Constructing a Vineyard Trellis

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Vineyard Trellis Systems

can be as simple as a single wire in a high cordon system (top) to as complex as this catch wire system being used for table grapes in California (bottom).

Function & Requirements of a Vineyard Trellis

Serves as a framework for training and supporting the vines.

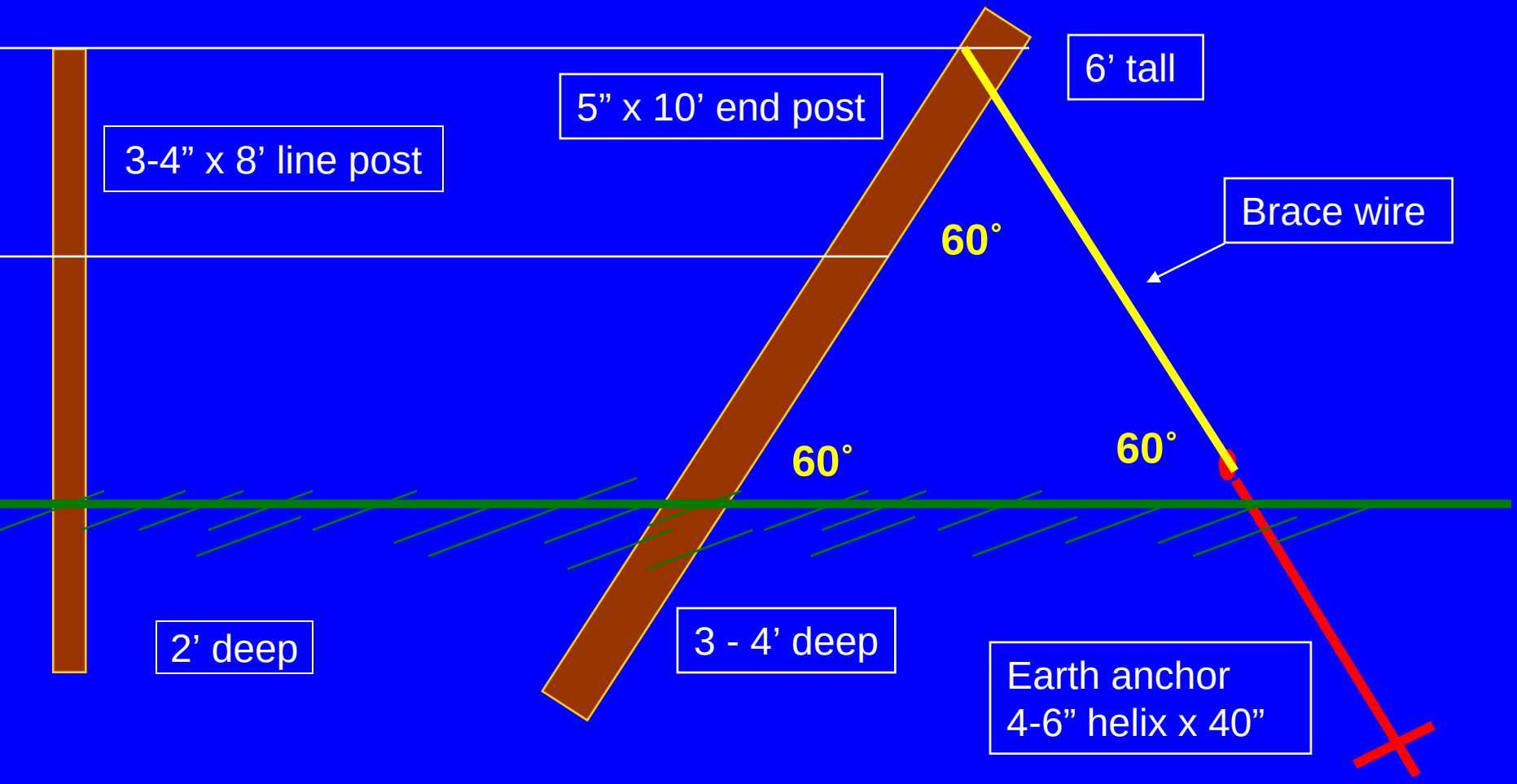
- Must be strong enough to support large crops and withstand high winds.
- Must last 20 or more years with routine maintenance.

Major Trellis Components

- **Posts: Wood** (preferred)**, steel, or other material spaced 21, 24 or 28 ft apart**
  - Dependent on vine spacing
- **Strong end-post design**
  - **Anchored:** earth anchor, tie-back post, or deadman for rows less than 600 ft.
  - **Braced:** H-brace or slant brace for rows over 600 ft.
- **High-tensile galvanized steel wire**
  - High cordon, or Kniffen: 1 to 3 wires
  - Vertical shoot positioning: 5 to 7 wires
  - Geneva Double Curtain: 3 or 4 wires

Anchored End Post System
with an Earth Anchor

Suitable for rows up to 600 ft, but this is affected by soil texture and anchor's helix diameter.



Earth Anchor Requirements

Shaft:

Minimum: 1/2” x 36”

Preferred: ≥ 5/8” x ≥ 40”

Helix:

Dia. (in.)	4	6
Area (sq. in.)	12.6	28.3
% of 6-inch	44.5	100
Suitable for rows up to (ft)*	~250	600

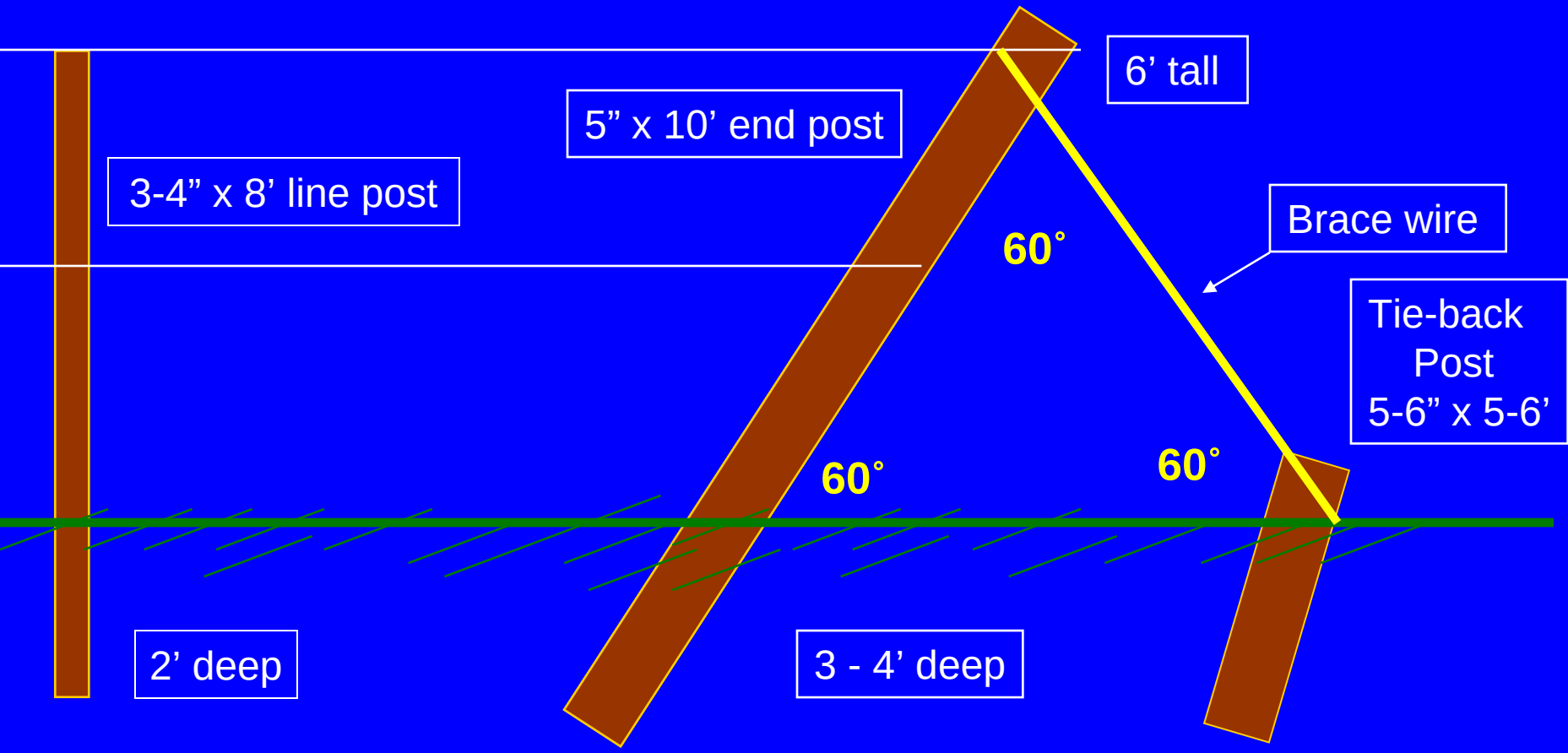
*** Suitable row length decreases on lighter, sandy soils.**

Anchored End Post System
with an Earth Anchor

Anchored End Post System

with a Tie-back Post

Suitable for rows up to 600 ft. Cost of materials will often determine whether an earth anchor or tie-back post is used.

