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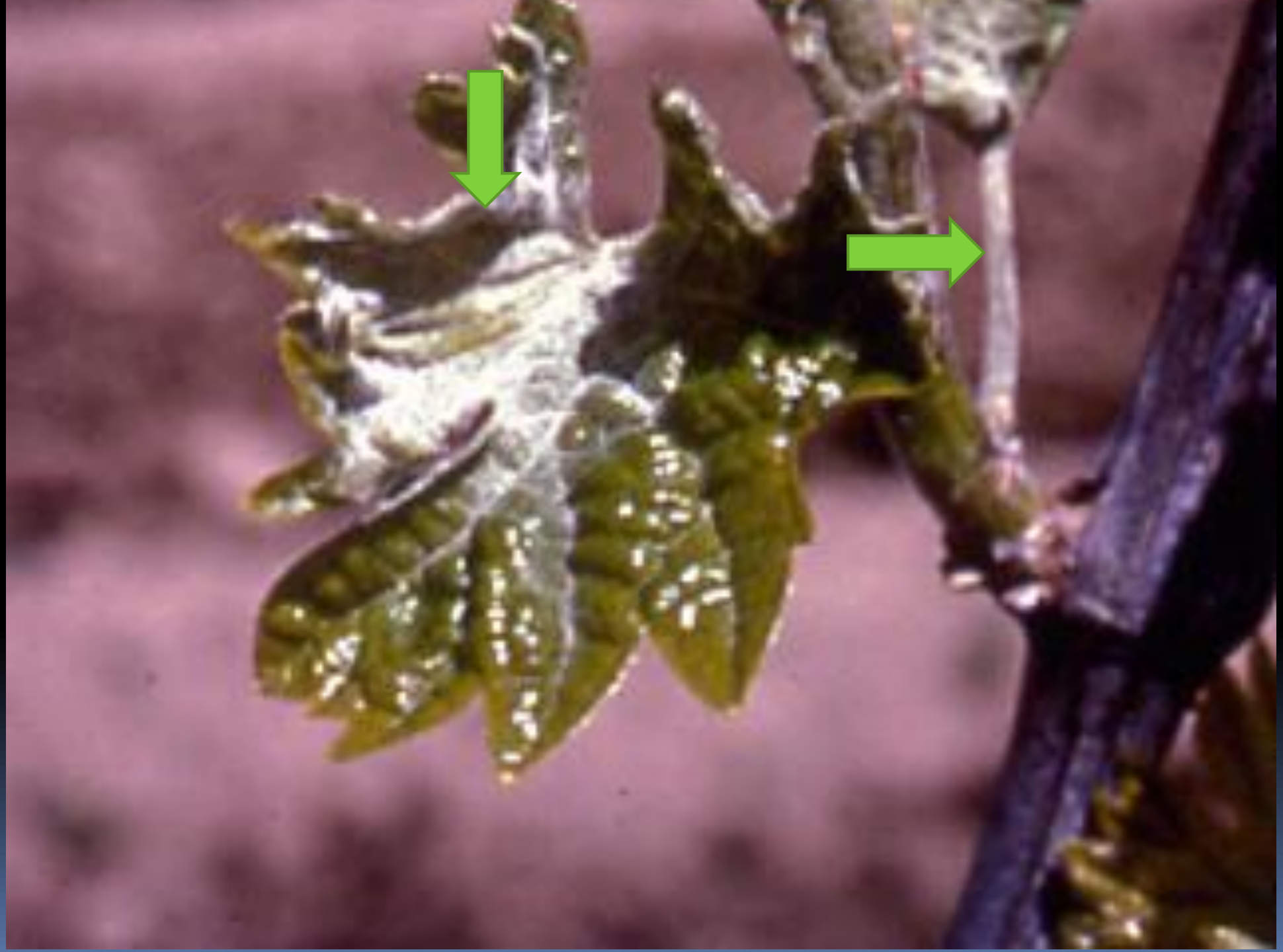
FOOTHILL GRAPE DAY MAY 18,2016

Powdery Mildew
Erysiphe necator

- Disease epidemiology/ Pathogen biology
  - Pathogen negatively effected by direct sunlight
    - Reduces sporulation, spore germination, infection and lesion expansion
  - Pathogen negatively effected by high temperatures
    - Reduces spore production
    - Reduces spore germination rate
    - Reduces infection rate
    - Affects reproduction rate

Grapevine Powdery Mildew

- Effects of Moisture
  - Optimum RH is 65%
  - No effect of higher RH
  - Effect of RH is overcome by temperature i.e. temperature more important.
  - Free water has negative effect on conidial sporulation, infection, and lesion expansion.
  - 2 mm or more of rainfall required for ascospore release at temperatures of 70-85 F
  - Free water has positive effect on ascospore germination



Bud Perennation

- Occurs on same vines each year
  - Flag and monitor
  - Remove flag shoot(s) and treat that vine and the 4 around the infected vine with Rally+JMS Stylet Oil, Inspire Super or Luna Experience
- Protect next year's buds during 3-6 leaf stage.
- Infection next year should be expressed at the same time as infection occurred this year i. e. if infection started during the formation of the 3rd leaf then that leaf will show disease next year. This allows the prediction of when the spray application should be made.

Cleistothecia (Chasmothecia)

- Form in late summer and fall.
- Wash from leaves with fall and winter rains onto cordons, canes, and spurs.
- Monitor for disease 7-10 days after ascospore release—lower surface of basal leaves.
- Control
  - Postharvest application of JMS Stylet Oil at 1.5-2.0% (for prevention of chasmothecia)
  - Dormant, directed spray application of Lime sulfur at 10 gal/A in 100 gal water
  - Budbreak application of df Sulfur at 5#/A
  - Budbreak application of JMS Stylet Oil at 1.5%

Effect of High Temperature

- Negative effect spore production
- Negative effect on lesion expansion
- Negative effect on spore germination
- Negative effect on infection process

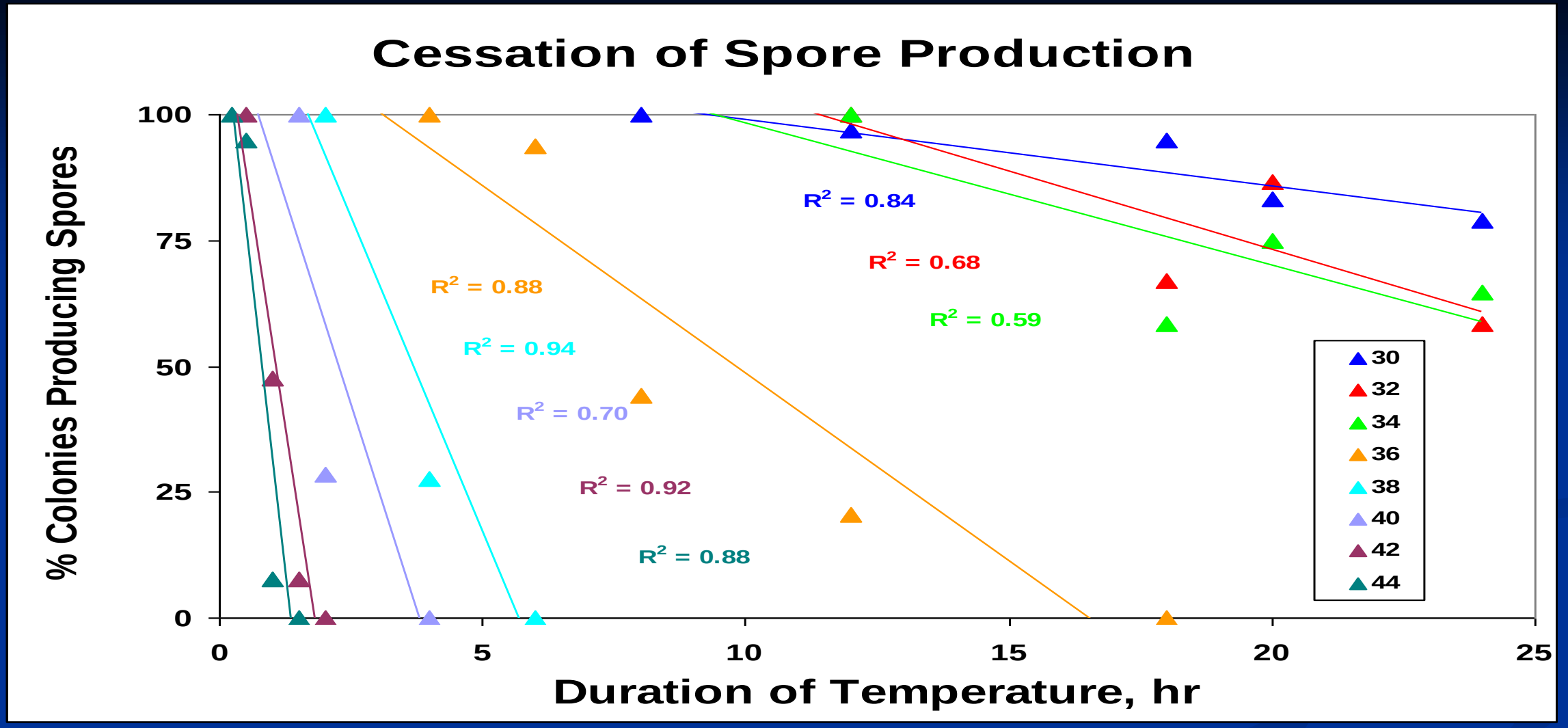


Figure 8. The effects of temperature and duration on cessation of *E. necator* spore production. Primary data were obtained as described for Figure 7. Colony survival was calculated for each leaf, each isolate, averaged for each duration, and plotted with linear regression trend lines. In order to obtain reasonable x-axis intercepts, only 1 zero value was used if consecutive zero values occurred; consecutive values of 100% were similarly truncated. Room temperature controls (22.5° C) were all 100% (data not shown).

