

NOV 11-13, 2019

SUSTAINABLE AG EXPO
&
**INTERNATIONAL SUSTAINABLE
WINEGROWING SUMMIT**

SAN LUIS OBISPO, CALIFORNIA

Trunk diseases in established vineyards: overview and management

Renaud Travadon
University of California, Davis

Grapevine trunk diseases in mature vineyards

- Dieback type (Eutypa, Botryosphaeria and Phomopsis)
- Wilt type (Esca, Black Measles)



Symptoms of Eutypa, Botryosphaeria and Phomopsis dieback



Dead spur positions



Cankers in cross-sections



Eutypa foliar symptoms

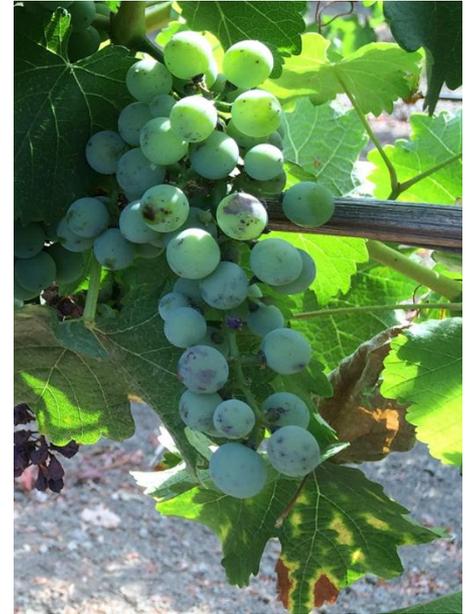
External symptoms of Esca (Black Measles)



Sudden collapse of vine in mid-summer



Interveinal necrosis on leaves



Berry spotting (Black Measles)

Internal symptoms of Esca (Black Measles)



Black spotting of wood in cross sections



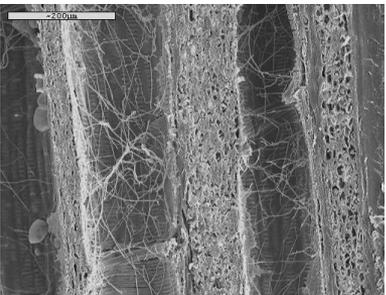
Black streaking of the wood in longitudinal sections



Frequent presence of white rot

Grapevine Trunk Disease cycle (Eutypa)

Photos credit: Mark Sosnowski, Australia



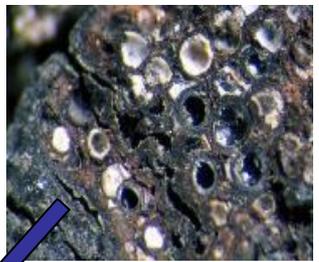
Toxins



Symptomatic vine



Infected wood



Perithecia of wood



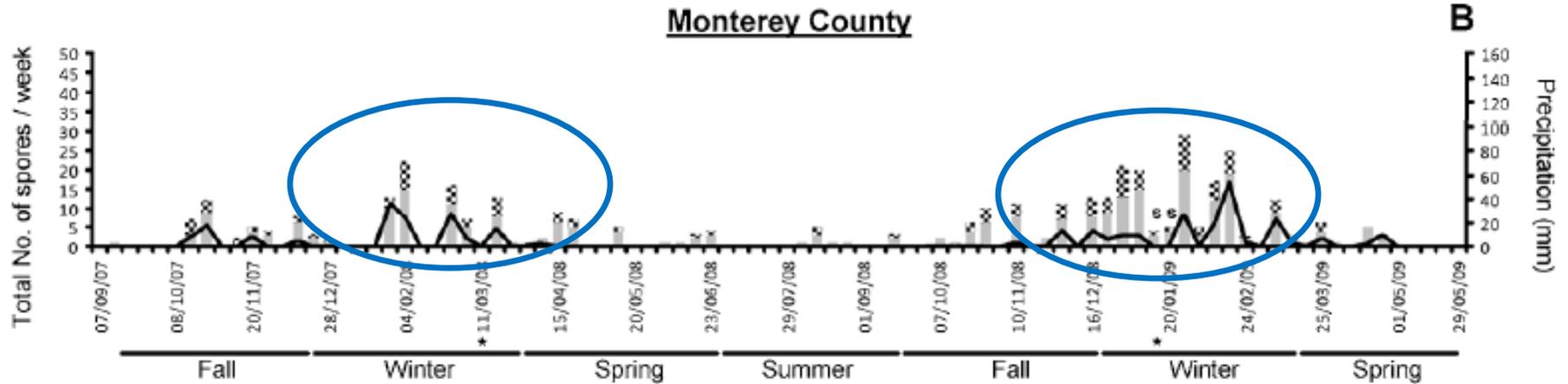
Windborne ascospores



Open wound infection

Infected xylem vessels

Most trunk pathogens spores are released during the rainy season



Botryosphaeria species spore trapping studies in California vineyards. Úrbez-Torres et al., 2010. Plant Disease.

Pruning wound infections



- The rainy season is also the pruning season in California.
- Pruning wound infections in winter are a critical step in the disease cycle of trunk pathogens

