SOUTH AUSTRALIAN RESEARCH & DEVELOPMENT INSTITUTE
PIRSA

Powdery mildew

Erysiphe necator

Barbara Hall

PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

SOUTH AUSTRALIA

Government of South Australia
Primary Industries and Regions SA

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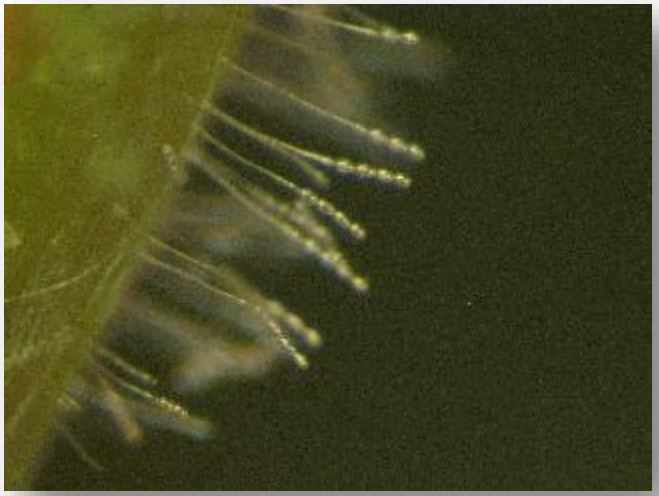
Powdery mildew

…a widespread, insidious fungal disease of (green) grapevines favoured by mild cloudy weather….

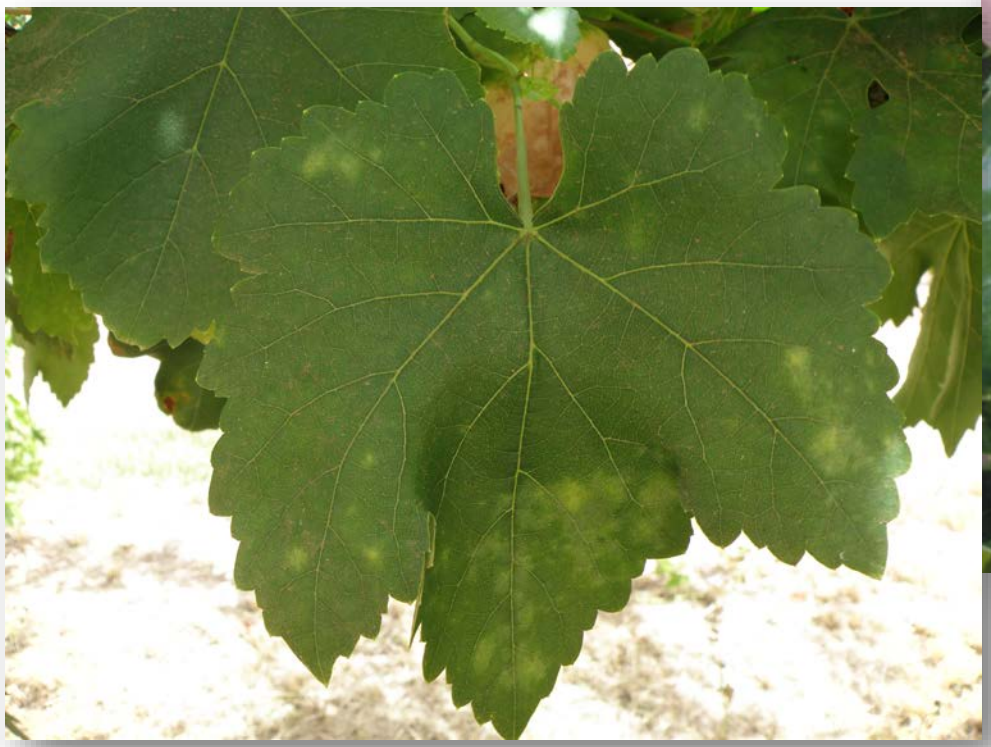
Powdery mildew

- **Biology 101**
  - **Symptoms**
  - **Infection**
- **Management options**



Symptoms - leaves

yellow green blotches



Symptoms - leaves

looks like early DM, herbicide damage

Symptoms - leaves

web-like ash grey – white fungal growth

(looks like downy mildew, leaf hairs)

Symptoms - leaves

browning of leaf veins (looks like rust mite feeding damage)