Two Potential Outcomes with multiple exposure to high temp

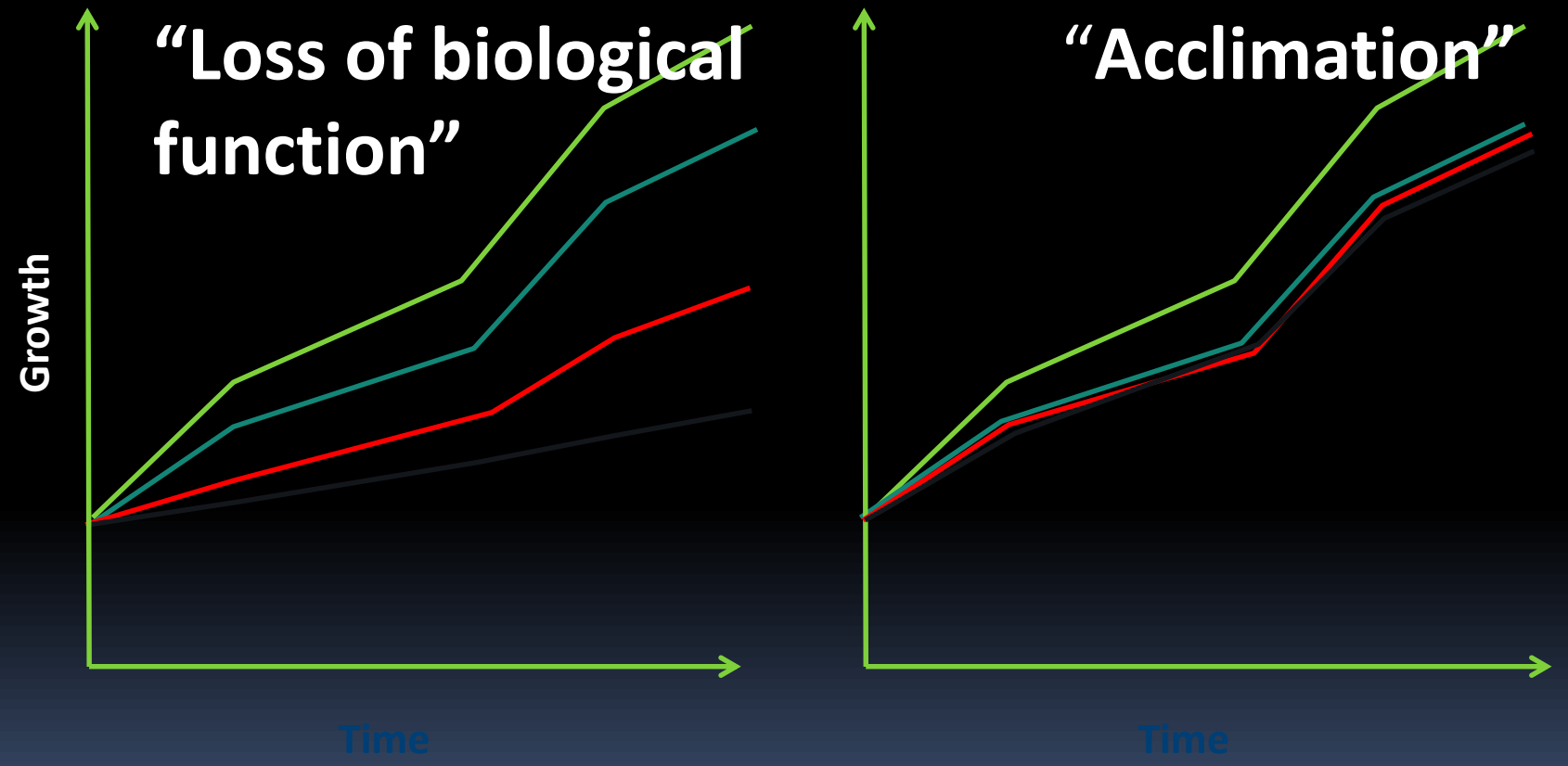
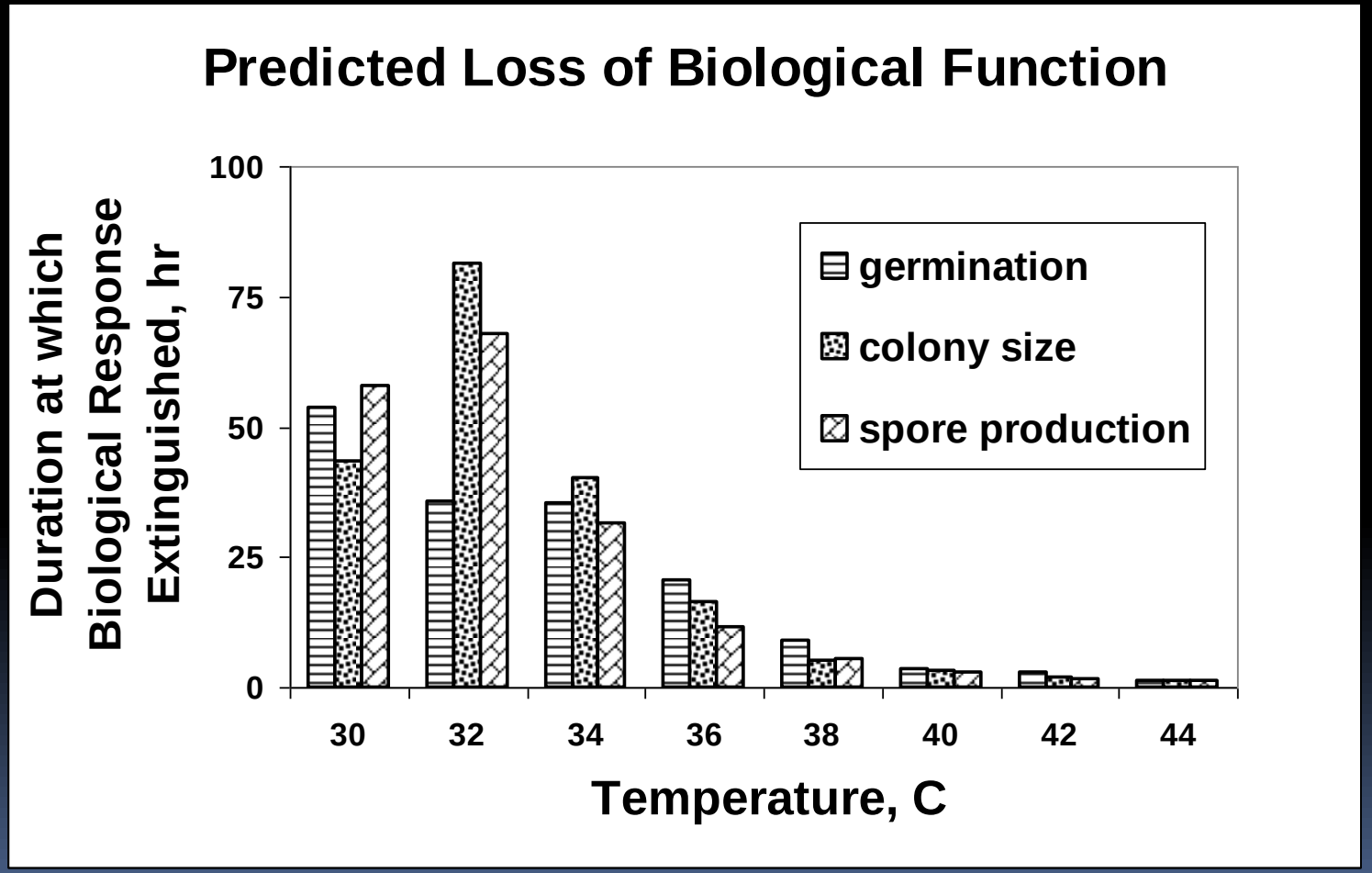
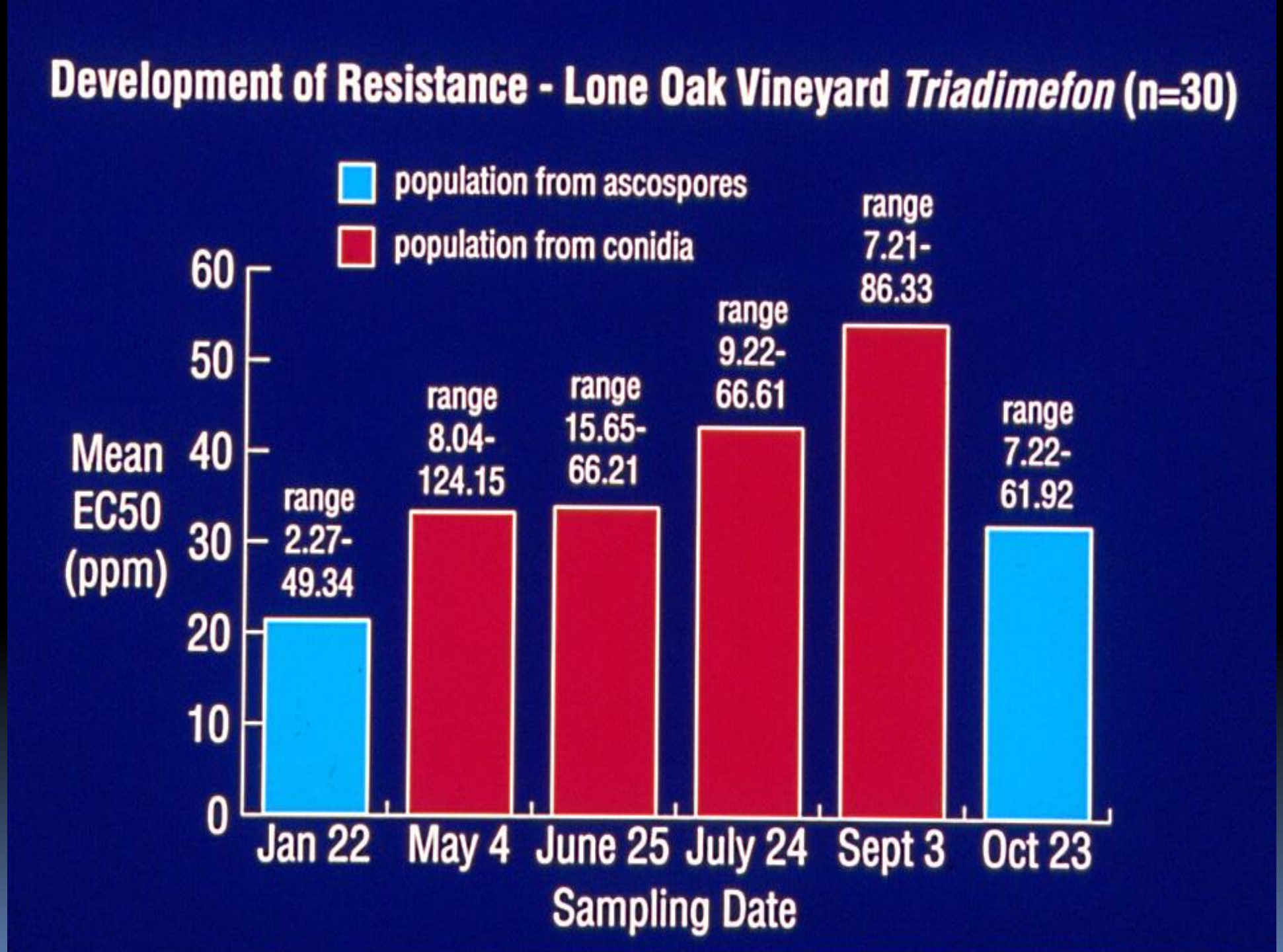


