Canopy Management in a Mature Vineyard

UC Cooperative Extension Central Sierra
Foothill Grape Day 2018
Vine Balance

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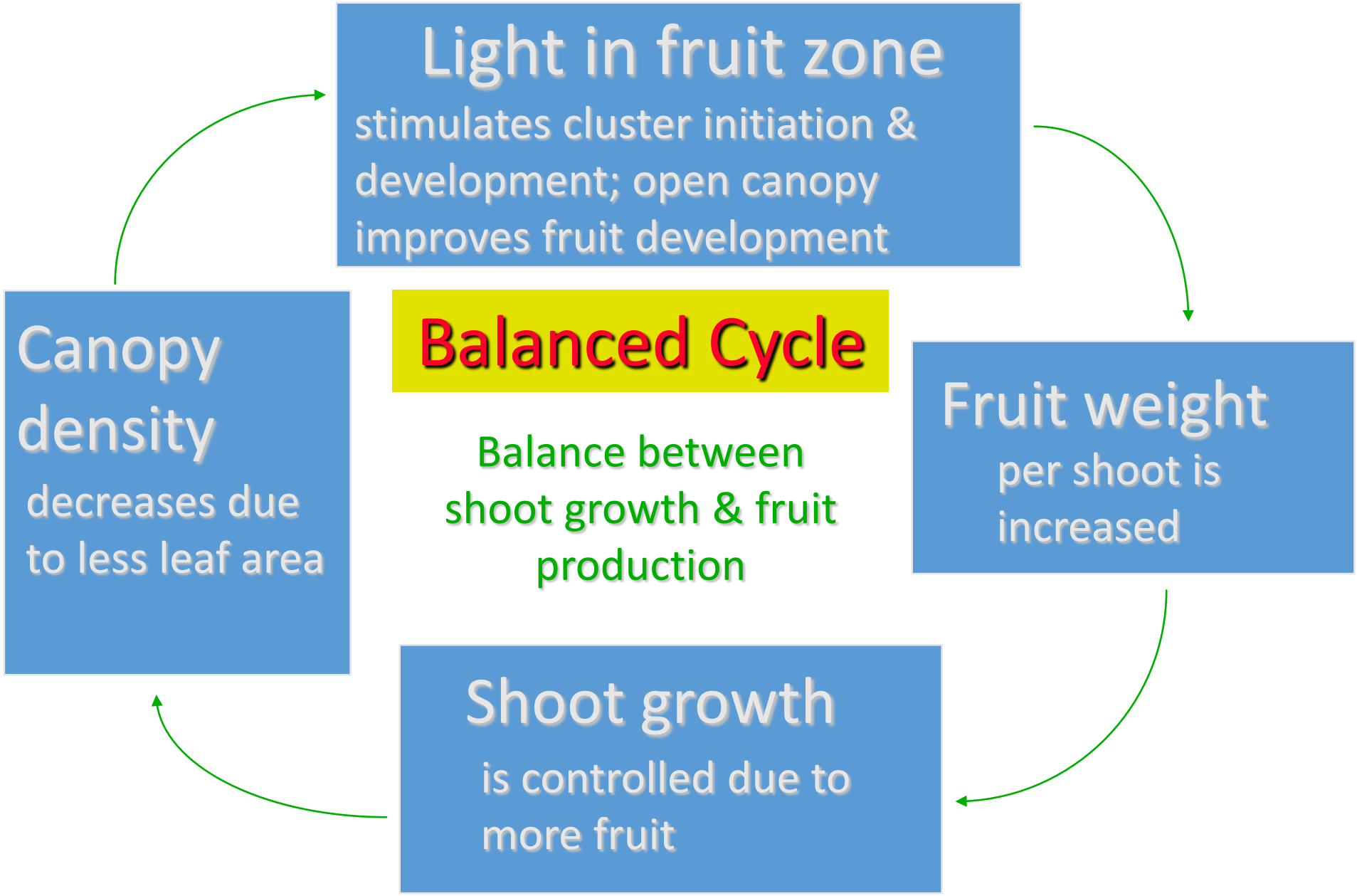
Vine balance

