Planning and Constructing Fences

Before you build new fences, replace existing fences, or consider more cross fencing, you must first plan. Your first consideration is having a well-built, permanent boundary fence. This is important so that:

- you have a fixed property line between you and your neighbor or between you and the highway.
- you can confine your cattle to your own farm. Liability for losses due to cattle-auto accidents or crop damage to surrounding farms can justify a well-built fence.
- your neighbor's cattle are fenced off from your property, which can protect your crops and your breeding program.

When planning your pasture layout and fences, obtain copies of aerial photographs from your county Natural Resources Conservation Service office and sketch plans on them. Lay out the fences to follow contours of the topography, providing fields that are as large and as uniform as possible for major pasture divisions. Once you have laid out the fence lines, locate necessary lanes and gates.

Keep in mind the shape of pastures. Square pastures are the most efficient because they allow animals to obtain forage with minimum trampling damage and use the least amount of fence material for a given land area. They also can be subdivided with less trouble. A pie-shaped arrangement is sometimes used to give animals access to a central water source. In these cases, cattle tend to overgraze and trample the area closest to the water and graze less in the back of the pasture. A lane to water provides an alternative to the pie-shaped design and reduces the trampled area. Figures 3-7, 3-8, and 3-9 show how fences might be arranged on a farmstead (these diagrams are from Kentucky Cooperative Extension publication ID-74, *Planning Fencing Systems for Intensive Grazing Management*).

Temporary electric fences can be used to subdivide pastures into smaller units which make grazing management easier.

Figure 3-7. Farm with two pastures. Further subdivision will permit better grazing management.

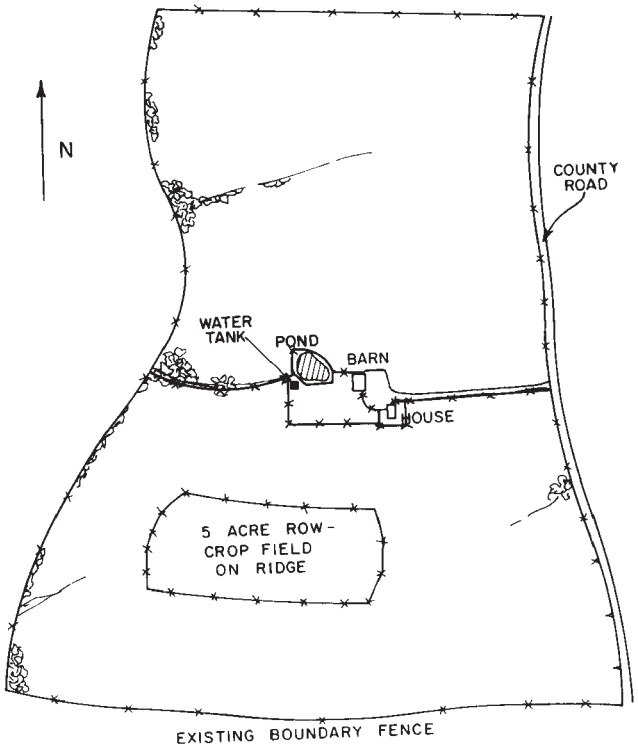


Figure 3-8. Subdivision to four paddocks using permanent (x-x-) and temporary (-) fence.

