Help in Addressing the Challenges to Entering the Vineyard and Winery Industry

Part 3
Iowa State University
Value Added Agriculture Program

United States Department of Agriculture
Risk Management Agency
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Planning to Start a Vineyard?
Potential for a new enterprise:

- Determine if your site is suitable for a vineyard.
- Determine if there is a market for grapes in the area.
  - Winery (private, cooperative, or build your own)
  - Other outlets: Farmer markets, grocery stores, hobbyist.
- Select cultivars to plant.
  - Adaptation to your specific conditions.
  - Use (wine, table, juice, jam & jellies) & demand.
- Plant the vines, establish trellis & begin training.
  - Financing
- Develop a good management program.
  - Time available
  - Cultural practices
Is your site suitable for grapes?

<table>
<thead>
<tr>
<th>Climate</th>
<th>Topography</th>
<th>Soils</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Winter Temperatures *</td>
<td>• Elevation</td>
<td>• Drainage</td>
</tr>
<tr>
<td>• Spring Frosts</td>
<td>• Degree of Slope</td>
<td>• Moisture Holding Capacity</td>
</tr>
<tr>
<td>• Length of Growing Season</td>
<td>• Direction of Slope</td>
<td>• pH</td>
</tr>
<tr>
<td>• Growing Degree Days</td>
<td></td>
<td>• Fertility</td>
</tr>
<tr>
<td>• Precipitation</td>
<td></td>
<td>• Organic Matter</td>
</tr>
</tbody>
</table>

* The most important climatic consideration.
Winter Temperatures

Determine what cultivars can be grown & how productive they will be.

Cane buds are the most tender portion of a grape vine.

- A compound bud with the potential to produce 3 or more shoots.
  - 1º bud: The most productive.
  - 2º bud: Less productive; varies with type & cultivar.
    - American types 50% or less productive
    - French hybrids 60-80% as productive.
  - 3º bud: Very un-productive
# Classification of Vine Hardiness

Based on the temperature at which injury begins to occur

<table>
<thead>
<tr>
<th>Temp. (°F)</th>
<th>Category</th>
<th>Suitable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 0</td>
<td>Very cold tender</td>
<td>Almost any.</td>
</tr>
<tr>
<td>- 5</td>
<td>Cold tender</td>
<td>Most northern <em>vinifera</em>.</td>
</tr>
<tr>
<td>- 10</td>
<td>Moderately hardy</td>
<td>Hardy <em>vinifera</em>, moderately hardy French hybrids.</td>
</tr>
<tr>
<td>- 15</td>
<td>Hardy</td>
<td>Hardy French hybrids, most <em>labrusca</em>.</td>
</tr>
<tr>
<td>≤ - 20</td>
<td>Very hardy</td>
<td>Hardy <em>labrusca</em>, most <em>riparia</em> hybrids.</td>
</tr>
</tbody>
</table>
**USDA Hardiness Zone Map**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Avg. Min. Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>2B</td>
<td>-40 to -45 F</td>
</tr>
<tr>
<td>3A</td>
<td>-35 to -40</td>
</tr>
<tr>
<td>3B</td>
<td>-30 to -35</td>
</tr>
<tr>
<td>4A</td>
<td>-25 to -30</td>
</tr>
<tr>
<td>4B</td>
<td>-20 to -25</td>
</tr>
<tr>
<td>5A</td>
<td>-15 to -20</td>
</tr>
<tr>
<td>5B</td>
<td>-10 to -15</td>
</tr>
<tr>
<td>6A</td>
<td>-5 to -10</td>
</tr>
</tbody>
</table>

Based on minimum temperatures from 1960 to 1990.
To avoid late-spring & early-fall frosts and extreme winter freezes, plant at least 50 feet above the valley floor.
## Length of the Growing Season

