Canopy Management

Growing Grapes in the Puget Sound Region

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Introduction

- Goals of canopy management
- Environmental factors
- Enhancing fruit set with foliar nutrition
- Trellising systems
  - Light distribution
  - Advantages

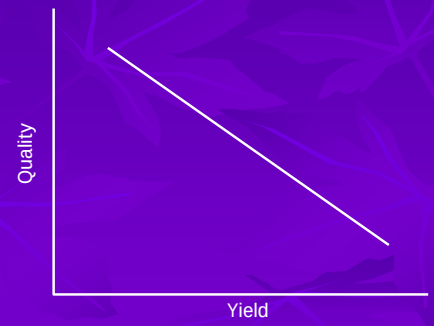
Introduction

- Techniques –
  - Pruning
  - Leaf and fruit thinning
  - Fruit effects
  - When to do it?

What are your goals?

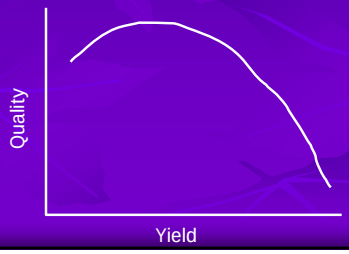
- Good, quality fruit!
- How do you get there?
- Typically thought that lower yields give better grape quality

Yield and Fruit Quality



Yield and Fruit Quality

- Not true…
  - Too much variation in real life
  - More of a slow drop off
  - What makes up yield?



Yield Components

Component	Determined During	Management Options
Vines/acre Nodes/vine	Planting Winter Pruning	Density/Trellis design Pruning Level
Shoots/node Clusters/shoot	Budbreak Cluster initiation	Pruning level Nutrition, Canopy mgmt
Flowers/cluster Berries/cluster	Budbreak Fruit set	? Irrigation, nutrition, temperature
Berry Weight	All season	Irrigation, nutrition

So, how do I get good quality?

- What else is going on?
  - Photosynthesis
  - Environmental effects
  - Bud development
  - Irrigation management
  - Fruit set
    - Vine nutrition
    - How to improve at bloom?
- Canopy management is key!

Canopy & Environment

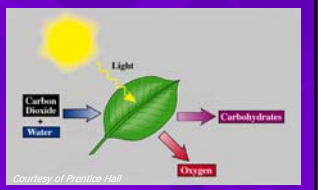
- Three scales
  - Macroclimate – regional climate (tens of sq. miles)
  - Mesoclimate – site (sometimes vineyard block)
  - Microclimate – area within canopy
    - Large canopies may be cooler, sparse canopies may be warmer
- Environment changes based on these ranges

Environmental Factors

- Environmental factors play big role!
  - Temperature
  - Wind
  - Light
  - Water
- Fruit Set – canopy & nutrients
- Canopy interacts with the environment
- Photosynthesis

Photosynthesis

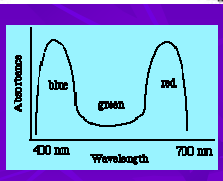
- Process takes sunlight, CO_2, and water = O_2 and carbohydrates
- Eventually used for growth and vine development



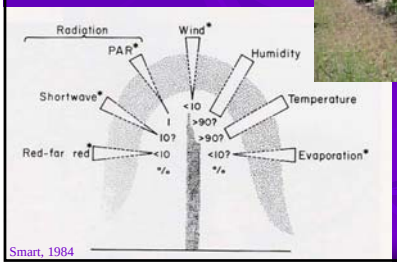
Courtesy of Prentice Hall

Light Quality

- Photosynthesis requires certain quantity
  - Also need certain *quality*
- Plants don't need entire spectrum
  - 400-700 nm
  - Photosynthetically active radiation (PAR)

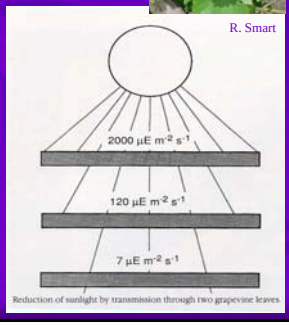


Inside the Canopy…

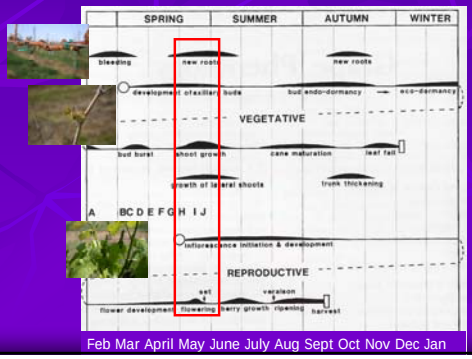


Light

- First layer absorbs almost all light
- Progressively less inside canopy
- First layer- most important layer
  - Thicker leaves than interior
- How important is it?

