

## Recent Research: Vine Balance and Fruit Thinning

"Sustainable Ag Expo"  
Monterey County

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## Acknowledgements

- Funding
  - American Vineyard Foundation
  - Viticultural Consortium (USDA)
  - California Competitive Grant Program RVE
- Team Members
  - Mike Anderson, Jason Benz, Janet Myers

## Brief Outline

- Vine Balance
  - Principles (from literature)
  - Factors affecting balance
    - Shoot number at pruning (data)
    - Rootstock contribution (data)
  - Conclusions
- Fruit thinning (a little more data)
  - Conclusions
- Question and Answer

## Take Aways

- PowerPoint slides (complete)
- Written handout
- <http://wineserver.ucdavis.edu/faculty>

## Vine Balance

Working Definition:

- When grapevine growth is appropriate for the trellis and spacing
- And the leaf area and amount of fruit are in proper proportion

## How many of you have read?

- Planting density and physiological balance: Comparing approaches to European viticulture in the 21st century. Intrieri, C. and I. Fillipetti. 2000.
  - *In: Proceedings of the ASEV 50th Anniversary Annual Meeting, pp 296-308, American Society for Enology and Viticulture, Davis, CA.*
- Leaf area/crop weight ratios of grapevines: Influence of fruit composition and wine quality. Kliewer, W. M. and N. K. Dokoozlian. 2000.
  - *In: Proceedings of the ASEV 50th Anniversary Annual Meeting, American Society for Enology and Viticulture, Davis, CA.*
  - American Journal for Enology and Viticulture 56:170-181. 2005

## Vine Balance

Two major contributors

- Conditions of balance are set at planting in the vineyard design (permanent)
  - Soil
  - Rootstock/scion
  - Spacing – row x vine
  - Trellis
- Conditions of balance are acted on by annual practices
  - Pruning (shoot number)
  - Nitrogen application
  - Irrigation
  - Cover crops

## Vine Balance

- Contributions to vine vigor

- Given
  - Soil (fertile vs less)
  - Scion (high vigor vs low)
- Decisions
  - Rootstock (high vigor vs low)
  - Spacing (wide vs narrow)
    - In-row (more than between-row)
  - Trellis (divided vs undivided)

## Two Scenarios

- Scenario 1

- Given
  - Soil: Deep, fertile
  - Scion: Syrah
- Decision
  - Rootstock: ?
  - Vine spacing: ?
  - Trellis: ?

- Scenario 2

- Given
  - Soil: Shallow, Infertile
  - Scion: Pinot noir
- Decision
  - Rootstock: ?
  - Vine spacing: ?
  - Trellis: ?

Decisions affect vine balance  
within given scenarios

- “Spacing defined solely by R x V spacing is only a beginning in the definition of canopies and within-canopy spacing of leaves.”

– Nelson Shaulis 1980. Responses of grapevines and grapes to spacing of and within canopies. Proceedings of the Centennial Symposium, 1880-1980, UC Davis (*emphasis added*)

## Dokoozlian and Kliewer Amer J. Enol. Vitic. 1995

- In too dense vine canopies:
  - High leaf layer number (by point quadrat)
  - High LA (>1.5 m<sup>2</sup>/m row)
  - Low PPFD (light) <2% of ambient (by light bar)
  - Low Red:Far-red light ratio
  - Low sunflecks in fruit zone
  - Low evaporative potential
- How many of these can you measure?

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Fortunately:

- **All are correlated with pruning wt!**

## Growth measurement

- Pruning wt
  - Expressed per vine is not helpful
  - Expressed per meter (ft) is helpful
- Pruning wt metrics
  - Smart and Robinson: 0.3 – 0.6 kg/m
  - Dokoozlian & Kliewer: 1.0 kg/m for Cab Sauv.

Even more informative than pruning wt alone

- Shoot number
- Shoot wt

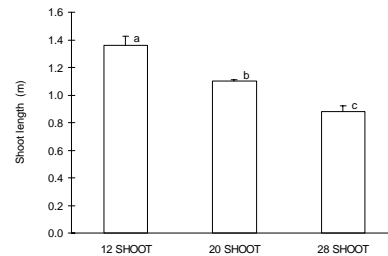
## Shoot number

- Recommended shoot density
  - For cordon-training, undivided
  - 12-15 shoots/meter
- Cannot achieve vine balance by adjusting shoot number out side this range.

