2009

Trellis Design & Installation in Afghanistan

USAID FROM THE AMERICAN PEOPLE

ROOTS OF PEACE

Roots of Peace

Afghanistan

1/25/2009

Grape Trellising in Afghanistan

Roots of Peace has installed trellises in over 1500 vineyards since 2005 on programs funded by USAID. ROP surveys of these vineyards trellised show 107% yield increase the second harvest after converting ground vines to trellises. Trellising has a major impact on both quality and quantity. This document reviews what ROP has learned from our experiences in regards to materials, design and installation. We also provide our recommendations for future trellis work given the economic restraints and local conditions here in Afghanistan.

Materials

Trellis post is the most costly part in the trellis system. The dominant varieties of table grapes in Afghanistan are very vigorous and their weight near harvest and strong winds in the Shamali dictate a rather stout solution. Trellis posts are installed for every two vines is the norm. This means that an average vineyard (2 jeribs, 0.4 ha, 1 acre) would require around 350 trellis posts. ROP has tested untreated wood and cement. Steel is used widely in California, but too costly in Afghanistan and cannot carry the heavy loads of the vigorous Afghan vines. As the farmers increase their yields, they will be able to afford more elaborate trellis systems. Table grape trellises in India, Egypt and California range dramatically. The most effective is a complete canopy system. This system is the most costly design by far, incorporating expensive steel throughout the jungle gym like structure that actually links separate rows together with an overhead trellis.

A simple start is best given this is a new technology for the Afghan farmers and the grape farmers are not flush with funds. Different designs should be initiated to provide options for future installations. ROP tried untreated wood posts first. They rotted out at the base after one year, proving not to be an effective alternative. Treated posts could be an option, but are not yet available in Afghanistan, unless you perform the treatment. USAID regulations would not allow for the copper-based insecticides. Furthermore, this treatment would not stop dry rot which appears the most problematic challenge. ROP installed untreated Poplar posts in 18 vineyards in 2005 and replaced them all with cement by 2006. The yield increases were dramatic, but their longevity was a serious problem. Cement is by far the favored material. Ranging from $6-$8 per post, depending upon their length, number of steel rebars and any cross members, their longevity is not questioned. ROP trained three companies in Kabul to manufacture cement trellis posts. The recommended trellis posts are 2.6 meters tall, contain 4

steel rebars and have pre-formed holes for 2 wires and a pre-formed hole for steel rebar cross member.

Trellis cross bars we are considering are simply 60cm of 1.5cm rebar inserted through a pre-formed hole in the top of the trellis post. The cross member must have some end piece that allows the wire to be threaded on each end. It can be as simple as a metal washer welded on to both ends.

The most cost-effective and locally available wire is a monofilament, galvanized wire. This is a 9 gauge soft wire (low carbon). High tensile wire does not bend well, so it cannot be wrapped around end posts to fasten. Furthermore, high tensile wire does not shrink and expand well. So with the extreme temperature variations in Afghanistan, the wire tension would vary dramatically, possible causing damage during the winter months.

Design Options

Cost is the key variable between these two designs. Yields will be higher with "T" Trellis for vigorous vines.

Simple Two-Wire	least expensive method, 110% yield increase after 2 seasons.
"T" Trellis	California Cascade arrangement, best for vigorous vines like Shindur Khani, Taifi
Overhead Canopy	Highest yield potential, by far most costly. Not described in this document due to prohibitive costs.

Anchoring Options

Firm anchors are required if you are to apply tension to the wire that will avoid sagging wires. Minimal anchoring will not work.

"Dead Man" Anchor	strongest installation, long rows possible
Sunken Post Anchor	simplicity of parts, most common method used outside of Afghanistan
Base of Post	short rows, limited clearance at end of rows, least cost

Fasteners

Devices are needed to be able to tighten and secure the wires. ROP tested at least 8 methods and favors the Gripple tool and fasteners. There are brute force methods, but to get consistent results and be able to later adjust the wire tension, the Gripple system was far superior than anything else tested. Most items tested were designed for applying tension to barbed wire or multi-strand wire. The smooth surface of the single strand wire we used does not provide good

gripping for these other tools. One tool can support hundreds of installations. Each Gripple fastener costs $0.80. The next best option was to twist the two wires that angle down to be fastened. Twisting these two wires together at both ends tightens the line sufficiently, but not to the recommended 120 kg pressure.

Different shaped vineyards will have slightly different parts requirements. Short rows will increase the number of anchoring parts. **Before a parts list is determined for a specific vineyard, the farmer must review his vineyard's specific geometry.**

Installation Timing

Trellises can be installed at any time during the year, but there are definitely times which are better. The ideal times are after harvest and before the major spring growth. Later in the spring and early summer the ground begins to harder making the work more difficult, and after veraison the grapes are more sensitive to movement. For new vineyards, installation should be done when the rooted cuttings are planted, but farmers can plant with grape stakes only and follow-up within a year with the trellis posts. Cement posts cannot be made in the coldest times of the year, so planning is required to pre-manufacture trellis posts prior to the onset of winter so that they are ready for installation after the spring thaw.

Installation Tools

Hand augers are the preferred method of digging the holes. The hole is smaller and as a result, the finished post is more firmly placed in the ground. Holes can be dug with shovels, but the post will not be as firm as with the hand auger. The Gripple wire tensioner tool is required to install the Gripple fasteners. Wire cutters are also necessary when installing the wiring.

ROOTS & PEACE

Parts List

For an "average" vineyard (2 jerib, 0.4 ha, 1 acre) the following parts are needed for each of the following designs. This vineyard is assumed to be square 63m x 63m, with 2.5 meter spacing along rows and between rows. This equates to 25 vines per row, 25 rows, 625 vines. The table below lists the parts costs only. No labor for installation or delivery charges.

