Oklahoma Vineyard Quality Project

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TRIP A:
1435.5 MI
P R N D 3 2 1
Fruit Quality Variables

- Interaction of elements that lead to fruit at harvest
  - 4 GEMS
    - Genotype
    - Environment
    - Management
    - Site
Genotype

aka

Cultivar, Variety
Grapevine genetics play an important role in site acclimation and adaptation.

Species have different abilities to withstand climatic conditions.

Genetically determined due to evolutionary factors (where is the origin of the species?)
Key Factors in Cultivar Selection

- Demand by winery
  - A cultivar the winery is willing to process
- Meet quality demands of the winery
- Tolerate the environment
  - Pest
  - Climate
- Produce profitable yields
- Produce consistently
Cultivar Decisions

• Not all grow well in Oklahoma

• Your decision should stem from knowledge of climate, disease, genetics, market, etc.

• “I like to drink ...” not a good enough reason for commercial production
Temperature Data by County - Jan 2007 Le Vigneron Newsletter

NOTES:
Group 1 - Decades With Economic Loss  Group 2 - Decades With Economic Break Even  Group 3 - All Decades Profitable  * Washington and Major counties included in Group 1.

1-12-07
Vinifera

- Origin from Europe/Mediterranean areas
- Rule of thumb is -5 °F, but expect some damage below 0 °F, mid-winter
- Susceptible to fluctuating fall, winter, and spring temperatures
- Drought will affect cold hardiness
Why *V. vinifera*?

- Makes highest quality wine
- Likes hot and dry conditions in summer (in general)
- Name recognition
- Productive
Why Not *V. vinifera*?

- Lack of cold hardiness
- Overly vigorous
- Little disease resistance
- Must be intensively managed
Hybrids

- Vary widely in quality, other attributes
- Usually more cold tolerant than vinifera
- Depends on the species used to constitute the cross
- As a general rule of thumb hardy to -10 °F
- Can be susceptible to fluctuating temperatures (cultivar dependent)
Why Interspecific Hybrids?

- Better Cold Hardiness
- Better Disease Resistance
- Better Productivity
Why Not Hybrids?

- Perceived lack of quality
- Huh?
American Species

- Vary widely in quality, etc.

- *Vitis labrusca, V. aestivalis, V. riparia* are often used for cold tolerance (possibly down to -40 °F)

- Others such as *V. rotundifolia* are cold tender (10 °F)

- Not as susceptible to fluctuating temperatures during fall and winter
Supply and Demand

- Avg price paid in OK for *V. vinifera* = $1000 to $1500/ton
  - Similar in TX

- Avg price paid in OK for hybrids = $400 to $700/ton
<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Midwest $/ton</th>
<th>MO $/ton</th>
<th>KY/TN $/ton</th>
<th>IN/IL $/ton</th>
<th>IA $/ton</th>
<th>NE $/ton</th>
<th>OH $/ton</th>
<th>VA $/ton</th>
<th>NY $/ton</th>
<th>OR $/ton</th>
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</thead>
<tbody>
<tr>
<td>Cab S</td>
<td>1617</td>
<td>1250</td>
<td>1750</td>
<td>2000</td>
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<td>.</td>
<td>1650</td>
<td>1959</td>
<td>1622</td>
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<td>Cab F</td>
<td>1536</td>
<td>1500</td>
<td>1675</td>
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<td>1527</td>
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<td>.</td>
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<td>.</td>
<td>1983</td>
<td>1756</td>
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<td>1570</td>
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<td>Sangio</td>
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<td>Syrah</td>
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<td>.</td>
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<td>1997</td>
<td>1750</td>
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<td>Zin</td>
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<td>Cynth</td>
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<td>900</td>
<td>1100</td>
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<td>Chamb</td>
<td>1011</td>
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<td>850</td>
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<td>.</td>
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<td>1300</td>
<td>1250</td>
<td>.</td>
<td>.</td>
<td>733</td>
<td>.</td>
</tr>
</tbody>
</table>
What Looked Good?