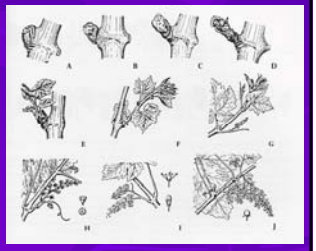


Yearly Growth in Grapes



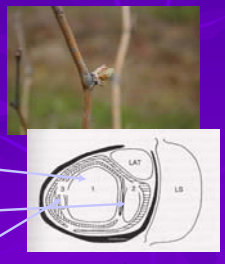
Buds & Nodes

- Buds are comprised of growing points protected by scales
- Three types:
  - Axillary bud
  - Dormant bud (grows next year)
  - Latent bud (only grows if vine is stressed)



Bud Structure

- Consists of primary, secondary and tertiary buds
- Primary – full crop
- Secondary – 30-50% of crop
- Tertiary – 5-10% of crop

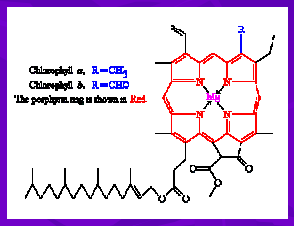


Light and Development

- Affects:
  - Bud development
  - Fruit color
  - Fruit acid levels
  - Fruit soluble sugars
  - Phenolics
  - Flavors
  - Berry shrivel? – some areas

We want berries!

- What can you do to help fruit set?
  - N^+
- Important nutrients:
  - Mg^+ - chlorophyll
  - K^+ - balances cell pressure
  - B^+ - important at bloom
- Many soil based fertilizers take time for plant to use
  - Difficult to get into soil solution



Foliar Fertilization

- Temporary fix
- Yearly problems need soil amendments
- Not effective for macronutrients
- Good way to supply micronutrients
- CAUTION – avoid toxicity!
  - Concentration
  - Tank mixes with pesticides

Foliar Sprays

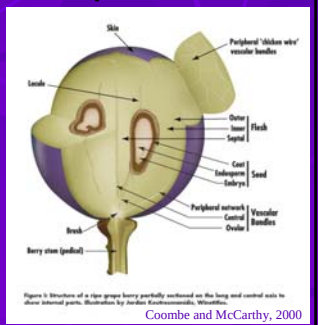
- Zn most common – widely deficient
- B^+ – before bloom to aid in fruit set
- Fe – most difficult to correct
  - Need to apply through soil long term
- K^+ - no effect
  - Requirements large for foliar feeds

Foliar Sprays

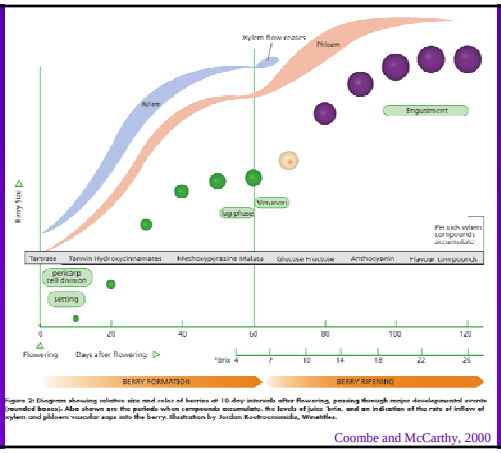
- Important to determine which is lacking
- Micronutrient 'alphabet soups' can be expensive
- Where do you want to spend money?

Grape Berry

- Seeds and skins high in tannins & phenols
- Interested in sugar accumulation
- Increase in berry color at veraison



Coombe and McCarthy, 2000



Coombe and McCarthy, 2000

Water

- All grapes need supplemental water
  - Summer months
  - Depends on *soil type*
  - Soils with higher OM tend to hold onto water
  - 16-20 inches?