<table>
<thead>
<tr>
<th>Frost-Free Days</th>
<th>Suitability for Grapes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 150</td>
<td>Unacceptable</td>
</tr>
<tr>
<td>150 to 160</td>
<td>Marginal: Only early season maturing varieties.</td>
</tr>
<tr>
<td>160 to 170</td>
<td>Satisfactory: Early &amp; most mid-season maturing varieties.</td>
</tr>
<tr>
<td>170 to 180</td>
<td>Good: Early, mid-season &amp; some late-season varieties.</td>
</tr>
<tr>
<td>&gt; 180</td>
<td>Excellent: Most varieties.</td>
</tr>
</tbody>
</table>

Is often very site specific.
Frost Free Days for Iowa & location of 2 research farms.
ISU Armstrong R&D Farm Vineyard

Elevation:
- Reduces the risk of spring & fall frosts.
- Extends the growing season.
- Protection from low winter temperatures.

The growing season has been as much as 3 weeks longer at this site compared to the Horticulture Research Station.
# Growing Degree Days

<table>
<thead>
<tr>
<th>Region</th>
<th>Degree Days*</th>
<th>Suggested Varieties for the Midwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>≤ 2,500</td>
<td>Very early ripening varieties.</td>
</tr>
<tr>
<td>II</td>
<td>2,501 to 3,000</td>
<td>Early, and early mid-season varieties.</td>
</tr>
<tr>
<td>III</td>
<td>3,001 to 3,500</td>
<td>Early, mid-season, and some early late-season varieties.</td>
</tr>
<tr>
<td>IV</td>
<td>3,501 to 4,000</td>
<td>Most varieties.</td>
</tr>
</tbody>
</table>

* Base 50° F;  Degree day = ((daily high + low) / 2) – 50

Based upon California grape regions developed by A. J. Winkler. www.iavaap.org
Precipitation

1-inch per week

- Varies with:
  a. Frequency of rain fall
  b. Rooting depth of the crop
     • Grapes are deep rooted.
  c. The soil’s moisture holding capacity.
     • Soil Texture
     • Soil depth
  d. Temperature, relative humidity, & wind as they affect transpiration.
  e. How the soil surface is maintained.
# Degree of Slope

- Soil moisture
  - Infiltration
  - Surface runoff
- Air drainage of frost protection.
- Soil erosion
- Cultural practices

[www.iavaap.org](http://www.iavaap.org)
Soils with “B”, “C” and “D” slopes are best suited for grapes.
## Direction of the Slope

<table>
<thead>
<tr>
<th>Growing Condition</th>
<th>N</th>
<th>S</th>
<th>E</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Sunlight</td>
<td>Lowest</td>
<td>Highest</td>
<td>Int. +</td>
<td>Int. -</td>
</tr>
<tr>
<td>Accumulation of Heat Units</td>
<td>Lowest</td>
<td>Highest</td>
<td>Int. -</td>
<td>Int. +</td>
</tr>
<tr>
<td>Need for Water</td>
<td>Lowest</td>
<td>Highest</td>
<td>Int. -</td>
<td>Int. +</td>
</tr>
<tr>
<td>Risk of a Spring Frost</td>
<td>Lowest</td>
<td>Highest</td>
<td>Int. -</td>
<td>Int. +</td>
</tr>
<tr>
<td>Risk of Fluctuating Winter Temperatures</td>
<td>Lowest</td>
<td>Highest</td>
<td>Int. -</td>
<td>Int. +</td>
</tr>
</tbody>
</table>
Direction of the Slope can be used to an advantage

- Sequence harvest
  - Within a variety
  - Between varieties
- When the length of the growing season is marginal, plant the latest maturing varieties on a south-facing slope.
Soil Selection Factors

• Internal Drainage
• Moisture Holding Capacity
  Texture
  Depth
• pH
• Fertility
County Soil Surveys

• Soil Series Description:
  Texture, Drainage, Fertility, Erosion

• Soil Profile Classification:
  Structure

• Table of Engineering Index Properties:
  Soil texture classification by depth

• Table of Physical & Chemical Properties:
  Permeability, Available water holding capacity, Organic matter content
Chances of Success are Limited
Under Conditions of Poor Internal Soil Drainage

