Frost recovery

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UCCE Central Sierra Farm Advisor

El Dorado Grape Growers Association Meeting 4-20-22

Amador WineGrowers Association Meeting 5-2-22

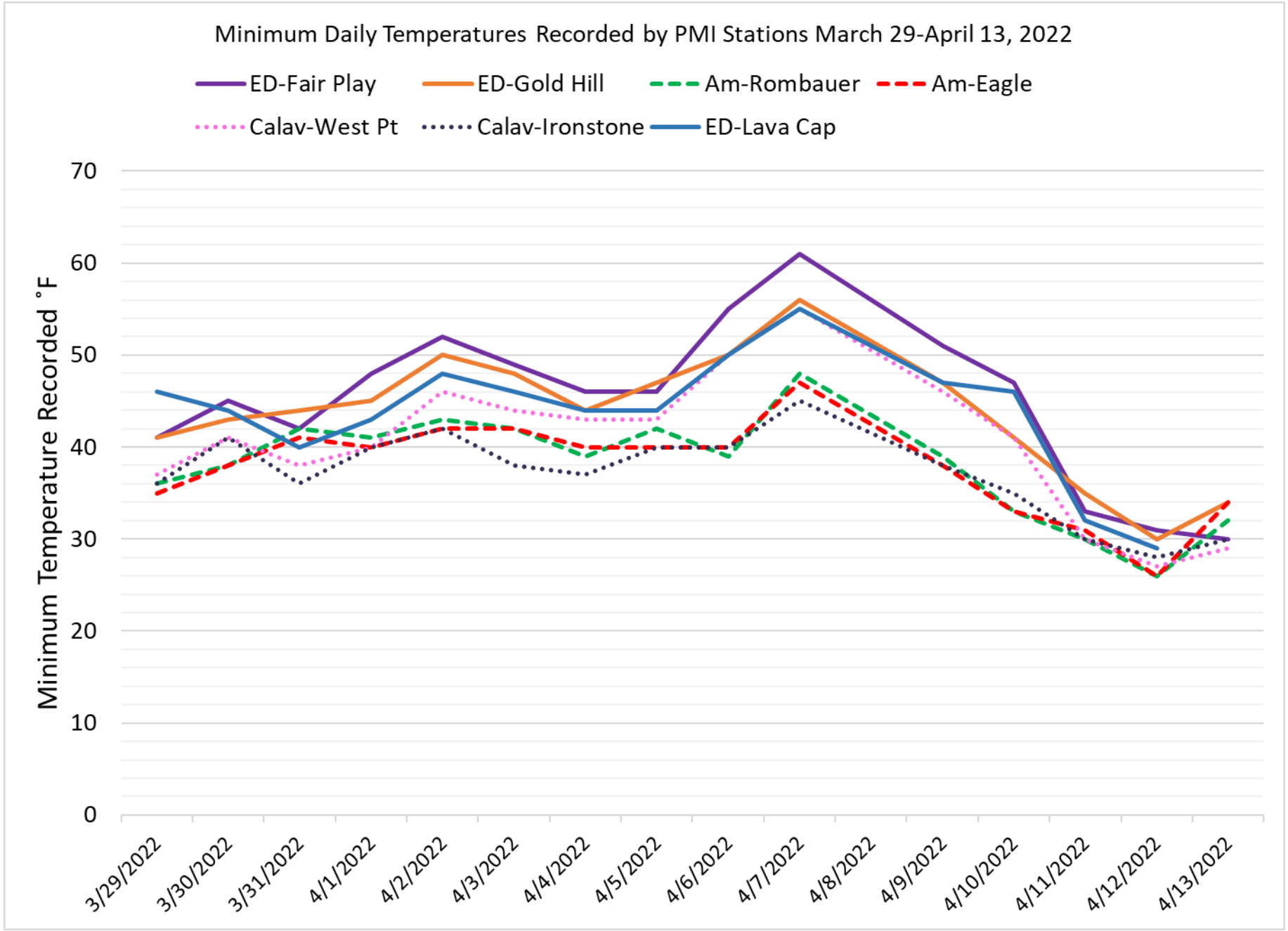
Best Advice I can offer based on research and conversations with colleagues:

Do nothing different.

