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Electric Fence Designs for Deterring White-tailed Deer

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Figure 1. White-tailed doe looking for food in a backyard garden.

White-tailed deer (*Odocoileus virginianus*) are adapted to many diverse habitats and environments, including cohabitation with people. Increasing numbers and severity of encounters between deer and people have become a pressing issue. According to the Insurance Information Institute (2018), one of every 167 drivers in the United States is expected to make an insurance claim resulting from a deer-related vehicular accident. Deer and the damage they cause leads to frustration and economic loss among homeowners, gardeners, and farmers (Figure 1). Deer will consume and destroy produce, ornamentals, seeds and seedlings, and grain crops.

Deer may pose a serious threat to the produce industry, home growers, or consumers if fecal contamination occurs on fruits, vegetables, and culinary herbs and if that produce is consumed raw. Outbreaks of E. coli, listeria and other pathogens have resulted in food-borne illnesses traced to fecal contamination of fresh produce by wildlife. The Food Safety Modernization Act (FSMA) Produce Safety Rule established science-based, minimum standards for minimizing microbial contamination of fresh produce. This rule applies to some farmers. However, home growers and all farmers can take a variety of steps to minimize the chance of microbial contamination from wildlife. These steps include conducting a pre-harvest assessment to look for signs of fecal matter or damage from animals, training of farm workers to recognize contamination, and steps to minimize animal intrusion (i.e. deer fencing).

Fencing is one component of an integrated pest management strategy to manage deer intrusions. Other methods are repellents, modifying habitat to be less attractive to deer, and population reduction. Allowing hunters to remove deer may not eliminate all damage, but having fewer deer at a location typically correlates with less damage. Using several methods at once is better than using one method alone. Deer learn behaviors from other deer, such as the means to encroach a fence. Legally removing these individual nuisance deer is recommended to improve fence effectiveness.

A number of fence designs have been tested experimentally. The simplest and most cost effective is a "natural" fence. Natural barriers can be created by building brush piles in the deer's path. Deer are creatures of habit often with set pathways. Blocking their route with brush piles can reroute them away from a produce

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field. Eventually natural fences will need to be replenished as old material decays. Adding a traditional fence with a natural diversion increases the effectiveness of exclusion.

Traditionally constructed fences should be at least eight feet in height and continue to ground level to keep most deer from jumping over. Deer will push through or crawl under barriers and can fit through openings as little as 10 inches wide.

A shock from electrified fencing is an additional incentive to deter deer from entering a crop field. A properly constructed and managed electric fence can be employed to modify deer behavior and condition them to avoid gardens and produce fields. The negative reinforcement of a shock trains deer to avoid the barrier. Check local laws first before constructing an electric fence.

A simple tactic to improve effectiveness of electric fencing is tying brightly colored plastic flagging onto a fence at a deer's eye-level. A flag's random movements in the wind, combined with a deer's unfamiliarity, may initially frighten and deter them from breaching the fence. Flagging can also aid deer in perceiving barriers such as a thin electric-fence wire.

Deer have a higher internal resistance to electricity than most animals due to their body shape, small hooves, and hollow hair. To condition deer for fence avoidance, consider baiting the wire with peanut butter applied to strips of aluminum foil hung in 20 to 40 foot intervals. In hot weather, make a cup on one end of the aluminum foil to hold the melting peanut butter in place and wrap the other end around the wire. Deer will bump their noses on the electric wire while smelling the peanut butter, ensuring they receive a shock and learn to avoid the field.

The Deer Shock Depot (2019) recommends only a 2,500-volt shock for repelling deer when targeting the nose or tongue but a stronger shock of 4,000 volts when targeting the body or hair. A minimum of 5,000 volts should be maintained with the two-layer electric fence design.

When comparing fence designs, factors to consider are your acceptable level of protection and whether a temporary or permanent fence is preferred. The level of protection you need may not require 100 percent exclusion of deer. A temporary fence which can be moved to protect smaller areas of vulnerable crops may repel most deer and be more cost-effective than a permanent fence. Consider motivating factors for deer encroachment and deer behavior in your area. Permanent fencing may be necessary when deer populations are high and all deer must be excluded. The following examples of fence designs range in ease of application, protection level, cost, and maintenance.

Two-Layer Electric Fence Design

Temporary electric fencing which uses step-in posts and braided wire is relatively easy to set up, portable, reusable, and cost effective, especially for smaller field sizes of less than one acre. The two-layer electric fence design (Figure 2) consists of two separate wire fences spaced approximately three feet apart. The innermost fence has two wire strands: a lower strand 10 inches above the ground and an upper strand 24 inches above the ground. The outer fence is one strand, 18 inches above ground. In some designs, the two wire strands are on the outside and one strand on the inside.

Figure 2. Corner of the two-layer fence protecting a turf demonstration at the Southwest Research and Extension Center in Hope, AR, 2018. Photo by Becky McPeake, University of Arkansas.