Internal drainage is the most important factor for determining if a site is suitable for grapes.
Reasons for Poor Soil Drainage

- Poor surface runoff
  - Slope
  - Depressions
- Lateral seepage
  - On slopes
  - Textural change
- Texture
  - High clay content

- Impervious layer in substrata
  - Clay layer
  - Compacted layer
  - Abrupt textural change
- High water table
## Soil Drainage Classification

<table>
<thead>
<tr>
<th>Description</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poorly drained</td>
<td>AVOID</td>
</tr>
<tr>
<td>Poorly drained</td>
<td>Avoid</td>
</tr>
<tr>
<td>Somewhat poorly drained</td>
<td>Marginal</td>
</tr>
<tr>
<td>Moderately well-drained</td>
<td>Suitable</td>
</tr>
<tr>
<td>Well-drained</td>
<td>Ideal</td>
</tr>
<tr>
<td>Excessively drained</td>
<td>Marginal</td>
</tr>
</tbody>
</table>

Always best to dig test holes to check the drainage.  
www.iavaap.org
Moisture Holding Capacity

Soil Texture + Soil Depth

Determine the need and frequency of irrigation.

<table>
<thead>
<tr>
<th>Texture</th>
<th>Inches Per foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>0.5</td>
</tr>
<tr>
<td>Loamy sand</td>
<td>1.0</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>1.5</td>
</tr>
<tr>
<td>Loam</td>
<td>2.0</td>
</tr>
<tr>
<td>Silt loam</td>
<td>2.5</td>
</tr>
<tr>
<td>Clay loam</td>
<td>2.5</td>
</tr>
<tr>
<td>Clay</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Soils shaded in green are generally the best suited for grapes because they have good moisture holding capacity & aeration.
Soil pH for Grapes

• **Desired range:** 5.5 to 6.5
  - American: 5.0 to 6.5 (~ 6.0 optimum)
  - French Hybrid: 5.5 to 6.5; (6.0 to 6.5 optimum)
  • Will tolerate a pH up to ~ 7.0

• **Adjust Soil pH:**
  - Below 6.0: bring up to 6.0 or 6.5 with lime.
  - Above 6.8: consider lowering to 6.5 or 6.0 with sulfur, or using acid forming fertilizers (ammonium sulfate).
Sulfur Requirement to Reduce the Soil pH to 6.5

Lbs of sulfur required to adjust the top 8 inches of soil.

Soil pH

Lbs per Acre

Economical?
Iron Chlorosis

Site with a soil pH of 8.0

Photographed by Eli Bergmeier
Soil Fertility

- **Least concern when selecting a site.**
  - Can amend the soil.

- **Midwest Soils: Concern for**
  - **P** Low in many soils.
  - **K** Grapes have a high requirement for K.
    - K can be tied up under non-cultivation as would occur in a vineyard.
  - **Mg** High Mg in the soil can inhibit the uptake of K.
    - Many Midwest soils are dolomitic in nature.
  - **Zn** Grapes have a relatively high requirement for Zn.
    - Many midwest soils are low in Zn.
Pre-plant Soil Test

- Test for: pH, P, K, Zn, Mg, O.M.
- Submit serial samples collected from 2 depths:
  - 0 to 6 inch depth.
  - 6 to 12 inch depth.
Soil Organic Matter

• Improves soil structure, moisture retention and fertility.
  2 to 3% is considered ideal for grapes.

• Midwest Soils:
  Range from < 1% up to 20%
  Well-drained soils in the 3 to 4% range
  OM is higher in poorer drained soils.

• Grapes grown on high organic soils tend to be less winter hardy.
  Release of N from organic matter.
  20 lb N / % OM / Ac / Yr
Nitrogen Released from Organic Matter

Lbs Actual N per Acre

% Soil Organic Matter

0 1 2 3 4 5 6 7 8 9 10

0 40 80 120 160 200 240

www.iavaap.org
Darker the color, higher the organic matter content.
Cultivar Selection

• **Intended Use (Market):**
  - Fresh
  - Juice / Jam / Jelly
  - Wine
    - Sell to a winery
    - Establish your own winery
Cultivar Selection for Wine

Sell to a Winery:
- What adapted cultivars do the wineries want?
  - Proven cultivar
  - New cultivar
- How much do they want?
- Are they willing to develop a long-term contract?

