COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

PLANNING FENCING SYSTEMS FOR INTENSIVE GRAZING MANAGEMENT

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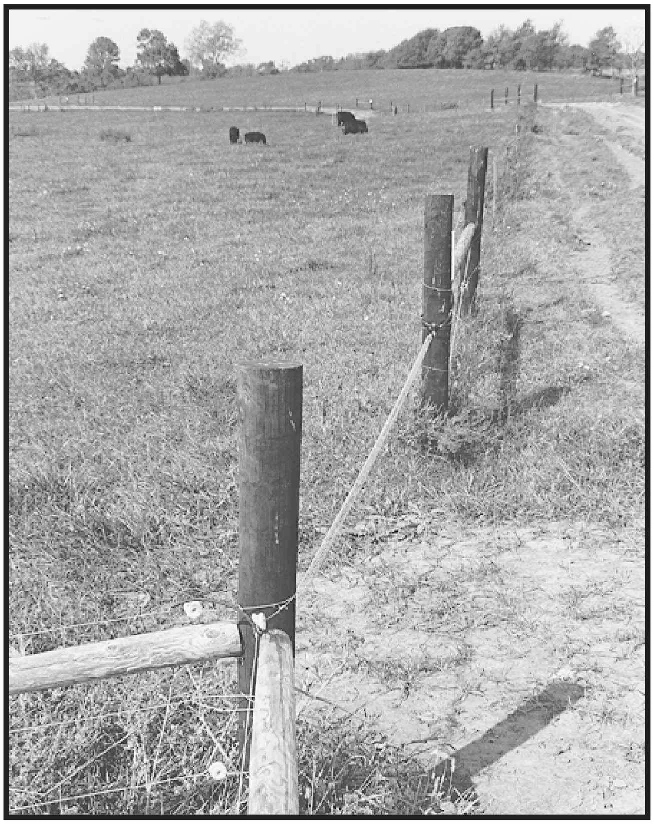

Intensive grazing may result in better utilization of Kentucky's forage resources. By better forage management through controlled grazing, producers may increase returns to the farm. To effectively develop a controlled grazing system, however, the producer must use fencing, which subdivides the pasture into sub-fields or paddocks. The animals may then be rotated among the paddocks to optimize forage and beef production from the system.

When you develop the layout for a fencing system, consider the following points:

- *Fixed resources on the farm, such as acreage, soil type, slope, rockiness;*
- *Semi-fixed resources, such as water supply, existing fences, existing grass base;*
- *Changeable resources, including forage type, temporary fences, cattle numbers;*
- *Other factors, including seasonal usage patterns, economics and land use for other enterprises.*

New advances in fencing technology provide the needed "tools" for an intensive grazing system. High tensile fence, brought to this country from New Zealand, offers an alternative to traditional woven and barbed wire for fence construction. Also, temporary electric fencing has recently been improved. Once you have evaluated resources and tools available, you can develop your fencing plan.

Evaluating Resources

Planned and managed pasture is often the most economical animal feed. Proper grazing management is a key to keeping pasture economical.

Because grasses and legumes recover quickly after grazing, they are good pasture plants. However, this quick recovery deceives the producer into thinking he can let his animals repeatedly graze closely without injuring the pasture.

What happens to pasture plants that are continuously grazed too close during the growing season? (See Figure 1.) Overgrazing reduces the leaves, where sunlight converts carbon, hydrogen, oxygen and minerals to plant tissue usable as animal food. This forces the plant to draw on food stored in the leaf sheathes, roots and crowns to produce new growth. The plant may draw on the storehouse until the supply is exhausted, then its production lessens until it dies of starvation.

The other extreme, undergrazing, wastes forage and may allow pasture plants to become mature and quality to deteriorate. Poor quality causes animals to have poor average daily gain and reduced beef production.

A system of controlled grazing will give pasture plants time to resupply their storehouses and rebuild their "factories." In short-duration grazing the pasture is fenced into many sub-pastures, each grazed for a short period and then given adequate rest periods for regrowth.

The goal of this fencing system plan is to best use available resources while providing the desired rest period for each of the paddocks. Additionally, the fence should

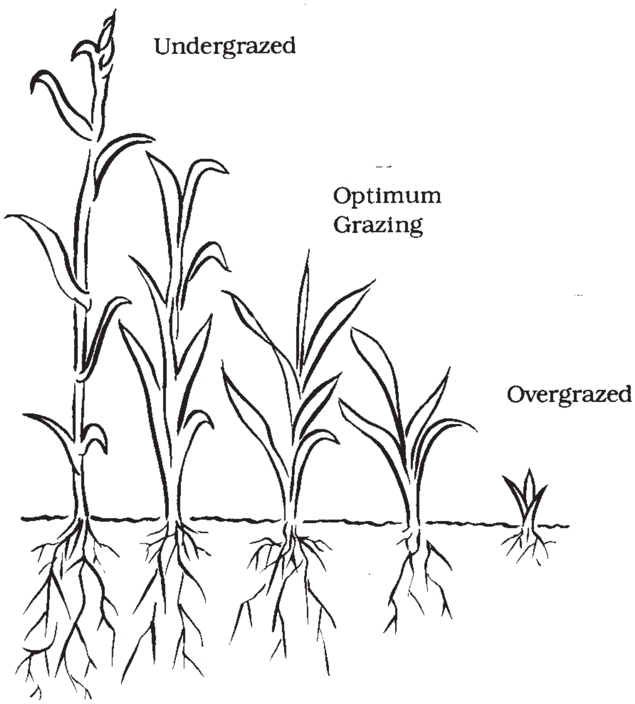

Figure 1. Grazing stages of the plant.

