Vineyard Design

Spacing and Trellis Selection

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Spacing & Trellis Decision Goals

SUSTAINABILITY

- **High quality**
- **High productivity per acre**
- **Vineyard that is efficient to farm (less inputs and labour)**

Trellis/Spacing should to match vigor

Factors Influencing Vigor

- **Soil – depth, texture, water-holding capacity, fertility**
- **Climate**
- **<u>Rootstock</u>**
- **Variety**
- **Spacing**
- **Farming practices – <u>irrigation</u>, <u>fertilization (N)</u>, site preparation, cover crops**

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Rootstock selection is the most important decision affecting vigour

www.grapevinerootstock.com

- **Climate? (cool, warm, hot) (irrigated, low availability, rain fed)**
- **Desired vigor?**
- **Salinity?**
- **Drainage?**
- **Soil pH?**
- **Nematode resistance?**

- **Pest resistance>vigor>soil>climate**

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SPACING

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Vineyard spacing has 2 components:

- **Row Spacing**
- **Vine Spacing**

Row Spacing:

- **Based on farming equipment**
- **Operational efficiency**
- **Water availability**
- **Light Interception efficiency**
- **Cost of the land (ultra premium)**

Vine Spacing:

- **Based on anticipated vine vigor**

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Row Spacing

- What equipment will be going down the row?
- How wide is it?

2.8m ~8 ft


9 Foot row width

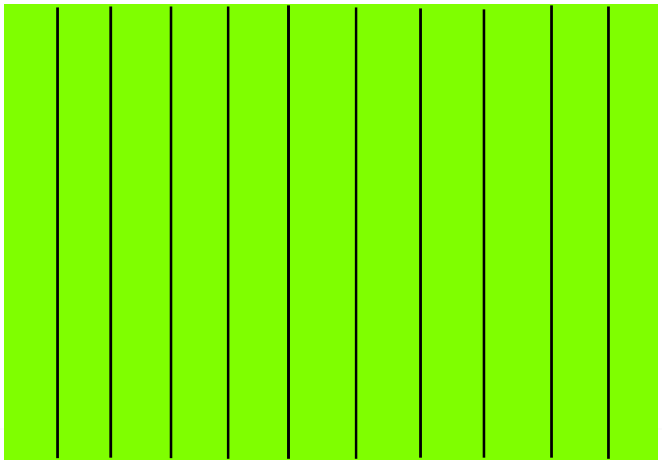

5-foot row
width

4 foot row
width

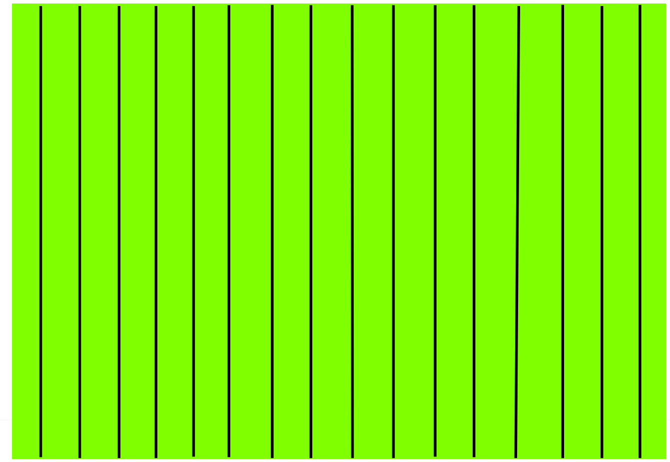

4 row sprayer


TARE 495

100 feet



100 feet



11 passes per tractor operation

17 passes per tractor operation

60% more time for tractor work:
mowing, cultivation, spraying, dusting

40-60% more time for hand vine care:
pruning, suckering, leaf removal, thinning...

Effect of vine spacing on labor

TABLE 5

Vine-spacing effect on labour input for canopy management, harvesting and pruning practices (man hours per hectare).

Spacing	Suckering	Shoot positioning	Topping and *shoot positioning	Harvesting	Pruning	Total
3 x 3	39,4 b	25,8 c	7,7 d	109,2 c	49,5 d	231,6
3 x1,5	40,4 b	27,1 c	9,3 d	122,7 bc	54,4 cd	253,9
2 x 2	48,6 b	25,3 c	10,2 d	147,1 b	65,2 c	296,4
2 x 1	58,0 b	34,6 bc	15,4 c	144,4 bc	67,5 c	319,9
1 x 1	106,4 a	56,4 b	22,8 b	206,1 a	104,2 b	495,9
1 x0,5	128,2 a	91,5 a	31,1 a	239,5 a	122,6 a	612,9

Values in columns followed by the same letter do not differ significantly ($p \leq 0{,}05$).

*The second shoot positioning was done along with topping just after pea berry size.

Spacing (m)	Yield/ vine (kg)	Yield (t/ha)
3 x 3	10,34 a	11,49 c
3 x 1,5	5,76 b	12,81bc
2 x 2	5,55 b	13,88 b
2 x 1	2,78 c	13,92 b
1 x 1	1,91 d	19,08 a
1 x 0,5	0,88 e	17,60 a

Hunter, 1998

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Planting Density

vines/acre = 43,560(sq ft/acre)/row spacing (ft) X vine spacing (ft)

Spacing (ft)	Vines per acre
8 x 12	454
6 x 12	605
4 x 12	908
8 x 8	681
6 x 8	908
4 x 8	1361

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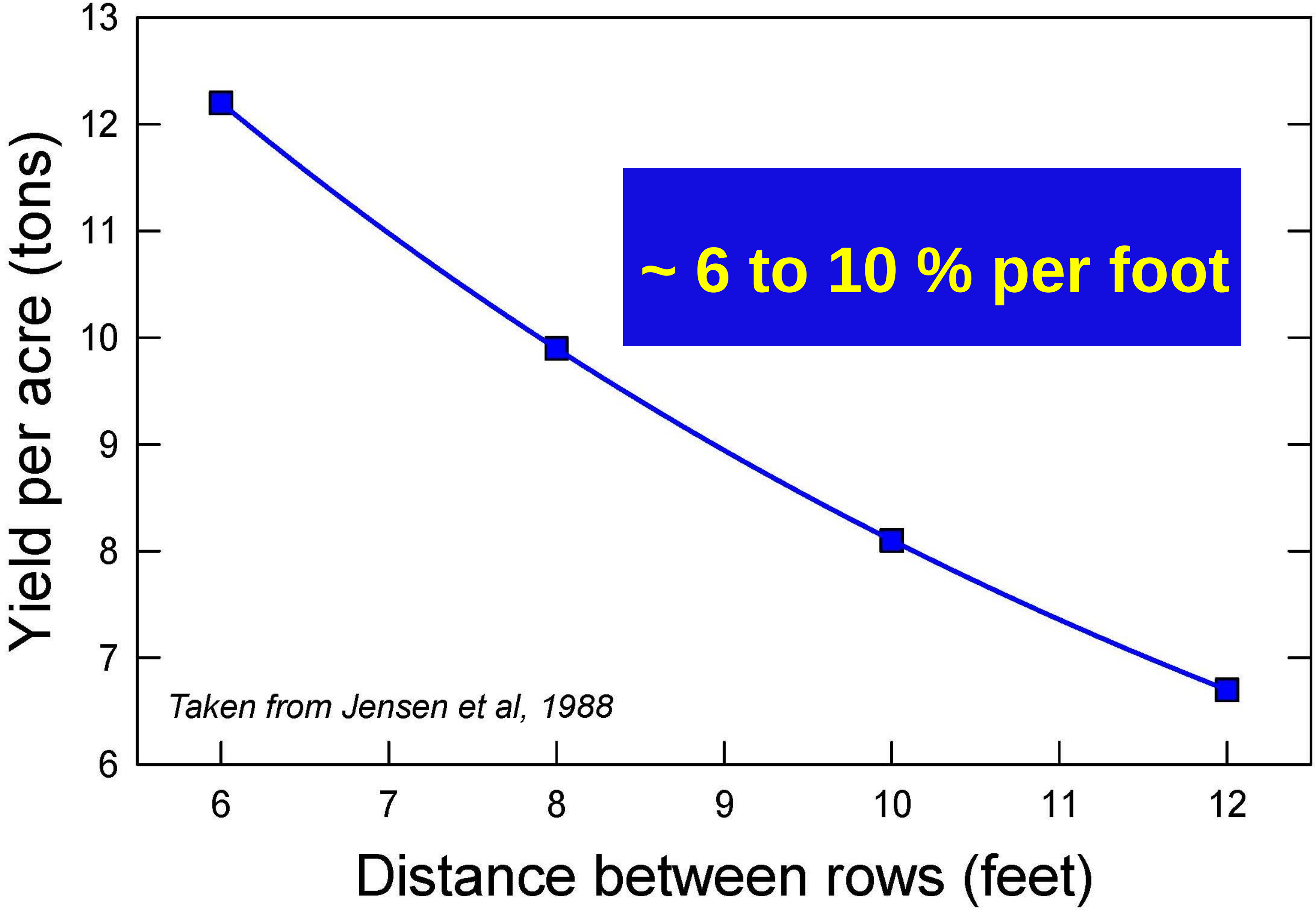
In-Row Vine Spacing

