Managing Botrytis Bunch Rot

Foothill Grape Day

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Type of tissue that Botrytis infects

- **Succulent tissue**: young shoots, petioles, blades
- **Dead tissue**: flower debris, dead leaves
- **Injured tissue**: insects, powdery mildew
- **Senescing tissue**: wilting flower debris, *ripening berries*

All green tissue is susceptible to infection in spring

Succulent tissue

Botrytis Shoot Blight

Required to germinate and infect:

- **65°- 75° F**
- **2 hours free water**

BOTRYTIS BUNCH ROT—DISEASE CYCLE

- Infection can occur (#1)
  - ***During bloom and post-bloom*** **(floral organs; cap scars)**
    - **Infections usually remain latent (dormant) until post-veraison up through harvest**
    - **Some can become active as fruit ripens and is no longer able to suppress fungus**

BOTRYTIS BUNCH ROT--DISEASE CYCLE

- Infection can occur (# 2)
  - ***After veraison*** **in ripening berries infected by diseased, dead blossom parts ("trash") trapped within clusters**
    - **Symptoms develop pre-harvest, but original infection (of trash) occurred at or near bloom**

BOTRYTIS BUNCH ROT--DISEASE CYCLE

- Infections can occur (#3)

In intact ripening berries **by physical contact with diseased berries (berry-to-berry spread)**

  - **"Nesting" phenomenon**
  - **Classic pattern of severe disease loss**

When a flower cluster is wet during or prior to set, floral debris can sporulate to

--begin new source of spores

--directly infect berries

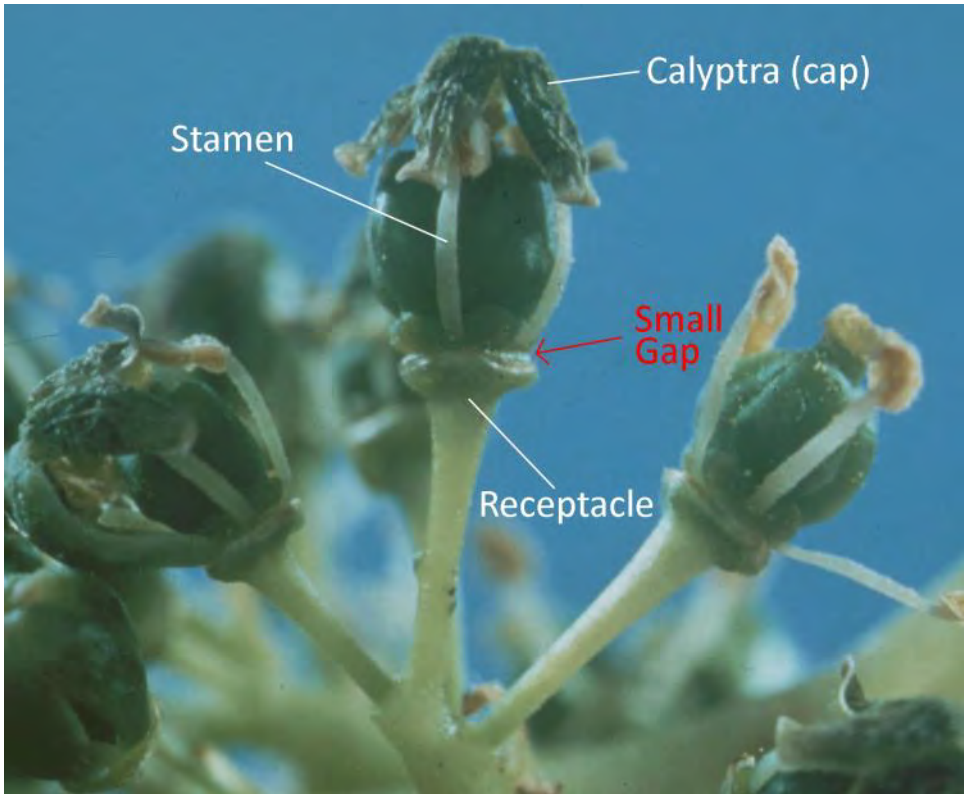
Photo: D. Gubler, UCD


Disease in fruit caused by diseased flower parts


Berries become infected, especially in wet springs. These infections *remain latent* until berry ripens

Direct entry into just-set berries through…

- wilting blossom parts
- dead blossom debris stuck to berries
- scars created when calyptra and stamens fall from flower