- Some hybrids
  - Seyval, Siegfried Reisling, Chambourcin, Chardonel, etc.
  - Had moderate to good crop loads even with freeze effects
  - Possibility for better tonnage

- Vinifera?
  - Reisling, Merlot (?)
  - Are they sustainable in the long run? Can 3-4 tons/acre be averaged over a 10 yr period?
Environment
Climatic Adaptability

- **On the low temperature side:**
  - Determined by the ability of a fully dormant plant to withstand exposure
  - Can be influenced by fluctuating temperatures
  - Bud damage or structural damage

- **On the high temperature side:**
  - Determined by the temperature at which respiration exceeds photosynthesis
  - Plant ceases to accumulate sugars
Temperature

- Interacts with genetic material to determine hardiness
- What is normal temperatures for the site?
- What is the record temperatures for the site?
- Count on wildly fluctuating temperatures in Oklahoma
Two Challenging Factors

- **Spring**
  - Fluctuating temperatures
  - Late frosts and freezes
  - Too little rain, too much rain
  - Hail, wind, etc.

- **Fall**
  - Fluctuating temperatures
  - Early freezes
  - Droughty
  - Hail, etc.
Climate Challenges

• Spring frost/freeze
  ○ April 8, 2007 got down to 23 °F
  ○ Problem was Chardonnay 50% budbreak on March 17!

• Fall freeze
  • October 9, 2000: 21°F (vines not hardened off yet)

• Overall, Stressful Conditions!
And Two More...

- **Summer**
  - Too hot
  - Too humid
  - Too dry

- **Winter**
  - Fluctuating temperatures
  - Too cold
  - Droughty, etc.
Oklahoma Climate

- **Summer blahs:**
  - 2011, July and August average high was $>102\, ^\circ F$
  - Summer (June-August) average lows often $>70\, ^\circ F$
  - Night relative humidity often 90+%
  - July 18-Aug 9, 2012 high temps ($^\circ F$): $>100\, ^\circ F$

- **Winter fluctuations and cold:**
  - 80 degrees $^\circ F$ was the difference in temperature from February 10 (-19 $^\circ F$) to February 12 (61 $^\circ F$), 2010
Management
# Oklahoma Vineyard Quality Project
## Assessment Form 1
Following Final Pruning, Mature Vineyard (VSP or High Cordon, Spur-Pruned)

### Vineyard Capacity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>% of Vineyards Deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5% Missing or Dead Vines</td>
<td>88%</td>
</tr>
<tr>
<td>0 to 5% Missing or Dead Cordon (exclusive of missing/dead vines)</td>
<td>48%</td>
</tr>
<tr>
<td>2.5 Spurs per foot of cordon (on average)</td>
<td>89%</td>
</tr>
<tr>
<td>Spur Cane diameter between 5/16” and 1/2 inch</td>
<td>89%</td>
</tr>
<tr>
<td>Spur Cane shape is round in cross-section</td>
<td>36%</td>
</tr>
<tr>
<td>Spur internode length between 1 to 4 inches</td>
<td>4%</td>
</tr>
<tr>
<td>Spur Cane color dark brown (or typical of cultivar) and is alive</td>
<td>58%</td>
</tr>
<tr>
<td>At least 95% spurs with 2 count buds per spur</td>
<td>84%</td>
</tr>
<tr>
<td>Weak spurs (cane diameter &lt; 5/16”) retain 1 count bud</td>
<td>82%</td>
</tr>
</tbody>
</table>

### Trellis & Training

<table>
<thead>
<tr>
<th>Parameter</th>
<th>% of Vineyards Deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trellis posts and wires in good condition, no repairs needed</td>
<td>24%</td>
</tr>
<tr>
<td>Trellis appropriate for vigor</td>
<td>36%</td>
</tr>
<tr>
<td>Training system appropriate for vigor</td>
<td>39%</td>
</tr>
<tr>
<td>Training system properly implemented (dimensions, vine parts)</td>
<td>64%</td>
</tr>
<tr>
<td>Trunk(s) straight, centered in row</td>
<td>21%</td>
</tr>
<tr>
<td>Cordon length no more than halfway to next vine</td>
<td>6%</td>
</tr>
<tr>
<td>Spurs on upper part of cordon, orientation &lt; 45° from vertical</td>
<td>38%</td>
</tr>
<tr>
<td>Spurs positioned close to cordon, &lt; 8 inches from upper bud to cordon</td>
<td>36%</td>
</tr>
</tbody>
</table>

