Basic Principles of Electric Fencing for Apiaries

Fred Putnam, Jr.

To everyone who attended the February 28, 2024, Zoom session, my apologies; we had a brief high-wind power outage that knocked me offline and thus disconnected me from Zoom

I have added some extra explanation on key slides.

I was cut off just after the video of the bear jumping the 42" fence.

Pay special attention to the subsequent section on grounding and connections.

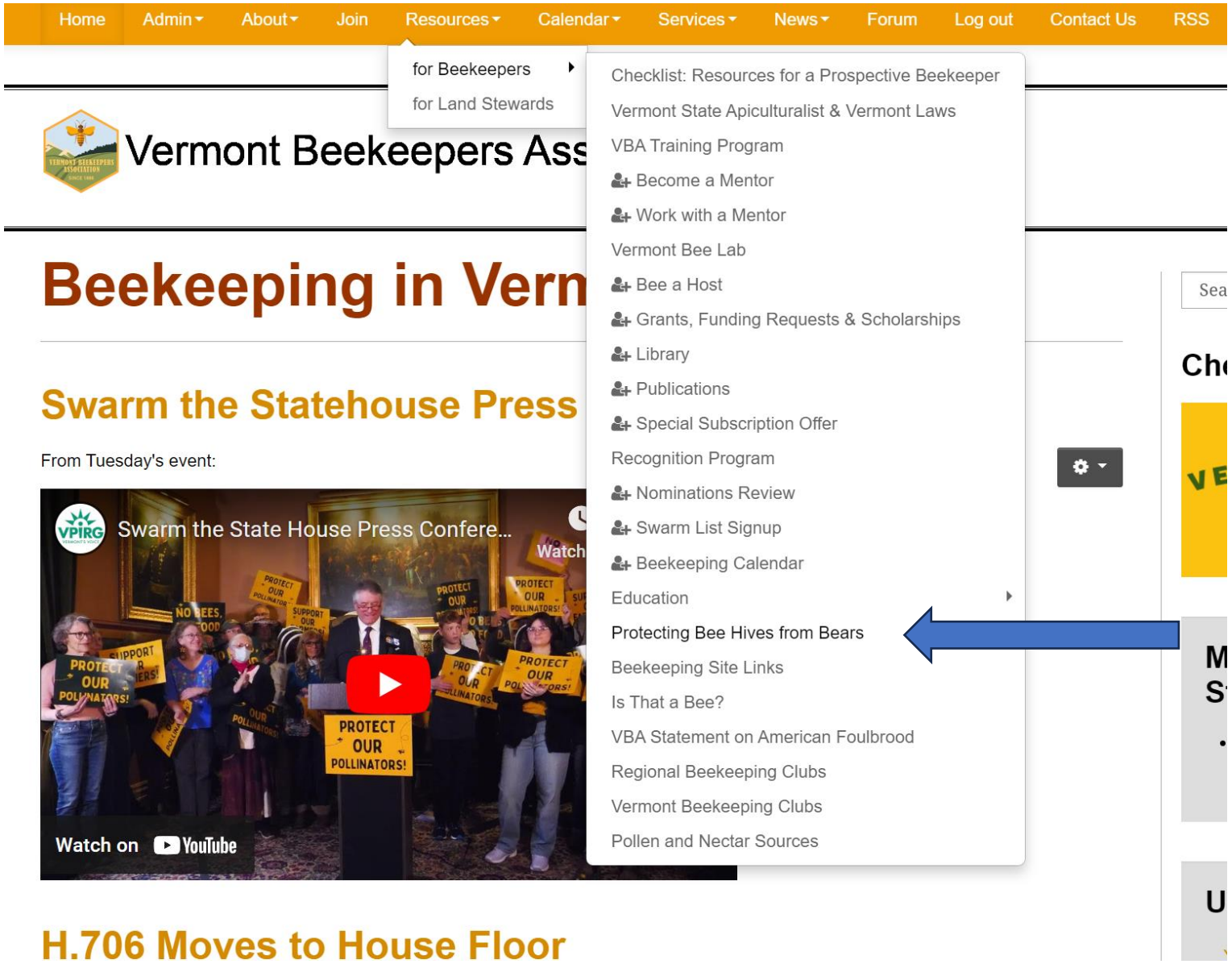
There's also info on managing fences during the winter.