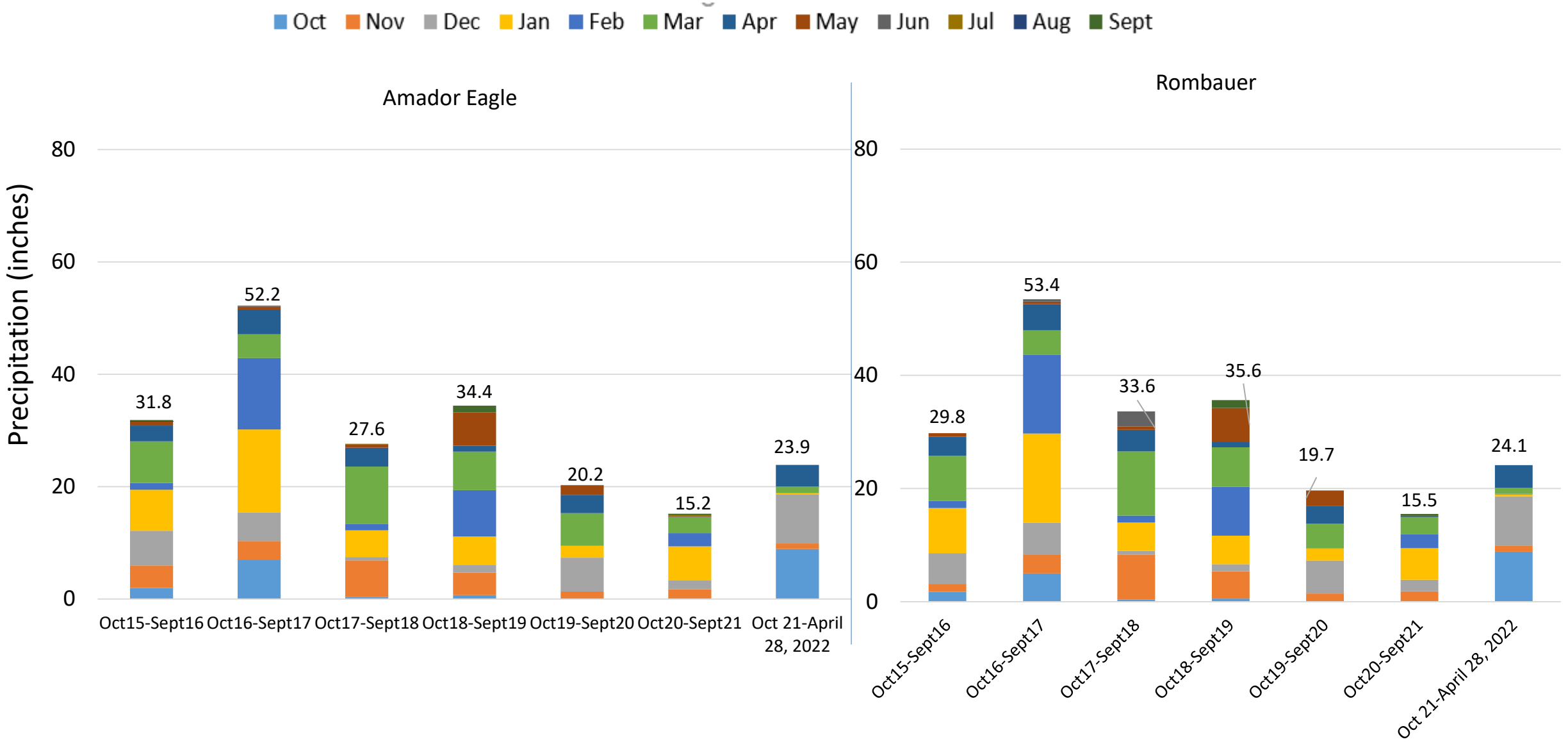
Pruning off dead shoots has shown no advantage in yield recovery and may even decrease potential fruit from secondary and latent buds.

Wait and shoot thin as would normally do, at normal time.