Design	**Posts**	**Grape Stakes** (only for new vineyards)	**Wire** (meters)	**Dead Man** (cement)	**Crossbars**	**Parts Cost** (new vineyard)	**Parts Cost** (existing vineyard)
Unit Pricing	$7.20	$0.20	$0.05 / meter	$1.00	$0.13		
1A Simple 2-wire with Dead Man	350 $2,520	625 $125	3,450 $173	50 $50	0 $0	$2,868	$2,743
1B T Trellis with Dead Man	350 $2,520	625 $125	6,900 $345	50 $50	350 $46	$3,086	$2,961
2A Simple 2-wire with Sunken Post	400 $2,880	625 $125	3,450 $173	0 $0	0 $0	$3,178	$3,053
2B T Trellis with Sunken Post	400 $2,880	625 $125	6,900 $345	0 $0	350 $46	$3,396	$3,271
3A Simple 2-wire with Base Anchor	350 $2,520	625 $125	3,550 $178	0 $0	0 $0	$2,823	$2,698
3B T Trellis with Base Anchor	350 $2,520	625 $125	7,100 $355	0 $0	350 $46	$3,046	$2,921

Recommendations

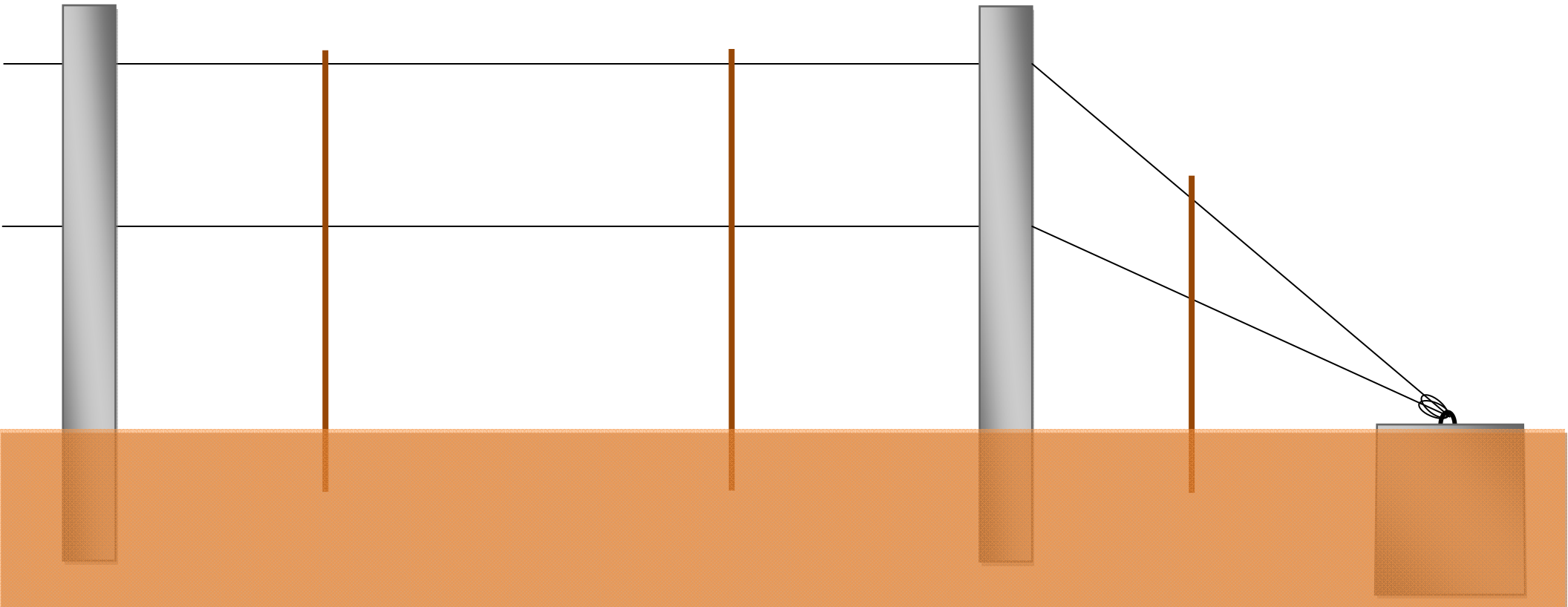
1. ROP recommends the implementation of Option 1B. Option 3B can be used when space at the end of the rows is limited.
2. Trellis posts should be 2.6 meters high, made of reinforced concrete. All trellises should either have a cross member to form a T or have the hole pre-formed so that the T can be added later. Trellis post should contain 4 rebar each.
3. Gripple fastening technology should be used.
4. Installation tools should be provided to individuals or companies willing to provide installation as a farm service or loaned to farmers via Extension Agents.
5. Installation should be done post-harvest until spring. Materials should be pre-staged before winter to meet demand during this period. No installation should be done between veraison and harvest.

DESIGN 1A: Basic Two-Wire Installation with Dead Man Anchor

Least expensive option; strong anchor allows for long rows.

Parts: 1 trellis post per 2 vines
1 grape stake per vine (new vines only)
Cement and steel loops for 2 dead man anchors per row
5m per vine of 9 gauge monofilament galvanized soft wire, plus 15m per row

Tools: hand auger
wire cutters
shovel

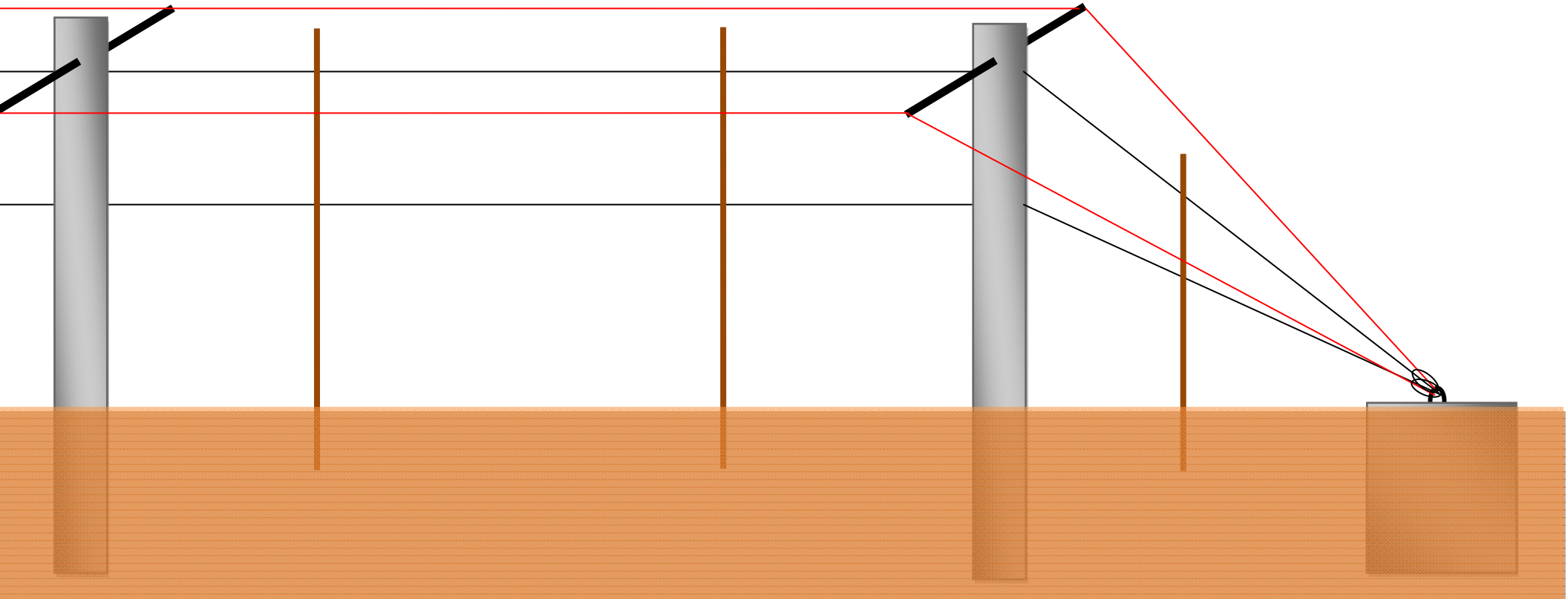


DESIGN 1B: Standard "T" Installation with Dead Man Anchor

strongest design for T trellising; good design for vigorous vines (Shindur Khani). Vines can cascade over both outside wires (California Cascade)

