

## Fence Materials

Our topics for this week are:

- Comparisons of wire strand, electric, wire mesh, rail or pipe, plank/board, and panel fences
- Types of fence posts

### Wire Strand

The most common farm fencing material in the U.S. is barbed wire. Barbed wire is two or more twisted strands of regular or high-tensile wire with two to four wire barbs with sharp points added every five to six inches. It can be put up on wood posts or steel T posts set in the ground eight to 20 feet apart.

Barbed wire fencing is relatively inexpensive. It was developed in the 1867 by a New York blacksmith, Michael Kelly, for containing cattle. The design was improved by Joseph Glidden. There is now 52 billion miles of barbed wire fence in the U.S. Barbed wire works relatively well for cattle because of their behavior and thick skin. However, barbed wire fencing is unacceptable for any other species. Because of the injuries it can cause to animals other than cattle, it has been called the “devil’s rope.” A minimum of four wires of 16 ½ gauge should be used for cattle containment.

Barbed wire should never be electrified. An animal caught in barbed wire will struggle violently if also being electrocuted and become severely lacerated. In some states, electrifying barbed wire is illegal. A strain of electrified smooth wire on offset insulators mounted on the pasture side of the fencing can be used to augment a barbed wire fence. This can be particularly helpful if keeping a bull separate from heifers.

High-tensile, smooth wire fence is 11 to 14-gauge. High-tension wire is a better choice than barbed wire for cattle, especially if also electrified, but high-tension wire is more expensive. Thick wire that is strung tight is an effective barrier without being electrified. High-tension wire requires heavy corner braces for proper stretching and strength to withstand a cow bumping or pushing into the wire. Brace wires for corners should be placed on the outside pasture-side of the fencing to prevent entrapment of a leg. Tension fences need braces at corners and every 1/8 mile. Standard high-tensile wire has three to five strands with posts every 10 to 12 ft.

High-tensile, polymer rail (plastic straps) has the appearance of plank fence since it is made with two high tensile steel wires joined by a four to six-inch sheet of vinyl.

### Electric

Electric fences have been used since the 1930s and are suitable for all mammalian farm animals. Advantages include relative low expense, low maintenance, easily modified, little to no skin damage, deterrent to trespassers and predators, and portability useful in subdividing pastures and pasture management. Electric fencing is for enclosing pastures. It is dangerous for animals and handlers if used on small enclosures because of the increased risk of an animal touching it, becoming agitated, and having limited room to move away.

Electric fence consists of a fence charger, conducting line (nine to 14 gauge smooth wire,

rope with copper or steel strands, conducting tape, or conducting mesh), and insulators for posts. Insulators prevent a metal post or wet wooden post from shorting out the fence. Fiberglass and plastic fence posts may not need insulators.

Grass and weeds underneath older electric fences should be kept trimmed to prevent shorting out the fence when wet. Modern low impedance models do not short out from contact with wet vegetation or cause fires during droughts as older models can. However, vegetation should also be regularly trimmed under newer electric fencing since if vegetation touches it some of the effectiveness of the fence will be drained.

Electric fences use very little electricity. Chargers (also called “controller” or “energizer”) are plug-in, battery, or solar powered. Plug-in chargers are more dependable and less expensive in the long-run than battery powered units. Solar powered chargers have the highest initial cost. Under some circumstances solar chargers are adequate, but solar chargers are not as powerful as AC chargers. For the safety of animals and humans, the charger should pulsate about once per second.

Chargers need to be grounded using six to eight foot steel or copper rods driven into the ground at least four feet, or however deep the constant moisture level is in the soil. Ground rods need to be at least 10 feet apart and connected by copper wire and at least 50 feet away from other ground rods or grounded metal objects. Otherwise, stray voltage problems may occur. Additional ground rods are needed every 3,000 ft. If lightning is common, additional ground rods should be placed at least every 150 ft to minimize damage to the fence and risk of electric strike reaching livestock. Because livestock have a horizontal posture with four legs on the ground, they are more likely to die from lightning strike than humans. Charger output is measured in pulses of joules. One joule will charge a strand of electric fence 6 miles. Because of their hair coats, animals are better insulated from electric shock than humans.

Ground wires will permit a charge delivered when the ground surface is dry. This is important in droughts when animals may be trying to feed under a fence after the pastures are depleted. One wire is used for temporary confinement to a grazing area, as in subdividing a pasture. One electric wire is also sufficient as a barrier on the animal containment side to reinforce otherwise weak non-electric fencing. One electric reinforcement wire may be ineffective during dry weather due to inadequate grounding.

Multiple wire fences should contain at least three wires with alternating hot (live) wire and ground wires. If four wires are used, the second wire should be the ground wire. If five wires are strung, the second and fourth wire should be grounds. Multiple wire electric fences can be effective for long distances, in dry areas, and can help control predators. Electric fences should be marked with public warnings every 200-250 feet. An electric wire six to eight inches off the ground can be helpful in stray dog control. At least 5,000 volts on the fence line is required to keep predators out. To deter horses, 2,000 to 3,000 volts are recommended. Ruminant livestock require 2,000 to 5,000 volts, and possibly more for bulls.

