Vineyard Training Systems

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Training System

- Arrange the grapevine to produce a system that ensures long term survival of the vine, productivity in terms of yield and quality, efficient use of space, and sunlight interception.

Variety Growth Habits

- *Vinifera:* upward growth
  - Cabernet Sauvignon, Chardonnay, Riesling
- *Hybrids:* range of growth patterns
  - Upward: Vignoles, St. Vincent
  - Trailing: St. Croix, La Crescent, Frontenac
  - Intermediate: Foch, La Crosse
    - Tend to place all in the trailing group
- *American:* trailing
  - Concord, Niagara, Steuben, Catawba
- Why fight the natural growth habit???

Climate and Site

- Does the variety receive a lot of winter injury?
- How vigorous are the vines at your location?
  - Different training systems are developed to handle different amounts of vigor
    - High vigor - need to spread out shoots
    - Low vigor - need to use system that is not too spread out

Labor and Mechanization

- Some systems are require more labor to be successful than others
- If you are looking at mechanizing in future you should choose a system set up for that

Vineyard Goals

- Aesthetics –vs- solely production
- Maximum yields or minimal labor?
- Fruit Quality
  - Specialized product
  - Bulk product
Vegetative Terminology

- **Trunk**: the main vertical perennial wood on vines originating from the soil level, rough bark
- **Cordon**: horizontally trained perennial wood that originated from the trunk and is usually trained along wires
- **Head**: region of the vine where the trunk tops off and where cordons originate if they exist
- **Arms**: short branch of perennial wood (2 yrs old +) with rough bark originating from off the cordon that canes can originate from
- **Shoots**: current season green actively growing stems on vines
- **Canes**: shoots that become woody in the fall and have smooth bark, fruit comes off of shoots arising from the canes
- **Nodes**: ridged segments on shoots or canes where leaves and buds arise
- **Fruiting Zone**: region where shoot originate and fruit is located

Assumptions

- Vigor is not inherently bad nor will it produce poor quality grapes,
- Excessive vigor (or vigor handled improperly) can cause problems
- Too high vigor: poor fruit due shading and low fruitfulness
- Too low of vigor: can’t ripen fruit or harden off canes

How does fruit ripen?

- Sugar accumulates in the fruit
  - Where does than come from?
- Photosynthates produced from leaves
- Minerals for leaf growth comes from roots

How does fruit ripen? Simplified

- More exposed leaves = more sugar produced
- From roots: minerals (N,P,K, etc), water, stored carbohydrates
- From leaves: Sugars produced that growing season Must balanced with hardening off of canes as well

It takes 30 uE/m2/s of light to maintain a leaf

So at anything less the 30 uE/m2/s, that leaf is costing energy

Full Sun~2,000 uE/m2/s

2 layer: 120 uE/m2/s (6%)

3 layer: 7 uE/m2/s (6%)

(adapted from Smart and Robinson 1991)
Canopy area

Training Systems

<table>
<thead>
<tr>
<th>Training Systems</th>
<th>Surface Area 12 ft row yrd^2/acre (% High Cordon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-wire Cordon  (VSP)</td>
<td>6343 (105%)</td>
</tr>
<tr>
<td>High-wire Cordon</td>
<td>6116 (100%)</td>
</tr>
<tr>
<td>Scott Henry</td>
<td>6343 (105%)</td>
</tr>
<tr>
<td>Smart Dyson</td>
<td>6343 (105%)</td>
</tr>
<tr>
<td>Smart Dyson Ballerina</td>
<td>6634 (110%)</td>
</tr>
<tr>
<td>Geneva Double Curtain</td>
<td>9684 (160%)</td>
</tr>
</tbody>
</table>

Midwest Grape Production Guide (based on)

Systems differ in....

- Direction shoots are arranged
- Use or non-use of cordons
- Divided or non divided canopies
- Amount of shoots that can be handled per foot or row
- Placement of fruiting zone

Cordon –vs- Head Systems

“Major” Systems

- Trailing Growth
  - High wire cordon
  - Geneva double curtain
- Upright Growth
  - Mid wire cordon
  - Guyot
  - Fan
  - Scott Henry
  - Smart Dyson
High Wire Cordon

**Pros:**
- Ideal for trailing and intermediate cultivars
- Ideal for medium to high vigor vines
- Fruit is up high for good exposure
- Orientating shoot downwards can slow down vigor
- Management can be mechanized