### Vine Health

<table>
<thead>
<tr>
<th>Parameter</th>
<th>% of Vineyards Deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active crown gall present on fewer than 2% of all trunks</td>
<td>12%</td>
</tr>
<tr>
<td>Dead areas less than 2% of cordon area (freeze, PD, wood canker, etc.)</td>
<td>58%</td>
</tr>
<tr>
<td>Phomopsis lesions or bleached canes on fewer than 2% of all spurs</td>
<td>6%</td>
</tr>
<tr>
<td>Cane borer holes in fewer than 2% of all spurs</td>
<td>8%</td>
</tr>
<tr>
<td>Spray records are available and up-to-date</td>
<td>20%</td>
</tr>
</tbody>
</table>

### Vineyard Floor

<table>
<thead>
<tr>
<th>Parameter</th>
<th>% of Vineyards Deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover crop appropriate for soil and climate (coverage and competition)</td>
<td>5%</td>
</tr>
<tr>
<td>Weed growth short and covers ≤ 50% of under vine area</td>
<td>27%</td>
</tr>
</tbody>
</table>

### Vineyard Business

<table>
<thead>
<tr>
<th>Parameter</th>
<th>% of Vineyards Deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance-based (e.g., yield, brix, TA, etc.) contract for all of crop</td>
<td>19%</td>
</tr>
</tbody>
</table>

Adapted from Texas A&M "Great Vineyards Program"

33 vineyards visited
Mean(spur diam) vs. Cultivar

Where (120 rows excluded)
Each error bar is constructed using the min and max of the data.
Where (120 rows excluded)
Each error bar is constructed using the min and max of the data.
Oklahoma Vineyard Quality Project
Assessment Form 2
Between Vendition and Harvest, Mature Vineyard

Vineyard Capacity

<table>
<thead>
<tr>
<th>% of vineyards deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5% Missing or Dead Vines</td>
</tr>
<tr>
<td>0 to 5% empty fruiting vine (exclusive of missing/dead vines)</td>
</tr>
<tr>
<td>4-6 shoots per linear foot of canopy (on average)</td>
</tr>
<tr>
<td>1-2 clusters per shoot</td>
</tr>
<tr>
<td>Good fruit set; clusters well-filled; berry size normal</td>
</tr>
</tbody>
</table>

Canopy Characteristics

<table>
<thead>
<tr>
<th>% of vineyards deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoot length 3 to 5 feet</td>
</tr>
<tr>
<td>15-20 leaves per shoot</td>
</tr>
<tr>
<td>Leaves appropriate size for cultivar</td>
</tr>
<tr>
<td>Shoot tip growth stopped or very slow</td>
</tr>
<tr>
<td>Lateral shoots absent or short; no more than 2-4 leaves per lateral</td>
</tr>
<tr>
<td>Clusters receiving indirect or filtered light; not full shade, not full sun</td>
</tr>
<tr>
<td>Fruit ripening uniformly</td>
</tr>
<tr>
<td>Normal leaf color</td>
</tr>
</tbody>
</table>

Vine and Fruit Health

<table>
<thead>
<tr>
<th>% of vineyards deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence of fruit diseases</td>
</tr>
<tr>
<td>Absence of foliar diseases</td>
</tr>
<tr>
<td>Absence of grape berry moth damage to fruit</td>
</tr>
<tr>
<td>Absence of green June beetle damage to fruit</td>
</tr>
<tr>
<td>Spray records are available and up-to-date</td>
</tr>
</tbody>
</table>

Vineyard Floor

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Vineyard Business

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<tr>
<td>Performance-based (e.g., yield, brix, TA, etc.) contract for all of crop</td>
</tr>
<tr>
<td>Crop Load Estimate</td>
</tr>
</tbody>
</table>

Adapted from Texas A&M "Great Vineyards Program"

25 Vineyards visited
Trellis Implementation

- Trellises were often deficient in one or more areas
- Most common problem on VSP – not enough canopy height
- Should have ~30 inches from cordon wire to top wire
- Other problems – sagging wires, cordon wires too high/low, lack of overall design (what is the system?), wrong system for cultivars grown
Canopy Management