Symptoms - leaves

young leaves distorted

Symptoms - leaves

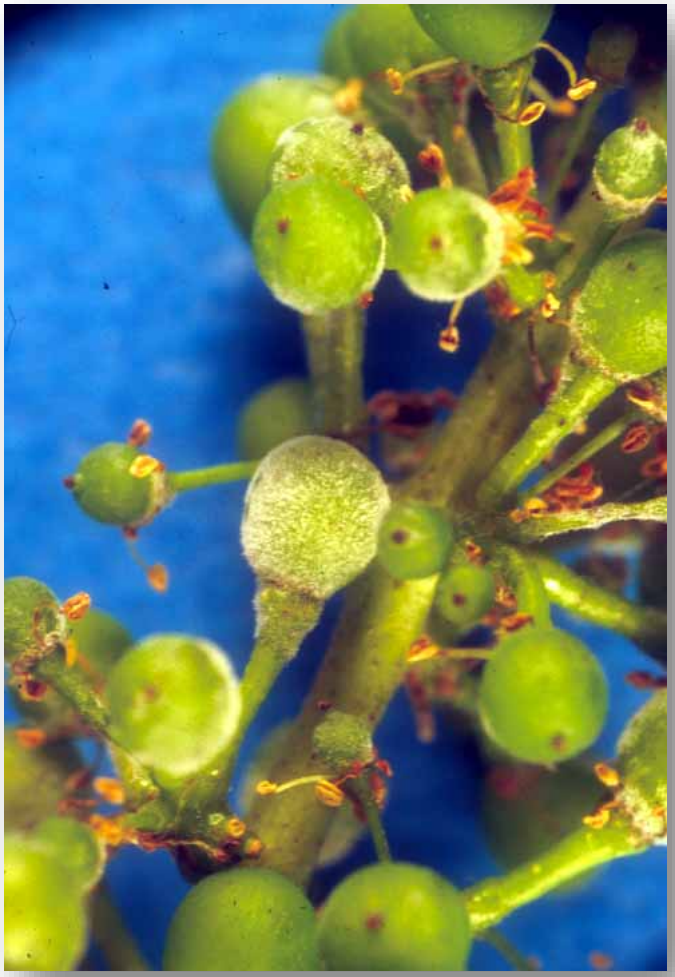
Can look like bud mite

Symptoms - canes

Symptoms - berries

Berries susceptible <~4 weeks post bloom

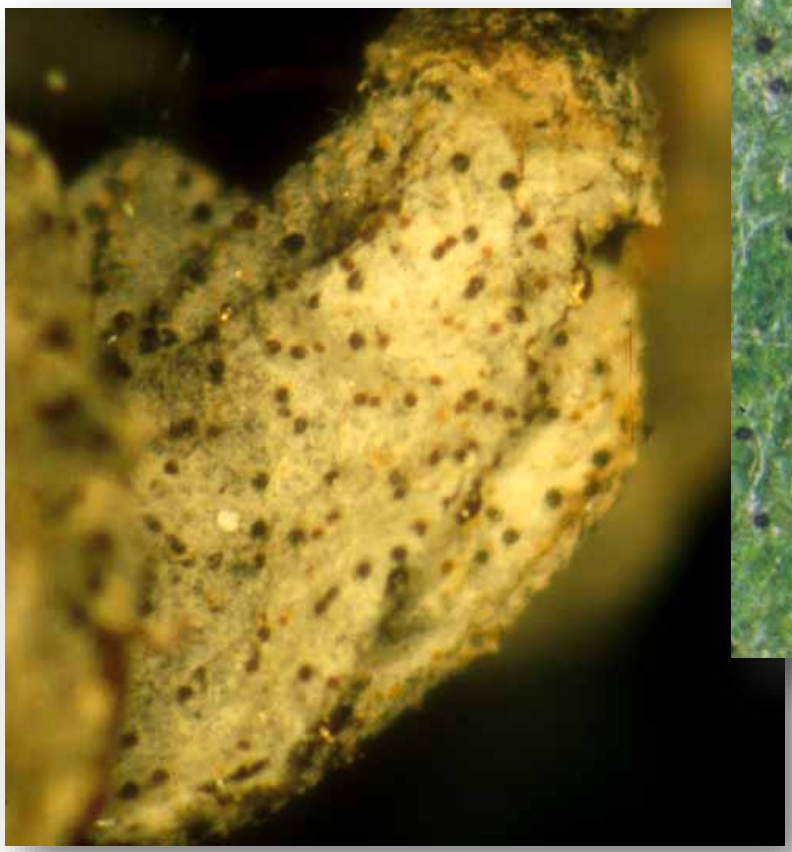
Peduncles and stems susceptible when green



