Soil & Crop Improvement Association of Nova Scotia

Electric Fencing for Pastured Livestock

Factsheet 2008

Electric fencing is the most versatile fencing option available, and is relatively economical. It can be set up to control all classes of pastured livestock. It can also be combined with other fence types to provide extra protection. When properly installed, electric fences can last for 20 years or more.

Electric fencing can be used for boundary and interior fencing, and either as a permanent or temporary installment. It can also be used in areas where other forms of fencing are not convenient, such as where the fencing must be moved fairly regularly. An electric fence is not designed to be used as a physical barrier. Rather, it is meant to be a psychological one, where the memory of a previous negative experience (that of receiving a shock) deters the animal from attempting to cross the barrier in the future.

Fig. 1. Five or six strands are sufficient for boundary sheep fencing. Note this is a ground wire return system, because live and ground wires alternate.

How It Works

The energizer generates short, high-voltage impulses that are sent through the fence line. When an animal touches a live wire, the circuit is completed because the current travels through the soil to the ground rods and back to the energizer (Fig. 2).

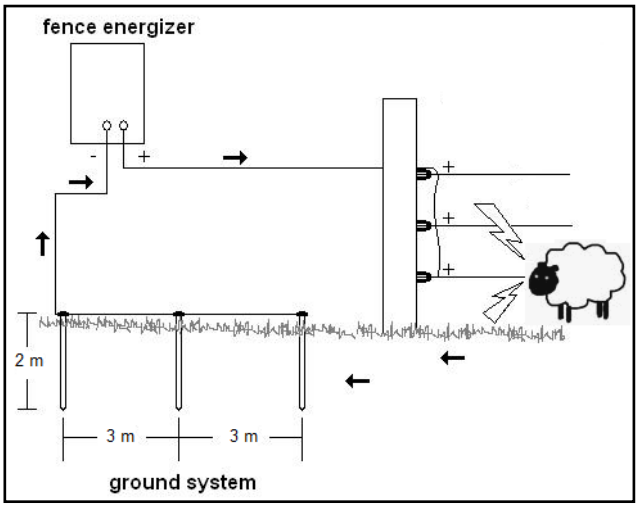


Fig. 2. The circuit is completed when the wire is touched.

Amperage, Voltage, Wattage and Joules

It is often easiest to understand these terms by comparing an electrical system to a water system. *Amperage* is a measure of current, like the flow of water through a pipe. *Voltage* is the difference in electrical potential between two points in an electrical circuit, similar to water pressure in the pipe. *Wattage* is a measure of the rate at which electrical energy is transferred by an electric circuit (amperage x voltage). Wattage is comparable to the rate of water flow times its pressure which equals the pump horsepower. Fence controllers can be energy rated by their wattage per second, or *joule* output.

In electric fence systems, voltage typically ranges from three to 10 kV. The joules, or quantity of energy, are partly what deters animals from touching the fence. Voltage is also important because a certain amount is required to overcome resistance (e.g., wool) and allow the energy to flow. The minimum voltage should be above three kV to be effective for most large livestock, but sheep and other livestock with heavy coats require a higher voltage (above five kV). Low voltage is almost always due to an insufficient ground system or is caused by inadequate electric fence system components which are grounding out the system.

Types of fencing circuits

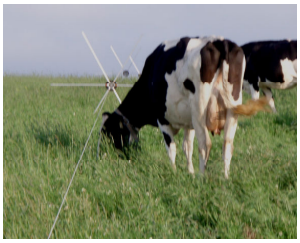
There are two types of wire setup for an electric fence system: an *all live wire system* and a *ground wire return system*. An all live wire system works well in regions with fairly even rainfall and green vegetation for most of the year, while a ground wire return system is used where there is low rainfall, or if soil conditions are stony, dry or frozen.

An all live wire system depends on the electrons to travel easily through the animal, into the soil and up into the grounding rods back to the energizer, so it requires the higher conductivity of moist soil. On the other hand, a ground wire return system depends on the current to go back to the energizer by way of a ground wire in the fence line. This setup can work in the same manner as the former, but animals can also complete the circuit by touching a live and ground wire at the same time.

Components of Electric Fences

Various components can be used to offset labour constraints associated with electric fence systems:

Electric net fencing is useful to contain sheep and helps to keep out predators since the entire net is electrified. Great care should be taken when using around lambs as they can easily become entangled.



Tumble wheels are convenient when the temporary fence needs to be moved frequently. Notice that only one strand of polywire is required to contain the cows.

