

Basic Principles of Electric Fencing for Apiaries



Fred Putnam Jr.

January 19, 2025, Update

Text guide on the VBA website:
Protecting bee hives from bears (and skunks)

<https://www.vermontbeekeepers.org/resources/for-beekeepers/protecting-bee-hives-from-bears>

Comprehensive
guide on the VBA
website:
Protecting bee
hives from bears
(and skunks)

The screenshot shows the Vermont Beekeepers Association website. At the top is a navigation bar with links: Home, Admin, About, Join, Resources, Calendar, Services, News, Forum, Log out, Contact Us, and RSS. A dropdown menu is open under 'Resources', listing items such as 'Checklist: Resources for a Prospective Beekeeper', 'Vermont State Apiculturalist & Vermont Laws', 'VBA Training Program', 'Become a Mentor', 'Work with a Mentor', 'Vermont Bee Lab', 'Bee a Host', 'Grants, Funding Requests & Scholarships', 'Library', 'Publications', 'Special Subscription Offer', 'Recognition Program', 'Nominations Review', 'Swarm List Signup', 'Beekeeping Calendar', 'Education', 'Protecting Bee Hives from Bears', 'Beekeeping Site Links', 'Is That a Bee?', 'VBA Statement on American Foulbrood', 'Regional Beekeeping Clubs', 'Vermont Beekeeping Clubs', and 'Pollen and Nectar Sources'. A blue arrow points to the 'Protecting Bee Hives from Bears' link. Below the navigation is the VBA logo and the text 'Vermont Beekeepers Ass'. The main heading is 'Beekeeping in Vern'. Below that is the article title 'Swarm the Statehouse Press' and the text 'From Tuesday's event:'. A video player shows a group of people at a press conference holding signs that say 'PROTECT OUR POLLINATORS!' and 'NO BEES. NO FOOD'. The video title is 'Swarm the State House Press Confere...'. At the bottom of the page is the article title 'H.706 Moves to House Floor'.

H.706 Moves to House Floor

Always...

Fence first then get bees!!

Bears will find your apiary.

If they get in, it will be harder to keep them out.

Dogs, noise, and sensor lights are not effective deterrents.

It's much easier to deter well-fed livestock
than to deter a hungry bear!

Two basic types of animal fences:

- Deterrent/psychological - Electric – Fence requires an electric current. Usually less expensive and requires less materials and effort to build.
- Physical barrier – Electric current NOT required. Requires heavy duty posts and tensioned wires or heavy metal panels. May still not deter bears (they can climb.)

Electric animal fences can be simple or complicated

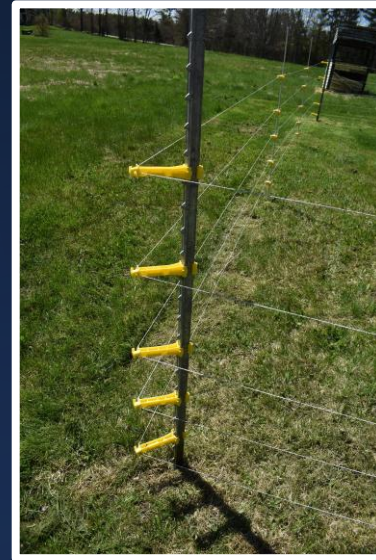
This will focus on less complex and less expensive.

The most common electric fence issues are:

- #1+++ Bad/insufficient grounding and bad connections.
- #1++ Lack of voltage monitoring.
- #1+ Poor fence condition - weeds, electric shorts, incompatible materials.
- Wrong energizer.
- Lack of animal “training” (baiting the fence.)

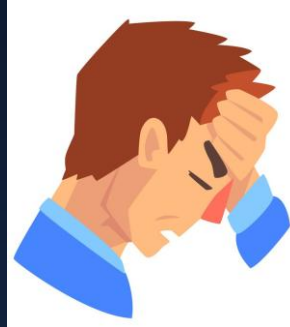
Common types of apiary electric fence wire

Strand – smooth metal or polywire



Each type requires its own unique style of insulator, gate handles, anchors, connectors, etc.

Mixing and matching types =



Tape



Netting:
5' Deer Quik
Fence



Standard 48" high net fences may not be high enough to deter "jumpers."



Basic types of apiary electric fence energizers

- Powered by household current (A/C plug-in)
- Battery powered D/C (sometimes A/C & D/C combo):



➤ Automotive or dry cell batteries – replace or recharge when they run low



➤ Solar – lead-acid battery that self recharges (most of the year!) with a small solar panel



Energizer specs to deter bears

➔ Minimum 1.0 output joule (or 1.3 stored joules.)

More is okay up to a limit.

A joule is a measure of output power = 1 watt-second. This characteristic is built into the energizer. You cannot measure this, it's not adjustable, and it is not affected by your fence setup.

➔ Minimum 7,000 volts. More is better – This is what you'll measure.

Grounding – #1 concern

- Use all galvanized wire & clamps to avoid bi-metal reactions and corrosion (Brass clamps are okay for grounds.)
- Use clamps – no twist wraps
- Do not use rebar or copper rods as grounds. They corrode, and you lose voltage on the fence lines.

Clamped connections: Yes
Galvanized rod: Yes

Twist wrap connections: No
Rebar: No
Copper rod: No



Photo credit: Wellscroft Fence Co.

The effective grounding radius around a grounding rod is about 5 feet.

Thus, grounding rods should be at least 10 feet apart.

If rods are too close to each other, they can act like one rod.