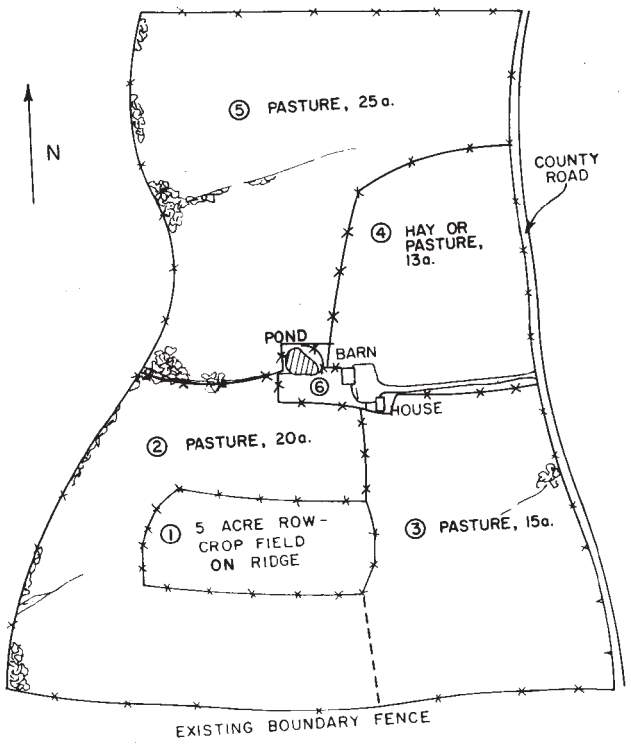
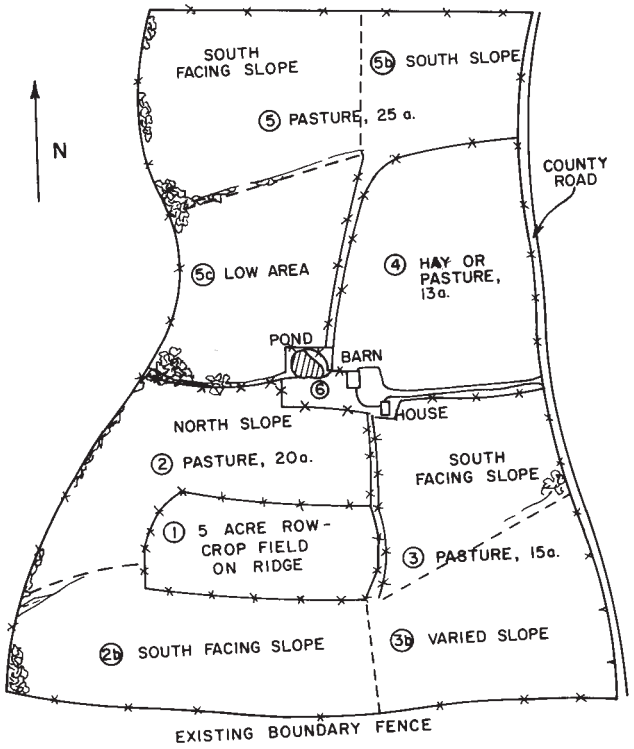


Figure 3-9. Subdivision to eight paddocks using portable fence.



Gate placement is important for animal movement. Locate the gate in the corner of the paddock so that when the first cows move out, the others, especially calves, follow rather than going along the inside of the fence (see Figure 3-10). Never locate a gate in the middle of a fence line with no way to "funnel" the cattle toward it.

Fence Types

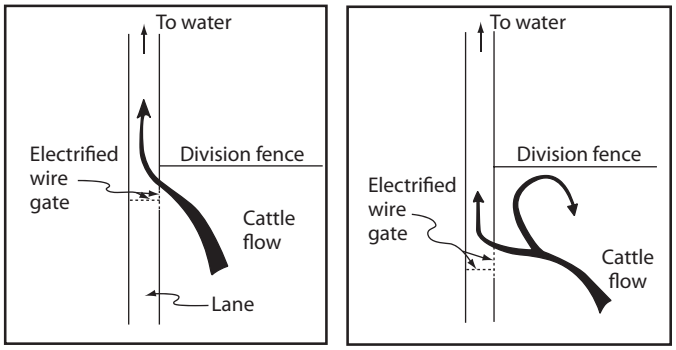
Fence types vary from physical barrier fences, such as woven wire, barbed wire, high tensile, and board fences, to psychological barriers, such as electric high or low tensile wire or portable polywire or polytape type fences. All of these types are used in Kentucky, and each has its advantages. Factors for selecting fence type include:

- affordability
- maintenance
- durability
- effectiveness on the livestock to be contained.

Woven Wire Fences

Woven wire fences are generally used for boundaries, lanes, and lots. A woven wire fence consists of a number of horizontal wires held apart by vertical wires called stays. The distance between horizontal line wires may vary from as close as 1½ inches at the bottom for small animals to as wide as 9 inches at the top for large animals. In general, the spacing between wires gets wider as the fence gets taller.

