Snohomish County Fruit Society
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COOL-CLIMATE GRAPE PRODUCTION

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wine.wsu.edu
VINES WILL RESPOND TO WHAT IS GIVEN TO THEM

**Capacity:** Productivity of the whole vine

**Vigor:** Growth rate of vine shoots

1 CROP = 2 YEARS

Vegetative cycle
The vegetative growth cycle comprises growth of the shoot, trunk, arms and roots.

Reproductive cycle
The reproductive growth cycle comprises inflorescence induction, initiation and formation, flowering and fruitset, berry formation and berry ripening (stages 1-8). Stages 1-4 happen inside the bud prior to the bud bursting and stages 5-8 are the shoot which forms after the bud has burst.

The diagram illustrates the sequence of events for a bud (Bud X), which developed on a growing shoot in spring of season 1 and which bursts to form a shoot in the spring of season 2.

VINE PRODUCTION BASICS

Why the site matters and how you can manipulate it.
COMMON CLIMATE FACTORS

• Growing season heat
  – How warm, or cool, an area is can influence variety choice; too cold or too hot = no grapes

• Total precipitation
  – Wine grapes need about 12 to 16 inches of rain during the season
  – When, and how much, precipitation in an area can greatly influence vine development

• Winter temperatures
  – How cold (or warm!) a winter is can determine vine survival or other development factors
### “CLIMATE” COMPARISONS

<table>
<thead>
<tr>
<th>Location</th>
<th>GDD (50°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount Vernon, WA</td>
<td>1,561 (1,965)</td>
</tr>
<tr>
<td><strong>Snohomish, WA</strong></td>
<td><strong>1,585 (2,077)</strong></td>
</tr>
<tr>
<td>Champagne (Reims, France)</td>
<td>1,756</td>
</tr>
<tr>
<td>Zürich, Switzerland</td>
<td>1,874</td>
</tr>
<tr>
<td>Würzburg, Germany</td>
<td>1,908</td>
</tr>
<tr>
<td>Burgundy (Dijon, France)</td>
<td>2,084</td>
</tr>
<tr>
<td><strong>Silverton, OR</strong></td>
<td><strong>2,282 (2,628)</strong></td>
</tr>
<tr>
<td>Bordeaux (France)</td>
<td>2,464</td>
</tr>
<tr>
<td><strong>Finger Lakes (Geneva), NY</strong></td>
<td><strong>2,510</strong></td>
</tr>
<tr>
<td>Keckskemét, Hungary</td>
<td>2,588</td>
</tr>
<tr>
<td>Canberra, Australia</td>
<td>2,714</td>
</tr>
<tr>
<td>Prosser, WA</td>
<td>2,771 (3,427)</td>
</tr>
<tr>
<td>Bozen/Bolzano, Italy</td>
<td>2,985</td>
</tr>
<tr>
<td><strong>Paterson, WA</strong></td>
<td><strong>3,002 (3,558)</strong></td>
</tr>
<tr>
<td>Udine, Italy</td>
<td>3,168</td>
</tr>
<tr>
<td>Fresno, CA</td>
<td>4,684</td>
</tr>
</tbody>
</table>

- The Puget Sound is a large AVA
  - Many different microclimates
  - General *average* GDDs range from 1400 to 2000

- The Puget Sound is cool-climate grape production

- Below 1600 GDD is generally unsuitable for grapes

Adapted from Bob Pool, Cornell University
WEATHER – ALTERING THE SITE

Tenting / Enveloping

- Tenting creates artificial heat accumulation due to greenhouse effect
- Raises air temperature
- More effective in sunny locations
- May increase risk of Botrytis shoot blight and powdery mildew

“Enveloping” at Dungeness Bay Vineyard.

Full article at: http://www.goodfruit.com/enveloping-vines-in-warmth/
Reflective Mulches

- Dark plastic mulches can raise soil temperature

- White mulches can reflect light / heat

- Not effective under cloudy conditions
## TOPOGRAPHY – ASPECT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>North</th>
<th>South</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bud break</td>
<td>Later</td>
<td>Earlier</td>
<td>Later</td>
<td>Earlier</td>
</tr>
<tr>
<td>Daily maximum temperature</td>
<td>Lower</td>
<td>Higher</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Speed of foliage drying</td>
<td>-</td>
<td>-</td>
<td>Faster</td>
<td>Slower</td>
</tr>
<tr>
<td>Heating of fruit (summer)</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
<td>More</td>
</tr>
<tr>
<td>Heating of vines (winter)</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
<td>More</td>
</tr>
<tr>
<td>Minimum winter temps</td>
<td>Lower</td>
<td>Higher</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Length of growing season</td>
<td>Shorter</td>
<td>Longer</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2.3 from: Wine Grape Production for Eastern North America. T. K. Wolf, editor
ALTERING THE “SITE” – PLANT MANIPULATION