More on Grounding

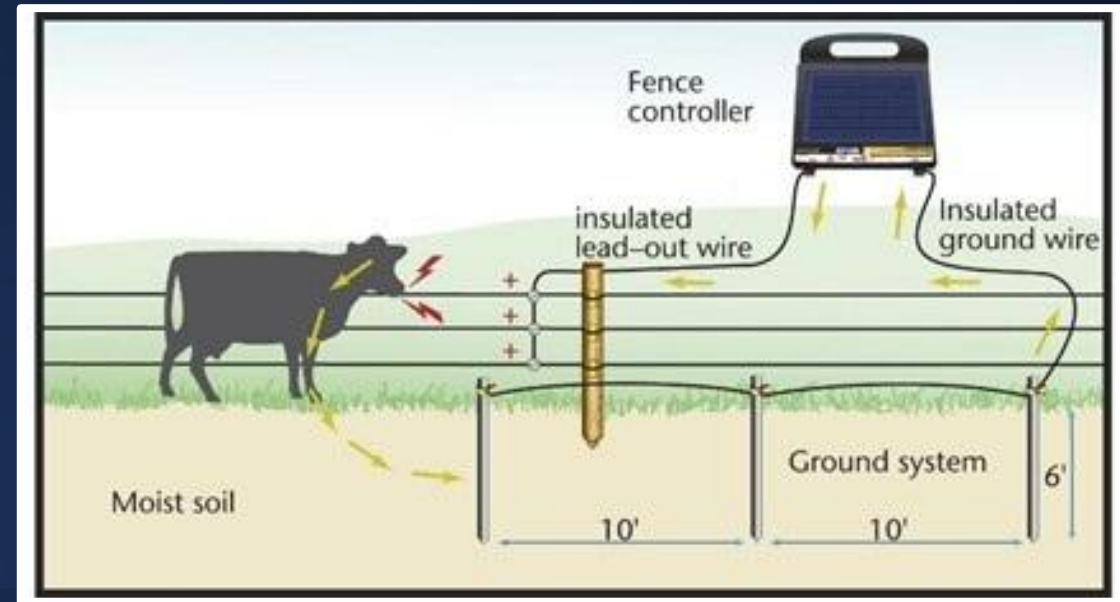
In general, start with three - 3' rods spaced 10' apart or one - 3' rod in a wet spot.

- Generally, at least 6 feet of grounding rod per joule of energizer output unless soils are wet (need less) or sandy or droughty (need more.)

Connect grounding rods by daisy chaining each rod together

- One continuous unbroken wire connecting all grounding rods to ground terminal on energizer.)