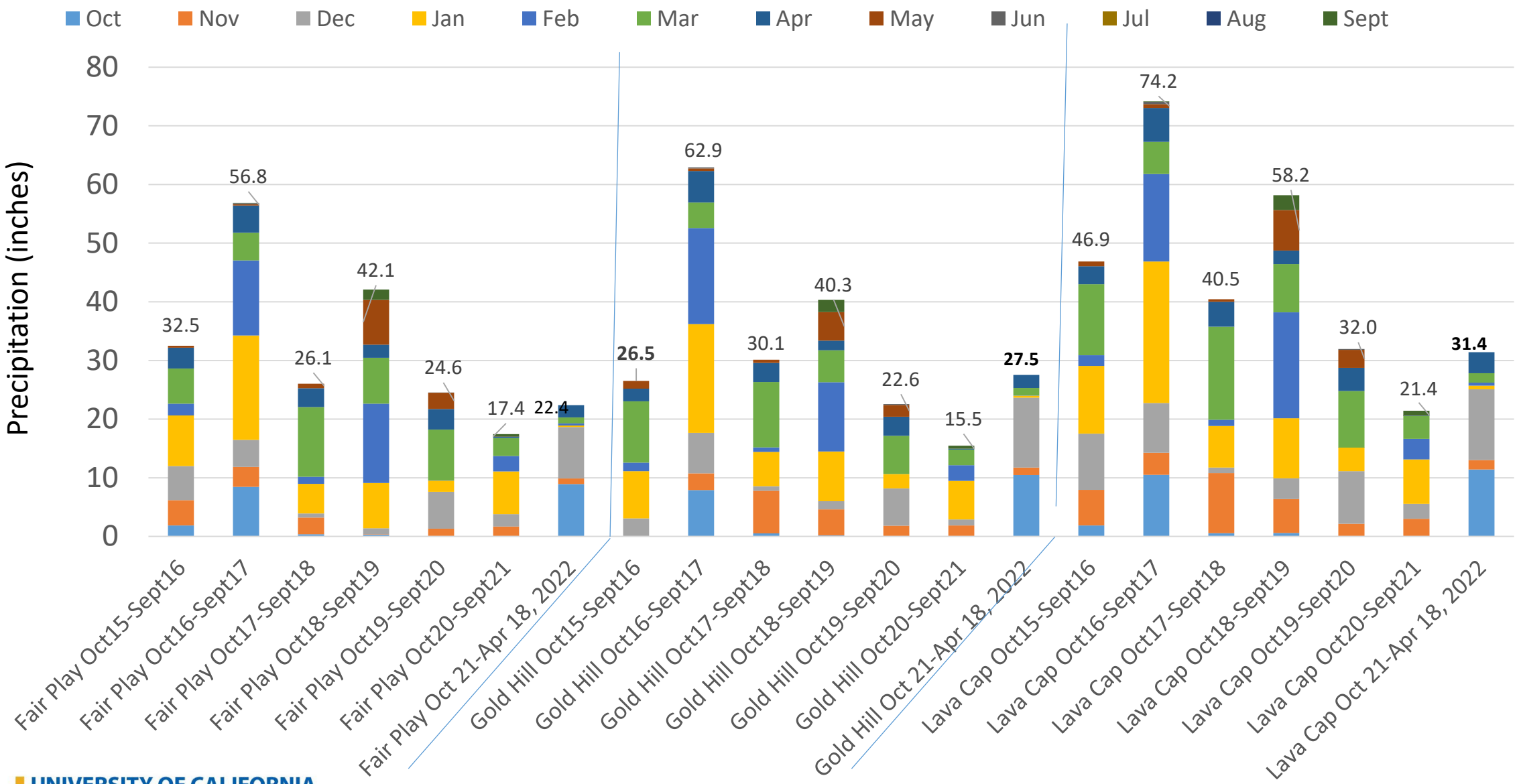
Vineyard Min. Temps
4/14/22
LR Wunderlich



Hydro year totals (inches) by month from Oct 2015 to April 28, 2022 for Amador Eagle and Rombauer Stations



Hydro year totals (inches) by month from Oct 2015 to April 18, 2022 for Fair Play, Gold Hill and Lava Cap Stations



UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources UC Cooperative Extension

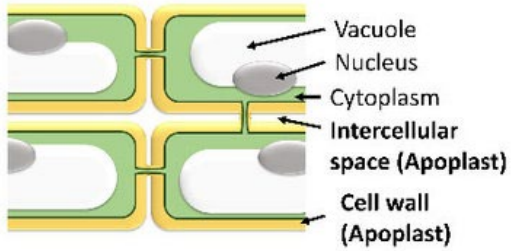
Frost

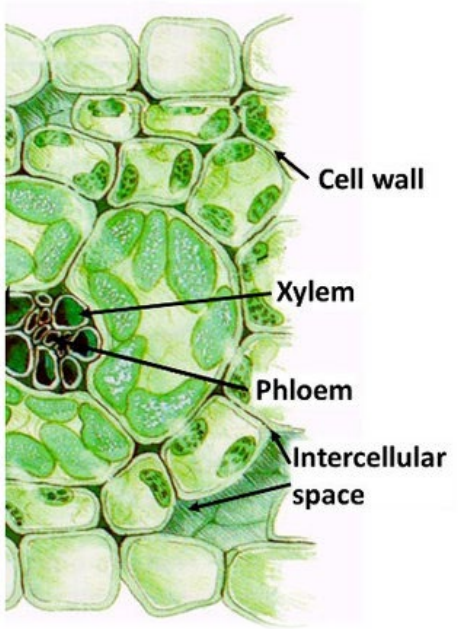
- Damage affected by location and local environment, growth stage (variety), condition of plant and age
- Young more affected than old
- Stressed more affected than healthy
- Different plant parts affected-flowers, leaves, stems more than limbs, trunk

- Process of ice formation
  - Intercellular spaces and cell wall-first, formation of crystals
  - Cellular spaces-water moves, dehydrates

- Role of Ice Nucleating Bacteria (INA bacteria)

  - Cover crops or weeds and INA





An opportunity to learn something more about your site

Critical Temperatures

The values shown below were determined in the laboratory and have not been checked extensively against field injury. These values are distributed as a guide for frost sensitivity of grapevines.