Effects of Time of Infection and Cluster Tightness

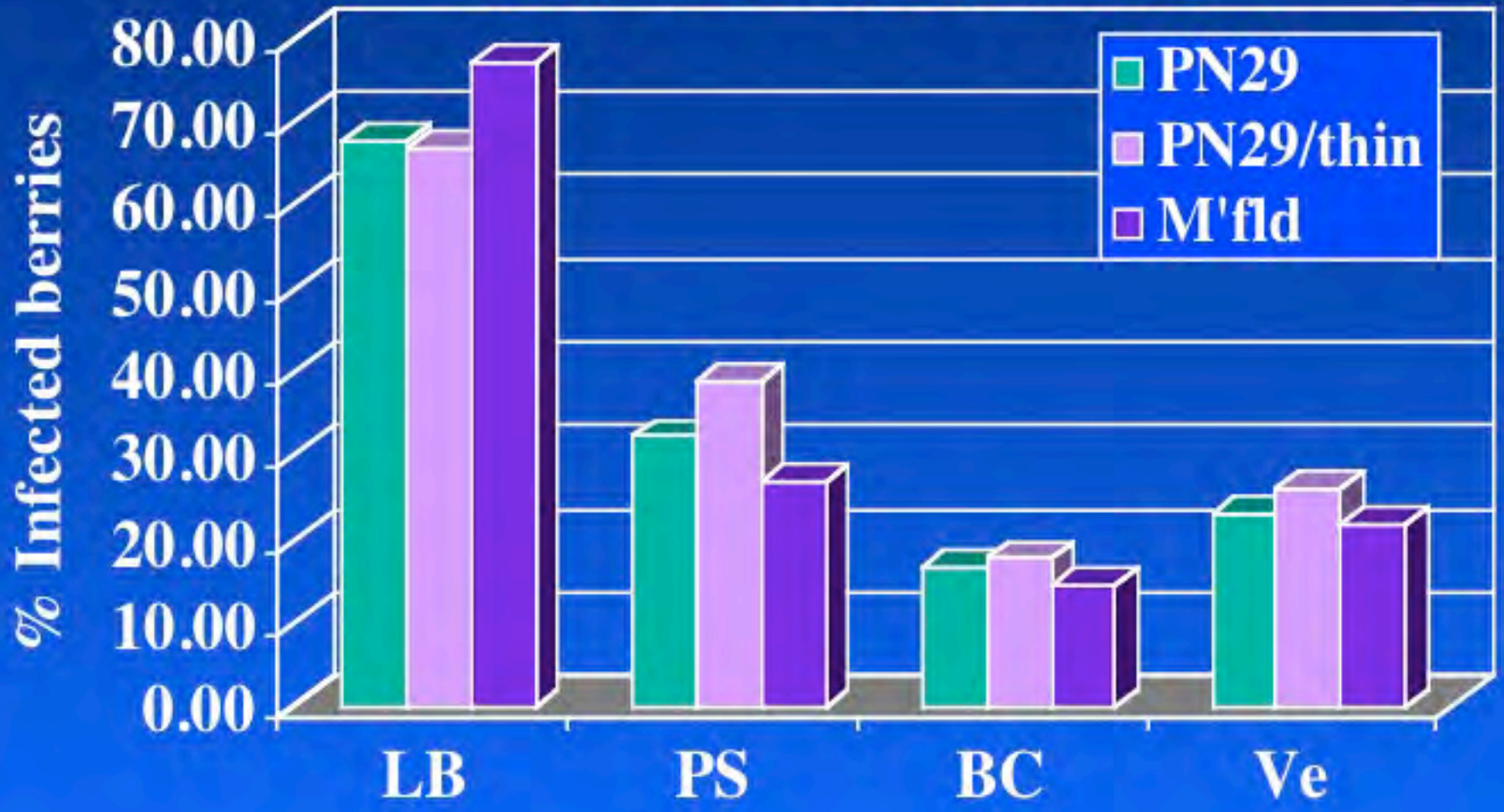
- Three Pinot Noir "clones"
  - 29 (tight clusters, disease problems)
  - Mariafeld (loose clusters, less disease in field)
  - 29, thinned to resemble Mariafeld

Effects of Time of Infection and Cluster Tightness

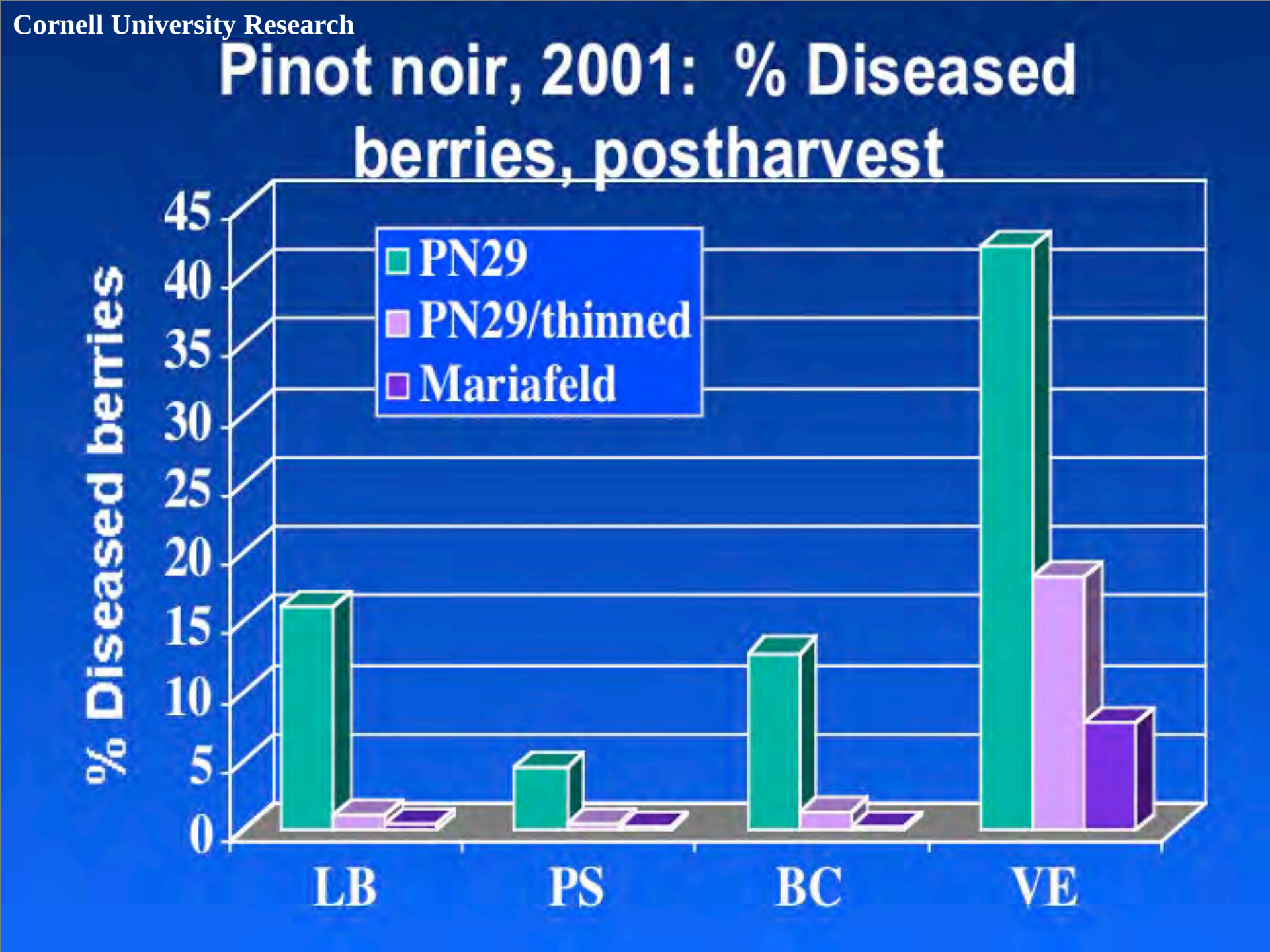
- Inoculate with *Botrytis* spores at four developmental stages
  - **Late bloom**
  - **Pea-size**
  - **Bunch closure**
  - **Veraison**