Water

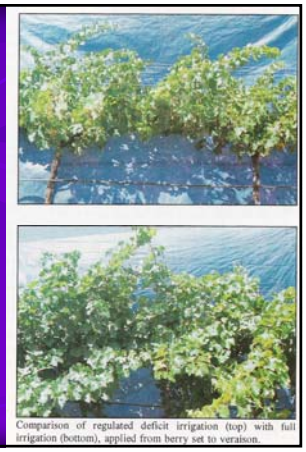
- Irrigation techniques
  - Affects canopy size
  - Full irrigation
  - Regulated Deficit Irrigation (RDI)
  - Partial Rootzone Drying (PRD)

Regulated Deficit Irrigation (RDI)

- Concept:
  - Hold back water to limit shoot growth early
  - = Smaller canopy
- Advantages:
  - Reduces shoot growth
  - Better bud development (increased light)
  - Fruit exposure

Canopies…

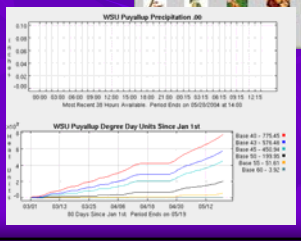
- RDI (top) from berry set to veraison
- Full irrigation = bigger canopy
  - Shading?
  - Fruit bud development?



Comparison of regulated deficit irrigation (top) with full irrigation (bottom), applied from berry set to veraison.

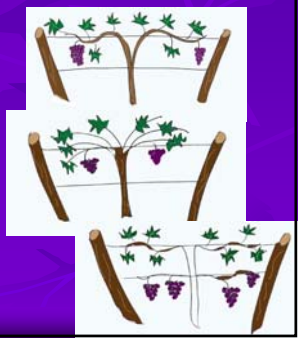
Managing Irrigation

- To implement –
  - Control canopy size by monitoring water status
  - PAWS
  - WISE



Defining Canopy Mgmt.

- Using various techniques – control leaf surface area
- Techniques
  - Proper trellising choice
  - Dormant pruning
  - Shoot thinning
  - Shoot positioning
  - Leaf removal



Advantages

- If you control canopy size:
  - Improve grape quality = good wine
  - Improve yield
    - Support more high quality grapes
  - Reduce diseases
    - Air flow

Goals of Canopy Management

- Simple!
- Inexpensive (efficient)
- Adapted for particular site
- Consider variety and vigor
  - Rootstock?

Tools

- Trellis design
  - Open canopy, sun exposure
- Dormant pruning
  - Manage fruiting positions
- Shoot thinning
- Shoot positioning
- Leaf removal
- Fruit removal

Trellis Design

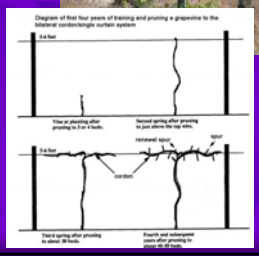
- Which one is right for me?
- Questions to ask:
  - Typical sunlight exposure?
  - Air movement?
  - Variety vigor?
  - Soil type?
  - Irrigation?
  - Pruning – hand or machine?

Additional Questions…

- Will it rot or rust?
  - Good question in this area!
- Are end posts secure?
- What is the cost?
- Does cost correlate with management?

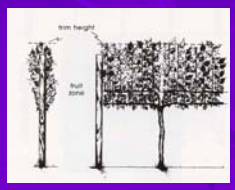
Bilateral Cordon

- Cordon, spur-pruned system
- Large portion of *vinifera* industry
- Well suited to areas with abundant sunlight



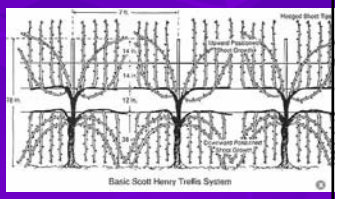
Vertical Shoot Positioned (VSP)

- Advantages:
  - Good air circulation for high risk areas
  - Sun exposure for fruit development



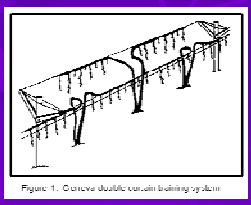
Scott-Henry Trellis System

- Developed in Oregon
- Well suited to overly vigorous varieties
- Labor intensive
  - Difficult to train shoots down
- Good fruit quality
  - Both tiers



Geneva Double Curtain

- Divided canopy
- Better sun exposure
- Good for high vigor varieties
  - Shoots are pointed down
- Increase number of shoots
  - Increased yield



Dormant Pruning

- Technique depends upon trellis system
- Many are spur-pruned systems
- How many to leave?
  - How fruitful is vine?
- Typically, 2-3 bud spurs

'Golden Rules' of Pruning

- Manage spurs to get good shoot positions
- 15 buds/lb of pruning weight
- Positions – no cross-row shading
- Leave 5 shoots/ft of canopy

What if Pruning Didn't Work?