Parts: 1 trellis post per 2 vines, with cross bars
1 grape stake per vine (new vines only)
cement and steel loops for 2 dead man anchors per row
10m per vine of 9 gauge monofilament galvanized soft wire, plus 15m per row

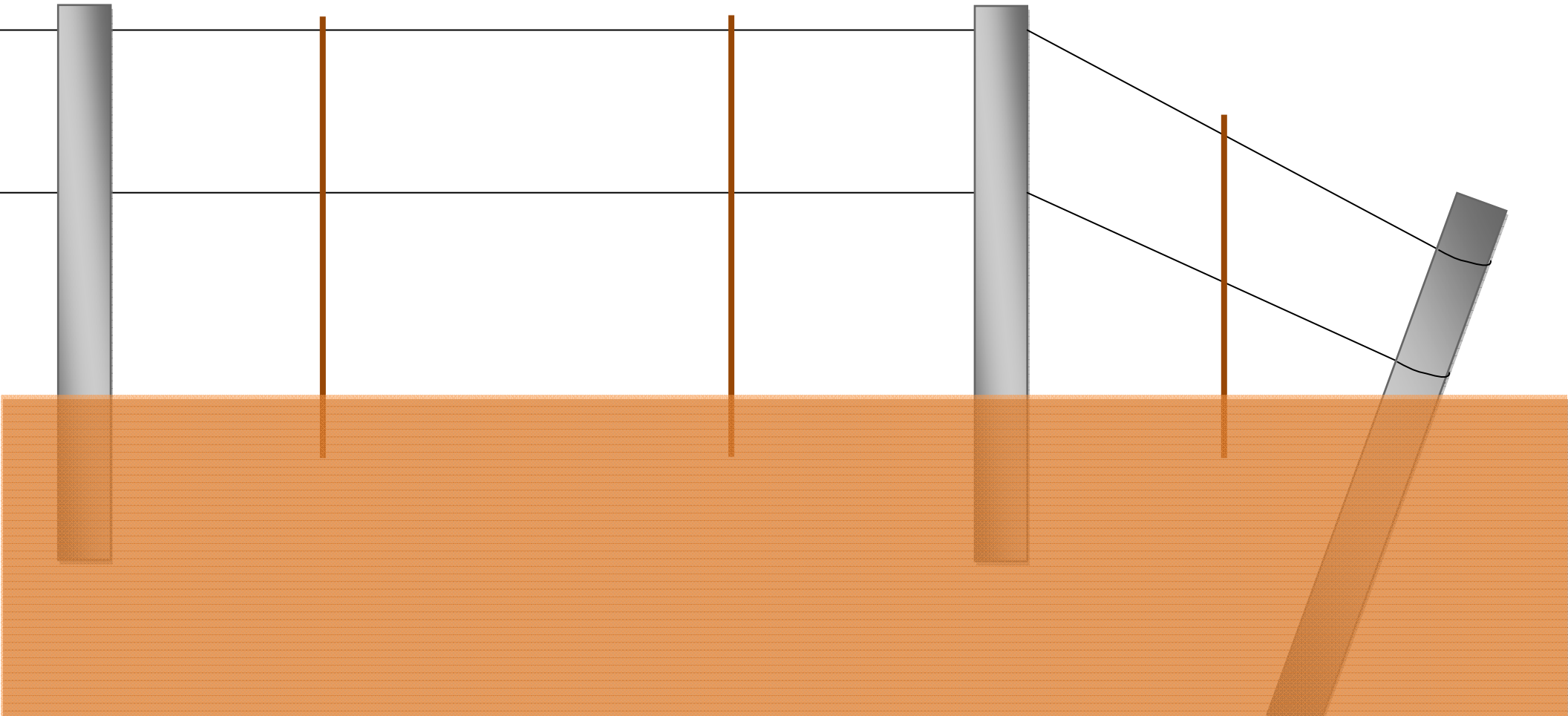
Tools: hand auger
wire cutters
shovel



DESIGN 2A: Basic Two-Wire Installation with Sunken Post Anchor.

Parts: 1 trellis post per 2 vines, plus two extra posts for the ends
1 grape stake per vine (new vines only)
5m per vine of 9 gauge monofilament galvanized soft wire, plus 15m per row