This two-layer design creates both a physical and visual barrier with behavioral conditioning from an electric shock (Figure 3). Unlike humans, deer vision is a combination of monocular vision from the sides and binocular vision to the front. A 3-D fence configuration is believed to confuse deer about the appropriate distance to jump over the fence. Tie flags onto the wire to help deer see the barrier. The additional deterrent of an electric shock when coming into contact with the wire physically conditions deer to stay away. Even if the fence's shocking system should become disabled temporarily, the area should remain protected from deer which have learned avoidance.

Figure 3. Doe on the outside of the two-layer fence at the Southwest Research and Extension Center in Hope, AR. Photo by Becky McPeake, University of Arkansas.

Table 1. Demonstrations of the two-layer temporary electric fence at repelling deer from various vegetation by University of Arkansas Cooperative Extension Service, 2019.

Location	Plot Size	Plant	Result	Comments
Faulkner County	50′ x 20′ (15 m x 6 m)	Pumpkins	No damage	Deer were seen around the fields, but no signs of damage in any of the pumpkin patch areas.
Hempstead County	80′ x 80′ (24 m x 24 m)	Purple hull peas	No damage	Complete harvest of peas.
Lonoke County	60′ x 36′ (18 m x 11 m)	Pumpkins	No damage	
Southwest Research & Experiment Station, Hempstead County	225′ x 70′ (68 m x 21 m)	Turf grass trial	50+ piles of deer feces marked outside the fence; 0 piles located inside fence	Trail camera detected one doe broaching fence; skunks, rabbits, and raccoons were detected broaching fence. Vole scat was found inside fence.

Figure 5. Series of photos capturing a doe encroaching two-layer electric fence at the Southwest Research and Extension Center in Hope, AR. The doe was caught on camera leaving the enclosure shortly after. No damage was reported inside the fence. Photos by Becky McPeake, University of Arkansas.

The two-layer electrified fence (Figure 4) has been used in a number of demonstrations in Arkansas (Table 1) with reported reductions in damage, though deer were not 100 percent excluded. In one demonstration, a single doe was captured on trail cameras walking over and through the fence, then exiting the fenced area shortly after (Figure 5).

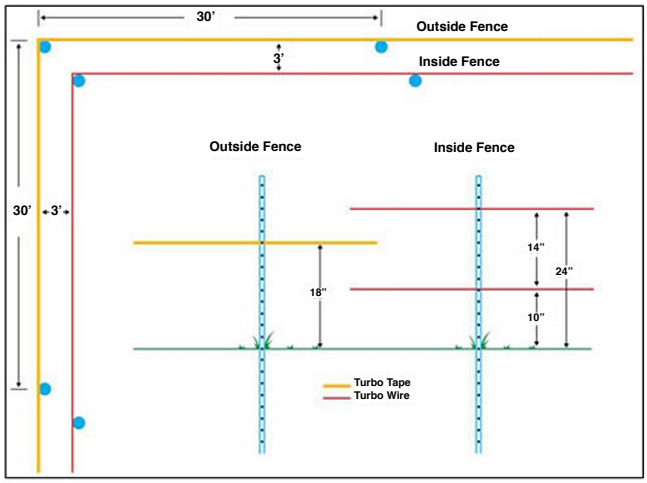

Figure 4. Electrified Two-Layer Wire Fence. Source: www.gallagher.com

Components used in the two-layer temporary electric fence demonstration:

1. A solar energizer with a wildlife setting.
2. A digital voltage meter to check voltage on the fence.
3. Rigid self-insulated posts, used at the corners of the fence.
4. Self-insulated tread-in post, used as the line post to maintain the proper wire height.
5. Turbo braid electric fence wire with a minimum of nine strands of wire filaments. Connect turbo braid to the fence terminal of the energizer.
6. Survey ribbon, tied to the turbo braid to increase visibility.
7. Galvanized ground rod and ground rod clamp. Connect the ground rod to the ground terminal of the energizer.

See the Animal Intrusion video on the University of Arkansas Cooperative Extension Service's website for more information on how to construct the two-layer fence: https://youtu.be/GvIcPOshgic. For more information and for further assistance, contact your local county extension agent.

Electri ied Seven-Wire Vertical Fence

A six foot high electrified vertical fence (Figure 6) is considered the most deer-proof design to exclude deer from larger fields (50+ acres) and are effective in moderate to high deer pressure areas. A variety of materials, wire spacing, and designs can be used when constructing a high tensile fence. A par-tial fence can reduce deer damage occurring primari-ly in an area of a field where deer frequent. One study reported a 13.5 percent reduction in deer damage after constructing a partial high tensile fence with 165 foot perpendicular wings strategically built between deer cover and corn fields ranging from 13 to 30 acres.