	In-Row Vine Spacing		
Parameter	1 m	2 m	3 m
Crop yield (mt/ha)	16.5	14.9	13.3
# Shoots/m row	24.7	21.2	19.3
# Clusters/ha (x103)	114.2	110.2	94.6
# Shoots/vine	24.7	42.4	58.1
# Clusters/shoot	1.74	1.76	1.62
# Clusters/vine	42	74	95
# Berries/cluster	115	121	126
Berry wt (g)	1.31	1.3	1.28
Cluster wt (g)	141	149	150

Based on 6-foot in-row spacing



Don’t forget that high yielding systems have wide rows.
… and a different rootstock

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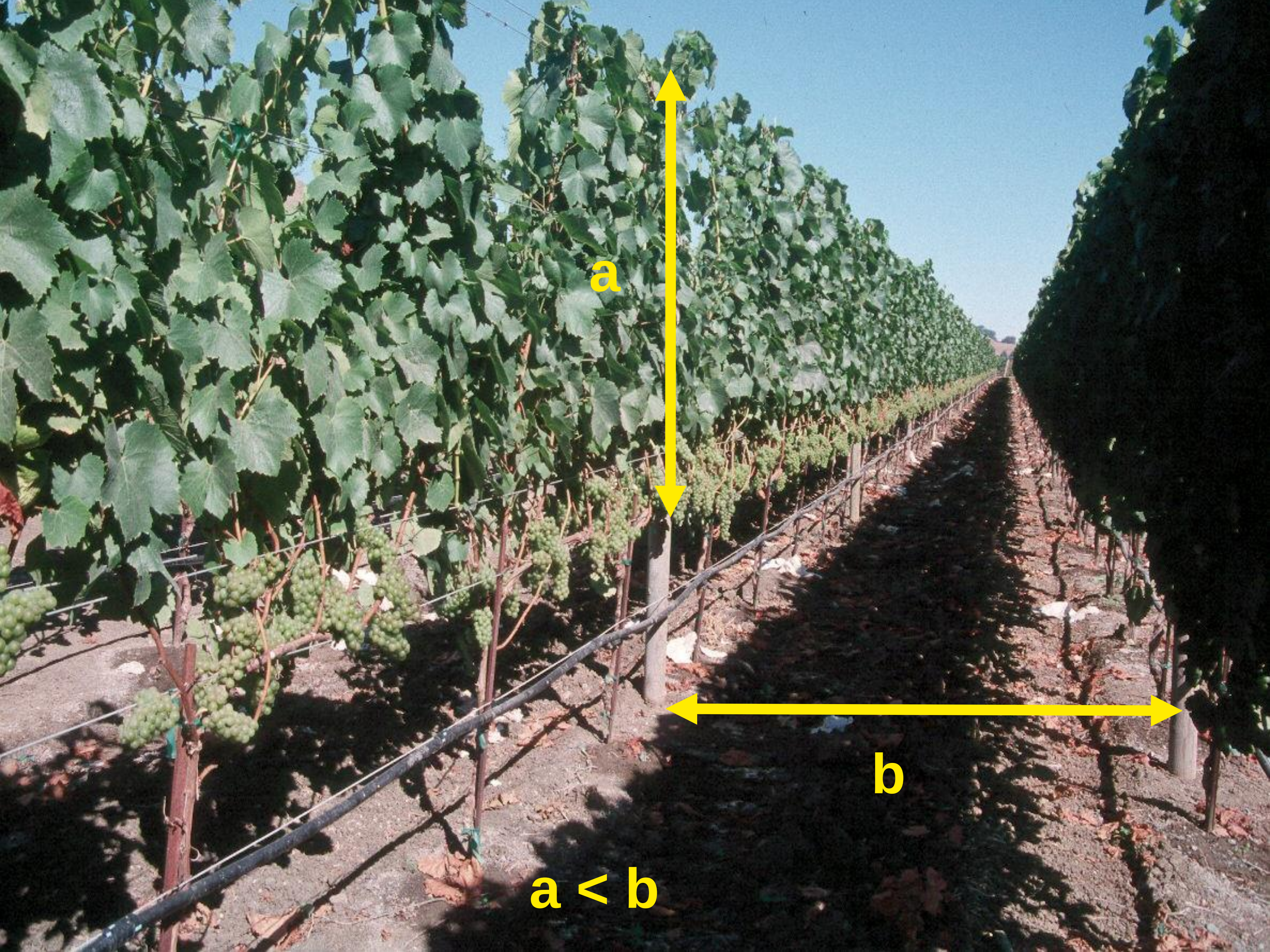
Light Interception efficiency