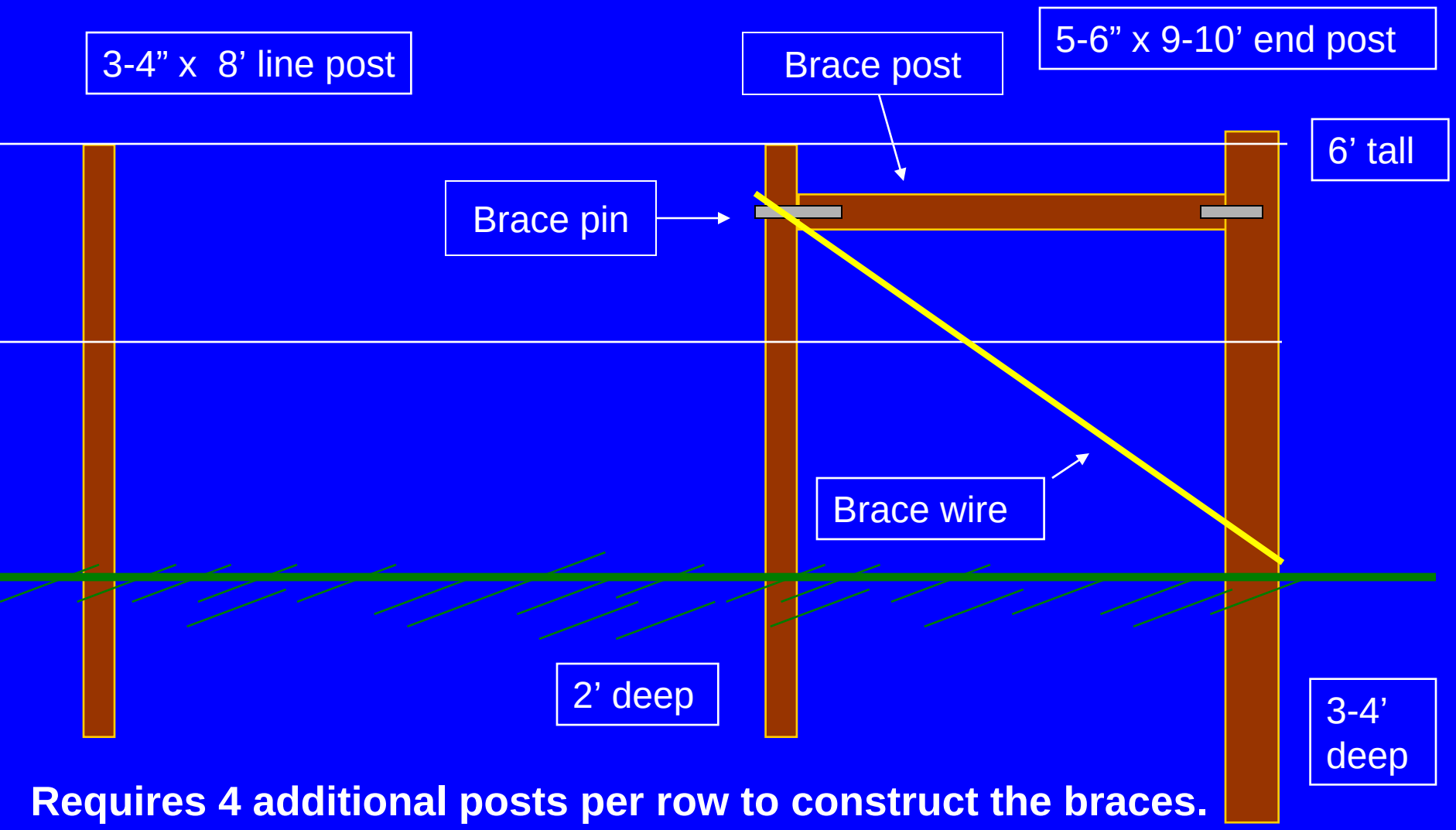


End Post System with a Tie-back Post

Mike White, ISU Extension

H-Brace End Post System

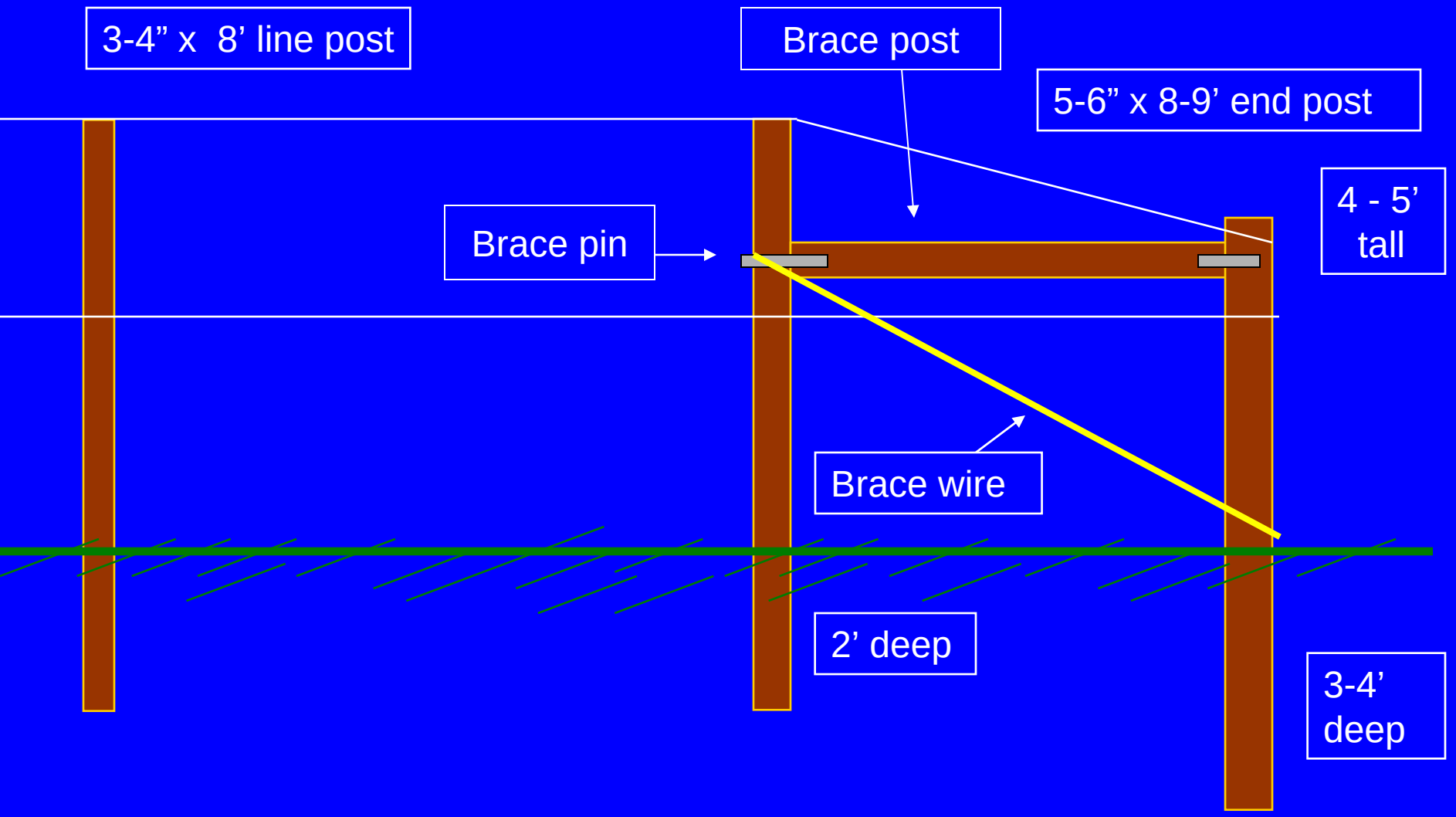
Required for rows over 600 ft



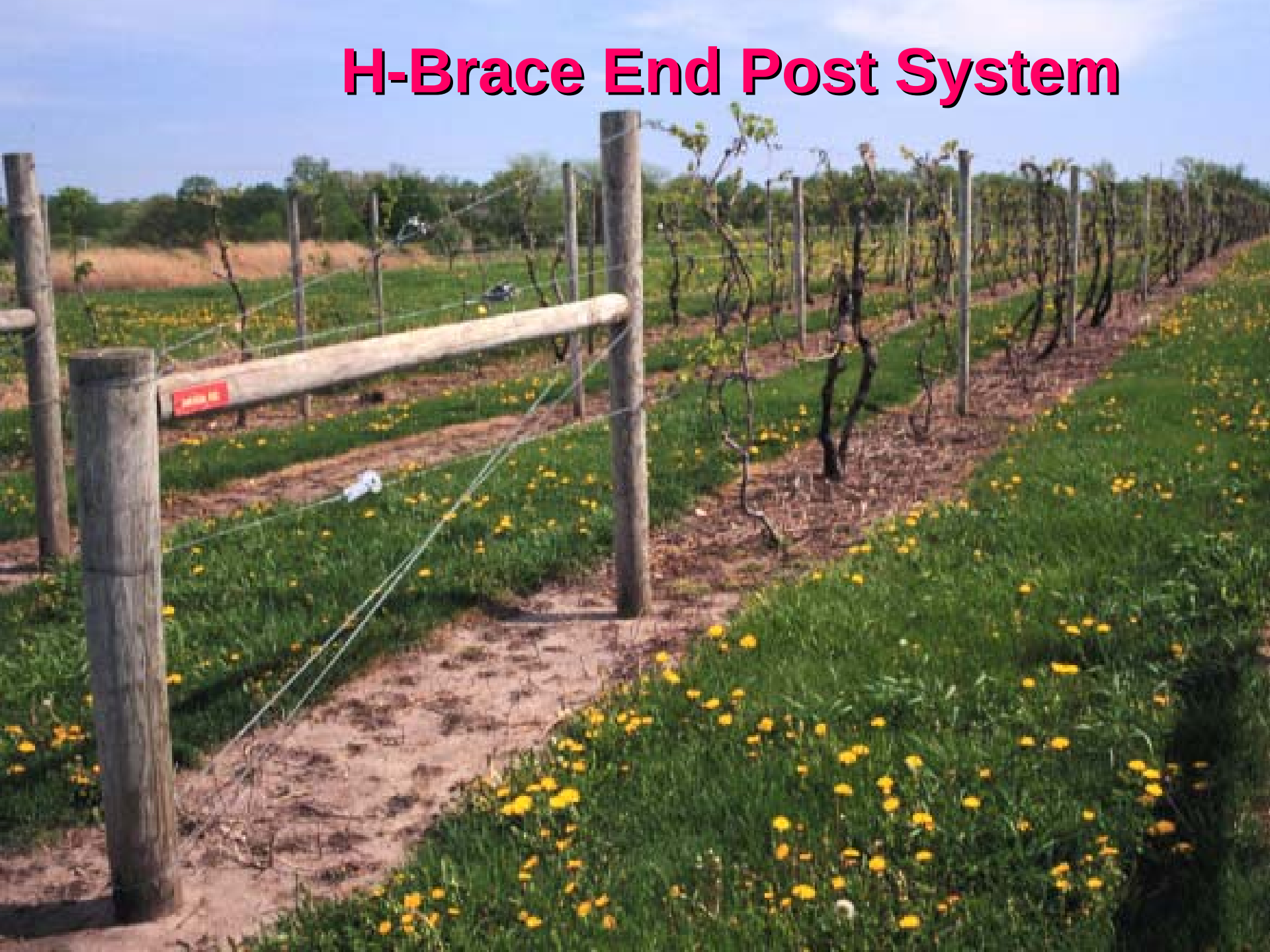
Requires 4 additional posts per row to construct the braces.

H-Brace End Post System

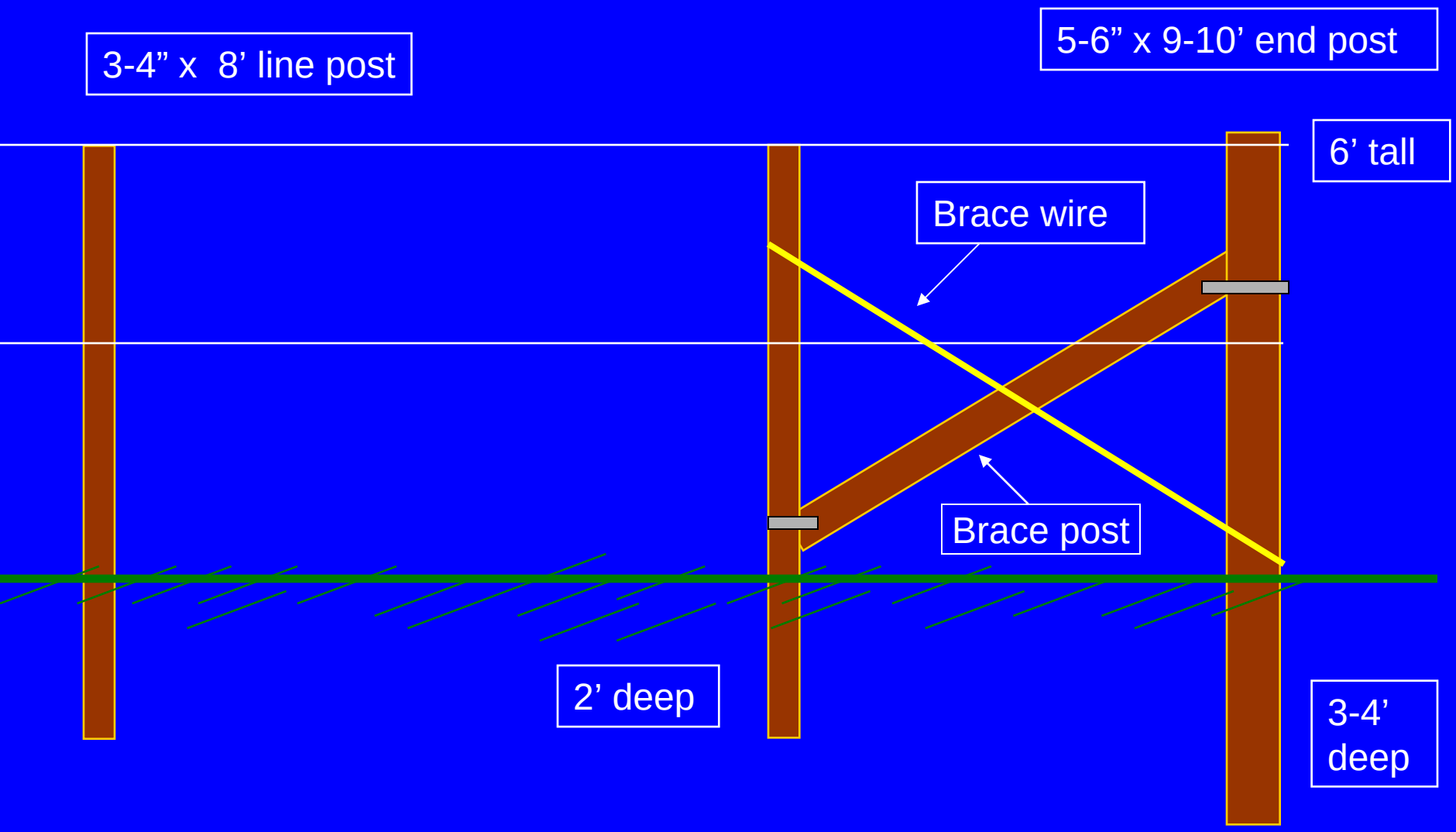
Optional method that allows the use of a shorter end post



H-Brace End Post System



Slant Brace End Post System



Trellis Post Materials

Red, southern yellow, or lodgepole pine:

- Pressure-treated with chromated copper arsenate (CCA).
- Life expectancy of 20 to 30 years (suppliers should be able to provide a guarantee).

Steel stakes:

- Can be substituted for line posts.
- Subject to bending and leaning.
- Should be used in combination with wood posts.

Other alternatives:

- Native timber
- Fiberglass
- Recycled plastic
- Reinforced concrete

Using Untreated Native Timber *

Resistance to Decay	
Osage Orange	Exceptional
Black Locust	Exceptional
Red Mulberry	Exceptional
Eastern Red Cedar	Very resistant
Honey Locust	Moderate

*** Native woods do not have useful natural resistance to termites.**

Charring the buried portion of a post may have merit. It reduces the availability of a food source, and generates wood tar that has some anti-microbial activity. There is no proof of benefit, but it might not hurt and may very well help to prolong the life of a post.

8 ft Steel Stakes being used in combination with native timber posts

Mike White, ISU Extension

Recycled Plastic Post

Mike White, ISU Extension

Vines Between Post

Vine Spacing	Post Spacing		
	21 ft	24 ft	28 ft
6 ft	-	4	-
7 ft	3	-	4
8 ft	-	3	-

- Vine vigor determines vine spacing in the row, and thereby affects post spacing. Do not exceed 30 ft between post.
- Equipment size, degree of side slope & training system often determines the spacing between rows.

Wood Trellis Post Comparison

Size vs Strength

Size *	Cross-sectional Area		Lateral Breaking Point	
Dia. (in)	Sq. in.	% of 4"Post	Lbs	% of 4"Post
2.5	4.91	39	**238**	25
3	7.07	56	**408**	42
3.5	9.62	77	**650**	67
4	12.57	100	**970**	100
5	19.64	156	**1893**	195
6	28.27	225	**3268**	337

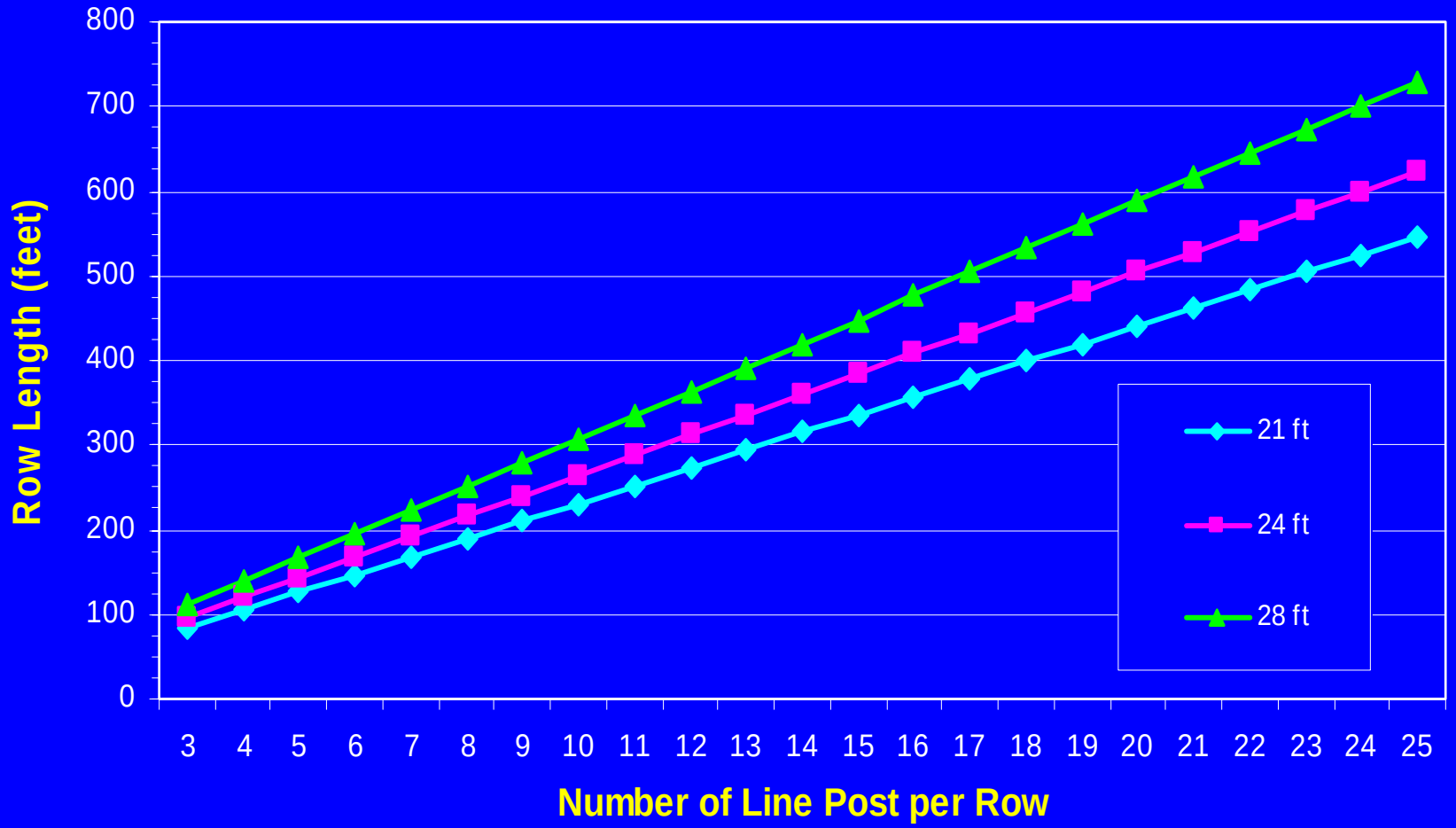
* Measured at narrow end

Preferred Post Size:

Line Post: 3 to 4 inch diameter

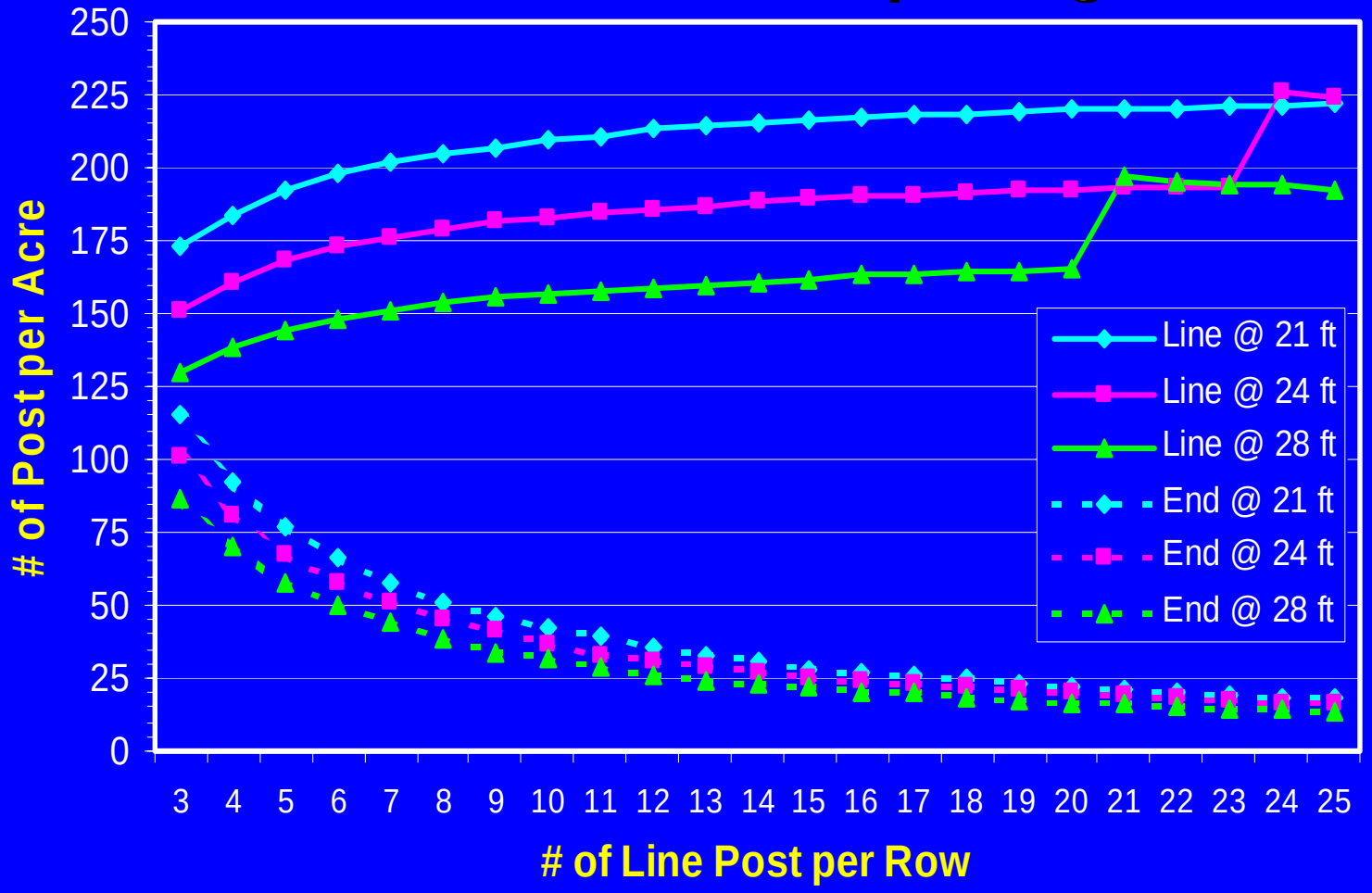
End Post: 5 to 6 inch diameter

Row Length at Different Line Post Spacings



Number of Post per Acre

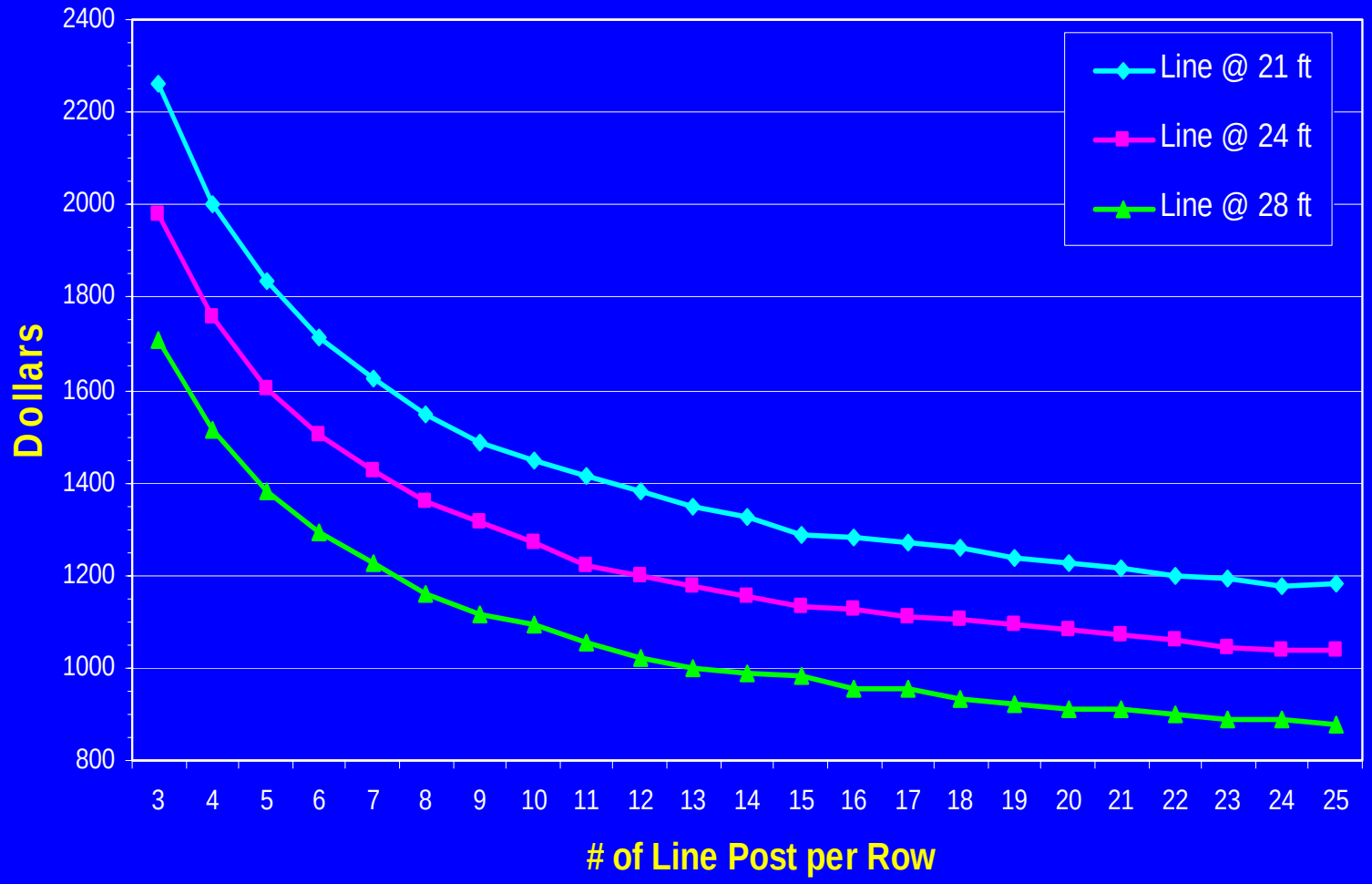
At a 9 ft Row Spacing



As the row length increases, fewer end posts are required per acre. The jump in line posts occurs when row length exceeds 600 ft and 4 extra line posts per row are required to construct end post braces.

Cost of Trellis Posts per Acre

For rows spaced 9 feet apart with 3” x 8’ line post and 5” x 10’ end posts.



With the cost end posts being 3 or more times greater than line posts, longer rows cost less to establish on a per acre basis.

Trellising Hardware

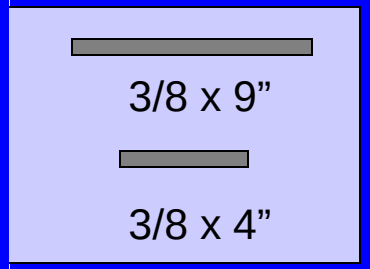
12.5 ga High-tensile Wire
& 9 ga Soft Wire

Wire Strainers

1 Strainer
handle

Crimping
Sleeves

Tension Indicator Spring
(Optional)



Steel Brace Pins
(for H-Brace)

Wire Vise
(for Rows < 200 ft)

Trellis Wire Characteristics

Low Carbon vs High-tensile

Wire		Yield Point (lbs) *		Breaking Point (lbs)	
Gauge	Dia. (in)	Low Carbon	High-tensile	Low Carbon	High-tensile
9	.148	1,119	-	1,324	-
10	.135	929	1,973	1,101	2,860
11	.121	747	1,587	886	2,300
12	.106	572	1,214	978	1,760
12.5	.099	-	1,063	-	1,540

* Tension at which the wire begins to stretch.

Preferred Wire for a Vineyard Trellis

Line wire: 12.5 gauge High-tensile

Brace wire: 9 gauge Low Carbon

- High-tensile wire cannot be twisted .
- Wires have similar yield and breaking points.
- Because high-tensile wire is not very subject to stretching, the tension on the wire should be reduced during the winter.
  - Estimated that a temperature drop from 80^{o} to -20^{o} F can increase the tension on 500 ft of 12.5 gauge high-tensile wire by 130 pounds due to shrinkage.
  - Tension indicator springs will absorb most of the additional tension.

Specialized Trellising Tools

Hydraulic Post Driver

Post Hole Auger

Wire Spinning Jenny

Chain-Grab Wire Puller

Crimping Tool

Other Tools & Materials

Tools:

- Hammer
- Fencing pliers
- Steel bar
- Tape measure
- 6 ft measuring stick
- Plumb bob
- Cordless Drill w/ 3/8” bit (for brace construction)

Materials:

- 1 3/4” or 2” Staples
- (Grounding rods, wire, & clamps)
- (Hardwood twitch sticks)

Lightning Damage

Risk can be reduced by grounding the wires to earth anchors or grounding rods.

Materials for 1 Acre of Trellis

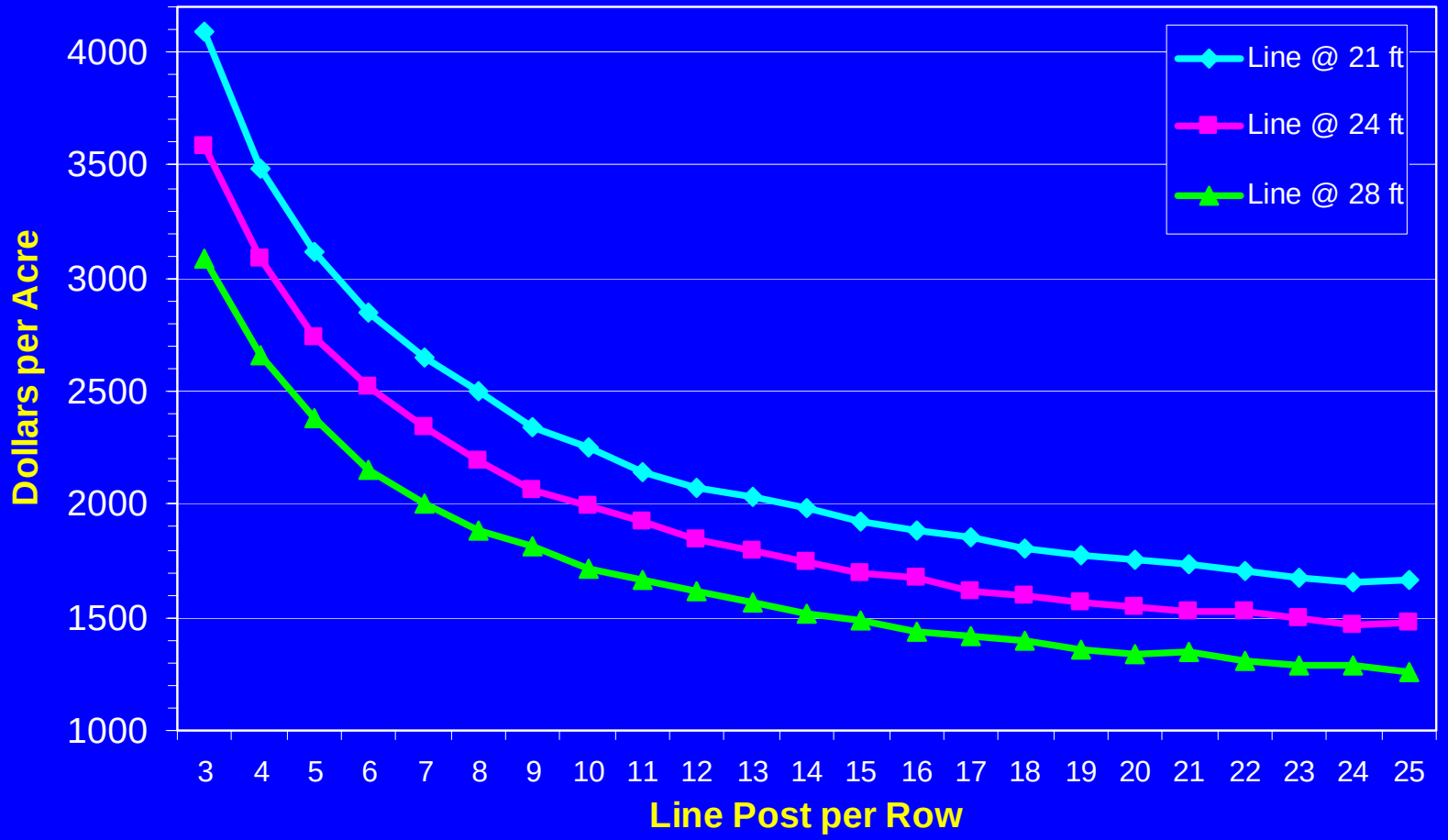
(11 Rows @ 9 ft apart w/ 2 wires)

Line Post Spacing	21 ft	24 ft	28 ft
Row Length	441 ft	432 ft	448 ft
3” x 8’ Line Post	220	187	165
5” x 10’ End Post	22	22	22
Earth Anchors	22	22	22
12.5 ga High-tensile wire (4,000 ft rolls)	2.49	2.44	2.53
Wire strainers w/ tension springs	22	22	22
Crimping sleeves (2 / splice)	92	92	92
2” staples (lbs @ 53/lb)	17.0	16.2	14.5
#9 soft wire (ft)	308	308	308

The number of end post, anchors, strainers, crimping sleeves & feet of soft wire needed per row remains constant regardless of row length..

Trellis Materials Cost per Acre

Rows 9 ft apart w/ 2 wires



As row length increases, the cost of trellis materials per acre goes down because fewer end posts, anchors, strainers, etc. are needed. The amount of high-tensile wire required per acre will remain relatively constant, and is an inexpensive item in comparison to posts.

