

Fencing FACTSHEET

CROP PROTECTION AND WILDLIFE CONTROL FENCES

Non-Electric and Electric Fence Designs

This factsheet outlines the use of non-electric and electric fence designs to protect crops from damage by wildlife. Permanent and temporary woven wire and strand wire designs are discussed.

NON-ELECTRIC FENCE DESIGNS FOR CROP PROTECTION

Fence protection of crops from damage by deer, coyote, elk, bear etc, is quite different from fencing domestic livestock. Driven by hunger, wildlife will at some point breach almost any fence design if food supply becomes limited. Non-electric fence designs range from low cost wire strand designs, which are not always effective, to high cost but effective woven wire designs. Electric fences or combination electric/nonelectric fences are sometimes chosen. See page 4.

Protecting Orchards and Vineyards from Deer

A standard nonelectric fence to exclude deer from orchards and vineyards is a high woven wire fence as shown on page 2 and described in detail in Factsheet 307.251-1 *Deer Exclusion Fencing for Orchards and Vineyard Using Woven Wire*. While effective, this design is also expensive. A combination of low woven wire with strands of barbed wire or htsw above the woven wire can be effective at a reduced cost. This design is on page 3.

Fencing a number of neighbouring farms with a common perimeter fence can often reduce fence costs and improve effectiveness.



Protecting Bee Hives From Bears

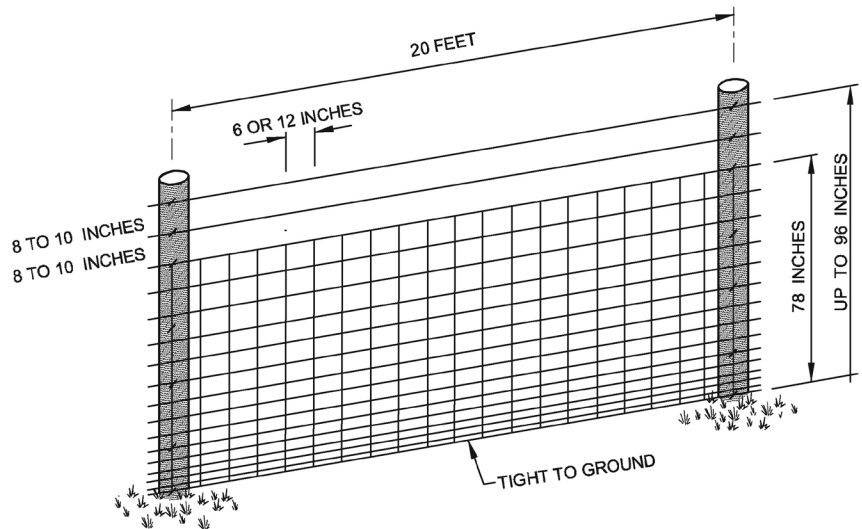
Protecting bee hives from bears is most effectively done with electric fences. See page 7. Bears can breach most nonelectric fences, although a woven wire fence can be effective.

Protecting Hay Stacks and Fields from Deer and Elk

Similar to deer fencing orchards, hay stacks or fields can be protected from deer and elk using a woven wire fence design described in detail in Factsheet 307.252-1 *Elk Exclusion Using Woven Wire Fencing*. While this design is practical for stack yards and small fields, it may be too costly for large fields.

Non-Electric Fence Design – Deer and Elk from Orchards and Vineyards

USE:	deer exclusion
WIRE:	woven, to 78 inches 14 horizontals 12 inch spaced verticals plus barbed or htsw above
*POSTS:	spaced 20 feet
HEIGHT:	up to 96 inches
DROPPERS:	none
*BRACES:	spaced up to 660 feet (8 per mile)



NOTES: See also 307.251-1 *Deer Exclusion Fencing for Orchards and Vineyard Using Woven Wire* for other designs

