

Source: Sink Relationships in the Grapevine

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Source: Sink Relations

Leaf = Photosynthesis = Source



Berry = Sugar Sink



Source-Sink

Sink – growing apex

Source – Leaf
photosynthesis

Sink - berry

Sink – roots, trunk



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From the Exposed Leaf to Fruit Sink

1

Amount of
available light

2

Amount of
intercepted light –
depends on leaf
area and canopy
structure



4

Depends on
number of sinks

3

Fraction of DM
exported to clusters



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Function of the grapevine canopy

- Carbon fixation
 - Yield
- Controlling cluster microclimate
 - Berry chemistry
 - Incidence of fungal infection



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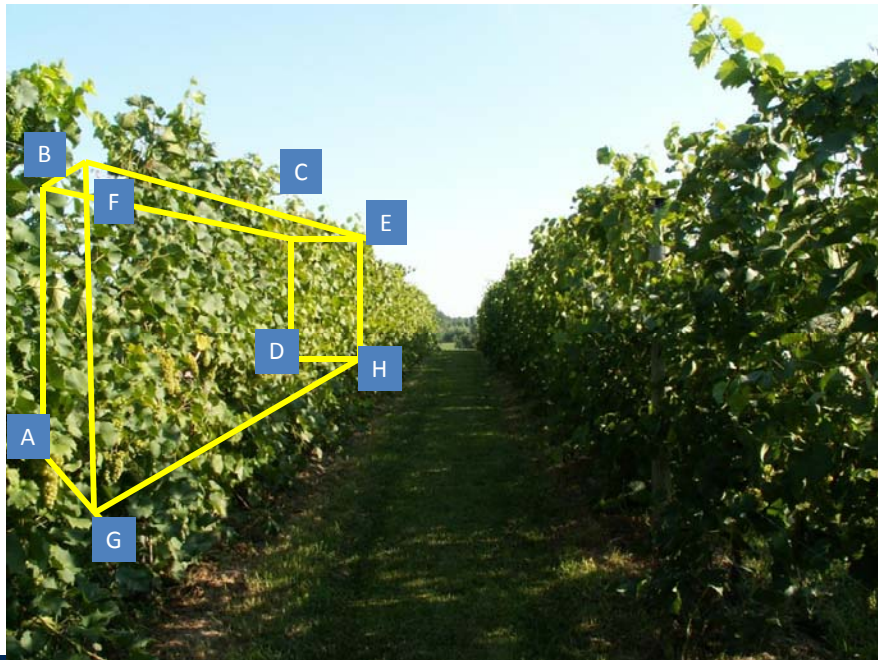
Optimum light environment in the fruit zone during ripening

Maximize diffuse or indirect sunlight within the canopy interior

Minimize exposure of clusters to direct sunlight – particularly in warm climates

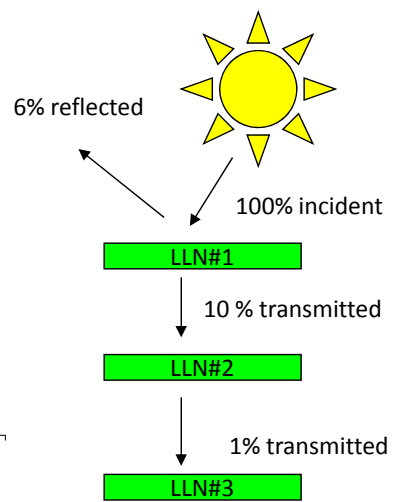
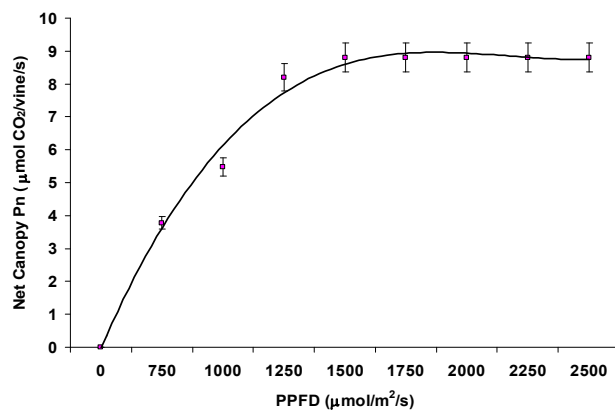


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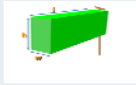
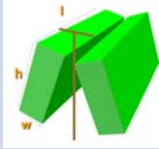
Radiation Effects on Whole Canopy



