Electric Fence for Feral Swine: Materials, Installation Guidelines, & Maintenance

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Modern swine (*Sus scrofa domestica*) were domesticated 9,000-10,000 years ago in Asia Minor and central China. Swine are now found on farms throughout the world, either held in pens or allowed to free-range to forage. Modern swine are the descendants of wild hogs (*Sus scrofa scrofa*) also called wild boars, razorbacks, piney woods rooters, Russian or Eurasian boars, and feral swine. Feral swine are domesticated pigs that have escaped or were released from captivity. After three (3) generations in the wild, domesticated pigs changed color, snouts became elongated, and took on a different appearance from domesticated relatives.

In the United States, feral swine are considered invasive and have caused damage to environmental, cultural, and historic sites across the nation. Economic damage, such as the destruction of agricultural crops, increased soil erosion, destruction of habitat, and spread of diseases (Mayer and Brisbin, 1991) have steadily increased with the spread of feral swine. The United States Department of Agriculture (USDA) 2018 indicated thirty-five (35) states have established feral swine problems with an estimated population that exceed six million (6,000,000) pests. Pimental et al. (2005) reported feral swine caused approximately 800 million dollars ($800,000,000) in damage for livestock producers, farmers, and wildlife managers. In 2018, USDA indicated feral swine now cause up to 1.5 billion dollars ($1,500,000,000) in damage and control efforts in the United States each year.

Because feral swine reproduce rapidly when compared to other wild ungulates (Taylor et al., 1998) and can withstand intensive harvesting when hunted (Giles, 1980), swine are capable of overpopulating areas in a short period of time (Barrett and Birmingham 1994). One mature female can start reproducing at seven (7) months old, with up to twelve (12) piglets per litter, and with one and a half (1.5) litters per year.

In Guam, early Spanish colonizers probably introduced domestic swine (S. scrofa) from the Philippines to the Marianas between 1672 and 1685 (Intoh 1986). Since introduction to Guam in the 17th Century, domestic pigs have escaped and established large populations throughout the island. In Guam, as in the United States, uncontrolled feral swine are so prolific and elusive, elimination is exceptionally difficult (Bach and Connor, 1997).

Agricultural crops, such as taro and watermelon were reported to be damaged by feral pigs in the areas of Inarajan, Malojloj, Dandan, Talofofo, Bubulao, Cross Island Road, Barrigada, Dededo, and Yigo (Conry, 1988). According to the 2017 Production Agriculture Review on Guam, forty-one percent (41%) of commercial farmers indicated negative impacts from feral swine, which made it the most common pest of 2017. Because feral swine have the capability to destroy valuable crops and property in one visit, agricultural and environmental damage will continue to increase as feral swine flourish (Seward et al. 2004). This guide offers site management recommendations for on farm feral swine control with the use of electric fencing.

The electric fence has been traditionally utilized to keep livestock confined to a given area. Current natural resource managers and agricultural producers are looking towards innovative exclusion tools, like the electric fence, to minimize the damage caused by

rapidly expanding feral swine populations (Reidy et al. 2018). The information given in this publication are materials, costs, installation guidelines, and maintenance involved with feral swine prevention using the electric fence.

Electric Fencing Materials & Installation Guidelines

Materials used for the initial project were based on availability on Guam, ease of construction, and economic viability. Most hardware stores in Guam can assist with ordering online to make materials available.

Energizer

Energizers are the most important component of an electric fence. An energizer is responsible for electrifying the barrier between crops and unwanted pests. Choosing the proper energizer is imperative to provide appropriate voltage for the needed perimeter. A low-impedance energizer with a minimum output of five 5,000 volts is adequate. A sufficient energizer, when properly installed and maintained, will provide multiple years of service as protection for property, products, and investments.

