



# Practical Considerations for Canopy/crop Management

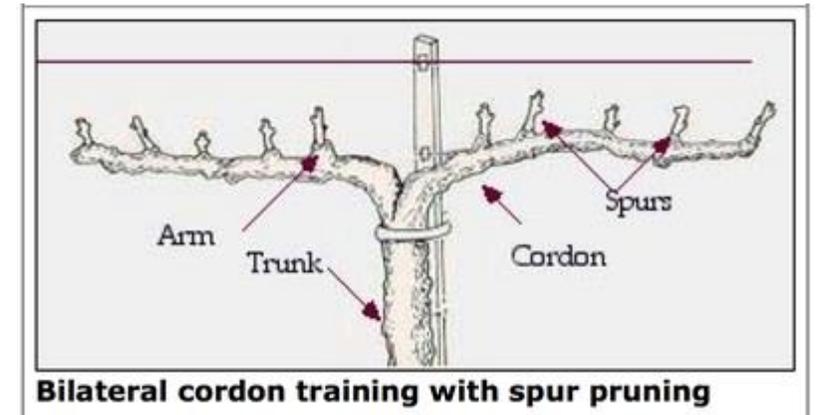
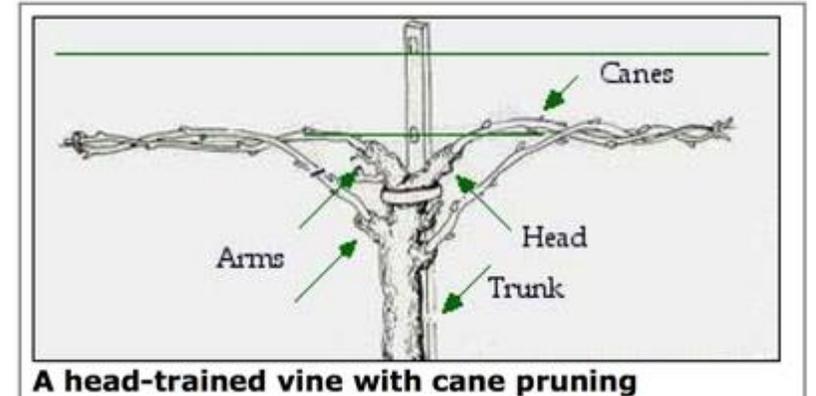
**Johann Martinez**

# Cultural practices affecting canopy and crop load

- Pruning
- Shoot thinning
- Shoot positioning
- Lateral / leaf removal
- Crop thinning
- ...Mechanized versions of it

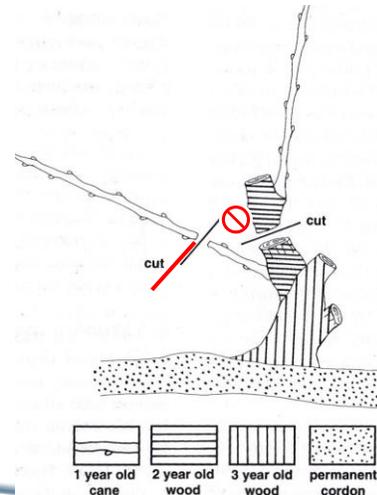
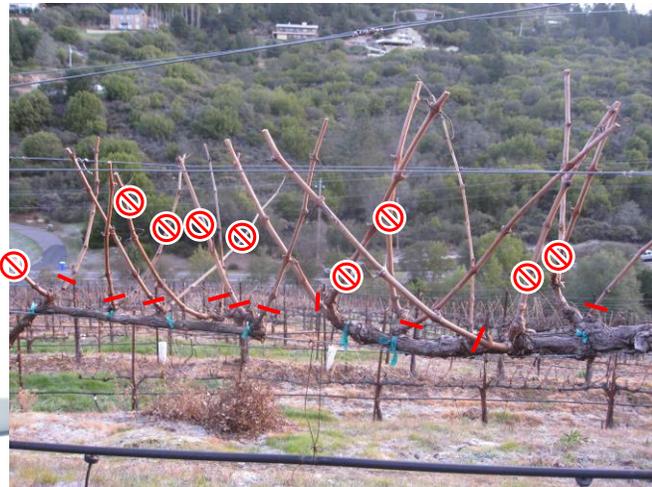
# Pruning (first pass of the season)

- Cane + head (no cordons) (aka guyot)
  - # canes and how long
- Spurs + cordons
  - Typically 2-bud spurs (1 bud for relaxed VSP)





# Pre pruning vs Mechanical pruning



# Shoot thinning and suckering



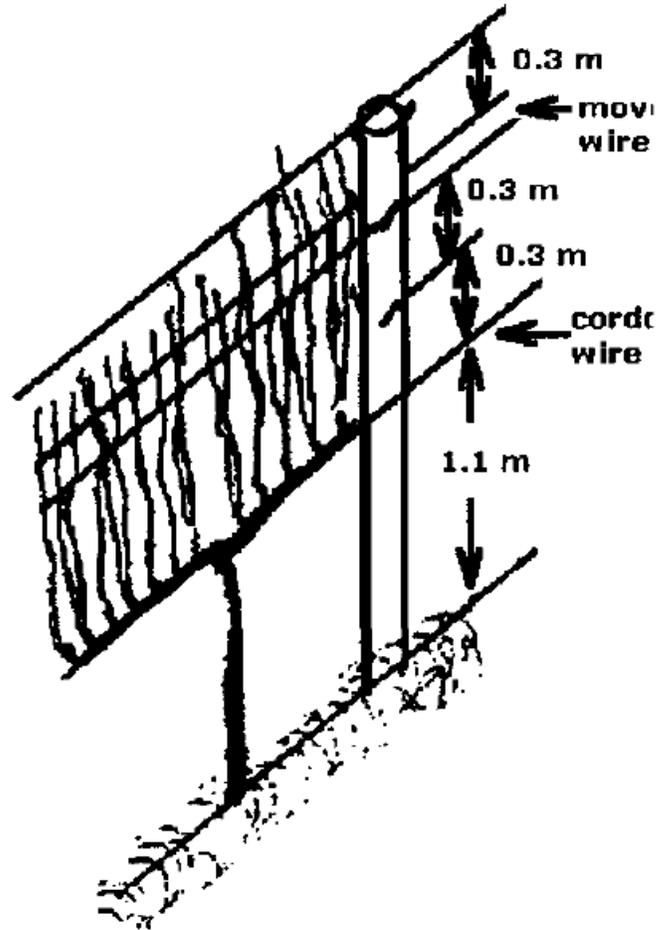
# Shoot thinning

- Growth starts with bud break (Late march-April)
- Each spur was pruned to “2 buds” but we may have 6-8 shoots
- Second pass of the season: 2-3 weeks after crews are sent.  
Wires down if they are up
- Do it too early and new shoots may appear, too late and shoots may be too hard. Risk of damage to the arm