Figure 10. Predicted loss of biological response as a function of temperature and duration of treatment for spore germination, colony size on day 10 and spore production. The predicted duration (h) at which the biological response is zero (x-intercept) was obtained from linear regression analysis of primary data in SAS.



Fungicide Resistance

- Resistance to DMI's!
- Resistance to Strobilurins?


Development of Resistance - Lone Oak Vineyard *Triadimefon* (n=30)
population from ascospores
population from conidia
Mean EC50 (ppm)
60
50
40
30
20
10
0
range 2.27-49.34
range 8.04-124.15
range 15.65-66.21
range 9.22-66.61
range 7.21-86.33
range 7.22-61.92
Jan 22
May 4
June 25
July 24
Sept 3
Oct 23
Sampling Date

Combating Overwintering Resistance

- Make sure the first application each year is NOT A DMI (Rally, Elite, Metal, Procure, etc.) OR Strobilurin (Abound, Sovran, Flint, Pristine
- Use multisite products first (Oil, df Sulfur, Dormant Lime Sulfur)

Resistance Management

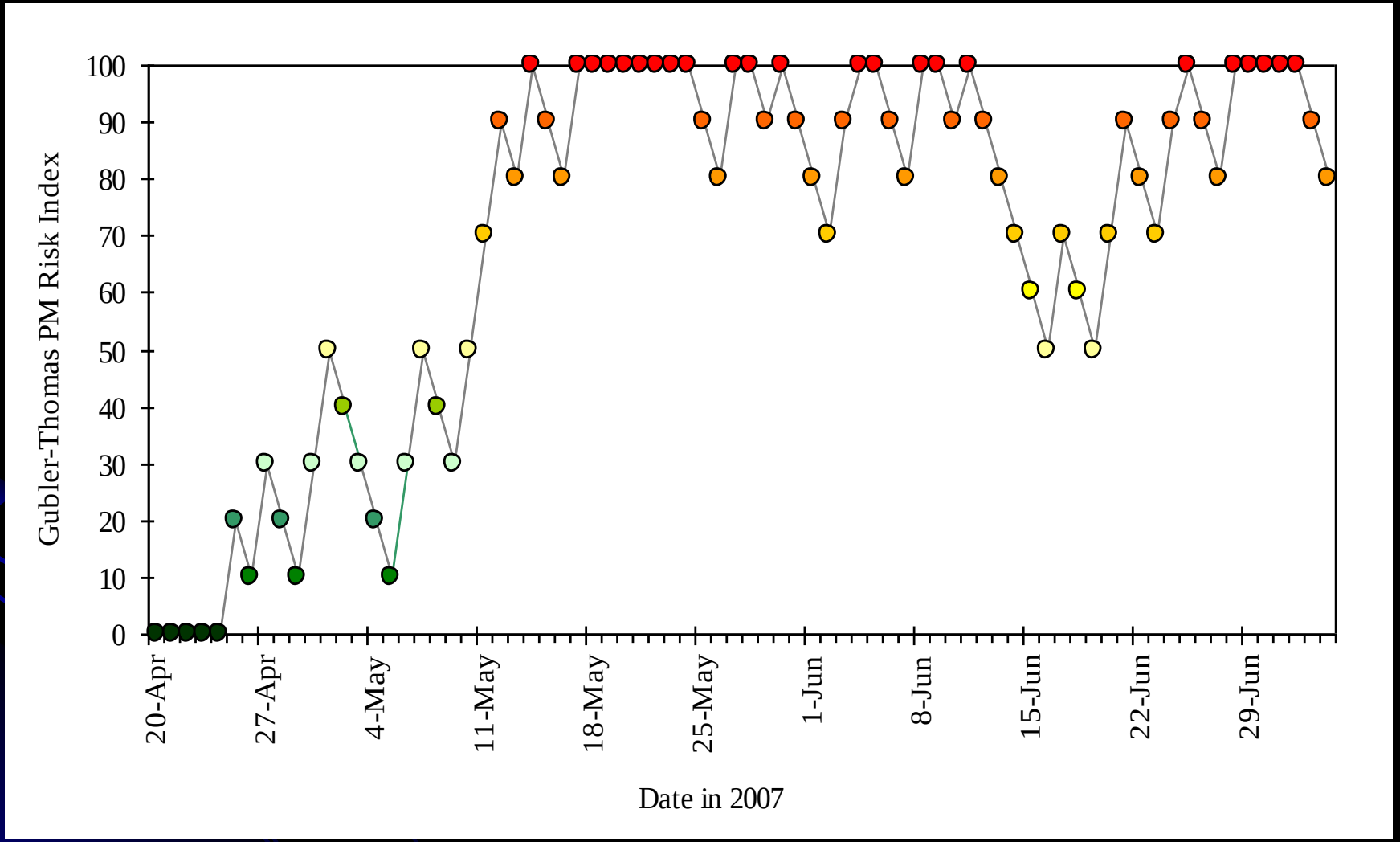
- Aim- Reduce Selection pressure to prevent further buildup of resistant strains.
- Should not use within class of chemistry for mixes or alternations i.e. NEVER DMI-DMI or Strob-Strob
- Do not stretch intervals unless you know what the level of disease pressure is. (UCDRI)
- Spray coverage is as important as the product you use.
- Coverage! Coverage! Coverage!

Powdery Mildew

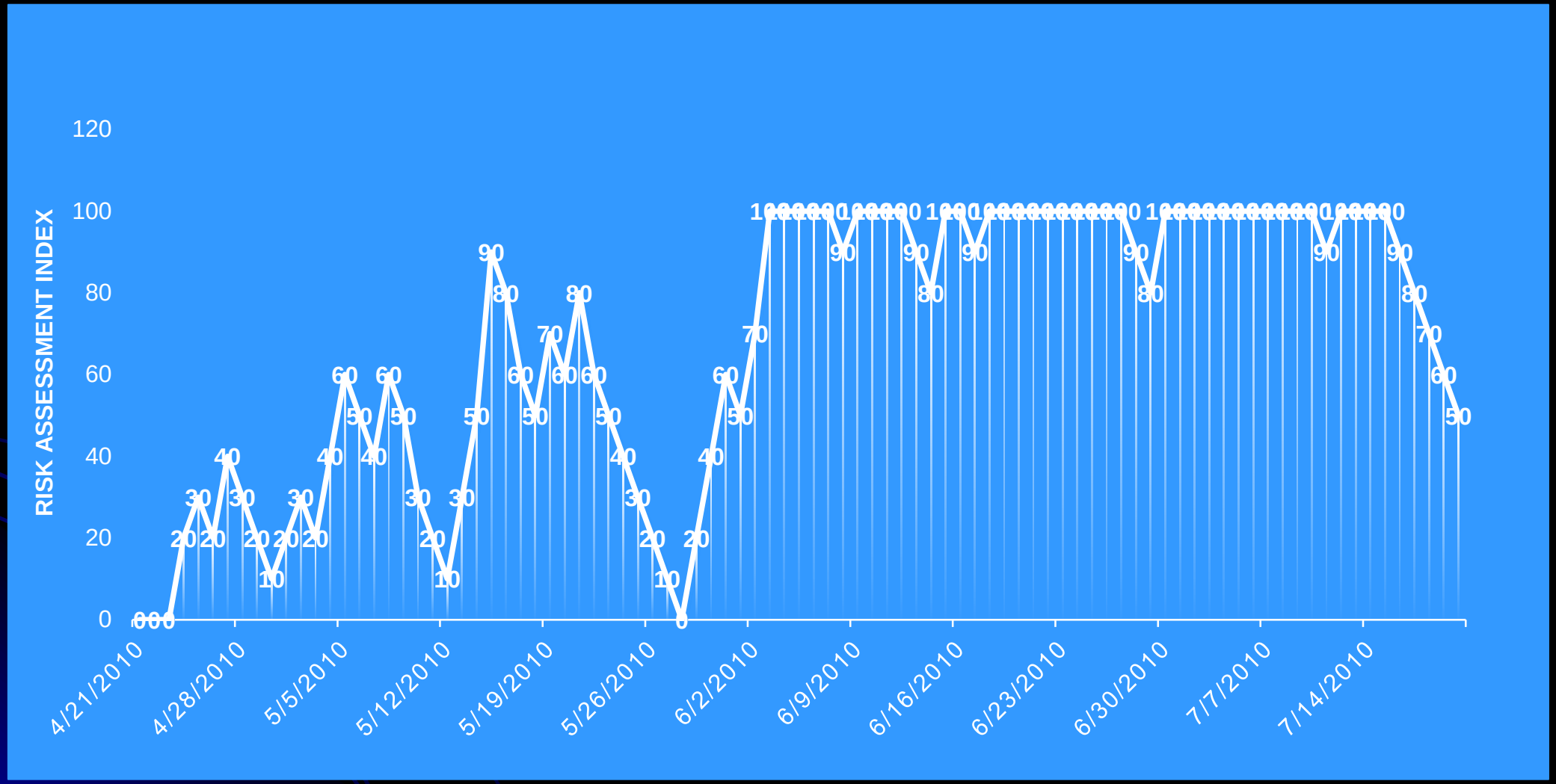
- Model Use
  - Stretch spray intervals under low to intermediate disease pressure.
  - Shorten spray intervals under high disease pressure
    - Organic products should be used on 5-7 day interval under high disease pressure with the exception of JMS Stylet Oil which can be used on 14 day interval under high pressure.
    - Sulfur dust use stretched to 30 day intervals using the RI model in California and Germany.