12 foot **6 foot**

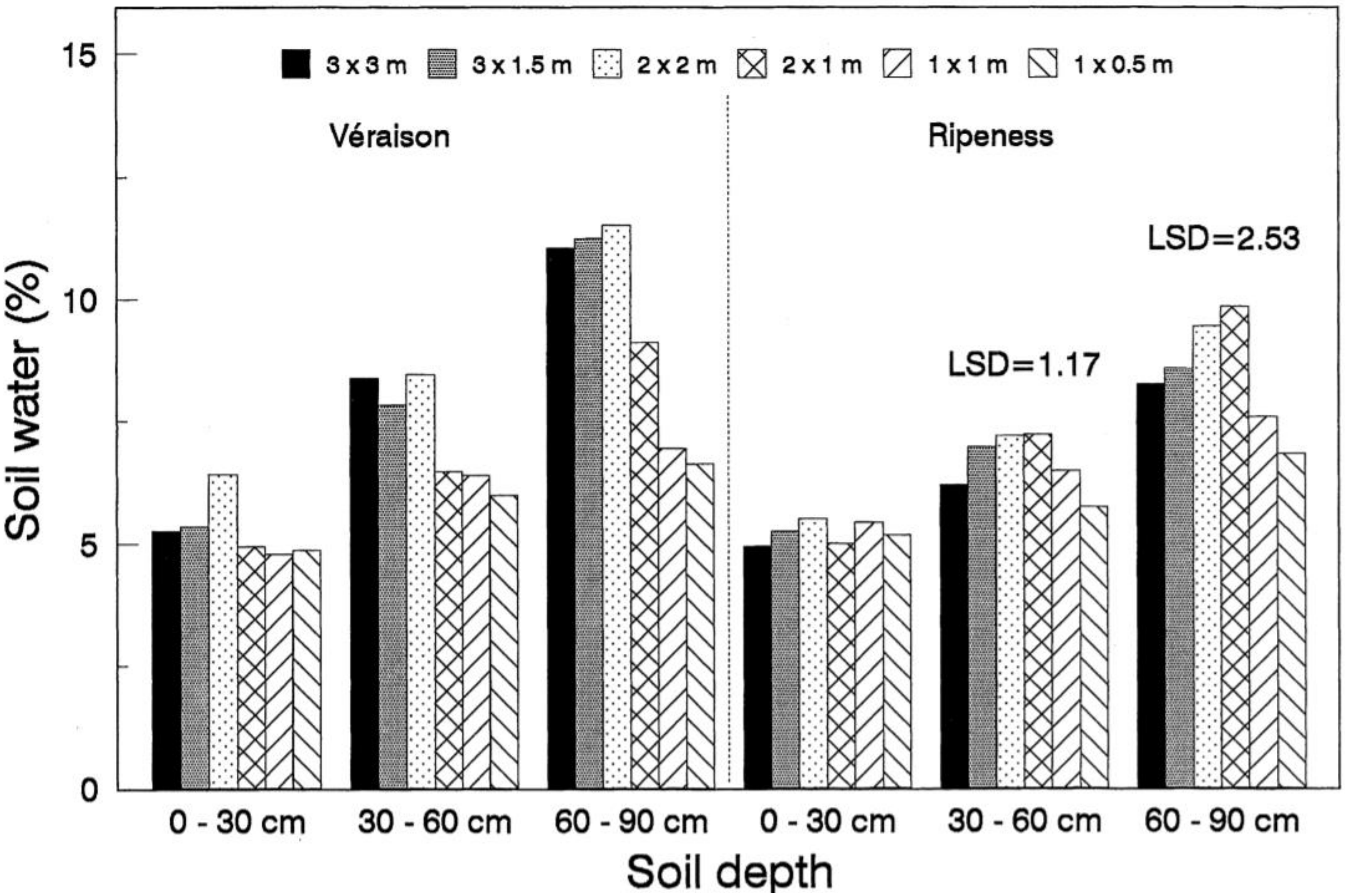

a
b
a < b

In-Row Vine Spacing

- (In a VSP) close enough together to produce a continuous fruit zone without gaps

True, if water is available and land is limited

Implications of vine spacing for water management



Hunter et al., 1998

ROW ORIENTATION

Row Direction Considerations

- Row length: long vs. short
- <u>Sunburn</u>
- Hillside slope
- Soil variability
- Prevailing wind
- Sunlight interception
- Ripening uniformity

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EFFECT OF OVEREXPOSURE

Over exposure: chronic

Can happen with T < 80° F, first signs 2 weeks post veraison and it gets worse

"Heat shock": acute

Need for T > 110° F and little exposure

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VSP Trellis

Row Direction	Balance of light exposure (ratio)	Sunburn risk
E-W	Maximum uneven (4:1)	High (south side)
N-S	Even (1:1)	Very high (west side)
NE-SW	Somewhat uneven (2:1)	Moderate (NW)
NW-SE	Somewhat uneven (2:1)	Extremely high (SW side)

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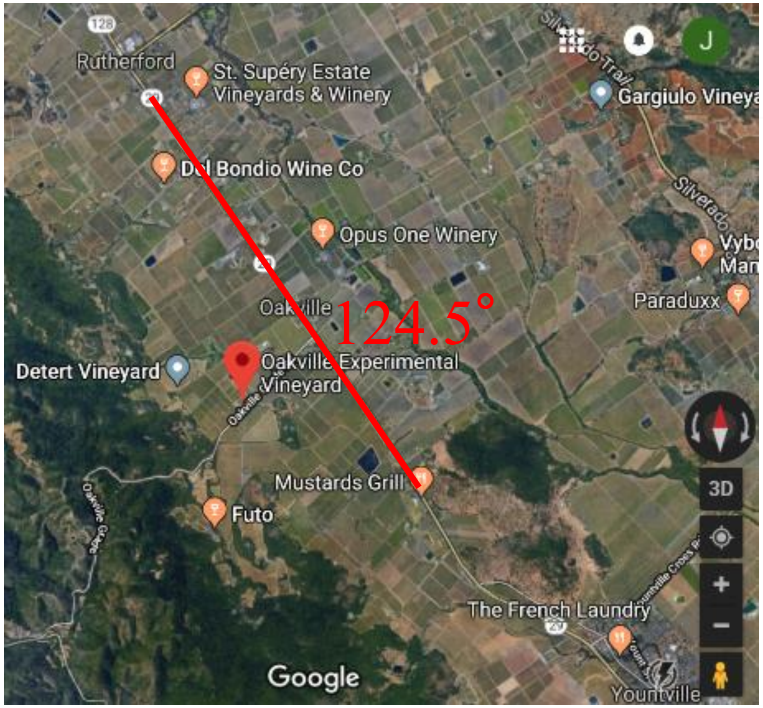
MITIGATION OF BERRY TEMPERATURE: ROW ORIENTATION (OAKVILLE-NAPA, CA)