Pruning effect on wood necrosis



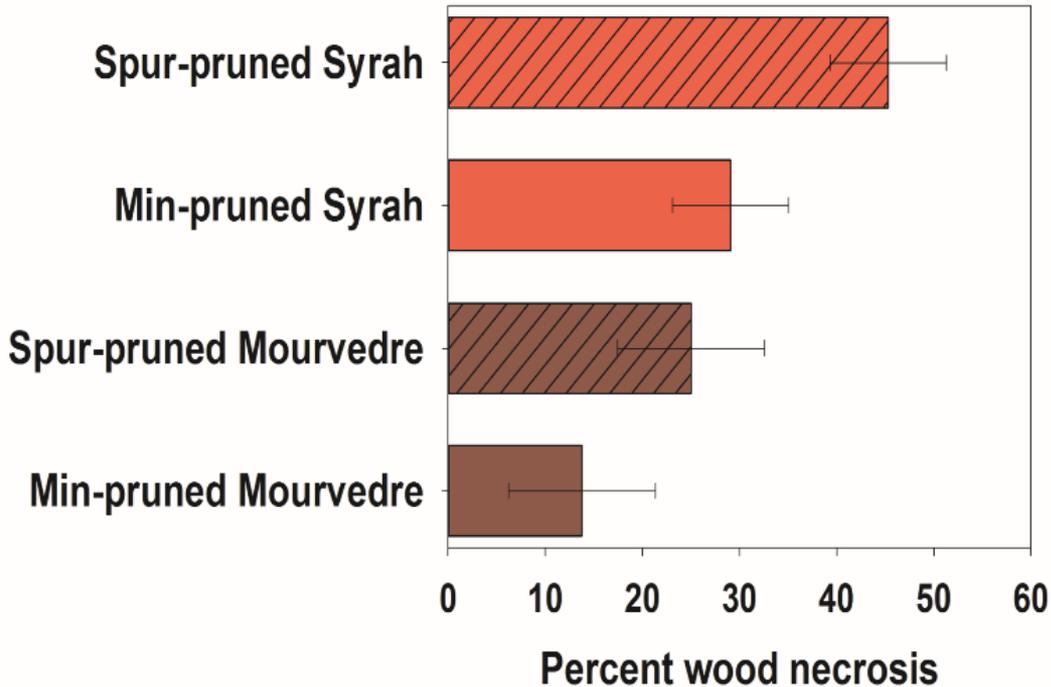
Spur pruning



Minimal pruning

Study conducted at an experimental station in southern France, on cultivars Syrah and Mourvedre.

Pruning effect on wood necrosis



- Spur pruned vines had significantly more wood necrosis than min-pruned vines.

Grapevine pruning systems influence the diversity of wood-colonizing fungi. Travadon et al., 2016. Fungal Ecology.

Pruning wound protection is pivotal for disease management

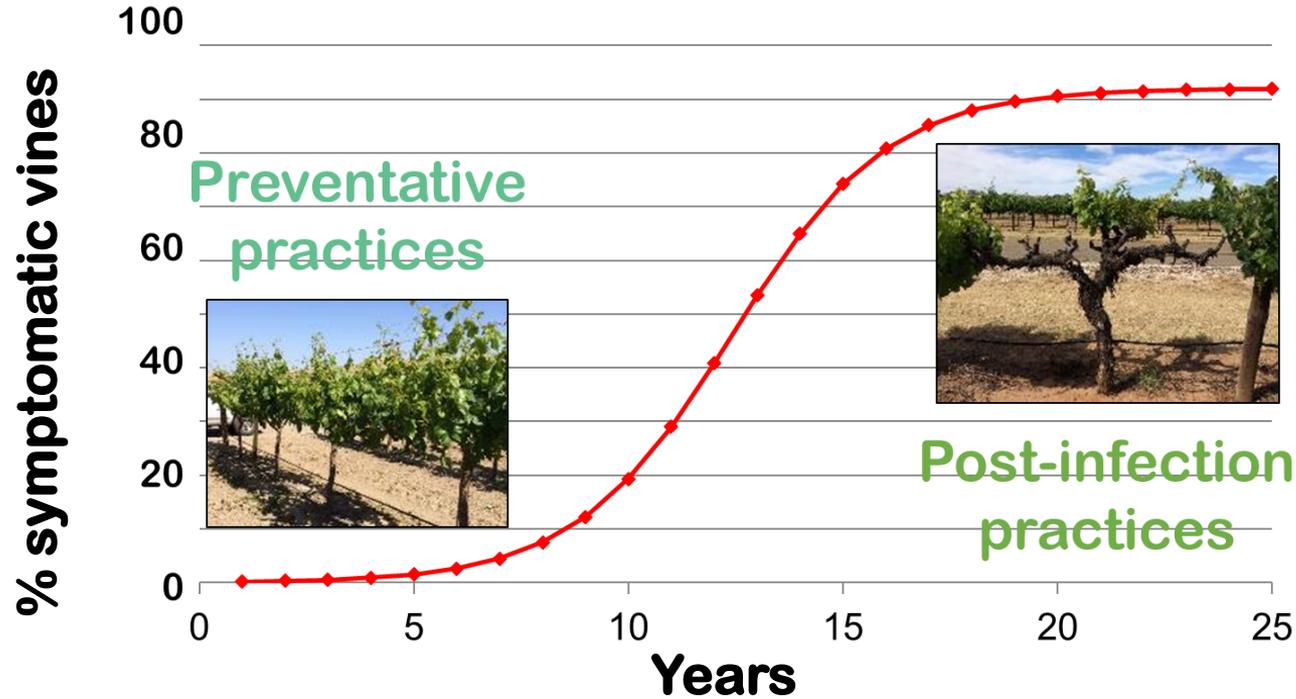


- Each dead spur means fewer clusters per vine

When canopy symptoms such as dead spur positions are visible, the woody structure of the vine may be extensively degraded.