Appropriate balance of vegetative to reproductive vine growth in order to

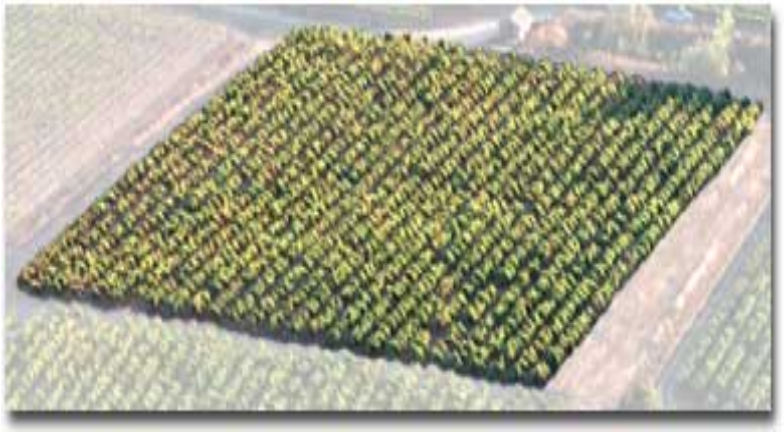
- Ripen the crop
- Develop appropriate reserves
- Develop fruitful buds the following year

A balanced vine will not require excessive canopy management

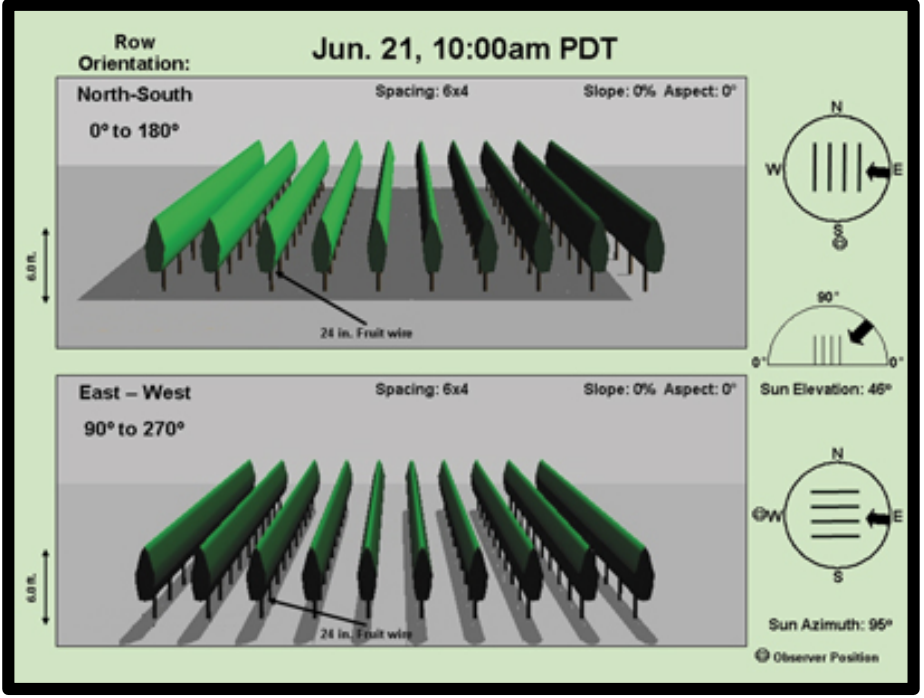

Light in fruit zone
stimulates cluster initiation & development; open canopy improves fruit development
Fruit weight
per shoot is increased
Shoot growth
is controlled due to more fruit
Canopy density
decreases due to less leaf area
Balanced Cycle
Balance between shoot growth & fruit production