N

0°



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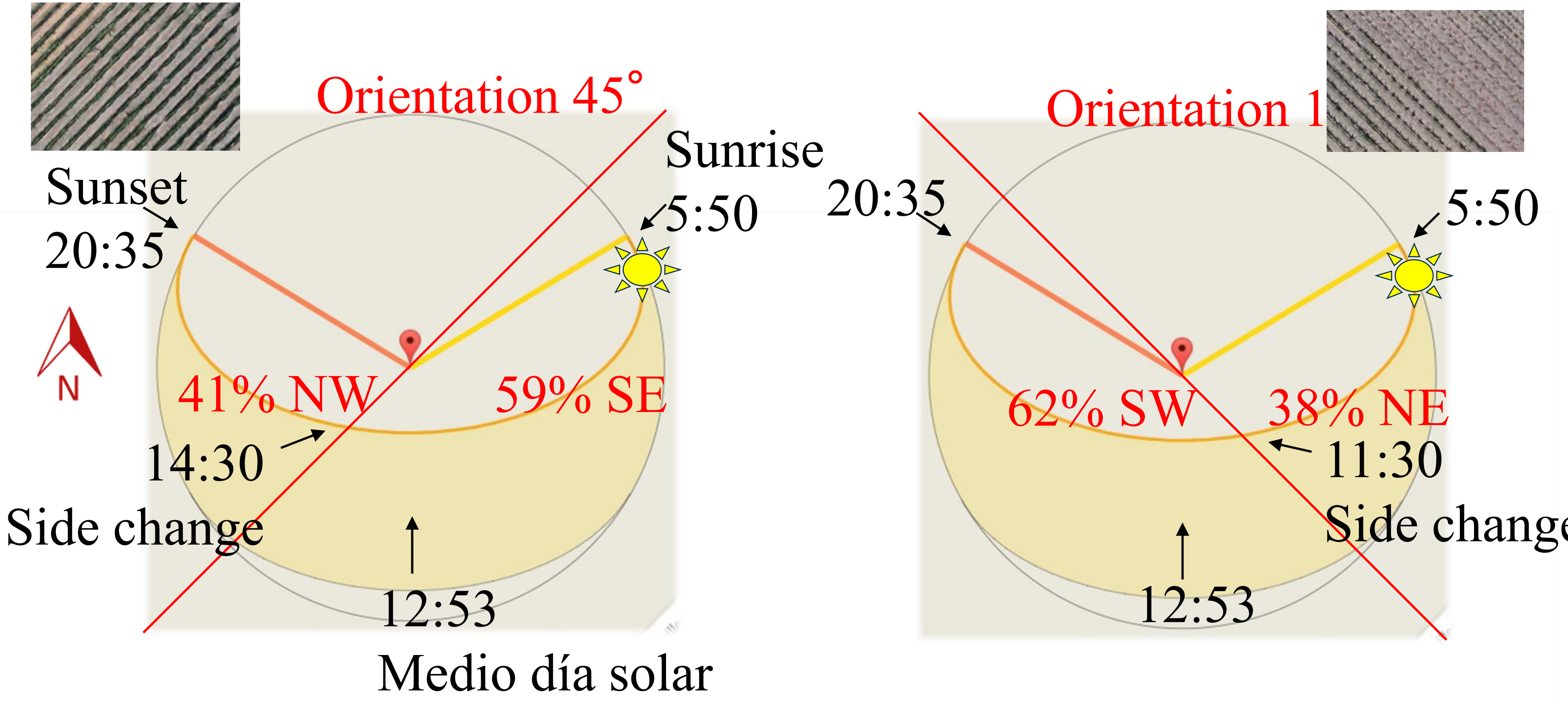
DISTRIBUTION OF SOLAR RADIATION BETWEEN THE TWO SIDES OF THE FRUIT ZONE



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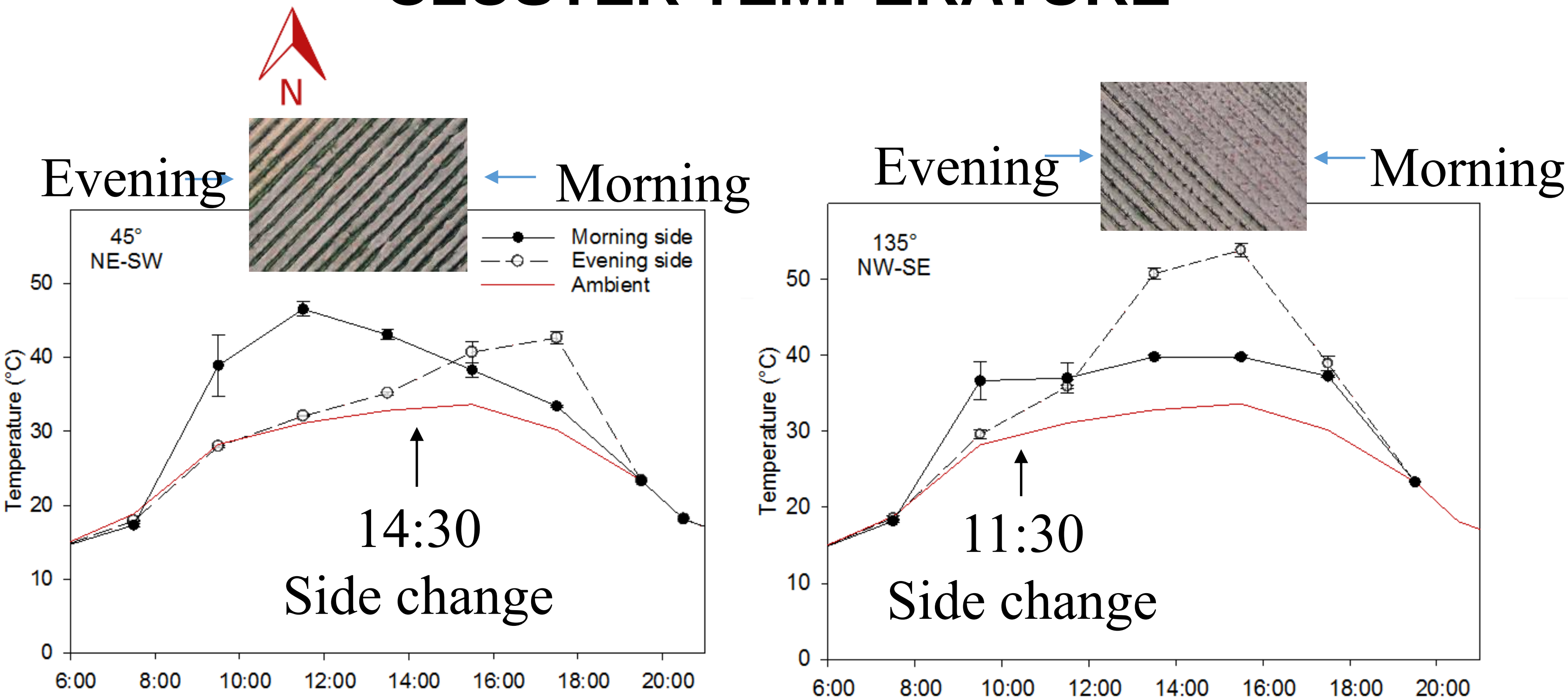
CLUSTER TEMPERATURE



The higher ambient temperature, the easier to reach critical temperature

TRELLIS

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Goals of Training/Trellis System

1. **Support the mechanical load of the grapevine**
2. **Facilitate the cultural operations**
3. **Maximize canopy exposure**
4. **Improve the canopy microclimate**
5. **Promote balance between the vegetative growth and crop to optimize quality and quantity**