create paddocks as homogenous as possible--that is, paddocks with similar forage and slope/aspect characteristics within the fence boundaries. Such paddocks are more likely to be grazed uniformly in a controlled grazing system.

Fixed Resources

Soil Type and Land Class

The farm's soil types and land classes are considered fixed resources. The land capability map of your farm, available from the Soil Conservation Service, should have this information. The soil type and land class assist you in determining the best use for each particular soft resource.

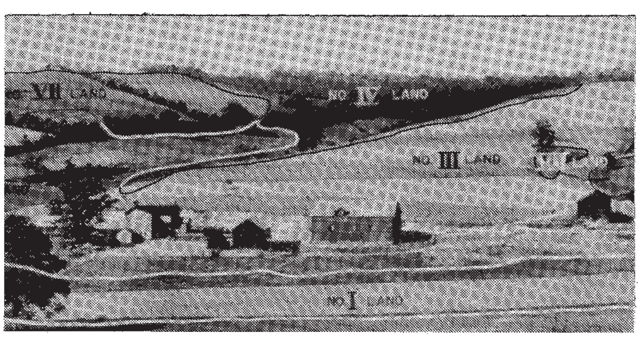

Figure 2.-Land capability classes. A range is shown from the nearly level land in the foreground (Class I), which can be cropped intensively, to the badly eroded hillsides (Classes VII and VIII)

Figure 2 illustrates the appearance of the various land classes. Classes are determined by slope, erodibility, drainage and soft depth. Figure 3 shows the suitability of the different classes of land for grazing and cultivation. Almost all land classes are suitable for some form of grazing, while Class V and below land is suitable for intensive grazing. Class VI land may also be intensively grazed if managed in a proper rotation and if erosion is held in check.

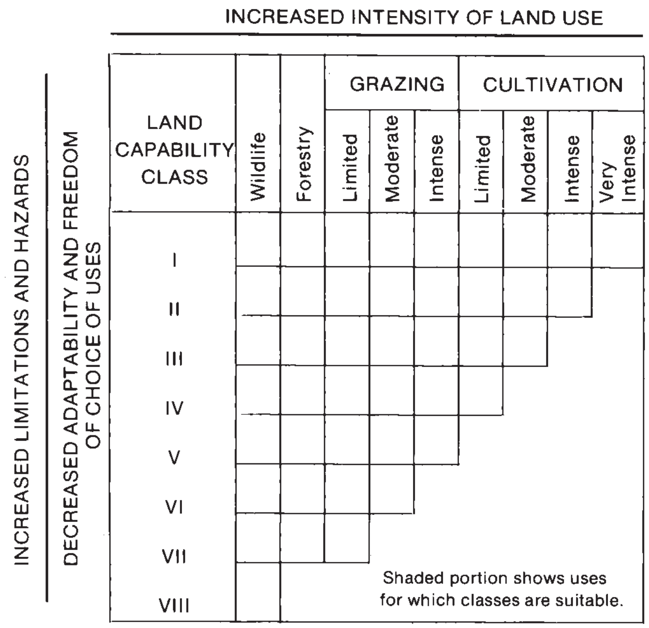

Figure 3. Intensity with which each land capability class can be used with safety. Note the increasing limitations on the uses to which the land can safely be put as one moves from Class 1 to Class VIII. (Modified from R. D. Hockensmith and J. G. Steele[1.)]

Slope/Aspect

The land's slope and orientation with respect to north (aspect) greatly influence plant environment and forage growth (see Figure 4). Early in the year a Southeast facing slope tends to warm up sooner and therefore have more growth of a particular forage, all other conditions being equal, than other slopes. Even though it is shaded late in the day, the Southeast facing slope has the advantage of continued warm temperature until evening. In summer, the sun is higher in the sky and present for a longer period. The Southwest facing slope begins to dry out because of exposure to wind and weather and may have a greater decline in production than other slopes. The North facing slope involves still another situation with respect to environment for the plant and the animal.

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), they will tend to overgraze and undergraze in the same field. This fact makes fence placement with respect to slope and aspect of the land very important.