Thanks to all of you for attending!

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)



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.

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.

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.

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

Special note...

Never combine barbed wire with an electric fence!

Building the fence: What you'll need

- Enough wire, polywire, or tape to run 5 or better yet, 6 lines, or;

- 5' high Deer Quik fence netting for whole perimeter – 4-foot net may not be high enough to deter jumpers.

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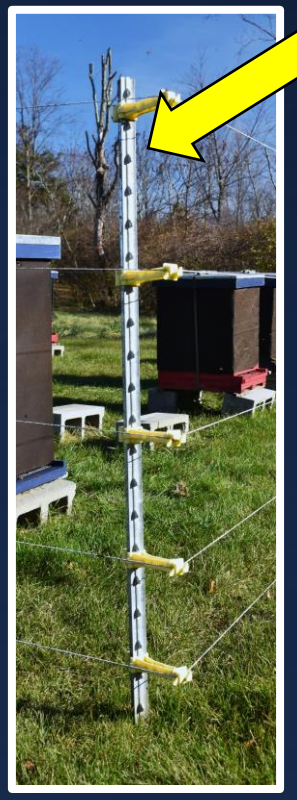
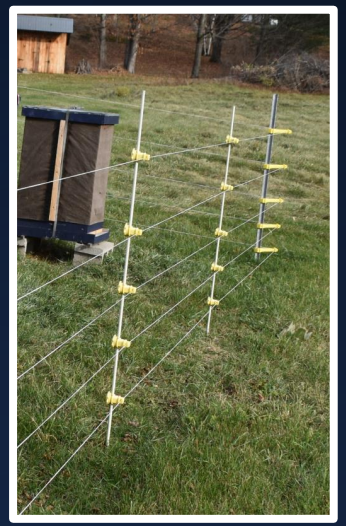
Corner posts – wood posts or metal t-posts. T-posts that are 1.33 lbs. per foot are the stiffest and galvanized posts will not rust.



Building the fence: 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



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 close to a grounded metal object even though the line is not touching the metal object.

5" standoff insulators on metal corner t-posts

Possible inductive loss with short insulator on metal post

Not an issue with plastic, wood, or fiberglass posts:

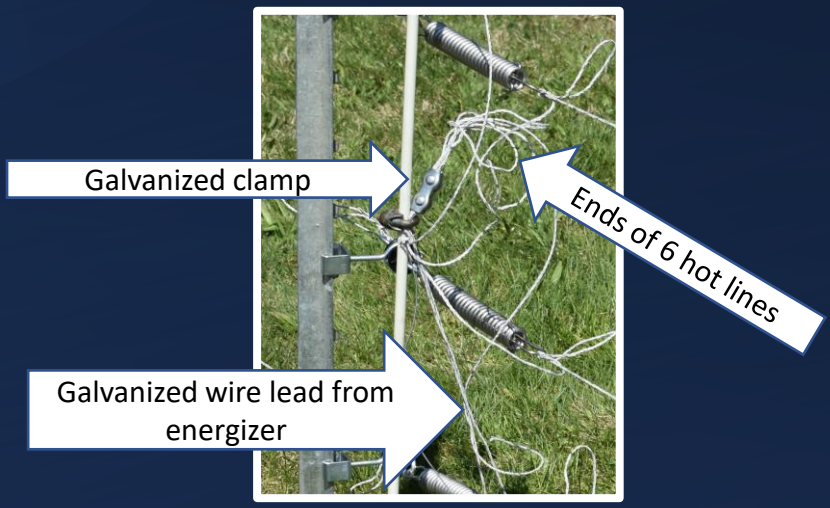
Building the fence: What you'll need

- Energizer

  1.0 or greater

  output 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.