Standard steel or aluminum wire can be used. Aluminum is rustproof and conducts electricity better than steel, but the conductivity of aluminum is only about 60% of copper, which is the best for conduction. Steel only has 10% of the conductivity of copper. Electric tape adds increased visibility, but tape flutters in the wind and can get weighed down with ice. Fluttering can be reduced by twisting the tape between fence posts. Polyester rope with interwoven copper or steel threads can function both as an electric and physical containment system.

The number of strands needed for primary fencing should be sufficient to keep livestock

from putting their heads between the strands and then getting shocked. The electric shock on their neck may cause them to jump forward sending them into the fence and destroying it. Only one strand may be sufficient for perimeter fencing or cross fencing. One strand of electric fence can also be used to supplement other fencing, such as inside mesh fencing for horses to prevent the horses from pushing on the mesh to scratch themselves or along the bottom of a hog fence to prevent hogs from rooting under the fence. An electric strand along the bottom of a fence can also be a deterrent to roaming packs of dogs or wild predators.

Electric fences have the disadvantages of possibly losing power and the visibility of the wire may be low. However, fladry (strips of fabric) tied to electric strands can enhance the fence's visibility. Electric fencing is not very effective for thickly coated animals or animals in powder snow. Barbed wire or mesh wire should never be electrified. The danger of being caught and shocked at the same time could have disastrous results. Lightning is a common cause of electric fence failure. People should never stand by an electric fence in a thunderstorm due to the risk of transmitted lightning strike.

### **Wire Mesh**

Wire mesh affords the best protection from escape and from entry of predators other than raptors. Mesh fencing is preferable for small ruminants, poultry, and mares with foals. The size of mesh openings should be appropriate for the species. Cattle mesh, also called field mesh, is often 4 X 4 inch spaces, or larger, economical and effective for cattle but dangerously large openings for other species. Cattle mesh should only be used to contain cattle.

Mesh may be welded wire or woven. Woven wire mesh is tied in the corners of each space, not spot welded. It is relatively expensive but is the best choice for strength. Woven wire is sold in 20-rod rolls (330 ft) made of aluminum or galvanized steel. Vertical wires are called stay wires and horizontal wires are line wires. A tag with the code 10-47-6-9 means 10 horizontal wires, 47 inches tall, 6 inches between stay wires, and 9 gauge wire (top and bottom wires are thicker). Adult cattle require 9 gauge wire and chicken wire is 20 gauge. Horse or ruminant mesh should be woven. It can have square, rectangular, or V-shaped openings. Poultry wire is welded with hexagonal openings. Galvanized wire, which is dipped in hot zinc oxide, is more resistant to rust. All fasteners should be galvanized as class 3 - heaviest galvanizing. During fence construction, mesh wire should be stapled on the contained animal side of the fence posts. Maintenance should include keeping fence line free of weeds and vines.

Enclosures of mesh fencing should have mesh gates. Mesh gates are safer than tube gates. They are less likely to allow legs to get caught and are necessary to continue the predator control that mesh fences provide.

Chain-link ("cyclone", "hurricane") fence is relatively expensive and neither welded nor tied at junctions. The wires run vertically and hook around the adjacent wire creating a diamond pattern. The tube posts and top tube rails of residential chain link fencing are too weak to withstand pressure from large animals. The mesh, peaks of the diamonds, usually project above the top tube railing which could snag halters, ear tags, neck chains, or other body attachments.

### **Rail or Pipe**

Welded steel pipe fence provides the greatest strength and is often used for stallion pens. It is unforgiving if bumped into, and if rail spacing is too wide, a head or leg can become caught. Component pipe fence is galvanized steel with horizontal rail connections that swivel to

accommodate changes in terrain and be simple to install, but expensive. Another form of steel rail is interlocking steel pipes that run through holes in wooden posts. Repair of pipe fencing requires welding skills. Aluminum rails are commercially available but may not have sufficient strength for livestock.

*Virginia rail fence* is zig-zagged rails. Split rail requires chiseled holes in posts to hold horizontal rails. No posts are required.

A *buck fence*, also called a jackleg fence, is a rail fence. It is used in terrain with frozen, rocky, or soggy ground because post holes do not have to be dug. Four or 5 inch diameter poles are used. The fence supports are 5 to 8 feet poles called “bucks.” Two buck posts are joined together in an X-shape. The crossed buck posts are joined by a 10-foot horizontal top rail, three to four outside horizontal rails, and one inside (rub pole) horizontal rail.

### **Plank (Board)**

Plank fencing can be made of wood or vinyl, or a combination. Wood plank fencing is the most traditional horse fencing in the U.S. It is also the most expensive plank fencing and requires the highest maintenance.