Reels are also useful for moving temporary fence. They can also be assembled so that several of them attach onto a post, allowing a three or four-strand fence to be moved at once.

Electric fence can be used to protect existing barbed or page wire fence when using offset brackets. These can be positioned on a fence post or on the fence itself.

The parts selected will depend on how the fence will be used. As permanent and boundary fencing, longer-lasting materials are more important than for portable fences. Typically 12.5 gauge, high tensile wire is used as it is very durable. Temporary fences on the other hand, are usually constructed with one to three strands of visible wire on portable step-in posts or tumble wheels. These fence posts should be highly insulated, using either fibreglass or plastic posts or steel posts with high quality insulators. Acceptable types of wire include various gauges of steel wire, polywire and polytape.

Designing a Fence System

The setup of temporary, permanent, interior and boundary fences will vary.

Permanent Fence

On level or rolling terrain, space posts every 20 to 30 m. Fewer posts allow the fence to absorb impact and bend back rather than break. In hilly areas, place extra posts in both high and low spots to prevent grounding and gaps. Just like other permanent fence systems, this system requires strong braces at corners and for very long fence lines, within the line (see brace section).

The top wire should always be hot to prevent animals from leaning over and pushing the fence. As well, a predator fence should always have a hot bottom wire. Always position one hot wire at shoulder height of the animal to be controlled.

Portable or Temporary Electric Fence

Posts can be spaced every eight to 25 m, depending on the terrain, and the wire should be tight enough to be straight.

When first setting up a temporary fence, check the voltage as far from the charger as possible. It should not be less than half what it was before the fence was connected; if so then a more powerful charger may be required, assuming the ground system is functioning properly.

Required number of wires

The number of wires along the fence line will depend on the livestock type, as well as the individual herd (see Table 1). Many cattle herds require only two or three strands of high tensile wire along the

perimeter, and one strand for the interior fence line. Sheep require more lines because their insulating wool allows them to easily squeeze between the wires. Exterior fences can be as few as five or six lines, but increase the number if there is a high predator presence. The number of lines used on interior fences can be as few as three, as long as there is a heavy enough charge and the animals are rotated often.

Livestock Type	Number of wires	Wire height (cm)	Minimum voltage
Cattle	1 - 2 (int) 3 - 4 (bdry)	81 - 106	3,000
Sheep, goats	3 - 5 (int) 5 - 6 (bdry)	46 - 61	5,000
predators	6 - 9 (bdry)	120 +	5,000

Fig. 3. Suggested permanent electric fence heights for various livestock classes (int= interior; bdry= boundary)

Fig. 4. Two strands of high tensile wire can contain most cattle herds. Always string fence wire on the inside of the fence.

Choosing a fence energizer:
Be sure to install an energizer that is suited to the type of livestock being fenced. Purchase a charger from a reputable dealer who understands the complexities of electric fencing and the grounding requirements. In general, impedance energizers are a better choice because they increase the shock through the line if vegetation touches the fence. Solar or battery operated energizers are useful in remote locations, but can be more expensive and require more maintenance. Also, theft may become an issue.

Pulse rate and intensity are important for safety. The pulse should be very intense and last for only 0.0003 seconds so fire risk is greatly reduced. Energizers with short pulses are called low impedance energizers and are more expensive but worth the money. Avoid energizers with 0.003 to 0.03 second pulses. The longer pulse time allows heat to build up and can potentially create arcs.

Installing the energizer
- Choose a central location, install under shelter;
- Use insulated cable designed for electric fences to run power to the fence (do not use household or industrial insulated cable which is rated for only 600 volts);
- Be sure that hot and ground wires do not touch buildings;
- Install lightning protection devices and a good ground system;
- Before connecting the fence, test the energizer with a voltage meter for later comparison if heavily loaded or shorted out.

Installing the Ground System

The majority of electric fence failures are due to a poor ground system. It is imperative that it is installed correctly so that the circuit can be easily completed (Fig. 1).

