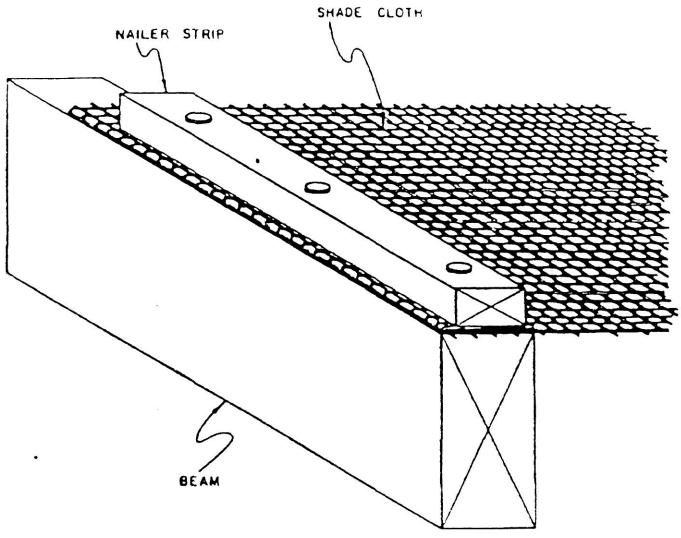

FIGURE 1. WOOD FRAME CONSTRUCTION, SHADE CLOTH CONNECTION

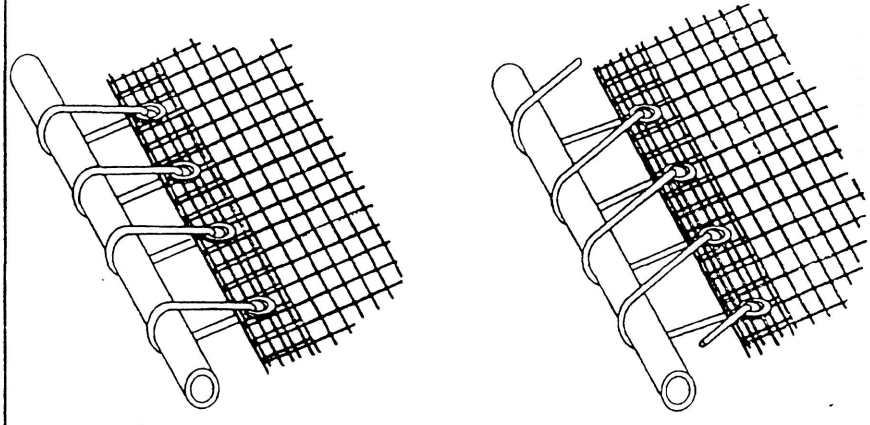

FIGURE 2. CABLE, PIPE, OR REBAR CONSTRUCTION SHADE CLOTH CONNECTION

HOW SHOULD I SPEND MY FESCUE SUPPLEMENTATION DOLLAR?

John Johns and Roy Burris [1]
Extension Beef Specialists
University of Kentucky

Fescue is the predominant pasture grass for 35 to 40 million acres across the U.S. Most of these pasture acres are used by beef producers for the production of feeder calves or grazing stocker cattle. Very few feeds can be considered as complete, that is that they supply all of the animal's nutrient needs for a desired level of production, and fescue is no exception. Generally speaking, producers will need to use a supplement whether they are using fescue as hay or grazing. The real issue that producers must address is how to keep supplementation costs at a minimum and still meet animal needs and what is the right supplement to use. This article will attempt to address these issues.

Before producers purchase any supplement, they must have certain information. First and foremost, they must know the nutrient content of the fescue they are using. If you don't know the nutrients that are limiting in the feed, you cannot possibly determine what supplement to use. A nutrient analysis is inexpensive and can be done through the Kentucky Department of Agriculture, several different feed companies or the University of Kentucky Cooperative Extension.

After the nutrient content of the fescue is determined, the second piece of information is the desired goals for the cattle. For cows, this may be as simple as maintaining or increasing body condition scores while for growing cattle, it may be a desired rate of gain. Whatever the goals, they must be considered in order to determine the third piece of information, the nutrient needs of the cattle in question. Now that the nutrient content of the fescue and the nutrient needs of the cattle are known, a logical and cost effective decision can be made about a supplement.

The nutrient content of fescue pasture or hay is dependent on its stage of maturity when utilized and the fertility as shown in Table 1. This data is a 3 year average of analysis of KY-31 fescue. Nitrogen was applied each year at the rate of 150 lbs of ammonium nitrate applied twice per year. Energy (TDN) and protein content decrease as maturity increases. Of course, producers should determine nutrient content from their own samples and not use these as an average.

Energy and protein needs of the cow and backgrounding calf are shown in Tables 2 and 3 respectively. These needs are expressed as a % of the ration dry matter. Several points are obvious. First as the cow increases productivity, her energy and protein needs increase. Early cut, nitrogen fertilized fescue exceeds the cow's protein needs at any stage of productivity. Later cut fescue even with nitrogen fertilization may not be adequate to meet protein needs of more productive or younger cows. Later cut, nonfertilized fescue certainly will be inadequate in protein content to meet the needs of more productive cattle.

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[1] Extension Specialists in Beef Cattle, University of Kentucky, Lexington and Princeton, Kentucky, respectively.