# Shoot positioning (3<sup>rd</sup> major pass)

- When? 50-80% of total shoot length reached (May-June).  
Shoots are long enough to be fixed by wires but tendrils are soft
- May be as simple as putting up the wires (low/mid vigor VSP with strong up-ward growth habit)
- Some systems need to be tied  
(Relaxed VSP in Oakville: lot of work)
- It may be none at all

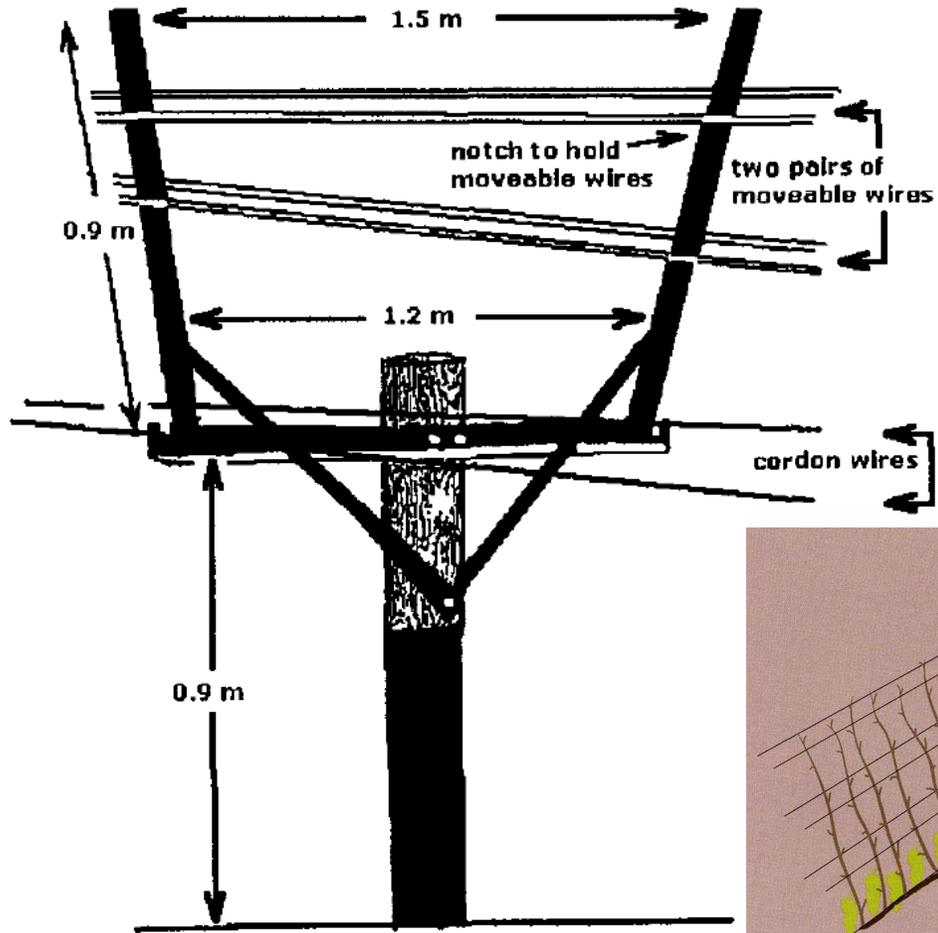
# Shoot positioning: Moveable Wires



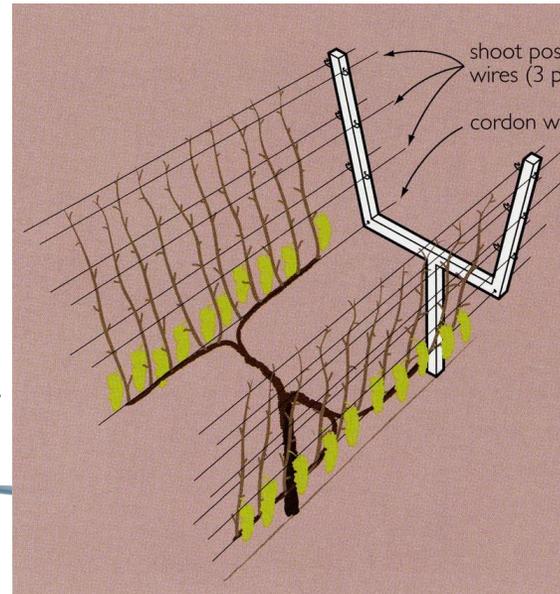
**Vertical Shoot Position  
(VSP)**

Kliewer et al., 1998

# Shoot positioning: Moveable Wires



**Lyre Trellis**



No wire positioning

There may be wires



Shoot between two wires



# Shoot positioning (3<sup>rd</sup> major pass)

- When? 50-80% of total shoot length reached (May-June). Shoots are long enough to be fixed by wires but tendrils are soft
- May be as simple as putting up the wires (low/mid vigor VSP with strong up-ward growth habit)
- Some systems need to be tied (Relaxed VSP aka V-trellis in Oakville: lot of work)
- It may be none at all