Erosion

Some land classes on the farm will be more susceptible to erosion than others. The land should be evaluated accord-

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[1] *Hockensmith, R. D. and J. G. Steele "Recent trends in the use of land capability classification." Soil Sci. Soc. Amer. Proc. 14:383-88, 1949.*

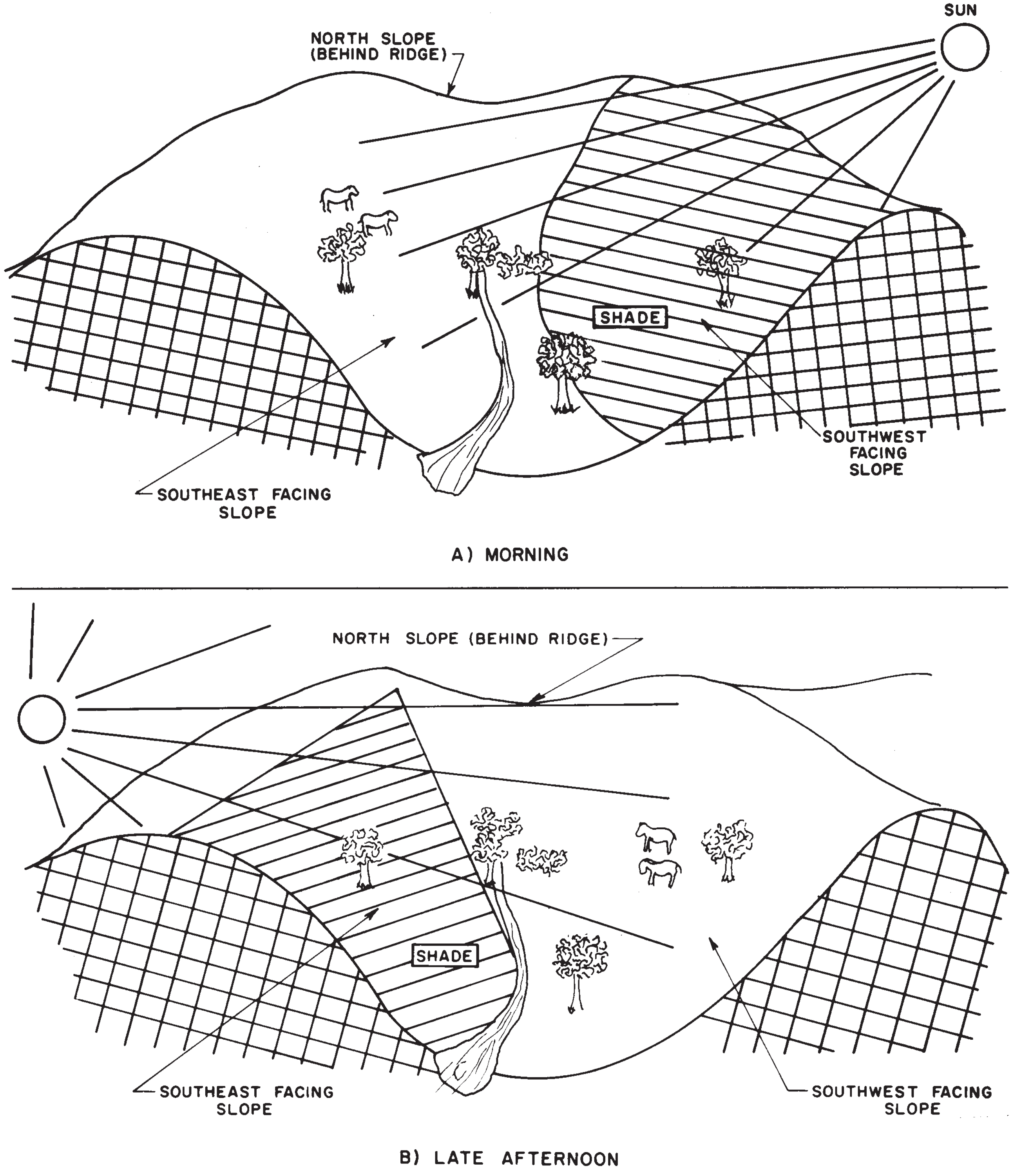


Figure 4.—Slope and orientation affect grazing behavior.

Figure 4A shows southeast-facing slope receiving morning sun. This slope will warm sooner in spring and have earlier growth.

Figure 4B shows southwest-facing slope receiving the afternoon sun. Because of the combination of sun and temperature, this slope dries out faster as the grazing season progresses.

ing to class to determine if intensive grazing is appropriate. Certain areas on the farm may be best fenced off completely from stock to try to limit erosion and possibly reclaim marginally eroded areas.

Rockiness and Obstructions

A farm may have areas of rock outcroppings and other situations which form barriers to machine use. These features may limit use of renovation with dover and other operations requiring machines, and may thus dictate which forage type is used or how the affected area is used for pasture.

Semi-Fixed Resources

Some of the resources on the farm are semipermanent but can be altered or added to. These are termed semi-fixed resources.

Water

Water supply is critical for a cattle production system. Cattle must have an adequate water supply, particularly during the hot summer months.

Suitable water sources can be wells, municipal water supply, ponds, streams or springs. Letting cattle drink directly from ponds and springs is a questionable practice because disease control may be difficult. Instead, a watering tank fed by the fenced pond or spring should be installed.