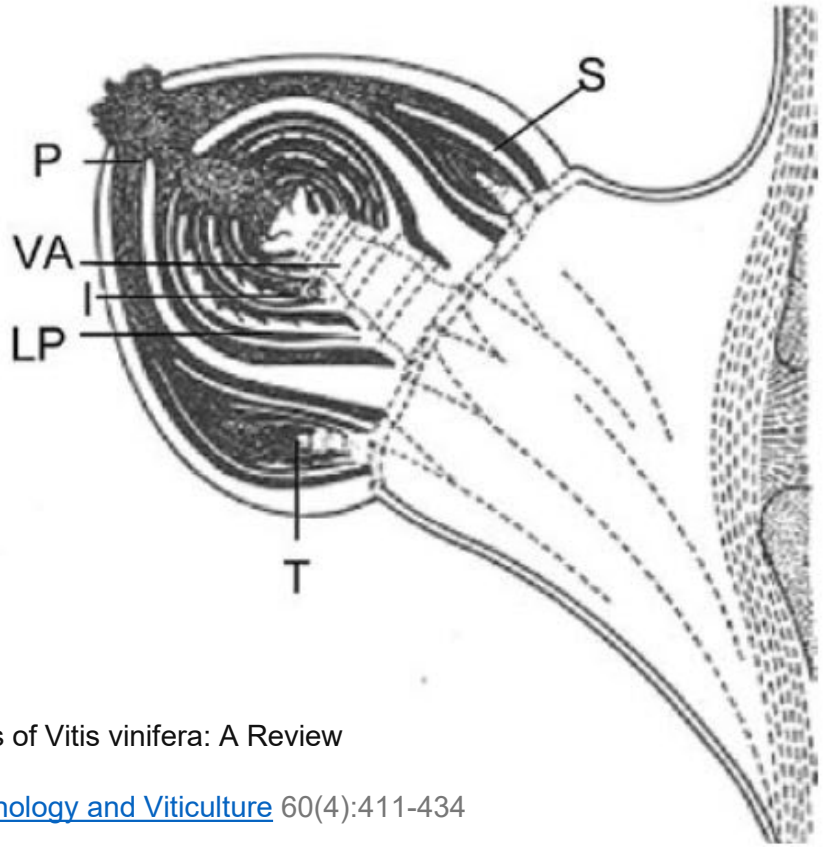
STAGE OF DEVELOPMENT DEFINITION		CRITICAL TEMPERATURES (°F)	
Stage	Description	T10	T90
Dormant	Closed bud, inactive.	<0	<0
First Swell	Buds increase in size, scales separate to show brown, fuzzy, young leaf tissue.	13	-3
Full Swell	Bud swells further, young leaves become pink. Still closed around growing point.	21	10
Bud Burst	Young Leaves separate at tip to show the growing point.	25	16
1st Leaf	First leaf is out of the bud, makes right angle with stem.	27	21
2nd Leaf	2nd leaf makes right angle with stem.	28	22
3rd Leaf		28	26
4th Leaf		28	27
5th Leaf		28	27

*Critical temperatures for 10 percent (T10) and 90 percent (T90) kill of primary buds.
E. L. Proebsting, V. P. Brummund and W. J. Clore. Washington State University, Prosser.

Some definitions
(from Larry Bettiga, Viticulture Advisor Monterey-Varietal Winegrape Production Short Course)

Bud: a rounded organ at the node of a cane or shoot formed in the axil of the leaf containing undeveloped shoots protected by overlapping scales.

Grape dormant buds (also referred to as latent buds or eyes) are compound in that they include more than one growing point. There are typically 3 growing points, a primary bud between two less prominent secondary buds.



The Flowering Process of Vitis vinifera: A Review
January 2009
American Journal of Enology and Viticulture 60(4):411-434
M. Vasconcelos et.al.

Figure

Caption

Figure 3 Compound grapevine bud immediately before budburst. P, primary bud; S, secondary bud; T, tertiary bud; LP, leaf primordium; I, inflorescence primordium; VA, vegetative axis (from Sartorius 1937).

Some definitions
(from Larry Bettiga, Viticulture Advisor Monterey-Varietal Winegrape Production Short Course)

Basal bud: Buds that develop in the axils of bracts at the base of a shoot. Internodal elongation is minimal so buds appear to be in a whorl around the base of the shoot or cane.

Count buds: Number of dormant buds on a spur or a cane, not including basal buds. First count bud is separated by ¼ inch or more from the basal buds below. Transitional forms may make it difficult to determine the first count bud.

Latent bud: a bud that has remained dormant for one year or longer, usually source of a water sprout.

Sucker: a shoot arising at or below ground level.