Tools: hand auger
shovel
wire cutters

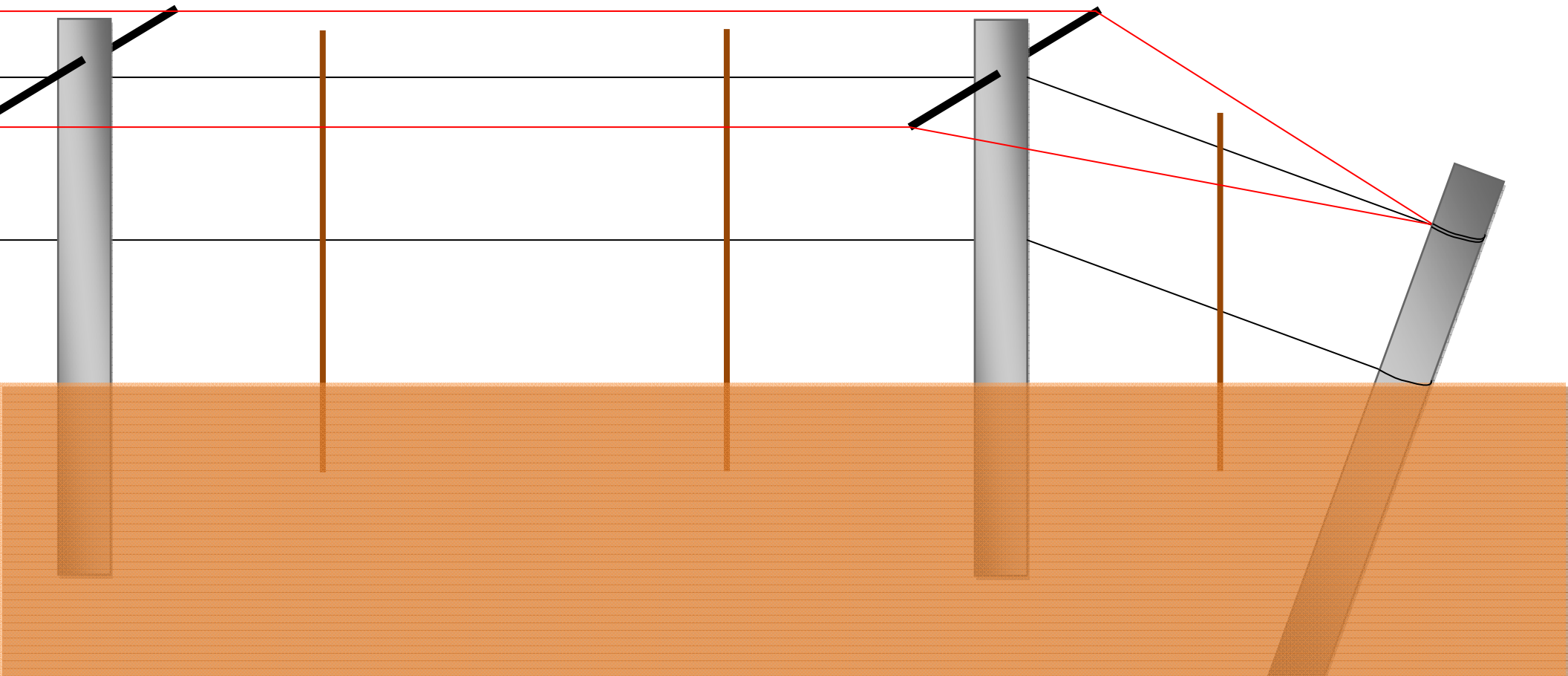


DESIGN 2B: Standard “T” Installation with Sunken Post Anchor

Most common design in California.

Parts: 1 trellis post per 2 vines, with cross bars, plus two additional trellis posts per row to serve as end posts
1 grape stake per vine (new vines only)
10m per vine of 9 gauge monofilament galvanized soft wire, plus 15m per row

Tools: hand auger
shovel
wire cutters

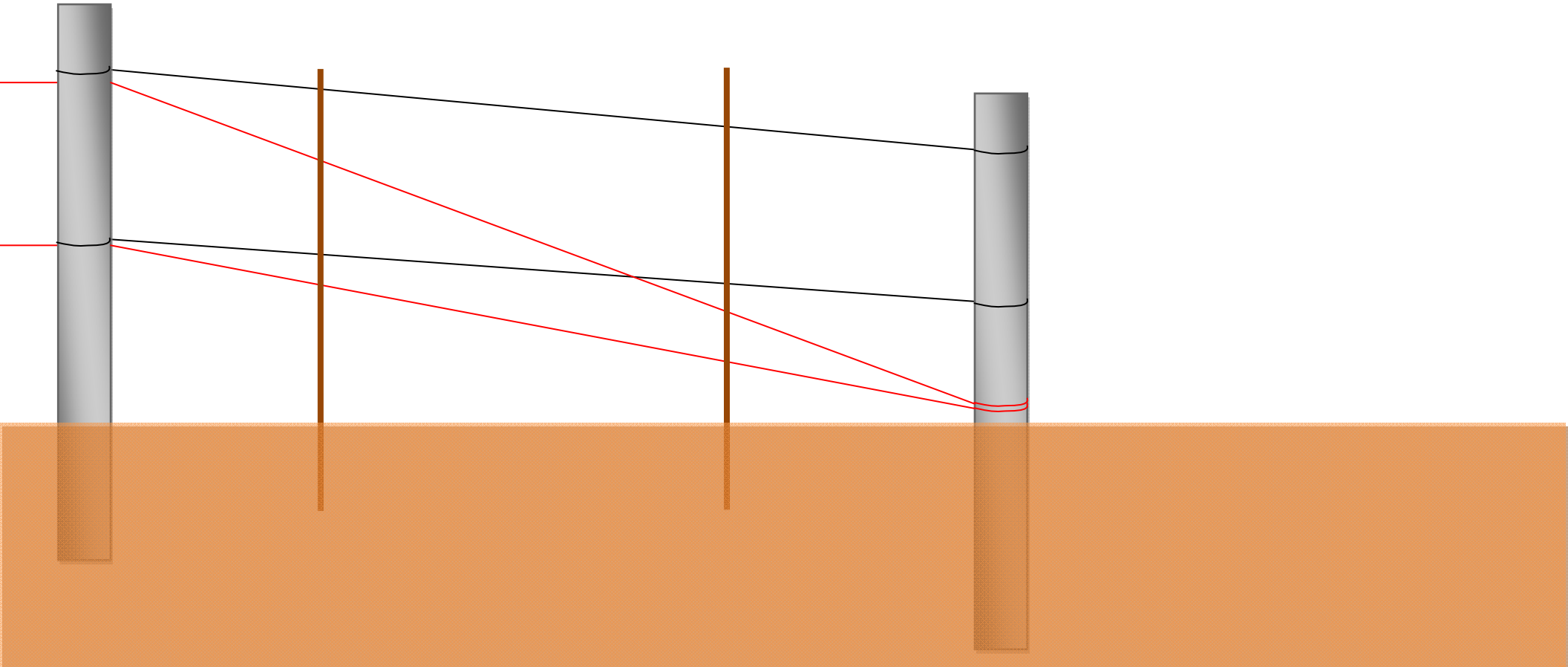


DESIGN 3A: Basic Two-Wire Installation with Base Anchor

this design can be used where space is limited at end of row and /or when row length is short

Parts: 1 trellis post per 2 vines
1 grape stake per vine (new vines only)
10m per vine of 9 gauge monofilament galvanized soft wire, plus 15m per row

