Site suitability: Evaluation of climatic, water and soil factors

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Outline

• Climatic factors
  – Too cold? Hot?
  – Adaptation

• Water factors
  – Quantity & quality; impacts over time

• Soil factors
  – Limitations for vine growth? Sites to avoid?
  – Fundamental site capacity
Climatic factors

- Seasonal heat accumulation (or average temp) influences varieties/types of production
- Winter cold damage
- Frost risk – next presentation
- Heat damage
- Wind
- Influence of topography, location choice
- Adaptation/adjustment
Hobo 64k Pendant temp
Growing season air temperature, April - October

Average 63 °F

15-min data

3225 DDf
### Degree day accumulation

#### Table 2: Winkler Region Growing Degree-Day Limits and Wine Style Suitability
(Winkler et al., 1974), updated by Jones et al. (2010).

<table>
<thead>
<tr>
<th>Regions</th>
<th>Degree-Days (F° Units)</th>
<th>Degree-Days (C° Units)</th>
<th>Suitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region Ia</td>
<td>1500-2000</td>
<td>850-1111</td>
<td>Only very early ripening varieties achieve high quality, mostly hybrid varieties and some V. <em>vinifera</em>.</td>
</tr>
<tr>
<td>Region Ib</td>
<td>2000-2500</td>
<td>1111-1389</td>
<td>Only very early ripening varieties achieve high quality, mostly hybrid varieties and some V. <em>vinifera</em>.</td>
</tr>
<tr>
<td>Region II</td>
<td>2500-3000</td>
<td>1389-1667</td>
<td>Early and mid-season table wine varieties will produce good quality wines.</td>
</tr>
<tr>
<td>Region III</td>
<td>3000-3500</td>
<td>1667-1944</td>
<td>Favorable for high production of standard to good quality table wines.</td>
</tr>
<tr>
<td>Region IV</td>
<td>3500-4000</td>
<td>1944-2222</td>
<td>Favorable for high production, but acceptable table wine quality at best.</td>
</tr>
<tr>
<td>Region V</td>
<td>4000-4900</td>
<td>2222-2700</td>
<td>Typically only suitable for extremely high production, fair quality table wine or table grape varieties destined for early season consumption are grown.</td>
</tr>
</tbody>
</table>

#### Grapevine Climate/Maturity Groupings

<table>
<thead>
<tr>
<th>Average Growing Season Temperature (NH Apr-Oct; SH Oct-Apr)</th>
<th>Cool</th>
<th>Intermediate</th>
<th>Warm</th>
<th>Hot</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 - 59°F</td>
<td>Muller-Thurgau</td>
<td>Pinot Gris</td>
<td>Gewurztraminer</td>
<td>Riesling</td>
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<tr>
<td>59 - 63°F</td>
<td>Pinot Noir</td>
<td>Chardonnay</td>
<td>Sauvignon Blanc</td>
<td>Semillon</td>
</tr>
<tr>
<td>63 - 67°F</td>
<td>Semillon</td>
<td>Cabernet Franc</td>
<td>Dolcetto</td>
<td>Merlot</td>
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<tr>
<td>67-72°F</td>
<td>Malbec</td>
<td>Sangiovese</td>
<td>Grenache</td>
<td>Carignane</td>
</tr>
<tr>
<td></td>
<td>Viognier</td>
<td>Zinfandel</td>
<td>Raisins</td>
<td>Nebbiolo</td>
</tr>
</tbody>
</table>

Figures by Greg Jones
Daytime warmth near the ground

Growing degree days (°F), April 1 - Oct. 31

<table>
<thead>
<tr>
<th>Height</th>
<th>3300</th>
<th>3400</th>
<th>3500</th>
<th>3600</th>
<th>3700</th>
<th>3800</th>
<th>3900</th>
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<td>1 ft</td>
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</tr>
</tbody>
</table>
Winter cold
Temperature extremes
Heat damage fruit

Summer heat
Wind
Increasing heat, lengthen season

Images:
Mari Vineyards, Michigan
Reducing heat
Reducing wind
Water supply factors

• Old adage:
  – Wine grape vineyard ET roughly 18” per year
• Some is supplied by rainfall
  – Not all rainfall is “effective”
  – Varies by locale: Paso Robles vs. Mendoza
• The rest needs to be supplied by irrigation
• Will require a certain total volume, and flow rate to meet peak demand
Irrigation amount as a function of regional rainfall in CA

Data from Paso Robles

Average annual applied irrigation (inches)

Rainfall the preceding winter (inches)
Paso Robles – Average monthly irrigation

Applied irrigation (inches/month)

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

Values range from 0.2 to 2.0 inches per month.
Sites differ from these averages

• Differing soil water storage capacity of individual sites; consider:
  • Deep soil, fine texture
    – Stores much more water, requires less irrigation
  • Shallow soil, coarse texture
    – Stores much less water, requires more irrigation
Differing canopy water requirements
Water quality concerns

• Grapes are sensitive to issues which may not affect other crops, e.g. alfalfa, pasture
  • High boron
  • High salinity (TDS)
  • Clogging potential – hardness, iron/manganese
  • Chloride toxicity
  • Sodium soil hazard, toxicity
Effect of high salinity (soil electrical conductivity)
Clogging potential

Calcium, magnesium carbonates

Iron, manganese
Sodium damage

- Destroys structure
- Impedes infiltration
Water analysis is key

• Test for “irrigation suitability”
• Heed lab recommendations for:
  – Limitations with sensitive crops (example boron)
  – Need to treat with acid, adjust pH
  – Ongoing maintenance for sodium
Soil factors

- Tilth: physical suitability for growing a crop
- Physical limitation: poor drainage, barriers
- Chemical limitations: lime, high magnesium
- Fertility: excess, insufficiency
- Variability: challenge for uniform growth
Need to evaluate deep soil conditions
Topography challenges
Shallow bedrock
Deep restricted drainage East of Mendoza, Argentina
Hardpan
Impermeable clay layer
Water-logged soils?
Texture challenge

- Pure sand
- Sandy clay
- Soil texture interface
- Zone of saturation
- Abrupt texture interface
- Pure sand

University of California
Agriculture and Natural Resources
Excessive fertility, nitrogen
Lime chlorosis
High magnesium – serpentine
Dense, poorly structured
Assessing variability
Edna Valley soil variability

- Heavy clay
- Poorly drained
- Poorly aerated

Loam + rocks
- Well drained
- Well aerated
Limitations to changing soil

Rock harvester

Deep ripper

Gypsum

Sulfur

Image: Dan Munk
Questions?