Materials for 1 Acre of Trellis

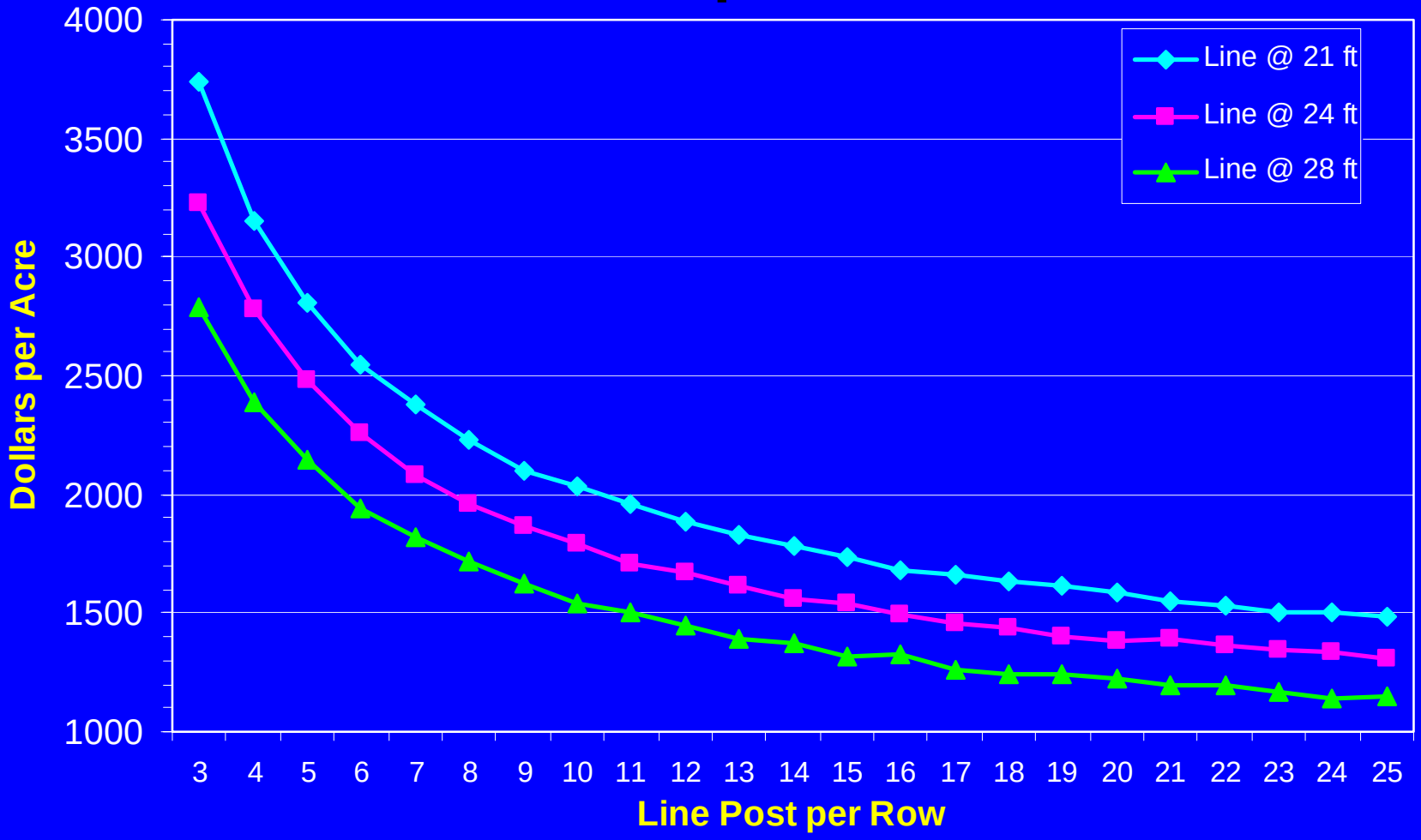
(10 Rows @ 10 ft apart w/ 2 wires)

Line Post Spacing	21 ft	24 ft	28 ft
Row Length	441 ft	432 ft	448 ft
3” x 8’ Line Post	200	170	150
5” x 10’ End Post	20	20	20
Earth Anchors	20	20	20
12.5 ga High-tensile wire (4,000 ft rolls)	2.26	2.22	2.30
Wire strainers w/ tension springs	20	20	20
Crimping sleeves (2 / splice)	84	84	84
2” staples (lbs @ 53/lb)	15.4	14.7	13.2
#9 soft wire (ft)	280	280	280

With wider rows, less material is required per acre. Row width is often determined by equipment size, the degree of side slope, and trellising system.

Trellis Materials Cost per Acre

Rows 10 ft apart w/ 2 wires



With few rows per acre, the cost of trellis material per acre is less.

Establishing a Trellis

Distribute and drive posts immediately after planting

Dr. Bruce Bordelon,
Dept. of Horticulture, Purdue University

Driving Posts

In proper position:

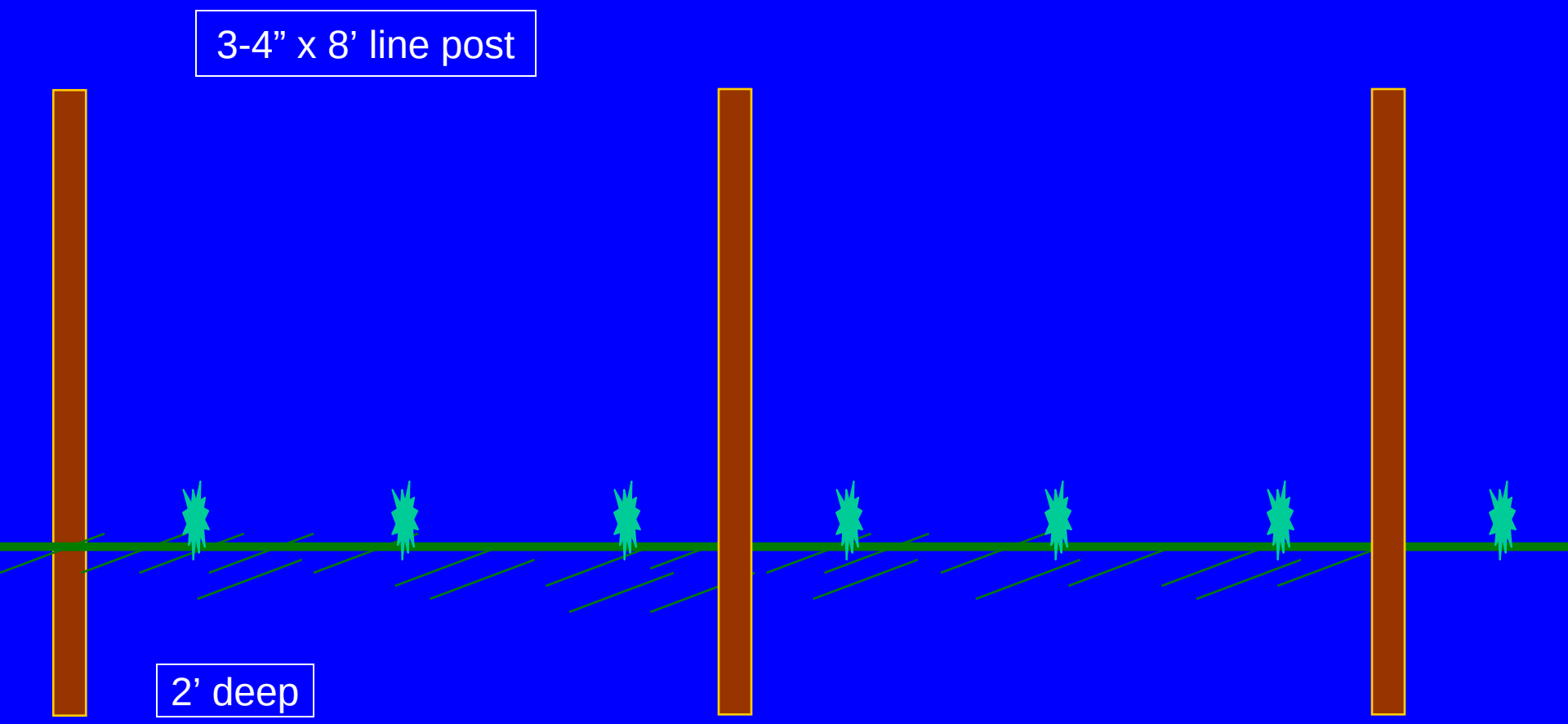
- Straight
- Narrow end down
- Correct depth

A pre-cut measuring stick provides a quick reference for gauging the proper depth.

Dr. Bruce Bordelon,
Dept. of Horticulture, Purdue University

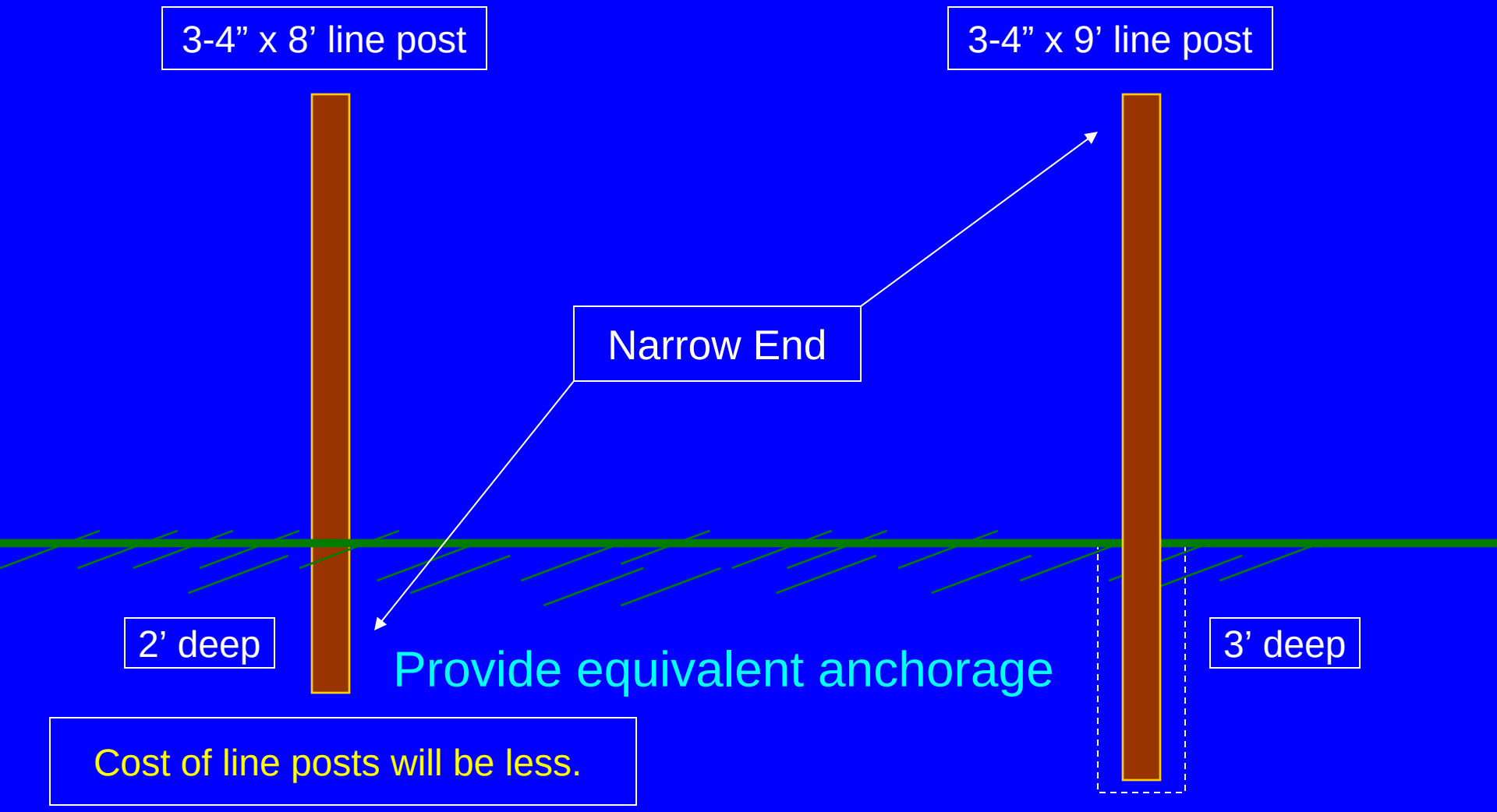
Line Post

Should be positioned between vines



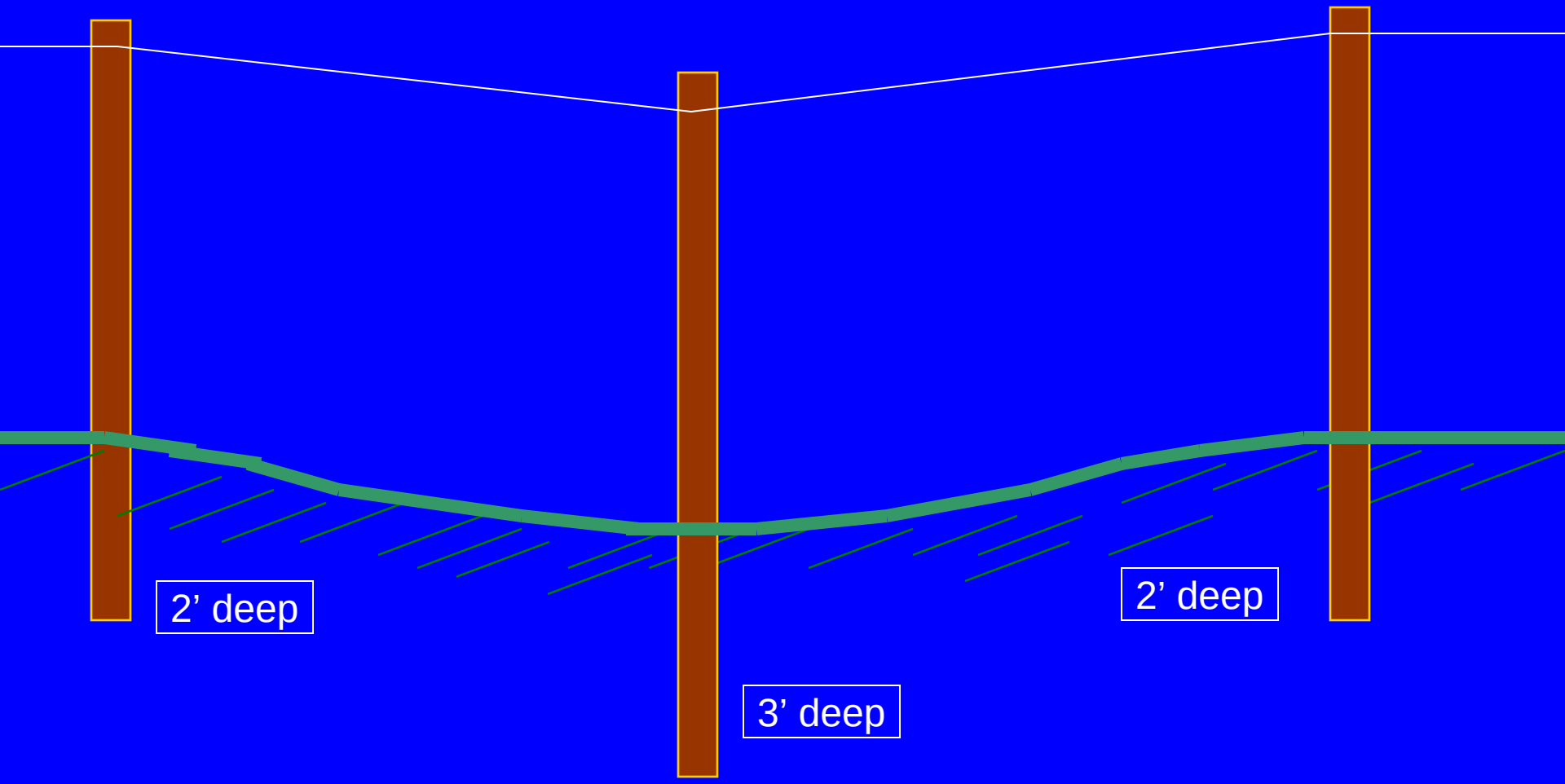
Line Post

Driven vs setting in an Augered hole



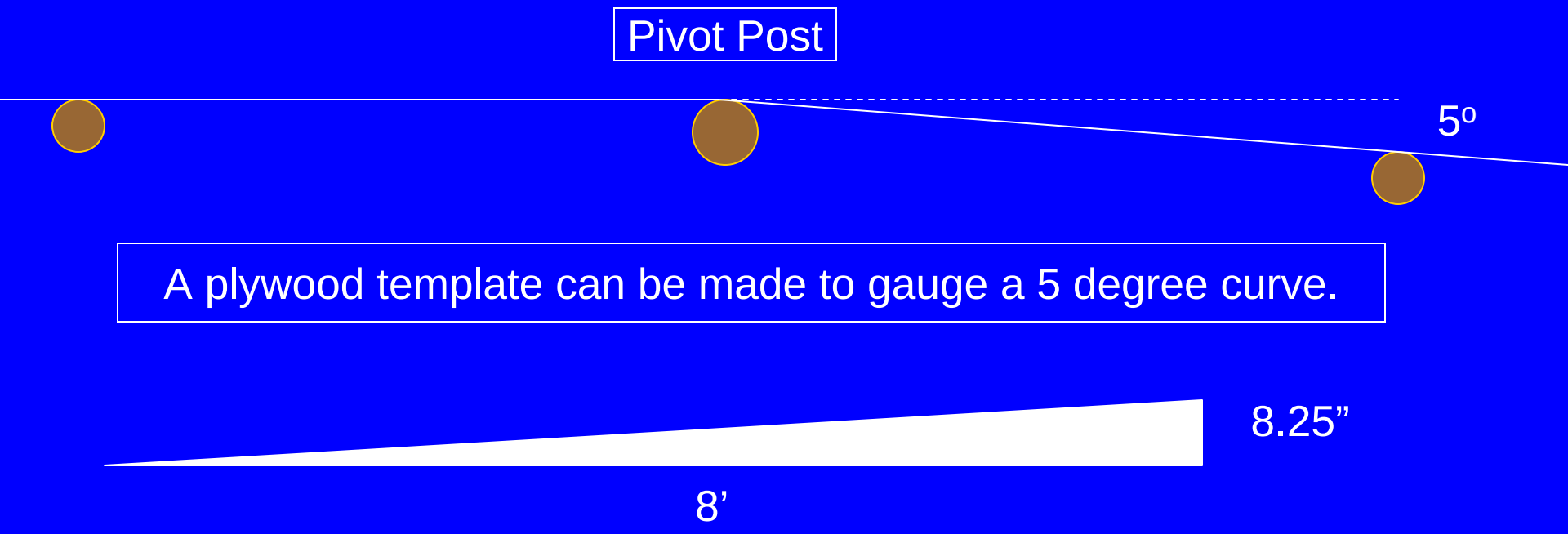
Posts in Swales

Posts in swales are prone to being pulled out by the wire tension. Use longer posts, and drive them deeper.