Figure 1 High Woven Wire Orchard / Vineyard Fence

Materials Required (per mile)*		Description
Wire:	16 rolls	<ul style="list-style-type: none"> - 14/78 hinged joint, standard - 17/75, 18/86, 19/89 or 20/96 knotted joint available - 12 inch spaced verticals standard - 6 inch spaced verticals available - 12½ ga. wires, usually htsw horizontals - galvanized, 330 foot rolls, 192 to 400 lb roll weight - tensioned to remove half of wire tension curve
Strands	1.4 rolls htsw/strand or, 4 rolls barbed/strand	<ul style="list-style-type: none"> - barbed or htsw; 2 or more strands
Line posts:	*264	<ul style="list-style-type: none"> - 4 to 5 inch dia x 11 feet long - pressure treated, pointed, domed - driven 3 feet
Brace posts:	*16	<ul style="list-style-type: none"> - 5 to 6 inch dia x 12 feet long (2 per brace) - pressure treated, pointed, domed - driven 4 feet
Brace rails:	*8	<ul style="list-style-type: none"> - 4 to 5 inch dia x 10 feet long (1 per brace) set at ¾ brace height
Staples:	¾ box	<ul style="list-style-type: none"> - 2 inch slash point, hot dip galvanized - angled across post grain by rotating away from the slash point - not driven home on line posts
Tensioners:		<ul style="list-style-type: none"> - 4 per strand per mile if htsw used above woven wire

* for level terrain—rough terrain may require more posts and braces

Non-Electric Fence Design – Deer and Elk from Orchards and Vineyards

- USE:** deer exclusion
- WIRE:** woven, to 47 inches
10 horizontals
12 inch spaced verticals
plus barbed or htsw above
- *POSTS:** spaced 20 feet
- HEIGHT:** up to 96 inches
- DROPPERS:** none
- *BRACES:** spaced up to 660 feet
(8 per mile)
- NOTES:** A modified design of **High Woven Wire Orchard Fence** using lower height woven wire with added top wires

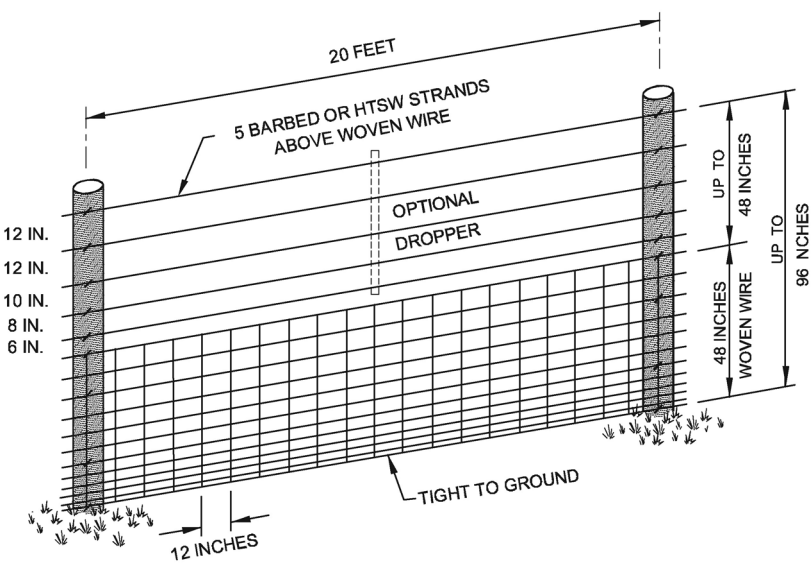


Figure 2 Low Woven Wire Orchard / Vineyard Fence

Materials Required (per mile)*		Description
Wire:	16 rolls	<ul style="list-style-type: none">- 10/47 hinged joint standard- 9/49 and 12/48 knotted joint available- 12 inch spaced verticals standard- 6 inch spaced verticals available- 12½ ga. wires, usually htsw horizontals- galvanized, 330 ft rolls, 130 to 224 lb- tensioned to remove 1/2 of wire tension curve
Strands:	1.4 rolls htsw/strand or, 4 rolls barbed/strand	<ul style="list-style-type: none">- barbed or htsw; 5 or more strands
Line posts:	*264	<ul style="list-style-type: none">- 4 to 5 inch dia x 11 feet long- pressure treated, pointed, domed- driven 3 feet
Brace posts:	*16	<ul style="list-style-type: none">- 5 to 6 inch dia x 12 feet long (2 per brace)- pressure treated, pointed, domed- driven 4 feet
Brace rails:	*8	<ul style="list-style-type: none">- 4 to 5 inch dia x 10 feet long (1 per brace) set at 3/4 brace height
Staples:	1 box	<ul style="list-style-type: none">- 2 inch slash point, hot dip galvanized- angled across post grain by rotating away from the slash point- not driven home on line posts
Tensioners:		<ul style="list-style-type: none">- 4 per htsw strand per mile
* for level terrain—rough terrain may require more posts and braces.		