Beef cattle need to drink 8 to 20 gal/day/1000 lb animal unit. Table 1 summarizes the requirements for water for various size animals according to outdoor temperature.

Because providing a separate water supply to each paddock is difficult, using a lane to water is a viable option. 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.

After you have taken inventory of your farm's fixed and changeable resources, you are ready to develop the fencing plan. Time spent now in planning the layout will save time and money in the long run. Planning on paper is much cheaper than planning during construction or afterwards.

Table l. Beef Cattle Water Requirements[1]

Daily needs, gal/head	50°F	90°F
400 lb Calves	4.2	9.5
800 lb Feeders	6.7	5.0
1,000 lb Feeders	7.7	6.5
Cows & Bulls	8.0	20.0

Waterer space minimums:

Tank on pasture .... 1 ft2 surface/10 head
Tank in lot .... 1 ft1 surface/25 head
Water fountain or
trough in lot .... 1-18 in., space/40 head

1 Wendling, L. T., Farmstead Engineering Conference, December, 1980.

Grass Base

The existing grass base on the farm is a semi-fixed resource. It is usually not economically possible to re-seed a tom/farm in any one year. However, a long-range forage plan (5 to 10 yr) should be developed considering the land resources on the farm and the enterprise(s) to be supported. The fencing layout needs to be developed with this plan in mind. Permanent fences will last 20 to 30 years, so a 5 to 10 year forage use plan is not projecting too far when laying out fencing.

Existing Permanent Fences

Existing permanent fences may fit very well into the controlled grazing plan. However, the presence of an existing fence should not limit thinking in the planning stages. The best use of land resources should be considered first.

Another consideration is the state of repair of the current fence. Old fences can be enhanced with a single wire electric fence on a strut that protrudes into the pasture. If it needs replacing, consideration should be given to a new location and technology currently available.

Changeable Resources

Certain farm resources may be altered in the short term (annually or less). These include forage type, temporary fencing and cattle numbers.

Forage Type

The forages to be used should be selected to provide a good supply over the grazing season. Your County Extension Agent can assist you in determining what types of forages to include in the grazing program.

Temporary Fences

All fences used to develop a controlled grazing system need not be permanent. Temporary fences may sub-divide fields which may later be used for cropping. Temporary fencing provides economic advantages when you need small paddocks.

Cattle Numbers

The stocking rate of cattle is a key resource which may be changed by well-timed sales as the season progresses. The initial stocking rate should be 2 to 4 head per acre for most well managed, intensive grazing systems in Kentucky.

Extension demonstrations-the "Graze-More-Beef" program--have shown good results with as many as 6.1 head per acre when some of the animals were sold around July 4. Cattle numbers were adjusted to account for lower forage production in the summer months and the larger size of the remaining animals.

Producers of pasture-fed cattle have traditionally bought in the spring and sold in the fall. However, the manager of an intensive grazing system must consider improving use of forage. He can alter stocking density by mid-year or more frequent sales, or he can expand pastures to include high quality aftermath of hay or haylage harvest.

Other Considerations

When you evaluate resources for fence planning, consider seasonal use patterns, shade and economics.

Figure 5. A typical soil capability map.

Seasonal Use Patterns

Cattle may graze more effectively on certain forages according to season. For example, endophyte-contaminated rescue is better used in the spring and fail as opposed to during the summer-slump period.

Shade

It is debatable whether or not you need shade available in all paddocks. If you use a lane to water, you may provide shade at the watering site. Observation of cattle grazing indicates they may graze longer in paddocks with no shade. However, research does show that exposure to long periods of hot weather without shade adversely affects cattle production.

Does Intensive Grazing Pay?

Economic tradeoffs are involved in developing an intensive grazing system. On the one hand, the producer must bear added costs for fencing, water supply, increased overhead and management for high stocking rates. With these added costs, the producer can expect added returns from increased production. In fact, the added returns may be substantial. "Graze-More-Beef" demonstrations have shown beef production of over 800 lb/acre as opposed to the traditional continuous-grazing production of 100-150 lb/acre at low stocking rates.

Controlled and intensive grazing is not without economic hazards, however. Extreme price fluctuations could cause large negative margins. Droughts can force sales! But the greatest potential hazard is that of underutilizing resources that have already been purchased in the form of seed planted and fertilizer spread.

The "Graze-More-Beef economic worksheet in this publication may be used to evaluate the profit potential for intensive grazing of steers or heifers on your farm.

Planning the Fencing Layout

The Layout Map

Three types of maps will help when you plan the fencing system: 1) the soil capability map, 2) an aerial photograph, and 3) a topographical map.

The **soil capability** map is discussed on p.2. Using that map and your knowledge of the farm, you can establish logical production boundaries for row crop fields, hay and pasture land and rough pasture areas. Figure 5 shows a typical soft capability map.

The **aerial photograph** is probably the most valuable for fence planning. This map should be available from the Agricultural Stabilization and Conservation Service (ASCS) office or the Soft Conservation Service (SCS) in your area. The SCS office may also have a topographical map which gives you information about the elevations and contours of your farm--the lay of the land.