Figure 3-10. Gate placement is important to good animal movement.



Woven wire fencing is available in many combinations of wire sizes and spacings and varies in numbers of horizontal line wires and fence heights. The height of most woven wire fencing materials ranges from 26 to 48 inches. Select fence height based on the animals' sizes and jumping abilities. Stay wires should be spaced 6 inches apart for small animals and 12 inches for large animals.

The standard design number is listed on the tag to describe the wire. For instance, a design number 1047-12-11 indicates the wire has 10 horizontal wires and is 47 inches high, stays are spaced 12 inches apart, and stay and filler wires (wires between the top and bottom line wires) are 11-gauge wire. The top and bottom wires are generally two sizes larger. Standard woven wire fence heights are shown in Table 3-2; weights are shown in Table 3-3.

Barbed Wire Fences

Barbed wire fences are made of two or more strands of smooth, galvanized-coated steel wire twisted together with two or four barbs spaced every 4 to 5 inches. Standard barbed wire fences usually have three to five strands of barbed wire stretched between posts spaced 15 to 25 feet apart. Barbed wire is sold in 80-rod rolls (80 rods = 1,320 feet = ¼ mile).

Board Fences

Board fences are attractive, strong, and safe for animals. They are typically used as border fences around the farm or home or for crowding areas in cattle working facilities. Board fences consist of 1- to 2-inch thick, 4- to 6-inch wide boards nailed to wooden posts spaced 8 to 10 feet apart. For additional strength, stagger the joints on the posts. For example, using four 16-foot boards and posts spaced 8 feet apart, the top and third boards should continuously span a given post (with the post at the center of the boards), while the joints of the second and bottom boards should butt together on that same post. Do the reverse on the next post.

The price of lumber, nails, paint, and other materials, along with the labor required, makes the cost of these fences considerably higher than most permanent wire fences. Upkeep is also high, especially if untreated lumber is used.

High Tensile Fences

High tensile fences are an increasingly popular type of fence. First used in New Zealand and Australia, they offer several advantages over conventional fencing because they:

- are easier to construct
- last longer
- are less expensive to build than most conventional fences
- require less maintenance.

Table 3-2. Common woven wire fence heights.

Design No.	Horizontal Wires	Height (in.)
635	6	35
726	7	26
832	8	32
845	8	34
939	9	39
949	9	49
1047	10	47
1156	11	56

Table 3-3. Woven wire fence weights.

Weight	Gauge of Top and Bottom Wires	Gauge of Intermediate Line Wires
Light	11	14½
Medium	10	12½
Heavy	9	11
Extra heavy	9	9

High tensile fences are constructed mostly with 12½- or 14-gauge Class III wires that have tensile strengths from 170,000 to 200,000 or more pounds per square inch (psi) and breaking strengths of approximately 1,800 pounds. This fence can withstand more than 1,100 pounds of livestock pressure without losing its elasticity, yet it is flexible enough to bend, wrap, tie in knots, or clamp with crimping sleeves. Wires are held in tension along wood, fiberglass, insulated metal posts, or a combination of posts and battens or droppers. Tension in the wire is maintained by permanent in-line strainers. Adequate tension for 12½-gauge high tensile wire is 200 pounds, indicated by a tension indicator spring.

High tensile wire fences can be used with electricity to improve animal-holding capability and predator control. It is important to use treated wood posts and set them properly in the ground with adequate braces to withstand the pressure caused by the tightly stretched wire.

Cable Fences

Cable fences are used primarily for confinement areas, such as holding pens, feedlots, and corrals. These fences usually consist of 3/8-inch smooth steel wire cables stretched between anchor posts. The cables are normally made out of seven wires twisted together. Heavy-duty springs are placed at one end of each cable to absorb the shock on the wires caused by animals pressing against them. Cables are usually passed through holes in wooden or steel posts.

Any number of cables can be used; however, a six-cable fence is often used for large animals. The spacing between cables depends on the type of animals to be confined.

Electric Fences

Electric fences are widely and successfully used in Kentucky. If constructed properly and energized with a controller designed to match the application, they can be an effective, safe, and inexpensive means of providing temporary and permanent fencing.