Tools: hand auger
shovel
wire cutters

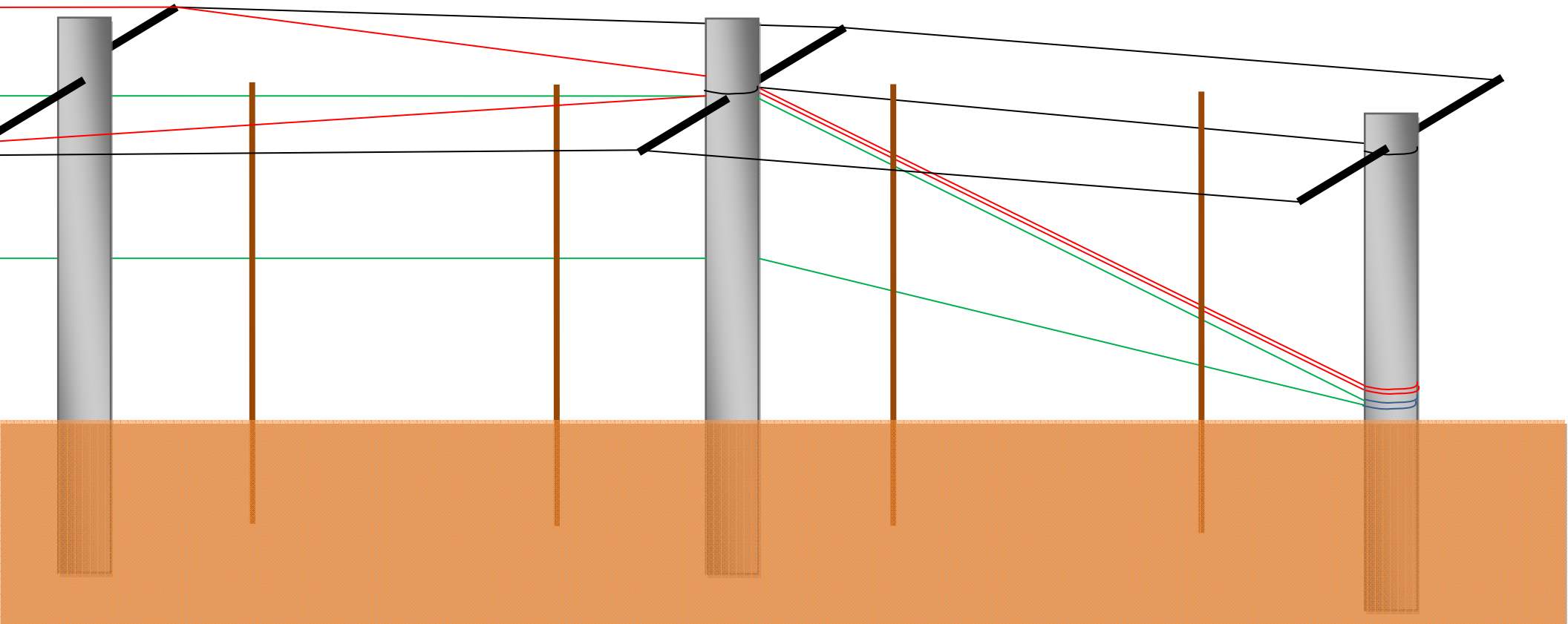


DESIGN 3B: Standard “T” Installation with Sunken Post Anchor

good design for limited space at end of rows; cannot be used on long rows; complicated wire install

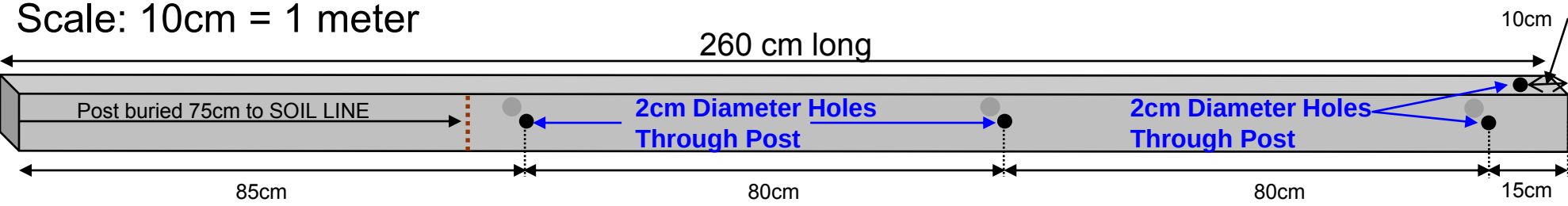
Parts: 1 trellis post per 2 vines, with cross bars
1 grape stake per vine (new vines only)
10m per vine of 9 gauge monofilament galvanized soft wire, plus 15m per row