Cornell University Research

LATENT INFECTIONS, 2001
INOCULATIONS



Cornell University Research



INFECTION TIMING/ CLUSTER ARCHITECTURE: CONCLUSIONS

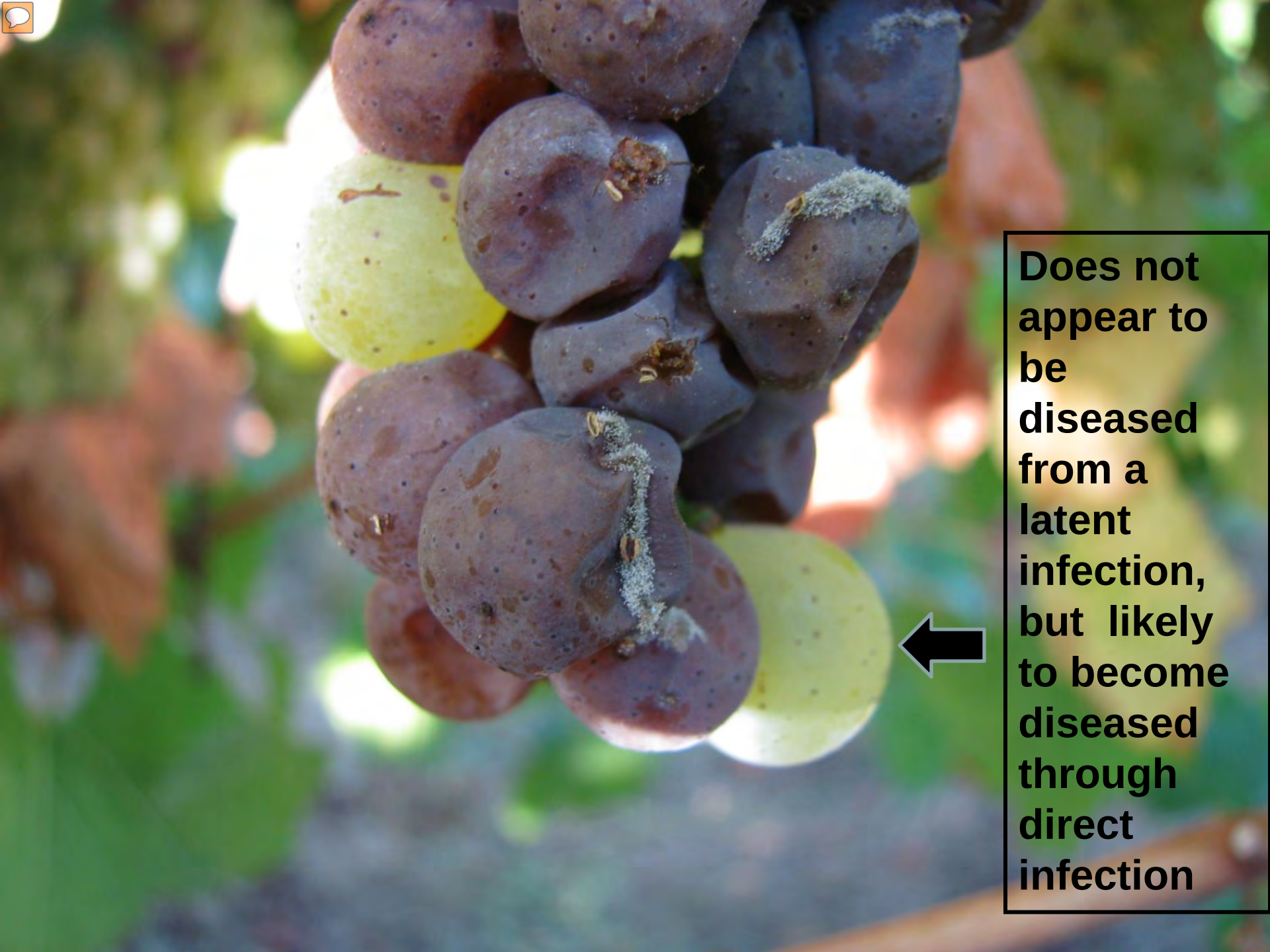
- **Most latent infections remained inactive (no disease)**
- **Cluster tightness has no effect on initial establishment of latent infections**
- **Cluster tightness has major effect on disease severity at harvest**