Suckering: Removal of shoots arising at or below ground, but a term often used by growers to include removal of unwanted shoots arising on the trunk.

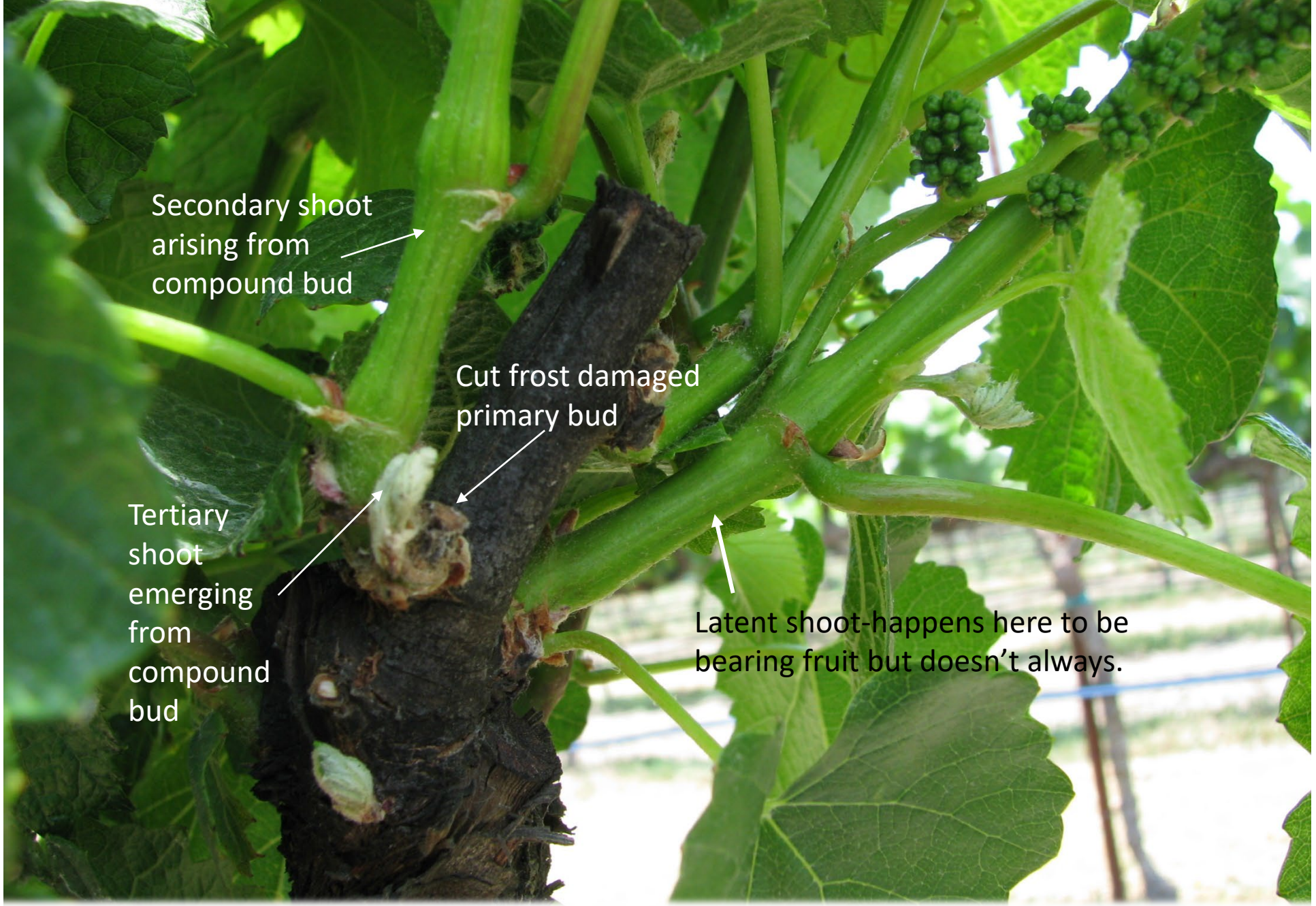
Photo: Rhonda Smith

Frost occurred that year April 20, 2008

This photo was taken May 29.

Note latent basal bud producing fruit.

Photo: Rhonda Smith



Fruit from secondary bud (of compound bud) varies by variety-it is typically smaller and fewer clusters than primary

VARIETY	FRUITFULLNESS OF 2 GROWING POINT*
WHITES	
Chardonnay	low
Chenin blanc	good
Gerwurtztraminer	low
Muscat Canelli	fairly good
Sauvignon blanc	very low
Semillon	low
White Riesling	very low
REDS	
Cabernet sauvignon	good
Merlot	good
Petit Sirah	fairly good
Pinot noir	low
Zinfandel	good

*from Wine Grape Varieties in the North Coast Counties of California, UC publication #4069, by A. N. Kasimatis, Bruce Bearden and Keith Bowers.