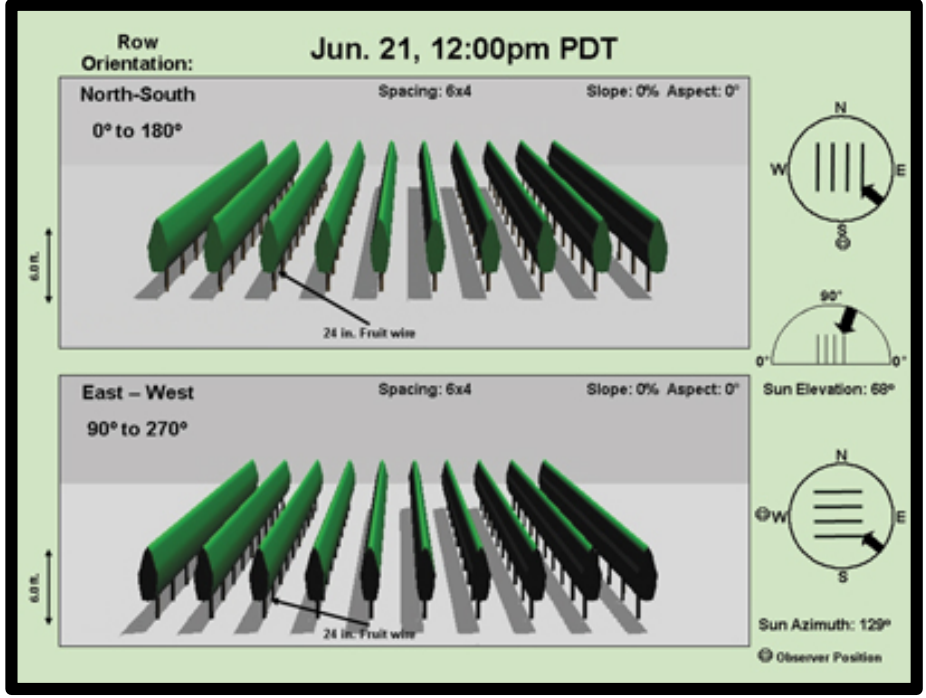
I. Initial decisions to achieve vine balance

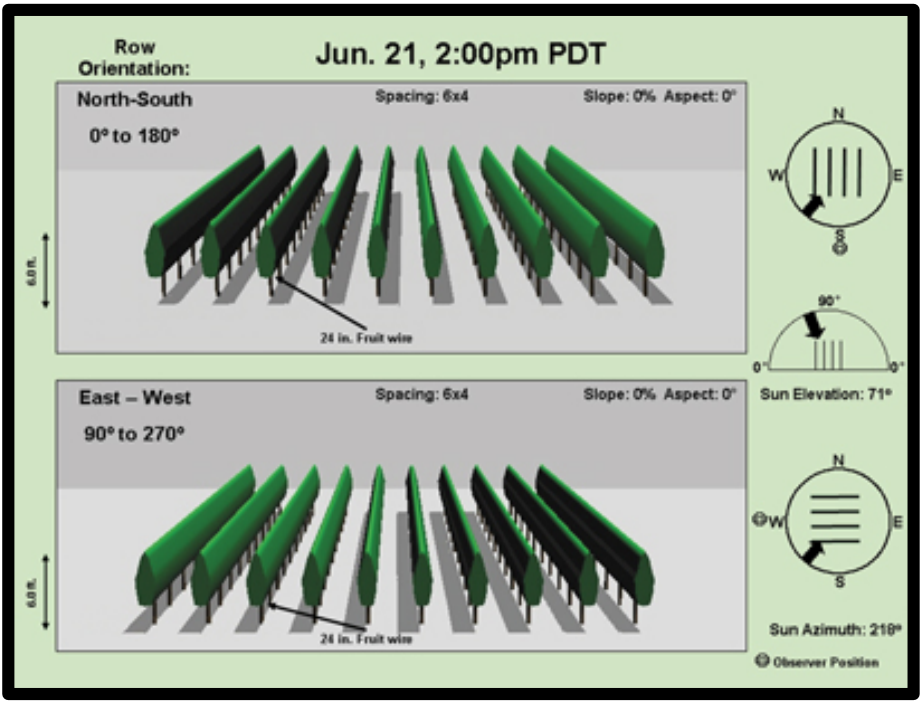
- Vineyard design
  - Row orientation
  - Row & vine spacing
  - Trellising
  - Rootstock

