

Permanent High-tensile Wire Electric Fence, Installation and Maintenance in Mountainous Region of Southwest China

Bin Luo¹, Xinghong Dai¹, Li Li², Xuedong Yang^{1,*}

¹Guizhou Extension Station of Grassland Technology, Guiyang, Guizhou, China

²Guizhou Vocational College of Agriculture, Guiyang, Guizhou, China

*Corresponding author

Keywords: High-tensile wire, electric fencing, installation, maintenance

Abstract: High-tensile wire electric fence is an effective facility for long-term management of grassland and grazing livestock, with advantages of cost effective, easy to install and maintain. Building a high-tensile wire fence that will provide years of service requires proper installation and maintenance. This paper introduces the important installation and maintenance steps to follow to ensure a durable high-tensile wire electric fence in mountainous region of Southwest China.

1. Introduction

Fences can protect grassland or manage livestock by presenting barriers to restrict animal movement. Barriers may be physical, psychological, or a combination of both. Making electric fencing with high tensile wire is the ideal type of fence for ‘management-intensive grazing’ [1]. High tensile wire fence can be used as a physical barrier and it is easily electrified to create a psychological barrier. They are also strong, long lasting, and user-friendly with less than half the annual maintenance cost as either a non-electric barbed wire fence or a mesh field fence [2].

Grassland animal husbandry in Southwest China is developing rapidly, and many farmers have been used electric fences for the management of grazing livestock. However, due to improper installation or inadequate maintenance, there are problems of short service life and high maintenance cost of electric fence, resulting in low economic benefits. Here we summarize the important steps for the installation and maintenance of high-tensile wire electric fence suitable for Southwest China, hoping to improve the economic benefits of electric fences in this area.

2. Planning and design of permanent high-tensile wire electric fence

2.1. Location of fence

The line of fence construction is planned by UAV aerial photography, and the distance is measured by GPS to determine where to put gates, alleyways and watering sites. Once the fence boundary is established, remove brush, loose rocks, trees, and tall grass from the fence line. When the fence line is well cleared in advance, the construction time of the fence can be effectively

reduced.

2.2. Style of fence

According to the type of livestock that will be managed by the electric fence, determine the number of wires that the fence should have, as well as the ideal height and spacing of these wires. The design height of the fence is 950 - 1200 mm. 3-wire fence is selected for large livestock and 5-wire fence is selected for small livestock. The distance between two wires should be ≥ 150 mm.

The recommended requirements of fence design for common livestock (Table 1, figure 1). When used to manage mixed livestock, the fence height should be suitable for large livestock, and the number of high tensile wires should be suitable for small livestock. Prepare materials of corresponding specifications and quantities according to the measured perimeter of the fence and the selected fence style.

Table 1: The number of wires and fence height for different livestock

Livestock	Fence Height(mm)	Number of Wires
Sheep, Goat, Pig	950	5
Cattle	1050	3
Horses	1200	3

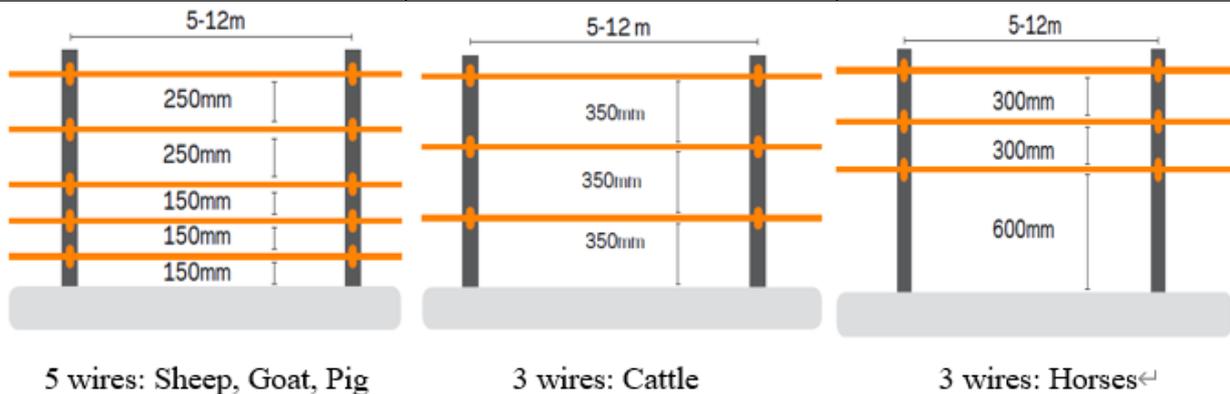


Figure 1: Ideal wire spacing for different livestock

3. Install posts

3.1. Strainer posts

Strainer post, including end, corner and gate post, need to be sturdy enough to bear the pressure exerted by the wires. Typically the wire tension is between 200 and 250 lb. of pressure [3]. Therefore, they should be sufficiently strong, buried adequately deep, and be appropriately braced.

The strainer posts should be vertical to the ground, and the above ground part should be 50 - 100 mm higher than the design height of the fence. The distance between each two strainer posts is 30 ~ 50 m. If there are obstacles, gullies, etc. within 50 m, which make the direction of the fence change greatly, additional strainer post should be added here. The pit for burying posts should be as small as possible, with the length (perpendicular to the direction of the fence) ≤ 500 mm, the width ≤ 300 mm, and the pit wall vertical to the ground. After digging the pit, tamp the strainer posts into the soil with a pile driver.