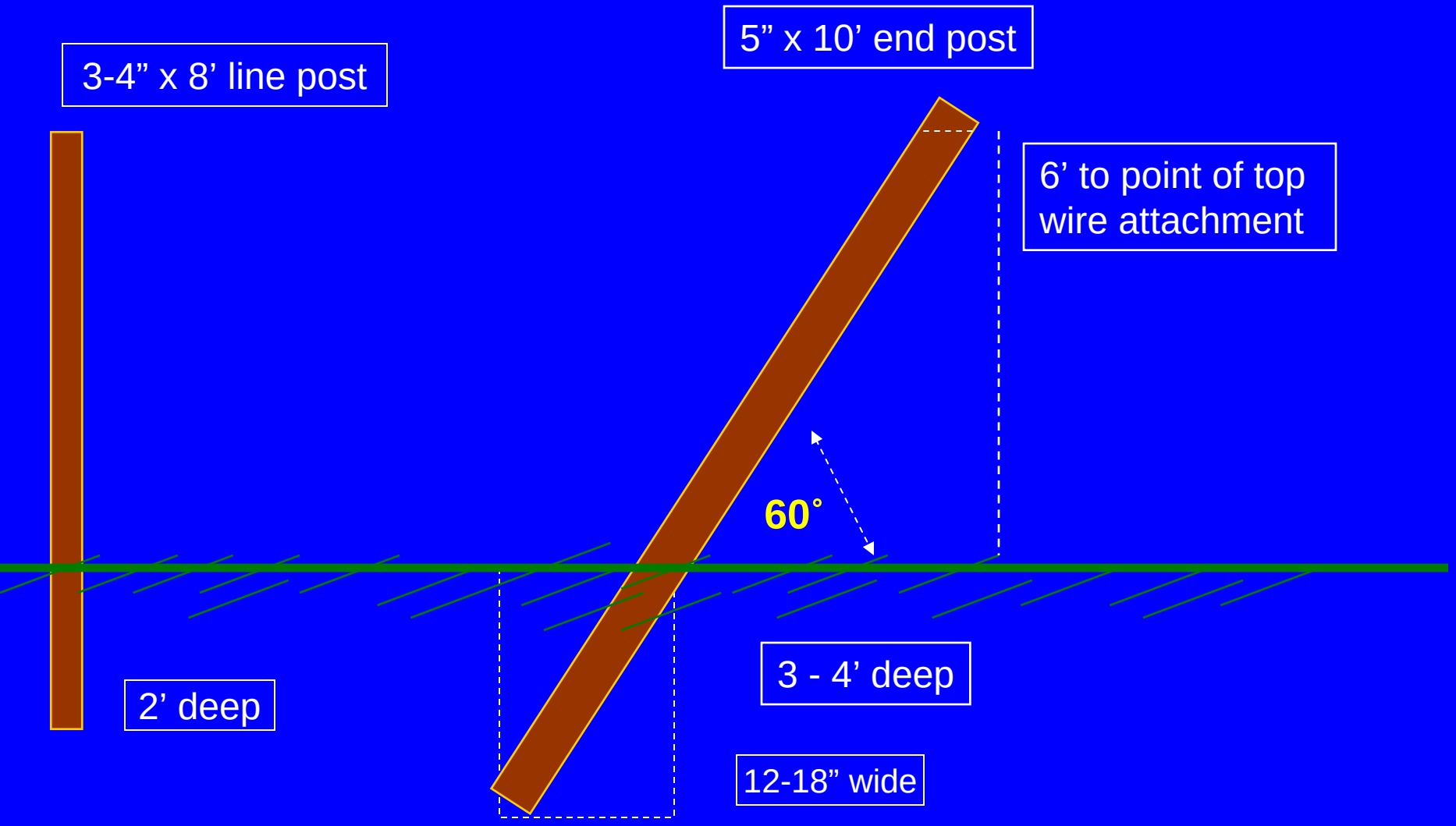
Planting on a Contour

Straight rows are preferred for stretching wire, but rows can be planted on a contour if the sharpness of the curve does not exceed 5 degrees per 30 ft of span. Pivot posts should be at least 4” dia. x 9’ and driven 3’ deep.



Constructing an Anchored End Post System

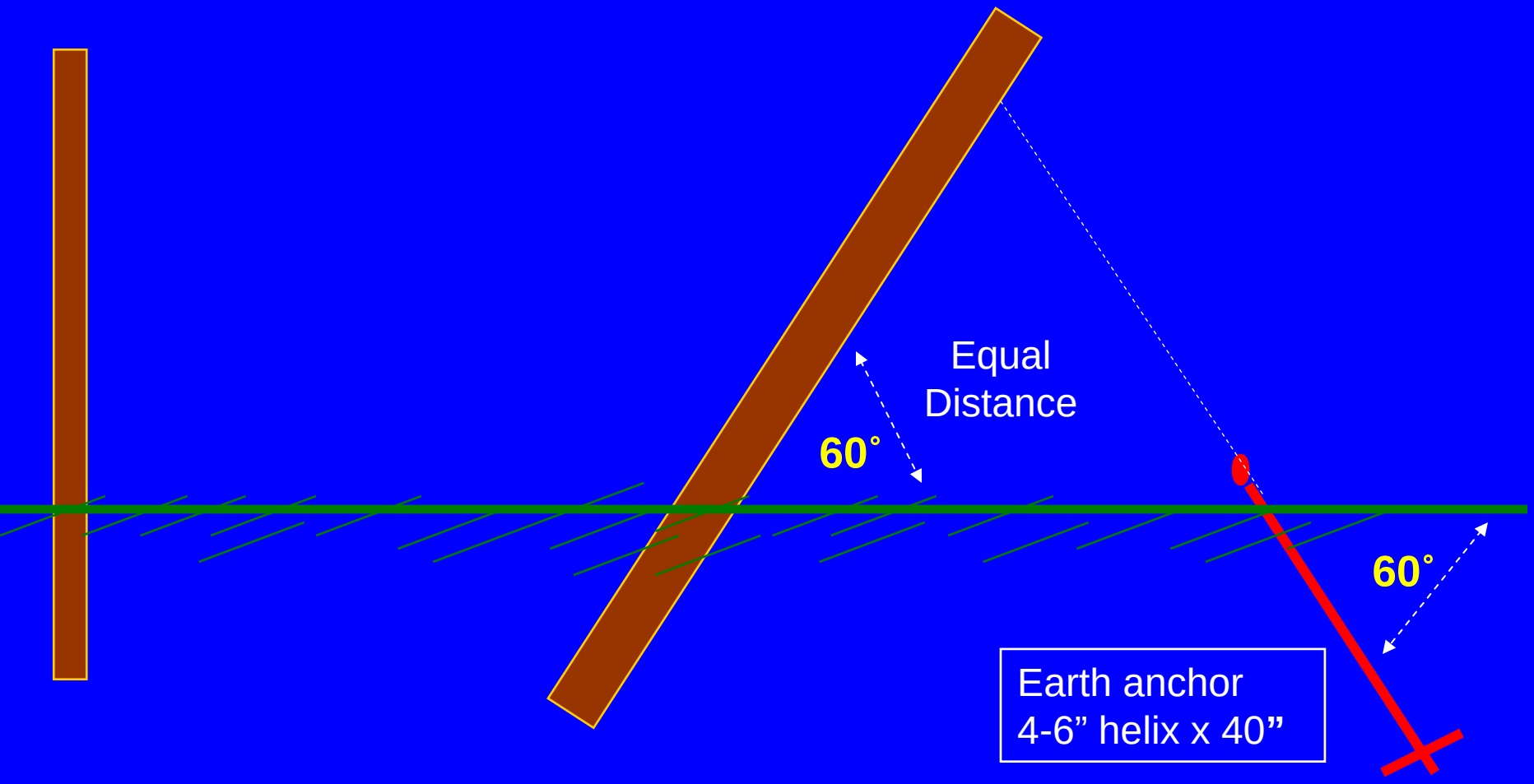
Set the end post in an augered hole, or drive in at an angle.



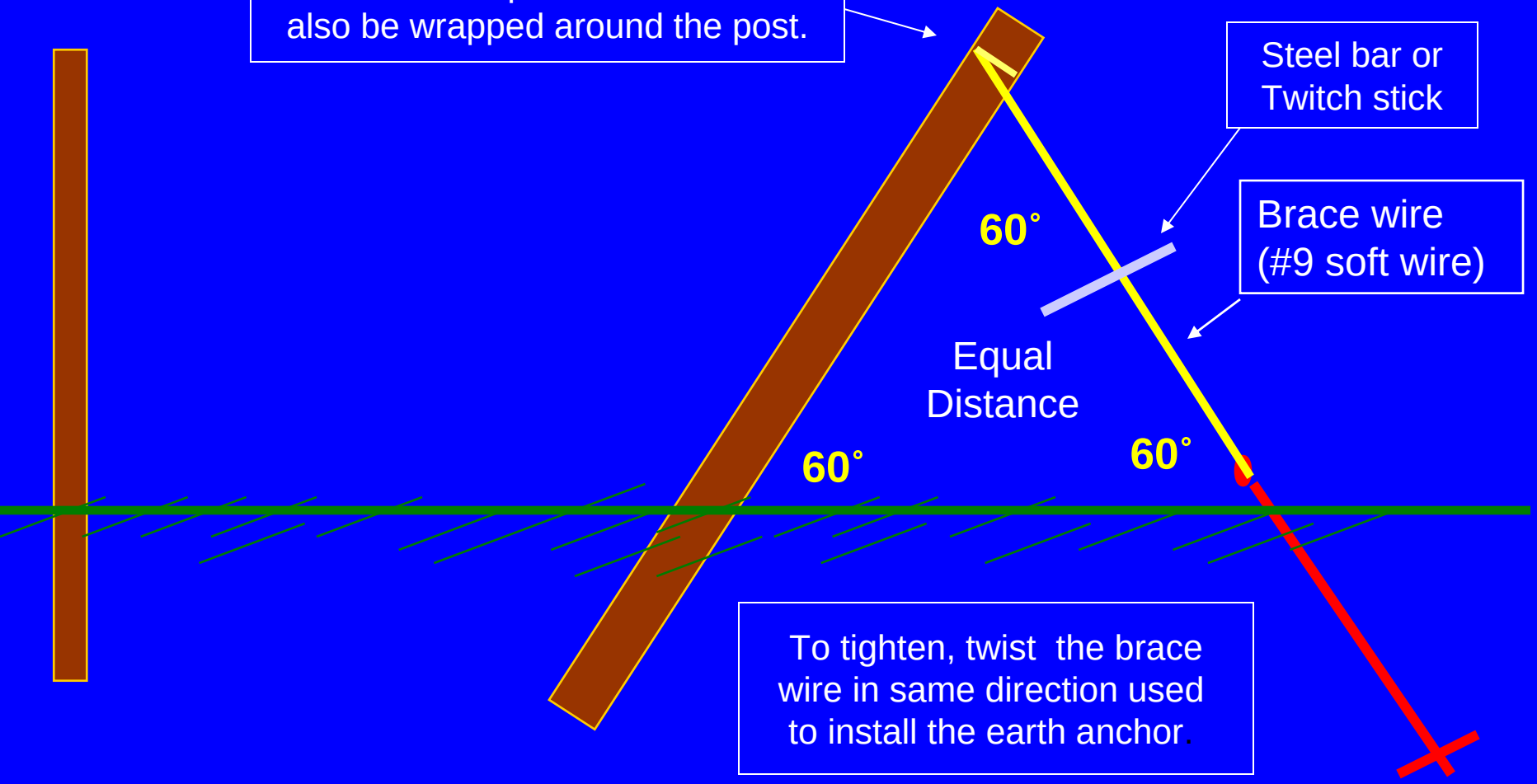
Install an Earth Anchor

by screwing it into the soil at an angle

that points to the spot of attachment for the brace wire.