Powdery Mildew Spore Trapping

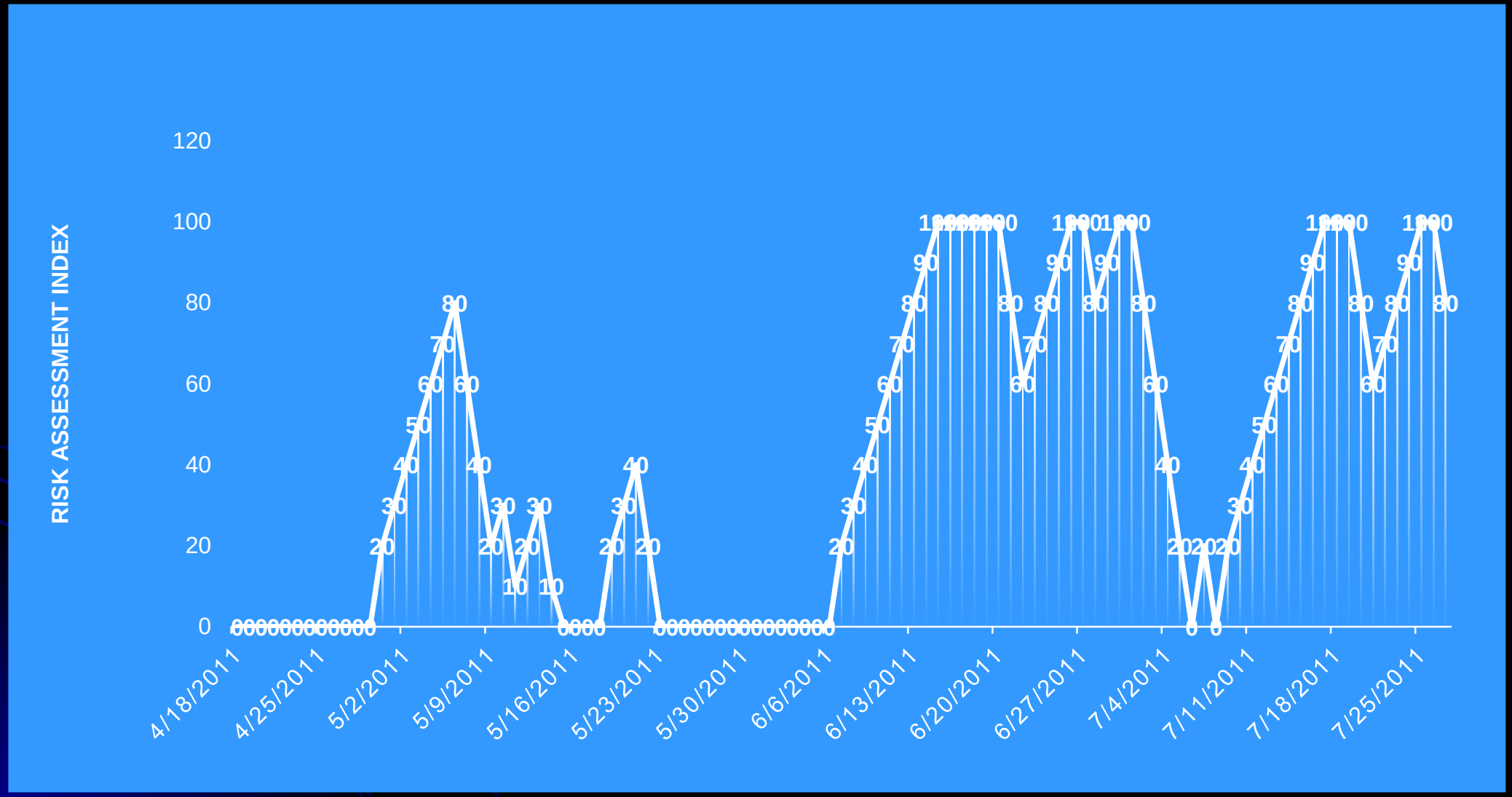
Gubler-Thomas Risk Index, Courtland CA. 2007