Distance range is indicated by the manufacturer and is measured by miles and/or acres. The measurement is based on using a single wire system. If more wires are intended for use, divide the distance range by the number of wires planned. This ratio allows an accurate amount of coverage for an electric fence with multiple wires. Another factor to consider is future expansion of coverage. If expansion is intended, purchase an energizer that will cover the current area and intended expansion area.

Most importantly, read the manufacturer's manual of the energizer purchased thoroughly before installation. The manufacturer's recommendations are important for fence construction, fence placement, grounding rod placement, other components of operation, and electrical hazards involved. Some manuals have tips for easier installation and troubleshooting recommendations if the energizer is not working properly. The manufacturer's warranty is important information that can be found in the manufacturer's manual as well.

Energizers can be powered by electric plug, battery, or solar panels. Each can be suitable for the proper situation. For the pilot project, solar energizers were chosen to account for lack of access to outlet power, ease of maintenance, and cost effectiveness. All solar energizers were available or able to be shipped to Guam.

Solar Energizers

Material	Cost ($)	Range (Miles)	Output (Voltage)
Fi-Shock 2 Mile Energizer	$120	2	8,000
Patriot SolarGuard 50 Energizer	$120	3	8,500
Patriot SolarGuard 155 Energizer	$174	10	10,000
Zareba Solar Energizer	$176	10	7,500

Source: Hardware stores in Guam. 2019

Fence Posts

Fence posts most used for permanent electric fencing are wood, steel, and fiberglass. A general post height of three (3) to five (5) feet is sufficient. The recommended post spacing for permanent electric fencing is fifteen (15) to thirty (30) feet.

In hilly areas, spacing between posts can be even closer than fifteen (15) feet. Place a post at the top of the hill and at the bottom of the hill for the fence wires to follow the contour of the land. This is to ensure the fence will not have any large gaps for the swine to dig under. Spacing is also dependent on the weight of feral swine placing pressure on the fence and soil depth. Steel "T" posts and rebars were chosen for cost effectiveness, ease of access, and low maintenance.

Fence Post Materials

Material	Cost per Piece ($)	Expected Life (years)	Maintenance
5′ T-Post	$5	25-30	Low
4′, 3/8″ Rebar	$3	15-20	Medium
Wood (Treated)	Unavailable*	10-30	Very Low
Fiberglass (Heavy-duty)	Unavailable*	25-30	Low

Source: Hardware stores in Guam, 2019. Fencing for Livestock Systems.

Fencing Wire

Fencing wire is used as a physical barrier to keep unwanted pests out of the production area. When contact

with a properly electrified fence is made, the shock received will affect the pest's nervous system. The result is learned behavior that deters pests from coming back to the area.

Permanent electric fence wire is usually made from galvanized steel or aluminum. However, galvanized steel is recommended since the ability for feral swine to snap aluminum wire is higher. Another factor in choosing proper fencing wire is thickness, which is measured by gauge. A lower gauge number indicates a thicker wire. A proper gauge for electrical fencing is gauge eight (8) to fourteen (14). It should be noted that electrical conductivity decreases as the wire gauge increases. For large, fenced areas in Guam, the recommended thickness is 12.5-gauge or lower to maximize the voltage output of the energizer. For smaller operations, which are more common in Guam, the 14-gauge wire is sufficient.

Another factor with galvanized wire is that its zinc coated to prevent rust. Class I galvanization is the thinnest coating and provides the least amount of protection from rust. Class III galvanization is the thickest zinc coating and provides the highest level of rust protection. For agriculture production on Guam, Class I galvanized wire is the most readily available and was used for the pilot project areas.

Electric fences are most made with a two-wire system, but one (1) to three (3) wires can be used. Swine tend to root and dig to push under barriers, which makes a low wire important. Fence construction in the pilot project used a two-wire system with a low wire, six (6) to eight (8) inches above ground and another wire fifteen (15) to twenty (20) inches above ground that proved sufficient. The top wire was placed to contact the chest or nose of an adult pig, while the bottom wire was placed to contact a piglet, or any attempt to dig into the fenced production area.