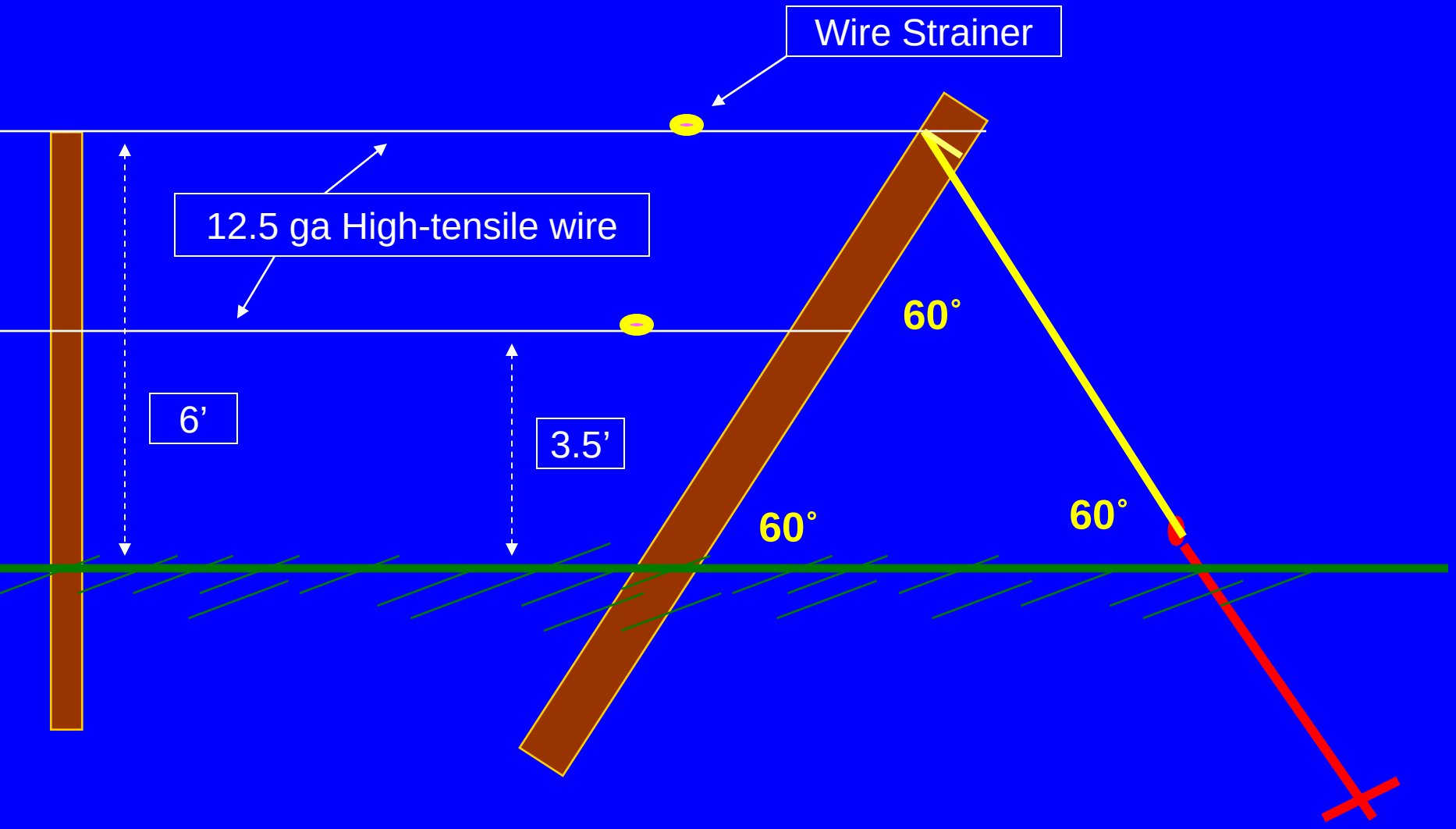


Attach Brace Wire
by forming a loop & twist to tighten



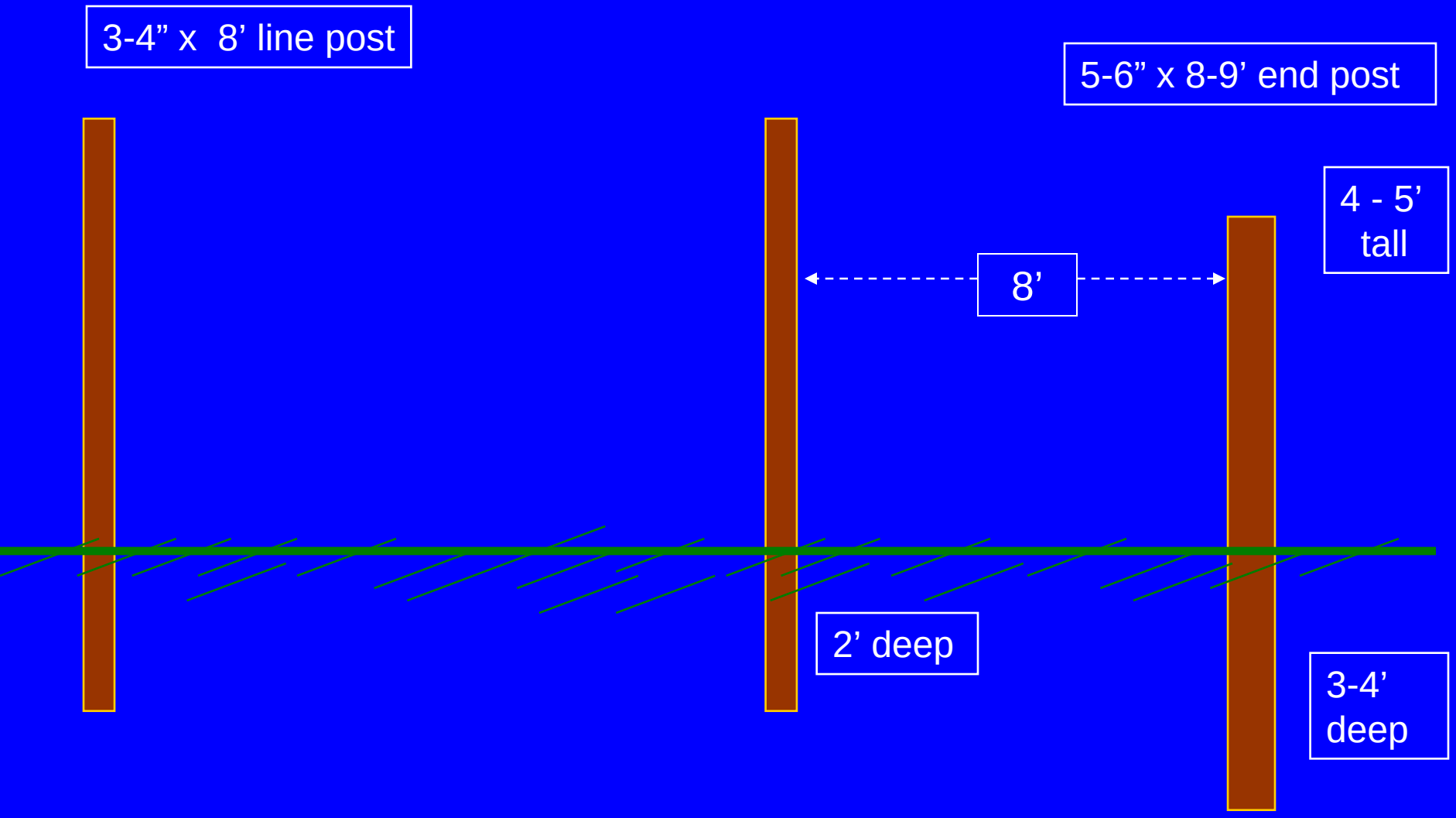
String, Attach, & Tighten Wires

Wire tension should be set at about 250 lbs.



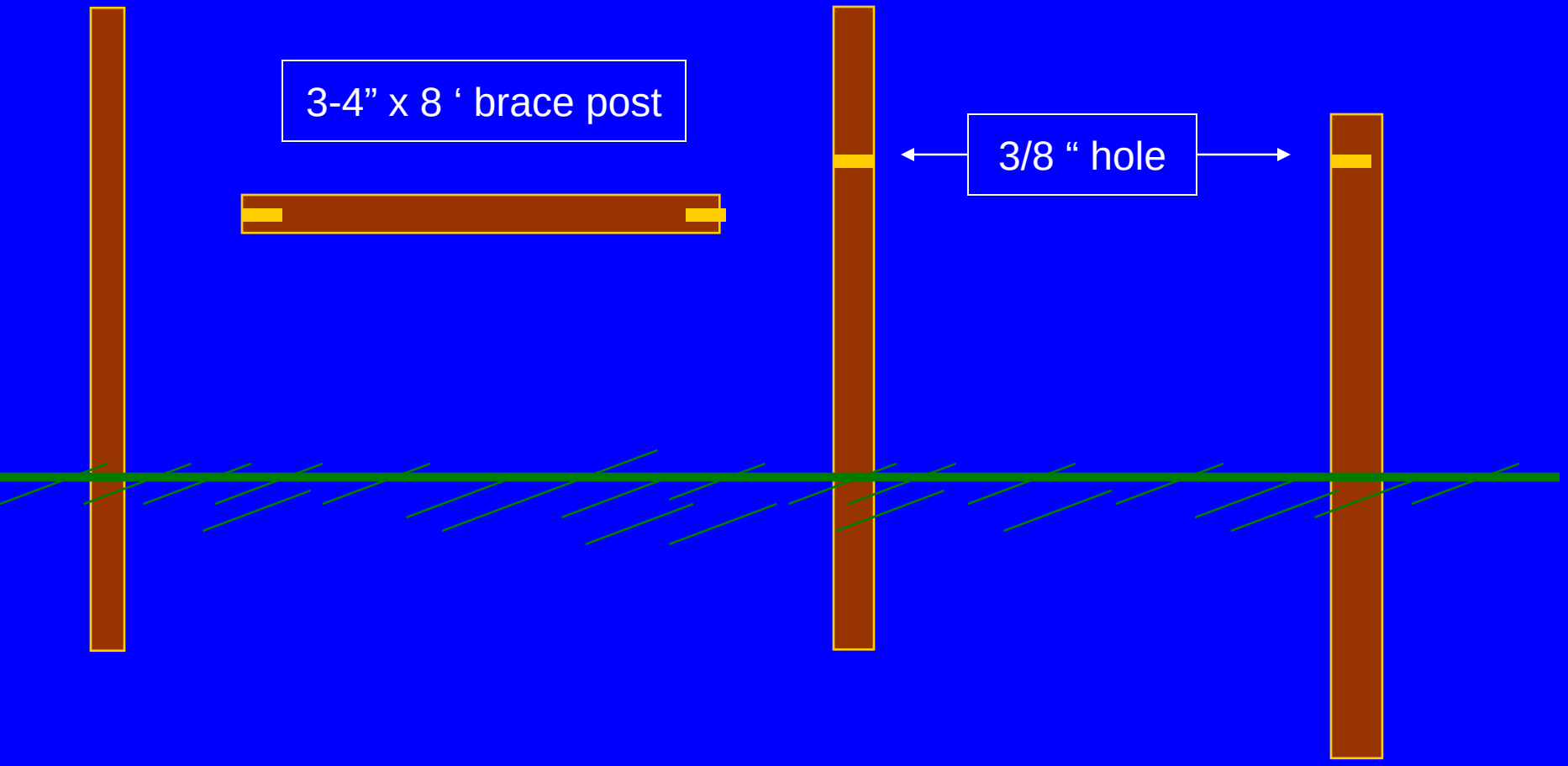
Constructing an H-Brace End Post System

Set end and line post 8 ft apart

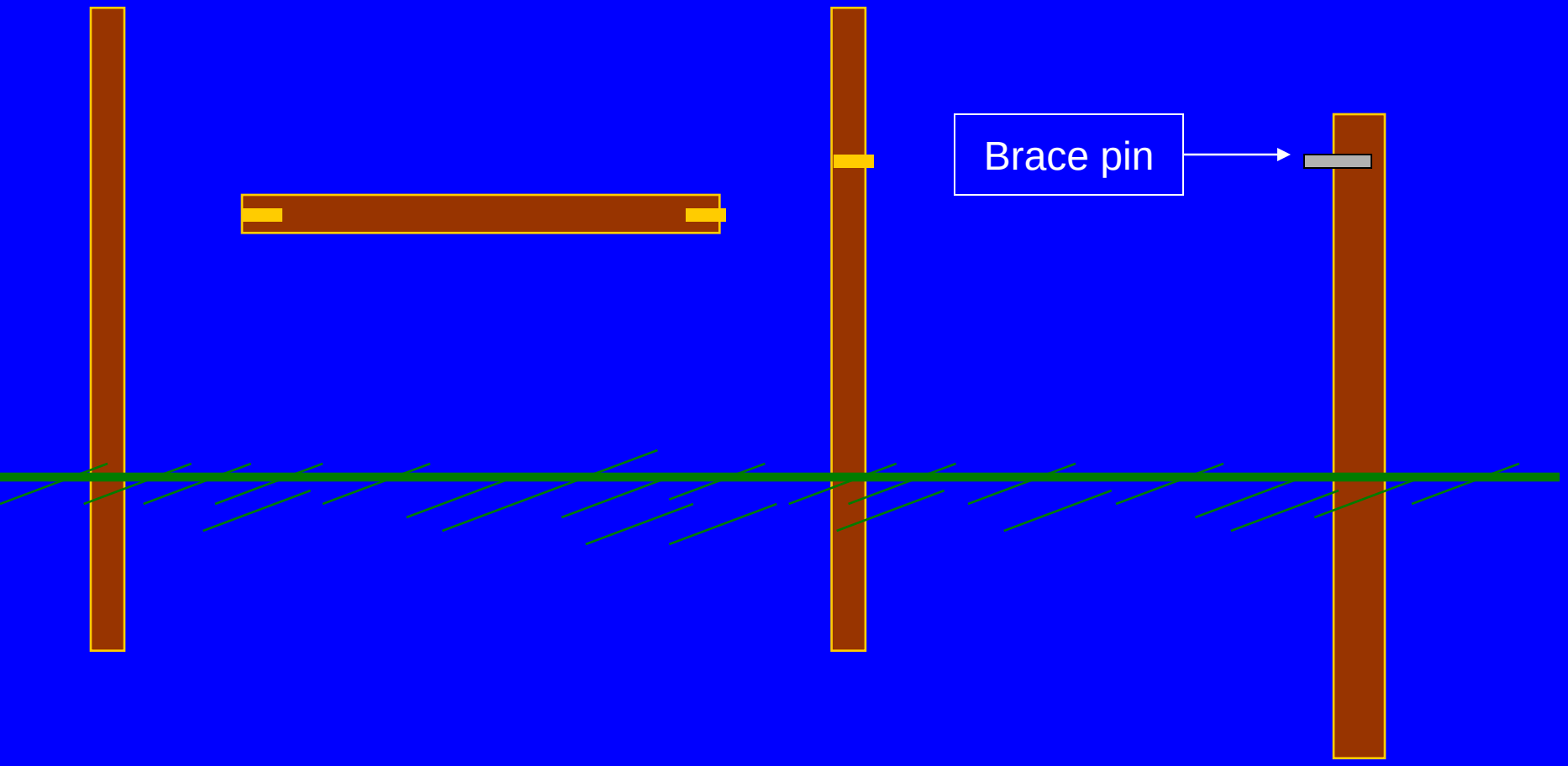


Drill 3/8” holes

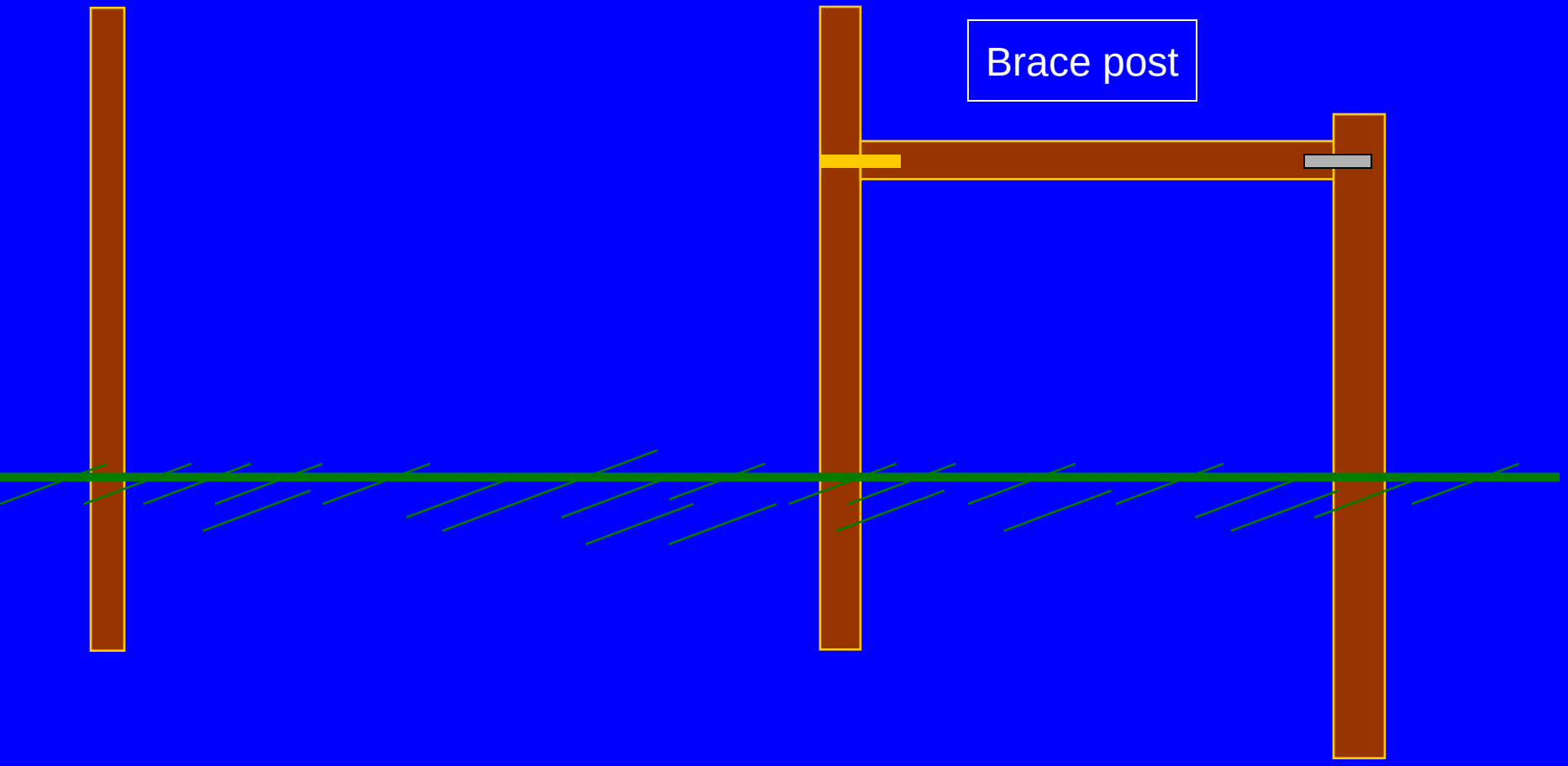
through the line post, into end post, and into both ends of the brace post