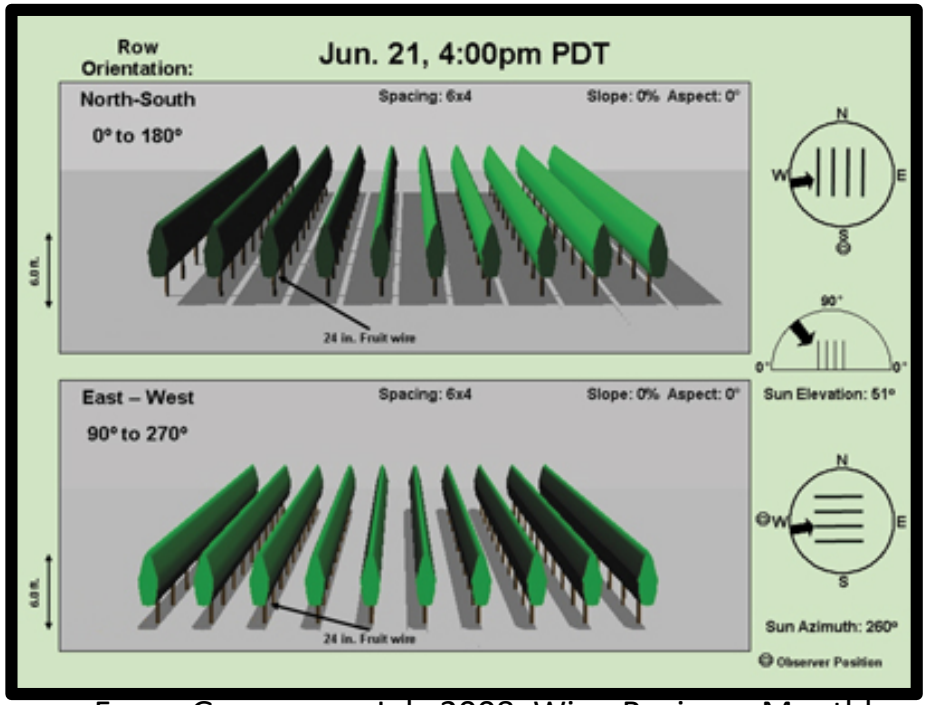


Anticipated vine capacity and site vigor are the primary considerations for vineyard design and canopy management









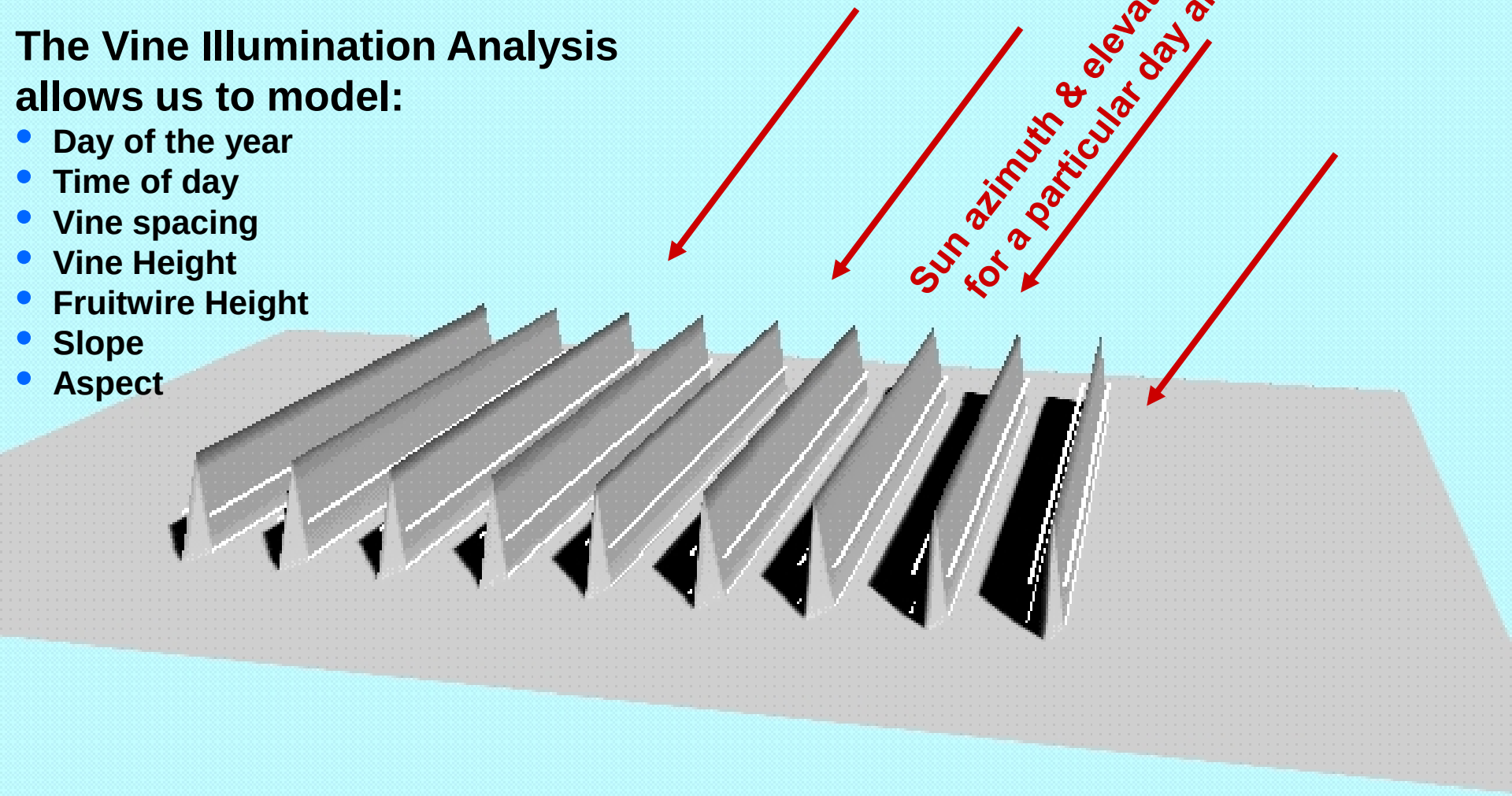
From: Greenspan. July 2008, Wine Business Monthly