Symptoms - berries

Symptoms - berries

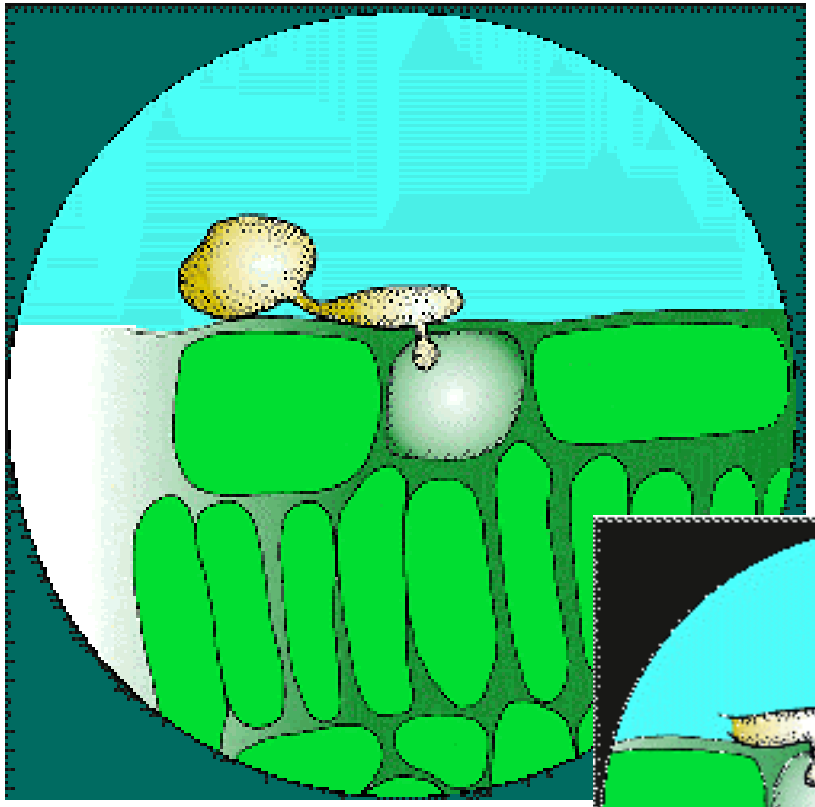
Symptoms – cleistothecia / chasmothecia



Cleistothecia

- Overwinter in bark, leaf litter
- Develop in January – March
- Change from yellow to black