Wood plank is oak or treated pine or poplar. Pressure treatment of soft woods with copper compounds will provide some resistance to rot. The quality of pressure treatment and duration of resistant to rot varies. Planks are 1 to 2 inches thick and 4 to 6 inches wide. Horses will chew pine planks, and all wood planks have to be repainted on a regular basis. They may bow or crack and break (especially if horses can rub on them), and there is a potential nail hazard. Wood plank fencing often requires use of an electric wire added to the top rail to aid in the horses having respect for the fence. To enhance a wood fence’s strength, horizontal poles or planks should span three posts. Therefore, horizontal planks on a fence with posts 8 feet apart should be 16 ft long. Nailed plank ends and middles should alternate going up or down a post. Wood planks should be spaced wide enough to prevent trapping an adult animal’s head and small enough to prevent escape of young animals. Nailing a top board flat on top of the posts enhances the fence’s stability and reduces chewing damage to the fence. Wood plank fencing can be painted or stained. White paint is most visible at night.

Vinyl (PVC) plank is lower maintenance than wood, but will develop mildew particularly on the north side and will have to be power-washed with mildew removing chemicals. Vinyl plank fence is expensive. Horses that rub on the fence can break or pop the planks out of the posts. If kicked, vinyl planks can break, splinter, and leave sharp edges which are dangerous. An electric barrier wire is generally needed on the inside of the top rail. There is a variety of vinyl fencing and not all vinyl fencing is strong enough for horses. Hollow plank is not strong enough to withstand pressures that horses exert on fences. Vinyl plank with internal ribs may be strong enough for some horses. Vinyl clad (polymer coated) plank is wood plank that has been dipped in vinyl. It is much stronger than hollow or ribbed vinyl plank but can warp with age. Vinyl used for fencing much contain a UV inhibitor or it will become brittle and crack with exposure to sunlight.

All wood or vinyl plank fencing must be repaired immediately or enclosed animals removed to another area of containment. Not only is escape possible when planks break, broken planks can become spears that can impale animals.

Concrete can be impregnated with wood colors and poured in molds that produce a surface texture of wood. Concrete plank fence is durable but dangerous to animals that run into it.

## **Panels**

Panels are welded steel rods 8 to 16 ft long. Their primary advantage is portability. Panels are used for quickly assembled pens for cattle, horses, and hogs. Panel heights vary by the intended species: cattle panels are 50 inches tall, horse panels are 60 inches tall, and hog panels are 34 inches tall. Panels are used for equine training pens and for isolation of sick, new, or injured horses. Square openings in the panels should be appropriate for the species. Feedlot panels have shorter height openings as they approach ground level which reduces the risk of a hoof getting caught or a piglet's head getting through and caught.

## **Fence Posts**

Posts can be wood, steel, plastic, fiberglass, stone, or concrete. Steel, fiberglass, and plastic posts are usually driven to be placed in the ground. Stone, concrete, vinyl, or vinyl clad must be hand set in dug holes. Wood posts can be driven or hand set. Wood posts set with hydraulic post-hole drivers are the most stable.

Wood posts that resist rot and insect infestation include cedar, cypress, redwood, and pressure-treated pine or fir. Wood line posts are typically set 8 ft apart but in straight stretches of level ground can go to 15 ft., 3 feet deep (depending on the locality frost-line), 4 inches around, and at least 4.5 ft high. Fence posts in pens should be 5 to 6 feet tall. Posts for high tensile wire or electrified rope can be up to 30 ft apart. Posts for corrals or round pens should be 6 ft apart.

Wood corner and gate posts are typically buried or driven 4 ft deep or buried 1/3 of their length, whichever is deeper. They should be at least 8 inches in diameter for corner and gate posts and brace posts should be 5 inches in diameter, or greater.

Line posts are usually 4 inches in diameter. Livestock will chew the edges of square posts if the posts on the animal's side of the fence. Round posts that are faced or half-round allow a more secure attachment for mesh fencing without edges that the animals can easily chew on.

Steel T-posts for horses should be topped with mushroom-shaped caps to reduce the risk of impalement. Wooden line posts should be used every 50 to 75 feet of T-posts to keep T-posts from bending if pushed on by cattle or horses.

Now, let's recap the key points to remember from today's episode:

- Barbed wire is only safe for containing cattle
- Electric fence is effective for all mammalian livestock and horses
- The appropriate size of holes in mesh fencing depends on the species to be contained
- Plank (wooden board) fencing is high maintenance
- Metal T-posts can impale rowdy horses

More information on animal handling is available in my book, *Animal Handling and Physical Restraint* published by CRC Press. It is also available on Amazon and from many other fine book supply sources.

Additional information is available at [www.betteranimalhandling.com](http://www.betteranimalhandling.com)

Don't forget serious injury or death can result from handling and restraining some animals. Safe

and effective handling and restraint requires experience and continual practice. Acquisition of the needed skills should be under the supervision of an experienced animal handler.