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High Tensile Permanent Electric Fence, Planning and Design

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Electric Fences are cost effective and easy to use, relatively simple to install, and efficient at controlling livestock. Therefore, electric fences are a great option for grazers, farmers, and gardeners alike (Beetz & Rinehart, 2010). High tensile wire is less expensive and more versatile than barbed wire or mesh wire fences. They are also strong, long lasting, and user-friendly (Edwards & Chamra, 2012). The versatility of high-tensile wire allows farmers to build a fence that meets their needs, making electric fencing with high-tensile wire the ideal type of fence for 'management-intensive grazing' (Beetz & Rinehart, 2010). This type of fence provides a physiological barrier as well as a physical barrier that improves the ability to keep animals in a specific area for a specific amount of time, allowing the rancher to better manage their livestock and land. This fact sheet provides detailed information about planning and designing a permanent electric fence.

Item	Woven Wire	Barbed Wire	Hi Tensile Non-Electric (8-strand)	Hi Tensile Electric (5-strand)
Estimated useful life (yr)	20	20	25	25
Average annual maintenance (% of initial cost)	8%	8%	5%	5%
Depreciation	$128	$97	$65	$47
Interest on investment (4%)	102	78	65	47
Maintenance	204	156	182	59
Total cost/foot/year	$0.33	$0.25	$0.16	$0.12

Table 1. Annual average ownership cost by fence type (Based on a 1,320 foot fence) (Edwards & Charma 2012).

Planning and Design of High Tensile Permanent Electric Fence

Step 1: Determine location of fence.
Use *Google Earth*, *Google Maps*, or an aerial photograph to plan the fence design. *Google Earth* is especially helpful because a ruler tool can be used to accurately measure distances. This will help inform important decisions such as where to put gates, alleyways, or watering sites, as well as help estimate the amount of materials needed to complete the project.

Figure 1: Google Earth screen shoot of new pasture to be fenced (outlined in yellow lines).

Step 2: Choose a grounding system for fence:
An energizer has an output terminal which pushes electric current onto the fence and an input terminal which receives electrical current from the grounding system. The fence is essentially an extension of the output terminal and the grounding system is essentially an extension of the input terminal. For electricity to travel from the fence system (output) to the grounding system (input) something must bridge the gap that separates the two from each other. When the animal bridges the gap between the electrified fence and the grounding system it produces an uncomfortable shock. This shock trains the animals to stay away from the fence. There are a couple of options when choosing a grounding system for the fence: a ground earth return system, a fence return system, or a combination of both systems.

A **ground earth return system** uses a grounding bed consisting of multiple metal rods that are driven into the soil and are connected to the input terminal on the charger with a metal wire. The electrical circuit is completed when an animal, or anything in contact with the ground, touches the fence. The animal acts as the bridge allowing the electrical current to flow from the output system to the input system resulting in an unpleasant shock in the process.

A **fence return system** does not require a grounding bed, but rather uses wires on the fence itself as the extension of the input terminal. Each alternate wire on the fence is connected to the input terminal, while the other wires are connected to the output terminal. For the electrical circuit to be completed in this system, an object must make a connection between one of the output wires and one of the input wires. These systems are ideal in dry, rocky, sandy, or otherwise non-conductive soils. If the soil is non-conductive a ground return system will not work because it depends on the conductivity of the soil to complete the circuit from the fence to the grounding rods in the soil.

It is also possible to use a combination of both systems where the input wires on the fence are connected to a grounding bed before returning to the input terminal. Using a dual system can be an advantage if the soil is moist and conductive

because the circuit will still be completed if an animal touches an output wire only, resulting in a shock. In addition, if the soil dries out and is non-conductive, the fence will still be effective. This type of dual system is ideal in areas where soil conductivity is good enough for a ground earth return system part of the year but dries out and becomes non-conductive for a portion of the year.

Step 3: Determine the type of animals that will be managed by the fence

Are you trying to keep livestock in, wildlife out, or both? These questions are important to answer at the beginning as they will determine the amount of wires the fence should have, as well as the ideal height and spacing for those wires. Consider the average height of the animal you plan to control. The animals should not be able to step or jump over the wire(s), nor should they be able to duck under the wire(s).

It is also important to consider the size of the animal's head. The wires should be spaced tight enough so that the animal cannot easily stick its head through the wires. Installing a fence for wildlife will require other factors to be taken into consideration. Individuals should learn about the unique behaviors of the animals they are trying to fence out. Individuals may want to take extra precautions for fences located next to busy roads or other potentially hazardous places. In addition, it is important to check with city or county officials for specific fencing regulations to ensure that you are in compliance.