Different aspects have different heat loads on canopy and fruit

Row Direction Optimization – mapping canopy exposure in the warmest period of the season

The Vine Illumination Analysis allows us to model:

- Day of the year
- Time of day
- Vine spacing
- Vine Height
- Fruitwire Height
- Slope
- Aspect

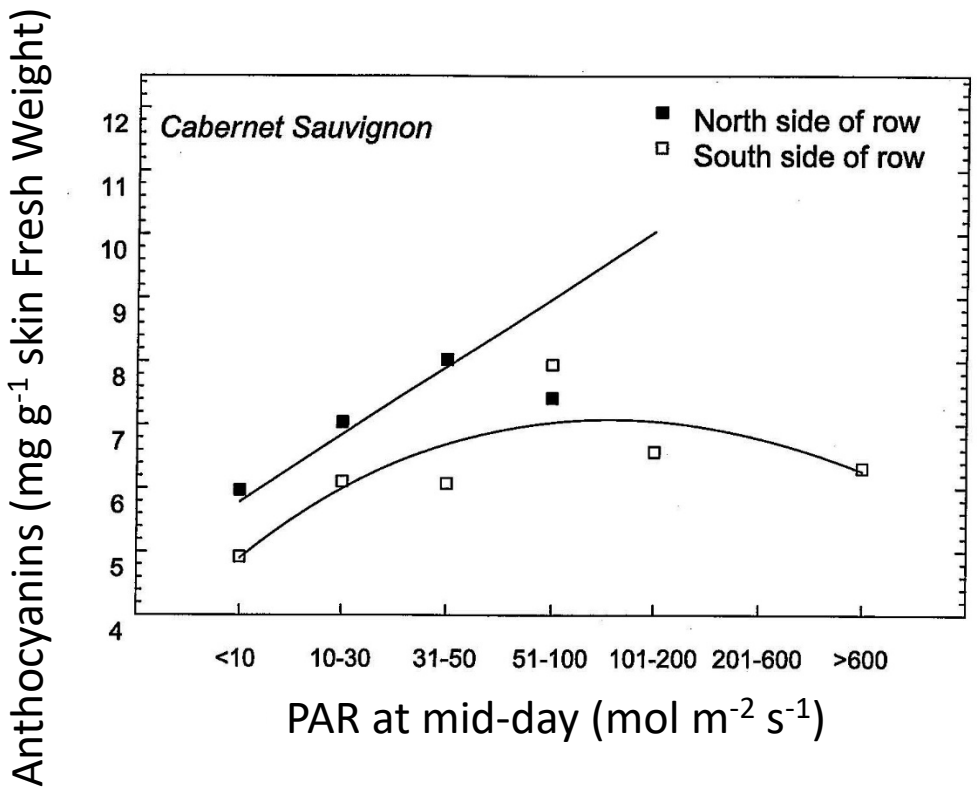


Mike Bobbitt & Associates
http://www.mikebobbitt.com/

Heat Damage

- Sunburn
- Excessive Sunlight Exposure