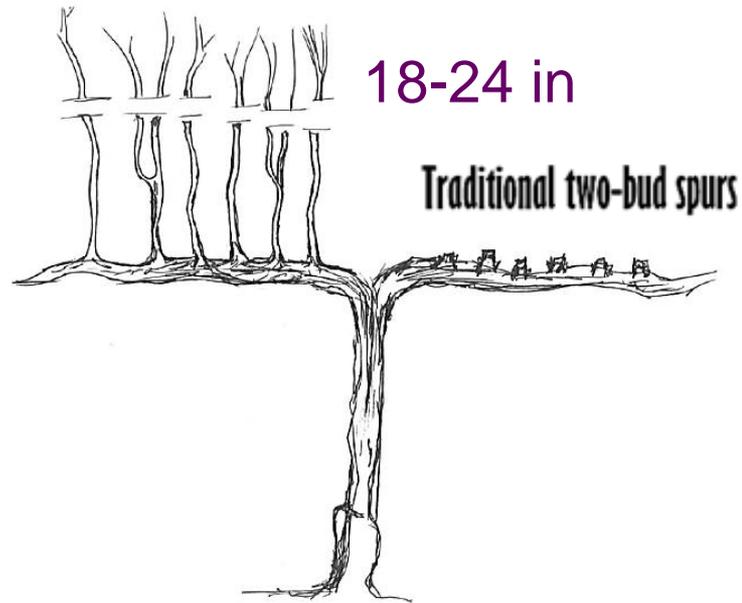


Disease incidence and vineyard age



Duthie et al., 1991, Colombard vineyards ranging from 5 to 34 years old

Preventative practices starting in young vineyards: Double pruning



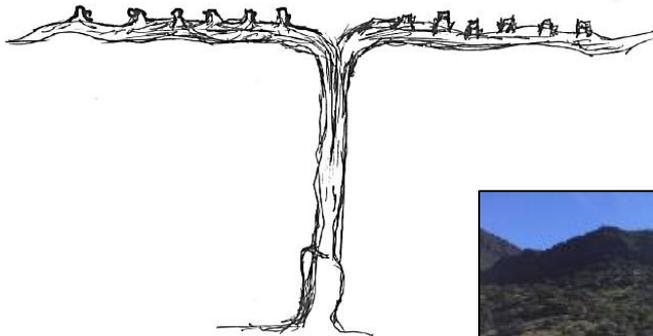
1st pass with mechanical pruner, Oct - Jan



2nd pass by hand

Preventative practices starting in young vineyards: **Delayed pruning**

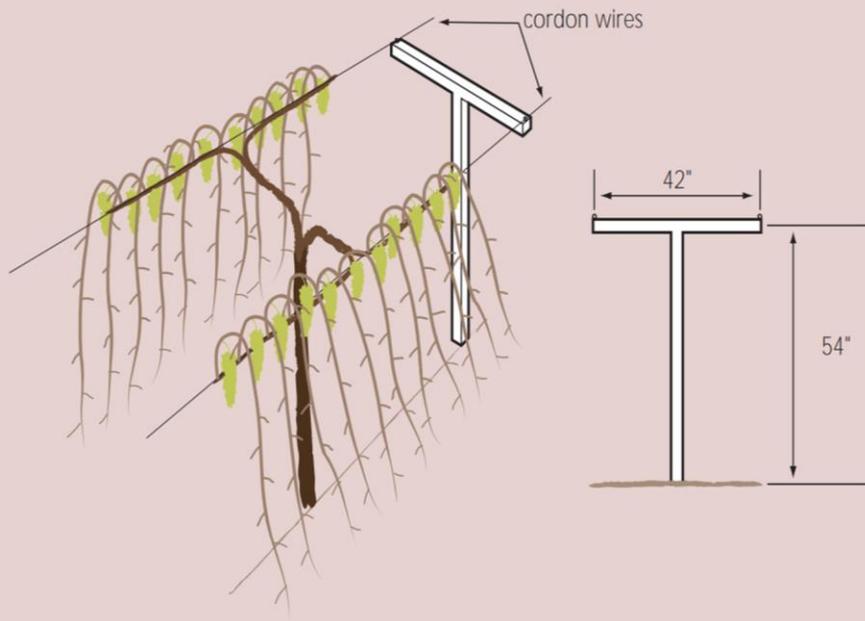
Traditional two-bud spurs



- Pruning as close as possible to bud break
- Warmer temperatures favor wound healing
- Lower levels of inoculum

Limitations to Double pruning

Double curtain (also called GDC type or Wye trellis)



- Not every training system can accommodate double pruning
- Competition for labor late in the pruning season for the second pruning pass

Limitations to Delayed pruning



A
Winter bud



B
Bud swell



C
Green shoot tip



D
Leaf emergence



E
Leaves unfolded



F
Flower clusters visible



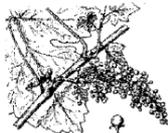
G
Flower clusters separated



H
Flowers separated



I
Bloom



J
Fruit set



K
Pea-sized berries



L
Berry touch

- Delayed pruning can affect the timing of each growth stage
- Sugar accumulation, wine quality
- Some pathogens' spores can be present late in the season

Preventative practices starting in young vineyards: Pruning wound protectants



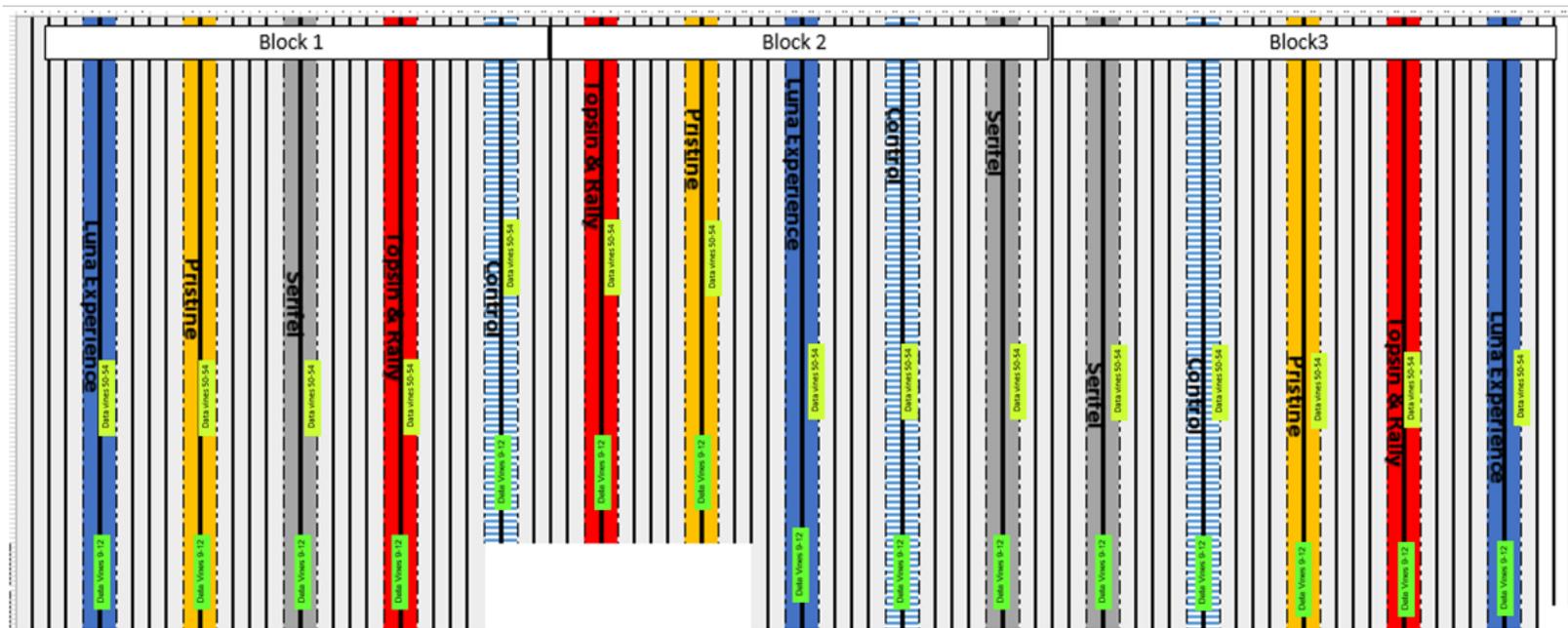
- Topsin M (thiophanate-methyl) 1.5 lbs in 50 GPA
- Rally (myclobutanil) 4-6 oz in 40-60 GPA
- B-lock (boron) 5% solution
- Vitiseal 1:10 dilution