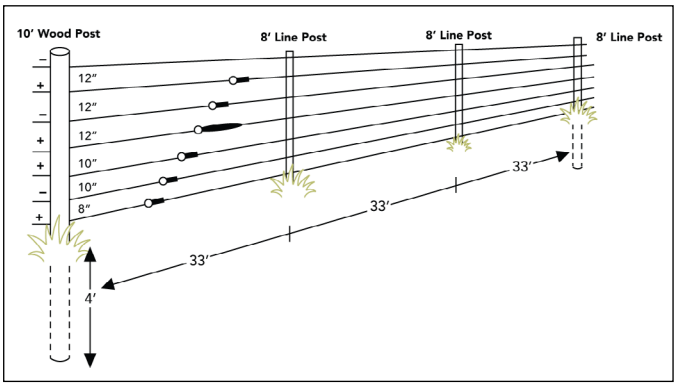

Figure 6. Electrified Seven-Wire Vertical Fence

Steps to buid a electrified seven-wire vertical fence:

1. Install rigid corner assemblies where necessary.
2. String a 12 ½ gauge high-tensile wire around the corner assemblies and apply light tension.
3. Set 8 foot line posts along the wire at 33 foot intervals.
4. Attach a wire to insulators at 8 inches above ground level and apply 150 to 250 pounds of tension.
5. Attach the remaining wires to insulators at the spacing indicated in the diagram below and apply 150 to 250 pounds of tension.
6. Connect the second, fourth, fifth and seventh wires from the top, to the positive (+) post of a well-grounded, low-impedance fence charger.
7. Connect the top, third and sixth wires directly to ground. The top wire should be negative for lightning protection.
8. Clear and maintain a 6 to 12 foot open area outside the fence so deer can see the fence.

Electrified Slanted Wire Fence

A slanted wire fence (Figure 7) combines the strengths of both the two-layer electric fence and the high-tensile fence. The lowest point of the slanted wire fence design is closest to the protected area and the highest wire is outside where deer are present. Like the two-layer electric fence, the slanted design is believed to be a visual barrier, deterring deer from attempting to jump. The lower wires keep deer from crawling under. Optionally, add an electrified line to the outer posts as an additional incentive for avoidance.

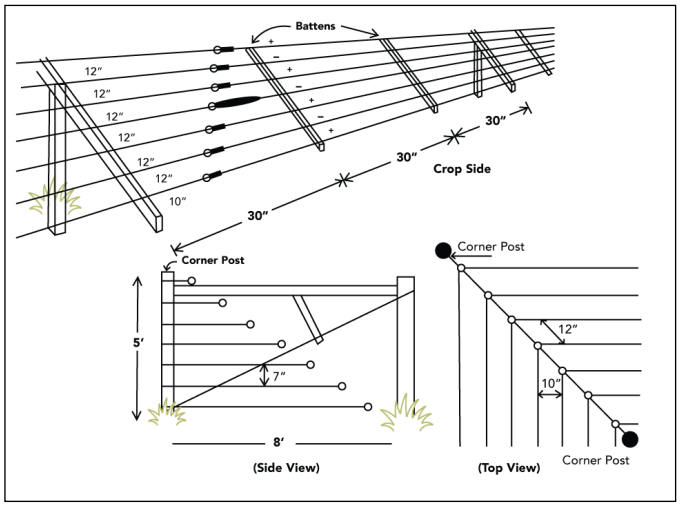

Figure 7. Electrified Slanted Wire Fence

Like other fences, mowing and weed trimming is necessary to keep vegetation and tree saplings from encroaching. With this particular design, herbicide applications may be necessary as the slanted structure may impede mowing and trimming. Any vegetation touching an electrified wire will cause some electricity to leave the line through grounding, which diminishes the remaining joules and voltage for effectively conditioning deer.

Steps to build a electrified slanted seven-wire deer fence:

1. Set rigid, swing corner assemblies where necessary.
2. String 12 ½ gauge high-tensile wire around the corner assemblies and apply light tension.
3. Set angle braces along the wire at 90 foot intervals.
4. Attach a wire at the 10 inch position and apply 150 pounds of tension.
5. Attach the remaining wires at 12 inch intervals and apply 150 pounds of tension.
6. Place fence battens at 30 foot intervals.
7. Connect the top, third, fifth, and bottom wires to the positive (+) post of a well-grounded, low-impedance fence charger.
8. Connect the second, fourth and sixth wires from the top directly to ground.
9. Clear and maintain a 6 to 12 foot area outside the fence so deer can see it.

Summary

A number of electric fence designs can be used to keep deer from entering gardens and crop fields. Electric fences described in this fact sheet are a two-layered electric fence, a seven-wire vertical fence, and a slanted seven-wire fence. The relatively inexpensive two-layer temporary fence was effective in protecting several, but not all, garden and turf demonstration plots. Permanent fencing such as the seven-wire vertical fence offers a higher level of protection for a higher financial investment. A slanted seven-wire design presents both a physical and visual barrier for deterring deer from attempting to jump.

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