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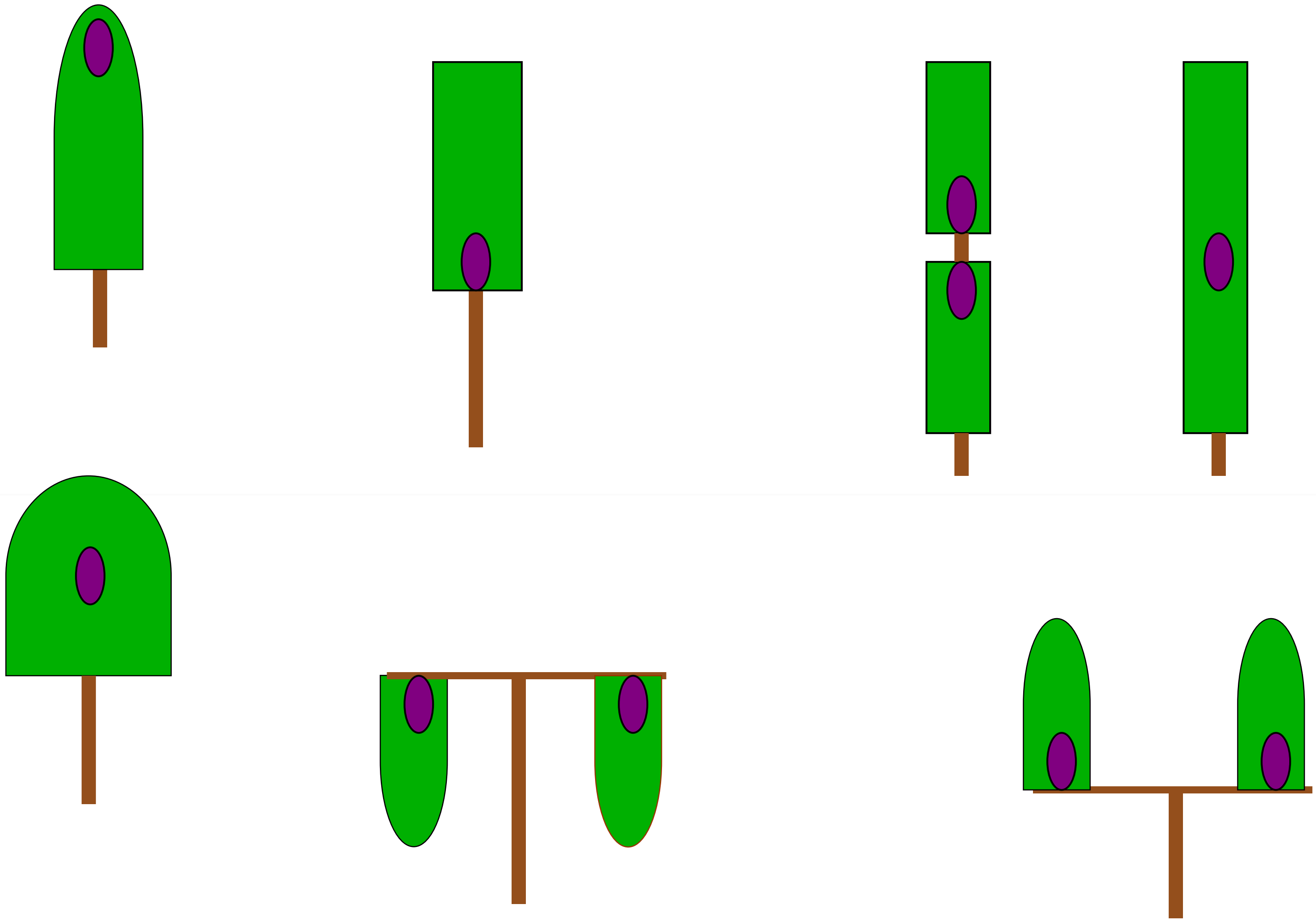
Vertical shoot positioned is everywhere, why?

Pros: Makes premium farming easy
Con: Limited yield, sensitive to overexposure



Trellis Options

Non-Trellised

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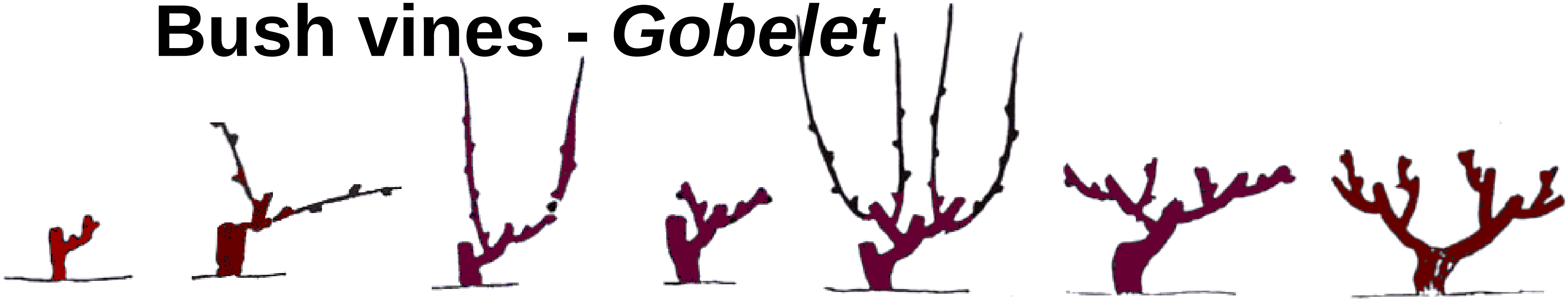
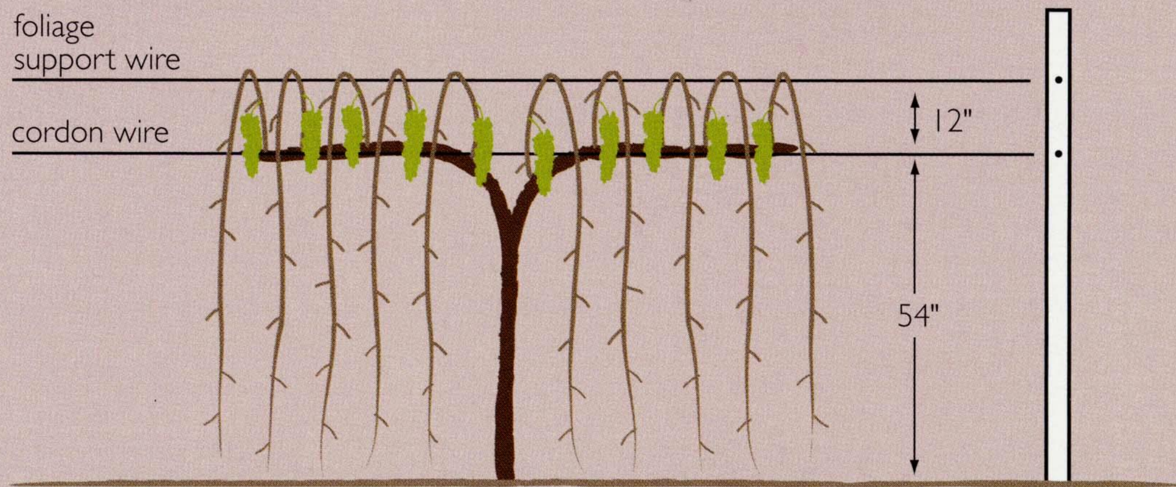
Bush vines - *Gobelet*



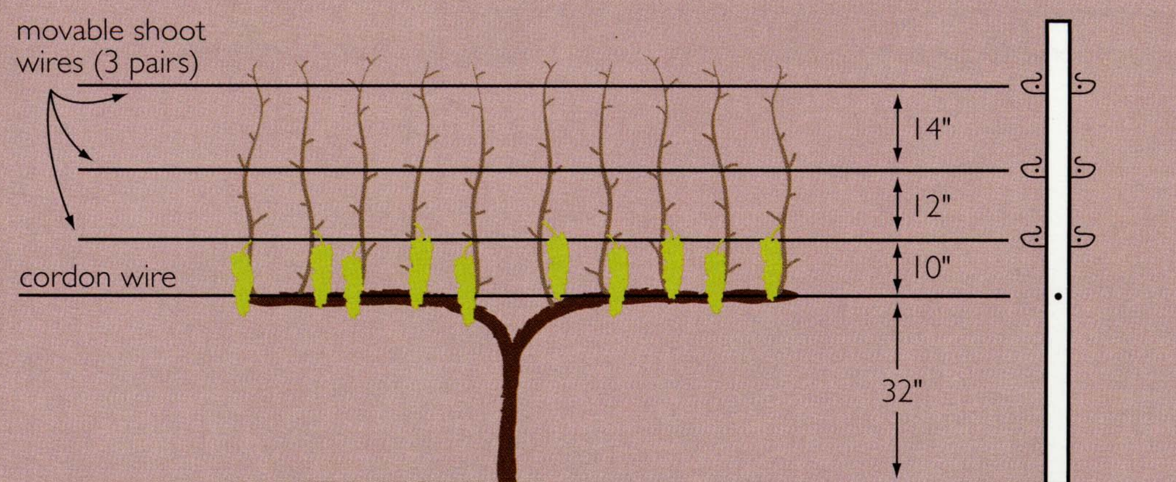
Single Curtain Systems

SINGLE CURTAIN SYSTEMS

Two-wire vertical trellis (also called Simple Curtain or California Sprawl)