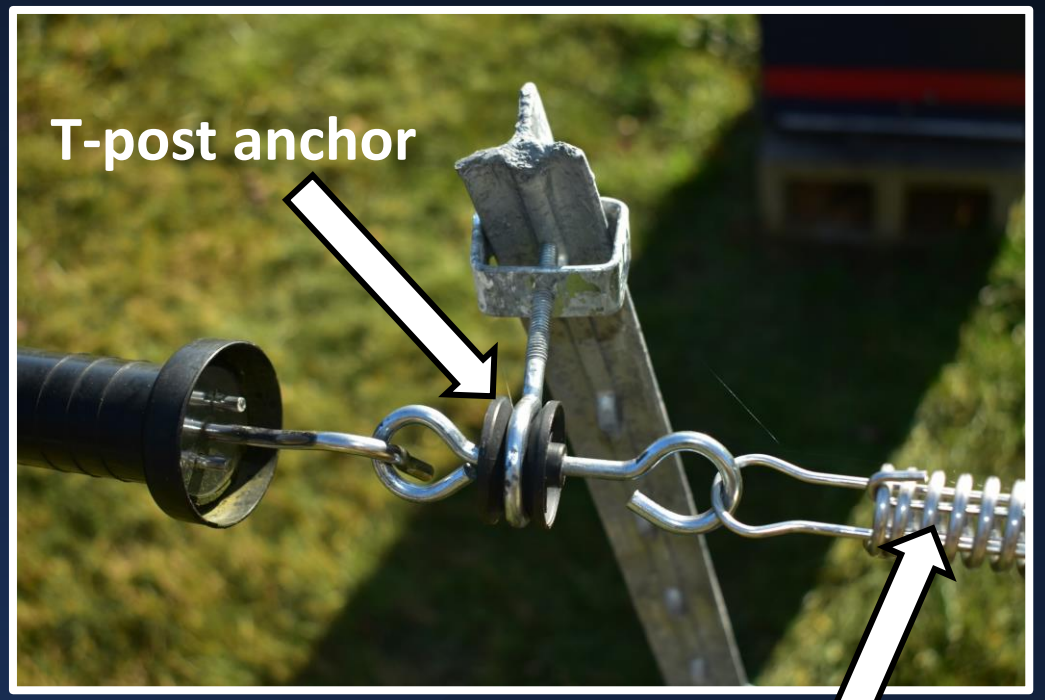
So, what does all of this cost? (Approximate)

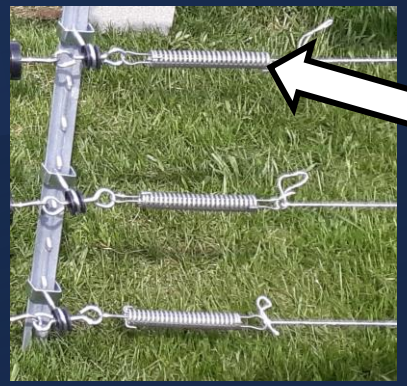
Expense item (does not include spare parts)	Approx. Cost
• Energizer (AC or solar/battery 1.0 or more output joules)	• $110 (AC) -$290 (solar)
• Grounding kit (Field Guardian)	• $35
• Insulators, t-posts & line posts, 6' corner t-posts 1.33 lb./ft., line posts, clamps	• $100-$140
• Wire–polywire (400') 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)	• $35-50
Total	$385 - 670