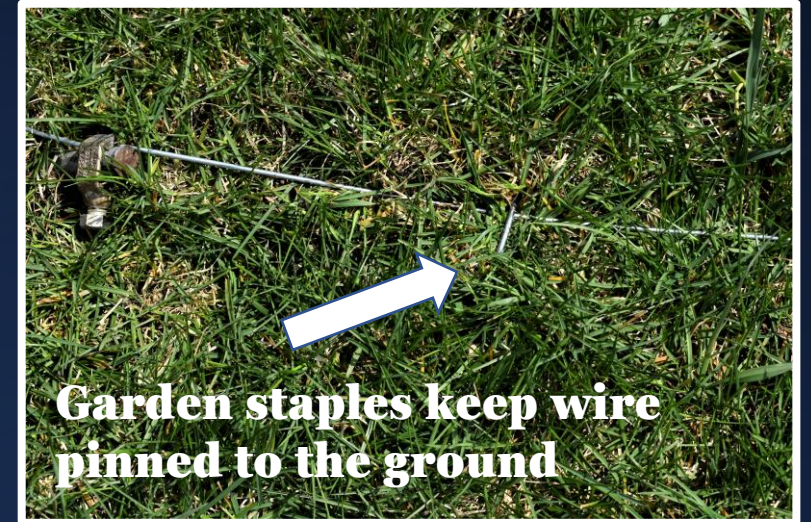
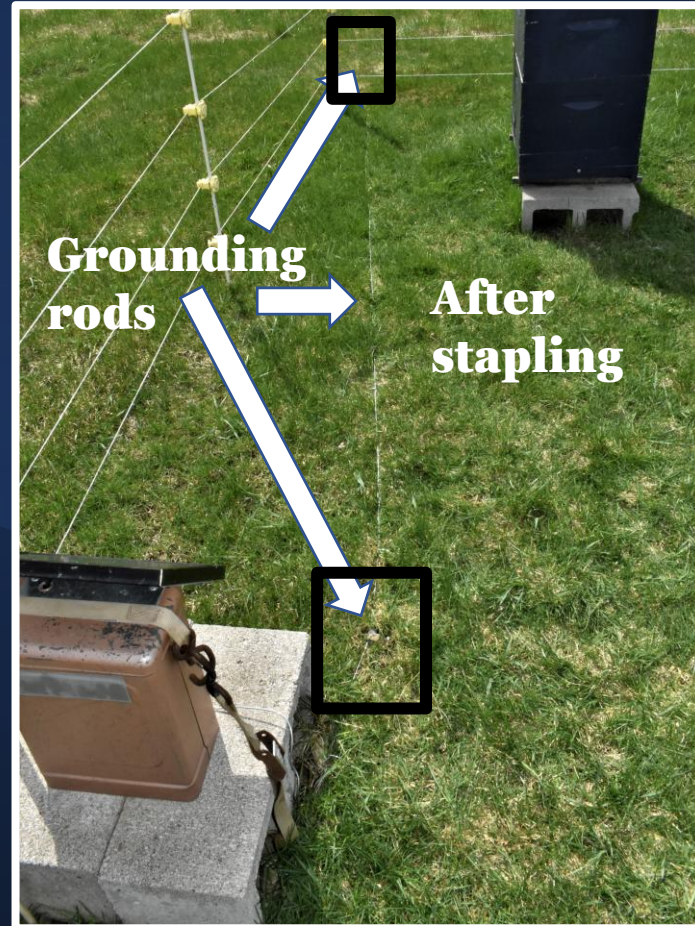
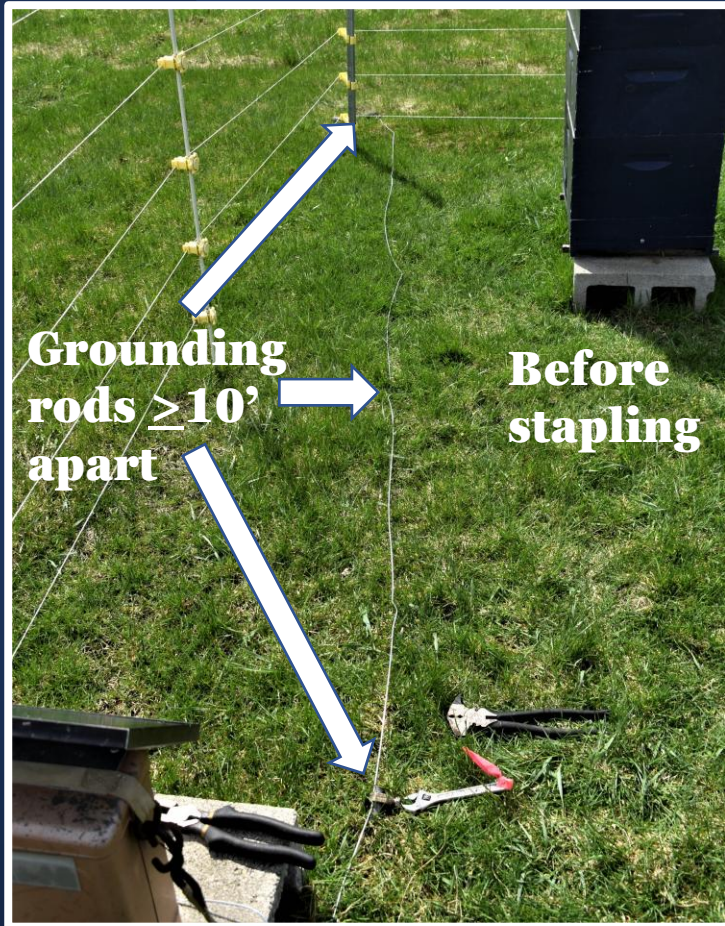
Might need more rods in droughty or shallow soils.
Less in wet spots.



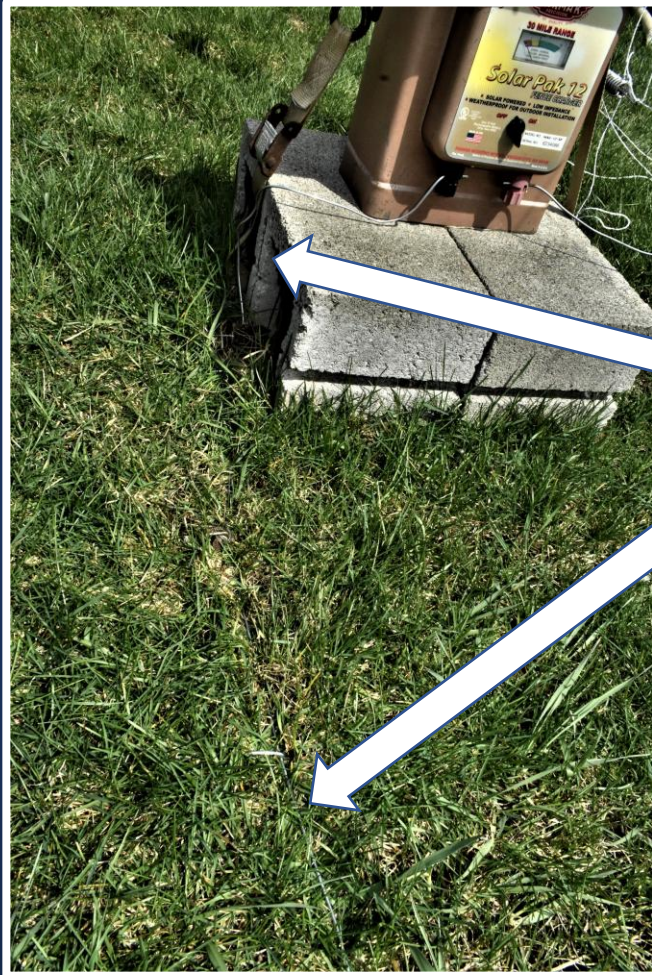
Grounding rods at least 10 feet apart.