Kurtural et al. 2003; Dami et al. 2005; Kurtural et al. 2005; 2006

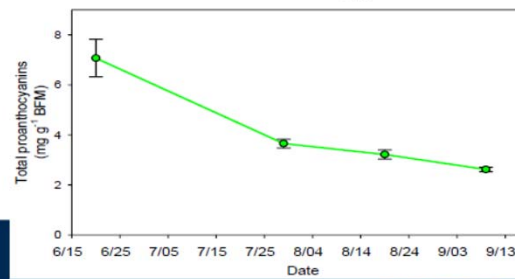
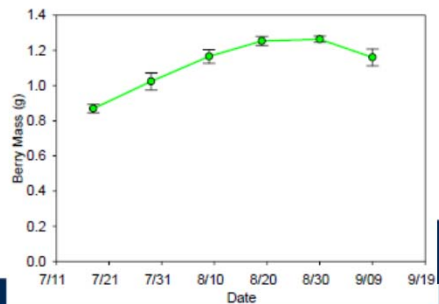
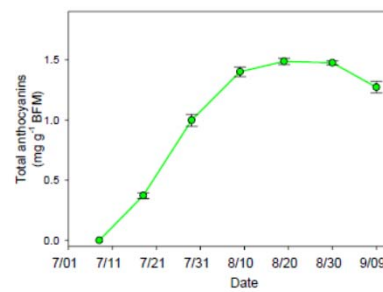
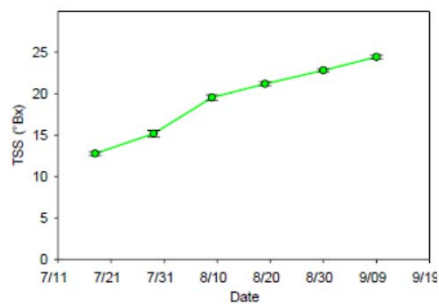
0.1% transmitted
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Common canopy types

Canopy type	Leaf area per vine	Exposed leaf area	Interior leaf area
	22 m ²	8 m ² (35%)	14 m ²
	22 m ²	6 m ² (25%)	16 m ²
	22 m ²	15 m ² (70%)	7 m ²

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Evolution of berry chemistry 'Cabernet Sauvignon'



Source:Sink Management

Balancing vegetative growth
with reproductive growth
Not a direct measurement
Single most important
practice



Vine balance thresholds
Ravaz index: 5 to 10 kg/kg
Pruning weight/ m of row:
0.8 to 1.0 kg/m

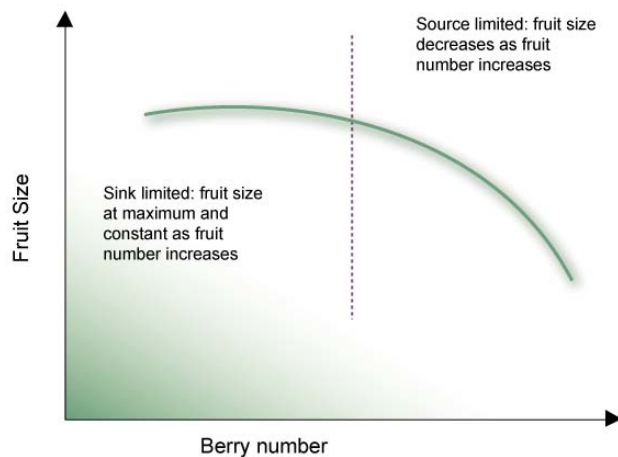
Unbalanced vines

- Large canopies
- High water demand
- Fruit of inferior 'quality'

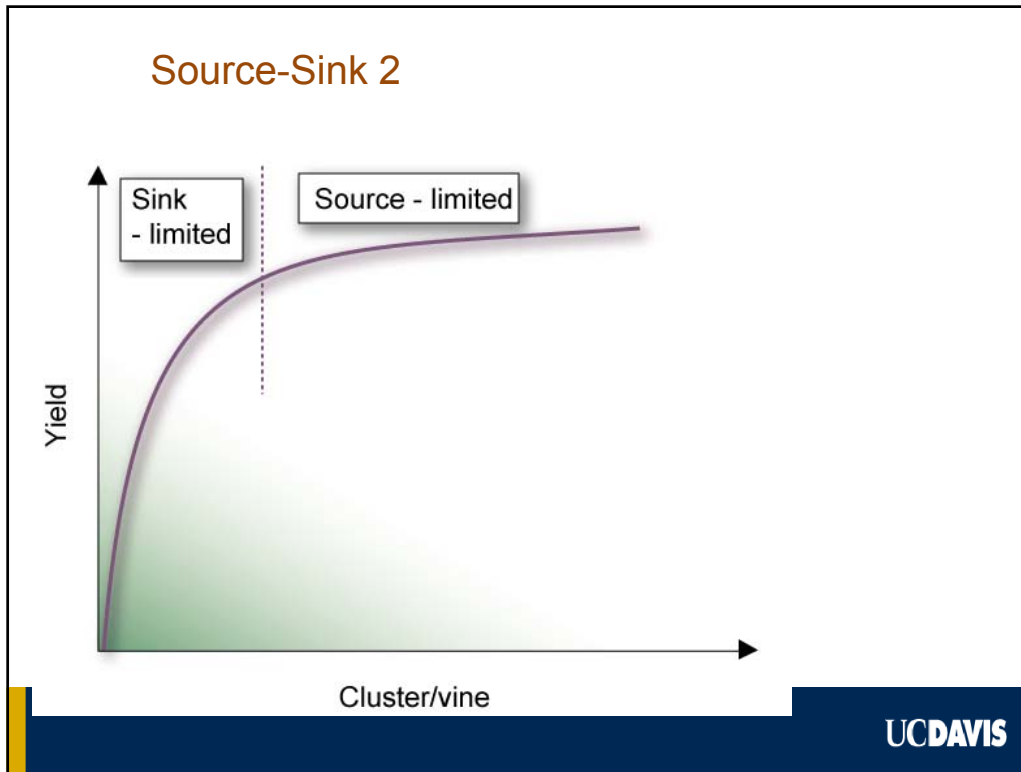
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Source-Sink