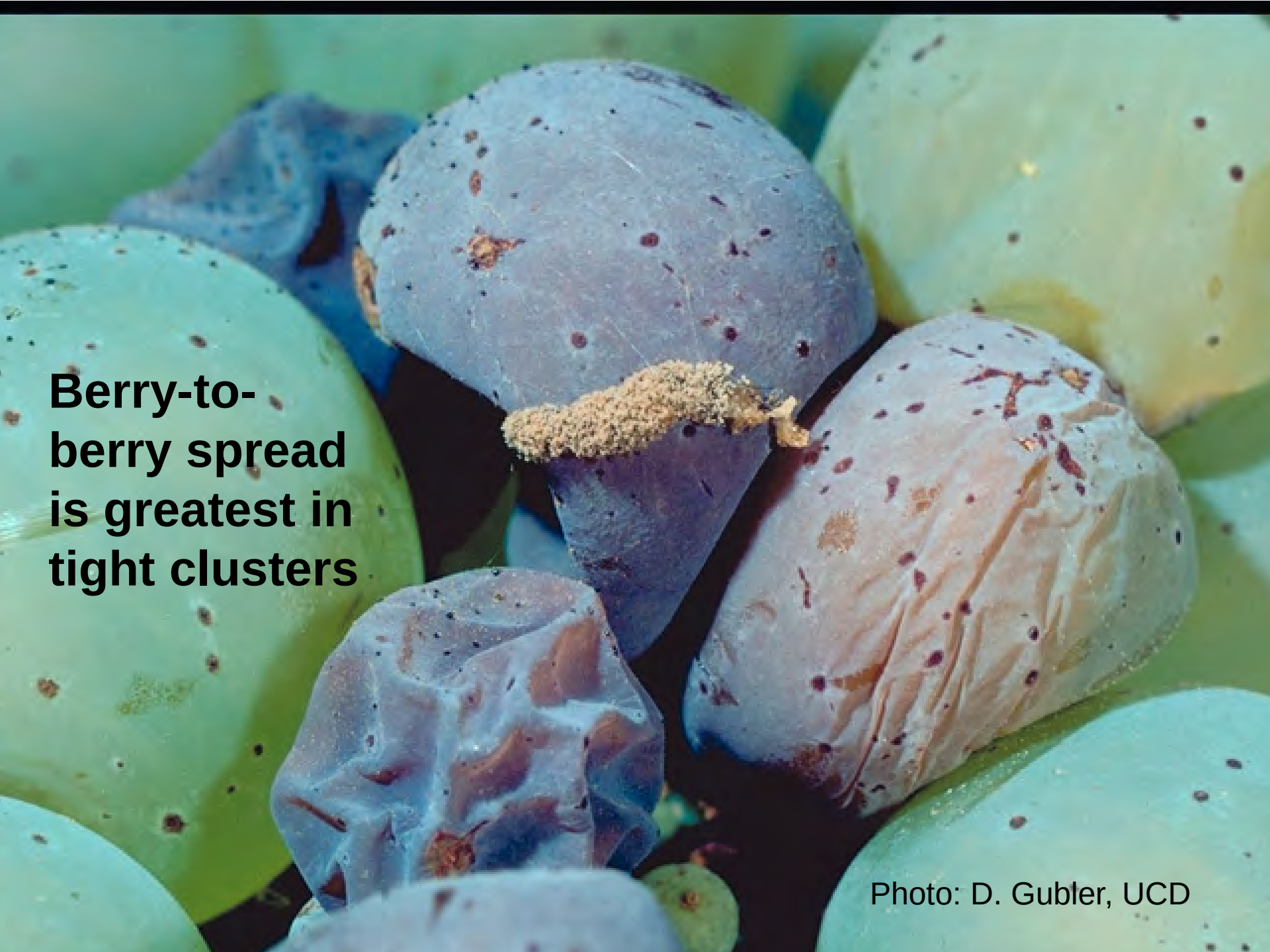
Conditions that promote latent infections becoming active in ripening fruit

- ????
- High humidity
- High soil moisture
- High berry nitrogen content
- Berry injury (powdery mildew infections, insects, wind)

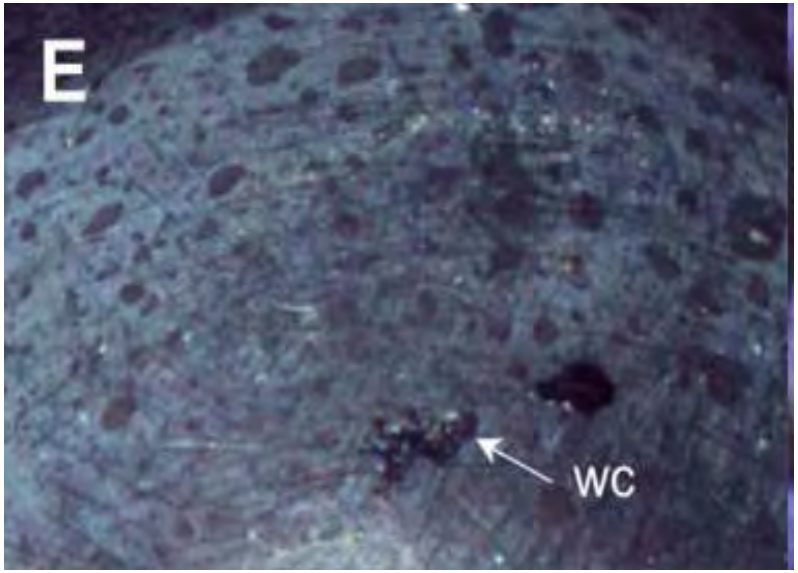
Exposed cluster with a few diseased berries

Berry epidermis splits.