Building the fence: Gate

One option: Spring loaded gate handles,

t-post anchors, lightweight spring tensioners



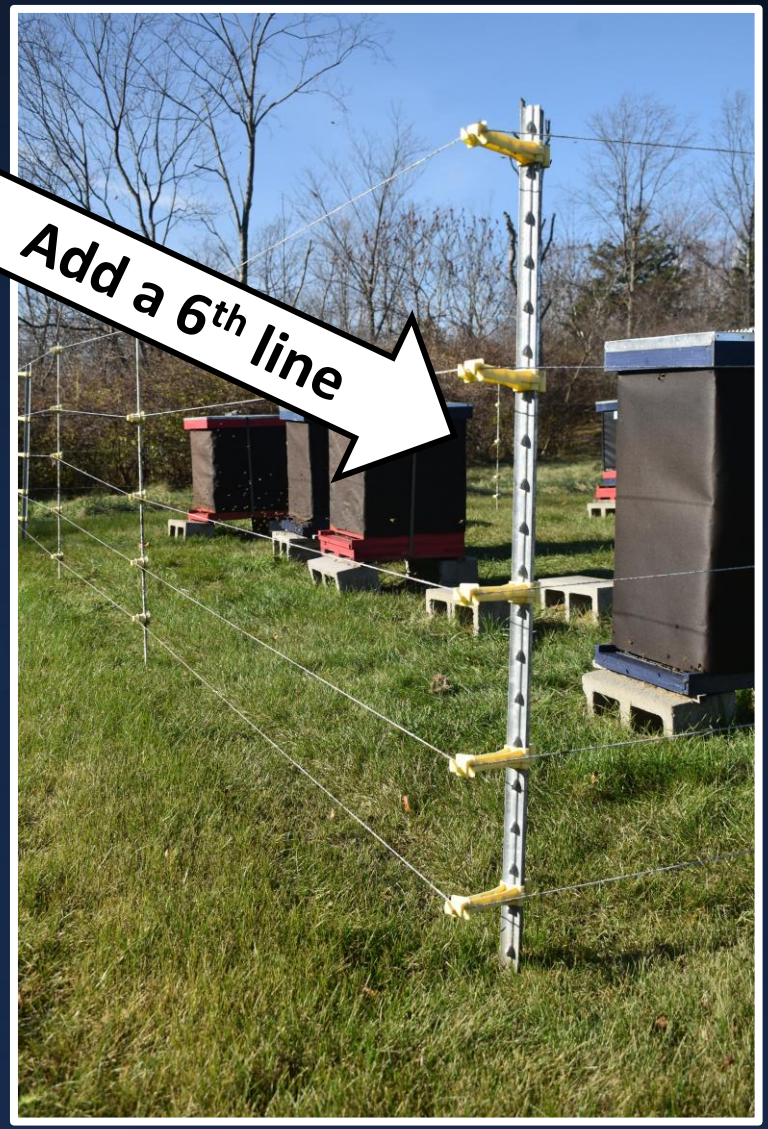


Lightweight spring tensioner

Building the fence: Wire or tape

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

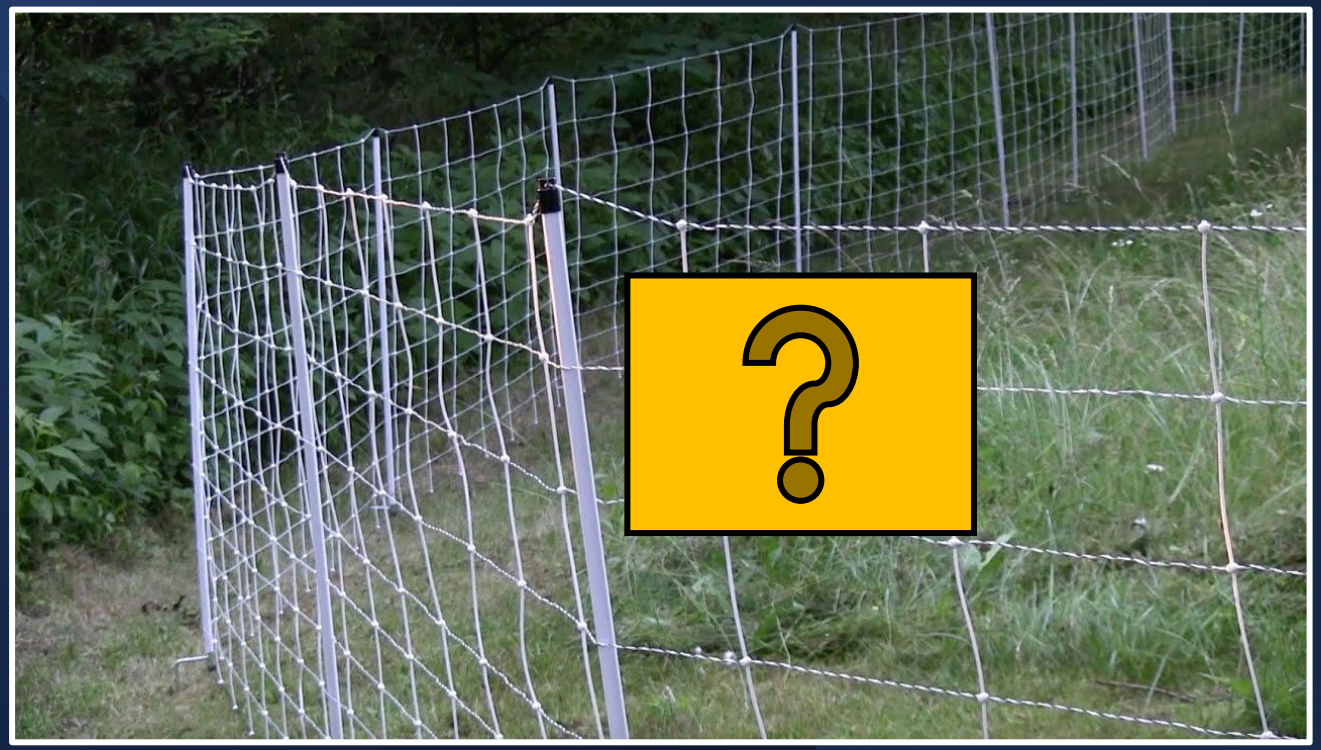
- Bottom line 5”-6” above ground to repel skunks and keep bears from digging under.)
- 2nd line 8-12” above the bottom line.
- Top line 5 feet above ground (or at the top of a 6-foot t-post.)
- Other lines equally spaced between.
- Intermediate support posts follow terrain but at least every 8 feet.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