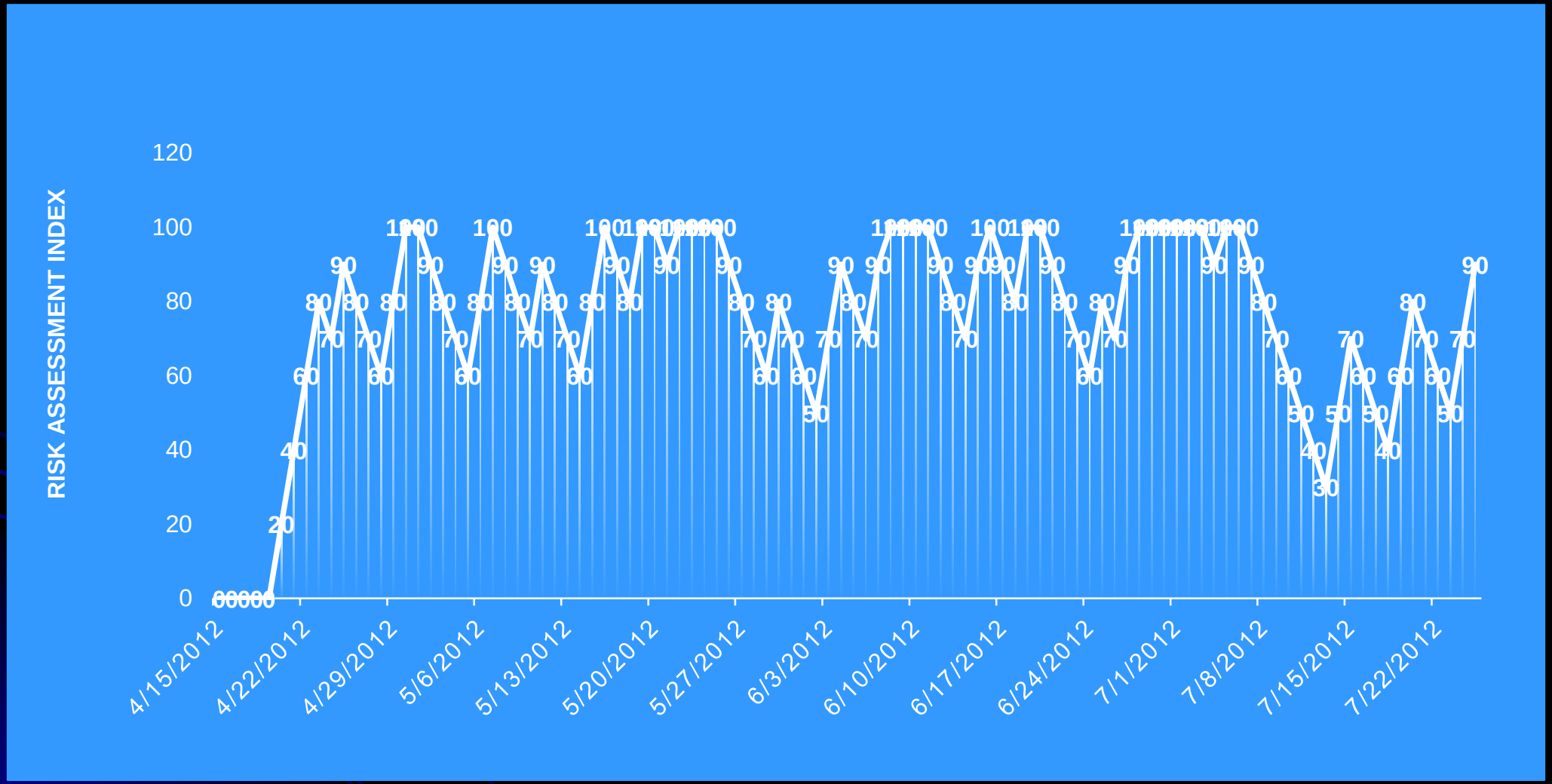
Gubler-Thomas PM Risk Index 2010



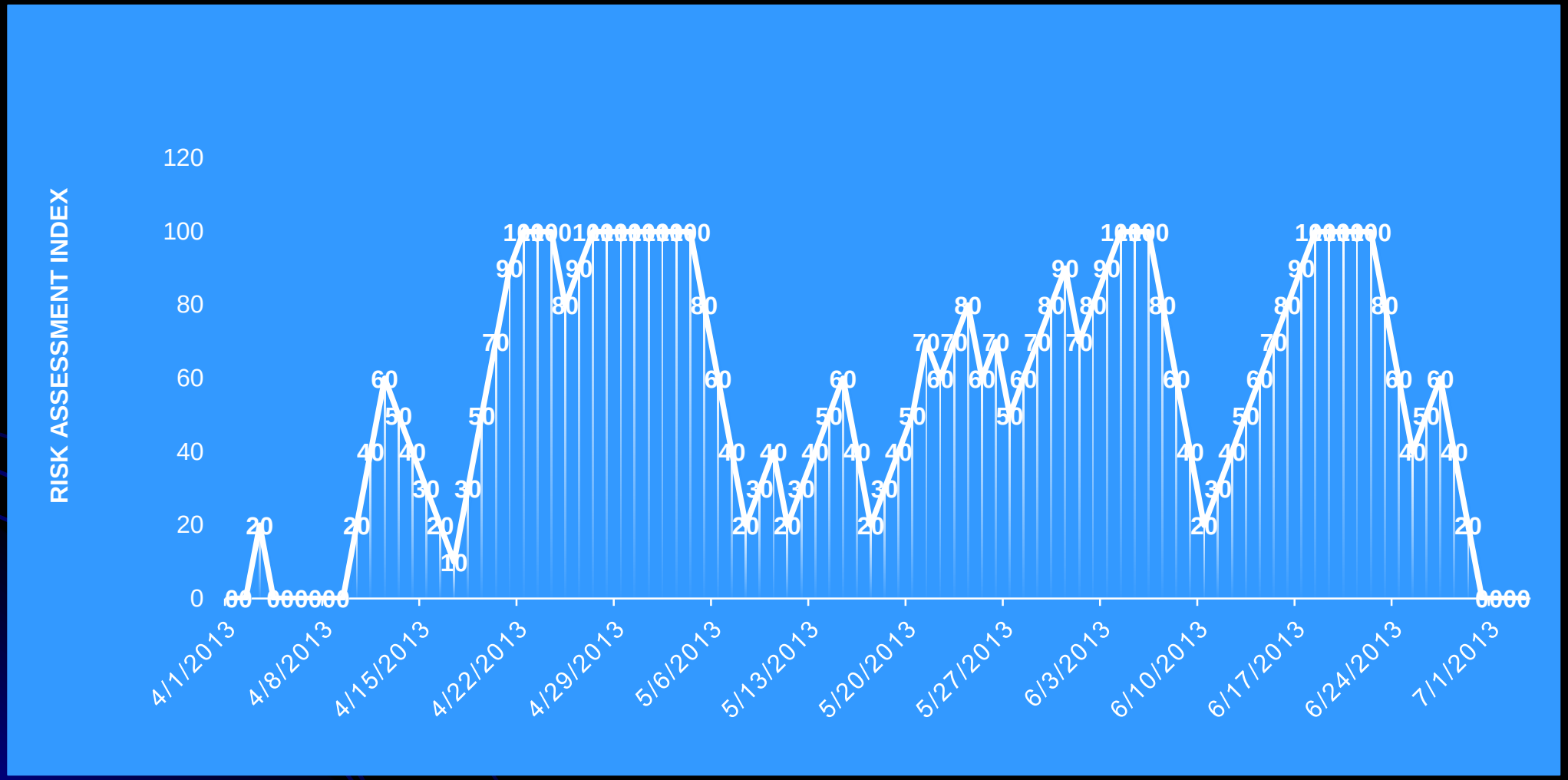
Gubler-Thomas PM Risk Index 2011



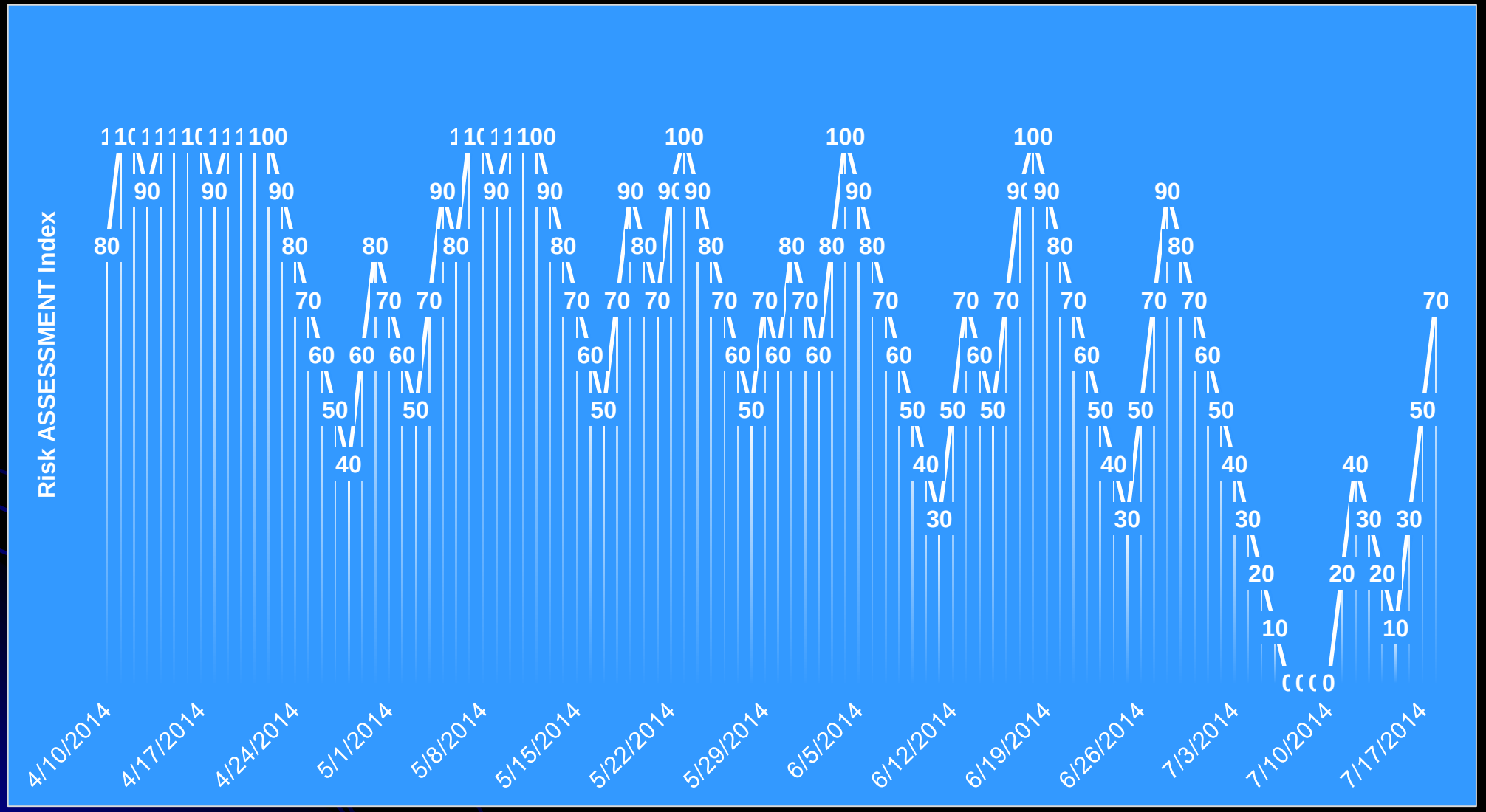
Gubler-Thomas PM Risk Index 2012



Gubler-Thomas PM Risk Index 2013



Gubler-Thomas PM Risk Index 2014



Effect of Dormant or Delayed Dormant Treatment on viability of Ascospores—Vineyard Trial

Treatment	Rate	% Germ	% w/Appressoria
Micronized S	5#	2	0
JMS Stylet Oil	2%	1	0
Lime Sulfur	10 g	1	0
Rally/Topsin	5oz+1.5#	0	0**
LS+JMS Oil	2+10	0	0
Citricide	2%	33	4
Untreated	----	30	6

**Also effective for canker disease

Fungicide Application: Rally + Topsin M

Powdery Mildew & Canker Disease Control

Early Season Powdery Mildew Control

- Budbreak applications = 95% control at disease onset.
  - Micronized S 5#/A in 100 gal water/A (above temperature of 22-23 C)
  - JMS Stylet Oil 1-2 % in 100 gal water/A
  - Other oils ?
  - Rally + Topsin M as a delayed dormant
    - Powdery mildew and canker control

Cultural Practices

- Increase direct sunlight
  - Leaf removal at cluster set- reduces pm by 50%
  - Shoot thinning
  - Crown suckering
- Decrease RH

Botrytis cinerea

BOTRYTIS BUNCH ROT


Leaf removal at cluster set
Also reduces blossom debris

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

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

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

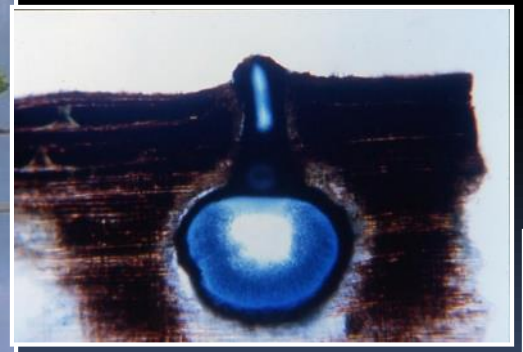
Blossom debris removal

- Leaf blower study
  - Reduced bunch rot by 30%

Canker Diseases

- Eutypa dieback
- Bot Canker
- Esca (Black measles, Spanish measles)