Establish a Winery:
- What do customers want?
- What adapted cultivars make quality wine?
- What styles of wine do I want to make?
- How much risk am I willing to take?
  - Cultivar adaptation
  - New cultivars

Develop a sound business / marketing plan before planting!
Cost of Establishing a Vineyard
Winery and Vineyard Feasibility Workbooks

Created September 2005

The Cost to Establish a Vineyard workbook is designed to report all the income and expense of a one-acre vineyard for up to 13 years. There are three different vineyard workbooks, each for a different trellis style.

• High Trellis
• Geneva Double Curtain
• Vertical Shoot Position

• Winery Ten Year Financial Planning Workbook (version 5)
  • Errors in the asset worksheet of version 1 were found in Column J that may affect the total investment. If you are using version 1 please check the numbers in cell J35, J49, and J185. Also check to see if the numbers add up correctly on line 181.

• Estimated Vineyard Establishment with a High Trellis and Production Cost Per Acre
• Estimated Vineyard Establishment with a Geneva double Curtain and Production Cost Per Acre
• Estimated Vineyard Establishment with a Vertical Shoot Position and Production Cost Per Acre
Factors Affecting the Cost of Vineyard Establishment

- Vine spacing (number per acre)*
- Cost of the vines*
- Method of planting
  - By hand, w/ an auger, or planting machine
- Length of the rows*
- Line post spacing (post per acre)
- Method used to install the line post
  - Post driver, or post hole auger
- End post design (Anchored vs H-Brace)
- Number of wires per row (training system)

* Most significant factors affecting the cost of establishment.
Vine Cost per Acre

Based upon vine spacing.

Value Added Agriculture Program

Value Added Agriculture Program

www.iavaap.org
Cost of Trellis Materials per Acre

Based upon row width and line post spacing.
Trellis Systems

- **Single curtain Bi-lateral Cordon**: 2 wires
- **6-cane Kniffen**: 3 wires
- **Vertical Shoot Positioning (VSP)**: 7 wires
- **Geneva Double Curtain**: 3 - 4 wires
Cost of Trellis Material per Acre by Training System*

* With an H-brace end post system. www.iavaap.org
Vineyard Establishment Workbooks*

**Systems:**

- **Single curtain bi-lateral cordon (Hi-Trellis)**
  - 10 rows/A @ 432 ft
  - 10 ft row spacing, 8 ft vine spacing (545 vines/A)
  - 2 wires

- **Geneva Double Curtain (GDC)**
  - 12 ft row spacing, 8 ft vine spacing (453 vines/A)
  - 8 rows /A @ 432 ft
  - 3 wires + cross arms

- **Vertical Shoot Positioning (VSP)**
  - 10 ft row spacing, 8 ft vine spacing (545 vines/A)
  - 10 rows/A @ 432 ft
  - 7 wires

*Defaults*, all can be changes to fit your specific conditions.  www.iavaap.org
Cultural Practices

March/April
- Inspect buds for winter injury
- Pruning, tying & brush removal
- Pre-emergence weed control
- Fertilize
- Dormant lime sulfur

May
- Disease & insect control
- Suckering
- Shoot thinning?
- Tying & training young vines
- Shoot positioning VSP

June
- Cluster thinning?
- Disease & insect control
- Shoot positioning VSP
- Tying young vines

July
- Disease & insect control
- Shoot positioning
- Post emergence weed control
- Shearing shoots
- Tying young vines
- Collect petiole sample
Cultural Practices

August/September
- Install bird netting
- Disease & insect control
- Begin testing maturity
- Leaf pulling, lateral shoot thinning?
- Shoot positioning & shearing VSP
- Harvest

September/October
- Remove bird netting
- Check soil pH

November – March
- Winterize equipment
- Repair trellis
- Plan for the next season