Building the fence: Netting

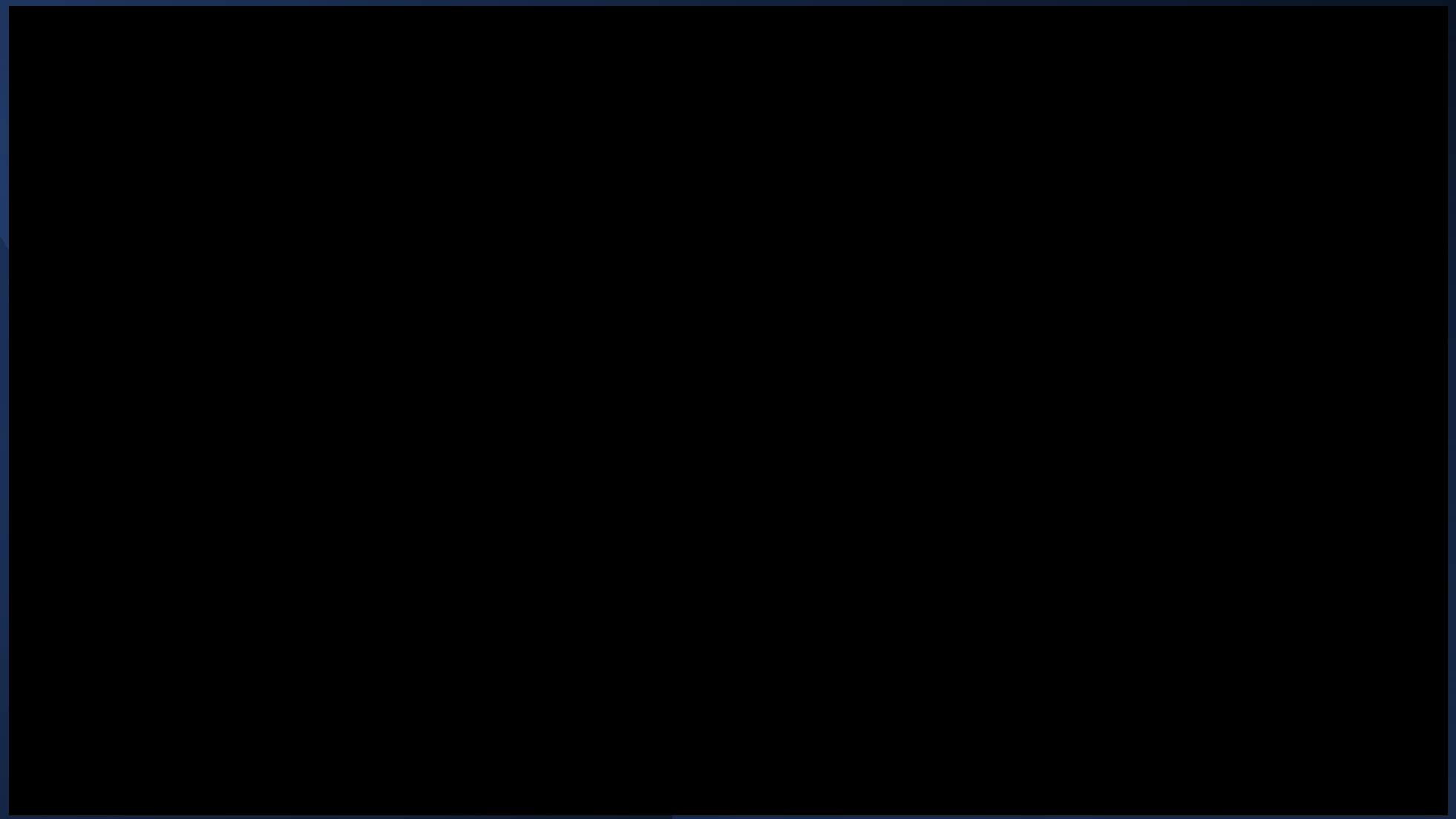
Netting 5’ tall (Deer Quik Fence)