# Hedging (mechanized)

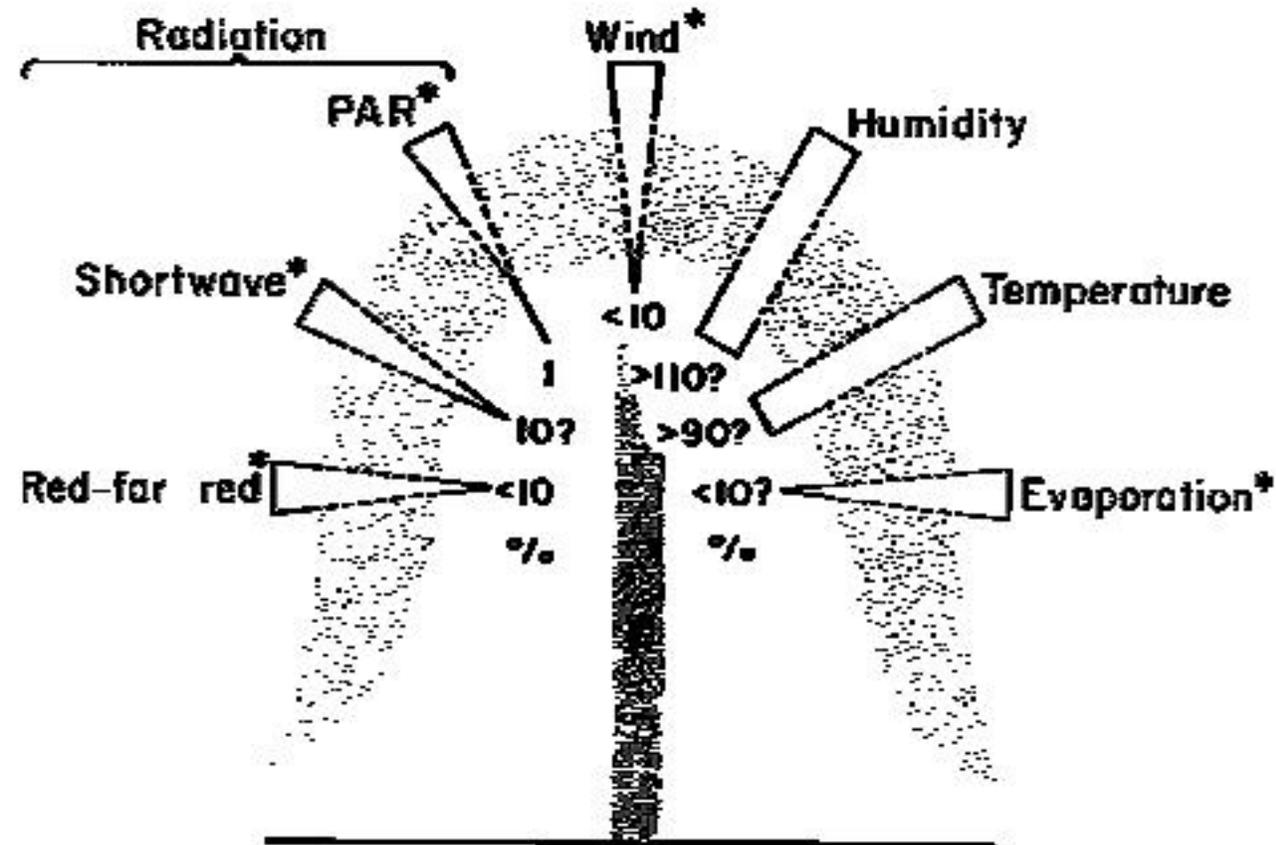


[www.pallenc.com](http://www.pallenc.com)



- When? ~100% of total shoot length reached (June).
- Done at the time can control vigor
- Why? ...looks pretty :-P
- Homogenization

# Relative differences in microclimate in a dense canopy



Do we stil need to manage?

# Leaf removal

- What cases? VSP, only one side...north or east, never south aspect in warm/hot climate
- When? From fruit set to veraison
- When not to? Early in the morning of a hot day. Check for heat waves. Grapes need acclimation!
- Why? Fruit has more light, temperature less humidity  
→ Better ripening, less incidence of fungal diseases