Ascospore infection

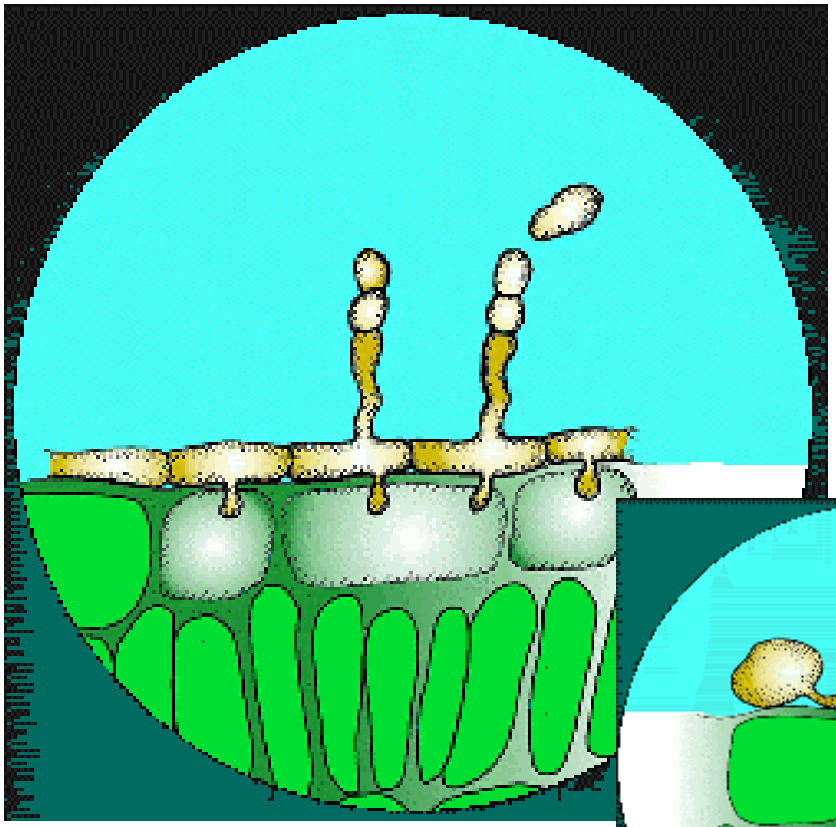


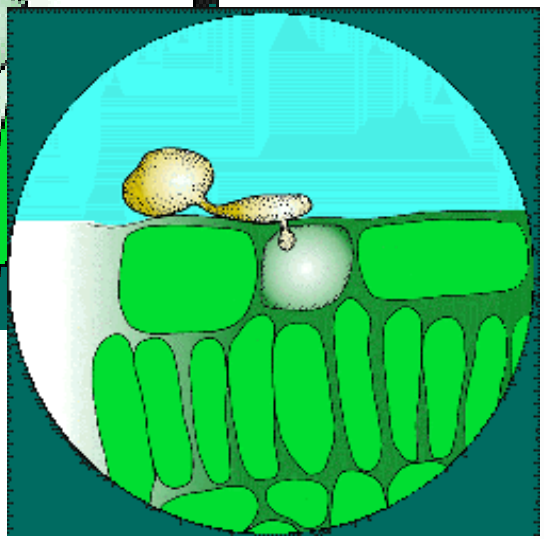
- Cleistothecia release spores after rain (in spring)
- 2.5mm / >10^{o}C
- Spread by wind and water
- Infect lower leaves

Flag shoots

- From hyphae in infected buds (Nov/Dec previous year)
- Obvious in Oct/Nov
- Few per vineyard
- Starting point of infection
- Spores spread by wind

Conidia infection



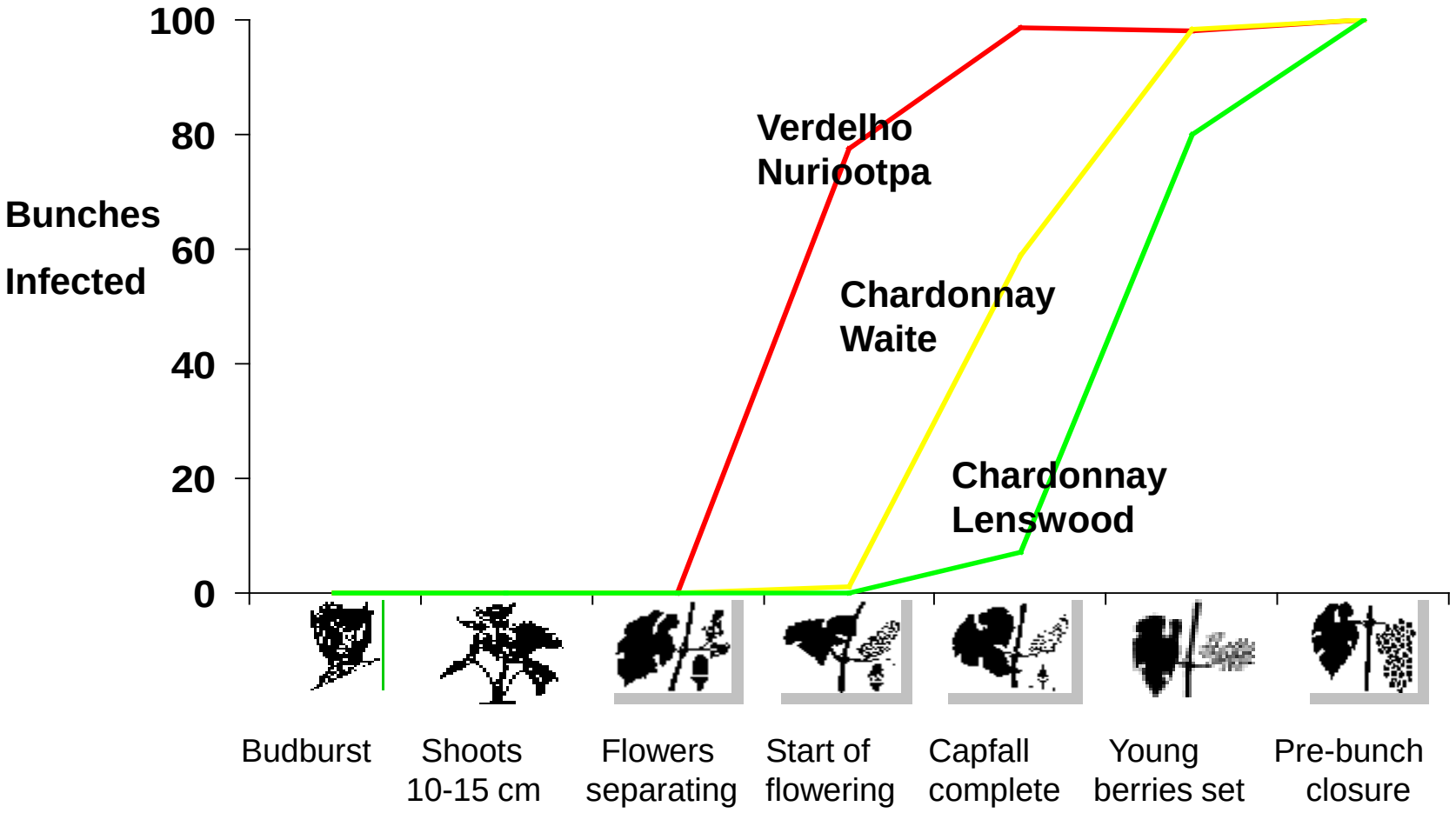


- Infection sites produce conidia
- Spores spread by wind
- Infect within 24 hours