Does not appear to be diseased from a latent infection, but likely to become diseased through direct infection


Berry-to-berry spread is greatest in tight clusters
Photo: D. Gubler, UCD

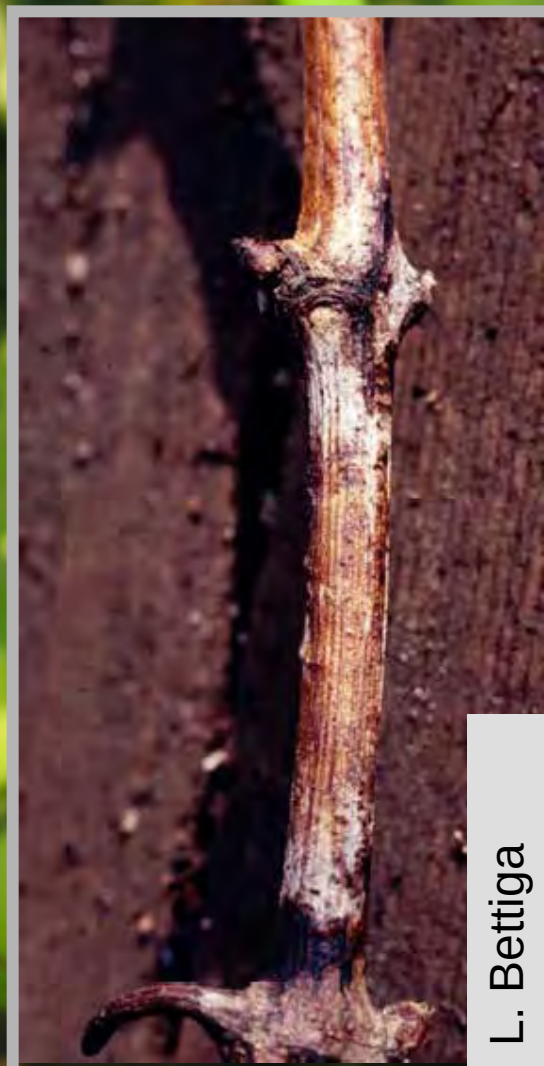
Berries infected directly through wounds



Gadoury, D. M., Seem, R. C., Wilcox, W. F., Henick-Kling, T., Conterno,L., Day, A., and Ficke, A. 2007. Effects of diffuse colonization of grape berries by *Uncinula necator* on bunch rots, berry microflora, and juice and wine quality. Phytopathology 97:1356-1365.

Injured tissue

Source of Botrytis spores



L. Bettiga

Source of Botrytis spores

Dead tissue

Botrytis Overwinters as sclerotia on cluster "mummies"

Effects of Pre-Harvest Rain: a series of events

- High RH activates latent infections
- High soil moisture activates latent infections, promotes secondary spread
- High RH promotes formation of new spores from diseased berries
- Free water promotes spore germination + berry cracking
  - Latent activation, injuries for new infection

Botrytis cinerea **CAUSES MORE INFECTIONS WHEN LEAVES STAY WET AT TEMPERATURES RANGING FROM 54-86° F.**

MORE THAN 16 CONTINUOUS HOURS OF LEAF WETNESS IS HIGHLY CONDUCIVE TO INFECTION ALMOST REGARDLESS OF TEMPERATURE.

Control

- Sanitation
- Avoid injury to berries
  - insects, powdery mildew
- Cluster architecture
  - Treatments to reduce berry touch
- Fungicides
  - Dormant lime sulfur (?)
  - Timing: bloom, pre-close, veraison