# By hand, but normally mechanized



Pneumatic leaf remover

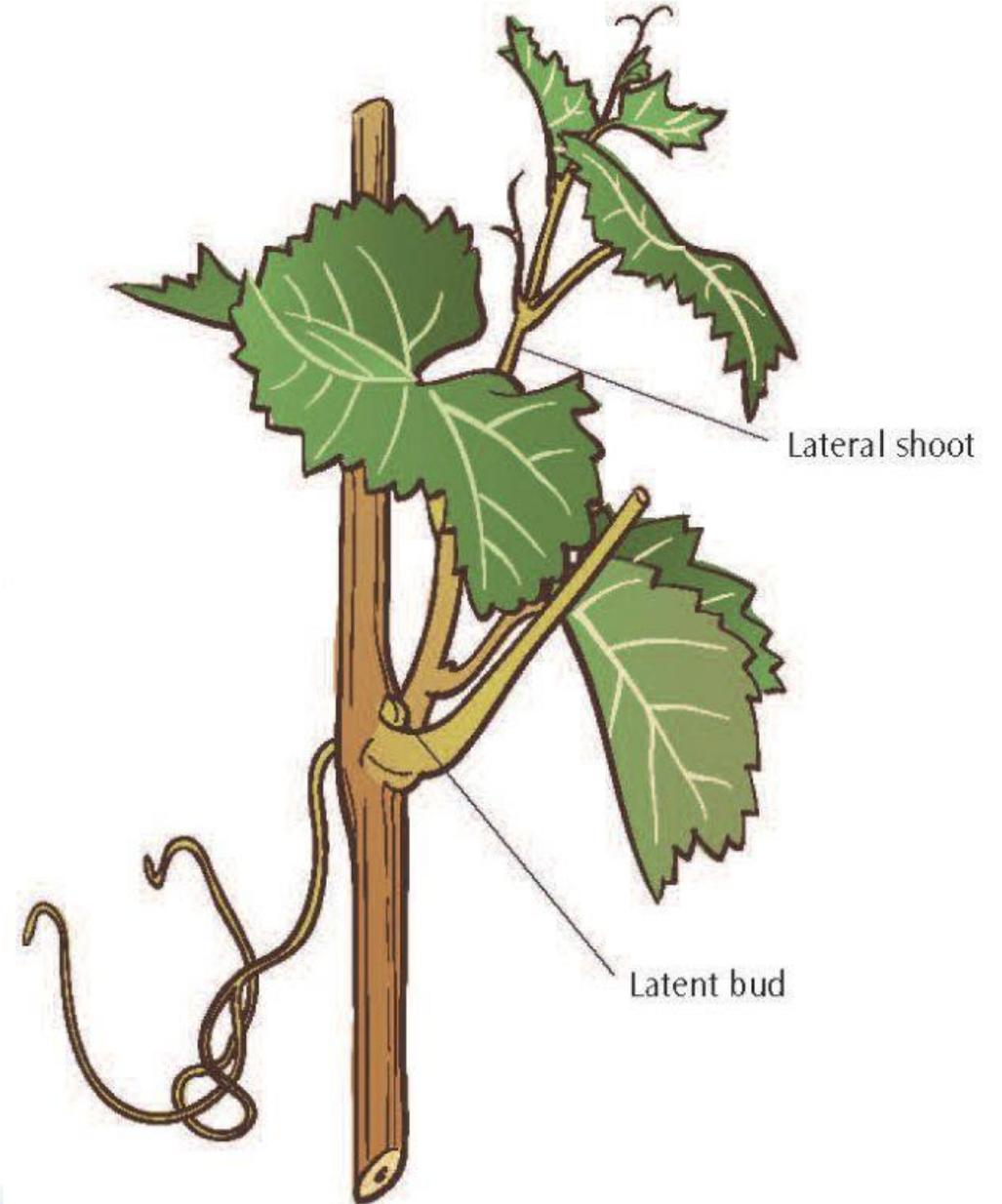


Longer leaves and shoots get hedged

Leaves around the clusters get gently sucked

# And/or lateral removal (always manual work)

- It can be combined to leaf removal
- Can be done in head trained
- Helps thicken the shoots

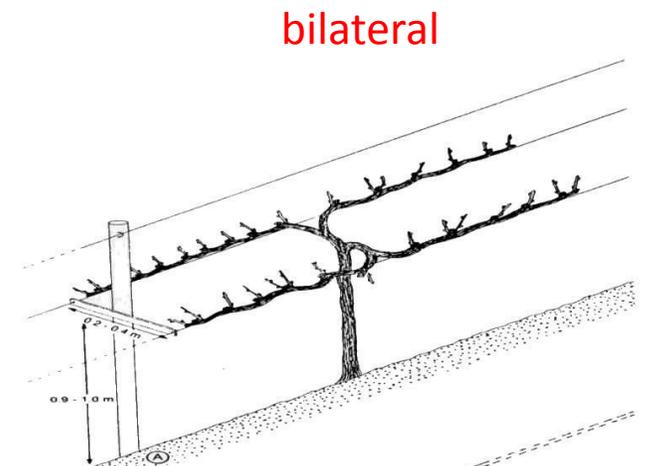
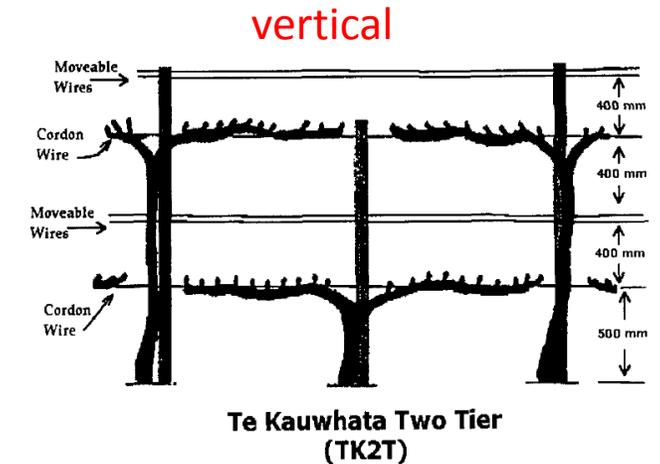


# Let's look at some numbers

Systems with two cordons per linear row

Parameter	Trellis-Training System					
	Vertical	Scott-Henry	TK2T	GDC	Lyre	V-trellis
# Shoots/vine	27.3	34.8	46.3	45.3	46.8	49.7
# Shoots/m canopy	14	9.1	12	11.8	12.3	13.2
Shoot length (cm)	130	142	102	120	103	136
# Nodes/shoot	24	25.5	20.2	23.8	21.3	25.2
Internode length (cm)	5.3	5.5	5	5.1	4.9	5.3
Primary leaf area/shoot (cm <sup>2</sup> )	2280	2470	1790	2120	1810	2380
Lateral leaf area/shoot (cm <sup>2</sup> )	1050	1190	610	900	600	950
Lateral leaf area (%)	28.5	30.5	24.5	28.7	23.9	27
Total leaf area/vine (m <sup>2</sup> )	8.4	11.6	10.7	13.2	11	15.8
Total leaf area/m canopy (m <sup>2</sup> )	4.72	3.2	2.9	3.52	2.98	4.51
Leaf area/g fruit (cm <sup>2</sup> /g)	14.4	15.9	11.9	13.1	11.2	15.5
Pruning weight (kg/vine)	1.58	2.04	1.74	1.99	1.73	2.51
Pruning weight/m row (kg/m)	0.89	1.17	0.99	1.08	0.97	1.43
Pruning weight/m canopy (kg/m)	0.89	0.59	0.5	0.54	0.48	0.72
Yield: pruning weight ratio	4.9	4.9	6.4	7	7.4	5.8
Shoot weight (g)	64	64	40	44	38	53