Yield and berry size, maturity, leaf area and wine sensory



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Source-Sink Balance

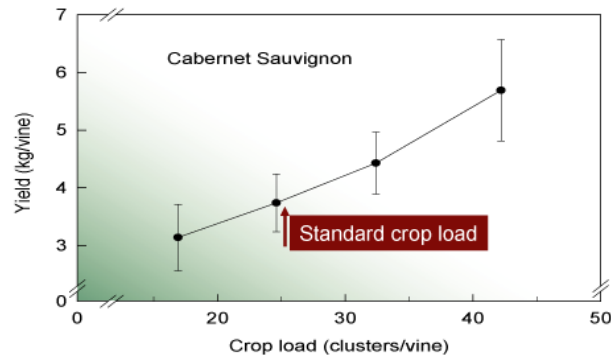
Balance between being sink limited or source limited

Source-sink balance

When fruit number is increased, fruit size does not change, when sink-limited, and decreases under source-limited conditions

Yield increases with crop load (bud or cluster numbers) when sink-limited, and does not increase when source-limited

Yield at Different Crop Loads by Thinning at Veraison (clusters/vine)

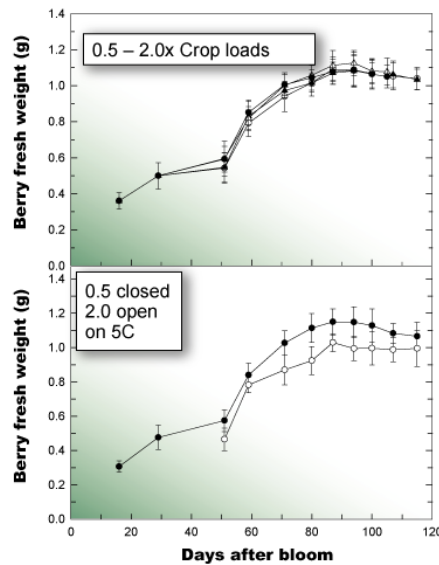


For dry-farmed vines at Oakville in Napa Valley, sink limited

Nuzzo and Matthews 2006

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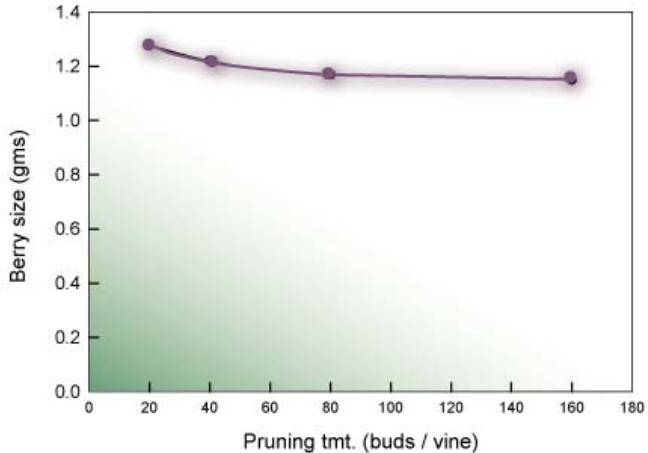
Berry Size at Different Crop Loads on dry farmed Cabernet Sauvignon



Nuzzo and Matthews 2006

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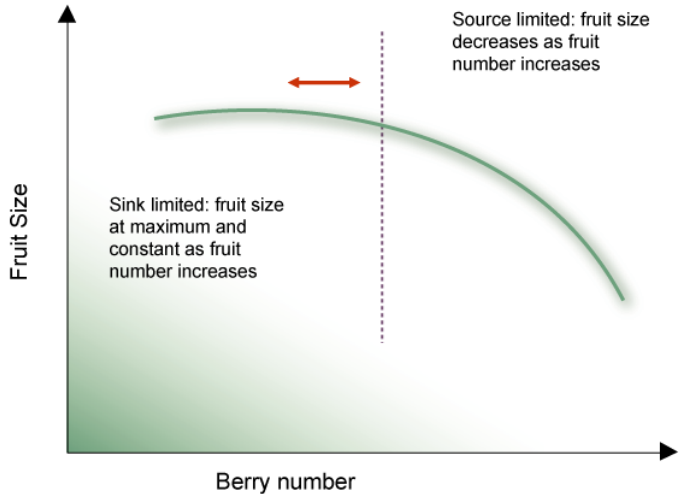
Response of Berry Size to Crop Load in Shiraz



Freeman et al. Shiraz - in Coombe and Dry.