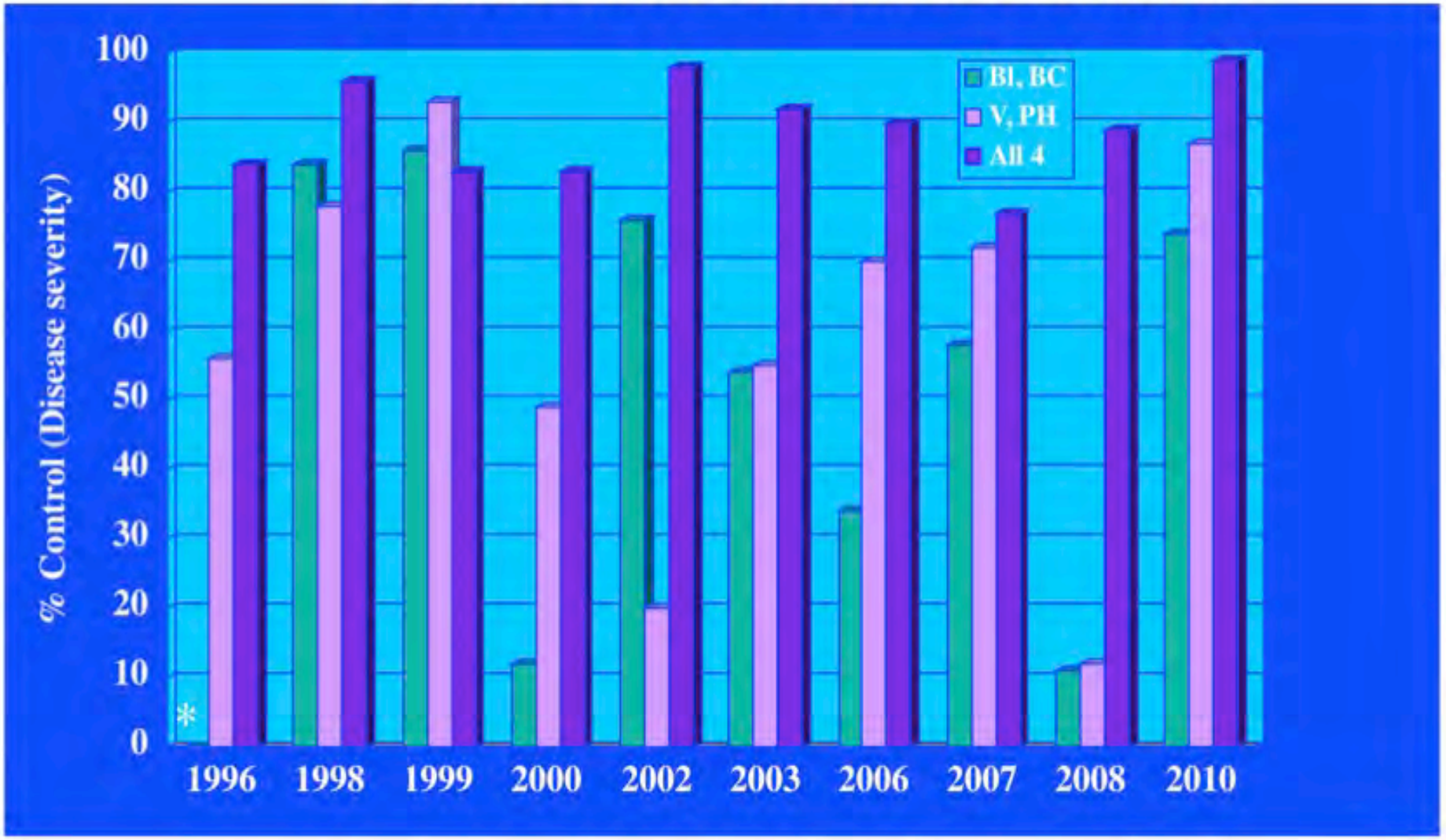
- Leaf removal
  - At *berry set*
  - Epicuticular wax

BOTRYTIS BUNCH ROT: CONSIDERATIONS

- Infection can occur:
  - Bloom
  - Post-bloom
  - Veraison thru harvest

- When is infection most likely or ultimately most damaging?
  - When is spray intervention most necessary?

Botrytis Spray Timing: Effect on Disease Control



Canopy Management Practices

- Winter pruning
- Suckering & shoot thinning
- Shoot positioning
- Weak shoot removal
- Leaf removal
- Lateral shoot removal

Generalized fruit responses to increased light and temperature

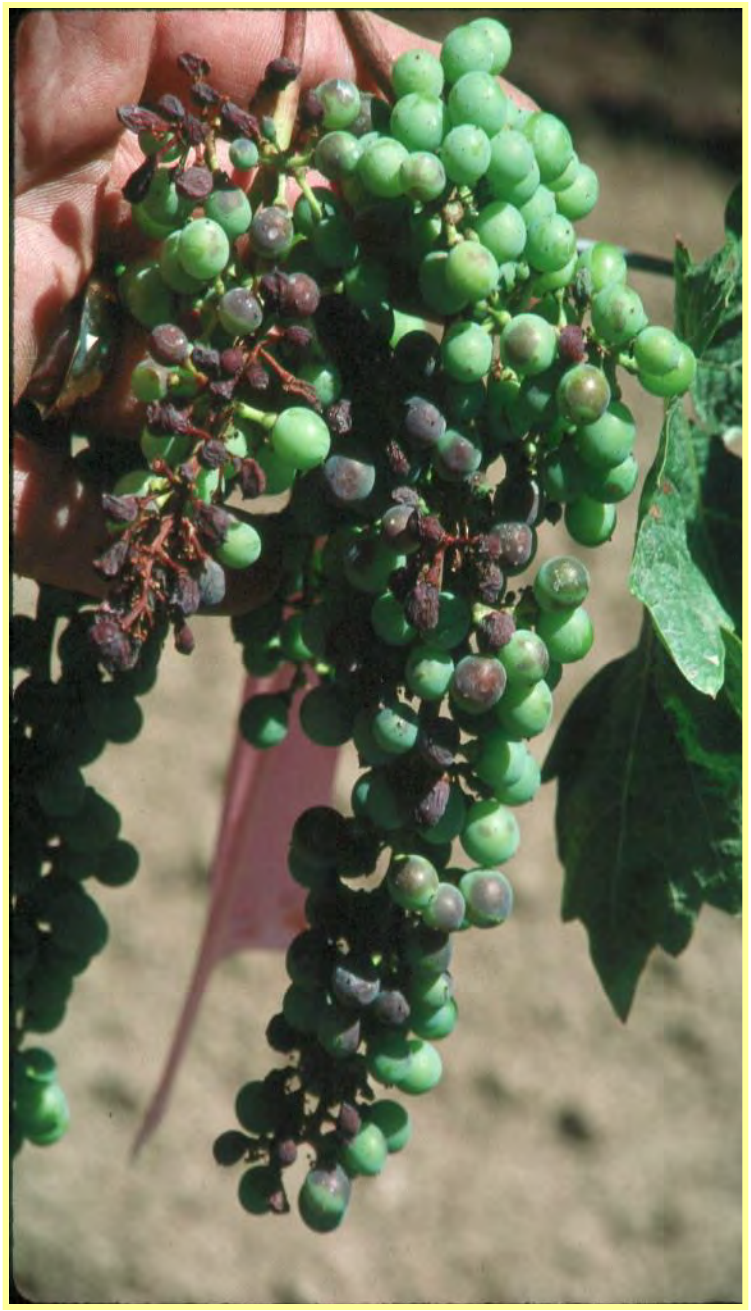
	Light	Temperature
Berry growth	+	+ / -
Berry composition:		
Sugar	+	+
Organic acids	+ / -	-
pH		+
Anthocyanins	+	+ / -
Phenolics	+	+ / -
Methoxypyrazines	-	-
Monoterpenes	+	-