Step l—Establishing Boundaries

On the aerial photograph map of your farm, field boundaries maybe established. Some tools you will need besides the map are:

1) A ruler or scale
2) Transparent overlay{s) for farm map
3) Marking pens.

You can plan using the transparent overlays and then the plan may be altered or revised by simply changing the overlay.

Figure 6 shows an example 80 acre farm. Figure 7 shows some symbols useful for planning fencing. A typical scale for aerial photographs is 1 in. = 660 ft.

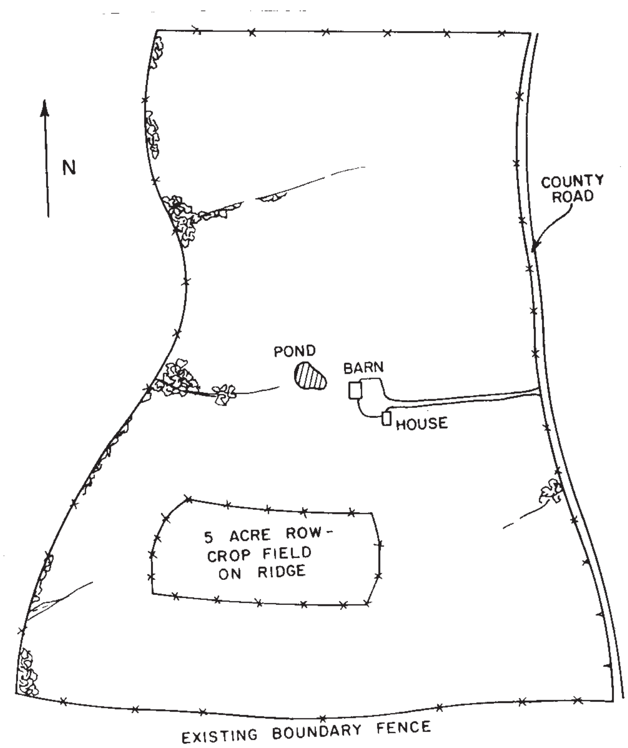


Figure 6. Example 80 acre farm.

For this particular farm, the fenced land on the ridge is Class III, day loam soil suitable for row crops. All other land in the farm varies from Class IV to Class VI clay soil, and will be used for hay and pasture.

The existing boundary fence and ridgetop field fence are both woven wire in good condition. If those fences were not in good shape, upgrading them would be the first priority in the fencing plan.

"GRAZE-MORE-BEEF" WORKSHEET

INCOME

A) Summer sale

No. Head Sold ________ x Sale Wt (lb) ________ x Sale Price ($/lb) ________ = $ ________

B) Fall sale

________ x ________ x ________ = + $ ________

TOTAL INCOME = $ ________

EXPENSES *(see bottom of chart for explanation of this section)*

A) **Purchase**

No. Head Bought ________ x Purchase Wt (lb) ________ x Purchase Price ($/lb) ________ = $ ________

*B) **Animal Costs**

Preparation, Conditioning, Health, Interest, etc.

No. Sold

1. Summer sale ________ x $ ________ /HD = $ ________
2. Fall sale ________ x $ ________ /HD = $ ________

C) **Land Charge

Price/acre ________ x No. Acres ________ = + $ ________

TOTAL COST = $ ________

PROFIT

A) **Overall**

Total Income $ ________ - Total Cost $ ________ = **TOTAL PROFIT** $ ________

B) **Profit Per Acre**

Profit $ ________ ÷ No. Acres ________ = **PROFIT/ACRE** $ ________

Explanation of Expenses Section

*B) **Animal Costs** should be calculated from your records. For planning purposes these values have been estimated to be $30/head for calves kept only until summer and $40/head for calves kept all season.

C) **Land Charge should be calculated from your records. For planning purposes $40/acre has been estimated to cover fertility and overseeding expenses

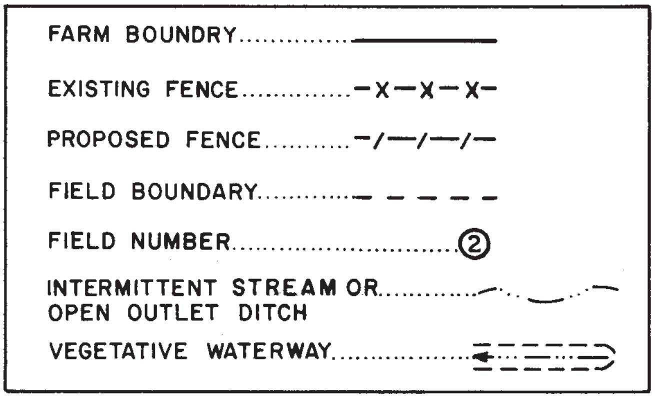


Figure 7. Planning symbols

Having a well-built permanent boundary fence is important for the following reasons:

1. To establish a fixed property line between you and your neighbor, or between you and the highway.

2. To confine your livestock to your own farm. Losses due to livestock killed on a highway and payment for damages to your neighbor's crops may be more than the cost of permanent fence.