Fence Wire Materials

Material (Class I Galvanization)	Cost per Piece ($)
14-Gauge Steel Wire (1/4 Mile Spool)	$39
12- Gauge Steel Wire	Unavailable*
8-Gauge Steel Wire	Unavailable*

Source: Hardware stores in Guam, 2019.

Grounding System

An electric fence is comprised of the energizer, fence posts, fence wires and the ground system. The ground system consists of rods that are pounded in the soil and wired back to the energizer. When the animal touches the electric fence the electric current flows from the energizer through the fence wires, through the animal, into the moist soil, to the ground rods and back to the energizer. This complete network or electric circuit provides sufficient shock to deter animals that contact the electric fence. Improper grounding will usually lead to an insufficient shock to animals that encounter the electric fence. The most common installation method for a ground system is to hammer a minimum of three (3), six (6) foot grounding rods at least five (5) feet into the ground. For shallow and/or rocky soils, driving grounding rods at a forty-five-degree (45°) angle will gain the most contact with soil. A distance of at least ten (10) feet between ground rods creates a higher probability of contact with moist soil. For best approach, simply follow directions from instruction manual provided by the manufacturer. Three (3), two (2) foot grounding rods were used for the pilot project because of known shallow soils in Guam, which proved to be sufficient.

Grounding System Materials

Material	Cost per Piece ($)
2 Ft. Complete Grounding Kit	$28
3 Ft. Complete Grounding Kit	$30
6 Ft. Complete Grounding Kit	$45

Source: Hardware stores in Guam, 2019.

Other Materials Needed

Electric fence insulators are needed to hold the fence wire in place, while keeping the wire from contacting the fence post. Most common insulators are made of plastic, glass, or porcelain. However, high-density polypropylene or polyethylene plastic can withstand the sun's ultraviolet rays and moisture variability in Guam.

A voltage meter is important to use to ensure the electric fence is working properly. Feral swine usually require 3,500 to 7,000 volts for an effective shock. Voltage meters will indicate whether the fence is within the proper range to deter feral swine.

Electric fence gate handles are needed to gain access to the enclosed production area. Gates should be placed at a corner of the field. Proper planning is needed to ensure all equipment can enter the enclosed area without damaging the electric fence.

Other Materials	
Material	Cost per Piece ($)
T-Post Insulators (25 pcs.)	$4
Rebar Insulators (25 pcs.)	$8
Voltage Tester	$16
Gate Handle	$6
Electric Fence Warning Sign (3 pcs.)	$3

Source: Hardware stores in Guam, 2019.

Maintenance

Once constructed, monitoring the electric fence is important. Repairs may be needed to the wire and/or insulators due to feral swine pressure on the newly erected electric fence. Extra parts should be purchased in case repair/replacements of wire and insulators are needed. Posts may need to be adjusted if feral swine push on fence as the charge hits the pest. However, as the feral swine population learns that the fence is electrified, swine tend to avoid the fenced area.

Keeping the fence free from contact with weeds and grass is also important. Contact with weeds can short the charge and drain the battery, thus making the fence useless. If this happens, shutting the energizer off for twenty-four (24) to forty-eight (48) hours should be sufficient for the battery to charge and work properly when turned back on. Regularly maintain weeds and grass under the fence and twelve (12) inches on either side of the fence. For safety purposes, turn the energizer off before grass maintenance occurs.

For safety reasons if an electric fence is erected on a farm, near a roadway, near or in a suburban area where it is near the public, there should be multiple signs that warn of its existence. These signs must be positioned along the fencing at eye level.

With proper monitoring and maintenance, electric fences can deter feral swine from entering the fenced area. In turn, effectively protecting property, equipment, and products from destruction and loss. For additional information on electric fence for production agriculture, visit [CNAS url].

For further information

Contact the University of Guam, Cooperative Extension and Outreach at 735-2080 for help or more information. Additional publications can be found on our website at: uog.edu/extension/publications.

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