• Row orientation
  – Myth: all rows need to be North-South

• North-South orientation
  – Maximizes sunlight capture
  – Maximizes heat exposure
  – Great for cooler locations

• East-West orientation
  – Minimized direct heat and light exposure
  – Good for warmer sites; sites with long days
Tools Much Moisture
• Drain tiles
  – Establish at preplant
• Canopy management
• Rootstock selection

Too Little Moisture
• Irrigation required
  – Permanent
  – Establishment
  – Supplemental (droughts)
• Cover crops and weed competition need consideration
CANOPY MANAGEMENT

Pruning and in-season canopy manipulation.
TRELLISING – VINE SPACING

- **Low Vigor Sites**
  - Narrow planting increases vines per acre and potential yield per acre
  - Wide spacing may result in canopy gaps (inefficient use of trellis for light capture)

- **High Vigor Sites**
  - Wider spacing allows each vine to optimize area for sunlight capture
  - Narrow density results in excess crowding and competition for light
TRELLISING – ROW SPACING

6 ft : 10 ft
0.6 : 1

5 ft : 4 ft
1.25 : 1

Image from Moyer et al. 2014, Growing Winegrapes in Maritime Western Washington, WSU #EM086e
TRAINING: VERTICAL SHOOT POSITIONING

• The Practice:
  – Designed to keep shoots off the ground
  – Easy to spray, train vines
• Fruit confined to a more limited space
• Shoot tips confined to a more limited space
• Uniformity allows for improved efficiency in some practices
VSP – THE DRAWBACKS

High Vigor

Low Vigor
VSP – THE DRAWBACKS

- Laborious
- In high-vigor sites:
  - Can result in densely-packed shoots which cause shading of interior leaves
  - In sunny climates can result in over-exposure of fruit
  - Dense canopies can prevent airflow through vineyard
  - Additional passes needed for shoot thinning and hedging
• **Advantages**
  – Adopted to existing VSP trellis (lower canopy height!)
  – Increases shoots / meter without added density

• **Disadvantages**
  – Not good for mechanization
  – Yield and ripening differences between zones

Image from: http://www.lodiwine.com/blog/abba-vineyard-turns-sunlight-into-syrah-perfection
• Removing actively growing shoot tips can stimulates lateral shoots
  – INCREASED canopy density in some instances
  – Breaking of apical dominance
  – Creates a new crop of young tissue during a high pressure time for powdery mildew infection
MANIPULATION – FRUIT-ZONE LEAF REMOVAL

Before

Prebloom fruit-zone leaf removal

AFTER

Prebloom fruit-zone leaf removal
FRUIT MANAGEMENT

Yield and pest management.
Vine Balance is:
- Matching vegetative growth to reproductive growth
- Sustainability in maintaining quality and quantity of fruit while maintaining overall vine health

Vine Balance is not:
- A pre-determined yield per acre without consideration of the site
- High-yields at a cost to vine health
- Low-yields at a cost (excess labor inputs)
## CROP LOAD – YIELD TO PRUNING WEIGHT RATIO

<table>
<thead>
<tr>
<th>Yield (lbs) / Pruning Weight (lbs)</th>
<th>Interpretation*</th>
</tr>
</thead>
</table>
| ≤3                                | **Cool Climates**: May be appropriate if climate is cool; however, ratio should not go below 2.  
**Moderate Climates & Hot Climates**: High vigor, low fruitfulness, dense canopy. Indicates under-cropping. |
| 5-10                              | **Cool Climates**: Optimal when on the low end; ratios above 5-6 may indicate over-cropping.  
**Moderate Climates**: Optimal  
**Hot Climates**: Optimal when on the high end. Ratios below 5 may indicate under-cropping. |
| > 10                              | **Cool Climates & Moderate Climates**: May indicate over-cropping.  
**Hot Climates**: May be appropriate as long as the vine can adequately ripen the crop. |

*Climate, in this scenario, refers to the temperatures during the growing season. Michelle suggests that the following are definitions of these climate classifications: Cool climates are <2100 GDD (50ºF), Moderate Climates are 2100-3000 GDD (50ºF) and Hot Climates are >3000 GDD (50ºF). Reference modified from Dry, P.R., P.G. Illand, and R. Ristic. 2004. What is vine balance? Proc. From the 12th Australian Wine Industry Technical Conference. 24-29 July, 2004. Melbourne, Victoria, AUS. P 68-74.
UNDER-CROPPING

• Too little fruit to act as a sink for the vegetative growth of the vine
  – Can result in excess canopy development
  – Excess canopy can then shade fruit, causing issues with flavor and sugar development
  – Excess canopy can lead to increased pest and disease pressure