*Apply before rain, which induces spore production/dispersal.

*Use highest spray volume to maximize coverage.

Testing pruning wound protectants in table grape vineyards

- 20 acre Scarlet royal vineyard
- Randomized complete block design



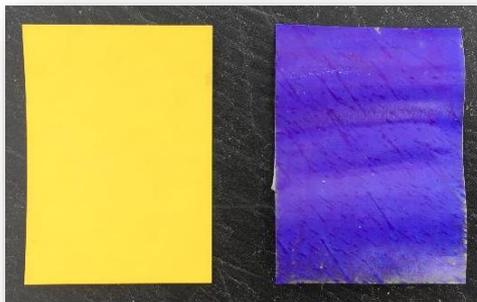
Testing pruning wound protectants in table grape vineyards



Pruning



Tractor spray - coverage



Inoculations

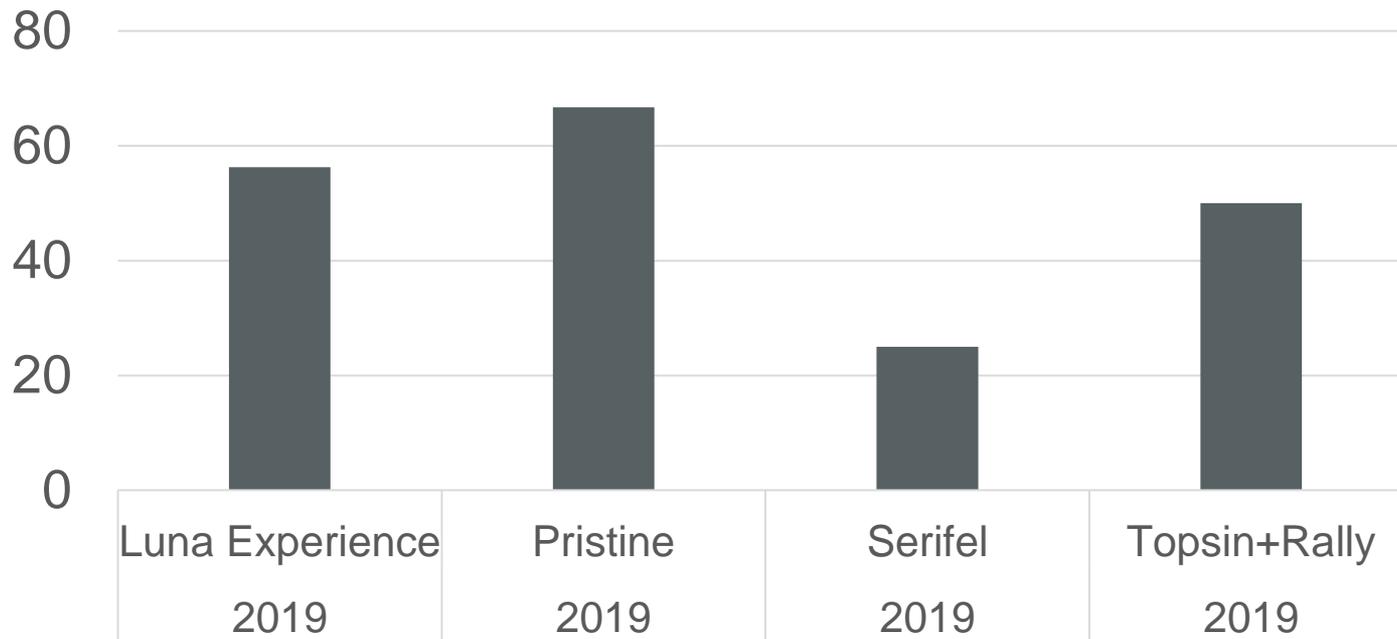
Testing pruning wound protectants in table grape vineyards

- Three fungicides
 - Topsin¹ & Rally² (Thiophanate-methyl¹ & Myclobutanil²),
 - Luna Experience (Fluopyram + Tebuconazole),
 - Pristine (Pyraclostrobin).
- One biocontrol agent: Serifel (*Bacillus amyloliquefaciens*)
- Control: Water

- Four trunk pathogens
 - Botryosphaeria dieback (*Neofusicoccum parvum*),
 - Eutypa dieback (*Eutypa lata*),
 - Phomopsis dieback (*Diaporthe ampelina*),
 - Esca (*Phaeomoniella chlamydospora*)
- Control: Water