ELECTRIC FENCE DESIGNS FOR CROP PROTECTION

Electric fences are widely used to control wildlife from damaging crops, ranging from hay fields and stacks to orchards and beehives. As previously discussed, fencing out wildlife driven by hunger is much different from fencing domestic livestock. At some hunger threshold almost any fence design may be breached by wildlife. The choice of electric fences is often a compromise between cost and effectiveness. They are not as costly as woven wire designs, but with proper installation and maintenance can be effective in many situations.

The cost of the installed fence should be in relation to the reduction in crop losses. For high value, high density orchards, for example, this may mean the selection of a very effective though costly high woven wire fence. However, if protecting a hay field or stack from elk, a lower cost electric fence may be chosen. The following electric fence designs should be chosen having fully considered these compromises.

Locating Electric Wildlife Fences

Whatever design is used, locating the fence in a way that is difficult for wildlife to approach will enhance its effectiveness. If the ground slopes up to the fence for instance, it will appear taller and will be more difficult for deer, etc. to challenge the fence. However, if the ground slopes down towards the fence, it may encourage deer to jump the fence.

Properly functioning wildlife fences will normally repel the animals concerned and move the problem to neighbouring areas. For this reason, cooperation between neighbours is required. In small acreage orchards, for example, a group boundary fence will be more effective and less expensive than a number of individual fences. A failure in one fence could let deer into many neighbouring orchards whereas a continuous boundary fence between all the orchards and the deer will be more effective. It will be important that required maintenance be shared. For larger areas such as hay fields, the fences may be erected on separate farms. However, here too an “area wide” approach to the problem may be useful.

Protecting Hay Stacks from Deer and Elk

Permanent Electric Fence. If a stack yard is fenced, an permanent electric fence may be less expensive than a board fence but may require more attention. See Figure 3, next page. For a detailed description of a ten wire field elk fence design see Factsheet 307.252-2 *Elk Exclusion Using Electric Fencing* .

Temporary Electric Fence. A temporary design to repel deer/elk from hay stacks is a lower cost option. Eight foot 2 x 4's spaced about 10 feet apart are leaned up against the stack. Seven wires spaced 10 inches apart are used. Alternate wires are either charged or grounded (wire return system - see page 2 of Factsheet 307.320-1 *Grounding Systems for Electric Fences*). The deer or elk cannot jump over the fence as the top wire is too close to the stack. When reaching through for hay, the animal receives a shock. To increase the fence visibility, a poly wire tape (1/2 inch or wider) can be added around the middle.

A gate is made by tying the wires off to adjacent 2 x 4's that can be simply swung away from the stack (fence and gate design from W. Burleson, Montana).

Permanent Electric Fence Design – Deer and Elk from Hay Stacks

USE:	deer and elk exclusion
WIRE:	7 strands, htsw
*POSTS:	spaced 30 feet
HEIGHT:	84 inches
DROPPERS:	none
*BRACES:	spaced up to 13200 feet (48 per mile)
NOTES:	For permanent stack yards. See also temporary electric fence information on page 4