• Excess canopy growth can delay cold acclimation
OVER-CROPPING

- Too much fruit for what the vine can handle
- Delays ripening
  - Sugar accumulation
  - Flavor development
- Reduces capacity of the vine to store nutrients for following year
- Can also reduce vine cold hardiness with consecutive years of over-cropping
OVER-CROPPING: CROP THINNING PREBLOOM

• **Advantages**
  – Easy to do, economical
  – Best reserved for establishing vineyards

• **Disadvantages**
  – Cluster compensation? (berry size)
  – What will the rest of the season be like?
  – Can increase shoot vigor
OVER-CROPPING: GREEN FRUIT THINNING

• Advantages
  – Timing is more economical
  – Can alter source-sink relationships in challenging vintages

• Disadvantages
  – Can stimulate shoot growth
  – What happens if crop loss at end of the season?
Adjusting the crop load late in the season does not aid in ripening, only in meeting contract specifications

This crop was thinned to half of its original crop
DISEASE AND PEST PRESSURE
VARIETY SELECTION

Varieties and rootstocks.
WHY IS THIS LAST?

• Beginning the journey with variety selection is not the most effective option
• Must understand production basics before the best variety can be selected
  – Your site will dictate the range of appropriate varieties
  – Your production philosophy will dictate the range of appropriate varieties
  – Forcing a variety
### COOL-CLIMATE VARIETIES

<table>
<thead>
<tr>
<th>1600 GDD</th>
<th>1601-1900 GDD</th>
<th>&gt; 1900 GDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siegerrebe (W)</td>
<td>Everything to left, plus:</td>
<td>Everything to left, plus:</td>
</tr>
<tr>
<td>Madeleine Angevine (W)</td>
<td>Chardonnay [Dijon cls] (W)</td>
<td>Sauvignon Blanc (W)</td>
</tr>
<tr>
<td>Burmunk (W)</td>
<td>Auxerrois (W)</td>
<td>Pinot Gris [Ruländer] (W)</td>
</tr>
<tr>
<td>Iskorka (W)</td>
<td>Müller-Thurgau (W)</td>
<td>Pinot Blanc (W)</td>
</tr>
<tr>
<td>Ortega (W)</td>
<td></td>
<td>Sylvaner (W)</td>
</tr>
<tr>
<td>Muscat of Norway (R)</td>
<td>Pinot Noir cl. Mariafeld (R) *</td>
<td>Pinot Noir clone Mariafeld (R)</td>
</tr>
<tr>
<td>Rondo (R)</td>
<td>Pinot Noir Precoce (R) *</td>
<td>Pinot Noir Precoce (R)</td>
</tr>
<tr>
<td></td>
<td>Regent (R)</td>
<td>Pinot Noir [Dijon clones] (R)</td>
</tr>
<tr>
<td></td>
<td>Garanoir (R)</td>
<td>Dornfelder (R)</td>
</tr>
<tr>
<td></td>
<td>Golubok (R)</td>
<td>Gamaret (R)</td>
</tr>
<tr>
<td></td>
<td>Agria (R)</td>
<td>Zweigelt (R)</td>
</tr>
<tr>
<td></td>
<td>Leon Millot (R)</td>
<td></td>
</tr>
</tbody>
</table>

*For sparkling wine production; may not adequately ripen for quality table wine production at this GDD level.*
<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Parentage</th>
<th>Low soil pH tolerance</th>
<th>Phylloxera Resistance</th>
<th>Nematode Resistance</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millardet et de Grasset 101-14</td>
<td><em>Vitis riparia</em> x <em>Vitis rupestris</em></td>
<td>No</td>
<td>Yes</td>
<td>Moderate to High</td>
<td>Cold tolerant, advanced maturity, low vigor</td>
</tr>
<tr>
<td>Couderc 3309</td>
<td><em>Vitis riparia</em> x <em>Vitis rupestris</em></td>
<td>Yes</td>
<td>Yes</td>
<td>Low</td>
<td>Drought resistant, low vigor</td>
</tr>
<tr>
<td>Millardet et de Grasset 420A</td>
<td><em>Vitis berlandieri</em> x <em>Vitis riparia</em></td>
<td>No</td>
<td>Yes</td>
<td>Low to Moderate</td>
<td>Moderate tolerance to wet soil, low vigor</td>
</tr>
<tr>
<td>Riparia Gloire</td>
<td><em>Vitis riparia</em></td>
<td>Yes</td>
<td>Yes</td>
<td>Low to Moderate</td>
<td>Low tolerance to wet soil, advanced maturity, low vigor</td>
</tr>
<tr>
<td>Schwarzmann</td>
<td><em>Vitis riparia</em> x <em>Vitis rupestris</em></td>
<td>Yes</td>
<td>Yes</td>
<td>Moderate to High</td>
<td>Moderate vigor</td>
</tr>
</tbody>
</table>
CLEAN PLANTS