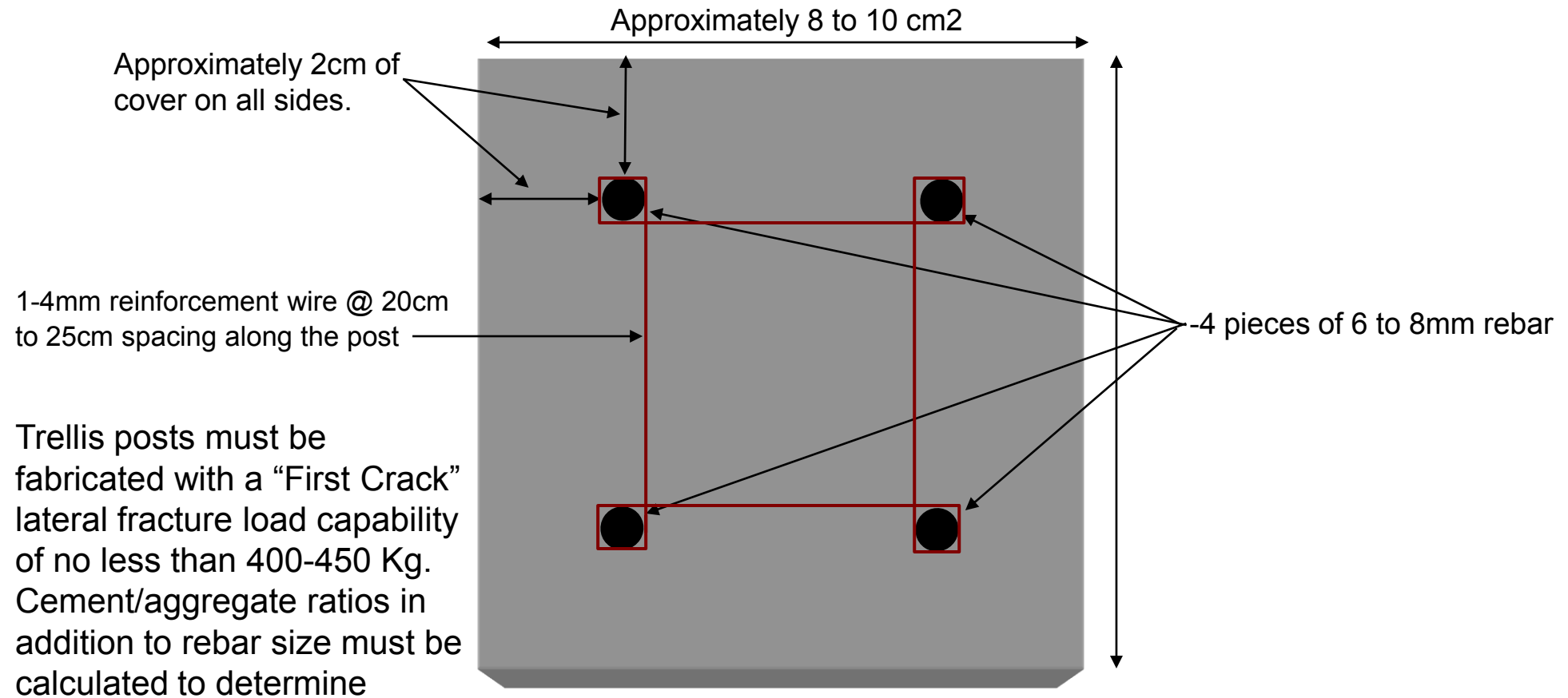
Tools: hand auger
shovel
wire cutters



Basic Grape Trellis Post Sketch

Scale: 10cm = 1 meter





Trellis posts must be fabricated with a “First Crack” lateral fracture load capability of no less than 400-450 Kg. Cement/aggregate ratios in addition to rebar size must be calculated to determine relative post strength.

End View Section of Post-Actual Size

Installation

Trellis

Trellis hole should be dug with hand auger to minimize soil disruption and provide a tighter fit. Post should be 60 cm in the ground.

Grape Stakes

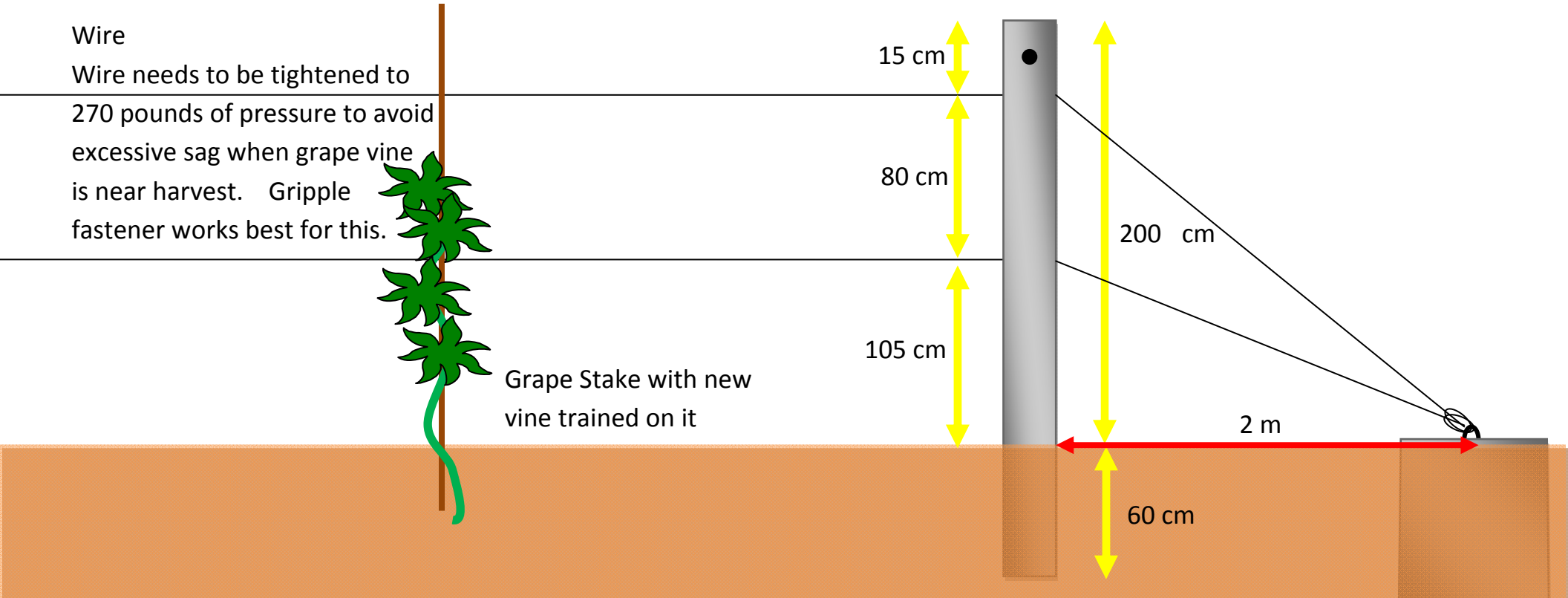
Grape stakes can be wood, metal, bamboo. They only need to survive until the grape vine is trained on to the top wire. Grape stake should be pushed at least 15 cm into ground and at least reach the top wire. A taller than necessary stake pole works well. When the bottom rots out, then simply pound it down.

Dead Man

The dead man anchor should be almost buried, but top should be above soil level. The dirt around the anchor should be firmly packed after placement.

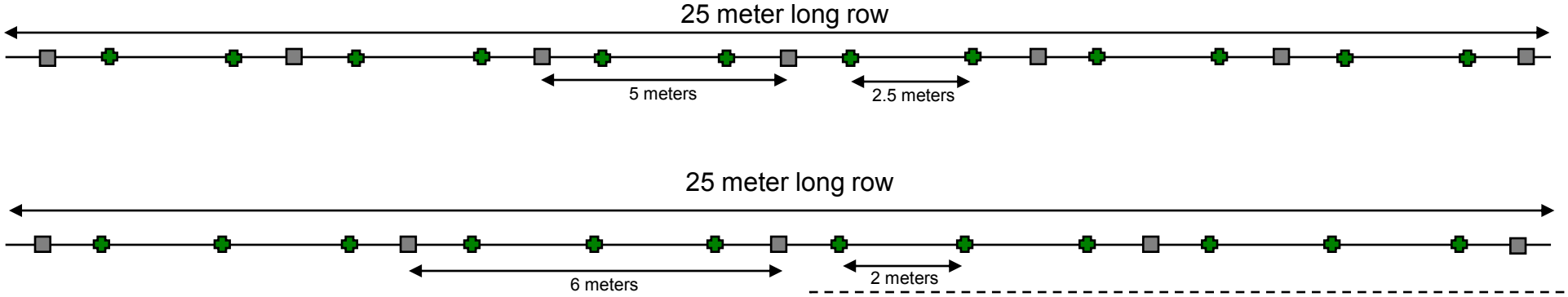
Wire

Wire needs to be tightened to 270 pounds of pressure to avoid excessive sag when grape vine is near harvest. Gripple fastener works best for this.