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



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.



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’ space between hives and fence to avoid “reach in” damage.
- Keep fence (and apiary) at least 20’ from woods line – 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.

Maintain the fence: Weed control

Photo courtesy of Bruce Cheever

- 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 Vaughn Collins

Grounding – #1 concern

Clamped connections: Yes
Galvanized rod: Yes

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

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

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

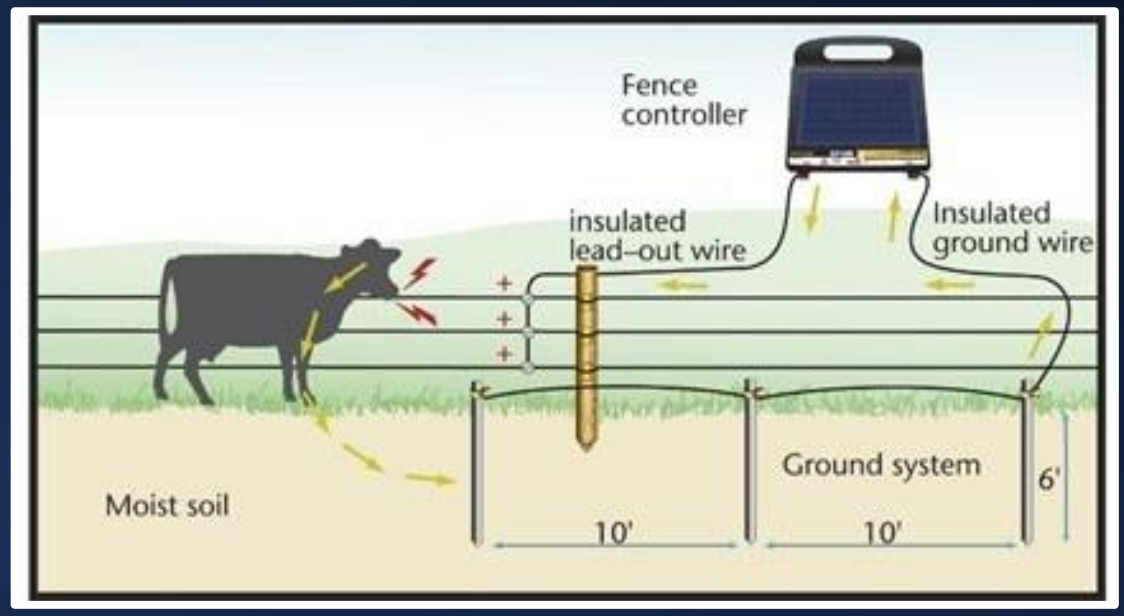
In general, start with three - 3' rods spaced 10' apart or one - 3' rod in a wet spot.

- 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 daisychaining each rod together