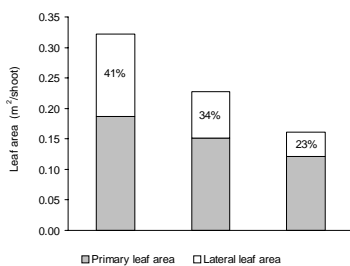
## Sangiovese Study

- Sangiovese/3309C (5<sup>th</sup> leaf)
- Atlas Peak Vineyards, Napa
- Three treatments
  - 12, 20 and 28 shoots per vine
- Adjusted in spring

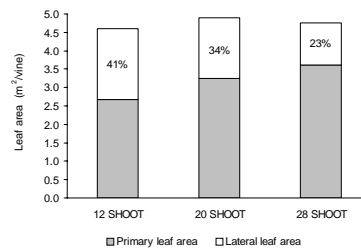
## Shoot number affects shoot length

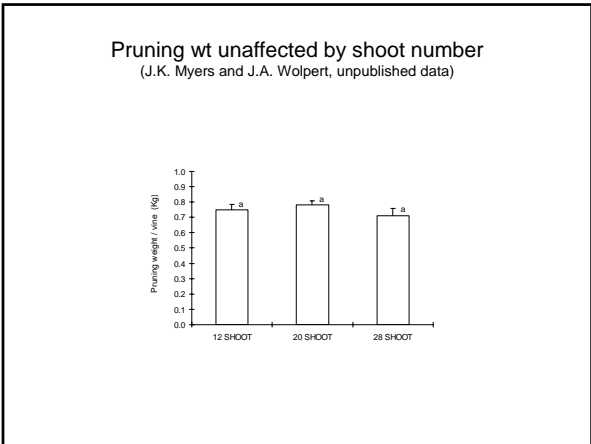


Longer shoots have more leaf area and have a greater % of leaf area as laterals



Manipulating shoot number per vine does not change leaf area per vine, but changes % primary vs lateral  
(J.K. Myers and J.A. Wolpert, unpublished data)



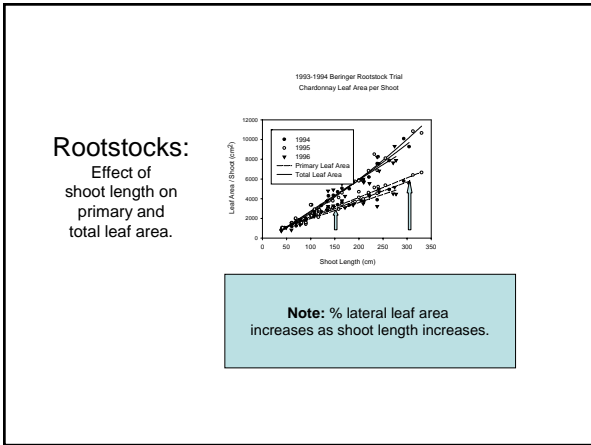


### Shoot number vs primary and lateral leaf area

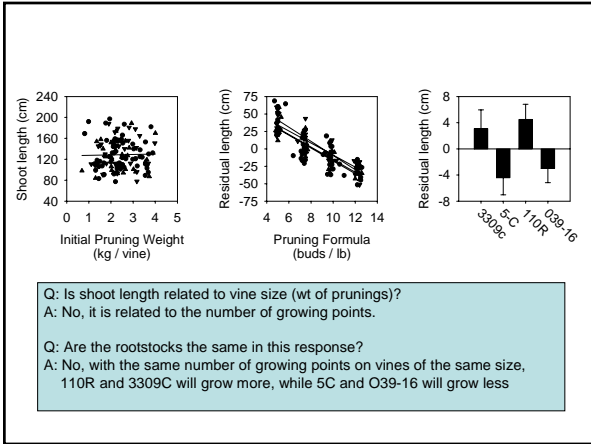
Primary shoots/m Canopy	Primary leaf area/ shoot (m <sup>2</sup> )	Lateral leaf area/ shoot (m <sup>2</sup> )	Canopy leaf area (m <sup>2</sup> /m)	Primary LA (m <sup>2</sup> /m)	Lateral LA (m <sup>2</sup> /m)
6	0.57	0.64	7.2	3.4	3.8
12	0.38	0.23	7.4	4.6	2.8
24	0.28	0.10	9.2	6.7	2.5