- Modifying canopy density to improve vine microclimate
  - Shoot removal
  - Crop load thinning
  - Leaf thinning
- Can significantly impact fruit composition of important components
  - Sugar
  - Acid
  - Tannins
  - Aroma compounds
Improve Fruit Quality

- Improve fruit quality and stabilize production over time.
- A given vine’s capacity to produce fruit is largely dependent on the amount of leaf area and photosynthetic activity.
- By consistently limiting the number of shoots and leaves by dormant pruning, one is also working to produce the maximum crop without delaying maturity year after year.
Grapevine Pruning

- One of the most important cultural practices
- Must be done each dormant season
- Directly influences yield, fruit quality, vine vigor, and cold hardiness
- Goal is to get maximum yield of high quality fruit without a reduction in cold hardiness
- Potential Problems: improper ripening, reduced cane maturity, reduced productivity of buds the following season, and decrease in size of root system
Selective Pruning

- Regulate the number and positions of shoots on a vine, and cluster number and size.

- By regulating the total number of buds, one is concentrating growth into remaining shoots and clusters.
Bud Selection

- Improve bud fruitfulness by bud selection and placement.

- Improvement of bud fruitfulness occurs generally when one selects healthy wood with plump buds that have been exposed to sunlight.
Under- and Over-cropping

- When a vine has too few buds, vines produce excessive leaf and stem growth and too few clusters.
- Undercropped: fruit and cane wood quality is diminished and fungal disease susceptibility increased.
- Overcropped: too many clusters and too few leaves to support them.
- Fruit and wood ripening are impaired, tolerance for stresses is limited, and in severe cases, vine growth capacity and health declines.
Balanced pruning is to maintain balance between vegetative growth and fruiting.

The amount (weight) of the previous year’s cane growth (1-yr-old canes) determines how many buds to retain for the current production year.

A base number of buds to retain for the first pound of trimmings has been established for various cultivars based on their inherent vine vigor and production characteristics.

To compensate for vine vigor, additional buds are retained for each additional pound of trimmings removed up to a maximum of 4 pounds.
Pruning with Winter Injury

- **0 to 20 % bud injury:**
  - No compensation is necessary.

- **20 to 80 % bud injury:**
  - Adjust the number of buds retained in proportion to the extent of injury.
  - If the weight of trimmings indicates that 50 buds should be retained and the extent of winter injury is 40%, then $50 \times 1.4 = 70$ buds should be retained.

- **80 % or more bud injury:**
  - Keep pruning to a minimum
Year after Year

- Practices conducted during the growing season will affect next year’s growth and productivity.
- Fruit buds for the current year’s crop were formed during the previous growing season.
- Light interception on leaves and buds important for development
Problem Management

• Grapevines have many pests and disorders
  ○ Insects
  ○ Diseases
  ○ Weeds
  ○ Animals
  ○ Abiotic

• Need to be controlled for success and reduction of plant stress
Site
The Ecoregions of Oklahoma

Legend
- Arkansas Valley
- Boston Mountains
- Central Great Plains
- Central Irregular Plains
- Cross Timbers
- East Central Texas Plains
- Flint Hills
- High Plains
- Ouachita Mountains
- Ozark Highlands
- South Central Plains
- Southwestern Tablelands
Oklahoma Soils

- An ideal vineyard soil is deep, well-drained, with moderate fertility and moderate water-holding capacity

- A wide variety of soils in Oklahoma, from sand to heavy clay

- Often low organic matter content

- Some have serious problems (e.g. Boron toxicity)
Soil and Petiole Samples

- **Soil:**
  - most lacking in P, some pH concerns, all low in N, some too high in B

- **Petiole:**
  - not applying enough N – all low, might consider applying micronutrient sprays as well especially Cu and Fe
Best Site Selection

- Best grapes are grown on sites chosen specifically for grapes
- Not all sites are suitable for high quality grapes
Recommendations to Improve Vineyard Quality

- Enhance vineyard quality and economic vitality by:
  - integrating hybrids into vineyards and wineries
  - implementing better pest control practices
  - fixing and retrofitting training systems to match cultivar
  - getting better at pruning and training
  - paying closer attention to nutrition and water
  - Starting to move toward mechanization
  - using rootstocks with vinifera in areas that support vinifera
Thank You

Special thanks to:
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