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

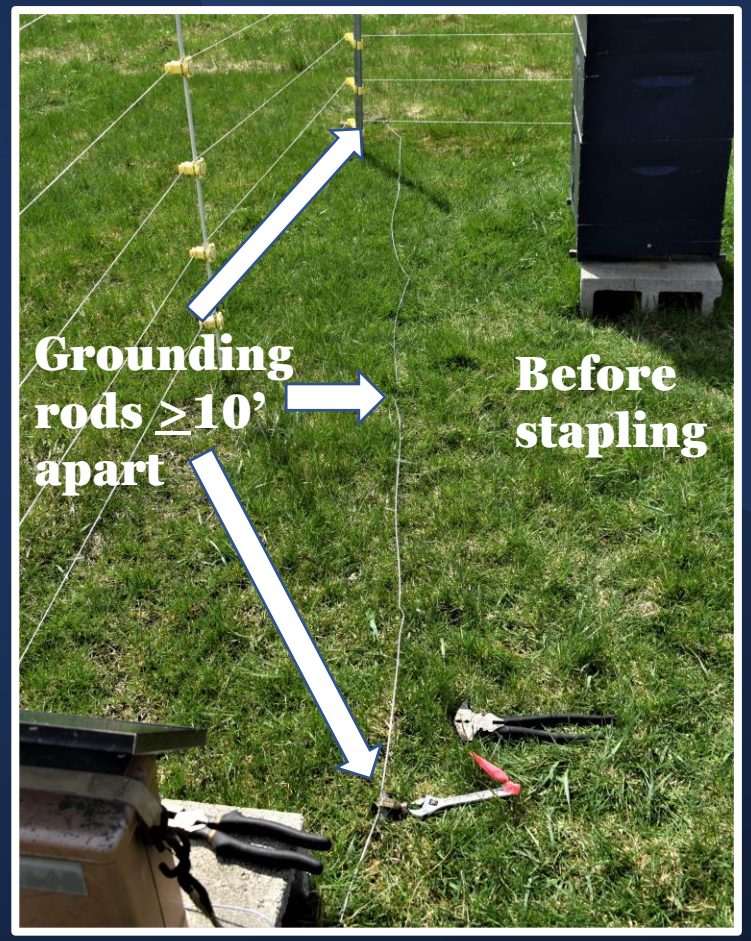
Might need more rods in droughty or shallow soils. Less in wet spots.

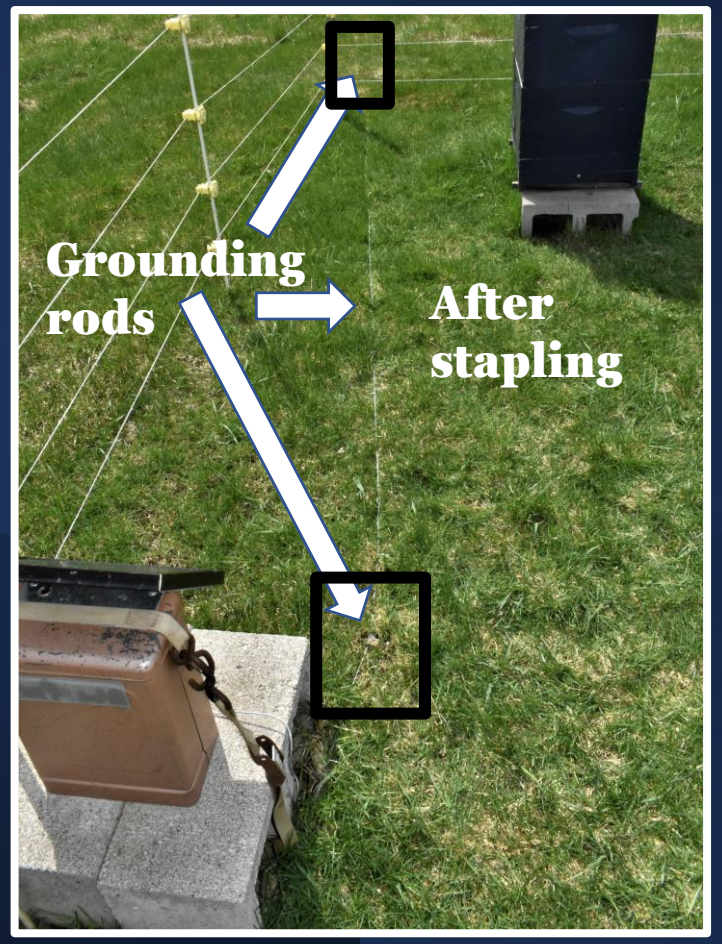


Grounding rods at least 10 feet apart.

