Fencing and Watering Systems for Grazing Alfalfa

Larry W. Turner¹

Controlled or rotational grazing can result in better utilization of the forage resources on your farm. By better forage management through controlled grazing, you can 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. Alfalfa grazing can play an important part in such a system. By using alfalfa, additional grazing management options are available, including avoiding high-endophyte fescue in hot summer periods thereby gaining an increased ability to sustain production in dry weather.

Fencing and water supply system design becomes particularly important when grazing alfalfa. The “rest” period is more important for alfalfa than for grass forages, and therefore paddock number is more critical. Reducing traffic and "sacrifice" areas becomes more valuable when the forage value is high. 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

For grazing alfalfa, each paddock area should generally be grazed once every 28-32 days. You may wish to creep graze calves ahead of cows onto alfalfa, or strip-graze across an alfalfa paddock. Strip-grazing with or without a back fence is often used on dairies where cows can be moved quite often.

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/or 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?**

Ideally, cattle grazing alfalfa should be concentrated into paddocks they can use in 3 to 5 days, according to many agronomists. Alfalfa pastures generally need 28 to 32 days of rest. Therefore, 7 to 10 paddocks are recommended for a controlled grazing program on alfalfa. This would allow 30 days rest (5 days x 6 paddocks) with the seventh paddock being the one the cattle are currently grazing. Another option is to provide the alfalfa paddock(s) as one or two paddocks in a multi-paddock rotation. However, then the animals must switch forages relatively often each grazing cycle.

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 many operations, the added benefits above approximately 7-10 paddocks are not worth the added costs of additional fencing, water, labor and management. An exception may be on many dairy operations, where cows are moved at least twice daily already, and a 12 or 24 hour rotation might become practical, allowing some additional improvement in pasture utilization efficiency.

**Incremental Fencing Costs for Increased Paddock Numbers**

Each step in subdividing a farm into paddocks requires additional investment, but the first one or two steps are the most costly. Consider an example for a possible change from a single field, continuous system to a multiple-paddock system on an 80-acre beef farm. The following steps and costs would be typical:
1) Add a single division fence, along with a training lot, and fence the pond.
   - 800' of division fence (3 wire) @ 20¢/ft $160
   - 1600' of lot fence (6-wire) @ $1.00/ft 1,600
   - High voltage, low impedance, solid-state energizer $300 300
   **subtotal** $2,060

2) Add more fence to create four paddocks.
   - 1300' of perm. 3-wire fence @ 20¢/ft 260
   - 300' of perm. single wire fence @ 10¢/ft 30
   **subtotal** $300

3) Add fence to create six paddocks
   - 1200' of perm. 3-wire fence @ 20¢/ft 240
   - 1200' of sgl.-wire temp. fence @ 10¢/ft 120
   **subtotal** $360

4) Add fence to create eight paddocks
   - 660' of poly. tape fence @ 15¢/ft $99

**TOTAL FENCING SYSTEM COST FOR 8 PADDOCKS, INCLUDING TRAINING LOT, LANES AND POND FENCING**
- **$2,909 or $36/acre**

The above costs are in a mid-range of many system costs. Creative use of available materials, such as use of 1/2" electrical conduit for posts, can lower the costs, while some commercially available posts will raise the costs of your fencing. On all but the training lot fence, labor is a low percentage of the total cost, since the single wire fences and even the 3-wire fences are low-tension installations. Using these costs, Table 1 illustrates the returns required in terms of beef production (total live weight gain) required per acre to justify investment in the fence specified above on the example 80-acre farm.

<table>
<thead>
<tr>
<th>Number of Paddocks</th>
<th>Fence System Cost ($)</th>
<th>Annual Beef Production Increase Required, (lb/acre)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2060</td>
<td>2060</td>
</tr>
<tr>
<td>4</td>
<td>390</td>
<td>2450</td>
</tr>
<tr>
<td>6</td>
<td>360</td>
<td>2810</td>
</tr>
<tr>
<td>8</td>
<td>99</td>
<td>2909</td>
</tr>
</tbody>
</table>

¹Assumes a 3-year simple payback and 60¢/lb) price for stocker cattle marketed.

Table 1. Costs and beef production required to recover fencing costs for a new 80-acre fencing system.
From Table 1, for a controlled grazing system with two paddocks, an increase in production of 14.3 lb/acre/year of beef will pay for the fence in 3 years. An added marginal investment to create 4 paddocks will only require the marginal return of 2.7 lb/acre more per year, or a total added production of 16.9 lb/acre. As you can see from the table, once the base system is in place, subdividing the fields using portable fence is very cost-effective. Only 20.1 lb/acre per year of production is required to recover the cost of an 8-paddock fencing system. The beef production increases needed are easily achievable and have been demonstrated on many commercial farms in Kentucky for stocker situations. In other operations, such as cow-calf or dairy, the same approach can be used to calculate fencing benefits. Of course, in all cases, other costs are incurred including water supply, added labor and management and overhead (interest, etc.). Where the basis for a training lot exists already, a simple electrified fence offset could cut costs greatly for the first phase by reducing the cost of the lot fence to as low as one tenth of the $1600 cost shown.

