



The Role of Fences in Commercial Horticulture and Small-Acreage Agriculture

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Introduction

Fences are used in agriculture to control the timing and intensity of use by domestic grazing animals or to preclude wildlife species that could damage a given crop. This bulletin focus on fences use in crop production to guard against damage and fecal contamination by wildlife. The impact of wildlife such as beaver, elk, deer, raccoons, rabbits, feral burros, javelina, and coyote could be an issue for growers. In areas such as Arizona with limited rainfall, forage diversity is limited, so irrigated cultivated plants may attract wildlife, including field and horticulture crops that are not well protected. Therefore, fencing is crucial for Arizona's crop production, especially among small-scale growers who do not have much to spare. Designing and properly constructing the best fence for the species and abundance of wildlife present is an important decision. In this bulletin, the aim is to highlight the critical roles of fences in commercial horticulture and small acreage operations, including factors to consider in selecting a fence, types of fences available, and associated challenges.

Importance of fence in commercial horticulture and small farms

Fencing helps protect crop fields from wildlife destruction. It also helps prevent pathogenic organisms and potential pathogens from fecal contamination of wildlife (Rivadeneira et al. 2018). Fencing enhances food safety by excluding wildlife that may carry such diseases. When considering fencing design and materials, it is critical to be aware of various wildlife species present in your area.

Factors to consider in selecting the best fence for specific needs

1. **Fencing regulations.** Some districts are classified as no-fence districts in Arizona, which means you cannot fence in these areas, or you may need special permission

to do so. Wildlife and animal welfare regulations in the state may not permit some types of fences, such as barbed and electric wire that have the potential to injure animals or interfere in the daily activities of wildlife, especially in areas having endangered animal species. Fences are recommended to be wildlife-friendly when possible. However, they should also be functional enough to preclude destructive or unwanted animal intrusion (Dolan and Mannan, 2009).

2. **Know the species and abundance of wildlife in the area.** It will help choose the right fence material. For example, when protecting an area from deer, you need at least an eight-foot fence with stability or a three-dimensional (3-D) fence.
3. **Consider the topography and microclimate of the area.** For example, the length of a fence post used on flat land may differ from a fence post length for sloped land (Hanophy and Golden, 2009). A sloped field in snow areas may require a much more durable and sturdier fence than a fence on flat ground where snow is uncommon. On a field with slope and snow, the fence act as barriers to drifting snow, which could damage or flatten the fence if it is not sturdy.
4. **The type of crop.** The fencing need for tree crops may be different from the fencing need for vegetable and cereal crops. Also, different crops may attract different wildlife species.
5. **Funds available for fences.** This is key to determine how much area can be covered. Start with a part of the field to test appropriateness and cost-effectiveness for specific needs. Additional fencing may be added over time as funds allow.
6. **The lifespan of the wire used for your fences.** This may not matter for short term projects, but for long term projects. Durable, long-lived materials are recommended.

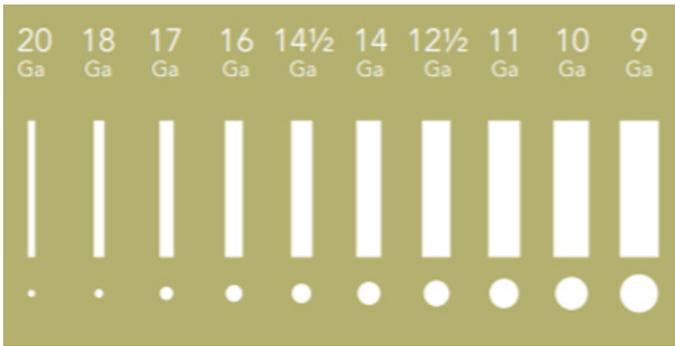


Figure 1: Wire gauge types and interpretations (Photo from Red Brand)

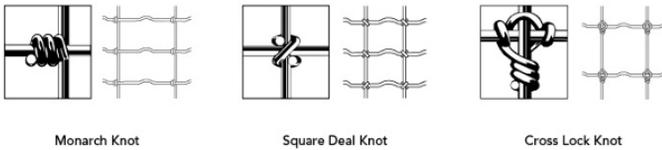


Figure 2: Types of fence knotting (Photo from Red Brand)

Types of fence wires and how to measure their strength

There are several types of wire available for field fencing needs. Some examples are barbed wire, welded wire, woven wire, chain link, and more. The wire gauge and the methods used in securing the wires together determine their strength. The American Wire Gauge (AWG) rating is used to gauge metal measurements by wire thickness, where smaller numbers represent thicker wires. For example, 12-gauge wire is thicker than 14-gauge wire (Figure 1). Gauge instruments for measuring wire strength come in different forms and shapes.