In a perfect world, leaf removal occurs at berry set

- Pre-bloom leaf removal can reduce cluster & berry size
- Post-veraison leaf removal can lead to fruit sunburn

Moderately exposed fruit with sunflecks





Effect of Leaf Removal and fungicide sprays on Botrytis bunch rot in Zinfandel, Lake County, 1986

INCIDENCE: PERCENT CLUSTERS WITH ROT

Rovral at 1.5 lb/acre applied at following timings:

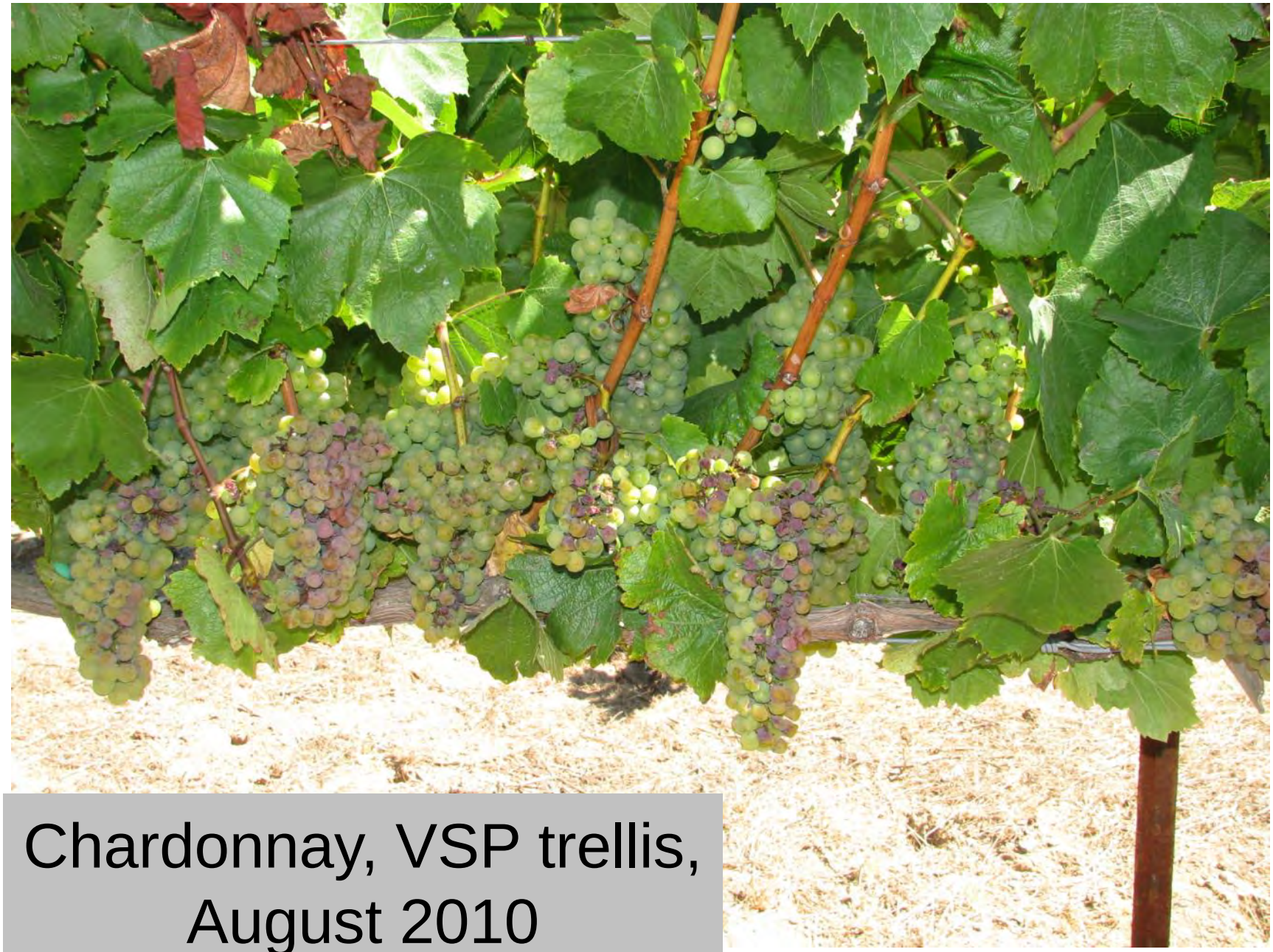
	Unsprayed Control	Bloom	Bloom+ Post-bloom	Pre-bloom+ Bloom+ Post-bloom	Mean
No Leaf Removal	28.2	31.1	22.7	18.7	25.2a
Leaf Removal	5.7	5.9	3.4	6.4	5.4b
Mean	16.9	18.5	13	12.6	