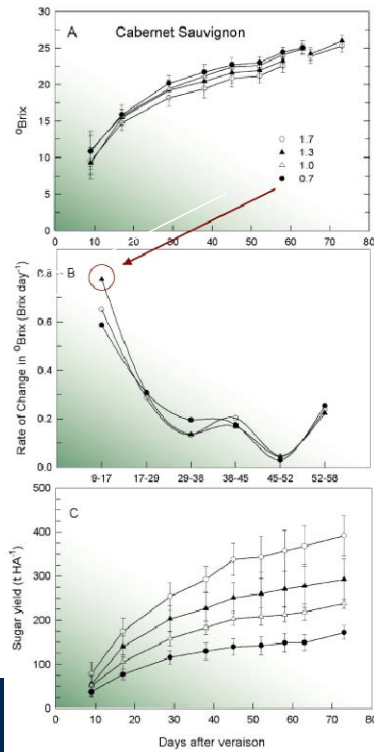


Source/Sink 1



Changes in Brix after Veraison

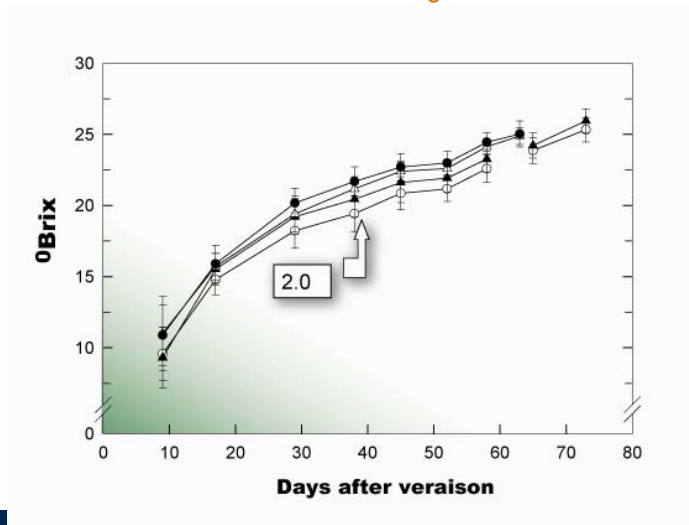
- Low crop level accelerates sugar accumulation
- Reduces amount of harvested 'wine'
- Dry farmed Cabernet Sauvignon



Nuzzo and Matthews
AJEV 2006

Sugar Accumulation at Various Crop Loads (0.5 – 2.0)

Cabernet Sauvignon

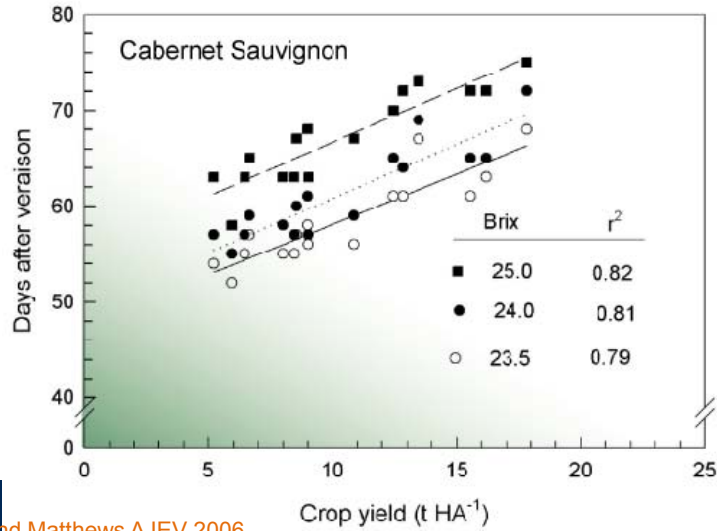


Nuzzo and Matthews AJEV 2006

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Brix Delay with Crop Load

Slope = 1 day / ton Cluster thinning

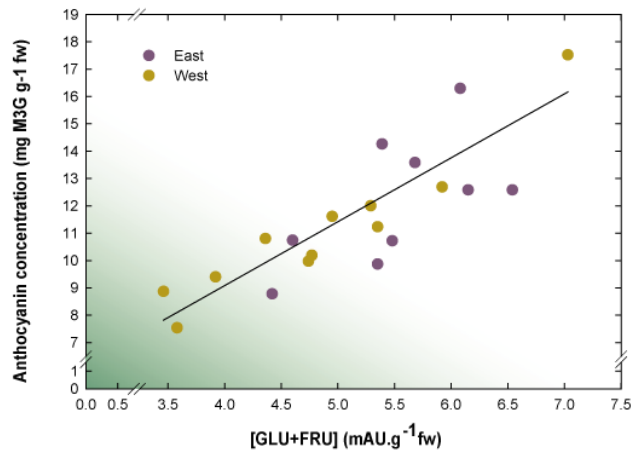


Nuzzo and Matthews AJEV 2006

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Anthocyanin Concentration Dependency