Should you try to remove damaged shoots?

"In trials with 'Folle blanche' in the Napa Valley in 1964, Lider (1) found yields after removal of all shoots or just those frost-injured did not differ significantly from yields of untreated control vines. Neither did he find a significant yield response when frost-damaged shoots were removed from 'Cabernet Sauvignon' and 'White Riesling' vines."- Kasimatis and Kissler, 1974

Lider, J. V. Some response of grapevines to treatment for frost in Napa Valley. Amer. J. Enol. Viticult. **16:231-6**

(1965).

Amer. J. Enol. Viticult., **Vol. 25, No. 1, 1974**

RESPONSES OF GRAPEVINES TO SHOOT BREAK-OUT FOLLOWING INJURY BY SPRING FROST

A. N. KASIMATIS and J. J. KISSLER

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Presented at the Annual Meeting of the American Society of Enologists, Del Monte Hyatt House, Monterey, California, June 21-23, 1973.

We gratefully acknowledge the excellent cooperation of San Joaquin County growers who made their vineyards available for this research: Angelo Stagnaro, Bert Ballatore, Leon Kirschenman, Carl Mettler, Mike Gikas, and Don Gallagher. We also thank Ned Vilas, Staff Research Associate, for valuable technical assistance.

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ABSTRACT

The cultivars 'Tokay,' 'Carignane,' 'Zinfandel,' 'Chenin blanc,' and 'Grenache' were used in shoot out by hand and on a second group only frost-damaged shoots were removed. All shoots on con-

Kasimatis and Kissler's treatments:

Treatment A, all shoots broken out;
Treatment B, only frost-damaged shoots broken out;
and Treatment C, control, no shoots broken out.

Removal of all shoots whether injured or not (Treatment A) was used to test whether the growth of secondary growing points was influenced by lack of shoot competition.

1972 frost in S.J. V.: temperatures recorded down to 28˚F

Kasimatis and Kissler, Amer. J. Enol. Viticult., Vol. 25, No. 1, 1974

TABLE 1

Stage of Development and Estimation of Frost Injury to Shoots at Time of Treatment on March 31 1972

Variety	Vineyard location	Shoot length (in.)	% shoots injured
'Carignane' (1)	Manteca	2-4	75-85
'Carignane' (2)	Ripon	1-4	20-25
'Tokay' (1)	Lodi	3-6	30
'Tokay' (2)	Lodi	2-4	60-70
'Zinfandel'	Lodi	2-5	40-50
'Grenache'	Manteca	4-8	95
'Chenin blanc'	Manteca	1-6	99

Kasimatis and Kissler saw no differences in their treatments

TABLE 2

Effect of Shoot Break-out on Cluster Number and Weight and of Yield of Fruit for 3 Vineyards[1]

		VINEYARD								
		'Carignane' (1)			'Carignane' (2)			'Tokay' (1)		
		Treatment			Treatment			Treatment		
		A	B	C	A	B	C	A	B	C
Primary growing points	clusters/vine	4.80*	14.92	13.15	4.27*	13.47	14.40	1.93**	9.20*	11.80
	lb/cluster	.38**	.62	.58	.76	.69	.78	1.42	1.38	1.58
	lb/vine	1.83*	9.19	7.51	3.23*	9.31	11.18	2.74**	12.20*	18.66
Secondary growing points	clusters/vine	3.73	3.53	3.23	1.60	1.67	2.27	1.00	.40	1.20
	lb/cluster	.22	.24	.25	.71	.61	.60	.46	.85	.56
	lb/vine	.83	.86	.82	1.14	1.02	1.36	.46	.34	.67
Basal buds	clusters/vine	27.47	25.46	21.38	9.40	12.87	13.87	11.80	9.33	8.33
	lb/cluster	.33	.40	.37	.67	.58	.69	.95	1.03	.98
	lb/vine	9.19	10.08	7.89	6.27	7.41	9.53	11.16	9.58	8.17
Latent buds	clusters/vine	35.93	49.85	51.92	19.73	20.40	26.47	8.40**	15.60	17.13
	lb/cluster	.31*	.38	.35	.52	.47	.52	.96	1.03	1.09
	lb/vine	11.08*	19.00	18.11	10.32	9.57*	13.81	8.08**	16.94	18.73
Auxiliary buds (Second crop)	lb/vine	1.13	1.51	1.59	1.*8**	2.27*	2.99	2.99	3.03	2.59
Total	clusters/vine	71.93*	93.77	89.69	35.00**	48.40	57.00	23.14**	34.53	38.47
	lb/cluster	.33	.43	.40	.65	.61	.68	1.10*	1.19	1.27
	lb/vine	24.07*	40.65	35.93	22.64**	29.59**	38.87	25.43**	41.19	48.83

* Significant at 95% level.
** Significant at 99% level.
[1] Treatments: A) All shoots broken out, B) Only frost-injured shoots broken out, and C) Control, no shoots broken out.