• DO NOT BRING PLANTS ACROSS STATE OR COUNTRY BORDERS
  – It is illegal in many cases
  – Don’t bring in something that ruins your industry

• There are legal processes for bringing in new material, but it does take time and money

• PLAN AHEAD IF YOU WANT TO GROW NON-CONVENTIONAL VARIETIES

Plant Clean. Stay Clean.
• Certified Plants
  – Certification programs are state-dependent
  – Washington only accepts plants from Certification programs in OR, CA and Canada
  – Certified plants must come from registered nursery mother blocks
  – Registered nursery mother blocks must receive plant material from Foundation blocks
  – Foundation blocks exist in WA and CA
MARKETS AND OPPORTUNITIES

• Sparkling wine
  – Can be made with lower-sugar / higher-acid fruit
  – Sparkling isn’t just for special occasions

• Desert wine
  – Additional sugar can be added to mask potentially high-acid
  – Can get a higher price point for lower-quality fruit

• Lower-alcohol table wine
  – Good wine doesn’t need to be 15% alcohol
  – Great wines at 10%; low alcohol and light body area great combination
RESOURCES

Washington State University
Viticulture and Enology Program
Managing a Vineyard

General Grape Production

- WESTERN WA - Growing Winegrapes in Maritime Western Washington - WSU #EM069e

Organic Farm Transition

- ORGANIC - Organic Transition: A Business Planner for Farmers, Ranchers and Food Entrepreneurs - Western SARE Document
- ORGANIC - Organic Grape Production Guide - Cornell University
- ORGANIC - Organic Winegrowing Manual - UC-ANR #3511

Variety Changing / Grafting - Over

- Chip Bud Grafting for Wine and Juice Grapes - WSU #82023
- Illustrated Guide to Field Grafting Grapevines - Northwest Berry & Grape Network (PNW Universities and USDA)
- Grape DNA Fingerprinting - A service provided by the Foundation Plant Service out of UC-Davis that can determine the variety/cultivar of an unknown grapevine. Clonal identification is currently not available.

Canopy and Crop Management

- Pruning Grapes: An Overview - eXtension.org / eViticulture.org Webpage
- Grapevine Pruning Practices - eXtension.org / eViticulture.org Webpage
- Pruning Basics - eXtension.org Webpage
  - WESTERN WA - Cane Pruning - OSU Video
  - Spur Pruning - OSU Video
- Canopy Management for Pacific Northwest Vineyards - WSU #82015e
- Vineyard Yield Estimation - WSU #EM068e
  - ESPAÑOL - Estimación del Rendimiento del Ví富orde - WSU #EM068ES
- Crop Thinning - eXtension.org Webpage
- Understanding Vine Balance - OSU #EM9068

General Grape Information

For general information regarding grape production, including common terms and techniques, please refer to the eViticulture website below. This website is populated with articles written by viticulture Extension specialists from across North America.
- eViticulture.org

Production Guides

Many different states in up-and-coming production areas have excellent resources on starting a small vineyard. The principles behind trellising and training a vine similar, and should help you in your backyard endeavors.

- Growing Grapes in Maritime Washington - WSU #EM069e
- Growing Grapes in the Home Garden - Oklahoma Cooperative Extension
- Growing Grapes in Your Home Garden - Oregon State University Extension
- Growing Grapes in the Home Garden - Colorado State University Extension
- Growing Grapes in the Backyard - University of California Cooperative Extension
- Table Grape Production - WSU V&E Webpage

Nutrient and Fertilizer Management

- ORGANIC - Soil Fertility in Organic Systems - #PNW644

Variety Selection for Your Backyard Vineyard

- Growing Grapes in Maritime Washington - WSU #EM069e
- Table Grapes for the Home Garden - Oregon State University
- Cool Climate Table Grape Varieties - Cornell University
- Grape DNA Fingerprinting - A service provided by the Foundation Plant Service out of UC-Davis that can determine the variety/cultivar of an unknown grapevine. Clonal identification is currently not available.

Trellising, Training, and Pruning Your Backyard Vineyard

- Training and Trellising Grapes - WSU #EB2017
- Pruning Basics for Backyard Grapes - WSU Webpage
- Pruning Backyard Grapes - Ohio State University Extension
WSU Viticulture and Enology Program

WSU V&E FACEBOOK

This is only a highlight - More publications are available!
http://irrigatedag.wsu.edu/subscribe-to-email-lists/

http://wine.wsu.edu/research-extension/publications/newsletter/