A Grounding Example

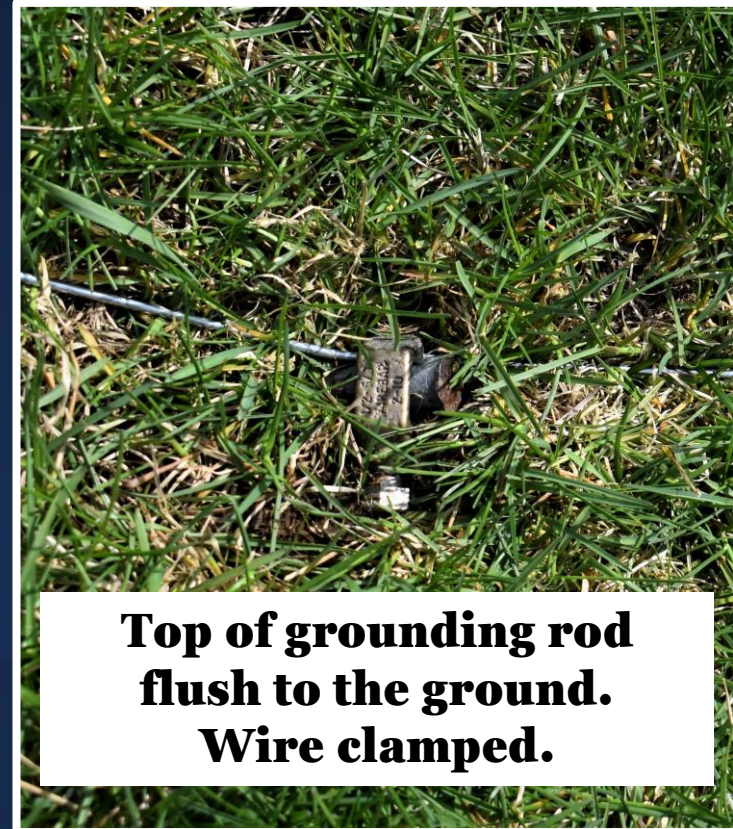
3' long rods spaced $>10'$ apart connected together with 12.5-gauge galvanized wire



A Grounding Example - cont



**One continuous wire
from farthest
grounding rod to
energizer –
“daisy chained”**



**Top of grounding rod
flush to the ground.
Wire clamped.**

Dead ends & Inductive voltage losses

- **Dead ends are okay; wires do not have to connect back onto each other.** Circuit is from the hot wire through the bear or skunk into the ground and back to the energizer through the grounding rod.
- **Inductive voltage losses:** Induction occurs when electricity is transferred from an electrified wire to a non-electrified gate or other metal object that is not in direct contact with the wire.

End of hot wires are not connected though the gate. This gate is a physical barrier not a deterrent or psychological barrier.



Inductive voltage loss

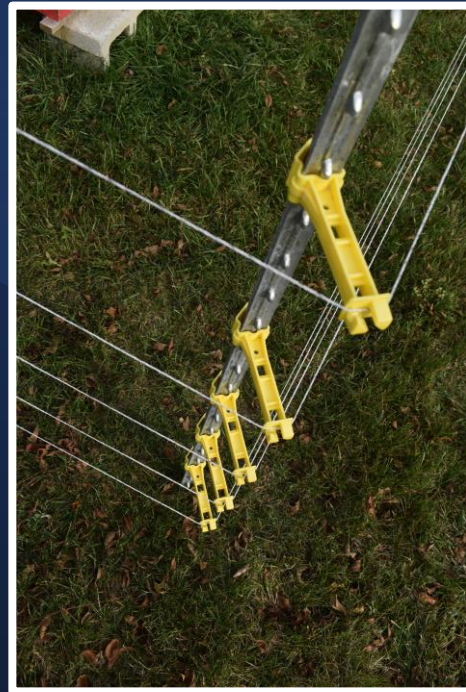
- Use correct insulators – If insulators are too short on metal posts, it's possible to have inductive voltage loss – voltage is drained away when wire or tape is very close to a grounded metal object even though the line is not touching the metal object.

Inductive voltage loss

Possible inductive loss
with short insulator on
metal post



Use 5" standoff
insulators on
metal posts



Use 5" Lock
Jawz or similar
on woven wire



Inductive losses
not an issue with
plastic, wood, or
fiberglass posts



Inductive voltage loss data

Distance from wire	Inductive voltage reading (volts)	
	Fern Lake	Sudbury
36"	---	680
12"	~1,000	~1,000
6"	~1,700	~1,500
3"	~2,000	~2,000
1"	~2,500	~2,400
½"	~3,000	~3,500

Inductive losses usually only an issue if:

- **Insufficient grounding**
- **Bad wire connections**
- **Energizer not powerful enough.**

i.e. voltage was already reduced

Tape passes through woven wire fence.



Short insulator.
Wire close to metal post.



A few tips...

- Put up the electric fence first, then get bees.

Or get a box of Kleenex and be ready to use them.



- Keep tension on lines or net but not too much.

- Keep the weeds out of your fence. Weeds will drain a lot of voltage especially when wet from dew or rain.



Can use mulch but too much can insulate the ground.

More tips...

- Get a good digital voltage tester (not a multi meter) and check the voltage after every visit.



- Keep your fence on 24/7/365. Bears do not reliably den up all winter any longer.

7,000-volt loss from two tiny stainless-steel wires in the polywire strand!



Issues happen that may not be visible: shorts, bad battery, beekeeper forgot to turn the energizer back on!

Building the fence: General apiary guidelines

- Locate solar charger panel in a sunny spot **INSIDE** the apiary.
- Enclose an area large enough to create a 6' distance between hives and fence to avoid “reach in” damage.
- Keep fence (and apiary) at least 20' from woods lines – bears like to hang out in that “protected” space between woods and apiary (does not apply to treelines in the middle of fields.)