Electric fencing does not need to be strong because it seldom comes under pressure, but it must be well designed and constructed to absorb the impact of animals. Adequate power for the length of fencing and type of animals to be confined is also essential. Electric fencing has a low installation cost, is inexpensive to operate, can be used to extend the life of old permanent fences, can be used for deer and predator control, and can be built for temporary or permanent use.

Various types of inexpensive, easily erected temporary electric fences are available. Probably the most popular are the polywire strands or ribbons—fine wires woven together with polyethylene fibers.

Polyethylene and steel braided wire (polywire) comes in various colors. Black is the most difficult for animals and people to see. Brighter colors, such as orange or white, are also available. Polytape, particularly the extra-wide type, is easier to see than polywire and works better for horses and in other cases where visibility is especially important. Some newer polywires and tapes incorporate more wires so that the resistance to current is lower, allowing longer runs of wire. A practical maximum for the lower wire density polywires is about 1,200 feet.

It is important to keep weeds and grass cut away from the fence, especially when using low impedance controllers. Polywires with stainless steel wires are more durable, but electric conductivity is lower. Aluminum conducts electricity better but tends to break more easily.

Aluminum, stainless steel, and high tensile wire also can be used. One advantage to using these type of wires is that they conduct electrical charges for longer distances than the small-diameter wires of polywire and polytapes. However, they are harder for the animals to see. To effectively train animals to stay within an electric fence, the animals need to see the wire as they feel the shock. Tying pieces of white cloth or brightly-colored plastic ribbon helps make these wires more visible.

An electric fence controller energizes the wire, and the moist earth completes the electrical circuit. Corners and end posts in temporary electric fences require minimal bracing. Line posts can be small and spaced far apart since the fence generally will be used for a short period of time.

Fencing Systems for Controlled Grazing

Table 3-4 provides a comparison of fence types to assist in making a selection that best fits your needs and budget. In Kentucky, the most economical fence type for controlled grazing fencing systems is often a combination of permanent electric smooth high tensile wire fence and temporary portable polywire (available on reels). An advantage of the reel is that it allows rapid set-up and take-down of the 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. Since it is electrified, high tensile wire for the permanent fence often can be installed using low-tension techniques. The following provides an overview of several types of fences and their appropriate place in a system.

For controlled grazing systems, the type of wire suggested for permanent boundary fence installations is New Zealand-type high tensile wire. This is 12½-gauge high tensile smooth wire that is heavily galvanized (Class III). Also, smaller diameter high tensile wires are now being used, particularly on interior division or paddock fences. These include 14½-gauge and 16-gauge 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 that is somewhat easier to work with when moving and handling the fence. An excellent alternative for very temporary installations is braided wire containing very fine gauge steel wires braided with polyethylene strands into a wire, ribbon, or tape. These wires work well for installations of up to 1,200 feet. Because of the lower cross-sectional area of the steel, energizer requirements differ from those of smooth high tensile wire. Some newer braided wires have more steel (thus less resistance), so they can be used in longer runs.

Wire spacing depends on the type of livestock being fenced. Table 3-5 presents suggested wire spacings for permanent or temporary electric fences.

Table 3-4. Comparison of common fences (1 post per 16').

Types		Strands	Wire Gauge	Height (in.)	Stay Spacing (in.)	Cost Index[1]	Fence Life (yrs.)[2]	Upkeep
Permanent materials	Barbed wire, 2-point	3	12½		4	132	33	high
		4	12½		4	143	33	high
		5	12½		4	154	33	high
		3	14		4	121	18	high
	Barbed wire, 4-point	3	12½		5	132	33	high
		4	12½		5	143	33	high
		5	12½		5	154	33	high
	Woven wire, light weight	top, bottom	11	26	6	154	19	high
		filler	14½	32	6	165	19	high
	Woven wire, medium weight	top, bottom	10	26	6	176	30	medium
		filler	12½	32	6	187	30	medium
		filler	12½	39	6	198	30	medium
		filler	12½	47	6	220	30	medium
	Woven wire, heavy weight	top, bottom	9	26	6	209	40	low
		filler	11	32	6	231	40	low
		filler	11	39	6	253	40	low
		filler	11	47	6	275	40	low
	High tensile wire	3	12½			44	30	medium
		4	12½			55	30	medium
		5	12½			66	30	medium
		8	12½			110	30	medium
Temporary materials	High tensile wire	2	12½			20-35	30	medium
		1	12½			15-25	30	medium
	Polywire					10-15	7-10	medium
	Aluminum wire		9			30-40	30	medium
			13			25-35	30	medium