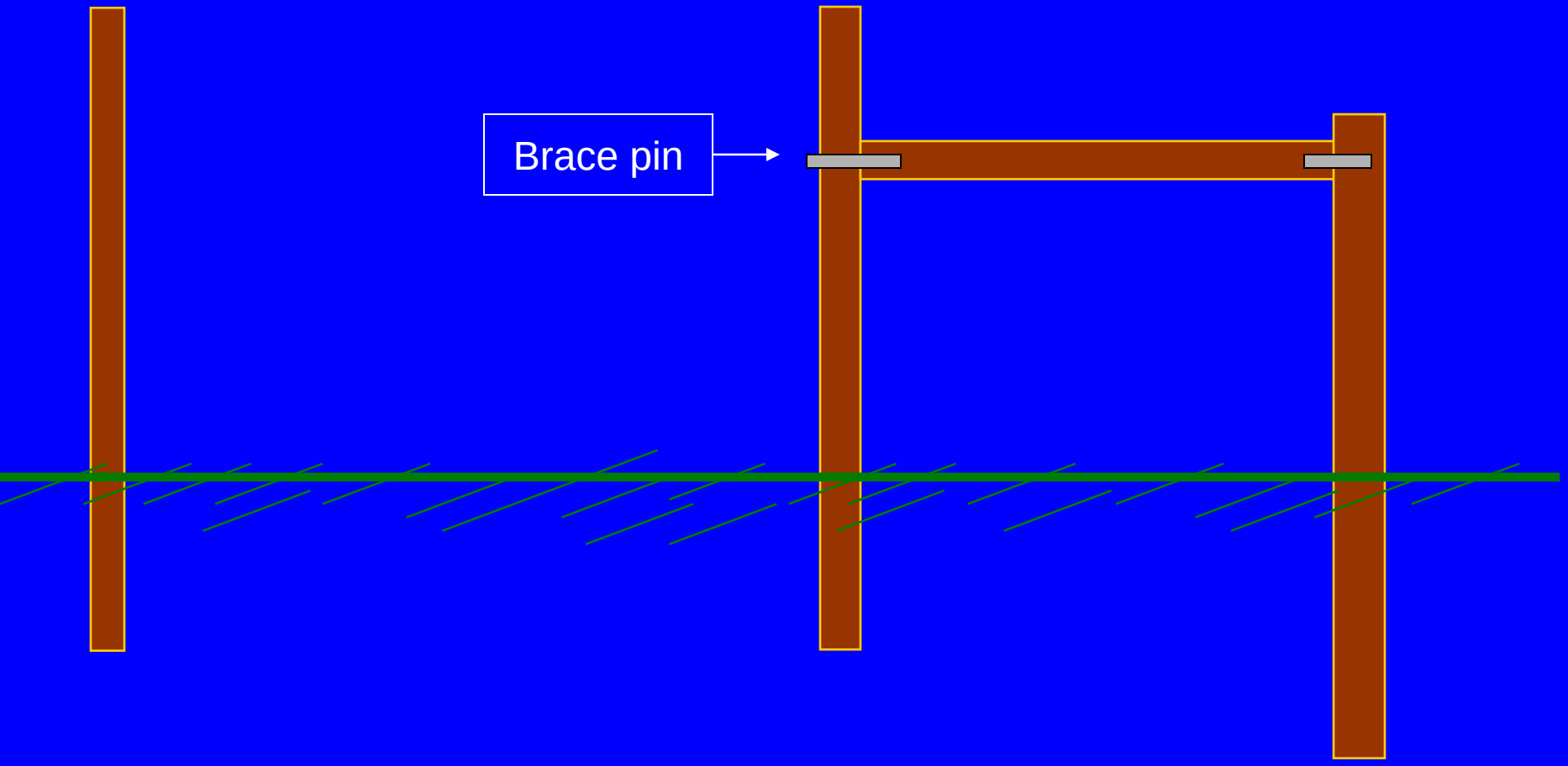
Insert a brace pin in the end post



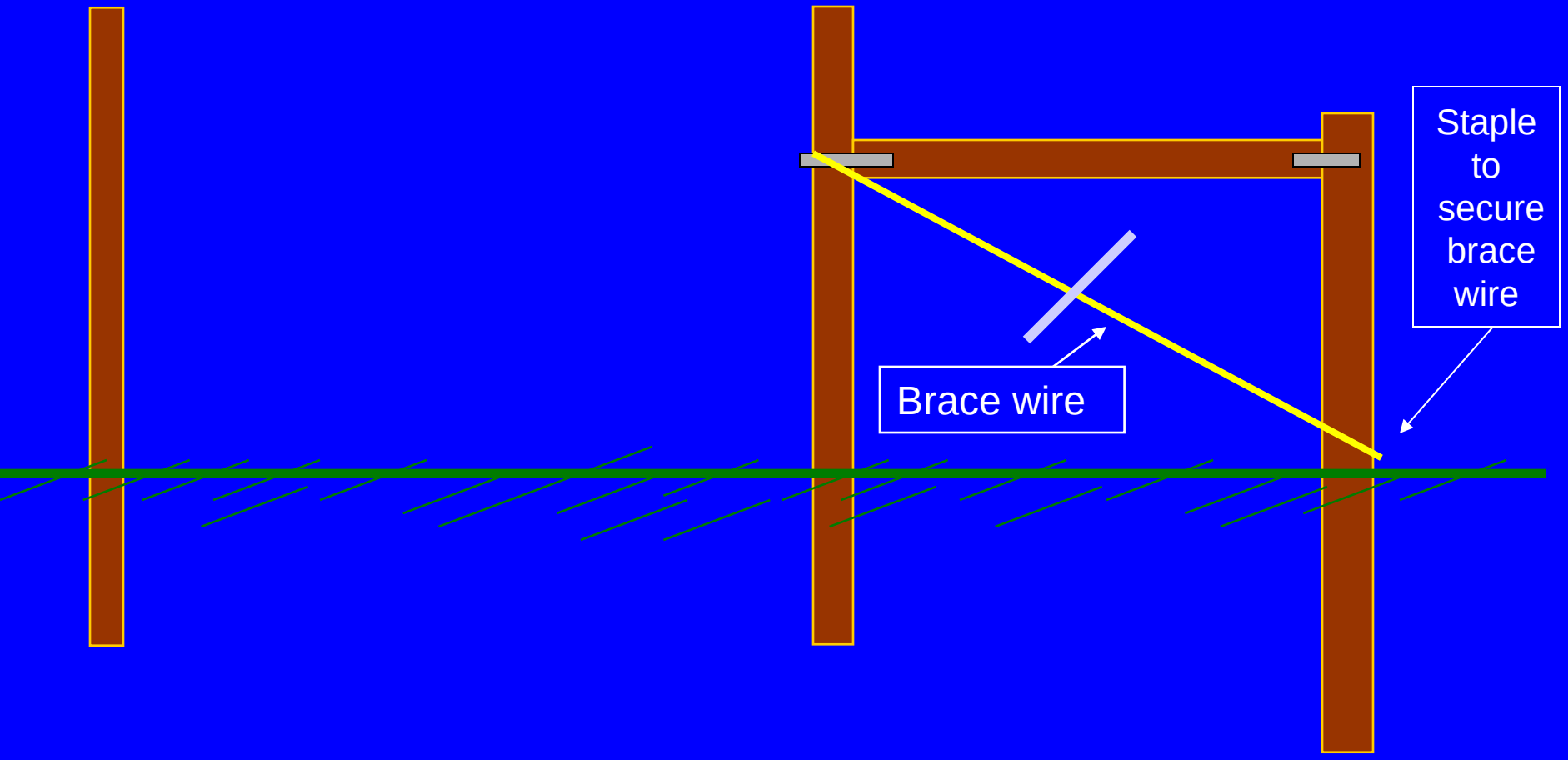
Place brace post
between end and line posts



Insert brace pin
to secure the brace post

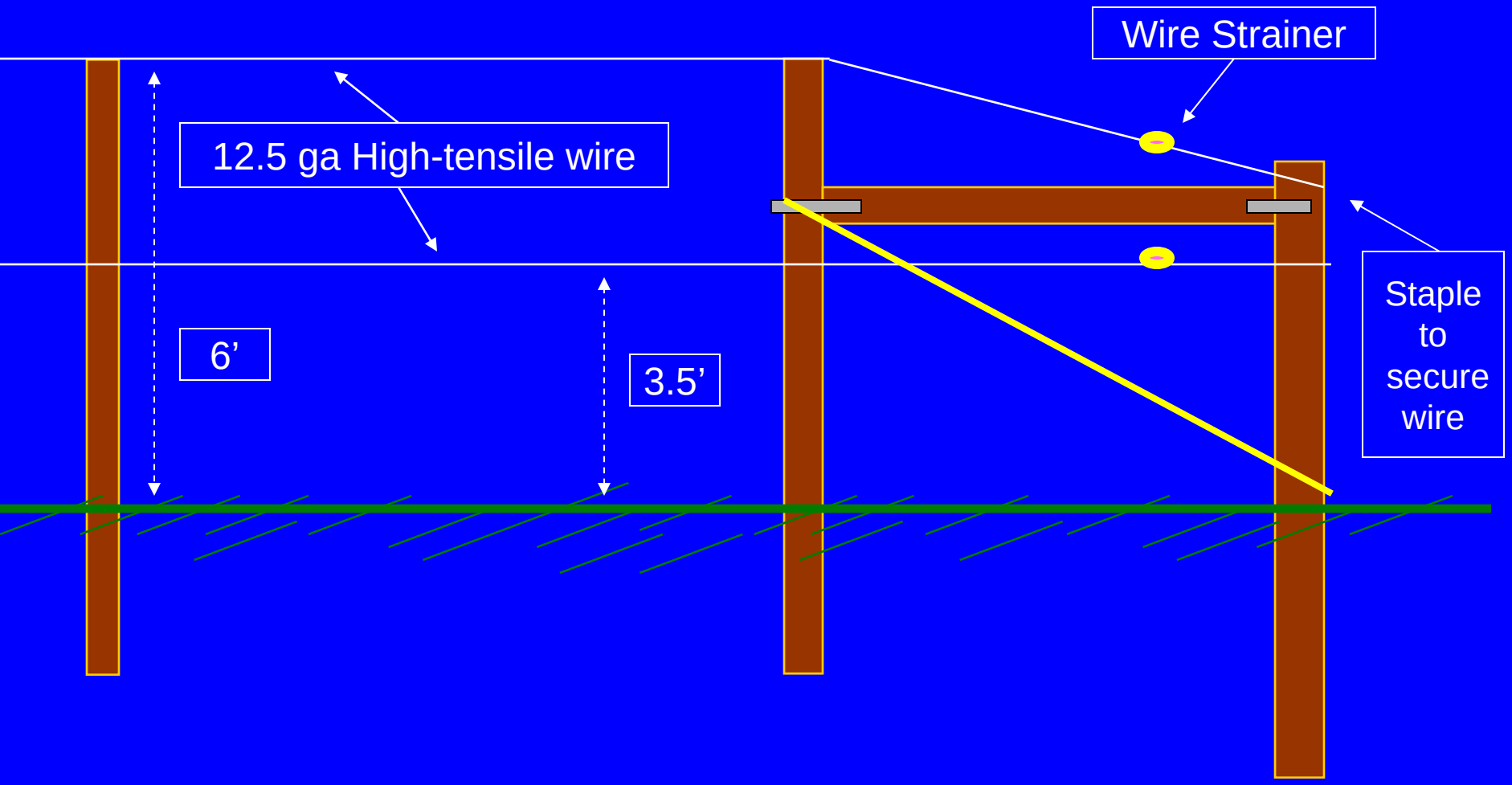


Attach Brace Wire
forming a loop & twist to tighten



String, Attach, & Tighten Wires

Wire tension should be set at about 250 lbs.



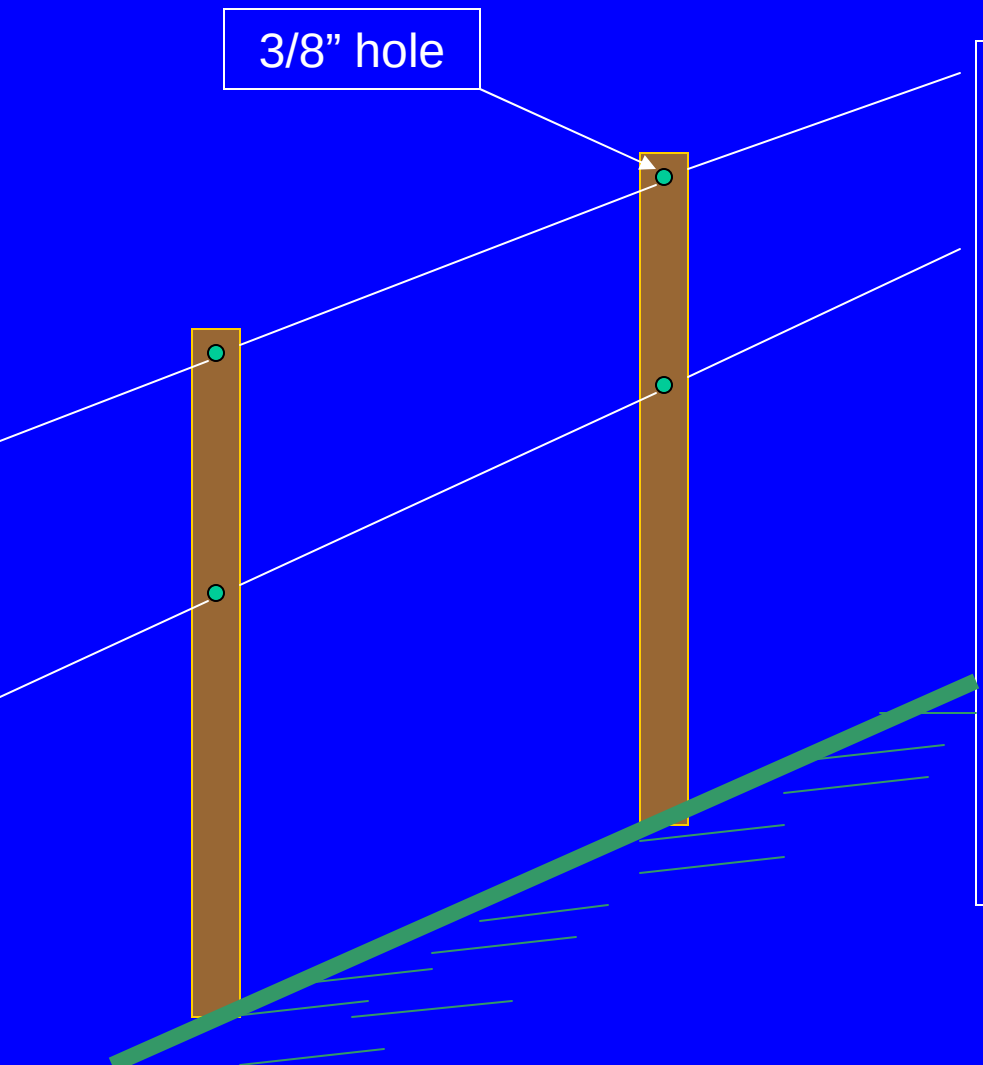
Attaching Wires to the Posts

- Use at least 1 3/4” long staples w/ slash-cut points.
- Staples should never be driven vertically into the post. Rotate the staple 45^{o} so that it straddles the grain of the wood.
- Position staple so that the points spread apart when driven into the post.
- Attach wire to the side of a post using 2 staples.
- When attaching wire to the top of a post, place the staple about 1/3 of the way from the center, and take measures to prevent the wire from cutting into the post (could be a staple placed under the wire).