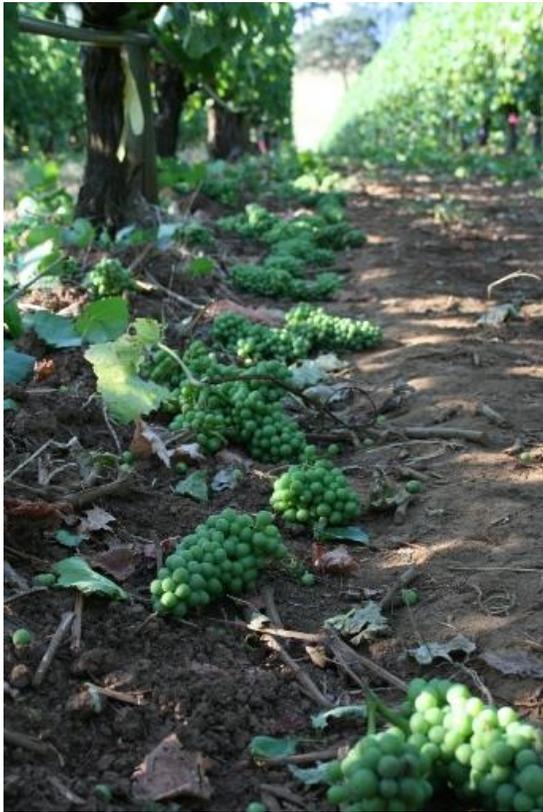
Data represents the average of three in-row vine spacings (1m, 2m and 3m) and two rootstocks (11039-16) for three years, 1993 through 1995. (1m, 2m and 3m)



**So you have a canopy...**



# Crop load



Why do we want to loose yields?  
Vine balance

# Purposes of cluster thinning

- Accelerate ripening and/or reduce berry size

When? 2 passes are normal

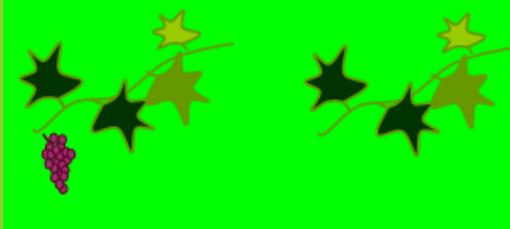
- After fruit set
- Veraison

## Remarks

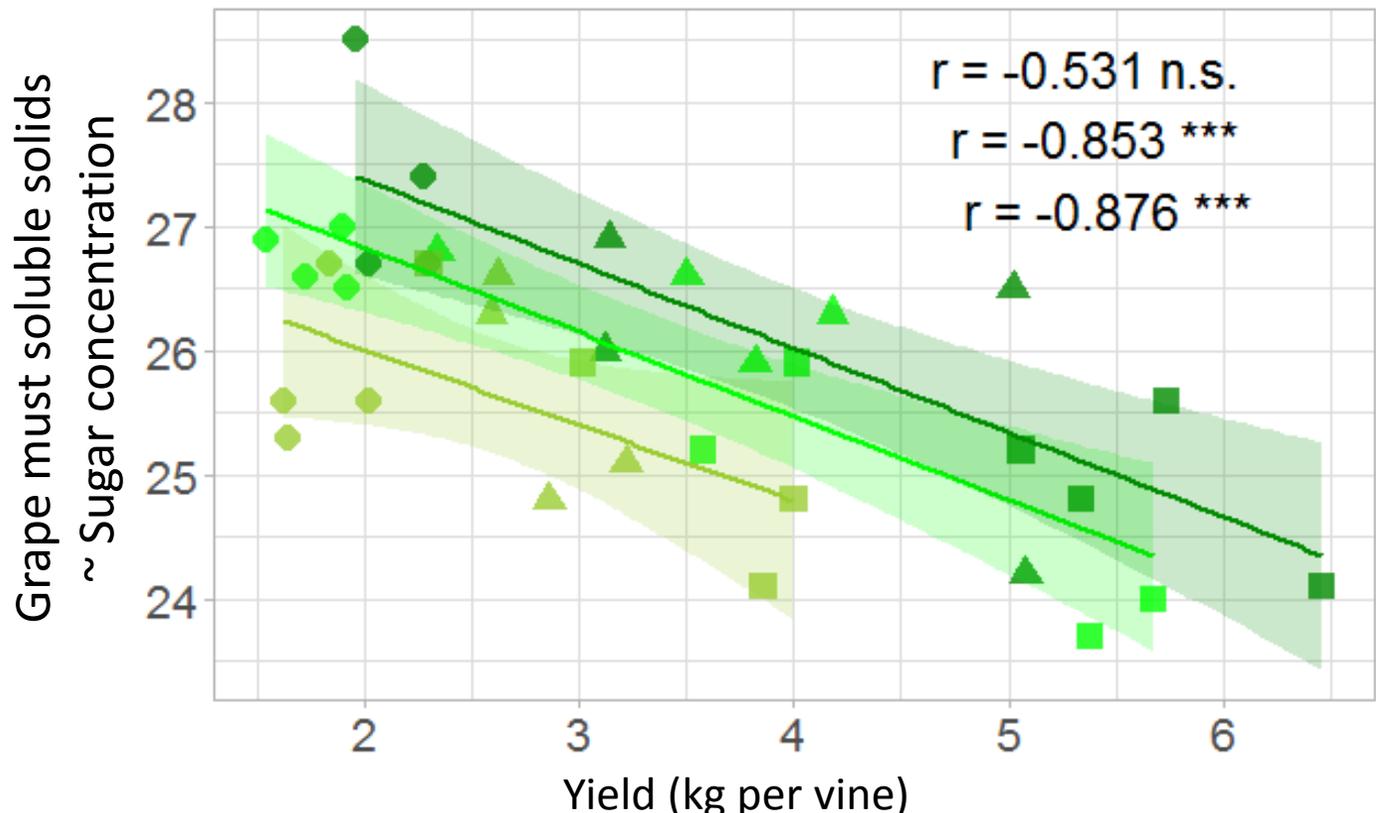
- Cluster thinning delayed to veraison to control berry size (or ripening)
- Cluster thinning delayed to mid ripening
- Some systems go for max yields and do not thin (provide big canopy and K)