Building the fence – General tips

- Energizer inside fence – Mount on a post in snow country
- No guy wires or other supports outside the fence – if needed, keep corner supports inside the apiary fence so bear will not become tangled in them.
- The grounding rod(s) can be located outside the apiary fence but staple the grounding wire to the ground.



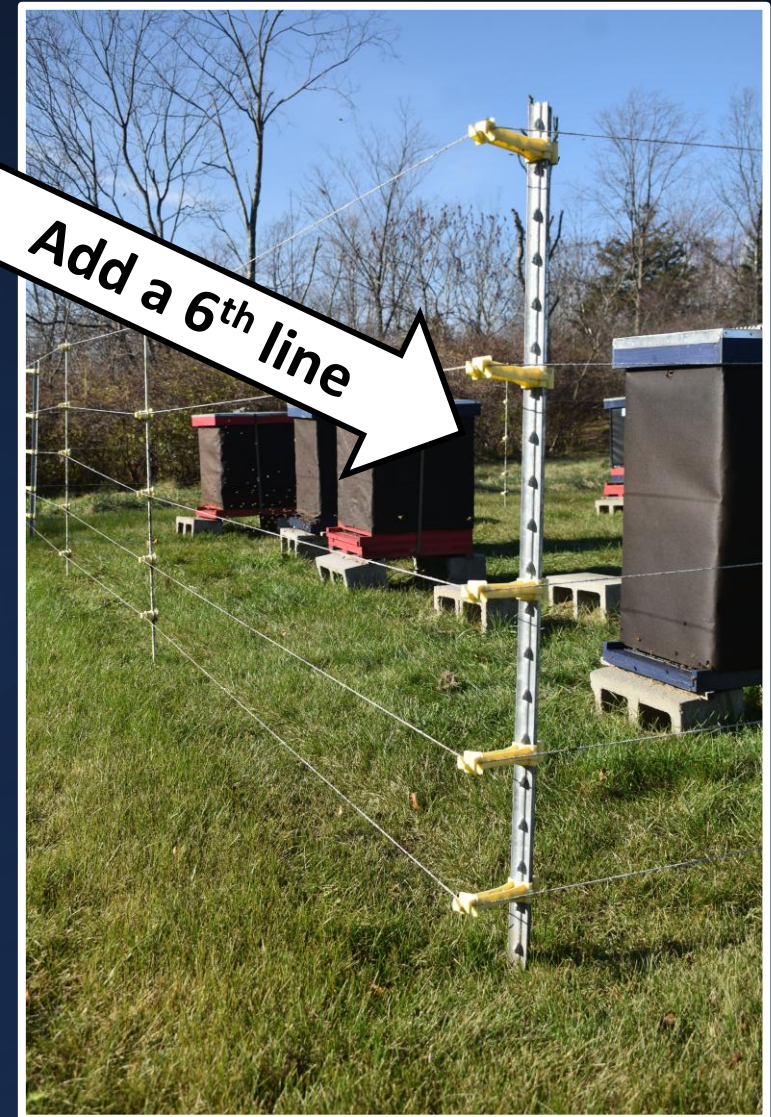
Building the fence: Wire or tape, or woven wire

Wire, polywire, or tape – min. 5 lines, 6 lines preferred

- Bottom line 5”-6” above ground to repel skunks and keep bears from digging under.
- 2nd line 8-12” above the bottom line.
- Top line 5 feet above ground (or at the top of a 6-foot t-post.)
- Other lines equally spaced between.
- Intermediate support posts follow terrain but at least every 8 feet.