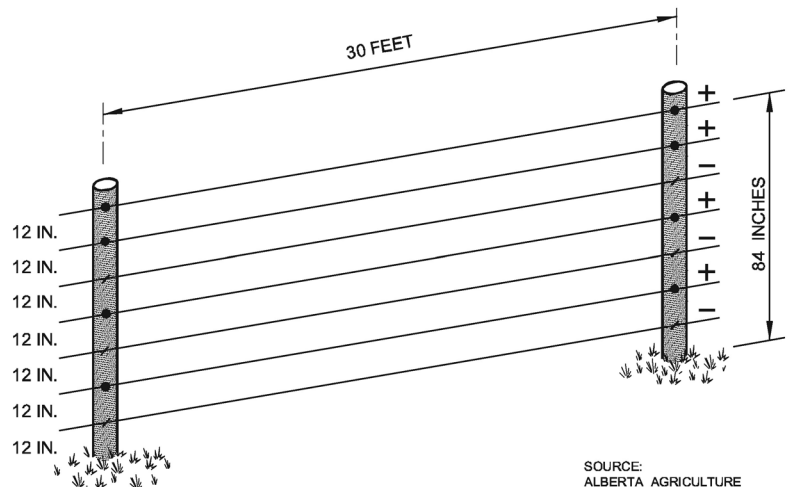


Figure 3 Permanent Electric Deer / Elk Exclusion Fence

Materials Required (per mile) *		Description
Wire:	9.9 rolls	<ul style="list-style-type: none"> - single strand htsw, 3750 feet per 100 lb roll - 12½ ga. Class 3 galvanizing (standard) - 1350 lb breaking strength (min) - tensioned to 150
Line posts:	*176	<ul style="list-style-type: none"> - 3 to 4 inch dia x 10 feet long (difficult to install in some soils) - pressure treated, pointed, domed - driven 2½ feet (min)
Brace posts:	*8	<ul style="list-style-type: none"> - 4 to 5 inch dia x 10 feet long (2 per brace) - pressure treated, pointed, domed - driven 3 feet (min)
Brace rails:	*4	<ul style="list-style-type: none"> - 4 to 5 inch dia x 10 feet long (1 per brace) set at 3/4 brace height
Staples:	3 wires: 1/5 box	<ul style="list-style-type: none"> - for grounded wires - 1¾ inch, slash point, hot dipped galvanized - angled across post grain by rotating away from slash point - not driven home on line posts
Line insulators:	4 wires: *704	<ul style="list-style-type: none"> - for electrified wires - plastic material, strong at winter temperatures - nail or screw onto post - have long “shorting” distance - easy to replace
Tie-off insulators:	4 wires: *32	<ul style="list-style-type: none"> - two per wire per braced section (8 per strand mile) - also required at change of direction

* for level terrain—rough terrain may require more posts, braces and insulators.

Protecting Beehives from Bears

Bears cause hive damage if allowed free access, especially upon emerging from hibernation or in early fall prior to hibernation. Electric fences can be effective in protecting hives when properly constructed and maintained. A design is shown in Figure 4 using 5, all electrified wires. Permanent or temporary posts may be used, depending on the hive site. For temporary sites, an option is a net fence fabric of poly wire with attached posts. See page 4 of Factsheet 307.100-1 *Commonly Used Wire for Agricultural Fences*.

Points to consider when using electric fences to control bears

- The electric fence design in Figure 4 has all wires electrified and an earth return system (see page 1 of Factsheet 307.320-1 *Grounding Systems for Electric Fences*). This limits its effectiveness to conditions of moist ground, unfrozen ground and no snow cover.
- It is said that if the bears nose gets through the wires the bear is through; this would indicate that the 7 inch wire spacing is a maximum and less space should be considered. They also may crawl under so the bottom wire height from ground should be no greater than the 8 inches indicated. An optional design is 7 wires spaced 6 inches apart with a 4 inch ground space on the bottom wire (total height of 40 inches).
- For maximum shock, a piece of woven wire laid flat on the ground out from the fence will ensure the bears feet are well grounded when they touch the electrified fence wires.
- To discourage gate climbing, use an electrified wire gate.
- Train” bears to the fence by baiting or otherwise drawing their attention to the wires so they will touch a wire, receive a shock, and leave the area. This can be done with a strong smelling food product (like a sardine can containing its juices) attached to a fence wire.
- There is some indication from producers that some bears, upon receiving a shock, will become enraged and “attack” the fence tearing it apart and gain access to the hives.

Permanent or Temporary Electric Fence Design – Bears and Beehives

USE:	bears from beehives
WIRE:	5 strands (optional 7 strands) permanent: htsw temporary: polywire or net
*POSTS:	spaced 12 feet permanent: wooden temporary: plastic/pvc
HEIGHT:	36 to 40 inches
DROPPERS:	none
*BRACES:	corner posts (small sites)
NOTES:	See page 6