Amer. J. Enol. Viticult., Vol. 25, No. 1, 1974

Williams, Dokoozlian and Wample, 1994. from “The Handbook of Environmental Physiology of Fruit Crops, Vol. 1. Temperate Crops”

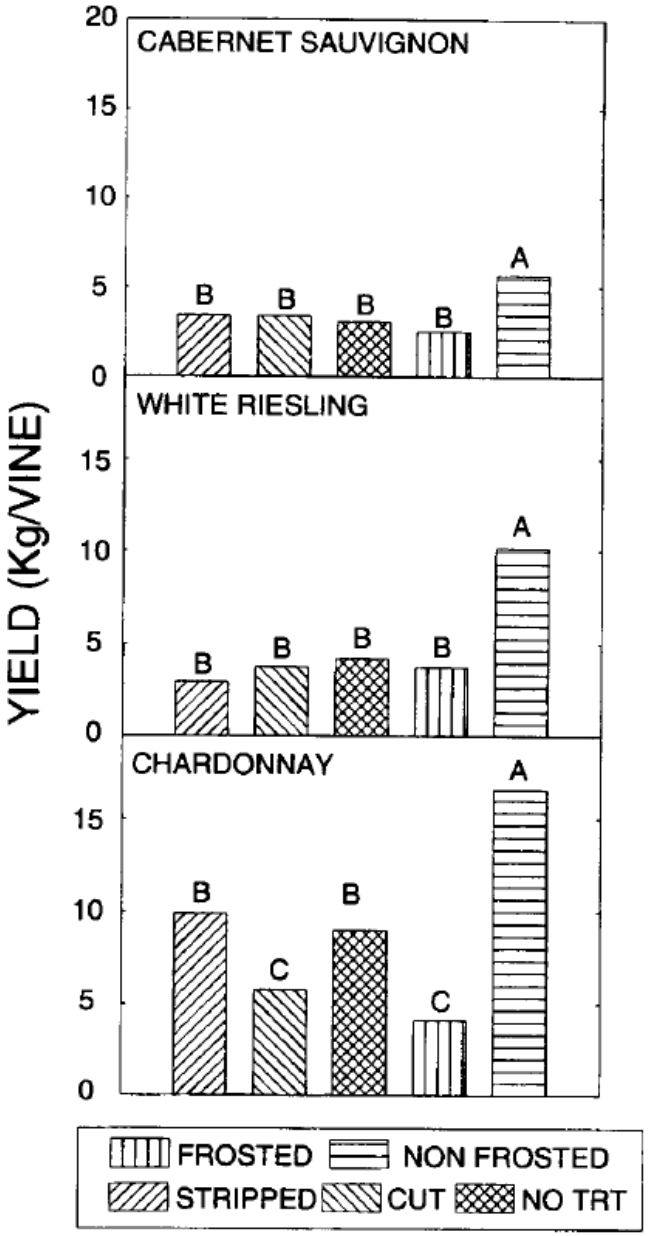


Figure 12 Yield response of ‘Cabernet Sauvignon,’ ‘White Riesling’ and ‘Chardonnay’ vines following spring frost injury during May 1992 in Washington, US. Treatments included removal of the partially frosted shoots by hand (stripped), removal of the frosted portion of the shoot with hand shears (cut), no treatment of partially frosted shoots (no trt), vines that were severely frosted with no additional treatment (frosted), and control (non-frosted) vines. Columns with different letters are significantly different at the p = .05 level or better. (R. Wample, unpublished data.)