3. At the same time, your neighbor's livestock is fenced off of your property. This can save damaging your crop or mixing scrub animals with your livestock.

This permanent fence will probably never be moved unless the adjoining property becomes part of your farm.

Step 2—Adding A Division Fence

The two-field flip/flop rotation maybe set up by adding a single permanent division fence. Figure 8 shows where the logical location for that fence would be.

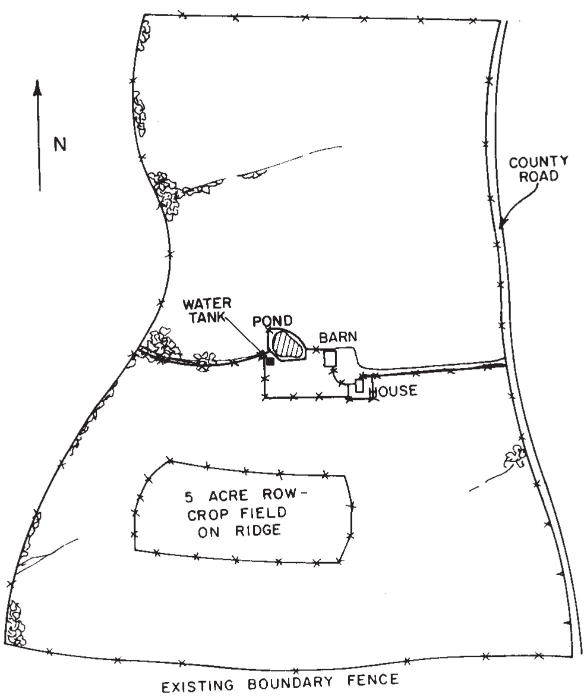


Figure 8. Adding a division fence.

Note also the fence system added around the pond and the central lot for handling, preparing animals for the grazing season and for access to a water tank from the pond.

Three-wire electric fence would be adequate for the division fence, with 5-wire electric fence used for the barn lot and around the pond. For our example farm, the cost would be approximately $192 for 800 ft of division fence and $592 for 1600 ft of lot fence plus $250 for a controller, or a total of $1,034. An annual increase in beef production of 7.8 lb/acre at 55 cents/lb would pay for the new fence in 3 years.

Notice that 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.

Contrary to intuition, the 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.

Step 3—Further Subdivision

Further subdivisions may be created with a combination of permanent and temporary fencing. Figure 9 shows the addition of a combination of permanent and temporary fence to create 4 grazing paddocks. Field #4 is somewhat rolling land and is planned for hay production. The fence follows the main contour of the land to provide a field of similar soil type and slope.

All paddocks have access to the central lot so that stock have a source of water and can be handled easily. The cost for constructing an additional 1300 ft of 3-wire permanent electric fence is $312. Portable electric fence is used for part of Field #3 at a cost of $48 for 300 ft to give a total additional cost of $360, or a total system cost of $1,394. This would require an increase in beef production of 10.6 lb/acre for a 3-year payback.

Step 4—Additional Temporary Subdivisions

Although the fencing system shown in Figure 9 gives a workable rotation system, slope and orientation differences within paddocks could still cause uneven grazing. A combination of portable and permanent fencing could be used to give the homogenous paddocks desired.

Figure 10 shows the example farm with the addition of portable electric fences to create 8 paddocks with fields of similar slope and forage type. Notice that permanent fences have been used to create lanes for access to the central water supply.

In this example, the additional paddocks can be created for relatively little additional cost. The major cost item is the permanent lane fencing, a cost of $288 for 1200 ft of additional 3-wire electric fence. Twelve hundred ft of temporary electric fence can be purchased for $192 and used at various locations, depending upon which field the cattle are in.

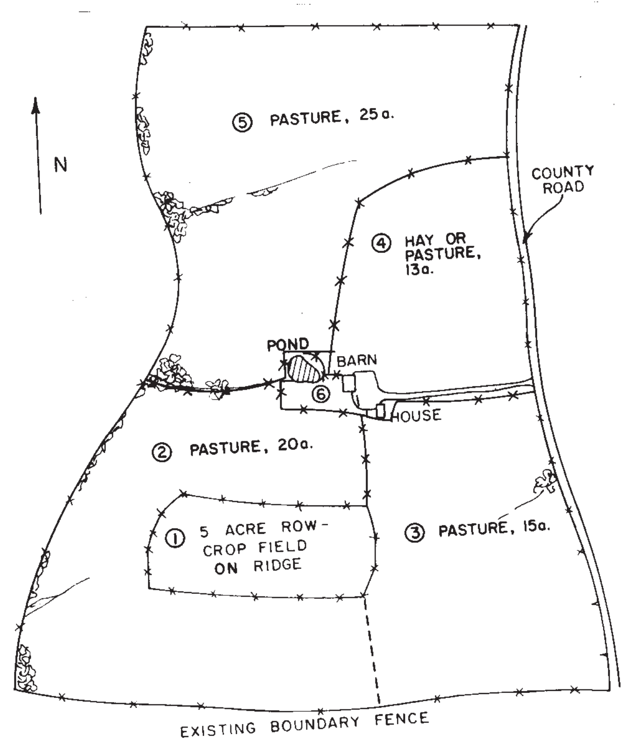


Figure 9. Subdivision to 4 paddocks using permanent (x-x-) and temporary (---) fence.