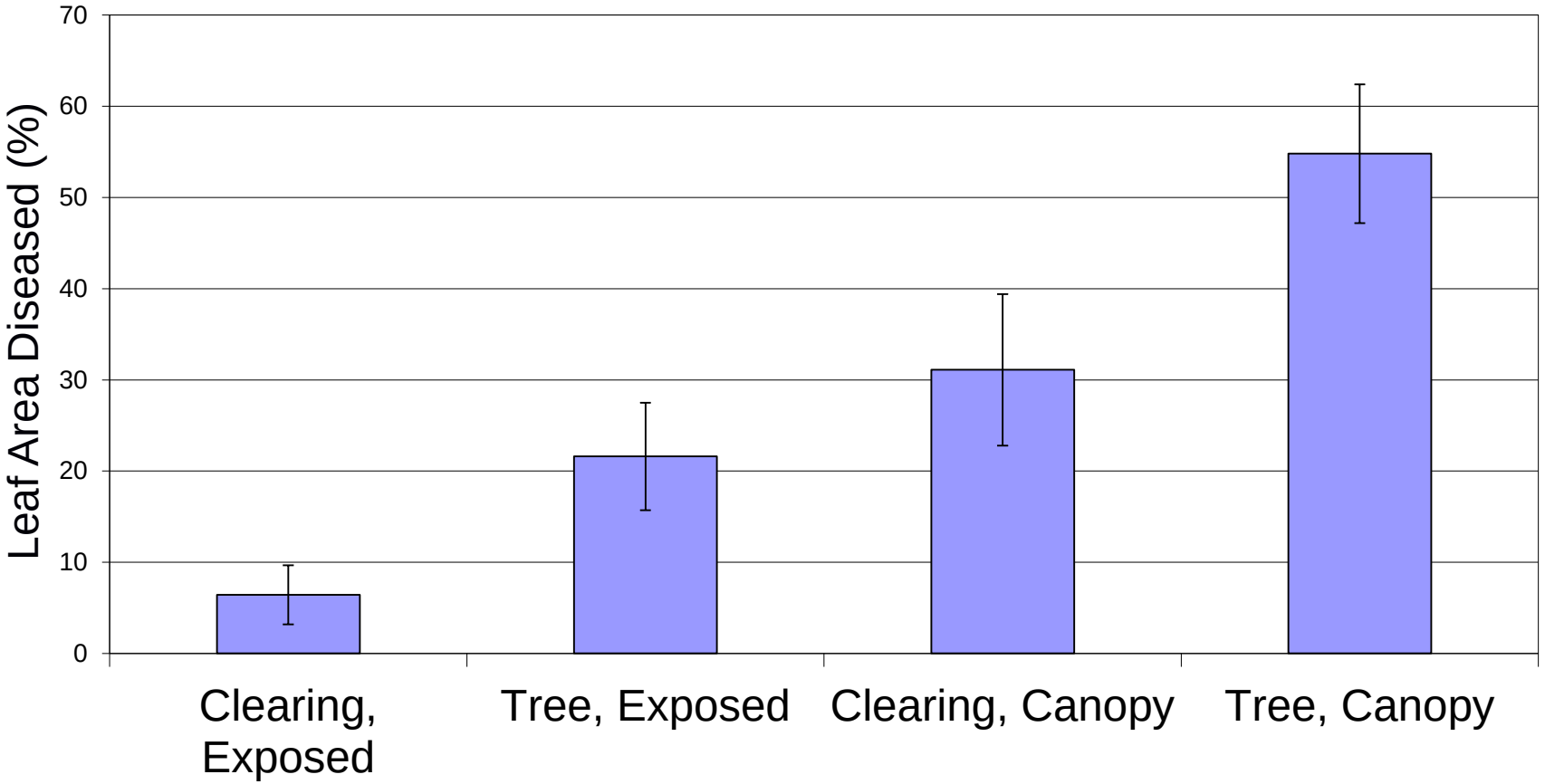
Temperature driven

Leaf temperature (°C)	Generation Time (days) (Spore to new colony)
8	25
12	12
16	7
23	6
27	5
32	not active