- Still have a large canopy?
- Shoot thinning
- Improves air circulation
- Regulates yield

Shoot Thinning

- Conserves reserves for fruit development
- When to do it?
  - As early as possible
  - Will open up canopy and prevent mistakes when pruning
- Want to avoid putting reserves into shoot growth !

Shoot Thinning

- How to do it?
  - Let the vine talk to you
- Need to balance between leaves and fruit
  - How many?

Shoot Positioning

- Trellis system
- Use of wires to position shoots
  - Up or down
- Better light interception
- Fruit exposure!
- When?
  - As soon as shoot reaches 'wind wire'
  - Height depends on trellis system

Cluster Thinning

- Removal of crop
- When to do it?
  - After fruit set to ensure good crop
  - Better evaluation
  - Earlier thinning = larger berries
- Sorokowsky, Reynolds, Schlosser study in Canada
- Clone of Chardonnay

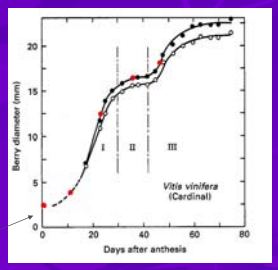
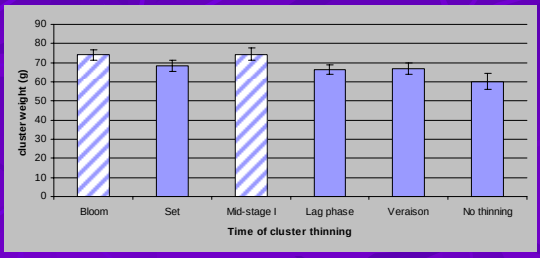
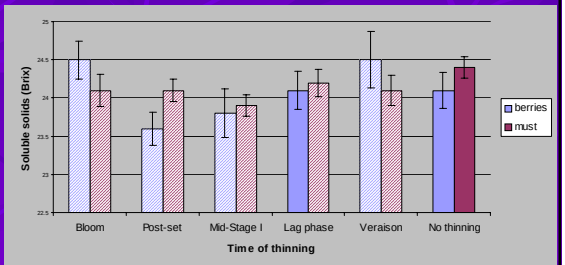


Figure 1: Impact of thinning time on mean cluster weight



- Cross-hatched bars differ significantly from unthinned control

Figure 3: Impact of thinning time on soluble solids in berry and must samples



- Cross-hatched bars differ significantly from unthinned control

Cluster Thinning

- Best results at and after fruit set
- Even in 'lag' phase
- Berry maturity advanced by thinning
- Increased pH, °Brix, and volatile terpenes

What else?

- Leaf stripping
- Promotes lateral growth
- Better spray coverage
- Improved microclimate
- Better air circulation
- When?
  - 2-4 weeks after fruit set

Fruit Exposure – Caution!

- Exposed fruit may get sunburned!
- Worse on West side of N-S vine rows
  - Do we need sunblock?
  - Yes! Leaves do the trick!

Berry temperature & exposure

- Using thermocouples, temperature measured
  - East side – shaded
  - East side – exposed
  - West side – shaded
  - West side – exposed
- Sunburn on west side, exposed!
- Same for W. WA?

What is Ideal?

- 5 Shoots per foot
- 3 foot shoots (total)
- 1/3 lb of pruning wood per foot
- 14-16 leaves per cluster (~1.5-2.5 in²/0.4 oz)
- 40% canopy gaps
- 60% fruit exposure

Summary

- Numerous factors affect canopy growth
- Many techniques to manage
- Optimum fruit exposure important
- Foliar feeds are temporary fix!
- Good balance required!

Check out the website!

http://www.fruit.wsu.edu/Grapeweb/index.html

THANK YOU!