Vineyard training & design

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Vineyards are complex: Break down into components

- Row spacing
- Vine spacing
- Cordon/spur vs head/cane
- Grapevine training systems
- Professional assistance with vineyard design
- Addressing site limitations
  - Wind machines
  - Irrigation
Row spacing

• Shading 1:1

<table>
<thead>
<tr>
<th>Row spacing (feet)</th>
<th>Linear feet of trellis/acre</th>
<th>Yield (tons/acre) at 1.5#/ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>4,500</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>5,000</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>5,500</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>6,000</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>7,500</td>
<td>5.6</td>
<td></td>
</tr>
</tbody>
</table>

But, be realistic…. 3 foot (1.5' + 1.5') buffer around equipment
Row orientation

- North-south
- East-west
- Up and down the hill
- Side-slope
Vine spacing (practical considerations)

• 5 feet between vines

• More vines per acre = greater establishment costs
  • Vines
  • Stakes
  • Planting labor

• More rapid trellis fill with closer vine spacing

• Missing vine = empty trellis
Vine spacing (research results)

Long-term Performance of Barbera Grown under Different Training Systems and Within-Row Vine Spacings

Fabio Bernizzoni, Matteo Gatti, Silvia Civardi, and Stefano Poni*

- "Vine capacity measured as leaf area decreased linearly with increasing within-row vine spacing”
- "Yield per meter of row decreased”.
- Vine spacing had no effect on grape composition.

Impact of Training System and Vine Spacing on Vine Performance, Berry Composition, and Wine Sensory Attributes of Riesling

Andrew G. Reynolds, Douglas A. Wardle, Margaret A. Cliff, and Marjorie King

Increasing vine spacing increased weight of cane pruning/vine linearly bud reduced cane pruning/m row and weights linearly, suggesting that any root completion, if present, of closely spaced vines on fertile, irrigated, well drained soil is insufficient to reduce vine vigor.
• Increase space between grapevines

• Pruning weight per meter of trellis goes down
  • A tool to reduce rate of vine vegetative growth
Vine spacing (interpretation)

• Low vigor site -> low capacity (small) vine -> high density vineyard
• High vigor site -> high capacity (big) vine -> low density vineyard

• Vine size is not uniform over the life of the vineyard
• Pruning/training system
If grafted, make sure the graft union is placed above the soil line at planting

… vines can settle after planting…

Graft union should be about 3-4” above soil line
What is a vine training system?

The **system** or **form** in which a vine is cultivated

- Large area of healthy leaves exposed to sunlight
Canopy management

The use of techniques which change the number and position of shoots and bunches in space with an aim to produce an open canopy and balanced vines.

(Smart & Robinson 1991. Sunlight into Wine)
Canopy management practices

- **Dormant pruning**
- **Shoot thinning**
  - When shoots ~ 5” long
  - 3-4 shoots / foot of row
- **Shoot positioning**
  - Training system-dependent
  - Two or three passes
- **Lateral shoot/ leaf removal**
  - From fruit-zones especially
- **Shoot hedging**
  - Leave approx. 2 ft. above top catch wire (VSP system)
Divided Canopies: manipulate spacing, increase yield, increase labor
## Cordon/spur v head/cane

<table>
<thead>
<tr>
<th></th>
<th>Cordon/Spur</th>
<th>Head/Cane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dormant pruning</td>
<td>Less time (mechanize?)</td>
<td>More time (tying)</td>
</tr>
<tr>
<td>Budbreak timing</td>
<td>No change</td>
<td>Delayed</td>
</tr>
<tr>
<td>Shoot thinning</td>
<td>More shoots (more time)</td>
<td>Fewer shoots (less time)</td>
</tr>
<tr>
<td>Crop yield</td>
<td>Slightly smaller</td>
<td>Slightly bigger</td>
</tr>
<tr>
<td>Vine size</td>
<td>Slightly bigger</td>
<td>Slightly smaller</td>
</tr>
<tr>
<td>Yield to pruning</td>
<td>Decrease</td>
<td>Increase</td>
</tr>
<tr>
<td>Net labor</td>
<td>No change</td>
<td>No change</td>
</tr>
</tbody>
</table>