[1] Labor costs are included, but the costs of electric controllers are not included.
[2] Fence life based on combination of post and wire life expectancy in a humid climate.
Source: Adapted from Buschermohle et al., University of Tennessee Extension Pub. EP-10-95.

Table 3-5. Suggested wire spacings for permanent or temporary electric fences.

	Distance from Ground (for Wire Number)				
Cattle Type	No. 1	No. 2	No. 3	No. 4	No. 5
Cows	30″				
Cows and calves	17″	38″			
Hard-to-hold cattle	17″	27″	38″		
Boundary fence	5″	10″	17″	27″	38″

Fence posts are available in many different types in Kentucky (Table 3-6). Always try to find the best post to meet the demands of the situation. For example, it is best to use good, treated posts for permanent boundary fences, while light fiberglass or steel posts are more suitable for temporary fences in a controlled grazing cell.

Often the least expensive option is to cut your own posts or purchase untreated wooden posts. They are highly variable in size, shape, and durability (Table 3-7). Osage orange posts have a life-span of 25 to 35 years; black locust or red cedar posts last 15 to 25 years. Other woods, such as oak, pine, and poplar, rot in just a few years unless they are pressure treated.

Wood posts come in a variety of sizes and lengths. The larger the top diameter, the stronger the post. Corners are the backbone of a fence. Whether you plan to install a woven wire, barbed wire, or high tensile wire fence, choose good corner posts. Corner and gate posts should have a diameter of at least 8 inches. Brace posts should be 5 inches or more in diameter. Line posts can be as small as 2½ inches, but larger diameter posts make the fence stronger and more durable.

Steel posts have several advantages. They weigh less, can be driven into the ground rather easily, will not rot, and are fireproof. They also help ground the fence against lightning when the soil is wet. They are more likely to be bent or forced out of line by livestock. A widely used method is to use wooden line posts every 50 to 75 feet to help keep steel posts from bending and improve the strength of the fence. Table 3-8 provides guidelines on post spacing for fences.

Fence construction includes setting posts, constructing braces, driving staples, and making splices. Corner and end-post assemblies are the foundation of the fence. The most common system is the horizontal brace or diagonal brace (Figure 3-11). Single-span assemblies may be used for fence lengths up to 10 rods (165 feet). Use double-span assemblies for 10 to 40 rods (165 to 660 feet). For more than 40 rods, use double-span construction plus braced line posts.

Table 3-6. Fence post characteristics.

Post Type	Bending Strength	Expected Life (yrs.)	Initial Cost	Fire Resistance	Maintenance
Steel-T, concrete	fair	25-30	medium	good	low
Steel rod, 3/8" dia.	poor	15-20	low	good	medium
Heavy-duty fiberglass-T	fair (flexible)	25-30	high	poor	low
Light-duty fiberglass-T	poor (flexible)	15-20	low	poor	medium
Pressure-treated wood	good	30-35	medium	poor	very low
Untreated wood	good	7-15	low	poor	high

Table 3-7. Life expectancy of wood posts.

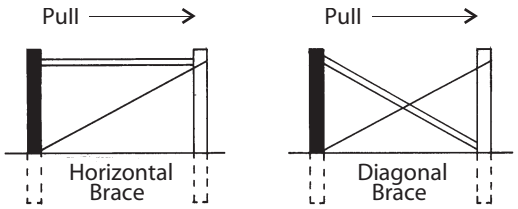
Kind	Untreated	Treated (pressure)	Treated (soak)
Osage o.	25-35 yrs.	—	—
R. cedar	15-25 yrs.	20-25 yrs.	20-25 yrs.
B. locust	15-25 yrs.	—	—
W. oak	5-10 yrs.	20-30 yrs.	15-30 yrs.
Hickory	2-6 yrs.	15-20 yrs.	10-15 yrs.
R. oak	2-6 yrs.	20-30 yrs.	20-30 yrs.
Y. poplar	2-6 yrs.	20-25 yrs.	15-25 yrs.
S. gum	3-6 yrs.	20-30 yrs.	20-30 yrs.
S. pine	3-7 yrs.	25-30 yrs.	15-20 yrs.