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 more popular. Small 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. Some newer braided wires have more steel (thus less resistance) so can be used in somewhat larger runs.

Wire spacing. Wire spacing depends upon the type of livestock being fenced. Table 2 presents suggested wire spacings for permanent or temporary electric fences.
Table 2. Suggested wire spacings for permanent and temporary electric fences.

<table>
<thead>
<tr>
<th>Cattle type</th>
<th>Wire Spacing Above Ground (for wire numbers)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Cows</td>
<td>30&quot;</td>
</tr>
<tr>
<td>Cows &amp; calves</td>
<td>17&quot;</td>
</tr>
<tr>
<td>Hard-to-hold</td>
<td>17&quot;</td>
</tr>
</tbody>
</table>
| 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

Water requirements vary depending upon the type and size of the animal, and on the time of year. Table 3 summarizes the requirements for beef cattle. Table 4 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 3. Water requirements for beef cattle, gallons/day.

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>50° F</th>
<th>90° F</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 pound calves</td>
<td>4-7</td>
<td>8-15</td>
</tr>
<tr>
<td>800 pound feeders</td>
<td>8</td>
<td>15-18</td>
</tr>
<tr>
<td>1000 pound feeders</td>
<td>9-10</td>
<td>18-20</td>
</tr>
<tr>
<td>Cows and bulls</td>
<td>9-14</td>
<td>18-27</td>
</tr>
</tbody>
</table>

Source: MWPS-6 Beef Housing and Equipment Handbook
Table 4. Waterer space requirements for beef cattle.

<table>
<thead>
<tr>
<th>Animal Weight</th>
<th>Water cup/bowl (hd/space)</th>
<th>Tank (hd/ft. of perimeter)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>on pasture</td>
<td>in lot</td>
</tr>
<tr>
<td>400-800 lb</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>1000 lb</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>1300 lb</td>
<td>14</td>
<td>18</td>
</tr>
</tbody>
</table>

Source: MWPS-6 Beef Housing and Equipment Handbook

Supply Rate

The size of the tank (reserve capacity) should be sufficient to supply all water required per herd drinking cycle (the entire herd will tend to drink their fill within a short time period). The other option is to have water flow out of the supply hose at a rate equal to the combined drinking capacity of all the cows that can drink at once.

Individual dairy cows will drink as much as 2 gallons per minute (gpm) or more if thirsty. Water systems without adequate reserve or flow rate force cows to wait for the tank to be replenished. Boss cows will dominate until they get their fill, and sometimes even then they will not let the more timid cows drink. Timid cows may be forced to wait long periods of time to get any water.

For small pasture tanks with little reserve capacity, try to provide a flow rate of at least 1 gpm for each cow that can drink at one time. When flow rates are less than the rate at which cows drink, large tanks should be used for reserve capacity. The reserve capacity of the tank should equal 2 gallons or more per cow in the pasturing group. The reserve should be replenished in 1 hour or less so that adequate water is available for the next drinking cycle. Larger reserve capacities are a good idea for cows on pasture during the day.

Example: There are 40 cows on pasture. The flow rate from the supply pipe is somewhat less than 2 gpm. There should be room for three cows to drink at once (one drinking space per 14 cows). There should be a flow rate in excess of 3 gpm (3 drinking cows multiplied by 1 gpm). However, this is not the case. Therefore, the tank capacity should be in excess of 80 gallons (2 gallons per cow multiplied by 50 cows) for marginally sufficient reserve. The flow rate should be at least $1\frac{1}{4}$ (1.33) gpm to refill the tank in approximately 1 hour (80 gallons divided by 60 minutes).

In most situations, the behavior of cows around the tank will indicate whether cows are getting water at a sufficient rate. Actual flow rate can be measured by noting how long it takes to fill a container of known size. Make this measurement at the end of the hose with the outlet control attached, not at the barn connection. The flow rate can be significantly less at the outlet due to pressure losses as water flows through the pipe and through the outlet.
Sources of water for grazing include municipal systems, springs, ponds, wells or other farm sources. The use of streams as water supplies may 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. Also, a larger water system will be needed since the animals will tend to all water at once by group rather than in a more individual pattern.

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 major 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 particularly for high-cost alfalfa pastures. 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

For alfalfa grazing, the four-paddock fencing system should be further sub-divided using portable fencing to give the proper size paddocks and rotation schedule 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 for alfalfa grazing, developed from experience and demonstrations, can be summarized as follows:

1) Concentrate cattle into paddocks they can use in 3 to 5 days. Pastures generally need 28 to 32 days of rest. Therefore, at least 7 or 8 paddocks are recommended to begin a controlled grazing program using alfalfa. Five 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 four or main paddocks may be laid out with permanent, low-tension fences and then further 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.

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