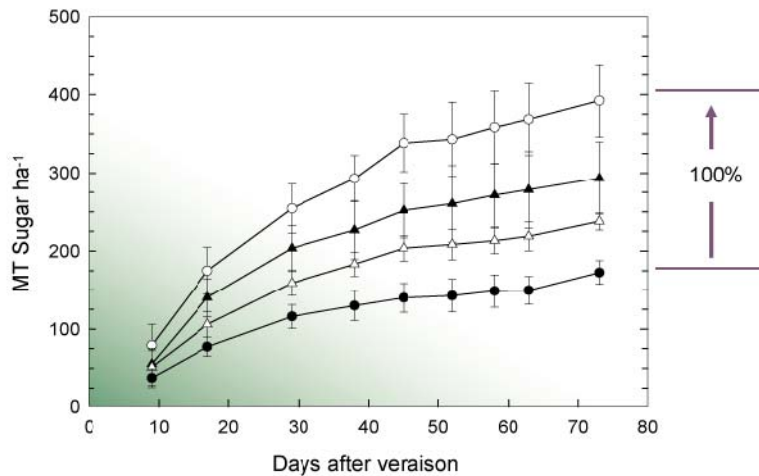
Anthocyanin concentration dependency on skin sugar levels



L.E. Williams

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Sugar Yield at Various Crop Loads



Nuzzo and Matthews AJEV 2006

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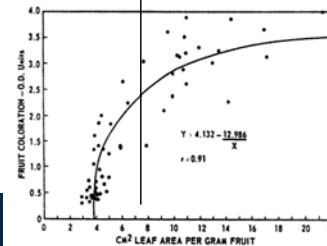
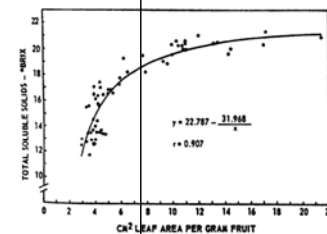
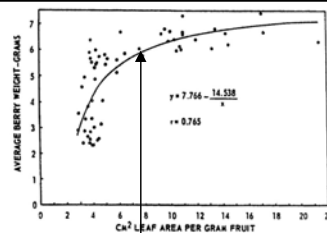
Crop Level and Leaf Area

Source-limited →

Experiments to reduce leaf area per unit of fruit until vines were clearly source limited

Responses of size, sugar, and color to increasing source (leaf area) saturated at about 10 – 12 sq. cm. / gm fruit

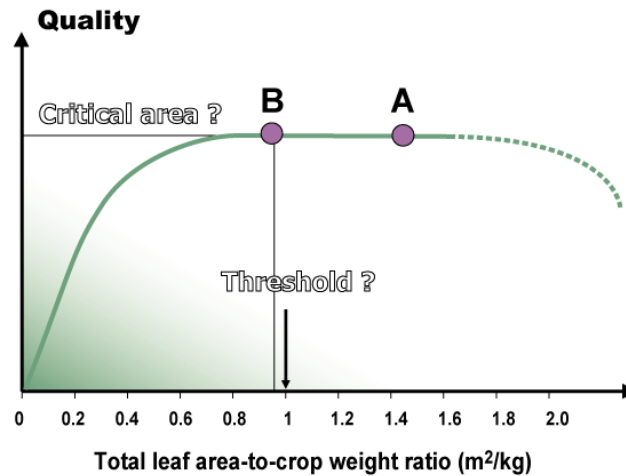
10-12 cm² leaf area / g fruit should form a cornerstone of our sense of 'balance'



Kliewer & Weaver 1971

AVIS

Ratio of Leaf Area to Fruit



S. Poni - Italy

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Vine Balance

Data does not indicate leaf area or pruning weight to fruit ratios provide an absolute value of source/sink relationships in grapevines
What can one measure to estimate whether the crop load can be ripened well?

- Impact on the cluster microclimate
- Important determinant of fruit composition
- Leaf area effects amount of radiation hitting the berry

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Over cropping ? Is this a thing?

Sugar delay

Sugar maturity not reached

Low color

And with more severe overcropping:

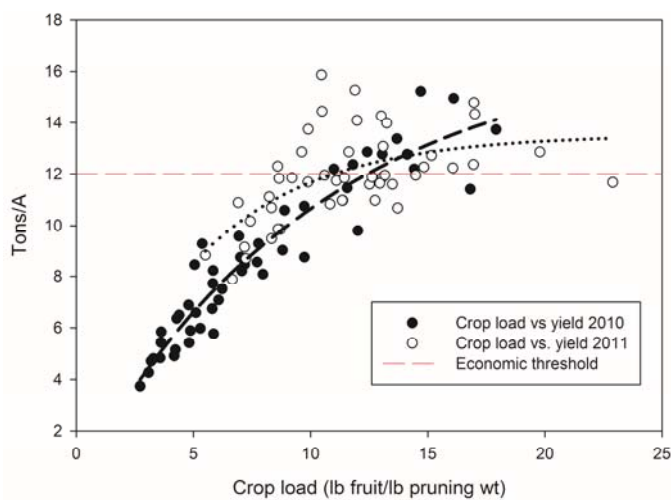
Poor cane ripening

Reduced fruitfulness, Slow, inhibited
budbreak

Increasing
severity

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Crop load management- the new reality