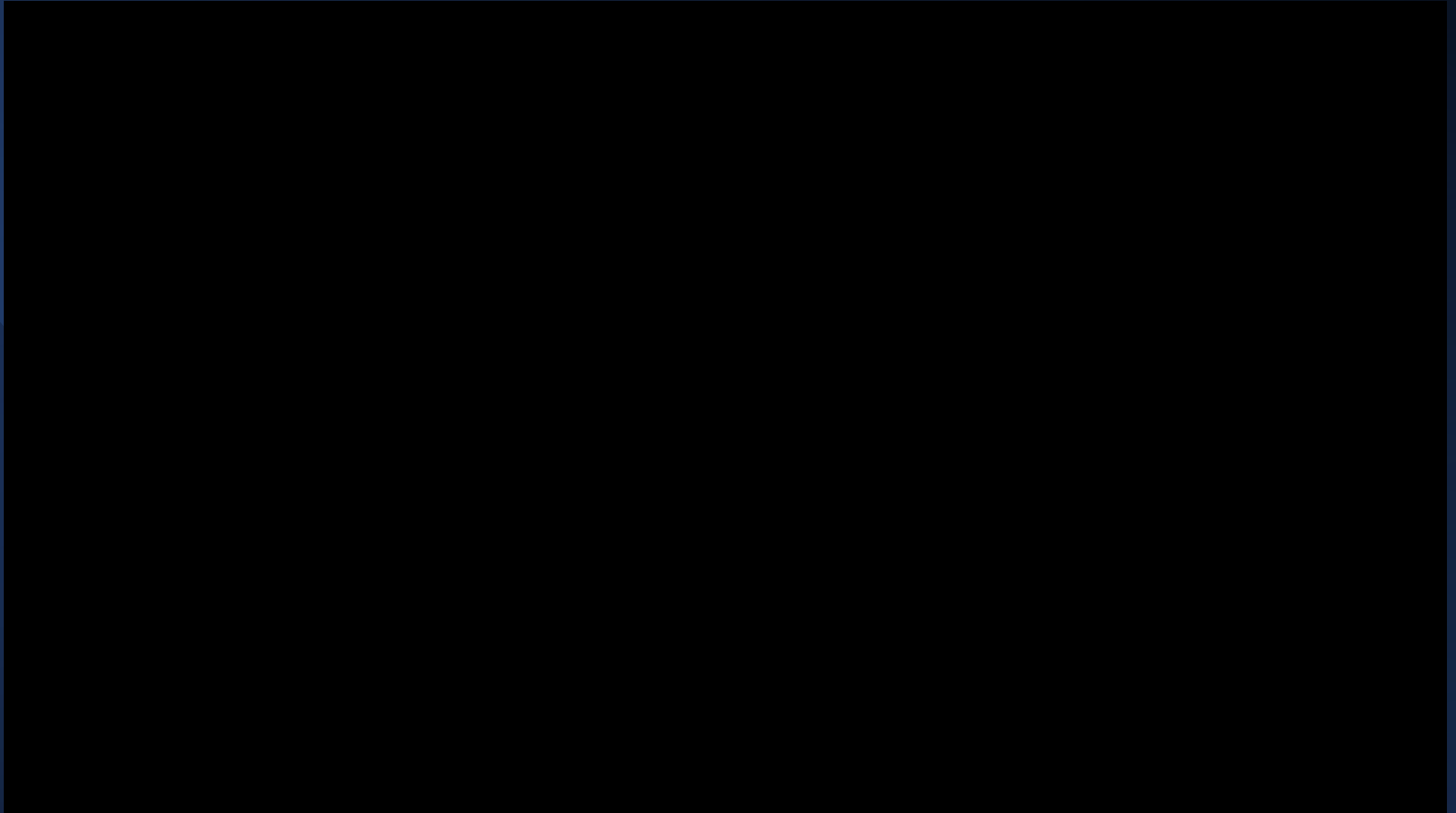
Woven wire should be 5’ high like Deer Quik fence

- Insulators on outside of posts.



Why the top line should be 5 feet high

Video of bear easily jumping over 42" high fence and tearing the cover off an unstrapped hive.

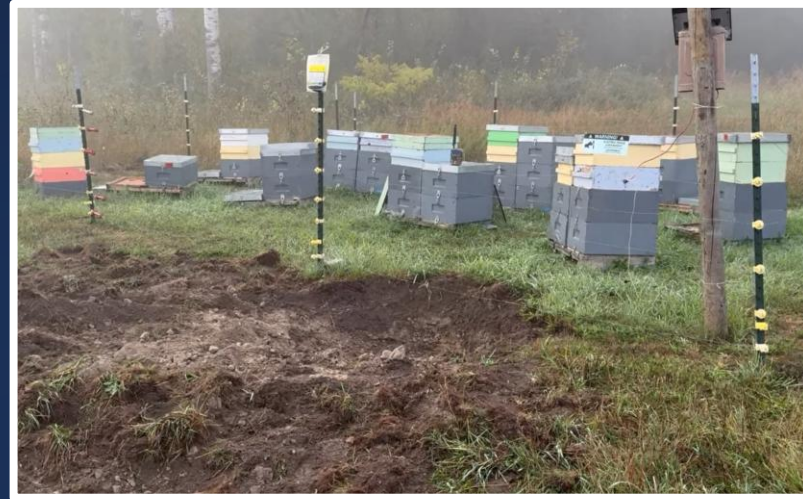


Other little bear tricks

Destroying your unused equipment when you're not home!



Digging under your electric fence!

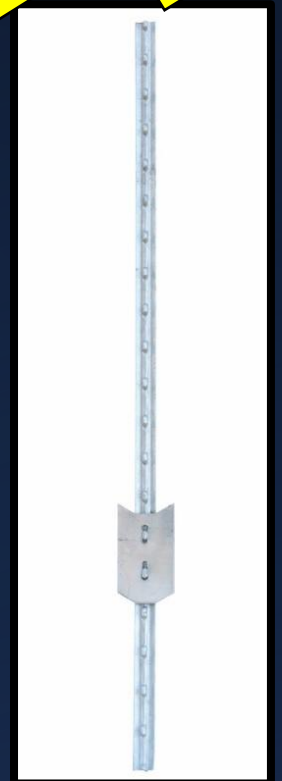


Building the fence: What you'll need

- Enough wire, polywire, or tape to run 5 or better yet, 6 lines, **OR**;
- netting for whole perimeter – 4-foot net may not be high enough to deter jumpers.