- Heat Stress

Influence of mid-day PAR levels on the pigment content of Cabernet Sauvignon grape berries on the north and south sides of the canopy row.



East-west row orientation

Modified from Bergqvist, et al., 2001. Amer J. Enol. Vitic.

II. Annual practices to achieve vine balance

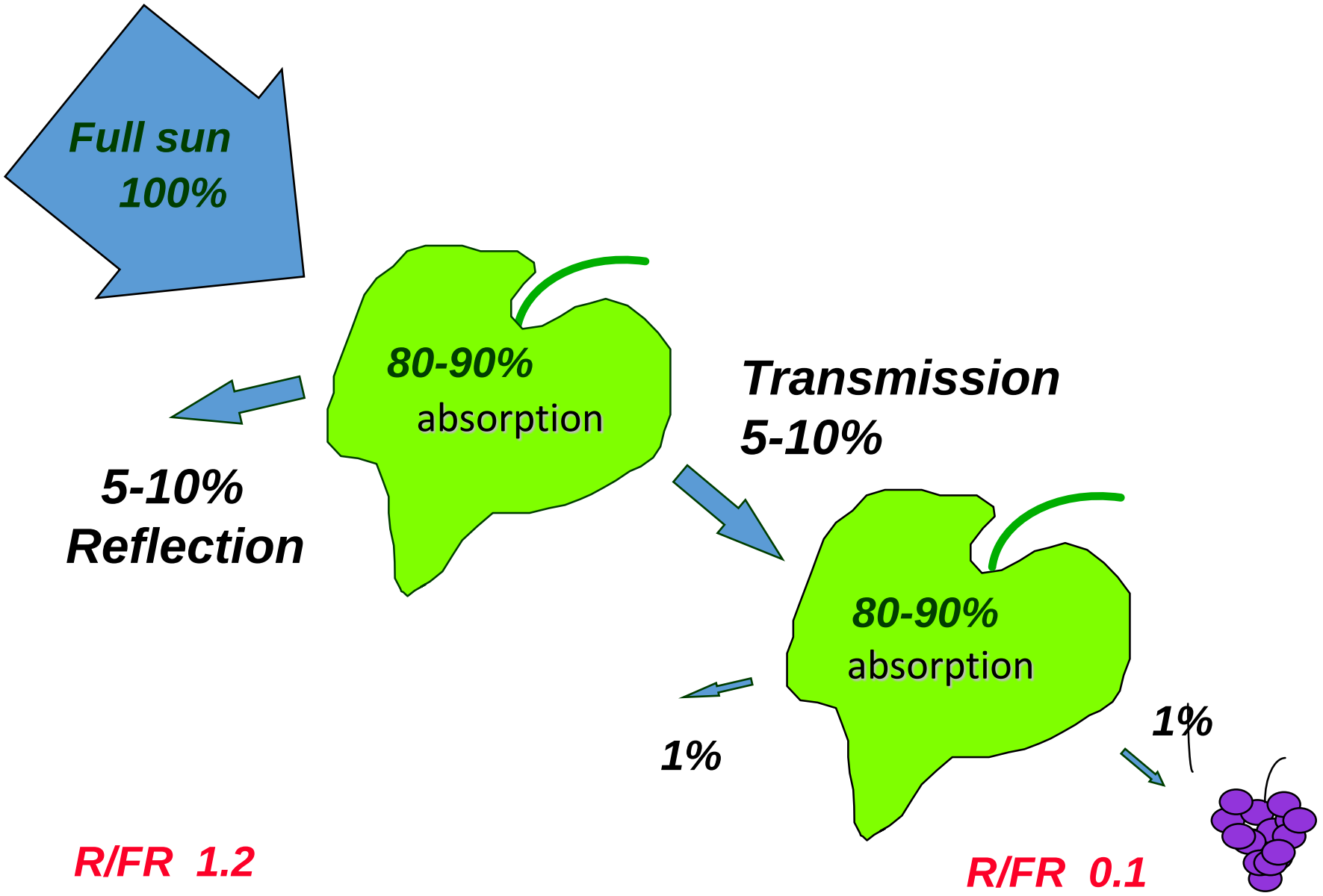
- Pruning
- Shoot thinning
- Shoot positioning
- Basal leaf removal
- Hedging
- Deficit irrigation and nutrient management