Table 3-8. Recommended post spacings.[1]

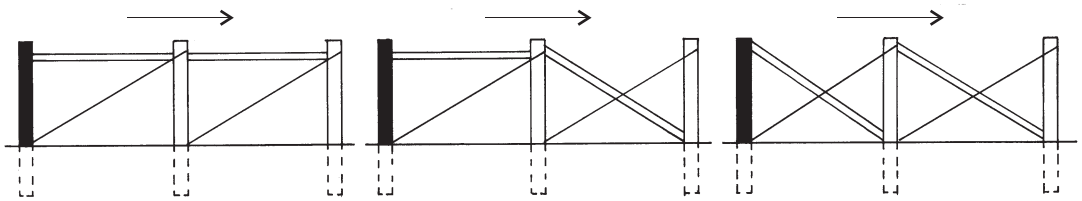
Fence	Spacing (feet)
Woven wire	14-16
Barbed wire	12-14
Electric[2]	20-75
High tensile[2]	16-60
Board	8
Corrals	6

[1] Driven posts are 1.7 times as strong as tamped posts.
[2] Depending on terrain, use of battens.

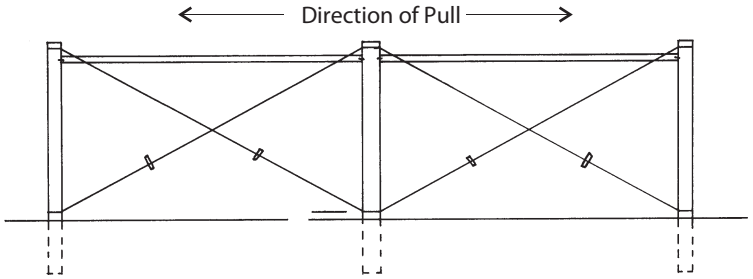
Figure 3-11. Corner and end-post assemblies for permanent wire fence.



Single-span brace assemblies of corner posts for short fences (up to 165 ft.)

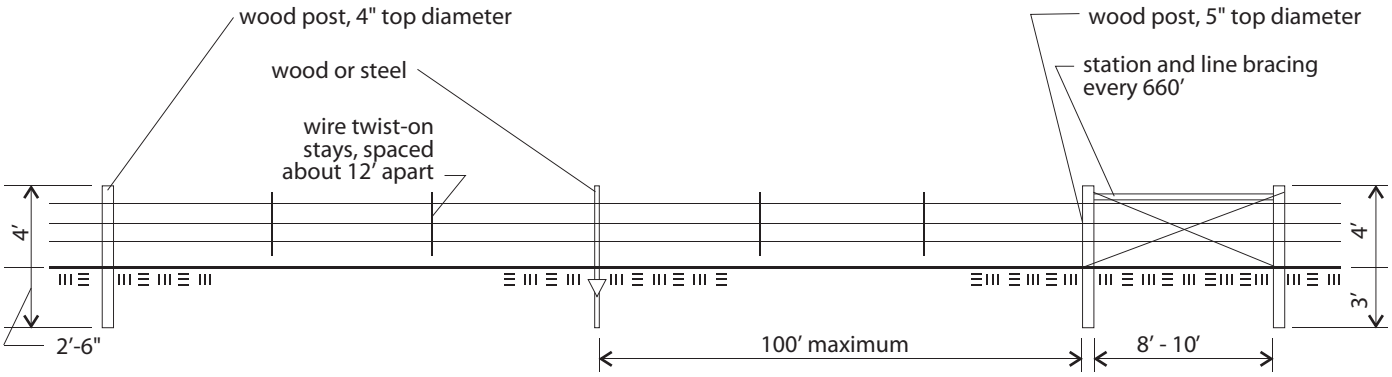


Double-span brace assemblies of corner posts for longer fences (165 - 660 ft.)