The fence strength depends on the mesh design, material, and method used by the fence manufacturer (welding, twist, chain link, and knots). Welded fence material may be less expensive but may also degrade and require a replacement sooner. The chain link fence is durable and sturdy with more resistance to larger wildlife; however, it is more costly than welded and knotted wire fence. Also, knotted fences are durable and come in three different types (monarch, square deal, and cross lock) (Figure 2). The monarch knot allows the fence to spring back into shape under pressure while the square deal provides strength, rigidity, and flexibility to the fence. On the other hand, the cross lock offers a level of superiority by giving resistance to animal intrusion and severe snowstorms.

Types of fences and their specific uses

Depending on the location of your field, goals, and budget, there are different options to choose from for your field fencing needs.

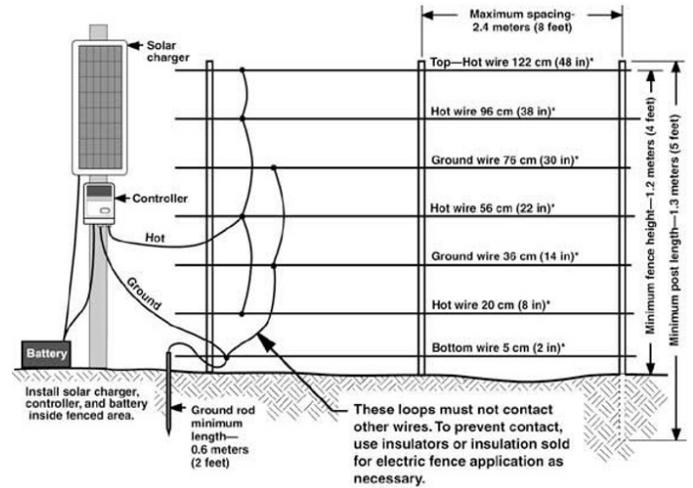


Figure 3: Solar electric fence (image obtained from the New Jersey Government web page)

Barbed Wire Fence: Barbed wire fence is composed of three or more horizontal strands of woven wire with inserted sharp barbs, which are held up between wooden, concrete, or metal poles using flexible wires, nails, or metal hooks. The spacing of eight to twelve feet is required between poles. Fence posts should be buried or pounded into a depth of at least one and one-half feet. The sharp barbs can inflict painful wounds on animals that may try to cross the fence, causing them to stay away. This type of fence would work well for docile animals but can be breached by more aggressive or large animals such as deer, javelina, feral swine, and elk. To control aggressive and large animals with a barbed wire fence, it may help to close-up the gaps between the strands to four inches or reinforce them with other wires between the poles and increasing fence height up to eight feet. For livestock fence where elk or feral burros are present, a piece of $\frac{3}{4}$ " or 1" Schedule 40 PVC can be installed with the top wire running through it. This allows the PVC pipe to rotate, thus preventing excessive damage to the fence and allowing elk and feral burros to cross the fence without injury (Anna, 2019). This may be useful in redirecting these species to minimize damage to crops. For detailed information on barbed wire fencing, refer to (NRCS-Ohio 2016, Standard 382, SBWF).

Electric Fence: Electric fences may look like a barbed wire fence in terms of construction, but the wire is smooth and connected to an electric power source. Solar electric fence chargers are available (Fig 3) and useful in Arizona, where solar energy is reliable. Higher voltage fence chargers may be required for persistent intruders. An electric fence's essential components are energizers, grounding, insulators, gates, corners, braces, and end assemblies (Figure 3).