Vertical-shoot-positioned trellis (VSP)



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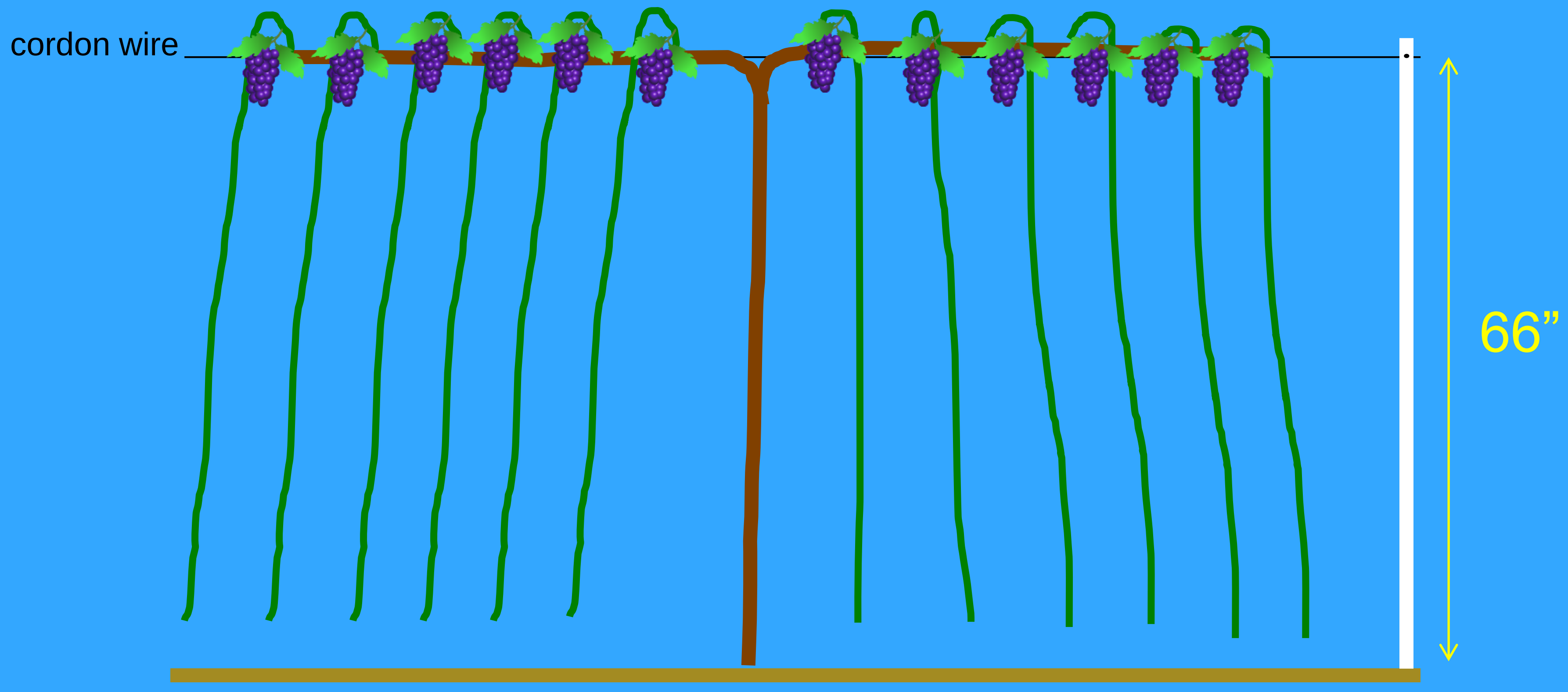
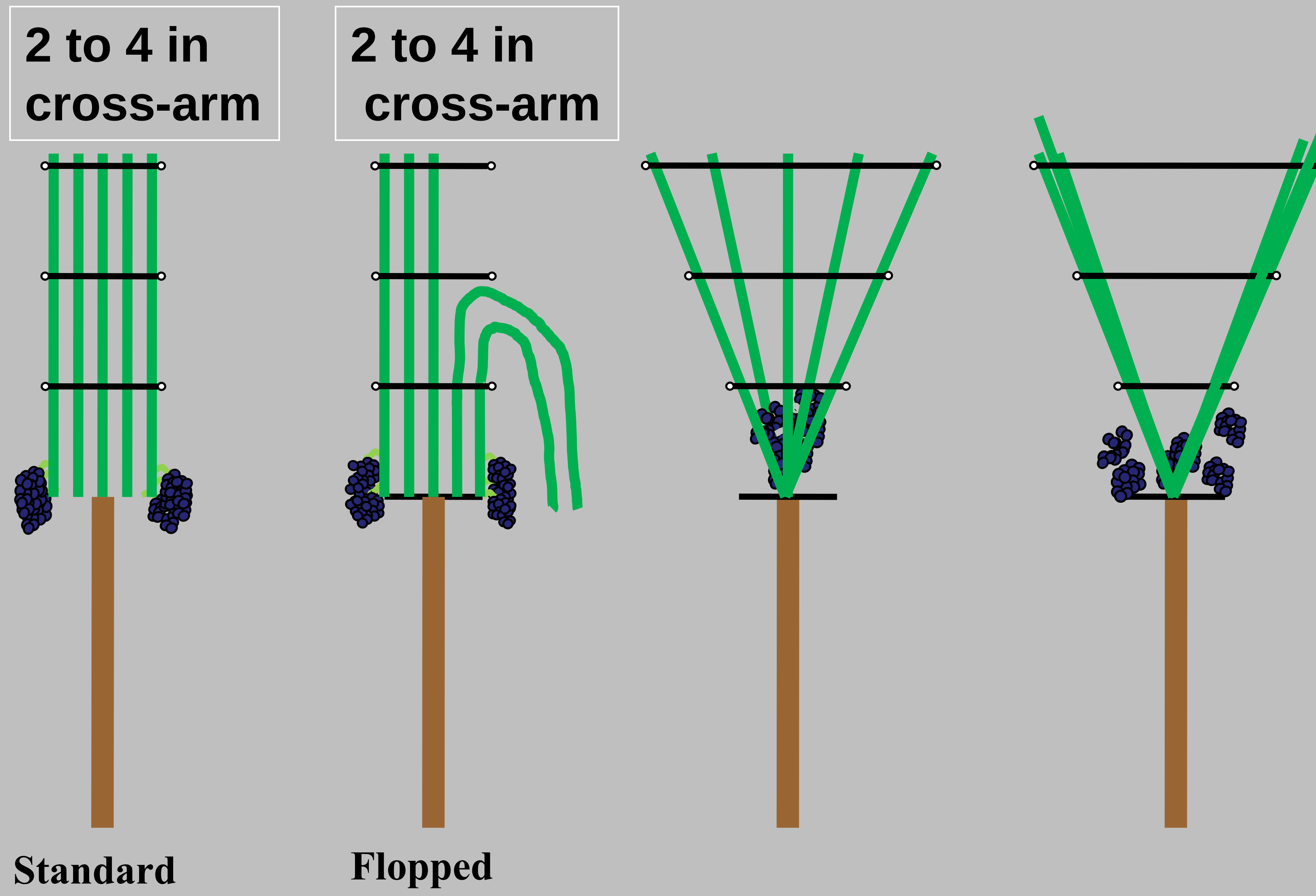
Single wire high cordon