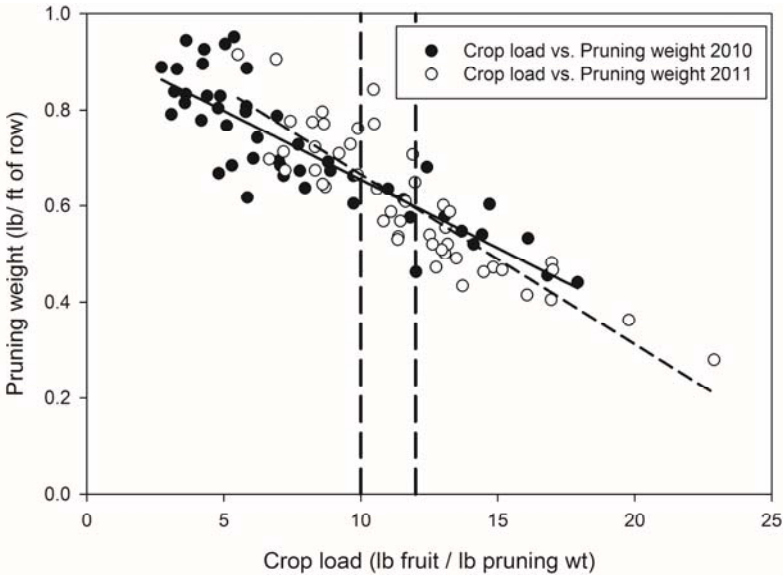


Hand pruned vs.
Machine pruned
Pinot gris

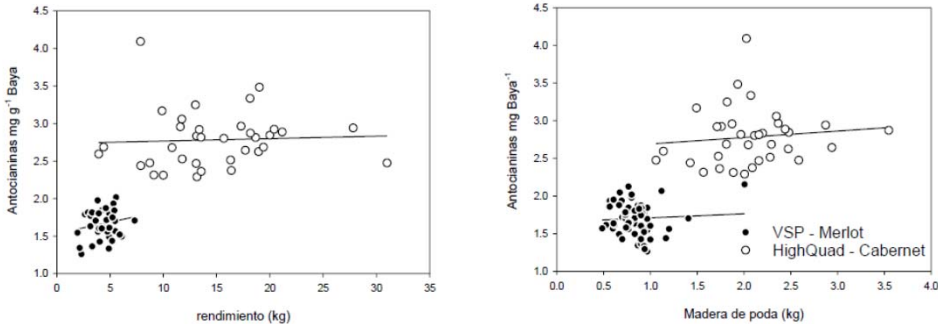
What is your ideal
crop load if
economic
threshold is 12
T/A?

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So crop it as much as you want?



Yield vs. 'Quality' Is this a thing on which we can hang out hat?



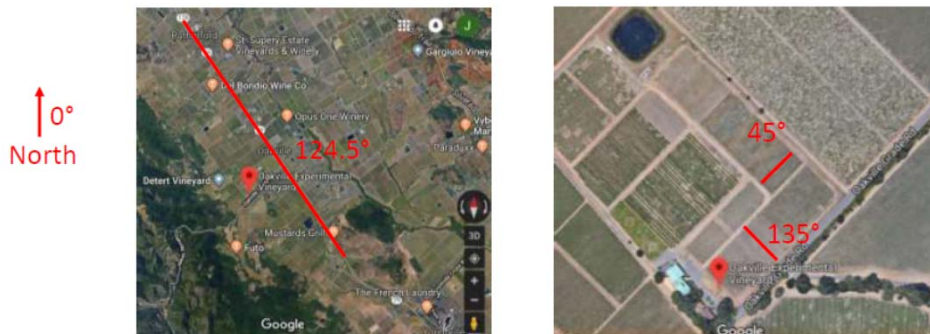
We have been unable to provide evidence that high yield or high vigor would reduce berry anthocyanin content across our trials in CA

What factors affect berry chemistry?

- Cluster microclimate
 - Temperature
 - Irradiation
 - Row orientation
 - Canopy height
 - Amount of exposed leaf area/run of row

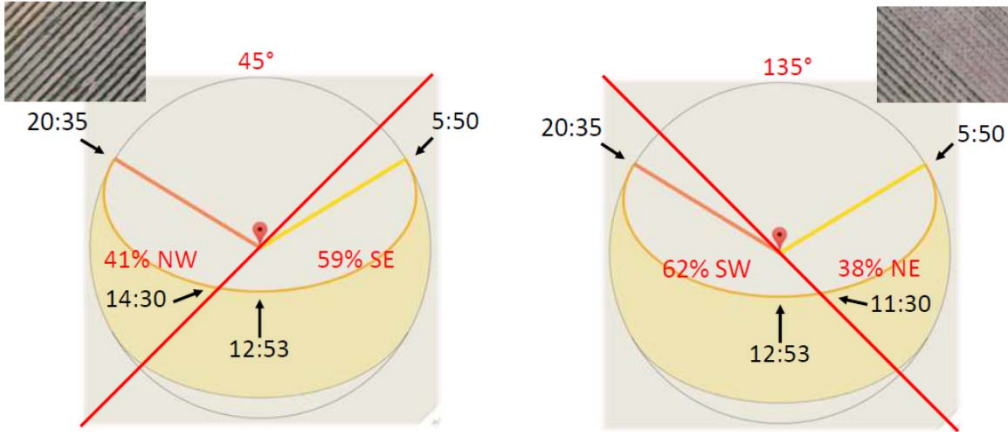
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Row orientation?