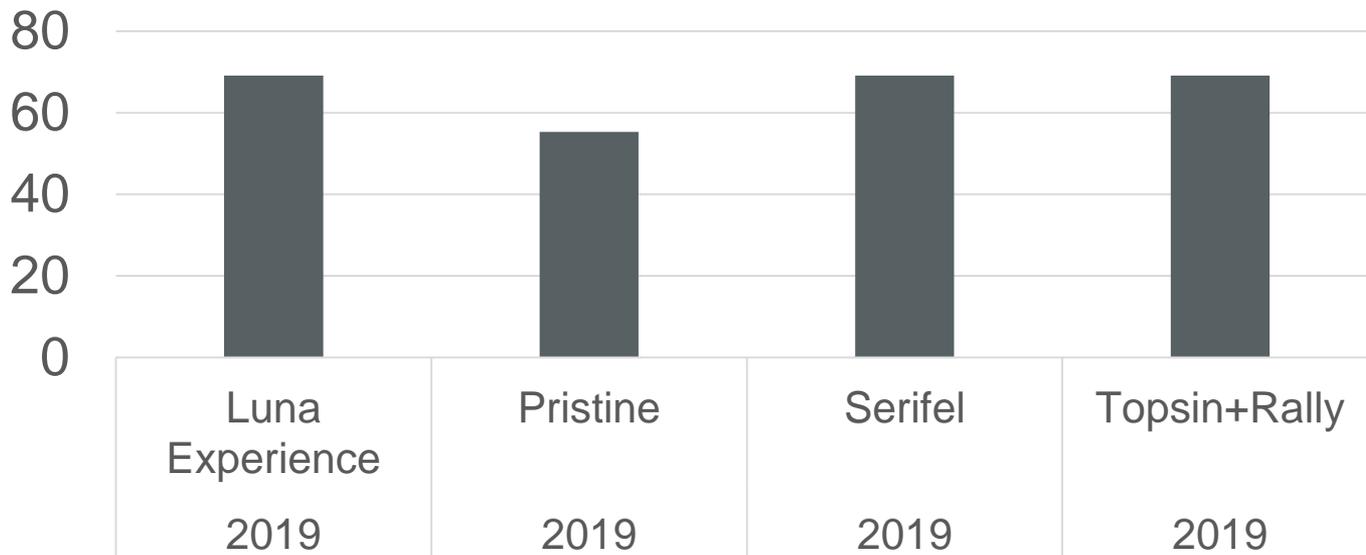
Testing pruning wound protectants in table grape vineyards

Disease control (% efficacy) for Eutypa



Testing pruning wound protectants in table grape vineyards

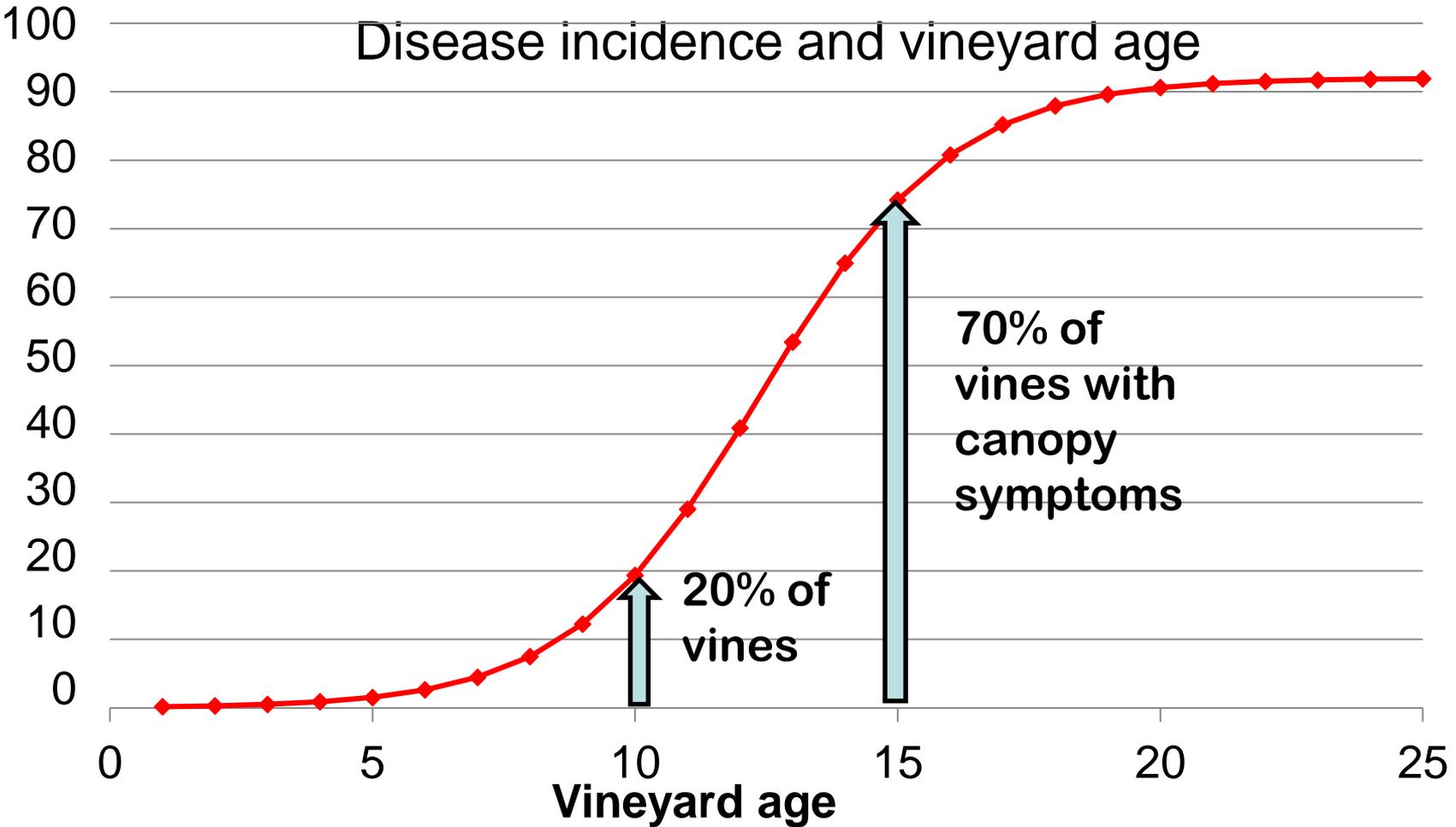
Disease control (% efficacy) for
Phaeomoniella (Esca)