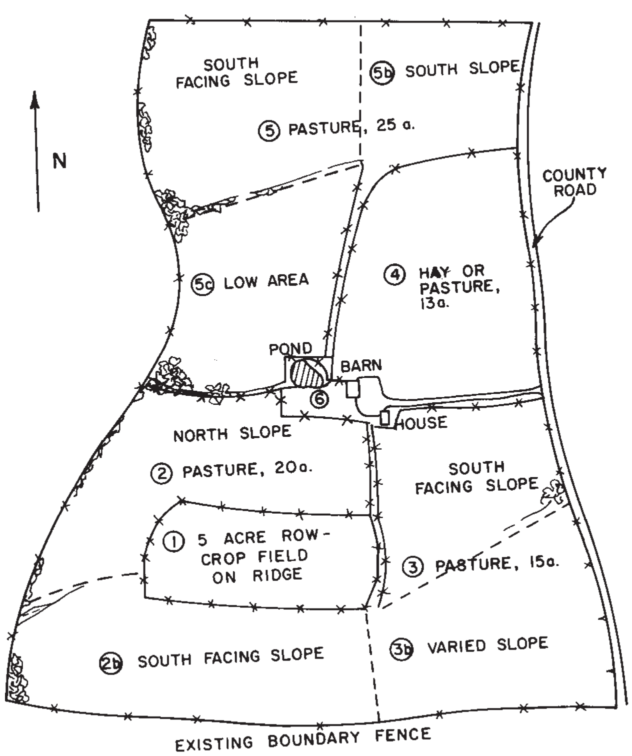


Figure 10. Subdivision to eight paddocks using portable fence.

These costs bring the total investment in the fencing system of Figure 10 to $1,874. Table 2 summarizes the costs and break-even beef production increases required for each stage of fence system development. The number of paddocks was ;increased to 16 to show the marginal cost of that increase. These figures show that for only $96, the system can be converted from an 8-field to a 16 field rotational system.

Table 2. Costs and Production Increases Required for Staged Fence System Development for Example 80 Acre Farm.

No. of Paddocks	Additional Fence System Cost $		Annual Beef Production Increase Requied (lb/A)*	
	Marginal	Total	Marginal	Total
1	0	0	0.0	0.0
2	1034	1034	7.8	7.8
4	360	1394	1.8	10.6
8	480	1874	3.6	14.2
16	96	1970	0.7	14.9

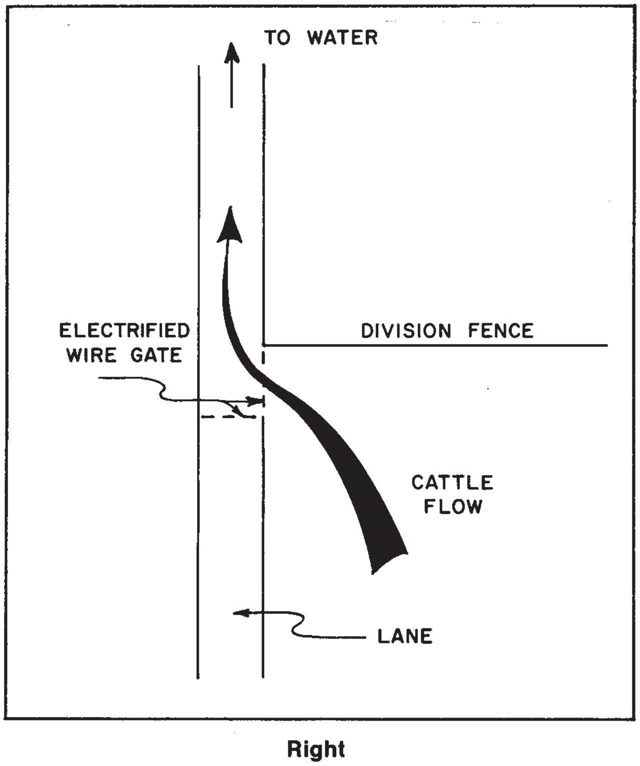
Gate Placement

Gate placement is important in a controlled grazing system because animals are moved frequently. A gate should be in a comer 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 (see Figure 11).

The Pie-Shape Arrangement

A word needs to be said about the use of a pie-shaped arrangement (see Figure 12) for fencing. Producers often plan such a fencing system so that animals have access to a central water source.

There are two problems with that arrangement. First, the area around the water source often becomes a mud hole from cattle congregating to such a small area. Secondly, creating paddocks that follow land contours is often more difficult with the pie-shape.