Rapid spread around flowering



Likes low light



cv. Chardonnay, Geneva, USA

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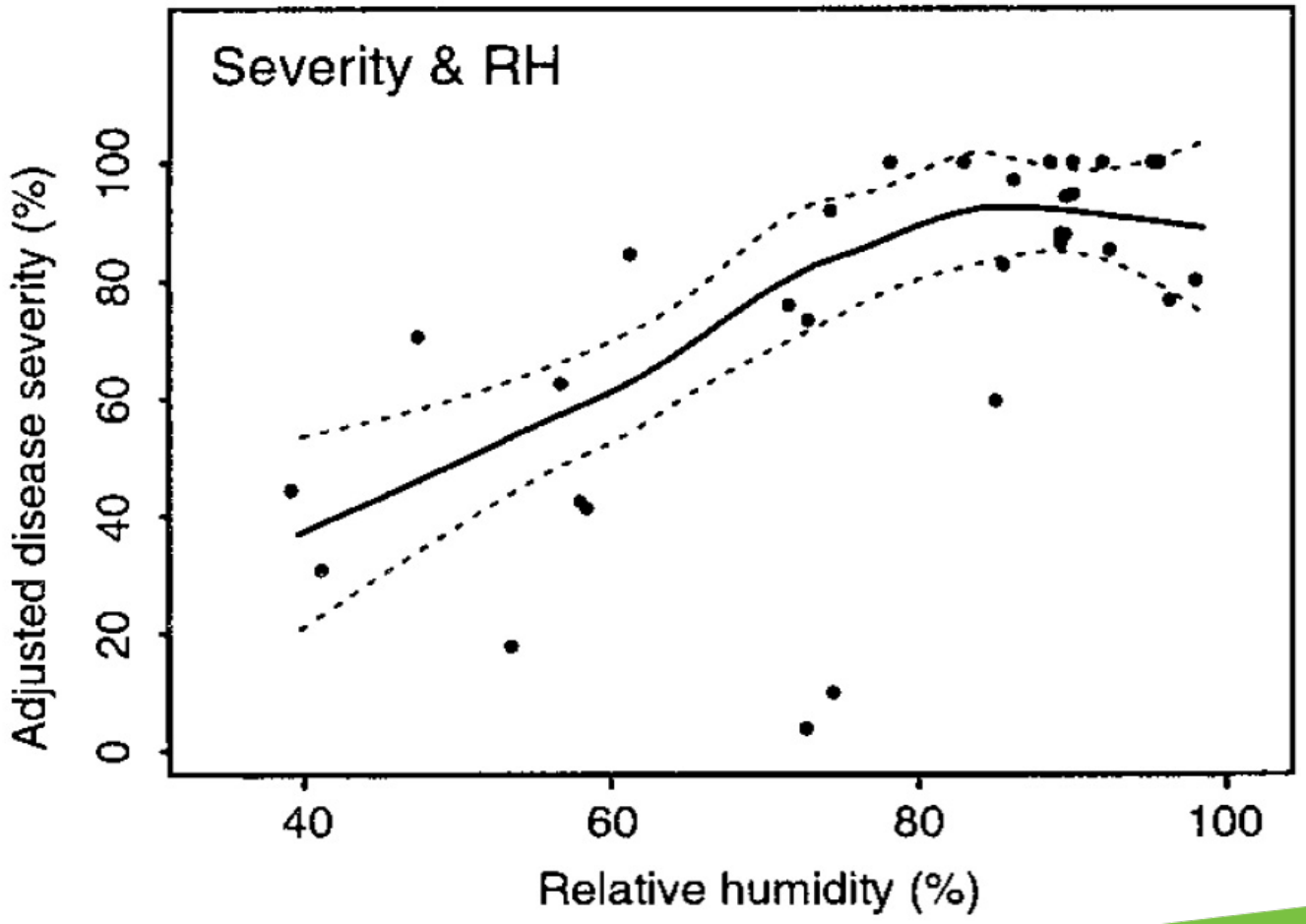
Humidity >40%