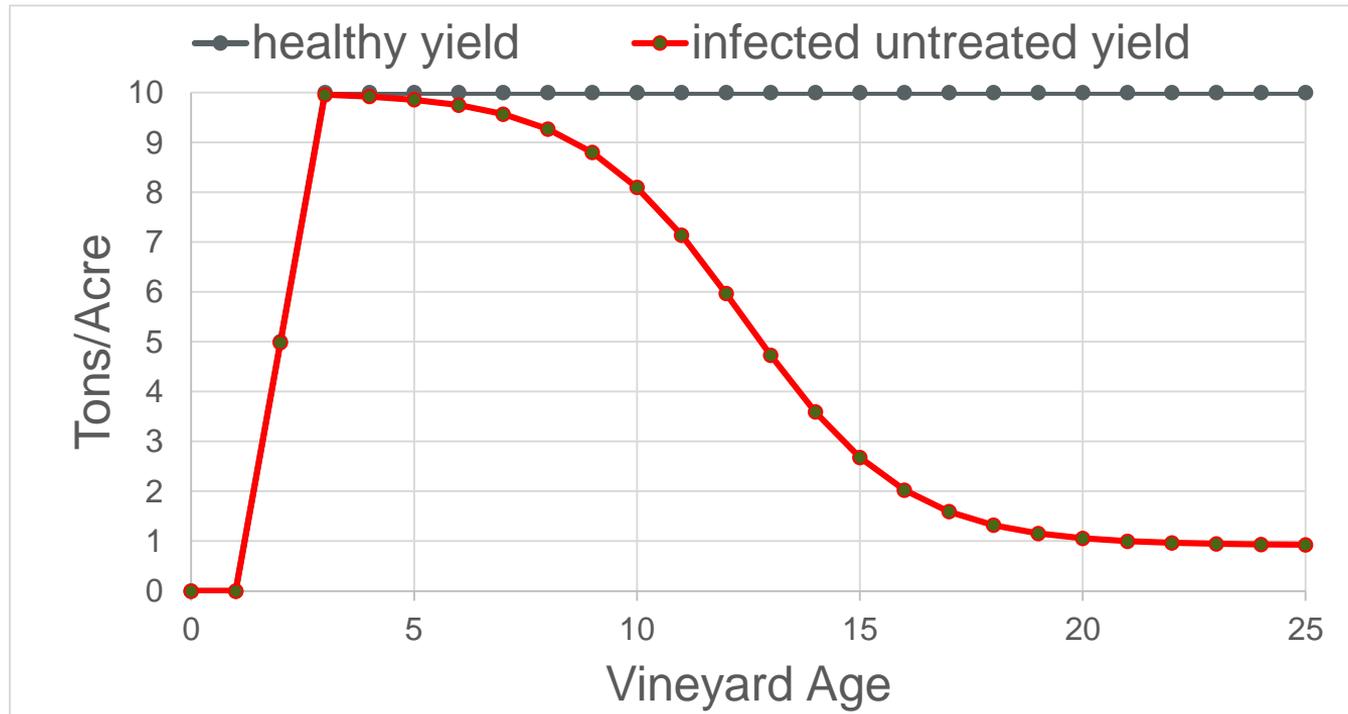
Cost estimates (per acre/year) of preventative practices (based on a survey of PCAs)

Delayed pruning	Prune late in the dormant season (February or later) by hand.	\$0
Double pruning	Prune early in the dormant season (December or January) with a mechanical-pruning machine; partially prune canes to a length of approx. 0.2 m. Prune again late in the dormant season (February or later) by hand; completely prune canes down to two-bud spurs.	\$100
Protectant-hand	<p>After pruning, apply protectant by hand, with a paintbrush or sponge to cover pruning wounds. Protectants registered for hand application are:</p> <ol style="list-style-type: none"> 1. Thiophanate-methyl (Topsin M WSB), 2. Boric acid (Tech-Gro B-Lock; Nutrient Technologies, Inc., Dinuba, California), 3. VitiSeal (VitiSeal International LLC, San Diego, California). 	\$55
Protectant-tractor	<p>After pruning, apply protectant by tractor, with spray nozzles aimed at pruning wounds. Protectants registered for spray application are:</p> <ol style="list-style-type: none"> 1. Topsin M WSB, 2. Myclobutanil (Rally; Dow Agrosiences LLC, Indianapolis, Indiana). 	\$50