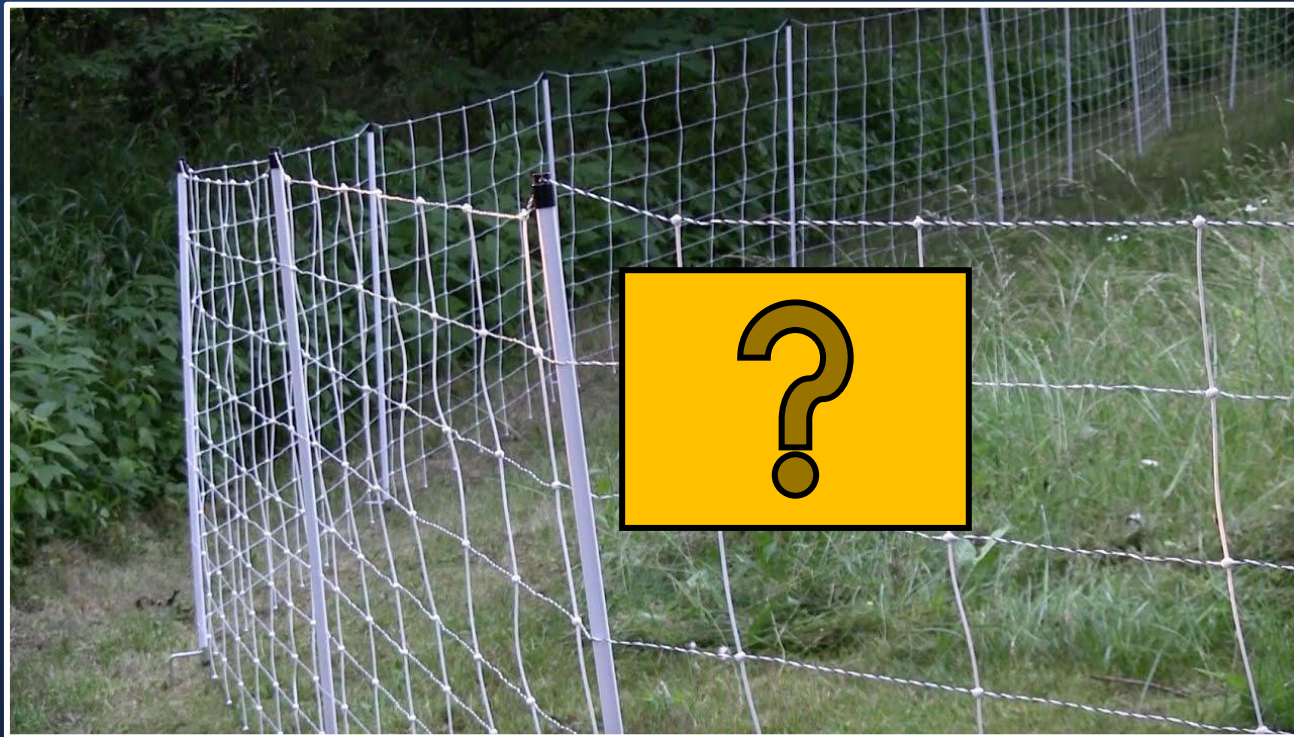
Corner posts – wood posts or metal t-posts. T-posts that are 1.33 lbs. per foot are the stiffest and galvanized posts will not rust.



Building the fence: Netting

Netting 5' tall (Deer Quik Fence)

Standard 4' netting may not be high enough to deter jumpers

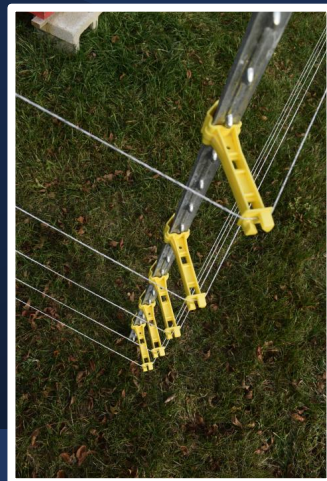


Special note..

Never combine barbed wire with an electric fence!

Building the fence: What you'll need

- T-post driver (if you use t-posts)
- In-line support posts (plastic or fiberglass or can use t-posts)
- A good grounding kit – three 3' galvanized rods, galvanized wire, and clamps (Field Guardian kit)
- Garden staples for grounding wire (optional)
- Correct insulators

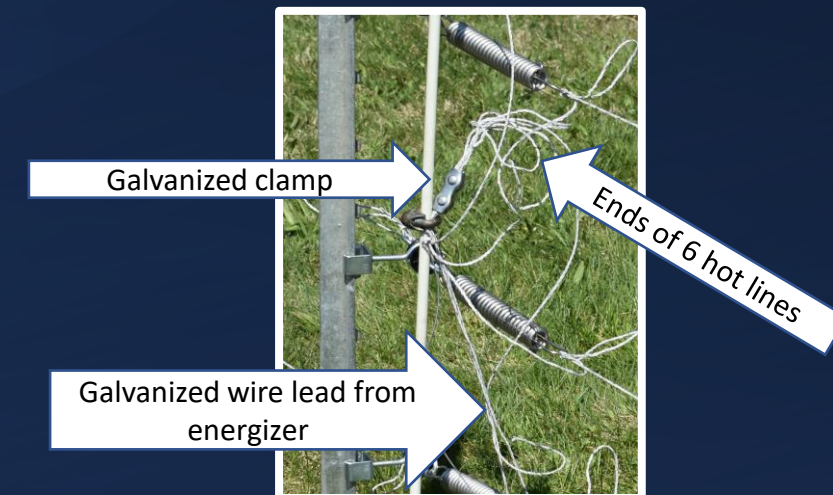


Building the fence: What you'll need

- **Energizer**
1.0 output joules
or more
(1.3 stored joules)