VSP Modifications



Vertical canopy division or separation

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Vertically Divided

- ✓Scott – Henry
- ✓Smart - Henry

Vertically Separated

- ✓Smart - Dyson

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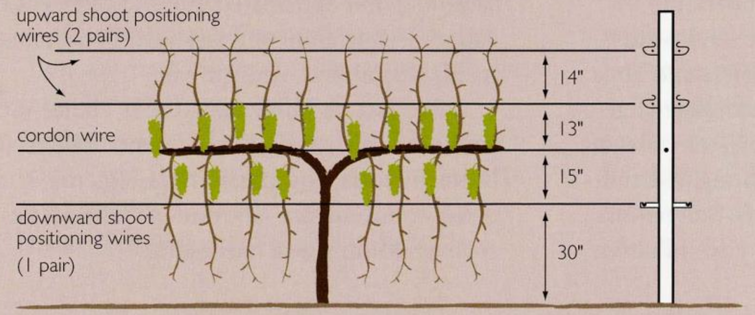
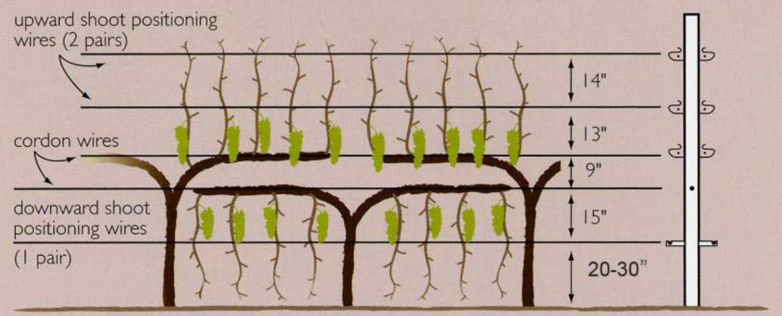
SINGLE CURTAIN SYSTEM WITH VERTICALLY DIVIDED FOLIAGE

Smart-Dyson



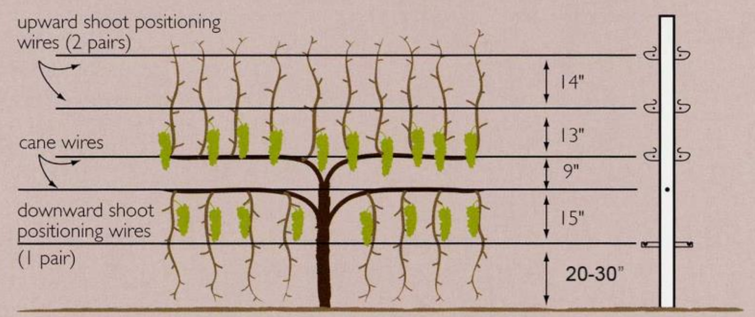
VERTICALLY DIVIDED DOUBLE CURTAIN

Smart-Henry



VERTICALLY DIVIDED DOUBLE CURTAIN

Scott Henry



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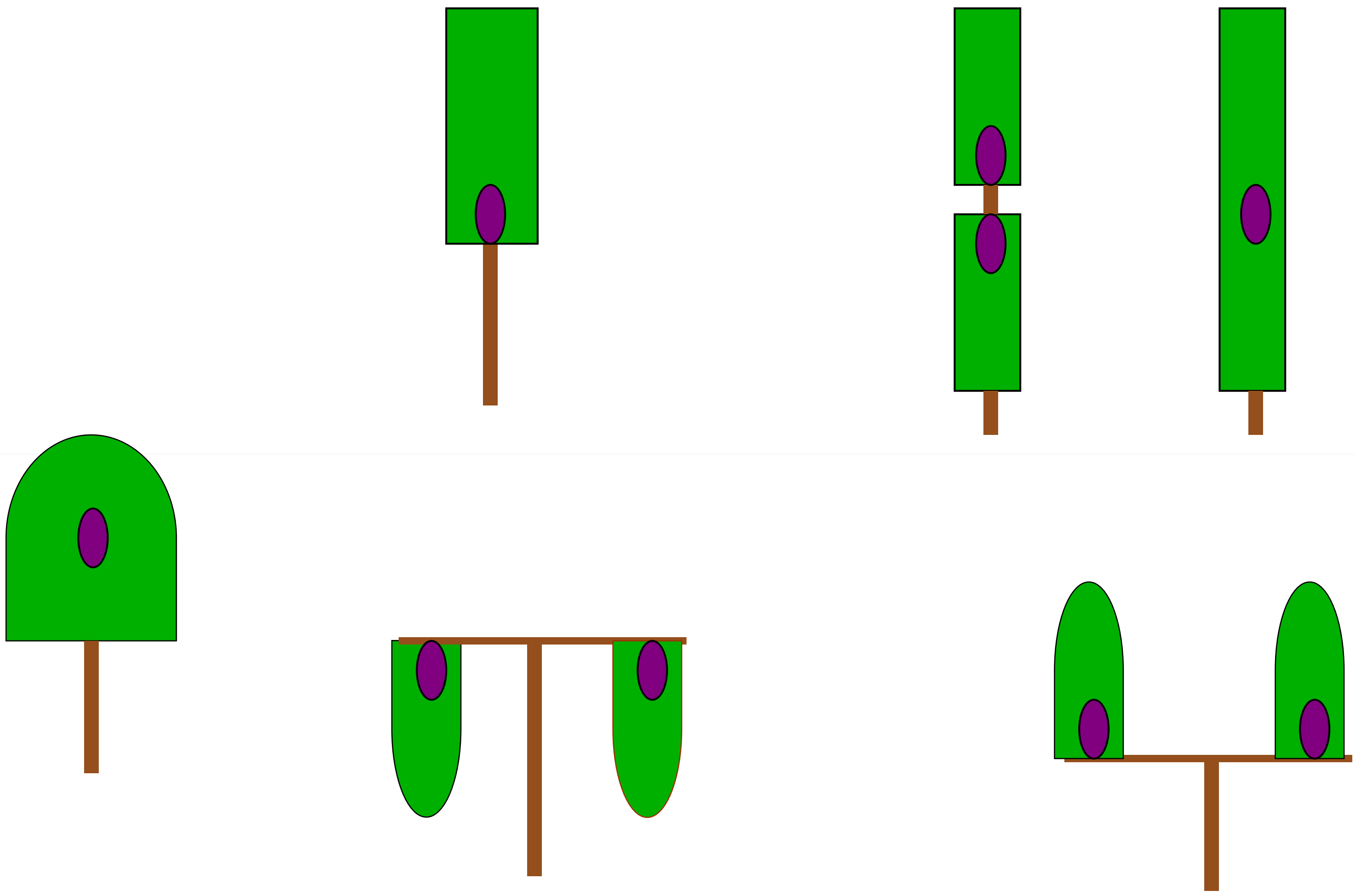
Horizontally Divided Double Curtain Systems



Trellis Options

Shoot Orientation	Result
Horizontal/ Downward	Moderate to low growth rate
Vertical	High growth rate