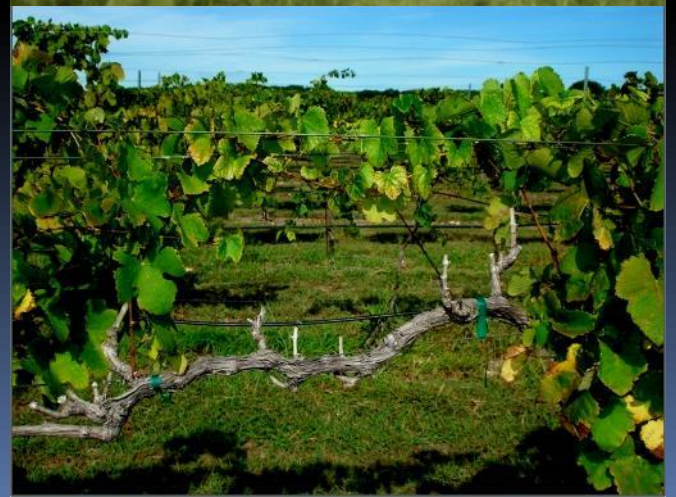
Eutypa Dieback

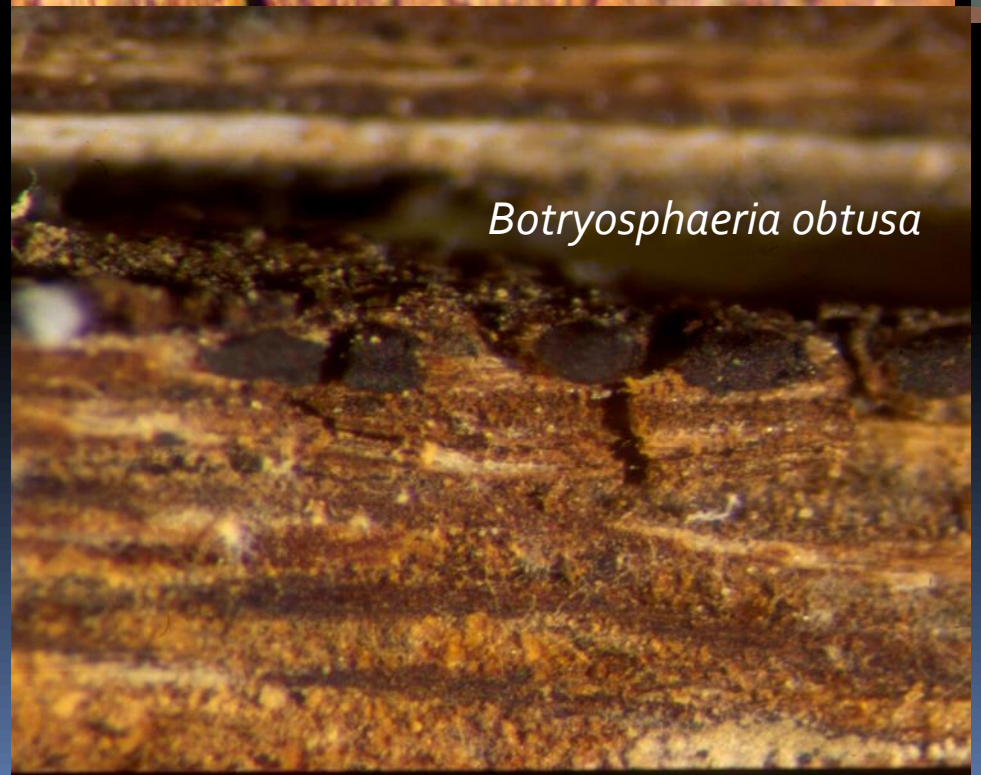


Canker Disease Control

Diatrypaceae, Botryosphaeriaceae and Valsaceae family

- *The* Family Botryosphaeriaceae constitutes the main fungi isolated from grapevine cankers in California
  - *Lasiodiplodia theobromae*, *Neofusicoccum parvum*, *Neofusicoccum luteum*, and *Neofusicoccum australe*
  - much more virulent than the well-known pathogen *E. lata.*

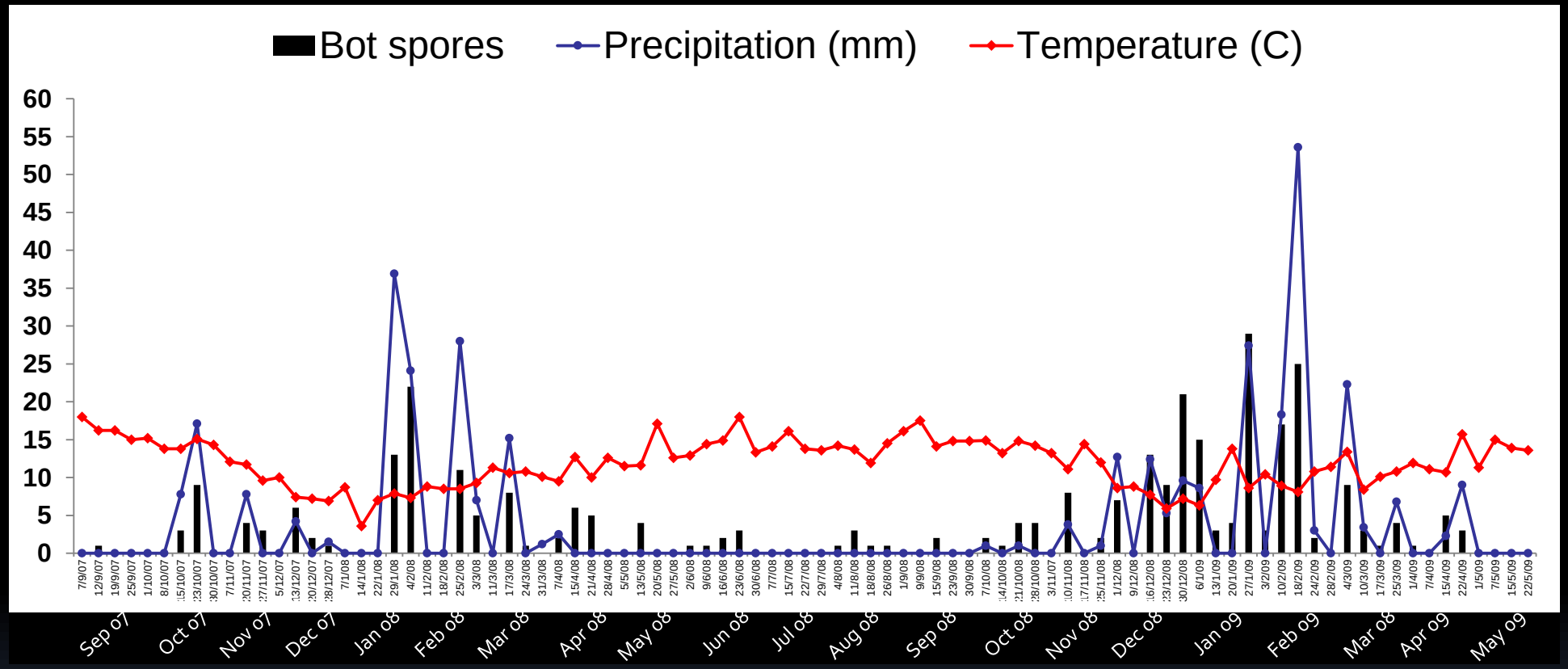




Dormant Liquid Lime Sulfur(ca polysulfide)

- 10 gal/a = 75% kill of overwintering fruiting structures.
- Coverage is an issue