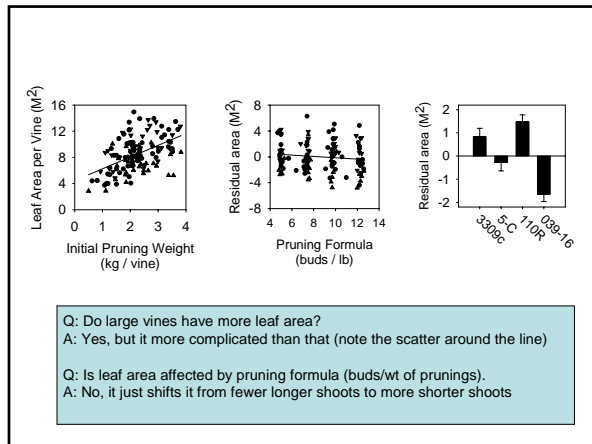
Dokoozlian Thesis, 1990  
(Unpublished data)

- ### Conclusions from Shoot Number work
- For vines of a given vigor:
    - Decreasing shoot number redistributes LA from shorter shoots to longer shoots and
    - Increases % lateral LA (in the fruiting zone?)
    - Decreases the LA to fruit wt ratio (m<sup>2</sup>/kg)
    - Decreases the fruit yield/cane prunings ratio (kg fruit/kg prunings)



- ### Oakville Cabernet Sauvignon
- Treatments
    - 4 Rootstocks: 3309C, 5C, 110R and O39-16
    - 4 Pruning levels: 5, 7, 10 and 12 buds per lb of growth
  - Conditions
    - Range of vine size from 1 to 4 kg/vine (0.5 kg/m to 2.0 kg/m)





## Conclusions

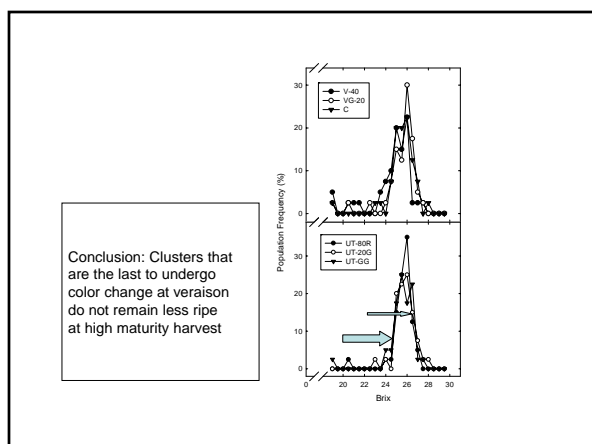
- For Sustainability
  - Balance is best achieved at vineyard design
    - We don't know as much about this as we should
  - Annual practices can be used to achieve balance
    - Requires inputs that are costly
  - Pruning is *not* one of the practices to achieve balance
    - When growth is too great – shading will result
    - When growth is too little – shoot number (=clusters) will be reduced, affecting yield per acre.

## Fruit Thinning

- Common practice:
  - At 80% Veraison, remove the final 20% green clusters
- Presumption:
  - Clusters behind in ripening, remain behind throughout ripening

## Experiment

Treatment	Timing	Cluster Thinning treatment	Clusters
UT-80R	80% Veraison	retained	reddest 80%
UT-20G	80% Veraison	retained and tagged	greenest 20%



## Fruit Thinning

- Conclusions
  - Late maturity may change our thinning practice
  - Need confirmation of the effect
  - Fruit ripening variability needs to be better understood

Questions?

- Thanks for your attention.