Canopy Management

A set of cultural practices designed to manage vegetative growth to meet fruit quantity and quality production goals

Outcomes of canopy management practices

- By manipulating the canopy, the environmental conditions within the canopy change
  - ***Sunlight interception on the canopy surface and in the fruit zone***
  - Temperature
  - Airflow
  - Humidity
- Crop load is also changed
  - Cluster count
  - Crop weight to leaf area ratio


Full sun
100%
80-90%
absorption
5-10%
Reflection
Transmission
5-10%
80-90%
absorption
1%
1%
R/FR 1.2
R/FR 0.1

Indices for low and high Cabernet Sauvignon grapevine canopies at harvest in the North Coast of Calfornia.

	Low density canopies	High density canopies
Canopy leaf area (m^2m^{-1} canopy length)	<4.0	>8.0
Fruit zone PPFD (% ambient)	>5.0	<2.0
Fruit zone R:FR	>0.35	<0.20
Canopy area receiving sunflecks in the fruit zone (%)	>20.0	<10.0
Point quadrant LLN in fruit zone	<2.5	>4.0
Point quadrant canopy gaps in fruit zone (%)	>20.0	<10.0
Evaporative potential in fruit zone (% ambient)	>70.0	<60.0
Canopy pruning weight (kg m^{-1} canopy length)	<1.0	>1.5

From Dokoozlian and Kliewer, 1995. Am. J. Enol. Vitic.

Canopy Assessment

- Point quadrat
  - Number of leaf layers
  - Percent interior leaves and clusters

  “Sunlight into Wine”,1991

- Enhanced Point Quadrat Analysis
  - James Meyers Cornell University

Key enzymes in the anthocyanin synthesis pathway are made or activated in response to light prior to veraison.

The accumulation of anthocyanins and other phenolics in berries is dependent on light exposure both pre- and post veraision.

- Timing of canopy management practices must result in light exposure on young fruit at berry set AND provide some shade on ripening fruit


Moderately exposed fruit
with sunflecks

Sunlight exposed fruit

- Increased rate of sugar accumulation
- greater anthocyanins
- greater total phenolics
- lower pH
- lower malic acid
- lower potassium

Sunlight exposed fruit

In cool regions:

- reduced vegetative character
- increased fruity/floral character

In warm to hot regions:

- Greater risk of sunburn
- loss of character due to high temperatures

Optimum light environment in the fruit zone during ripening

- Maximize diffuse sunlight within the canopy interior
- Minimize exposure of clusters to direct sunlight

Shoot thinning

- Purpose:
- Reduce shoot congestion and **crop load**
- Removed are sterile shoots and cluster-bearing shoots that pushed from non-count nodes
- Removed are multiple shoots from same node
- Timing: 6-10 inches

Shoot thinning

Shoot thinning

Removing doubles

Shoot thinning (late)

Shoot positioning

- Purpose:
- Maintains the canopy form in VSP canopies and facilitates driving in narrow row spacing
- Maintains canopy separation in horizontally divided canopies
- Improves light penetration in the inside face of horizontally divided canopies that shade themselves

Lyre Trellis

Clips used to position shoots vertically

Hedging

- Purpose:
- Maintains canopy shape, prevents shading, facilitates tractor passes and mechanized leaf removal
- Timing: near veraison