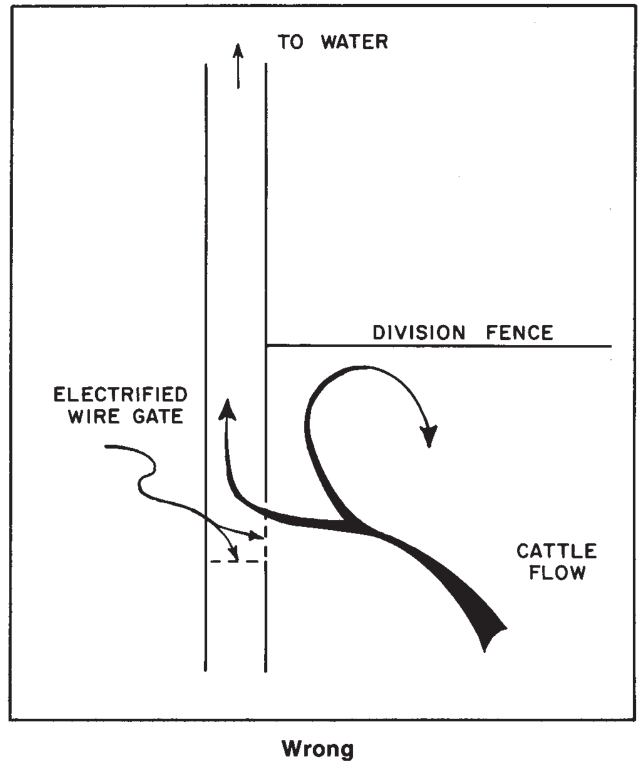


Figure 11. Gate placement is important to good animal movement.

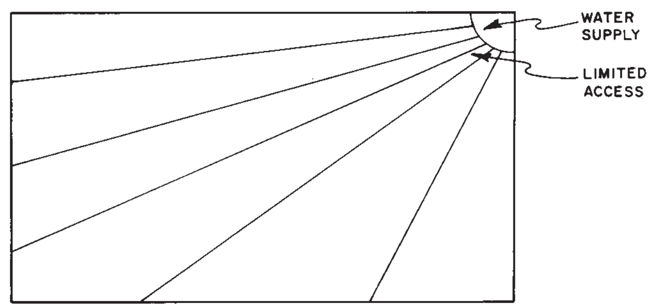


Figure 12. The pie-shaped division arrangement to a central water source.

Fence Construction

The recommended fence type for rotational grazing fencing systems is a combination of permanent electric high tensile fence and portable electric polyethylene and steel braided fence.

The permanent electric high-tensile fence is about 1/4 to 1/3 the cost of woven wire, has a 30-year projected life as compared to 20 years and about 1/3 to 1/2 the maintenance of woven wire. Permanent high-tensile fencing is also a good option but can be more than twice the cost of 3-wire electric fence. Table 3 summarizes cost estimates for materials and labor to construct several types of fencing.

Table 3. Fencing Costs

	------Fence Cost ($/100 ft)-------		
Fence Type	**Materials**	**Labor**	**Total**
4 woven wire + 1 barb	70	25	95
10 wire high-tensile	55	20	75
5 wire barb	44	27	71
8 wire high-tensile	46	11	57
3 wire high-tensile electric	20	4	24
3 wire portable electric	16	--	16
1 wire portable electric	6	--	6

The newer portable electric wire fence consists of braided polyethylene plastic interwoven with stainless-steel strands to carry up to 8000 pulsating volts. This braided wire is available in various colors and lengths, as a cord or ribbon and can be purchased on reels for ease of handling. The advantage of the reel is that it allows rapid set-up and take-down offence 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. Caution: This wire is designed to be used with high voltage, pulsating energizers. Conventional weed-burning charges will melt the synthetic fibers that are woven with the steel wire.

Space does not permit a full description offence construction techniques. For further information, see the additional publications listed at the end of this publication.

Conclusion

Fencing systems for controlled grazing must be tailored to each individual farm. There are common principles, though, which should be used for every farm. Paddocks should be created from soil that is as uniform in slope/aspect and forage characteristics as possible. Fences should follow contours to accomplish that. Lanes of up to 1/4 mile should be considered for water supply.

You can design a controlled grazing fencing system using currently available fencing materials. It can be both functional and economical, with the potential to pay back in 3 years or less under many conditions, and will add value to a farm.

For Additional Information:

On Fence Construction

AEU-29 "Costs, Construction and Suppliers for High Tensile Wire Fencing"

NRAES-11 "High Tensile Wire Fencing" ($4.00)

These materials are available through Dept. of Agricultural Engineering
University of Kentucky
Lexington, KY 40546-0075.

On Cattle Management

ASC-56 "Producing Slaughter Beef with Grain on Pasture"

On Forage Grazing Management

AGR-26 "Renovating Grass Fields"

AGR-44 "Season of the Year Affects Nutritional Value of Tall Fescue"

AGR-85 "Efficient Pasture Systems"

AGR-102 "Erosion--Its Effect on Soil Properties, Productivity and Profit"

ID-5 "A Beef Forage System"

4-H-1306 "Graze More Beef Project Manual"

These materials are available through your County Extension Office.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, C. Oran Little, Director of Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, and Kentucky State University, Frankfort.