**Cons:**
- Requires a lot of perennial wood, so not ideal for marginal cultivars
- Canopy can become too dense if not positioned

**Shoot Positioning Combing**

**Geneva Double Curtain**

**High Wire Cordon**

syn: Hudson River Umbrella, Top Wire Cordon, High Wire Bilateral Cordon, Single Curtain

66-72"

36-40"

Non-combed

Combed

36-48"

40-50"
Geneva Double Curtain

Pros:
• Ideal for trailing and intermediate cultivars
• Ideal for high vigor vines
• Fruit is up high for good exposure
• Orientating shoot downwards can slow down vigor
• Allows for more shoots to be retained and not cause shade
• Potential for higher yields
• Twice the fruiting zone as compared to High Wire Cordon

Cons:
• Requires a lot of perennial wood, so not ideal for marginal cultivars
• Canopy can become very dense if not positioned
• Shoot positioning required to not allow the canopies to grow together
• Requires more extensive trellis system
• Requires wider spaced rows

Head Systems for Trailing Cultivars

• Umbrella Kniffin
• 4 Arm Kniffin
• Keuka High Renewal

Mid Wire Cordon
syn: Vertical Shoot Position (VSP)

Pros:
• Ideal for upright growing cultivars
• Ideal for low to moderate vigor vines
• Allows for easy access to fruit zone for thinning, leaf pulling, etc
• Aesthetics

Cons:
• Not suited to high vigor vines
• More labor required for tucking shoots for canopy management
• Fruiting zone is low and prone to shade if not managed correctly
• Fruit may have increased predation due to low height
Dealing with vigor

- Important part of mid wire training systems
- Vines with excessive vigor can shade fruiting zone of the adjacent rows

Shoot Positioning: Tucking

View looking into a trellis row

Shoot Positioning “Tucking” on mid wire system (VSP)

Midwest Grape Production Guide
Guyot

Pros:
• Useful in cultivars that do not bear heavily on short canes
• Allows for excellent shoot spacing
• Others similar to mid wire cordon

Cons:
• Pruning takes more time pruning
• Not good for regions that have a lot late frost damage
• Similar to mid wire cordon
### Smart Dyson

**Pros:**
- Ideal for high vigor upright growing cultivars
- Can maintain narrow row spacing
- Allows for more shoots to be maintained
- Twice the fruiting zone as mid wire cordon
- Potential for higher crops

**Cons:**
- Usually requires trellis extension to increase height
- Increased amount of canopy management
- Crop on shoot positioned downward often ripen later

### Scott Henry

**Pros:**
- Ideal for high vigor upright growing cultivars
- Can maintain narrow row spacing
- Allows for more shoots to be maintained
- Twice the fruiting zone as mid wire cordon
- Potential for higher crops

**Cons:**
- Usually requires trellis extension to increase height
- Increased amount of canopy management
- Cordons, shoots, and canes positioned downward often have fruit that ripens later and has more die back

### Fan

- Fan
- Dimensions: 66-72" x 44-56" x 24-36"
Fan

Pros:
• Allows fruit producing regions to potentially be insulated with snow cover
• Flexible for regions with a lot of winter injury or the planting of marginally hardy cultivars

Cons:
• Fruit can be low to the ground and thus difficult to work with
• No defined fruiting zone and therefore variable fruit exposure

Other Systems for Upright Growing Cultivars
• Pendlebogen
• Lyre
• Low Cordon

If planting a new vineyard stay flexible

• Look at vineyards using similar varieties and soils
• Actual vine growth may be different than anticipated
• Easier to deal with too much vigor than too little (too little is not profitable)
• Start with a smaller planting and in future plantings adapt from what you have learned

Choosing a System

• Keep in mind you can be successful with many of the systems
• Most research studies have shown that some varieties can be grown equally well with the mid wire and high wire cordon systems
• Issue of how much extra work involved
• Many people have ‘compared’ but not in fair trials

Choosing a System

• First look at the growth habit of the cultivar when growing freely
  – Catalogs and nurseries and only guides
  – Does the variety grow upright? Trailing? Somewhere in between?
  – Is the variety highly vigorous or not?