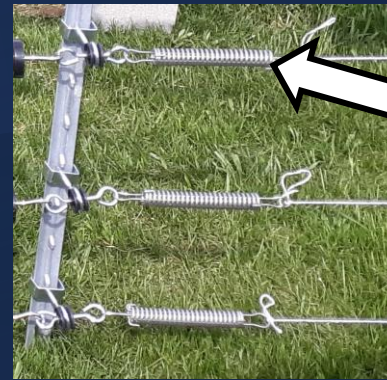
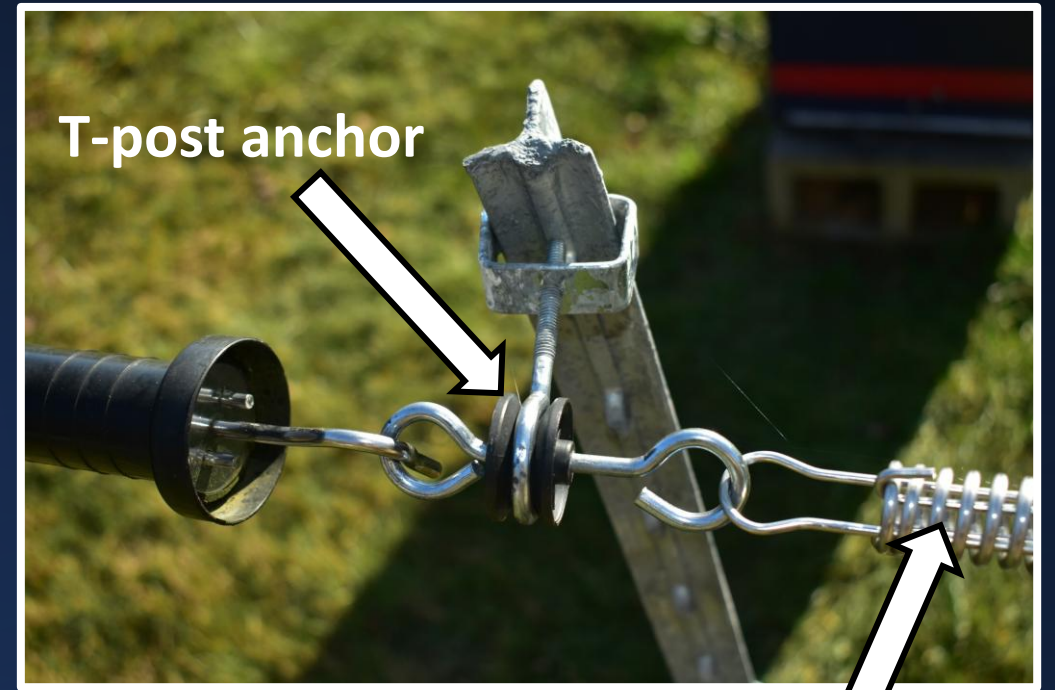


- **A gate: A net gate or wire gate handles and loop anchors or other anchors.**
- **Clamps for wire leads from energizer to charged lines.**



Building the fence: Gate

One option: Spring loaded gate handles,
t-post anchors, lightweight spring tensioners



Lightweight spring
tensioner

Maintain the fence: Weed control

- String trim under bottom wire.
- Weed barrier like cardboard, roofing paper/shingles, geotextile, crushed stone, old carpet, or commercially available landscape edging.



Photo courtesy of Bruce Cheever



Photo courtesy of Vaughn Collins

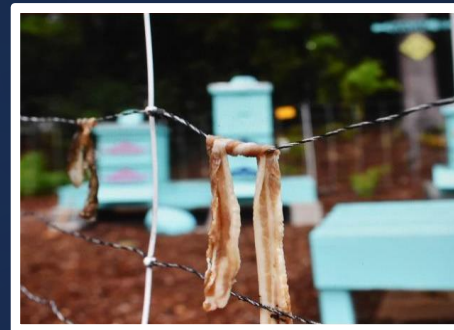


Some final thoughts...

- Place a warning sign on the fence.



- Bait the fence.



- Strap the hives as a last line of defense (Mann Lake carries galvanized metal banding straps that a bear cannot tear. Avoid cheap lightweight ratchet straps.)



So, what does all of this cost? (Approximate)

Expense item

(does not include spare parts)

Approx. Cost

• Energizer (AC or solar/battery 1.0 or more output joules)	• \$110 (AC) -\$350 (solar)
• Grounding kit (Field Guardian)	• \$60
• Insulators, t-posts & line posts, 6' corner t-posts 1.33 lb./ft., line posts, clamps	• \$100-\$140
• Wire-polywire (400') or Deer Quik Fence net (5'x100')	• \$35-\$150
• Gate handles (anchors & springs optional)	• \$30-\$80
• T post driver (optional but very helpful)	• \$55
• Voltage tester (digital inductive or probe)	• \$35-55
Total	\$425 - 890

Winter

Winter Prep and Winter Electric Fence Maintenance

Winter fence actions

- Raise the bottom line(s) on a wire fence to prevent snow and ice from pinning it to the ground.
- Check solar energizer batteries – Dec. & Jan.



01.11.2021 13:13

Our eastern snow is conductive!

Testing by Cheever and Putnam during winter 2023, 2024, 2025 with voltage tester probe in the snow (**snowpack was the grounding medium**), stepping on it like a bear compacting the snow

- **Minimum voltage found: 6,500 volts**
- **Typical voltage: 8,000 to 10,000 volts (max tester reading)**

Nb need for two-line (alternating hot-ground-hot-ground) setup during winter in New England.

Winter fence actions

- May need to remove deep snow accumulations and raise lines further.



Mounting the energizer on a post reduces snow accumulation on solar panels.

Basic Apiary Electric Fence Principles

Fred Putnam, Jr.

Vermont Certified Beekeeper

Brandon, VT 05733

802-247-3323 landline

802-353-7979 mobile/text

countryblossomshoney@gmail.com



"I don't think the new electric fence is engendering the fear we intended."