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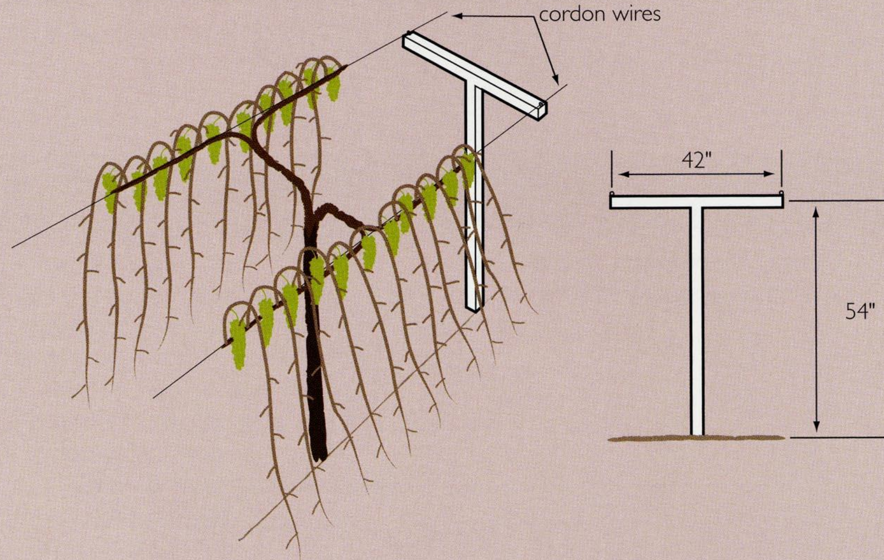
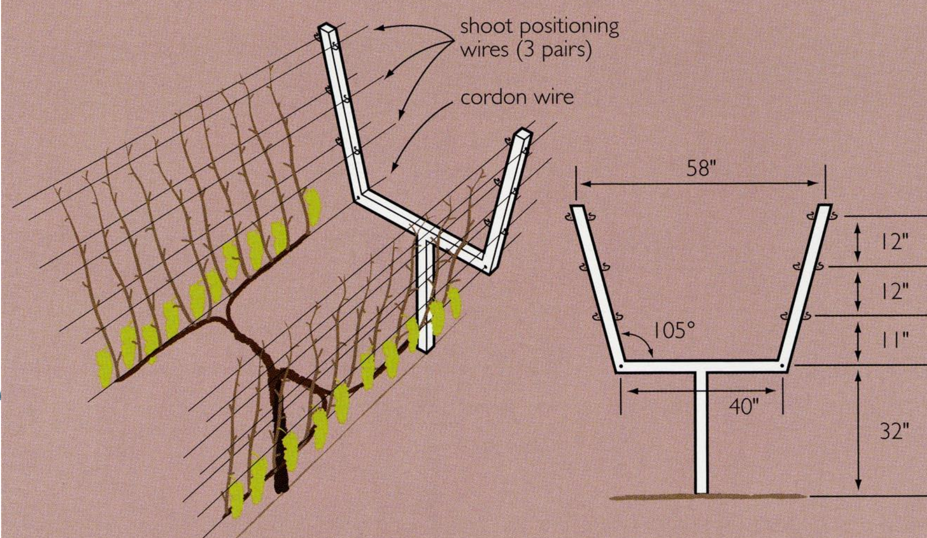
HORIZONTALLY DIVIDED DOUBLE CURTAIN

Double curtain (also called GDC type or Wye trellis)



Lyre trellis



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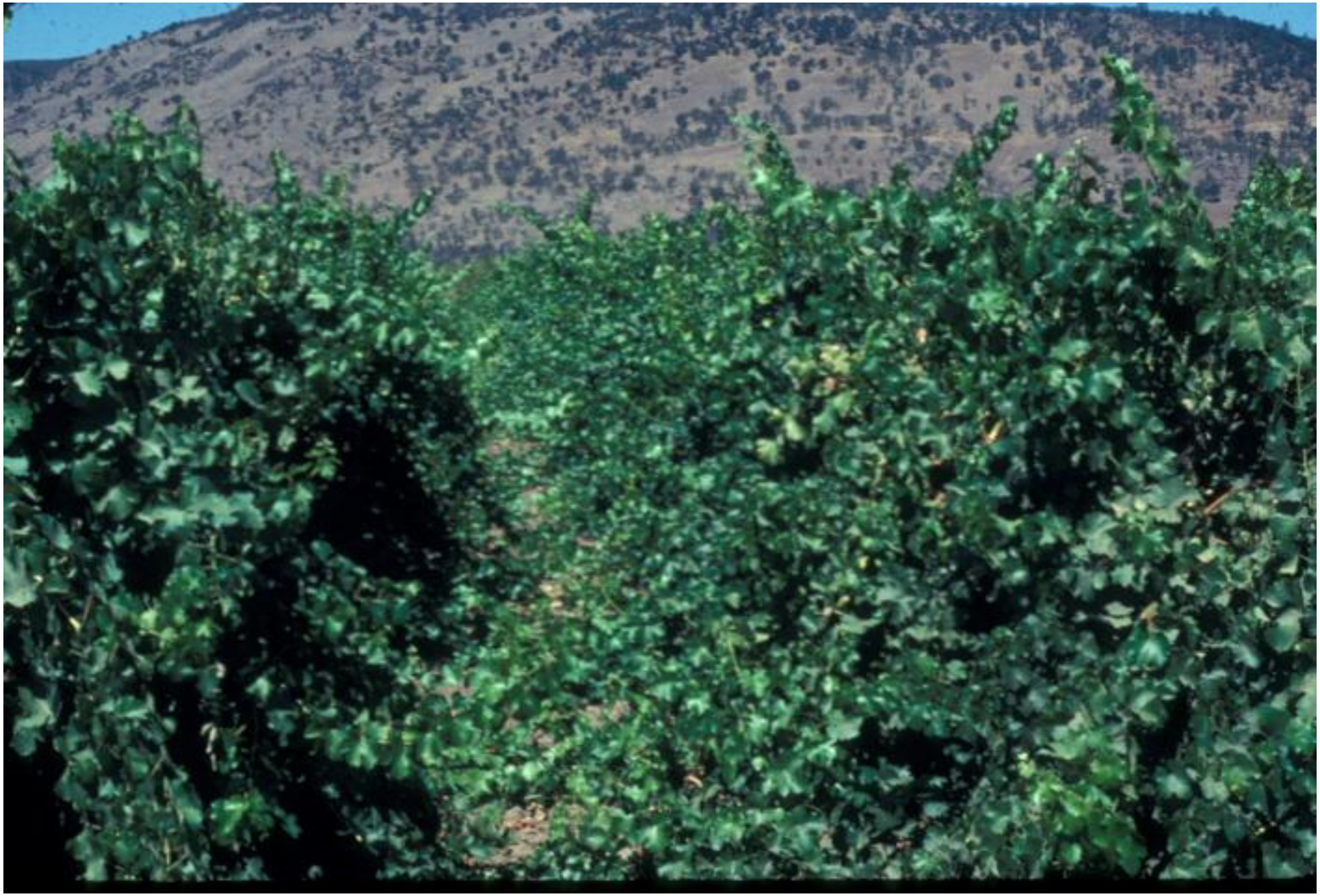


Other Design Considerations

- **End assemblies**
- **Metal or wood trellis materials**
- **Staging areas**
- **Turn-around space (20 to 30 ft)**
- **Ability to mechanize harvest and pruning**

Vineyard Design Summary

- **Row orientation: 22˚ is ideal (NNE-SSW). Aim for long rows. Avoid NW-SE (135˚)**
- **Row spacing: Machinery>Land cost vs water economy>labor**
- **In-Row spacing: 4-6ft . Bigger may reduce quality, vigor and yields. Smaller may be too expensive, high vigor and water use**
- **Trellis...go simple? VSP or Head trained (Gobelet)**
- **Some conflicts: double cordon with 4 ft rows will not work well for many reasons**

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Questions ?