A Grounding Example

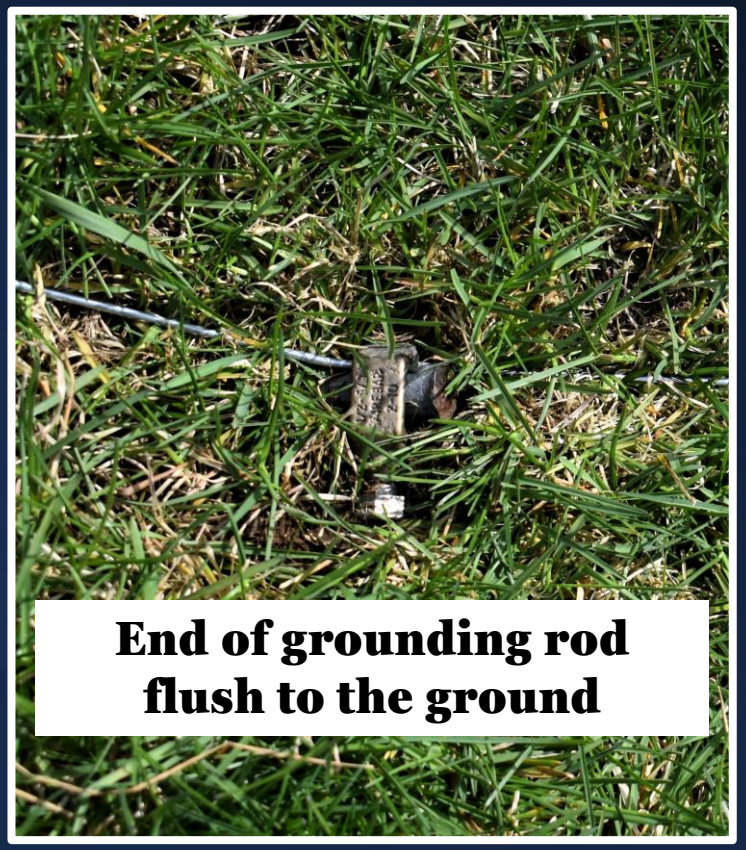
3’ long rods spaced >10’ apart connected together with 12.5-gauge galvanized wire





A Grounding Example – cont

One continuous wire from farthest grounding rod to energizer – "daisychained"



End of grounding rod flush to the ground

Some final thoughts...

- Place a warning sign on the fence.

- Bait the fence.

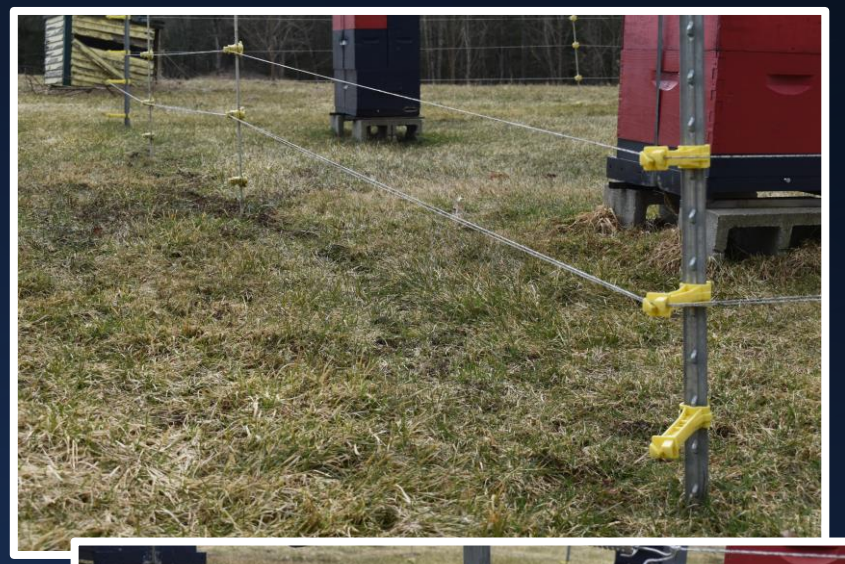
- Strap the hives as a last line of defense (Mann Lake carries galvanized metal banding straps that a bear cannot tear. Avoid cheap lightweight ratchet straps.)

Winter Prep and Winter Electric Fence Maintenance

Wnter 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.



Our eastern snow is conductive!

Testing by Cheever and Putnam during winter 2023 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)

No need for two-line (alternating hot-ground-hot-ground) setup during winter in New England.

Wnter 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

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