Vaseline slides spore trapping results in Monterey County

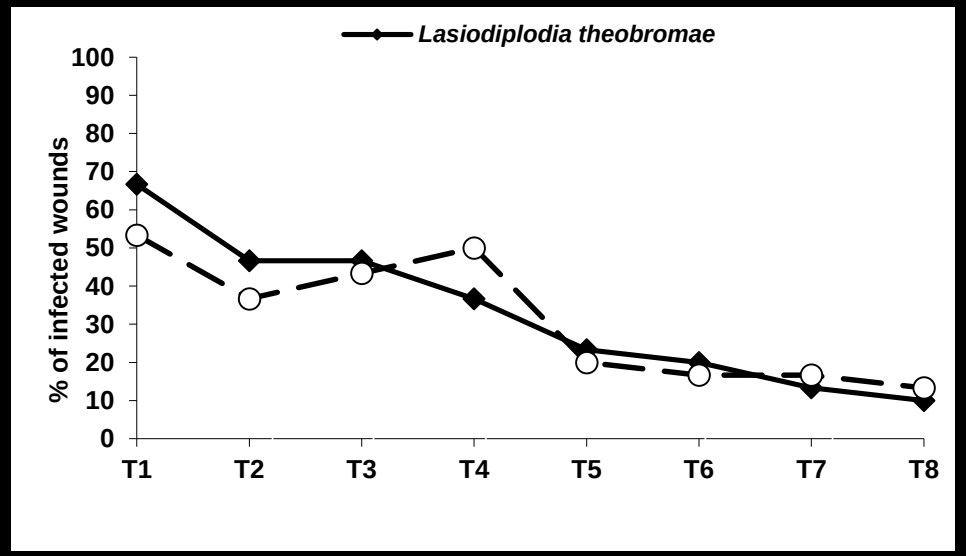


Bot spores values = Total spores / 2 ml of H_2O

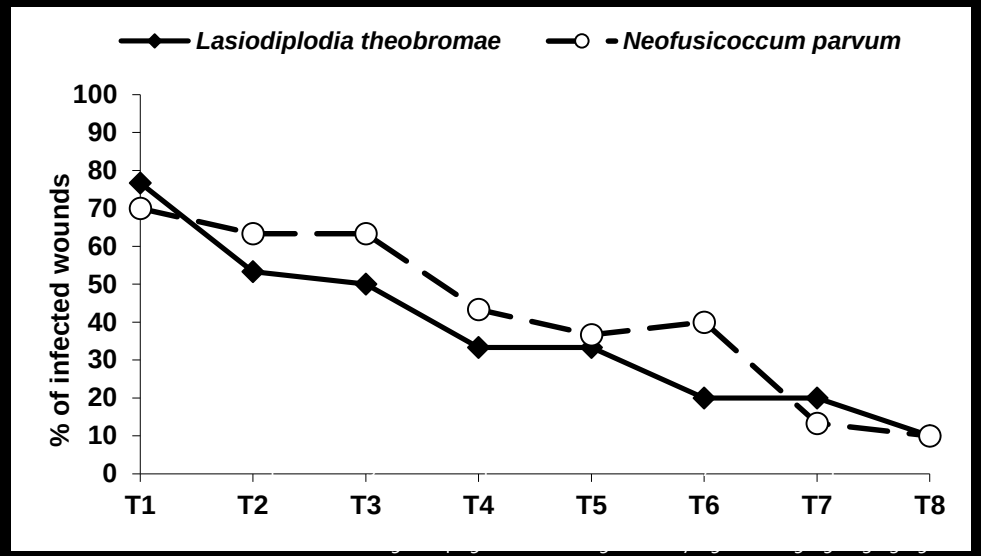
Úrbez-Torres et al. Plant Dis. (In revision)

Chardonnay 2008-2009 Time Course Inoc

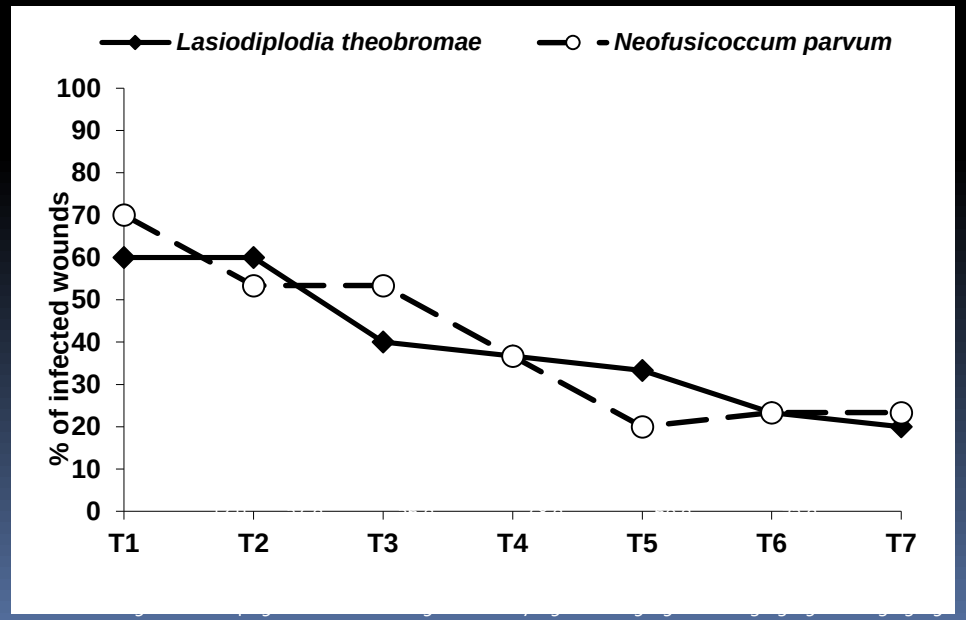
November



December

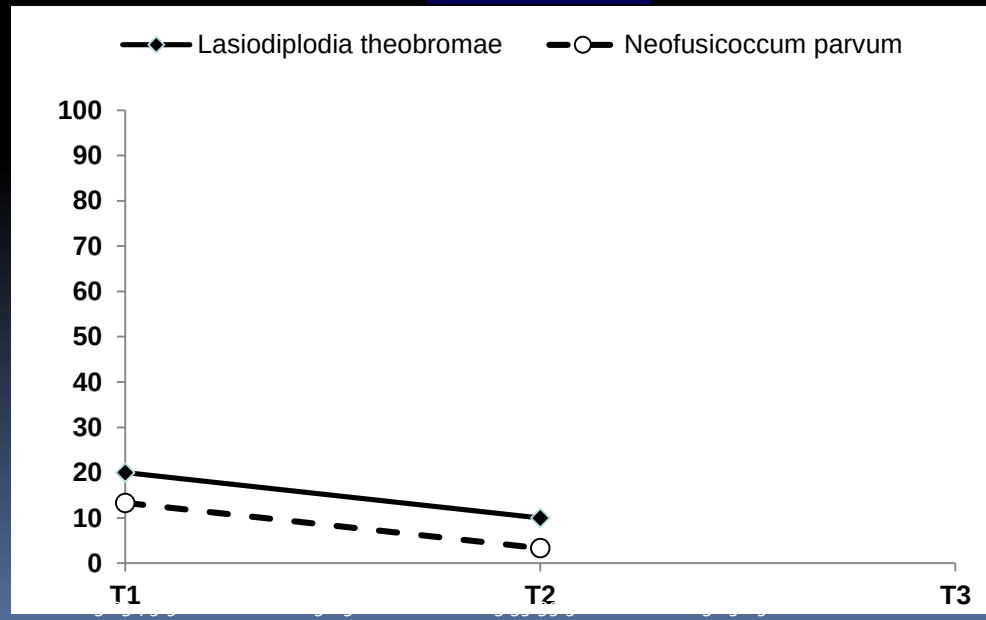


January



February

March

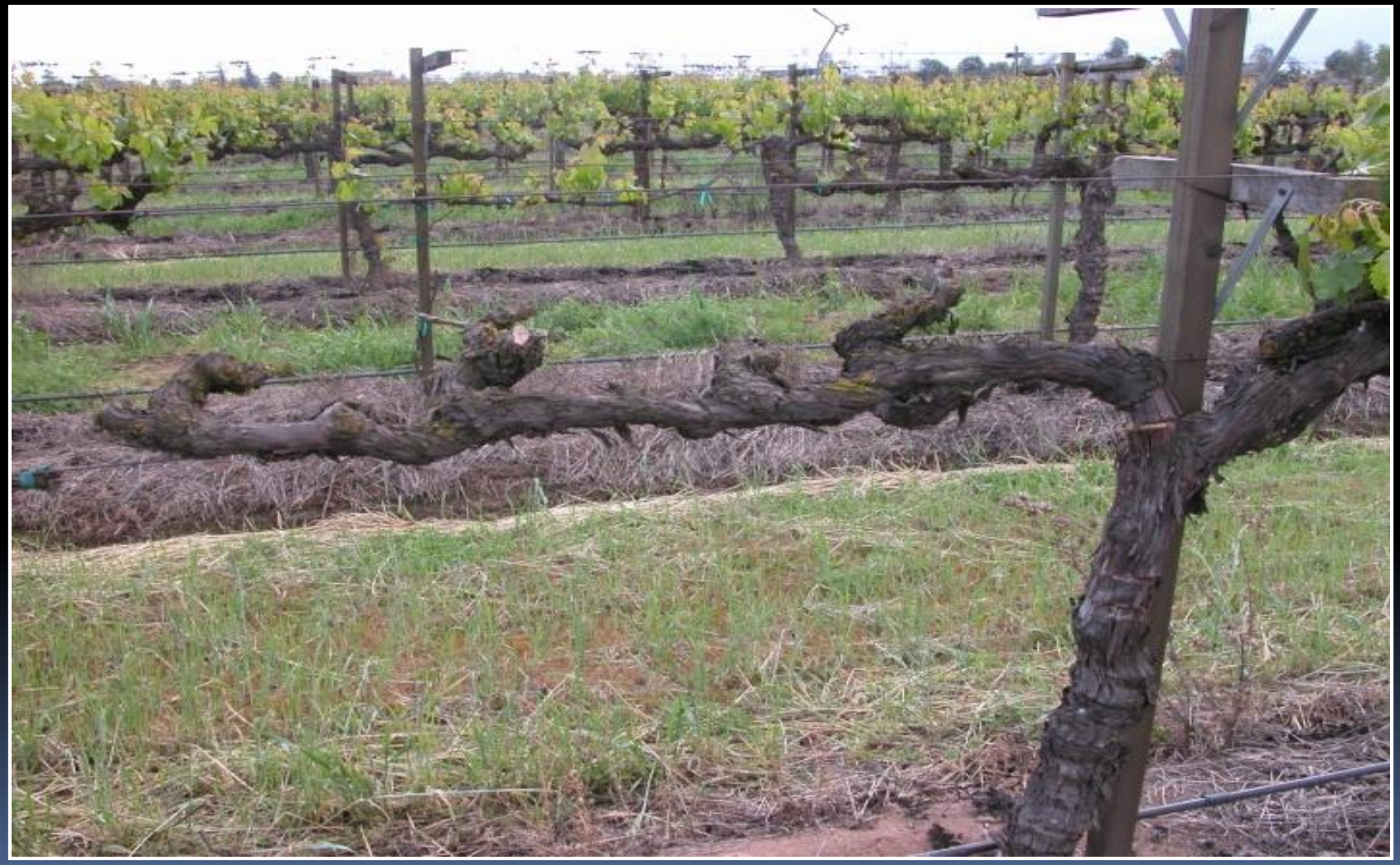


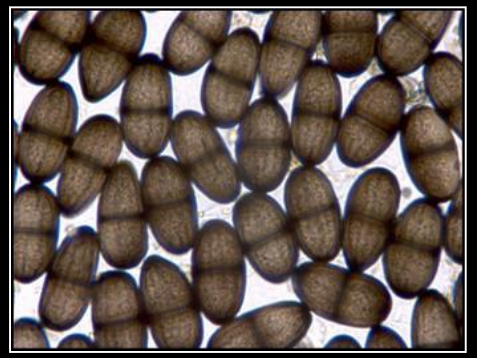
Double Pruning-First pruning in Nov-Jan
Final pruning (2 buds) late February - early March