# Experimental Design

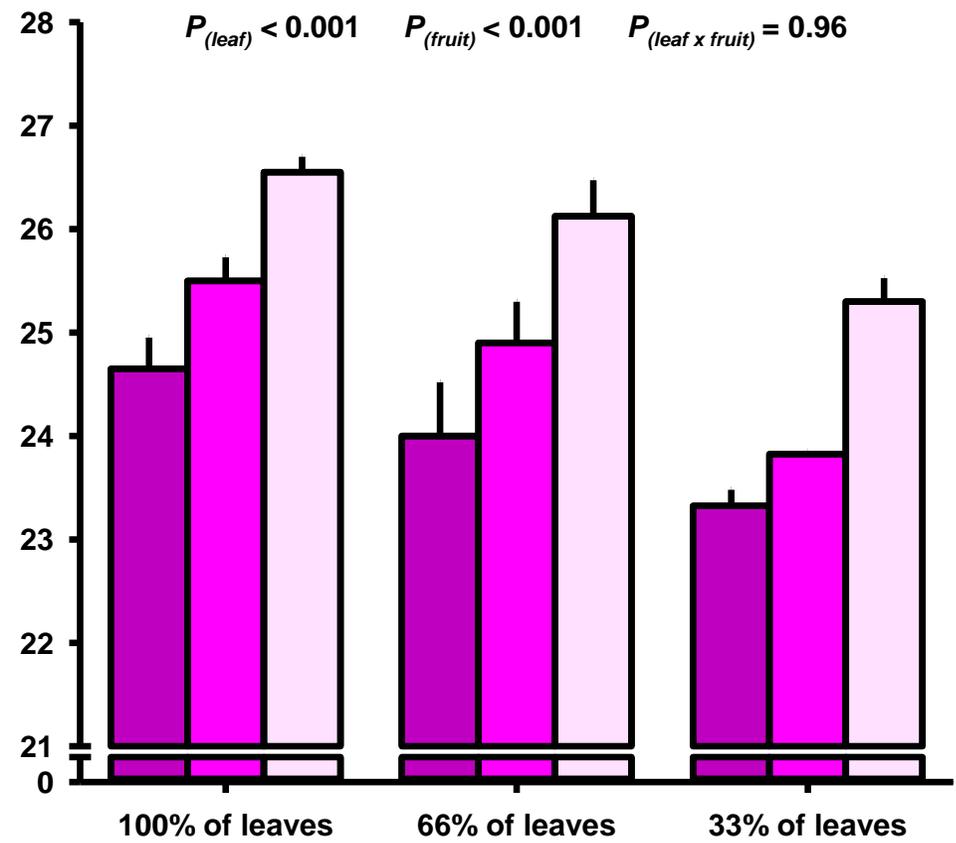
Pre treatment: laterals removed and vines adjusted to 22 shoots per vine in 6m

	33% of fruit 	66% of fruit 	100%: ~45 clusters 
33%: 2/3 of leaves removed 			
66%: 1/3 of leaves removed 			
100%: No leaf removal 			

# Effect of cluster thinning

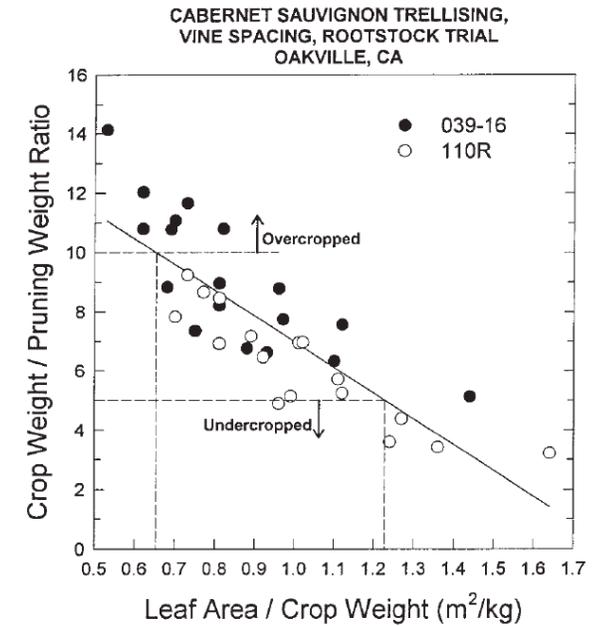
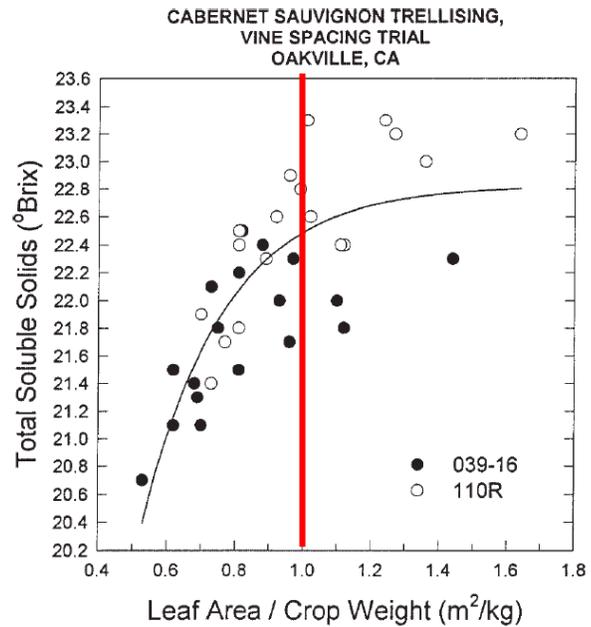
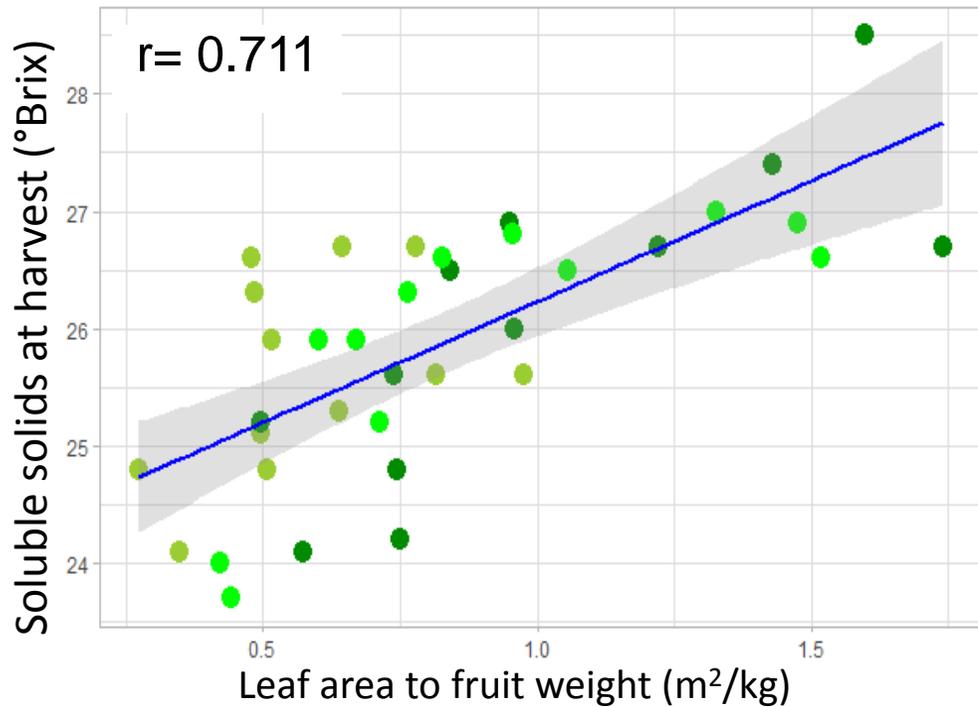