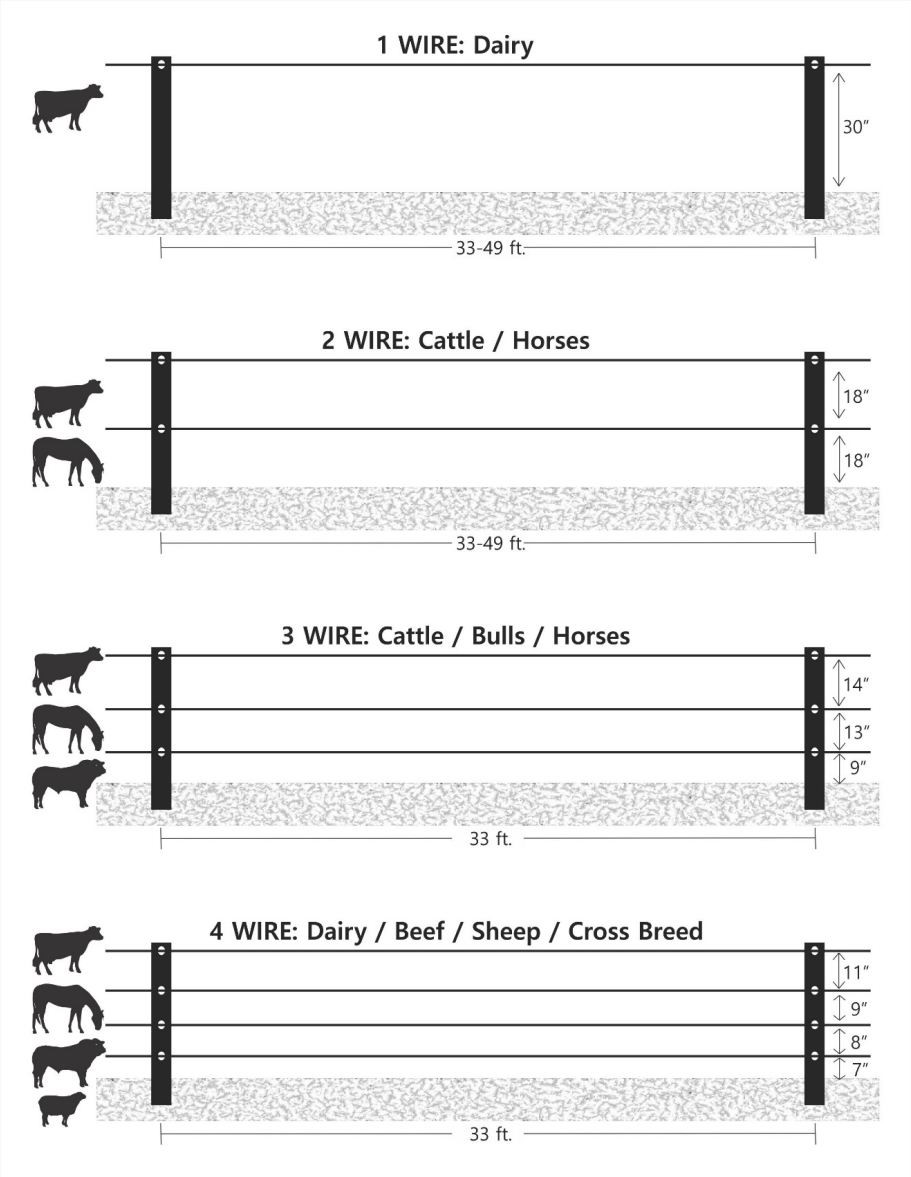

Figure 2: Ideal wire spacing for livestock (Staffix, n.d.).

Step 4: Choose an energizer.
Once you know how large your fence is going to be and how many wires it will have, you are ready to select an energizer. As a general rule, one joule of output is sufficient for every mile of fence (Gerrish, 1999). However, it is probably a good idea to contact a reputable electric fence dealer to hear their recommendations. They work with farmers all over the country and will likely be able to help you find the ideal energizer for your needs.

High Tensile Fencing Materials (2019 Prices)	
Energizer – 3 joule ($230)	Digital Voltmeter ($32)
High Tensile Wire - 12.5 Gauge ($98/4,000')	Spinning Jenny ($80)
Corner and End Post – 8'X4" ($9)	Post Driver with Spring ($40)
Intermediate Posts – Composite ($6)	Pilot Driver for Composite Post ($110)
Aluminum Tube Gate – 10ft. ($85)	Strainer Tightener ($5)
Spring Gate – 24 ft. max. ($13)	Crimp Tool ($55)
Grounding Kit ($40)	Electric Fence Sign ($1.50)
Lightening Diverter ($8)	Brace Pin ($0.66/12")
Wraparound Insulator ($50/100')	Barbed Staple ($2.75/lb)
Insulated Wire -12.5 gauge ($21/100')	Cotter Pin ($7.50/100 pack)
Strainer with Spring ($4)	Open Tap Crimp Sleeves ($5/15 pack)
Double U Insulator ($8/10 pack)	Crimp Sleeve ($14/100 pack)
Pinlock Insulator ($8/25 pack)	

Table 2: Fencing tools and materials (Kencove, 2019).

Summary

Developing a comprehensive high tensile electric fence plan will ensure your fence is built in the right place for the right reason and make the installation and electrification of the fence go smoothly. Having a solid high tensile electric fence plan will give you the added confidence to properly install and electrify the fence. This will ensuring a firm fence that will control animals efficiently and reliably for many years and aiding in improved sustainable grazing management practices. This is the first High Tensile Electric Fence fact sheet in a series. The other USU Extension electric fence factsheets in this series include: High Tensile Electric Fence Instillation and High Tensile Electric Fence Electrifying the Fence. A review of these fact sheets will greatly increase the readers understanding of High Tensile Electric Fence design and construction.

References

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