Basic Grape Vine & Post Spacing

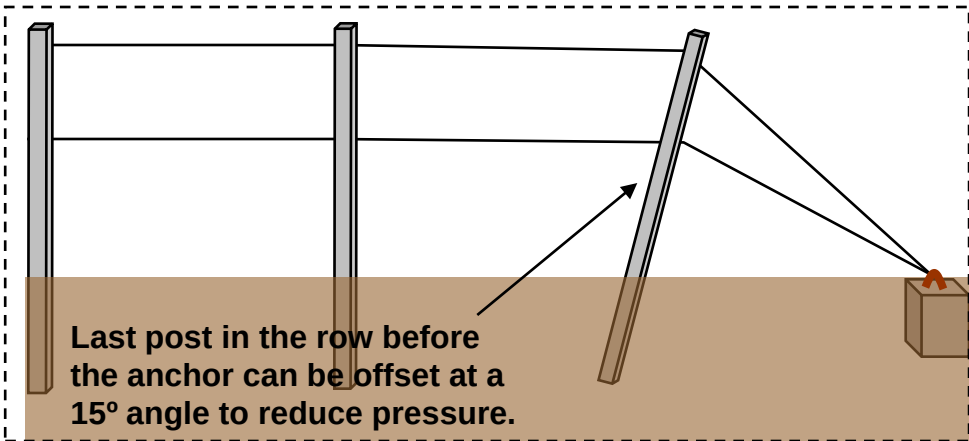
Average vineyard setup is approximately 700 vines/acre or 1722 vines/hectare. Vines are spaced at 2.5 meters apart and rows spaced at 2.5 meters apart. Trellis posts are spaced approximately 5 meters apart or one for every two vines. For a two wire trellis system, approximately 2820 meters of trellis wire/acre, or 6965 meters wire/hectare, is required. Shorter rows require more wire due to row end wire requirements. For post and anchor placement, see inset.



Scale: 1cm = 1 meter

■ = trellis posts spaced approximately 5 meters apart

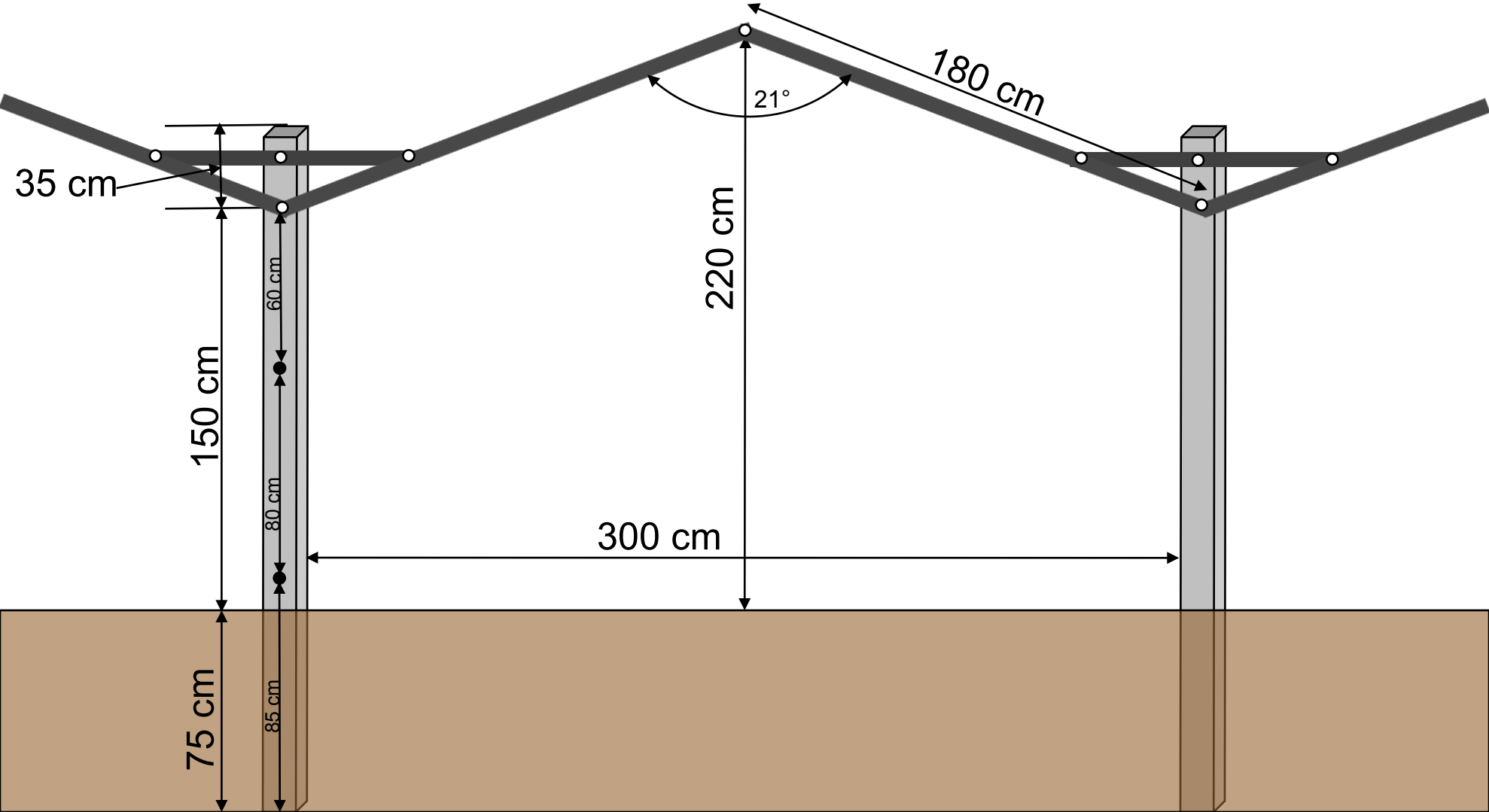
● = grape vines spaced approximately 2.5 meters apart