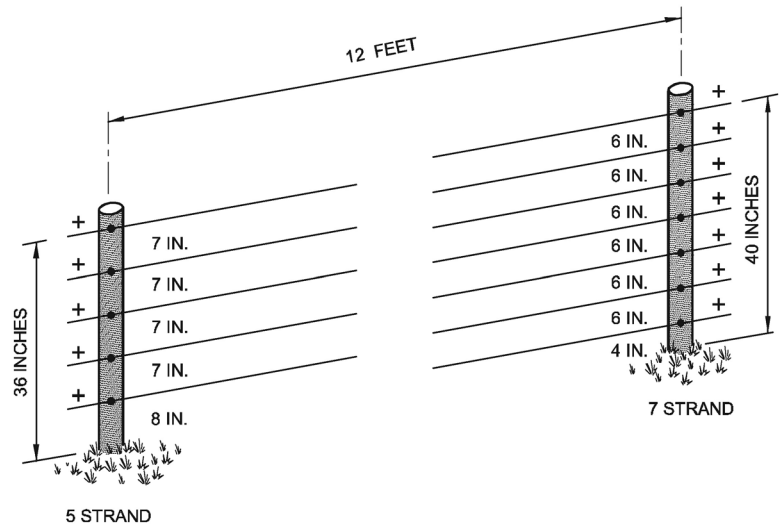


Figure 4 Permanent / Temporary Electric Bear / Beehive Fence

Materials Required (per 100 feet) Description

Wire:	5 strand: 0.13 roll 7 strand: 0.19 roll or, 5 strand: 500 ft 7 strand: 700 ft	- single strand htsw, 3750 feet per 100 lb roll - single strand polywire, various roll sizes
Line posts:	8	- Permanent: 2 to 3 inch dia x 6 feet long - pressure treated, pointed, domed - driven 2 feet (min) - Temporary: plastic, PVC, fibreglass
Brace posts:	8 per site (typical rectangle site) 4 corners per site (typical rectangle site)	- Permanent: 3 to 4 inch dia x 7 feet long (2 per brace) - pressure treated, pointed, domed - driven 3 feet (min) - Temporary: sturdy corner post sufficient
Brace rails:	4 (typical rectangle site)	- Permanent: 3 to 4 inch dia x 8 feet long
Line insulators:	5-strand: 40 7-strand: 56	- Permanent : one per wire per post - plastic material, strong - Temporary : posts are insulating - no line insulators required
Tie-off insulators:	5 strand: 20 7 strand: 28	- Permanent : one per wire per corner - Temporary : posts are insulating - no tie-off insulators required

Protecting Livestock from Dogs and Coyotes

Both electric and nonelectric fencing can be effective, non-lethal control tools. However, coyotes are among the most difficult to control as they will dig under, climb through or over, or jump over most standard fences, electrified or not !

Upgrading Existing Fences. To upgrade existing woven wire fences such as 48 inch high sheep fences (with mesh openings no larger than 6 inch x 4 inch):

For a totally nonelectric fence:

- Add height (total height of 54 to 66 inches) with barbed or smooth fence wire; and
- Add a barbed ground level wire to reduce digging.

With electric options:

- Add height with an electrified smooth fence wire(s);
- Add an electrified offset wire 6-8 inch above the ground and set out towards the coyote side by 4 to 8 inches (this will require good vegetation control) -consider offsets at mid-fence and top; and
- Ground the woven wire.

New Fence - Non-electric. In new construction, non-electric woven wire fences using special features can be effective in coyote control. Research has shown for near 100% control, all the following features must be present:

- Height, minimum of 66 inches to repel jumping;
- Mesh openings, maximum of 6 inch x 4 inch (preferably smaller) to repel crawling through (important for the bottom 2 feet);
- A top overhang of 15 inches (formed by bending the top of the woven wire 45 degrees outwards to the coyote side of the fence and securing to support arms attached to the line posts) to repel climbing over;
- A 15 inch apron along the ground (coyote side) of 6 inch woven wire attached to the fence wire every 2 feet to prevent digging under the fence; and
- In the most difficult cases, plywood shields at the braces to remove brace members as toe holds in climbing.

New Fence - Electric. Electric fences are more often selected for coyote control due to lower costs, especially for long fences. The following designs may not provide the same level of control as the woven wire design but will control all but the most persistent animals. For electrified coyote fences to be effective they should:

- Be energized with controllers capable of delivering 4000–5000 volts as a shock;
- Have minimum space between wires in the bottom 2-3 feet of 6 to 8 inches;
- Be 66 inch high to repel jumpers (note, that lower height coyote electric fences will be effective if the animal is enticed to crawl between the wires because of the wire spacings chosen - see the following designs); and
- Have good vegetation control to prevent shorting along the bottom wire(s).

For extra control against digging animals, use a ground level nonelectric barbed wire.