- 100% of leaves    ▲ 100% of fruit
- 66% of leaves    ■ 66% of fruit
- 33% of leaves    ● 33% of fruit



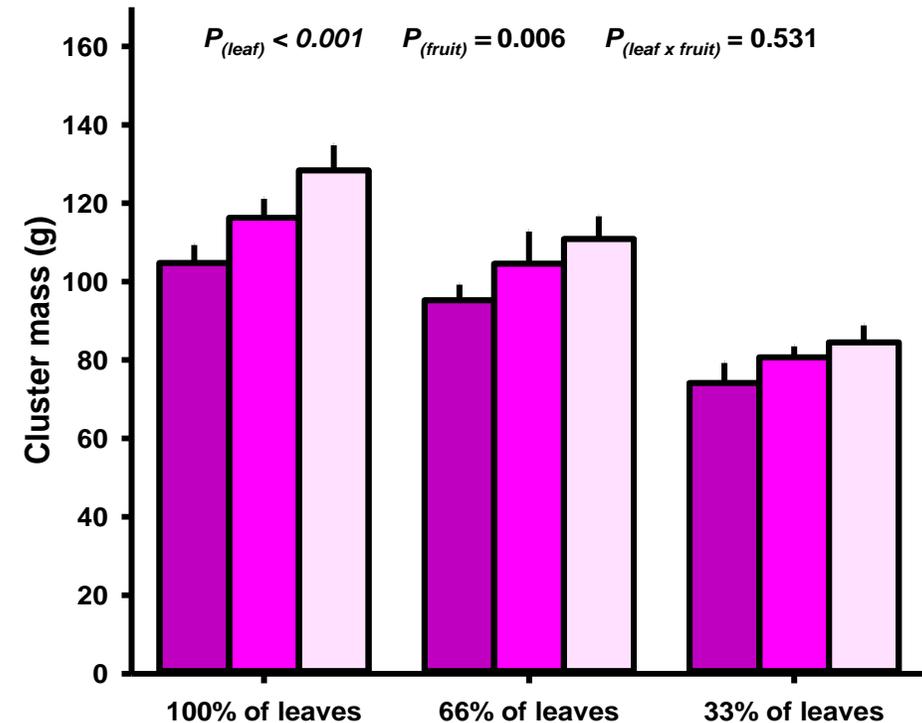
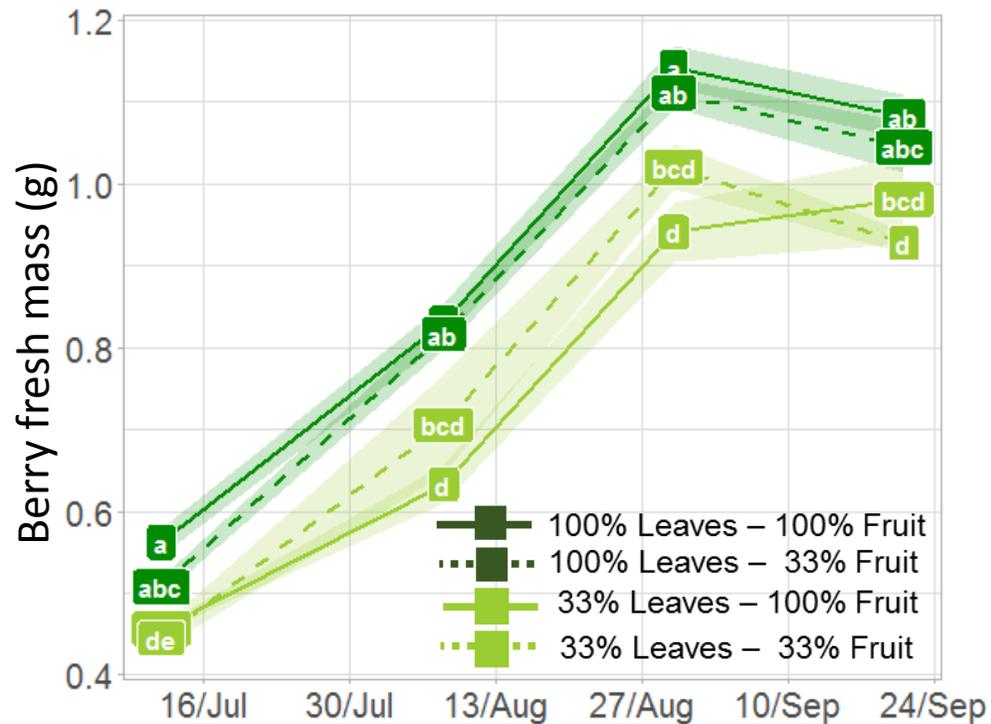
- 100% of fruit
- 66% of fruit
- 33% of fruit