Carroll, J.E. & Wilcox, W.F. (2003) Phytopathology 93:1137-1144

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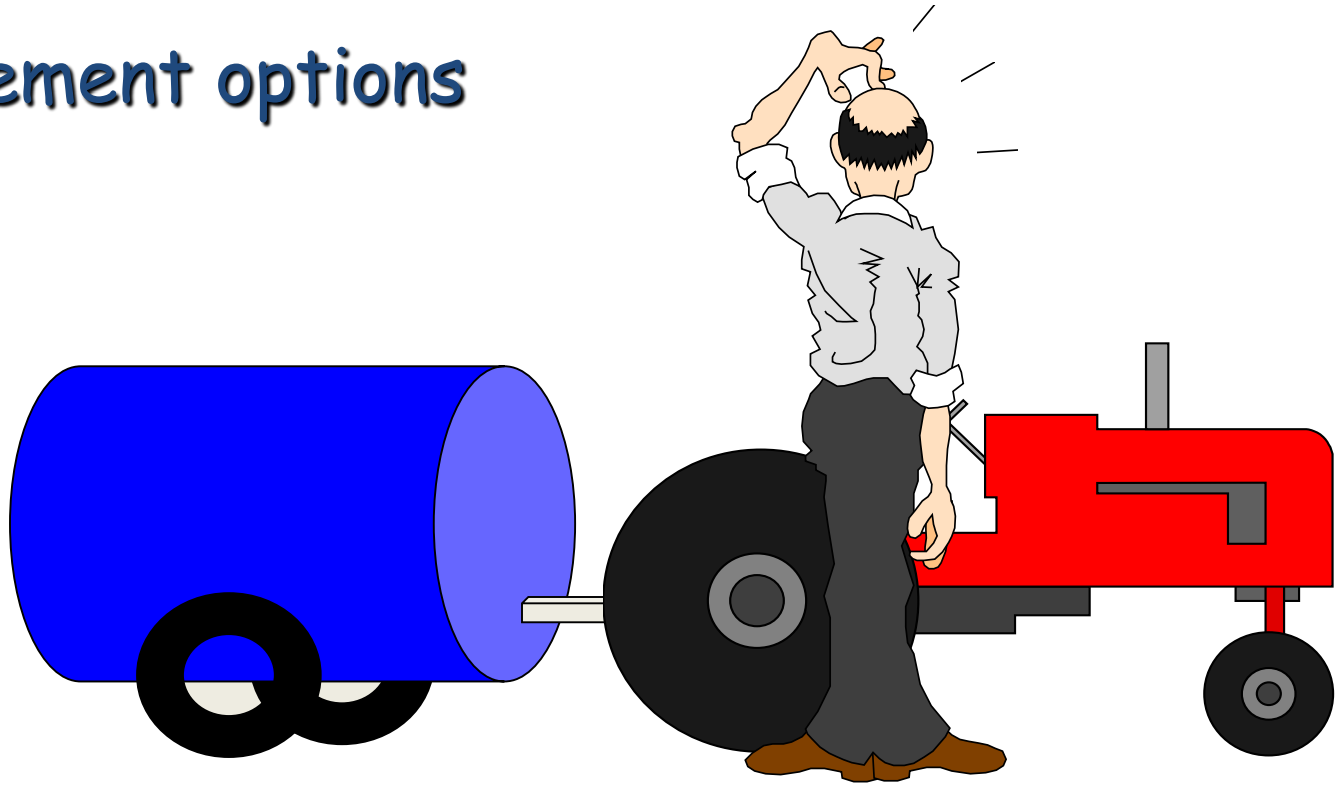
To spray or not to spray….

Management options



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Cultural options

- Canopy management – encourage air movement and spray penetration
  - trellising
  - pruning
  - plucking and trimming
- Control vigour

Chemical decisions

Consider

- How often is it a problem?
- Has it ever caused crop loss?
- Timing of conditions that favour infection and disease progress in relation to susceptible growth stages
- Possible infection sources
  - Flag shoots
  - Cleistothecia
  - Neighbouring vineyards??

Chemical decisions

Consider

- Cost
- Activity of chemicals
  - Protectant or curative (don't wait until powdery established)
  - Systemic, translaminar or surface acting
- Activity against other pests and diseases
- Impact on non-target organisms
- Resistance management
- Withholding periods
- Weather conditions
- Site & seasonal pressure

Options

- Programmed cover sprays
  - Bud burst?
  - initiate at 10-20 cm shoot growth or 2 weeks after budburst
  - 7 – 10 day intervals around flowering

- Monitor and spray on first signs
  - spray immediately
  - again 7-14 days later
  - spray regular intervals up to veraison – IF DISEASE PRESENT

Monitoring

Why?

- establish disease progress
- disease potential
- choose spraying strategy
- assess control effectiveness

Where?

- previously infected areas
- infected canes from last season
- susceptible varieties, dense canopies
- wet and sheltered sites

Monitoring

When?

- weekly intervals from budburst to veraison, again after harvest

How?

- check 200 vines, 50 - 100 clusters
- both sides of the canopy
- check inside the vine canopy
- use a hand lens to look for hyphae and spores
- tag flag shoots

What?