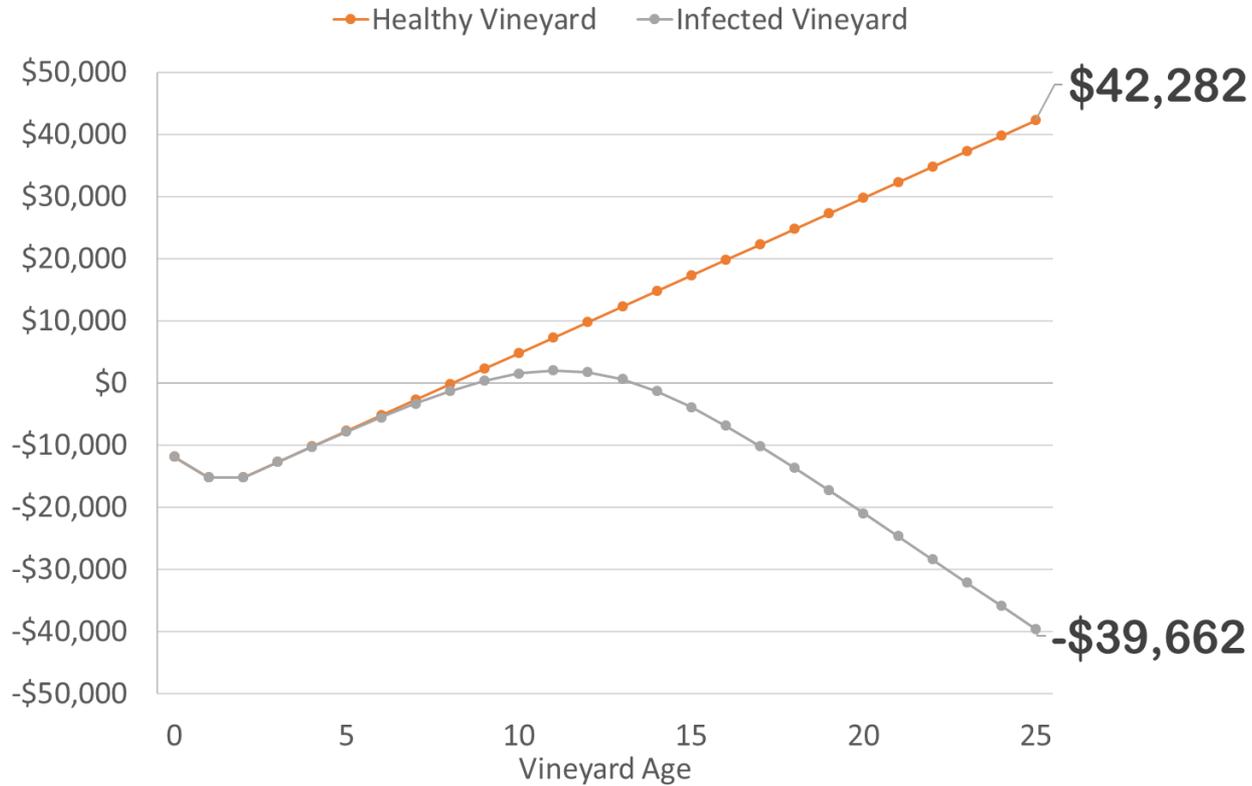
Disease incidence and vineyard age



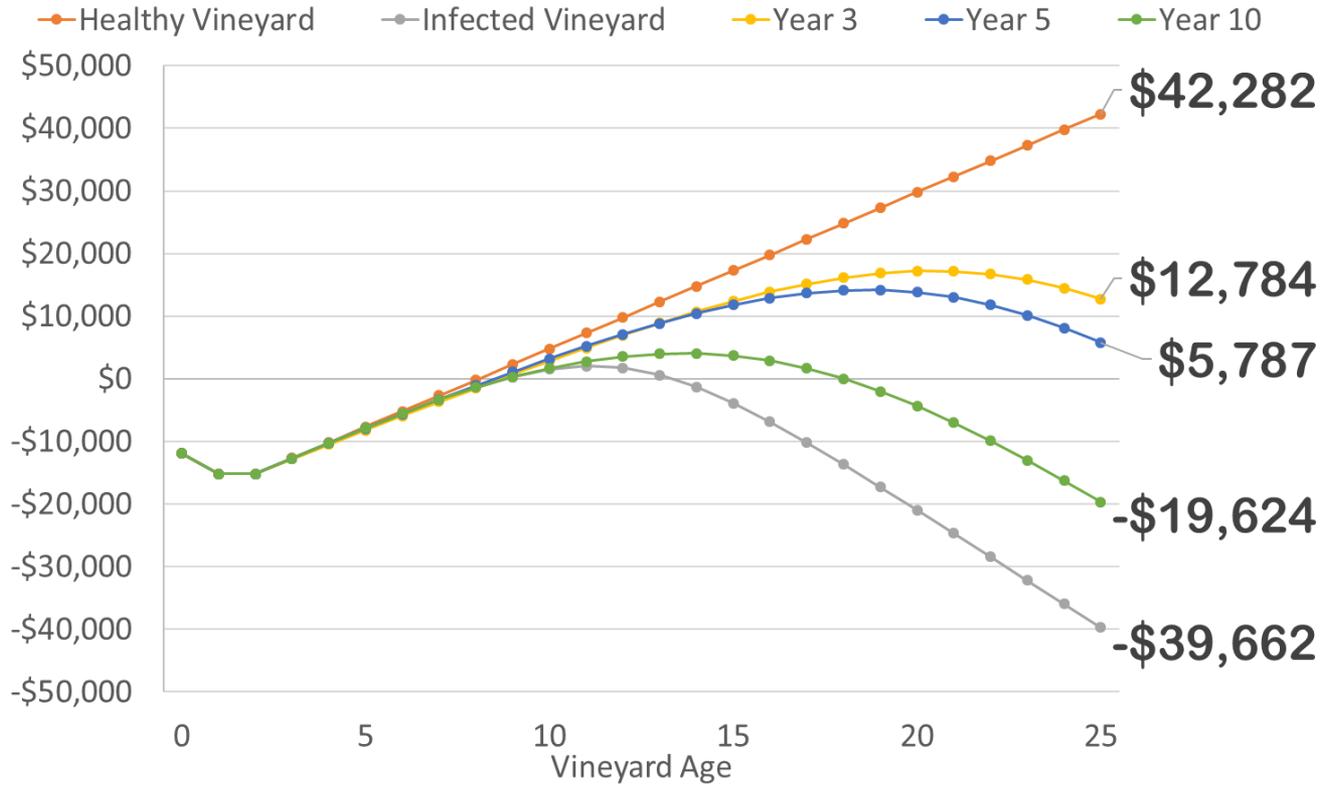
Annual yields for healthy vs. infected Cabernet Sauvignon vineyards -- crush district 11 (Lodi) --



Cumulative net returns (per acre)



Cumulative net returns (per acre) using Topsin M as pruning wound protectant, assuming 50% disease control efficacy.