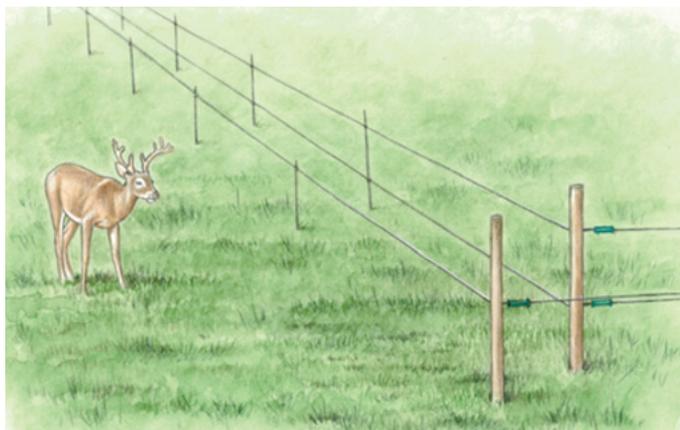


Figure 4: 3-D electric fence for deer (photo from AGCO publication in My Farmlife.com with Illustration by Ray E. Watkins Jr.)

The electric fence serves as a deterrent to the animal when the body encounters the fence. This may be cheaper than other forms of fences because less material and design is required. In recent years, three-dimensional design electric fencing is becoming more common. This design has two parallel rows instead of one, as in Figure 4. Three-dimensional fences (Figure 4) are best to control deer, using two fences spaced 3 feet apart. The first fence (outer) is a single wire of 30 to 32 inches high, and the second fence (inner) has two wires with about 20- and 48-inches heights, respectively (Figure 4). Though deer are excellent jumpers, 3-D confuses their sense of depth perception and discourages them from jumping. In dry areas and during drought, an electric fence's efficacy may decrease due to the ground's inefficiency to conduct electricity. Wet soil conducts electricity better than dry soil. Grazing animals can also be taught to respect electric fences by baiting the opposite side of the fence with grain or other preferred foods. After a short time, most grazing animals learn to respect electric fences. Domestic livestock that do not respect electric fencing may be culled or kept in a different paddock (University of Maine Extension, n. a.).

Electric fence recommendations for specific wildlife control

A multi-purpose electric fence designed to keep all types of wildlife away is strongly recommended. The wires should be both close to the ground and adequately spaced up to eight feet in height, suspended on durable and sturdy poles, as in Figure 3 (USDA, NRCS, 2010). Keep in mind that vegetation can interfere by grounding electric fences. Regular checks and maintenance can prevent this.

Field Fence: This fence is made with welded, woven, or mesh wire attached to solid poles with nails, flexible wire, or hooks (Figure 5). The spacing of fifteen to twenty feet is required between poles with at least 1.5 feet buried beneath the soil. The wire used for these fences is heavy gauge and



Figure 5: Field fence protection from deer (photo by NRSC 2010).



Figure 5: Field fence protection from deer (photo by Red Brand).

is effective for keeping away feral swine and other large livestock. These fences typically utilize 12-gauge wire, but 10-gauge wire could be used for the fence's top and bottom lines for additional strength.

There are variations of field fences based on whether the wires are knotted or woven. The Woven wire design uses a unique crimped joint, which allows some flexibility under pressure and enables the fence to spring back to shape. The deer fence, for example, is specially designed for deer and elk. It is designed with the height required to exclude these animals (at least 8 feet tall) and with the sturdiness necessary (Figure 6). Javelina and feral swine may require extra measures such as using a chain link or connecting electricity to the knot deer fence.

To preclude rabbits, install poultry wire at the bottom of the fence (three-foot height). The poultry wire should be made into an "L-shape" and fitted to the fence's base. To control climbers such as squirrels and woodrats, growing space can be covered entirely with poultry wire with seams connected using "j-clips" or "hog rings," which are often used to construct rabbit cages (Figure 7).



Figure 7: J-clip pliers with uninstalled j-clip (left) and installed j-clip tying poultry wire to woven wire fence (right) (Picture by Jeff Schalaus)

Challenges associated with fencing fields

- The cost of materials could vary greatly depending on the type of fence required.
- Putting up the right fence could be labor-intensive with a need for technical expertise in some cases.
- Local and state regulations must be followed and may require paperwork and permits before erecting a fence.
- Fencing can be an iterative process as unforeseen species appear or migrate to the farm/orchard.

Conclusions

- Choose a fence that meets your needs to protect crops from intruding or damaging wildlife..
- Know and meet state and district regulations on fencing in your area.
- Use fences that are friendly to wildlife without compromising crop protection and food safety.
- Effective fencing can be an iterative process. Be prepared to add or modify existing fences to increase efficacy and preclude unanticipated animals. Hungry wildlife will let you know where the weak points are in your fence design.

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