Standard Gable Trellis

Scale: 5cm = 1 meter

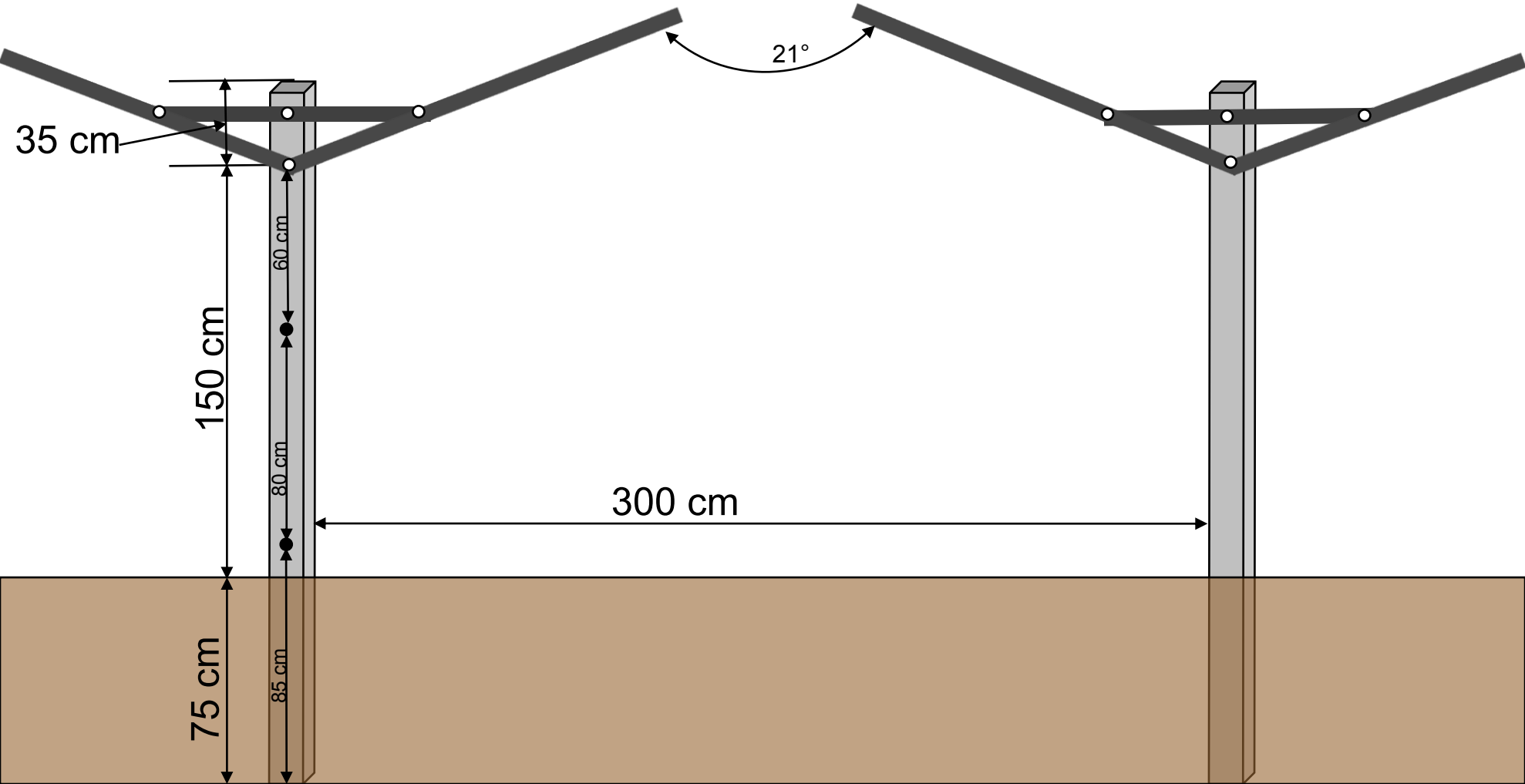
Gable structure built from 30mm L-Rail steel bolted together with galvanized steel bolts at 4 points plus at center between rows. 7 wire system. VARIENCE FROM POST STANDARD: Additional hole through post needed at 35 cm from top. NOTE: ALL measurements are approximate and will vary depending on each trellis installation.



Open Gable Trellis

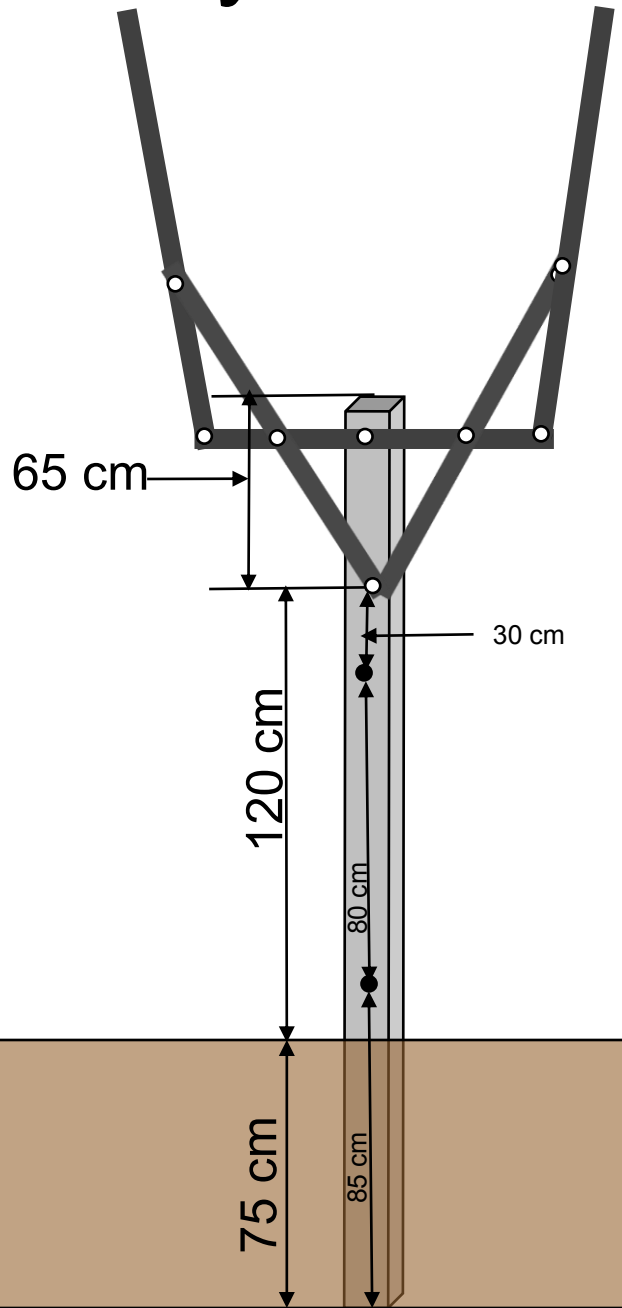
Scale: 5cm = 1 meter

Gable structure built from 30mm L-Rail steel bolted together with galvanized steel bolts at 4 points. 7 wire system. VARIENCE FROM POST STANDARD: Additional hole through post needed at 35 cm from top. NOTE: ALL measurements are approximate and will vary depending on each trellis installation.



Lyre Trellis

Scale: 5cm = 1 meter



Lyre structure built from 30mm L-Rail steel bolted together with galvanized steel bolts at 8 points. 9 wire system. VARIENCE FROM POST STANDARD: Additional hole through post needed at 35 cm from top. NOTE: ALL measurements are approximate and will vary depending on each trellis installation.