Post-infection practices in older vineyards



- Retrain new cordons
- Wood infections are permanent
- No eradication

Post-infection practices in older vineyards



- Vine surgery (trunk renewal)
- Keep older trunk to maintain production
- Protect large cuts

Post-infection practices in older vineyards



- Perform on all vine with symptoms in mature vineyard
- Loose production for 2 years
- Remove all infected wood

Cost estimates (per acre/year) of post-infection practices

Replant specific vines	Dig up symptomatic vines. Replant with new grapevines.	\$162
Replant whole block	Remove all vines (symptomatic and healthy) and replant with new grapevines.	\$15000
Retrain cordon	Cut off symptomatic cordon. Attach a new shoot, growing from the top of the trunk, horizontally to the trellis system; this becomes the new cordon.	\$112
Retrain trunk	Cut off symptomatic vine just above a new shoot, growing from the base of the trunk. Train the new shoot up a vertical stake; this becomes the new trunk. In the dormant season, attach two canes horizontally to the trellis system; these become the new cordons.	\$400
Sanitation	Cut off individual dead spurs or entire symptomatic cordon. Burn or remove from the vineyard.	\$90

NET RETURNS FOR CRIMSON SEEDLESS

--PER ACRE AFTER 25 YEARS--

	No vine surgery
No Topsin	-\$53,986

NET RETURNS WITH VINE SURGERY --PER ACRE AFTER 25 YEARS--

Vine surgery only (on all symptomatic vines)

Year 11	Year 12	Year 13	Year 14	Year 15
\$56,560	\$54,993	\$50,244	\$42,924	\$33,832



NET RETURNS WITH VINE SURGERY OR TOPSIN --PER ACRE AFTER 25 YEARS--

Vine surgery only (on all symptomatic vines)

Year 11	Year 12	Year 13	Year 14	Year 15
\$56,560	\$54,993	\$50,244	\$42,924	\$33,832

Topsin only

(50% of pruning
wounds protected)

Year 3	\$57,043
Year 5	\$39,824
Year 10	-\$11,478

NET RETURNS WITH VINE SURGERY AND TOPSIN

--PER ACRE AFTER 25 YEARS--

<u>Topsin</u>	<u>Vine surgery</u>				
	Year 11	Year 12	Year 13	Year 14	Year 15
Year 3	\$91,493	\$93,297	\$94,094	\$94,009	\$93,141
Year 5	\$89,389	\$90,553	\$90,578	\$89,576	\$87,633
Year 10	\$77,206	\$75,163	\$71,679	\$66,927	\$61,084

Summary

- **Preventative practices are most cost-effective when adopted in young, healthy vineyards.**
- **Vine surgery in combination with a preventative practice is more cost-effective than either alone.**
- **When approx 20% of vines have symptoms, this is best time for vine surgery.**

treeandvinetrunkdiseases.org/trunk-disease-management-in-california-2

SCRIP TRUNK DISEASE PROJECT PAGE

WHERE WE SAVE GRAPES

HOME RESEARCH EXTENSION NEWS & ACTIVITIES ABOUT US LINKS

TRUNK DISEASE MANAGEMENT IN CALIFORNIA

Applications of pruning-wound protectants

Fungicides that prevent infection of pruning wounds are labeled for dormant-season use in California:

1. Thiophanate-methyl (Topsin M WSB; United Phosphorus, Inc., King of Prussia, Pennsylvania)
2. Myclobutanil (Rally; Dow Agrosciences LLC, Indianapolis, Indiana)

In addition, there are other non-fungicidal materials that form a toxic or physical barrier to infection:

1. Boric acid (Figure 7; Tech-Gro B-Lock; Nutrient Technologies, Inc., Dinuba, California)
2. VitiSeal (VitiSeal International LLC, San Diego, California)

***For more details on pruning-wound protectants, please refer to the Eutypa dieback section of the UC Grape Pest Management Guidelines (<http://www.ipm.ucdavis.edu/PMG/r302100611.html>, which is applicable to all trunk diseases).*

All pruning-wound protectants must remain continuously active for 30 days if vines are pruned in December or January, during the period of high risk of infection.

Reapplication may be necessary, depending on the protectant used and the timing of its first application with respect to rain. Rain triggers spore production and washes protectants off pruning wounds, so try to schedule applications before rain, maybe more so than immediately after pruning.

SEARCH

SEARCH

CATEGORIES

- Disease Resistance
- Identifying Sociological Hurdles to Adoption Practices
- New Detection Tools
- New Extension Tools
- Progress Reports

TAG CLOUD

2014 2015 Agrobacterium spp. almond Baumgartner Board Meeting Botryosphaeria cultivar selection cultivar selection Detection Early Infection Detection



Figure 7

treeandvinetrunkdiseases.org

NOV 11-13, 2019

SUSTAINABLE AG EXPO
&
**INTERNATIONAL SUSTAINABLE
WINEGROWING SUMMIT**

SAN LUIS OBISPO, CALIFORNIA

Thank you for your attention

Renaud Travadon
rtravadon@ucdavis.edu

Kendra Baumgartner, Jonathan Kaplan, Albre Brown

Product	Chemical Name	Active Ingredient (per acre)	Application Interval	Group Number	Producer
Luna Experience	Fluopyram + Tebuconazole	6.4 fl oz/acre 189.271 ml	12 to 21 days	7, 3	Bayer CropScience
Pristine	Pyraclostrobin	23 oz/acre 652.03 g	14 to 21 days	7, 11	BASF
Serifel	<i>Bacillus amyloliquefaciens</i>	16 oz/acre (1.0 lb/acre)	5 to 10 days	44	BASF
Topsin¹ & Rally²	Thiophanate-methyl ¹	1 ½ lb/acre ¹	7 to 14 days ¹	1 ¹	United Phosphorus, Inc ¹
	Myclobutanil ²	6 oz/acre ²	10 to 14 days ²	3 ²	Dow AgroSciences LLC ²
Latron B-1956	Modified phthalic glycerol alkyd resin	2oz or 60ml	NA	NA	J. R. Simplot Company