Set up the ground rods:
- A minimum of three, 2m rods (in order to reach permanent moisture) should be used with a minimum of 3m separation between each.
- Using at least three rods and spacing them will increase the chance of the circuit being easily and quickly completed. More are required for very long fence lines.
- Choose an area that is normally damp and avoid covered areas (so not in or right beside a barn).
- Keep a minimum of 15m from a utility ground rod, underground telephone or power cable, underground water pipe or milking parlour as this could cause stray voltage. Check with the utility companies before you dig.
- Attach insulated cable or bare 12 ½ gauge wire with a ground rod clamp to the ground rod farthest from the charger. Run the wire to the next rod and attach it with a clamp, repeat for the last one and then attach the wire to the ground terminal on the charger.
- **Test the ground system** with a volt meter that reads down to 100 volts. Measure the ground

wire between the energizer and at least one m from the first ground rod: **if more than 200 volts is measured more ground rods are required.**

By alternating the ground and live wires on the fence, when an animal touches both wires at the same time the circuit is completed. Note that the ground wire in the fence can easily short out the system if conductive material joins both wires. Make sure to keep the fence clear of vegetation.

Corner and Gate Braces

In order to properly hold up the fence, gate and corner braces must be constructed correctly. The most common design is the "H" brace (Fig. 5):

- All posts must be large: 15 cm in diameter and 2.5 m long;
- End posts go in the ground at least one m and are placed no less than 2.5 m apart;
- For strength, a horizontal crossbar is spiked between the brace and end posts and a guy-wire is attached to the brace post under the crossbar to the bottom of the end post; it is tightened with a tension device left on the wire;
- Fences with more than five wire strands require a double H brace and fences over 200 m long require mid-line braces.

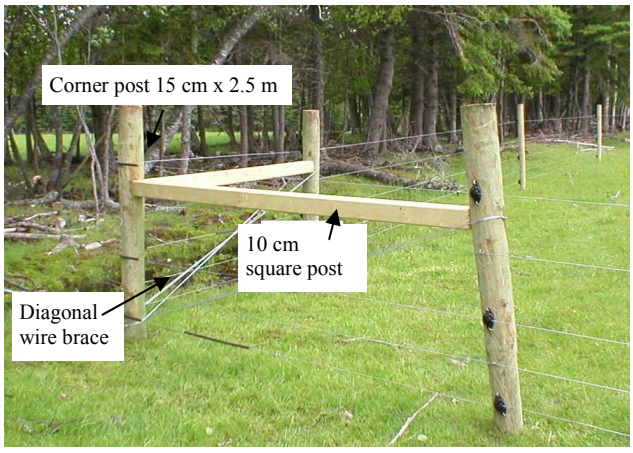


Fig 6. An example of a corner design.

Gates

Always run electricity under a gate using heavy duty insulated cable which can be run through a plastic pipe. If the gate itself is electrified, connect it so that it is unpowered when unhooked. This way it will not drain the power from the fence when laying on ground.

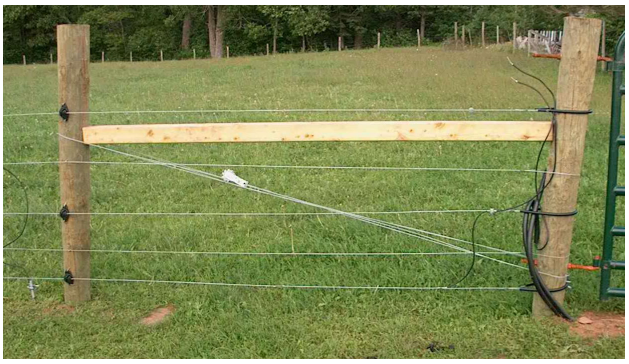


Fig 6. When setting up gates, an 'H' brace should be used for correct fence support, and run the charged wire underground to avoid equipment from damaging it.

General Fencing Tips

Tips for Cattle:

- Perimeter fence: 2-4 strands is sufficient.
- Height of permanent fences should be 1 m; wires spaced about 30 cm apart.
- Interior fence: 1-2 strands is sufficient.
- Height of temporary fences should be no less than 90 cm; wires spaced about 30 cm apart.
- Voltage should be at least 3000 volts to hold all classes of cattle in.

Tips for Sheep

- Since sheep are more insulated, a ground return system may work better to increase the amount of shock delivered.
- Perimeter fence: 5-6 strands is sufficient
- Wire spacing of permanent fence: bottom 3 are 15 cm apart, upper wires are spread 25 cm and 30 cm, respectively.
- Interior fence: 2-4 strands is sufficient.
- Wire spacing of temporary fence: bottom 20-30 cm off the ground, and others separated by 30 cm.
- For added predator protection, increase the number of wires. Another option (though harder to maintain) is to install a low, electrified offset wire around the exterior of the perimeter fence 30 cm out and 15 cm off the ground.
- Voltage should be a minimum of 5000 volts to effectively deter sheep from pushing through.

Remember that visibility and power is more important than height to control animals

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