Second Crop

Formed on lateral shoots arising from active axillary buds

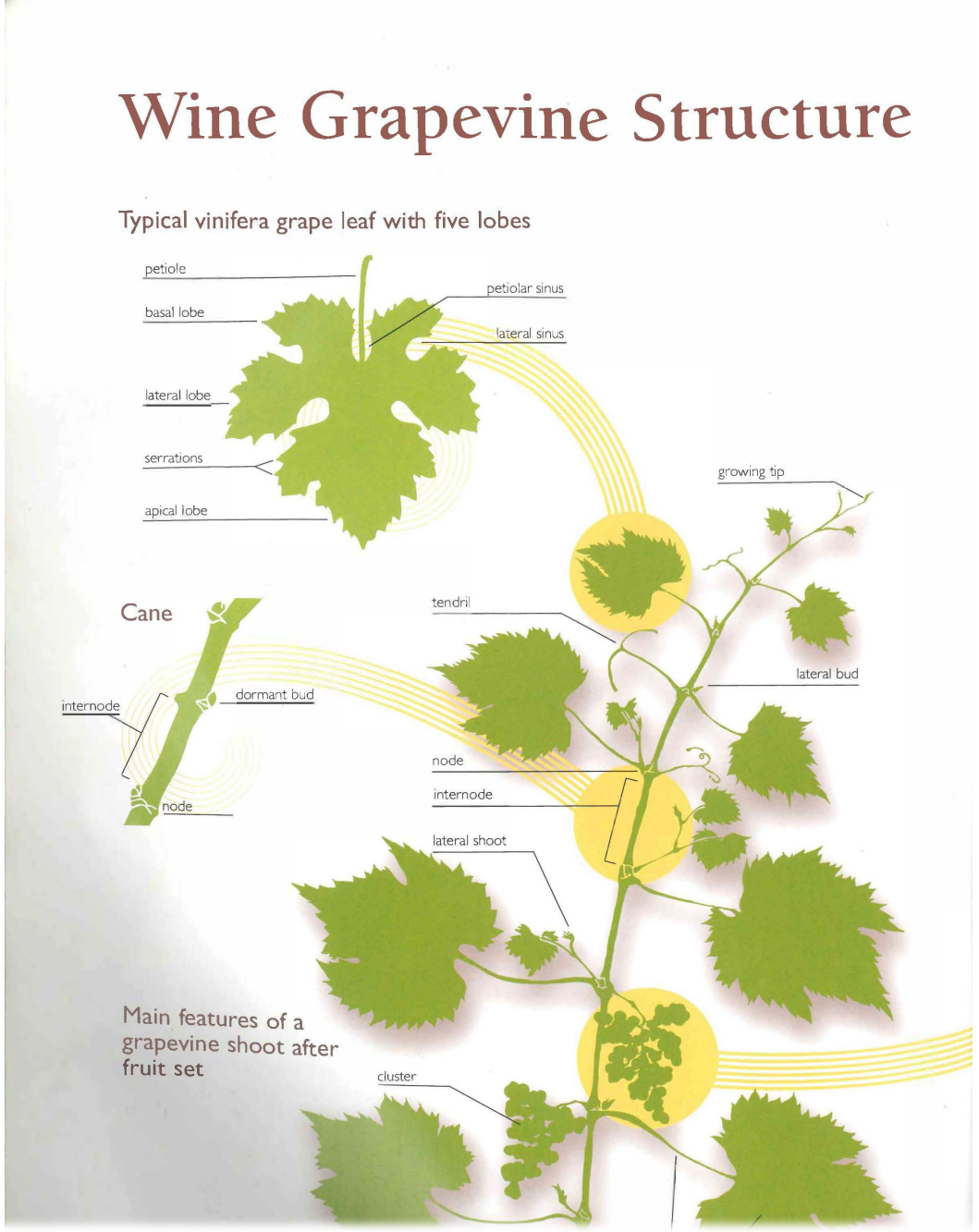
2 types of laterals:

- Woody lateral-can serve like a cane
  - From injured or pinched shoot or horizontal
  - Bear second crop-only some varieties
  - May also produce secondary laterals and third crop (rarely matures)

- Temporary (non-woody)
  - Increase leaf canopy
  - Drop off at end of season

Most varieties do not have good (or any) fruit production from laterals (second crop)

Primary and secondary crop influenced by previous year



Varieties that may have a second crop

- Barbera- “moderate”
- Carignane- “significant”
- Petite sirah- “substantial” in some years
- Gamay- “vigorous vines produce a large second crop”
- Pinot noir- “significant”

- Others?

- Problem with management-ripen later/harvest later than first crop

- Amount of crop varies by year and by variety

Photo: Rhonda Smith

So, 3 possible sources of fruit if primary buds are gone

Secondary buds-arising from compound count bud
rule of thumb is that they produce about 30% of crop that primary would (T. Martinson, Lasko and Bates, Cornell)

Latent buds-non-count buds that emerge from trunks and cordons. Not much information on fruitfulness.

Lateral shoots- (secondary crop).

Previous year management can make a big difference on fruitfulness of *any* bud.

Young vineyards are much more susceptible to frost damage-SERIOUS-than mature vines because they have less non-structural carbohydrate stored, AND they are closer to the ground.

In some cases, even if a small shoot pushes, the damage may be better mitigated by replanting.

No additional N or mineral nutrition, over normal program, is needed.

Photo: Rhonda Smith

Photo: Rhonda Smith

What about disease?

- Continue with your powdery mildew disease control to keep inoculum low for next year, and to protect whatever precious crop you have this year
- Botrytis could be more of an issue-due to dead material left in the vines.
- Botrytis especially in tight clustered varieties, and later ripening varieties, when we have rain, dew or moisture before harvest.
- If it's a dry year-ignore it
- Open canopies will help control
- If you have, important to get a botrytis fungicide in before bunch closure (can double as your last mildew spray)