Effect of Leaf Removal and fungicide sprays on Botrytis bunch rot in Zinfandel, Lake County, 1986

SEVERITY: PERCENT ROT PER CLUSTER

Rovral at 1.5 lb/acre applied at following timings:

	Unsprayed Control	Bloom	Bloom+ Post-bloom	Pre-bloom+ Bloom+ Post-bloom	Mean
No Leaf Removal	10.7	14.2	11.2	8.2	11.1a
Leaf Removal	1.2	1.0	1.1	2.9	1.6b
Mean	5.9	7.6	6.1	5.6	

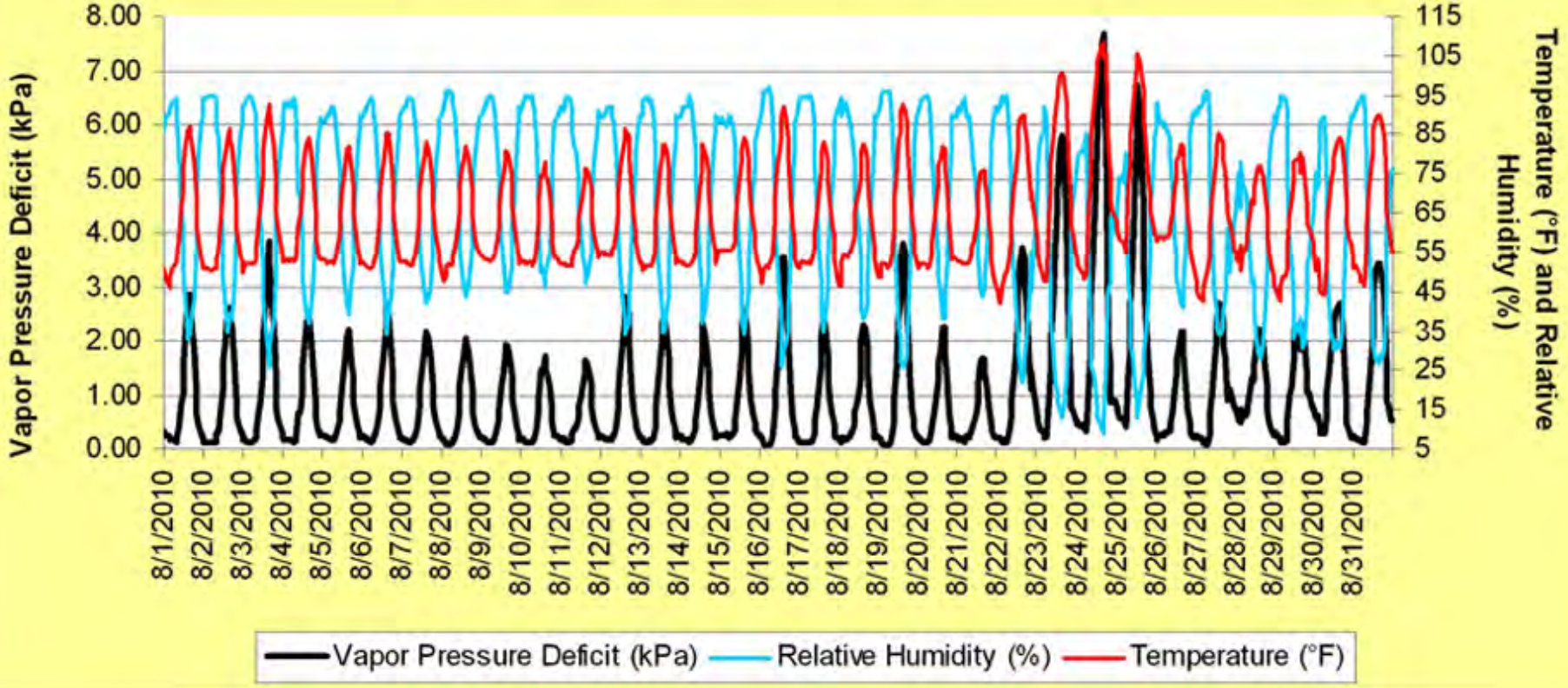


Chardonnay, VSP trellis, August 2010


Chardonnay, Smart Dyson trellis, August 2010

Zinfandel, head trained spur pruned, August 2010

Figure 2. Vapor Pressure Deficit, Temperature and Relative Humidity
Alexander Valley (Piccolo), 8/01/2010- 8/31/2010



Factors affecting cluster exposure

- Row orientation
- Aspect
- Trellis design
- Water management
- Canopy management

Take home messages

- Latent infections usually remain “latent” through harvest UNLESS things get wet!
- In cool or foggy regions, apply ***preventative*** treatments (bloom, pre-close, veraison)
- Canopy management practices that increase cluster exposure reduces disease
- Degree of cluster exposure is related to your site and your risk tolerance.

Annual results of UC Davis Bunch Rot Efficacy Trials:

- http://plantpathology.ucdavis.edu/ext/

UCCE *Sonoma County Viticulture Newsletter*; (December 2011 issue on Botrytis and powdery mildew)

- http://cesonoma.ucdavis.edu/