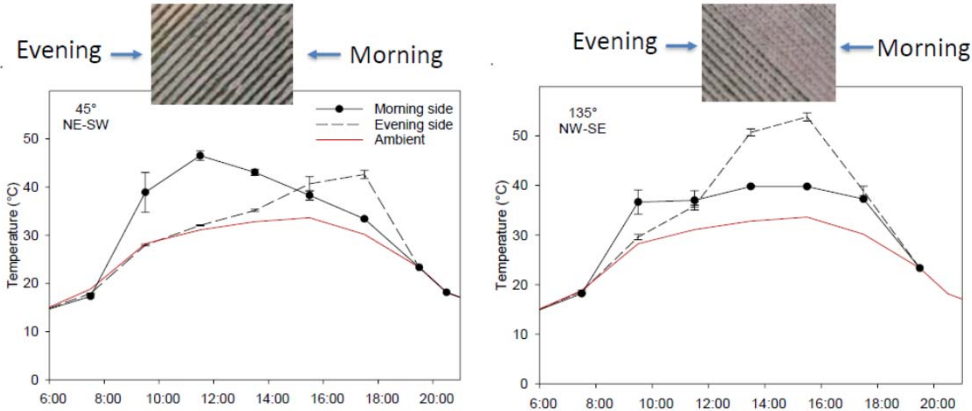
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Row orientation?



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Temperature of berries



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VSP vs Sprawl

2 bud spur-pruned vertical shoot positioned (VSP)



1 foot canes with sprawling vegetation



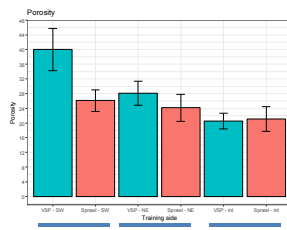
Fish eye lens pictures from cluster perspective

6 clusters (east, west and interior) from 4 vines and 2 trellis (VSP and Sprawl)

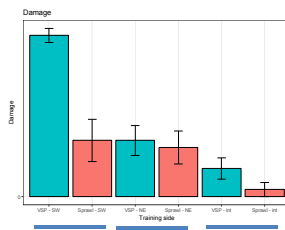
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VSP versus California Sprawl

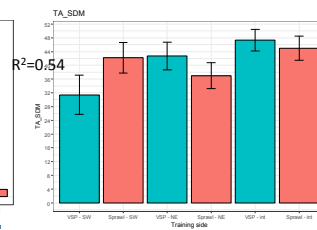
■ VSP
■ Sprawl



Canopy porosity



Visual assessment of damage

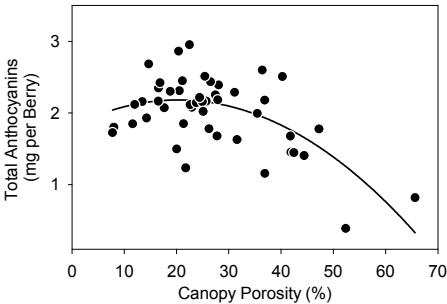


Anthocyanins

$R^2=0.54$

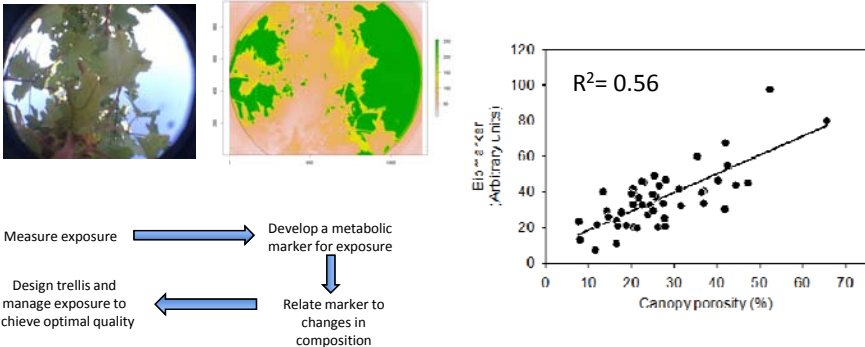
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NEGATIVE RELATION BETWEEN CANOPY POROSITY AND ANTHOCYANINS



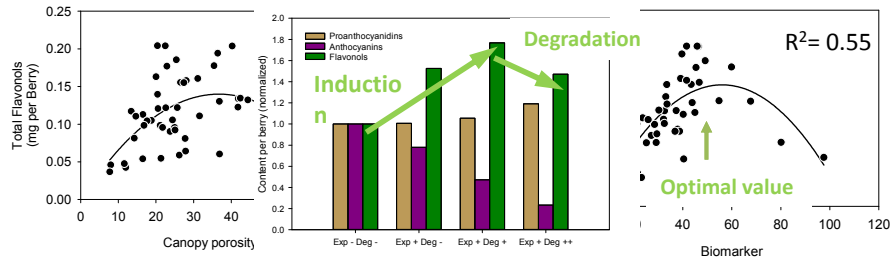
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OPTIMIZATION OF CANOPIES THROUGH METABOLIC MARKERS