Pull posts for the middle of long fences (over 660 ft.)

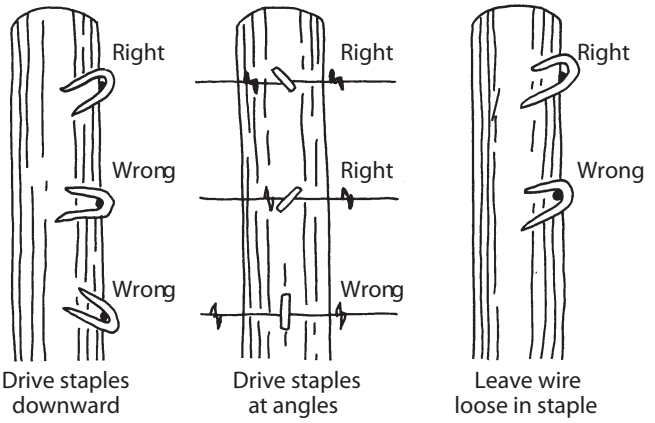
Figure 3-12. Suspension fence.



Suspension fences (shown in Figure 3-12) are long spans of barbed wire over level to rolling terrain. Moderately tensioned wire that moves freely between staples and posts is essential. Place line posts every 100 feet on level terrain and closer on rolling terrain. Put stays every 15 to 20 feet between posts.

Staple length, diameter, and type of post all affect the holding power. For treated posts, use 1¾-inch, 9-gauge galvanized staples with slash-cut points. Drive staples slightly off vertical so they straddle the wood grain and wires may move freely (Figure 3-13). String wire on the cattle side of the posts (unless appearance is important) and on the outside of curves.

Figure 3-13. Proper stapling for fence construction.



Feed Bunks and Feeding Facilities

Feeding facilities should be designed so that they are convenient to the animals and encourage feed intake. The size of feed bunk needed depends on the size of the cattle, whether they are all fed at one time, and whether they eat on both sides of the bunk. When selecting a feed bunk, consider drainage, manure buildup, and materials needed.

Enough space should be provided so that animals are not crowded, thereby reducing stress around the bunk or feeding area and improving intake. Table 3-9 gives feeder space requirements for various ages of cattle and feeding schemes. Proper opening spaces and throat heights for feed bunks are important to relieving stress and providing adequate access for cattle of varying sizes. Figure 3-14 illustrates a bunk design that has proven to be good for many producers. Table 3-10 indicates suggested throat heights and neck rail heights for feed bunks for various sized cattle. This design is most appropriate for covered bunks and bunks inside buildings. The feed area allows for ease of cleaning, and the height of the bunk allows the cattle to eat in a more natural grazing position. In facilities where cattle have access to both sides of a bunk, use a partition on both sides of the feed. Other design options, including elevated bunks or mangers, are available in MWP S-6, "Beef Housing and Equipment Handbook," and through the University of Kentucky Plan Service (2).

Many Kentucky cattle producers successfully feed cattle in bunks without any roof or covering. For summertime feeding, however, feeding under roof is strongly encouraged for high-producing animals. This reduces heat stress and encourages animals to use the bunk. For winter conditions, some type of windbreak is advised if the bunk is on a ridge top or open to northwest winds. Ideally, a feed bunk offering cattle access on both sides should be oriented north-south, so the surfaces on both sides of the bunk have an opportunity to dry out from exposure to the sun. For bunks located outside or in locations where manure is not scraped frequently,

Table 3-9. Feeder space requirements for cattle feeding facilities.

	Space Requirement (inches/animal)				
Feeding Program	Calves (400-800 lb.)	Finishing (800-1,200 lb.)	Bred heifers (800 lb.)	Cows (1,000 lb.)	Bulls (1,500 lb.)
Once-a-day	18-22	22-26	22-26	24-30	26-30
Twice-a-day	9-11	11-13	11-13	12-15	12-15
Self-fed grain	3-4	4-6	4-6	5-6	5-6
Self-fed roughage	9-10	10-11	11-12	12-13	13-14

Source: Midwest Plan Service, Beef Housing and Equipment Handbook, MWPS-6.