# Proportion leaves: fruit determines ripening speed



Kliewer and Dokoozlian (2005)

# Doing all the thinning at fruit set increases berry size



# Some more practical numbers

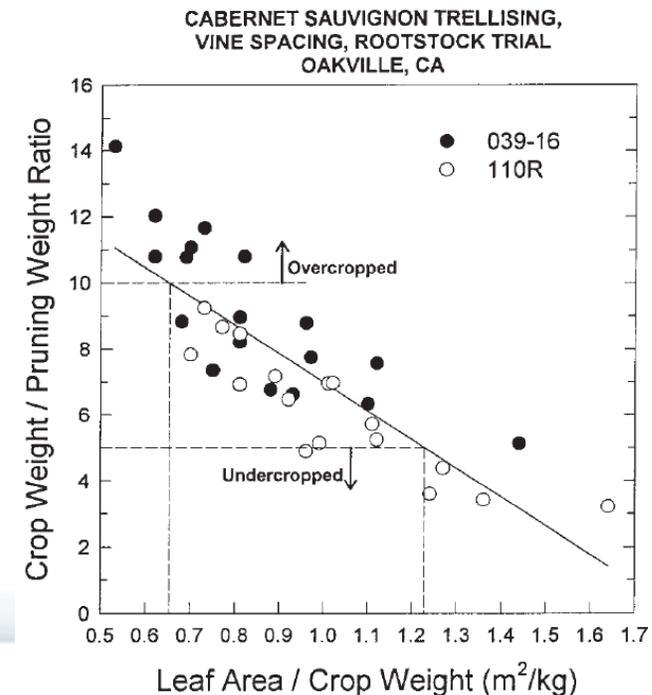
## # leaves and clusters (example)

- 2 m in row spacing per vine
- 350 leaves in main shoots (100%)
- 24 shoots
- 33 clusters
- 10-12 leaves per cluster

- Cool climates may need more
- White varieties: higher yields with same canopy

## lbs fruit/lbs pruning wood weight

- <5 underpropped
- 5-10 adequate
- >10 over cropped



# Vine balance: Fruit to pruning wood ratio

- Weight the fruit at harvest
- Weight all the shoots collected after pruning
- Do it on few vines keeping track which vines



# Let's look at some numbers

Parameter	Trellis-Training System					
	Vertical	Scott-Henry	TK2T	GDC	Lyre	V-trellis
# Shoots/vine	27.3	34.8	46.3	45.3	46.8	49.7
# Shoots/m canopy	14	9.1	12	11.8	12.3	13.2
Shoot length (cm)	130	142	102	120	103	136
# Nodes/shoot	24	25.5	20.2	23.8	21.3	25.2
Internode length (cm)	5.3	5.5	5	5.1	4.9	5.3
Primary leaf area/shoot (cm <sup>2</sup> )	2280	2470	1790	2120	1810	2380
Lateral leaf area/shoot (cm <sup>2</sup> )	1050	1190	610	900	600	950
Lateral leaf area (%)	28.5	30.5	24.5	28.7	23.9	27
Total leaf area/vine (m <sup>2</sup> )	8.4	11.6	10.7	13.2	11	15.8
Total leaf area/m canopy (m <sup>2</sup> )	4.72	3.2	2.9	3.52	2.98	4.51
Leaf area/g fruit (cm <sup>2</sup> /g)	14.4	15.9	11.9	13.1	11.2	15.5
Pruning weight (kg/vine)	1.58	2.04	1.74	1.99	1.73	2.51
Pruning weight/m row (kg/m)	0.89	1.17	0.99	1.08	0.97	1.43
Pruning weight/m canopy (kg/m)	0.89	0.59	0.5	0.54	0.48	0.72
Yield: pruning weight ratio	4.9	4.9	6.4	7	7.4	5.8
Shoot weight (g)	64	64	40	44	38	53

Data represents the average of three in-row vine spacings (1m, 2m and 3m) and two rootstocks (1039-16) for three years, 1993 through 1995. (1m, 2m and 3m)

# Duplicating the cordons to increase yields with low impact on vine balance and quality

Trellis system	Crop yield (mt/ha)	Shoots/vine (no.)	Clusters/shoot (no.)	Cluster/vine (no.)	Berries/cluster (no.)	Berry wt (g)	TSS (°Brix)
Vertical	9.9	27	1.75	47	123	1.34	23.3
Scott-Henry	12.8	35	1.86	66	108	1.33	22.8
TK2T	15.3	46	1.63	75	116	1.3	22.6
GDC	15.9	45	1.71	76	122	1.28	23.1
Lyre	16.8	47	1.66	80	125	1.24	22.6
V-trellis	18.6	50	1.63	79	131	1.3	22.7

# How is done commercially (even more practical)

- 1<sup>st</sup> pass (after berry set):
  - If 3 clusters per shoot: remove the upper. Misshaped (round), lagged, lower quality...
  - Excessive thinning can lead to big berries
- 2<sup>nd</sup> pass (at veraison):
  - Low/mid vigor premium: One cluster per shoot
  - Big canopies (>5ft shoots) can support 1.5 or 2 clusters per shoot
  - Veraison helps to spot lagged clusters and remove them

# Questions?

## Characteristics of the Ideal Wine Grape Canopy

Canopy Character	Optimal Value
Shoot density	~ 5 shoots per foot
Shoot length,	15 to 20 nodes
Lateral shoot development	None to very minimal
Growing shoot tip presence	Ideally none
Ratio of leaf area to fruit weight	3 to 8 ft <sup>2</sup> /lb (0.6 to 1.5 m <sup>2</sup> /kg)
Leaf layer number	1-2
Percent exterior leaves	80-100%
Percent exposed clusters	50 to 80%
Cane weight	0.7 to 1.4 oz (20 to 40 g)
Internode length	2.4 to 3.1 in 6 to 8 cm
Pruning weight	0.2 to 0.4 lb/ft (0.3 to 0.6 kg/m)
Ratio of crop weight to pruning weight	5-10