Variety Growth Habits

• Vinifera: upward growth
  – Cabernet Sauvignon, Chardonnay, Riesling
• Hybrids: range of growth patterns
  – Upward: Vignoles, St. Vincent
  – Trailing: St. Croix, La Crescent, Frontenac
  – Intermediate: Foch, La Crosse
• American: trailing
  – Concord, Niagara, Steuben, Catawba
• Why fight the natural growth habit???
Variety Growth Habits

- Impact on choice of directing shoots in the training system
- Personal choice is to assume using the high wire cordon system, then ask if there are reasons to choose to a different system
- Don’t work against the variety tendency and gravity

Variety Growth Habits

- Trailing Growth= high wire cordon or Geneva double curtain
- Upward Growth= mid wire cordon, guyot, Scott Henry, Smart Dyson
- Margins of hardiness= fan, regardless of growth habit

Vine Vigor

- Vigor varies greatly by site and management techniques
  - Marechal Foch is an example
  - Do not assume that a variety is vigorous enough if you have not grown it or seen it grown in similar conditions
- Anticipate based on inherent vine vigor and the soil conditions

Vine Vigor

- Low Vigor Site
  - High water table
  - Shallow soils
  - Soils with high levels of clay
  - Compacted soils
  - Weed infested
  - Excessive deer predation
- High vigor site
  - Low water table, but available water
  - Well drained soil
  - Deep soils
  - Soil with excellent structure

Is your system matched to your vines?

<table>
<thead>
<tr>
<th>Class of Vine Vigor</th>
<th>Water Table</th>
<th>Plantable Space</th>
<th>Row Spacing</th>
<th>Training System / Vine Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Less than 0.5</td>
<td>Less than 2</td>
<td>More than 15</td>
<td>High organic growth or fan, not enough shoot should reduce shoot and focus on removing vine size.</td>
</tr>
<tr>
<td>Medium</td>
<td>0.3 – 0.4</td>
<td>2.4 – 2.2</td>
<td>5 – 12</td>
<td>Balanced, not enough shoot should reduce shoot and focus on removing vine size.</td>
</tr>
<tr>
<td>High</td>
<td>More than 0.4</td>
<td>More than 2</td>
<td>Less than 3</td>
<td>Balanced, not enough shoot should reduce shoot and focus on removing vine size.</td>
</tr>
</tbody>
</table>

Comments and Recommendations: * Balanced *: vines. This situation is optimum. Should keep the same vigor/qualities.

Vine Vigor

- Will impact vine spacing and choice of training system
  - Will look at vine spacing a bit later in the module
- Have already selected based on growth habit now select based on vigor
Seyval Research Data

High wire cordon vs Mid wire cordon by Andrew Reynolds

– In BC both had similar vigor, and fruit composition, but HWC had higher yields
– In NY pruning weights were higher in MWC with yields statistically the same, MWC had more shaded fruit and 2/3 year HWC had higher sugar content
– No values on time to do either

Table 10: Guidelines to Matching Training Systems with Potential Vineyard Vinifer Based on Distribution of Sunlight, Vertical Yape, and Row and Vine spacing

| Training/Rowing System | Anticipated Site/Wine | Direct and Backward Sunlight | Row Spacing | Vine Spacing
|-------------------------|-----------------------|----------------------------|-------------|-------------
| Non-wire systems        |                       |                            |             |             |
| Vertical Sunlight       | + + +                 | + +                        | + +         | + +         |
| High Cordon            | + + +                 | + +                        | + +         | + +         |
| Mid-wire systems       |                       |                            |             |             |
| Short Distance         | + + +                 | + +                        | + +         | + +         |
| Supercord Cordon       | + + +                 | + +                        | + +         | + +         |
| Long or "U"            | + + +                 | + +                        | + +         | + +         |

| 1. Anticipated Site/Wine Ranking: High = deep and fertile soil; abundant water supply by and high water holding capacity. Moderate = average to better than average for the area; more water can be applied without excessive drainage. Poor = thinner, light texture soil with limited water holding capacity or availability of water.
| 2. Direct and Backward Sunlight: + More appropriate Choice; + + Good choice; + + + Less appropriate choice recommended.
| 3. Row Spacing: Narrow = 3 to 4 ft; Wide = 7 to 11 ft.
| 4. Vine Spacing: Narrow = 6 to 8 ft; Wide = 11 to 14 ft.

Traminette Research Data

Bordelon et al

SH: highest PW, yield (100%),
MWC: high PW, yield (74%),
HWC: moderate PW, yield (96%),

In Conclusion

• Keep in mind that staying flexible is key
• Be realistic about the time involved
• Look at a successful vineyard with similar conditions and varieties
• You can change systems once if you realize later on that a different system is better adapted
• Learn from your mistakes and apply it to future plantings.