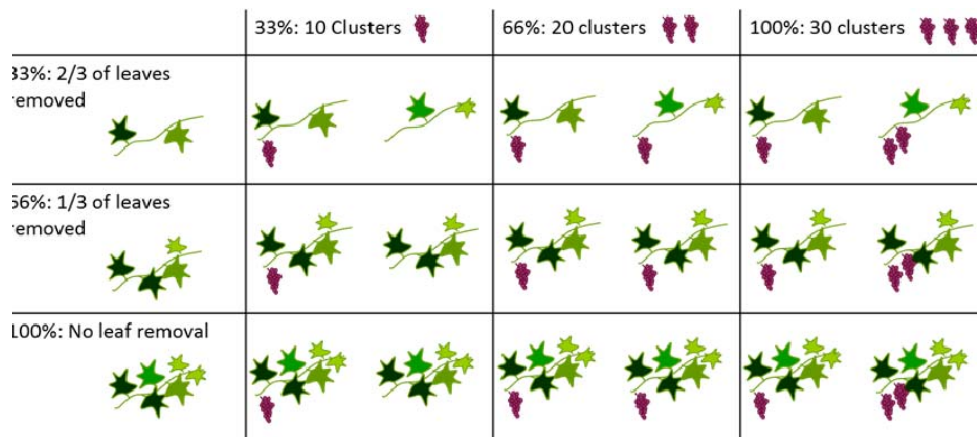
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METABOLIC DATA LOGGER (BIOMARKER) VS CANOPY POROSITY ASSESSMENT



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New Source: Sink trial at Oakville Station



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How does it look in the field?

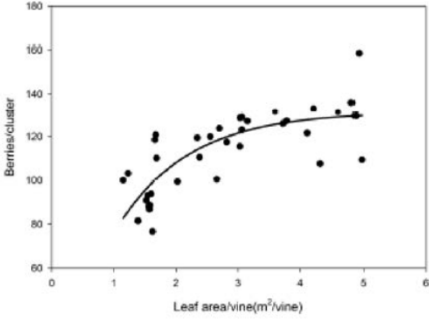
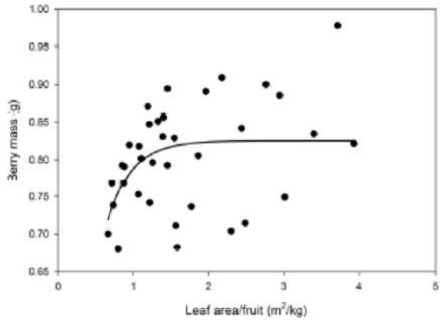


33%: 10 clusters
33%: 2/3 of leaf area removed

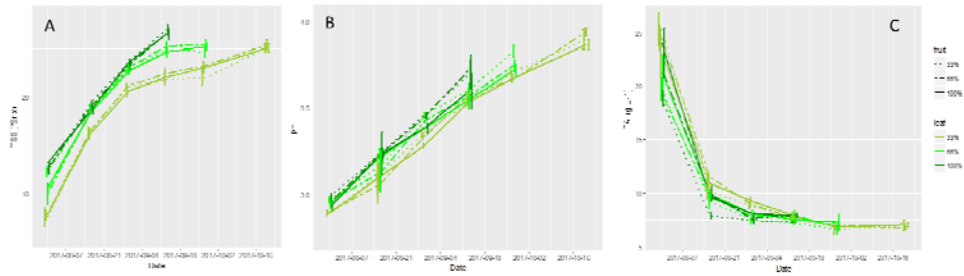
100%: 30 clusters
100% All leaves retained



Yawn. Nothing new here? Or is there?

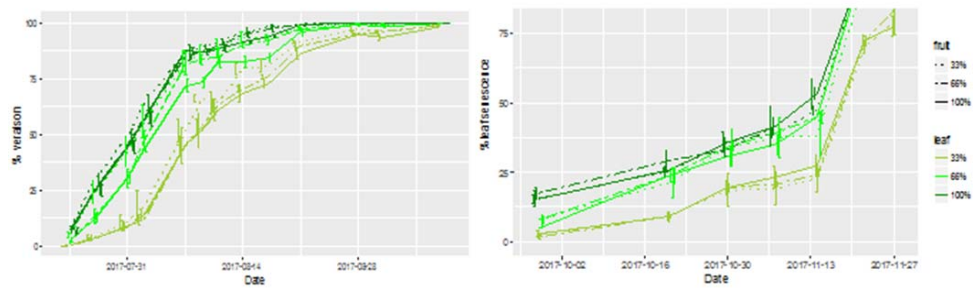


Shifts in ripening



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Shift in phenology



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Summary

Vine balance can be evaluated on basis of adequate sugar and color accumulation

Exposed leaf area per foot of row may be a better indicator

Not grower friendly

Berry flavors are derived from berry metabolism

Berry flavors are not translocated – more on this throughout the day

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THANK YOU FOR LISTENING!

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6 3/4/2018

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