Permanent Electric Fence Design – Dog and Coyote Control

- USE:** dog and coyote control
- WIRE:** 7 or 9 strands htsw
- *POSTS:** spaced 15 to 20 feet
- HEIGHT:** 54 to 67 inches
- DROPPERS:** none
- *BRACES:** spaced up to 1320 feet (4 per mile)
- NOTES:** See page 10

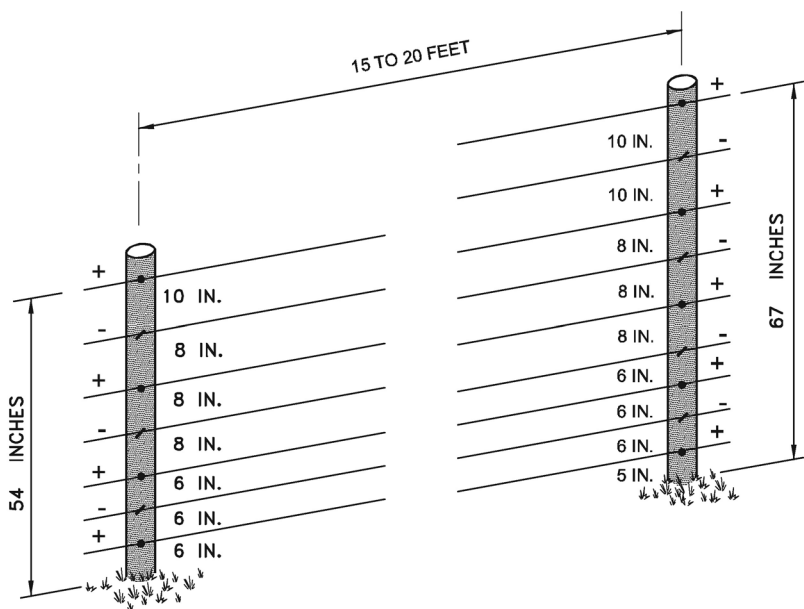


Figure 5 Permanent Electric Dog and Coyote Fence

Materials Required (per mile)*		Description
Wire:	7 strand: 9.9 rolls 9 strand: 12.7 rolls	- single strand htsw, 3750 ft/100 lb roll - 12½ ga. Class 3 galvanizing (standard) - 1350 lb breaking strength (min) - tensioned to 150 lb
Line posts:	7 strand: *352 or 264 9 strand: *352 or 264	- 7–strand fence, 3 to 4 inch dia x 7 feet long - 9–strand fence 3 to 4 inch dia x 8 feet long - pressure treated, pointed, domed - driven 2 feet (min)
Brace posts:	*8	- 4 to 5 inch dia x 8 feet long; 9 feet long for high fence (2 per brace) - pressure treated, pointed, domed - driven 3 feet (min)
Brace rails:	*4	- 3 to 4 inch dia x 8 feet long (1 per brace) - set to ¾ of brace height
Staples:	7 strand (3 wires): 1/3 box staples 9 strand (4 wires): ½ box staples	- for grounded wires (where used) - 1¾ inch, slash point, hot dipped galvanized - angled across post grain by rotating away from slash point - not driven home on line posts

* for level terrain – rough terrain may require more posts, braces and insulators.

(Design continued on following page)

(Design continued from previous page)

Line	7 strand (4 wires):	- for electrified wires (4 or 5 wires)
insulators:	15 ft posts: *1408	- plastic material, strong
	20 ft posts: *1056	- nail or screw onto post
	9 strand (5 wires):	- have long “shorting” distance
	15 ft posts: *17602	- easy to replace
	20 ft posts: *1320	
Tie-off	7 strand (4 wires):	- two per wire per braced section tie-off (8 per strand mile)
insulators:	*32	- also required at change of direction
	9 strand (5 wires):	
	*40	

* for level terrain – rough terrain may require more posts, braces and insulators.

**Points to consider
when using
electric fences
to control coyotes**

- 100% effectiveness is not to be expected -exceptional animals may not be repelled.
- Coyotes may have different tendencies in different areas regarding jumping fences.
- Designs attempt to entice the animal to try to go through the fence (by not presenting a formidable barrier that they will try to jump over or dig under) so a shock will be felt, hopefully discouraging the animal entirely. Wire spacings of 6 to 8 inches are therefore considered best in the lower part of the fence.
- Bottom electrified wires may short out without good vegetation control.
- Remove the charge from lower wires as snow accumulates.
- Snow accumulations will reduce the effective fence height and may increase jumping tendencies.
- A 12 wire design is also used: 66 inch high, wire spacings of 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6 - this design may, however, encourage digging or jumping.
- Consider a ground level nonelectric barbed wire (4 rolls/mile) to discourage digging.

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