Bury bedlogs. Bedlogs should be buried in the soil on both sides of the strainer posts, perpendicular to the direction of the fence wire, to reinforce the strainer posts, and to increase the bearing capacity area between wires and strainer posts. Bedlogs should be sawed into two pieces

from the middle of the cross section with logs whose diameter is not less than strainer posts, and then cut into wood sections with a length of ≥ 400 mm, and buried on both sides of the strainer posts perpendicular to the direction of the fence, with a buried depth of 200 - 300 mm underground.

Treatment of special circumstances: (1) when installing strainer posts in soft soil areas, filling materials such as stones and logs can be appropriately stuffed to stabilize the posts. (2) When installing strainer posts in shallow soil areas, concrete can be used to fix the posts. (3) For strainer posts in areas where piles are difficult to fix, easy to damage or poor stability, should bury braces in the direction of force or ground anchors in the opposite direction of force.

3.2. Intermediate posts

As a general rule 5-12 m between intermediate posts is an appropriate spacing, the specific distance is determined according to the actual situation. Rolling or hilly terrain may require closer spacing and level or evenly sloped terrain may allow more distant spacing. In order to ensure that the intermediate posts are in a straight line, a fence wire can be tied to the bottom of the two strainer posts and tensioned, and the intermediate posts can be installed with this wire as a reference.

4. Hang high-tensile wires

Mark the position of insulator or strainer corresponding to each high tensile wire on the strainer posts according to figure 1. Connect the two ends of the high tensile wire to the corresponding insulator and strainer of the two end posts respectively. Hang the high tensile wire on the corresponding position of the intermediate posts with clips, and finally tighten the wire with strainers.

5. Install underground wires

Buried wires need to be insulated and buried deep enough to prevent damage from animals, heavy machinery or tillage implements. We recommend burying underground insulated wires at least 300 mm deep. The insulated wire should be parallel to other power supply lines, and keep a distance of more than 100 m. If the insulated wire inevitably intersects with other power supply lines, it should be crossed as vertically as possible. Finally, peel off the insulation layer with wire stripper to expose the metal wire, tightly connect the underground wire with the wires on the fence using wire clamps, and cut off the excess wire.

6. Install energizer

AC type and battery type Energizer should be installed in relatively dry buildings with power supply near the fence to avoid external force damage. The distance between the energizer and the grounding system of other power supply systems should be ≥ 20 m. Solar type energizer should be installed in the open air near the fence without any shelter. One joule of output can usually be supplied to per mile of fence [4], so the number of solar type energizer and the capacity of solar panels can be selected according to the length of the fence. The lead-out wire is led out from the output terminal and connected to the double insulated high voltage cable. Ground rods are connected to the energizer input terminal with ground wire, and the ground rods should be buried in moist soil at least 500 mm deep.

7. Install gates

The gate post should be sturdy enough to bear the weight of fence gate. The width of the fence gate should ensure the free access of farm machinery. If the gate needs to be energized, A power switch should be added nearby to control the energization of the gate.

8. Hang warning signs

The warning signs should be hung on the fence along the highway and sidewalk at least every 90 m. The warning sign should be made of PVC, with length ≥ 200 mm, width ≥ 100 mm, thickness ≥ 1.2 mm, and the protection grade is not lower than IPx4. It is recommended to use striking yellow as the background color of the warning board, and use black font to mark the words "high voltage danger" and "electric fence" with a font height of not less than 25 mm.

9. Power-on test

9.1. No-load test

Disconnect the lead-out wire and the ground wire from the terminals on the energizer. Check the no-load voltage on the energizer, if the voltage is lower than the manufacturer's specifications, then there is an issue with the energizer.

9.2. Load test

After the electric fence is energized, check the lead-out wire and fence-line. If there is an abnormal voltage, it is necessary to check whether there are heavy vegetation growing on the fence, broken wires, poor insulation and bad connections.

10. Maintenance

In order to ensure the normal use and prolong the service life of the electric fence, the electric fence should be maintained regularly according to the following aspects: (1) Clean the vegetation around the fence. (2) Check the looseness of fence wire and posts and deal with it in time. (3) Check the lead-out wire and fence-line. If there is an abnormal voltage, find out the cause and deal with it in time. (4) If using a solar or battery energizer, it is also necessary to check and maintain the batteries.

11. Summary

As long as it is properly installed and maintained, the high tensile wire electric fence can serve for more than 20 years. During this period, it only costs less than half of the maintenance cost as either a non-electric barbed wire fence or a mesh field fence, and grazing livestock can be better managed.

Acknowledgements

This work is supported by Guizhou Province Science and Technology Support Program of China (Qiankehezhicheng [2021] Yiban 143).

References

- [1] Beetz, A. E., & Rinehart, L. (2010). *Rotational Grazing*. National Sustainable Agriculture Information Service.
- [2] Edwards, W., Chamra, A., Mayer, R., & Olsen, T. (2012). *Estimated costs for livestock fencing*. Iowa State University Extension and Outreach, 1-4.
- [3] Palmer, M., Thacker, E., Cromwell, S., Heaton, K., & Carter, K. (2020). *High Tensile Permanent Electric Fence, Installation*.
- [4] Gerrish, J. (1999). *Fence systems for grazing management*. Missouri Grazing Manual, 89-99.