**Vine spacing**
Help

- Cooperative Extension
- NRCS
  - Planning for vineyard/farm development
    - Water quality
    - Invasive plants
  - Erosion mitigation
  - Roads
  - Storage & mixing area

- http://newa.cornell.edu/
Addressing site limitation

- Wind machines
- Tile drainage

Risk management is the identification, evaluation, and prioritization of risks
Addressing site limitation: Irrigation

Positive
• Vineyard development - crop production in early years
• Means to supply supplemental water in drought
• Injector
  • Fertilizer
  • Insecticides

Negative
• Material cost
• Installation cost
• Infrastructure/design
• Inconsistent need in established vineyard
• Maintenance

Temporary irrigation for vineyard installation
Other problems...

Is the block making you money?

How old is the block?
Has/Will the vineyard pay for itself?
Cold injury...

• Example:
  • Cold tender variety planted in 2014
    • Cold injury in 2015
    • and 2016
    • And 2017
  • Replant with a less tender variety
    • Two management zones
Training system conversion

- Example: Conversion from spur to cane
- No skip year
- One messy year with extra canopy management costs

- Limitations
  - Vine age
  - Trunk diseases
  - Is the problem due to training system
Too much....

- Too much vigor
  - Cover crops
  - Divide the canopy
  - Take out every other vine

- Too much disease
  - Time sensitive canopy management
  - Diligent spray program
Problems...

• Vine training...
  • Training system conversion
  • Spur to cane
  • VSP to highwire

• Variety
  • Cold injury
  • Not selling wine
Other problems....

- Trellis hardware
  - There are always thing that you can buy
    - Will they solve your problem?
    - Or will more labor with time sensitive vineyard tasks

- Vineyard design
  - Is it something you can live with?
  - When and how to push out a vineyard?
    - There is a cost to every option...
Every vineyard is unique

• Site
• Varieties
• Production goals
Planting options

Mechanically planted
- fast and efficient
- may be limited on steep sites
- may plant too deep / shallow
- acreage cutoff? (~5-7 acres?)

Manual Planting
- less soil disturbance = less erosion
  and maintenance of soil structure
- may be necessary on steep sites
- slower
Plant material

• # of Vines to Order
• Nurseries (“Protocol 2010”)
• When to Order (18 months out)
• What to Order (ask for certified)
  - Rootstock
  - Variety
  - Clone
• Delivery
- Water before and after planting...
- Plant when soil is still moist (spring)
- Drip irrigation is helpful – an unusually dry year can cost a year’s growth
Grow Tubes

Benefits
• Physical protection
• Herbicide

Limitations
• Cost
• Spindly growth
• Diseases, insects
• Removal (labor)
  • Winter damage
Training

• **Immediate goal:**
  • Healthy, exposed foliage
  • Develop the vine’s permanent features (i.e. trunks)

• **Long-term goal:**
  • Develop vine to fill trellis and train a canopy that can produce and ripen fruit for the lifespan of vineyard
Early Vine Training

- Straight up!
- Keep off ground
- Tie to stake
- 2 trunks
- Drop clusters
  - Eliminate weed competition
- Keep canopy clean
... Later vine training...

Goal: Fill trellis to produce a crop
DIVIDED CANOPIES

- Less popular than single canopy systems:
- More time required for canopy management and trellis maintenance
- Can increase yield per unit area of land
- May be beneficial on sites with higher plant water and nutrient availability.
Grapevine training systems: Wildlife deterrence

- Fences
- Nets
- Perimeter-block geometry
Professional assistance with vineyard design

• Professional surveyor
  • Pre-vineyard development
    • Determine where to clear
    • Maximize linear feet of row

• Computer Assisted Design
  i. Communicate parameters
    a) Headlands
    b) Row orientation
    c) Maximum, minimum row length
    d) Soil characteristics
  ii. Planning – reports/visualization
  iii. Stake out
Professional assistance with vineyard design:

Underlying soil

• How to assess soil...
  a. Free resources
  b. Landforms
  c. Performance of groundcover
  d. Characterization of soil

Design blocks for uniform vine size

What if the block is in place...