VRA

Rootstock effect on capacity and the need to hedge for passage

Leaf removal

- Purpose: In vineyards with low light levels in the fruit zone, removing the basal leaves (and/or lateral shoots) will expose clusters to sunlight during ripening
- Timing: fruit set
  - Pre-bloom leaf removal can reduce fruit set
  - Post-veraison leaf removal can lead to sunburn if clusters are in direct sunlight
- Shoot density affects the need for leaf removal

Lateral shoot removal in fruit zone

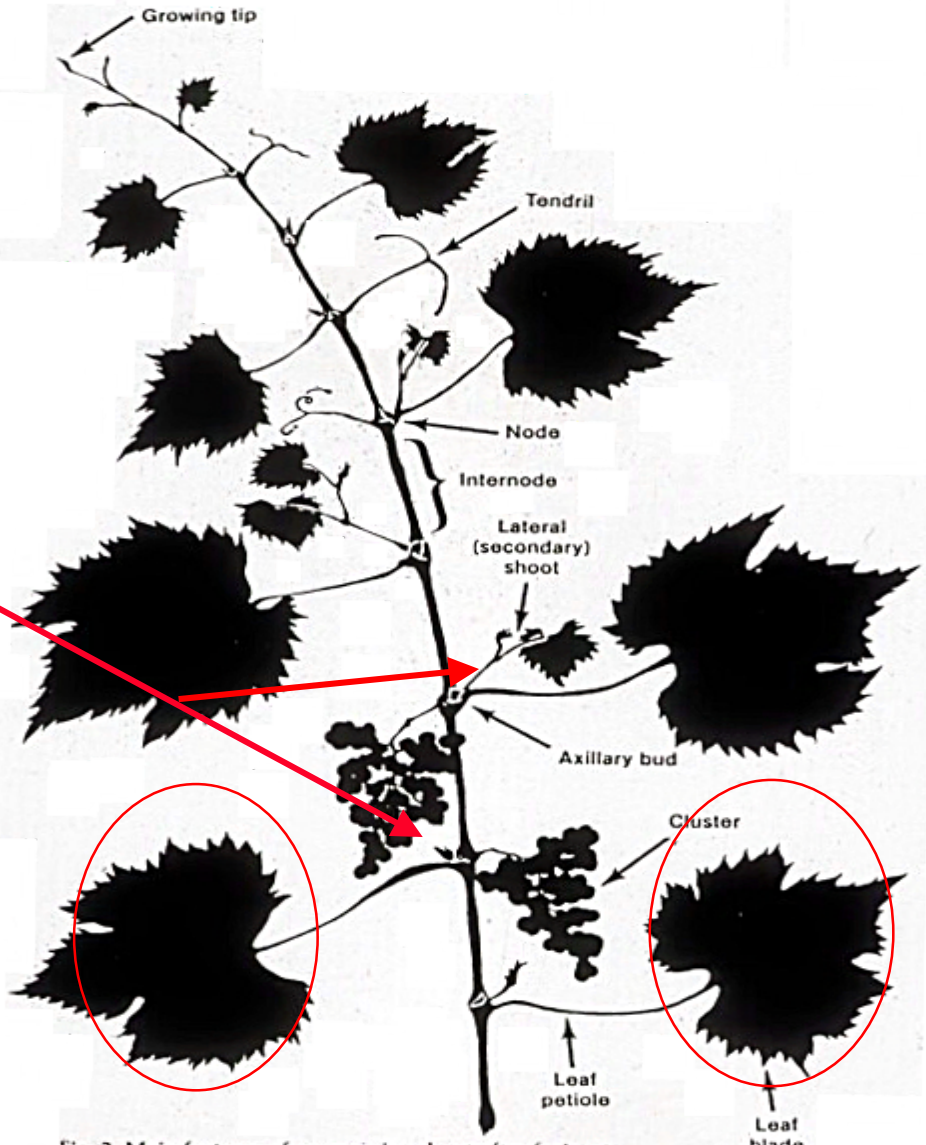


Fig. 2. Main features of a grapevine shoot after fruit set.

Basal leaf removal

Mid-July
leaf and lateral removal


Excessive leaf removal


Moderately exposed fruit with sunflecks

Thank you