Double Stapling

to attach wire to the side of a post

Running Wires Through Holes Drilled in Posts



An alternative to stapling:

- Requires more construction time.
  - Drilling the holes.
  - Running the wire through the holes.
- Some risk of the wires cutting into the post, particularly on rises and in swales.

Alternate Tie-off Methods

Wire Vice (cannot reduce tension)

Crimping Sleeve

For rows 200 ft or less

Wire Strainer at one end

Suitable for 200 ft to 500 ft rows

Wire Strainer in the middle

For rows 500 ft or longer

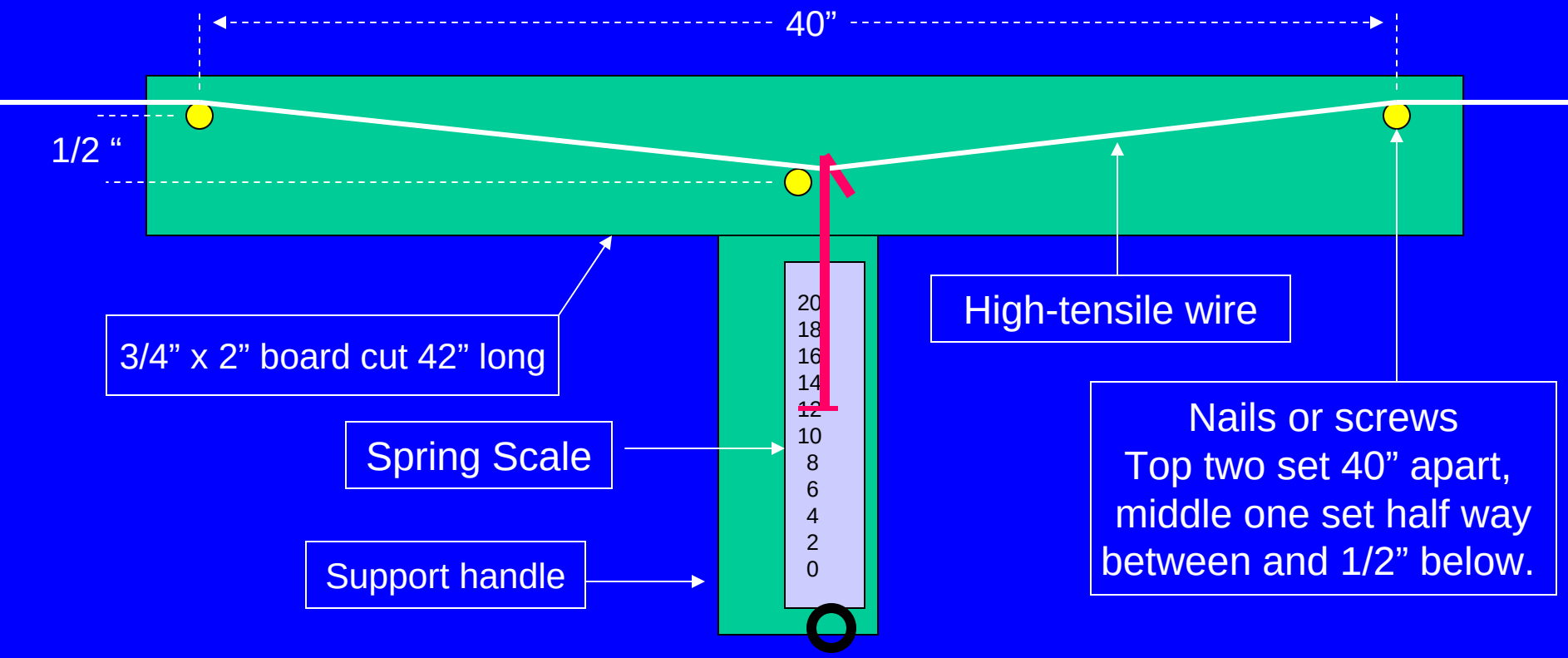
Using Crimping Sleeves

to attach wires to end post. Staples are used to secure wires at the proper height

Install Strainers to Tighten Wires

to a tension of about 250 pounds

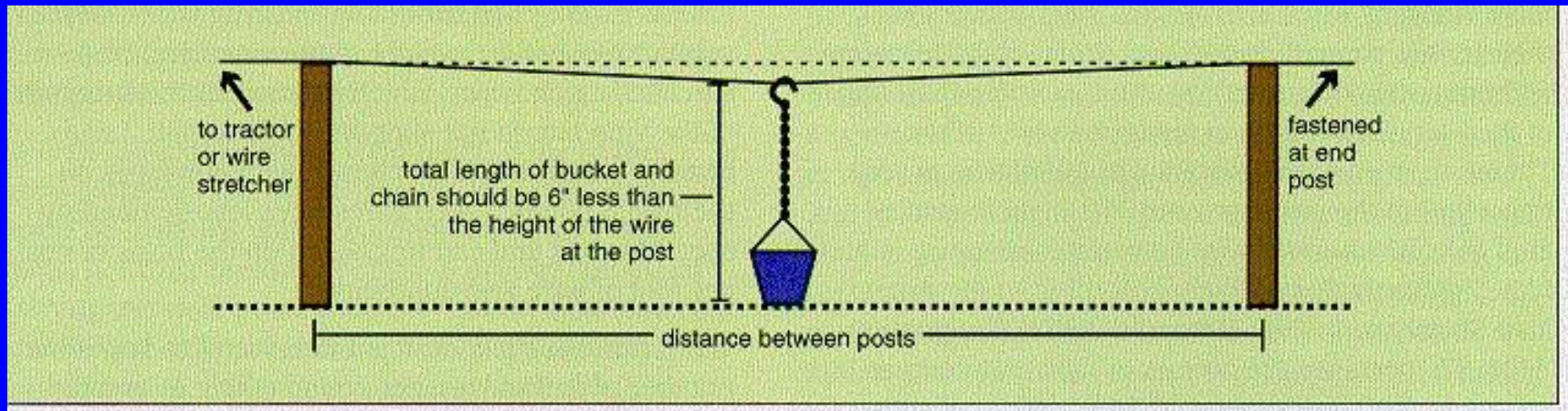
Building & Using a Wire Tension Gauge



Attach the spring scale to the wire and pull the wire to the middle nail. Read the pounds tension required to pull the wire to the nail and multiply by 20 to determine the wire tension. For example, a pull of 12.5 lbs x 20 = 250 lbs tension on the wire.

From: How to Build Orchard and Vineyard Trellises, US Steel, Pittsburg, PA

Method to Measure Wire Tension



ig. 31. A technique for tensioning wires to be used in conjunction with information in Table 8. (Figure reproduced
ourtesy of Washington State University Extension.)

Table 8. The total test weight, in pounds, of a chain, bucket and its contents that will indicate 270 or 300 psi tension on wire for three post spacings when used as indicated in Fig. 31.

Desired wire tension (lb)	Test weight (lb) for 6-inch sag for three post spacings (feet)		
	24	21	18
300	25.0	28.6	33.3
270	22.5	25.7	30.0

From: Vineyard Establishment II, Planting and Early Care of Vineyards. Michigan St. Univ. Ext. Bull. E-2645

Vineyard Training Systems

High Cordon System

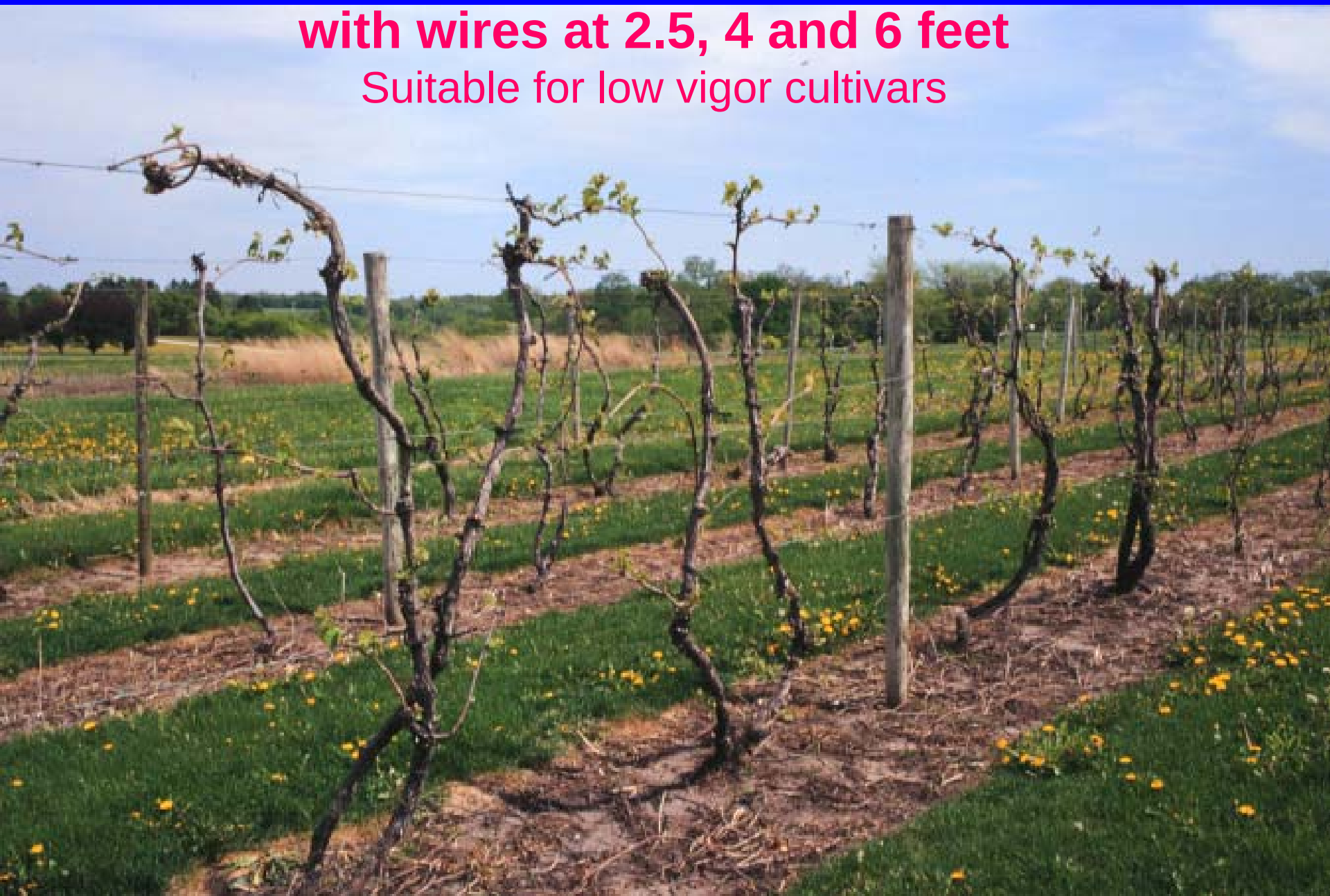
("Single Curtain, Bi-lateral Cordon")

Suited for American and many French-American hybrid cultivars with a trailing / drooping growth habit

6-Cane Kniffen System

with wires at 2.5, 4 and 6 feet

Suitable for low vigor cultivars



Umbrella Kniffen System

Suited for American cultivars requiring pruning to long canes. Requires extra labor to tie canes to lower wires

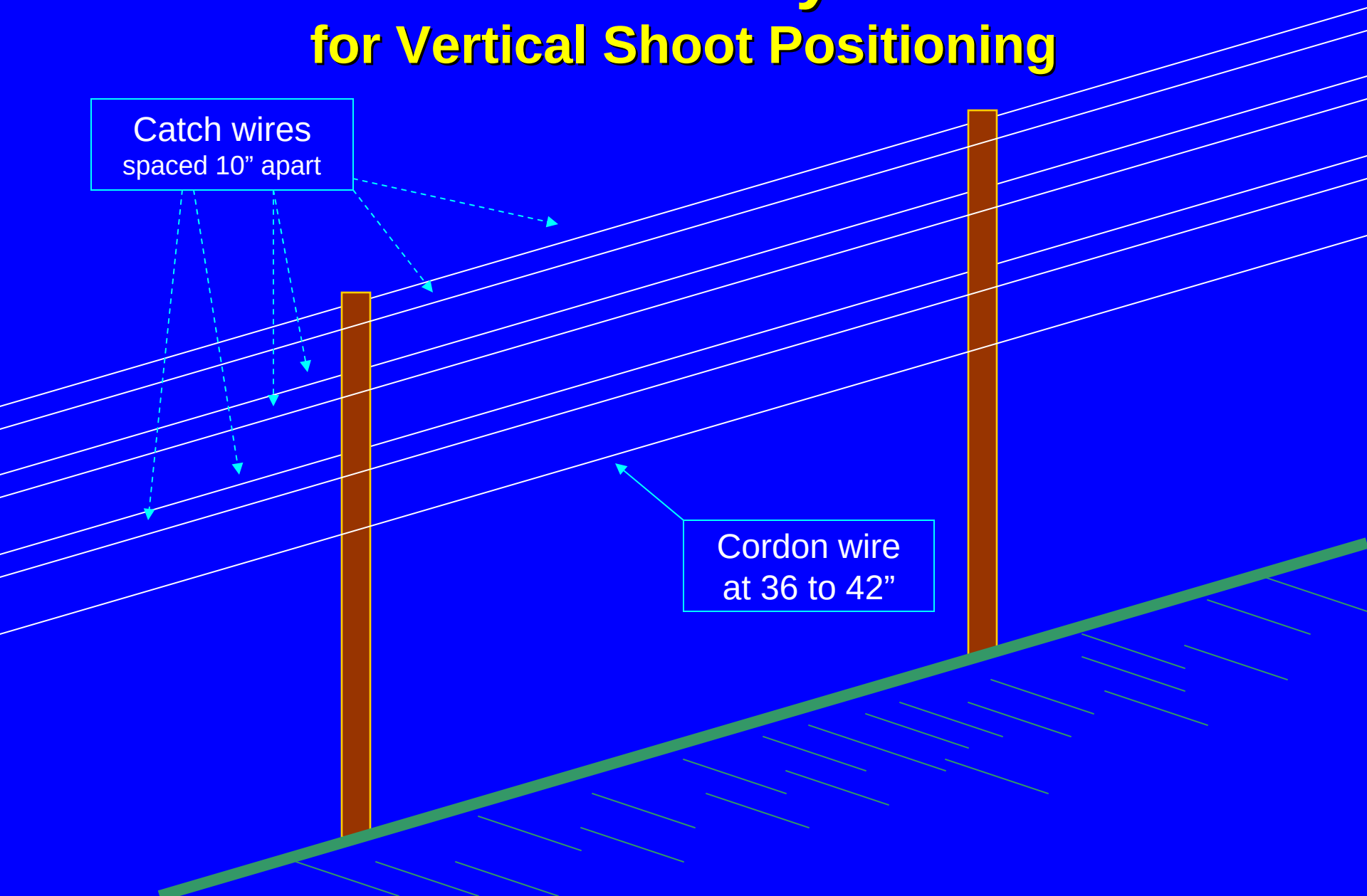
Geneva Double Curtain System

Suitable for high vigor vines. Minimum row width for this system should be 10 feet.

Geneva Double Curtain

with metal post at each vine, or a **mid-level cordon with catch wires** for *V. vinifera* cultivars. Bottom wire supports a trickle irrigation line.

Catch Wire System
for Vertical Shoot Positioning



Vertical Shoot Positioning

Suited for cultivars with an upright growth habit

Trailing / Drooping

Characteristic of
American species

Upright

Characteristic of *V. vinifera*
& some French-Amer. hybrids

Cultivars Suited for Vertical Shoot Positioning

Semi-upright:

- Chambourcin
- De Chaunac
- La Crosse
- Prairie Star
- Seyval Blanc

Upright:

- Chelois
- Vignoles

Vertical Shoot Positioning
‘LaCrosse’ vines in an Iowa vineyard