Mode of Action	Product	Active Ingredient	Activity group
QoI	*multiple*	azoxystrobin	11
	Cabrio, Pavo, Symbio	pyraclostrobin	
	Flint	trifloxystrobin	
DMIs	Bayfidan, Allitron, Citadel, Tridim, Triadimenol	triadimenol	3
	Domark, Mettle	tetraconazole	
	Mycloss, Myclonil	myclobutanil	
	Topas, Azotic, Delos, Pearl, Ruby	penconazole	
	Digger	difenoconazole	
	multiple	tebuconazole	
	Triadimefon	triadimefon	

What?

Mode of Action	Product	Active Ingredient	Activity group
SDHI	Miravis	pydiflumetofen	7
Amine	Prosper	spiroxamine	5
aza-napthalene	Legend, Quinfen	quinoxyfen	13
	Talendo	proquinazid	13
unknown	Flute	cyflufenamid	U6
Actin-disruption	Kusabi	pyriofenone	U8
	Vivando	metrafenone	U8
Multi-site activity	Copper	various	M1
	Sulphur	various	M2
	Peratec	Hydrogen peroxide	M
	Ecocarb	Potassium bicarbonate	M2
	Biopest	Parafinnic oil	n/a

Sulphur

- Sulphur
  - kills spores and hyphae
  - multi-site, resistance unlikely
  - less effective under 18^{o}C?
  - only wettable sulphur is rainfast
  - new growth unprotected
  - persistent on sprayed leaves

- Little or no toxicity with applications of 6 and 12 kg rates when 35 to 40^{o}C to:
  - Chardonnay (Loxton)
  - Shiraz (Nuriootpa)
  - Sauvignon blanc (Lenswood)

- Effect of humidity??

The other fungicides….

- translaminar movement
- effective in cool temperatures
- restrictions on use - resistance management strategy
- rainfast
- tank mixtures with sulphur or coppers ???

Alternatives:

Choices:

- Potassium bicarbonate (Ecocarb, Amicarb)
- Oils (Synertrol Horti-oil, Biocover, Biopest)
- Peratec
- Biologicals (*Bacillus subtilis* eg Serenade)
- Foliar nutrients (MKP, VigorCal)
- Chitosan, plant and seaweed extracts, milk/whey

Alternatives:

Issues:

- Not systemic or volatile
  - Good coverage is essential
  - Need more frequent applications
- May be more expensive than sulphur
- Not effective with high disease pressure
- Not recommended for use on highly susceptible cultivars
- Many not registered

Spray programs

Research findings:

- The chemicals work
  - Using more than 1 chemistry improved control – 3 even better
- Many programs available

Spray programs

Early season

- critical to protect new growth.
- reduce the potential carry-over in bud infections
- lower cost as less chemical required per hectare

Spray programs

Early season

- Weeks 2,4,6 after budburst
  - or 20, 40 & 60 cm shoots
- Sulphur generally used early
- Can use synthetic (eg DMI, Prosper) if high risk:
  - powdery levels high the previous year
  - flag shoots detected

Spray programs

Flowering / fruit set

- Flowering critical – berries most susceptible, conditions favourable

- Chemical strategy – use other than sulphur and mix and match

Spray programs

Post fruit set

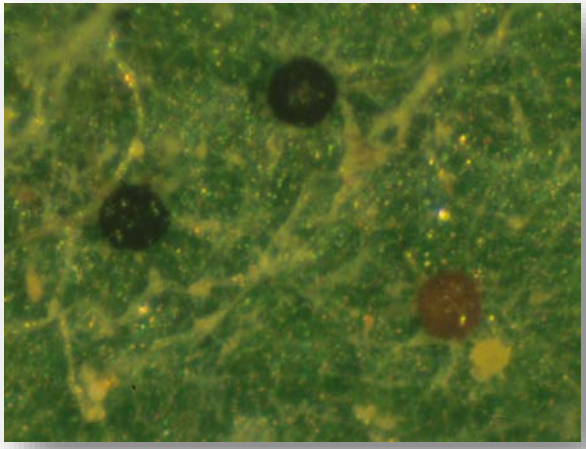
- Depends on disease pressure
- Sulphur/Legend positioned for this period
- Leaf and berry stem control

Always check withholding period

Post harvest options

Limited value - unless on young vines for leaf retention

- Flag shoots already infected
- Doesn’t prevent carry over of cleistothecia



Poor control:

- Incompatibility
- Water quality
- Resistance issues
- Selection, timing & frequency of sprays
- Water volumes
- New spray equipment
- Chemical dose
- Spray coverage

3 T's of Powdery Mildew Control

- Timing
- Treatment
- Technique

Hit hard, Hit early (Paul Ehrlich 1913)

Thanks……