Eutypa dieback Canker

- Botryosphaeria canker "Bot Canker" in California 1990

Botryodiplodia theobroma=Botryosphaeria rhodina=Lasiodiplodia theobromae





“Bot Canker”
Disease Cycle

Blockage of vascular system

Spore release:

Rainfall

Sprinkler irrigation

Fog

Double Pruning Final pruning (2 buds) late February - early March

Effective Products Against Canker Pathogens

- DMI's- some have activity against Eutypa (Rally, 2X)
- Benzimidazole- Excellent activity against all pathogens (Topsin M, 2X)
- B- excellent activity against Eutypa (B-LOCK, 1X)
- Vitiseal with or w/o Rally + Topsin M
  - Paint or daub 1X
  - Spray (1: 9 dilution)1X
- Biological's- good activity if applied 2 weeks before infection (Trichoderma, Cladosporium)
- New products being tested
  - BSP tractor application
  - Nanofiber hand application

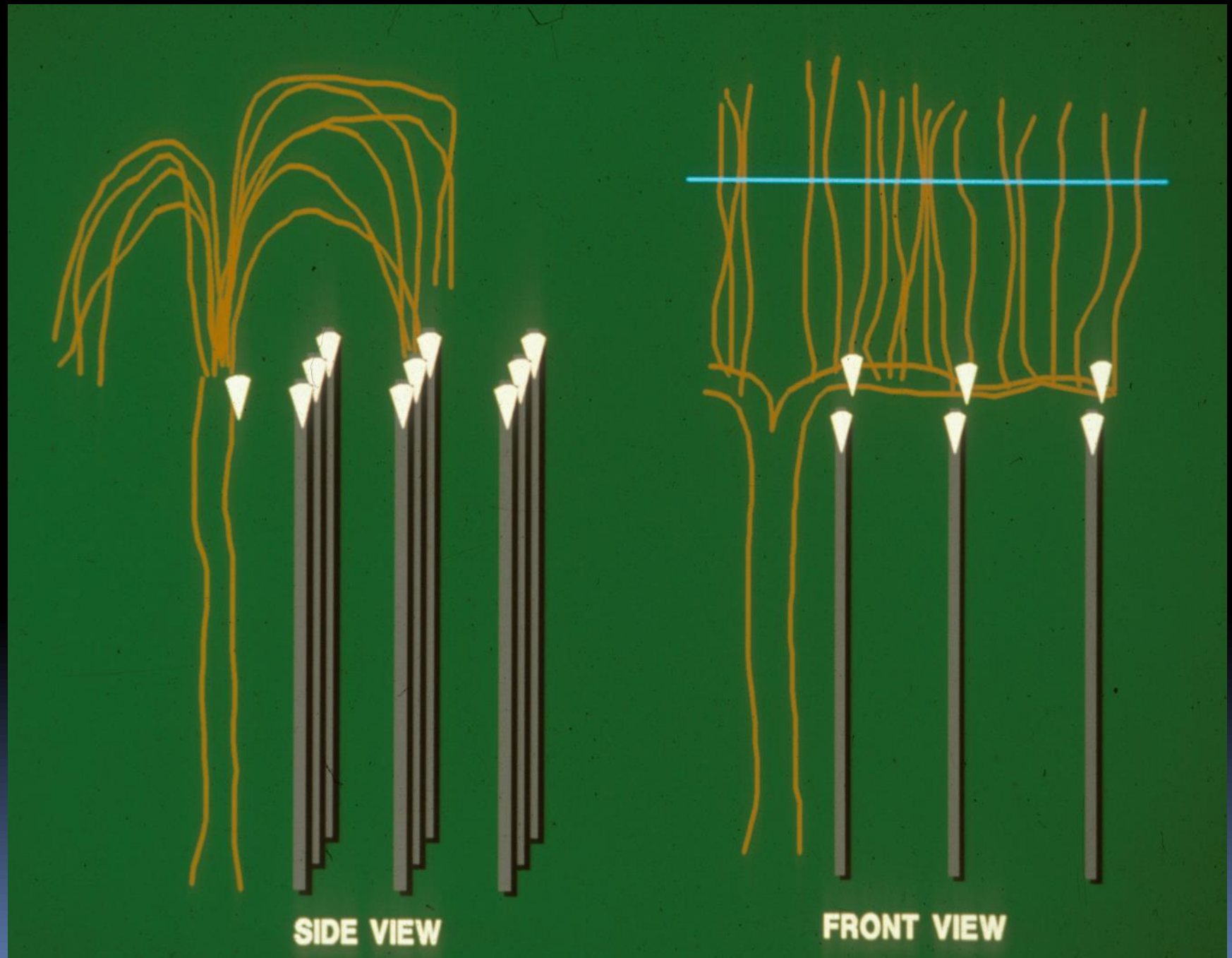
Fungicide Application: Rally + Topsin M

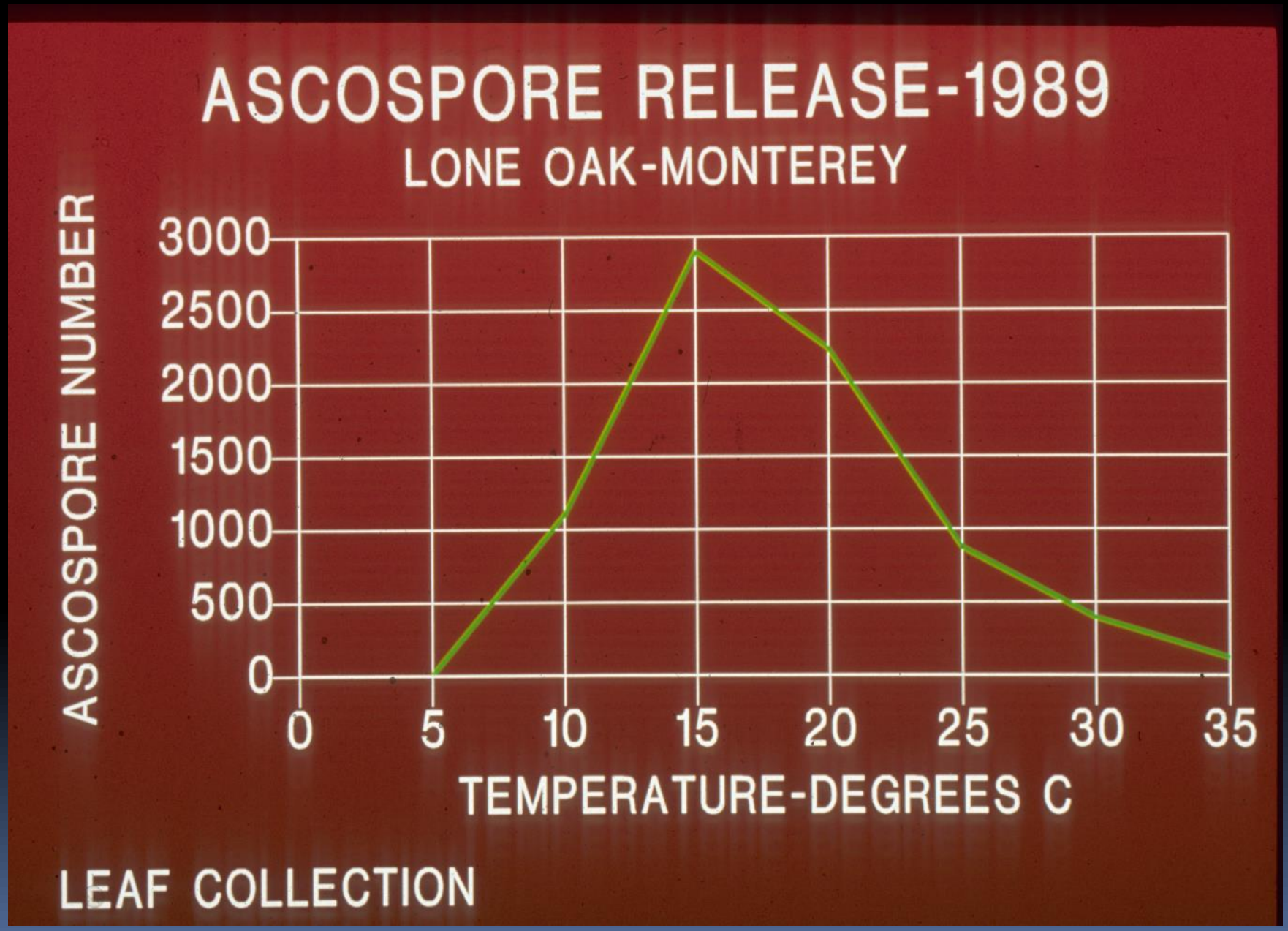
Powdery Mildew & Canker Disease Control


PAK-TANK


MAX-TANK

- Thank You!


SIDE VIEW
FRONT VIEW


ASCOSPORE RELEASE-1989
LONE OAK-MONTEREY
ASCOSPORE NUMBER
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
TEMPERATURE-DEGREES C
LEAF COLLECTION

THE EFFECT OF TEMPERATURE ON ASCOSPORE VIABILITY

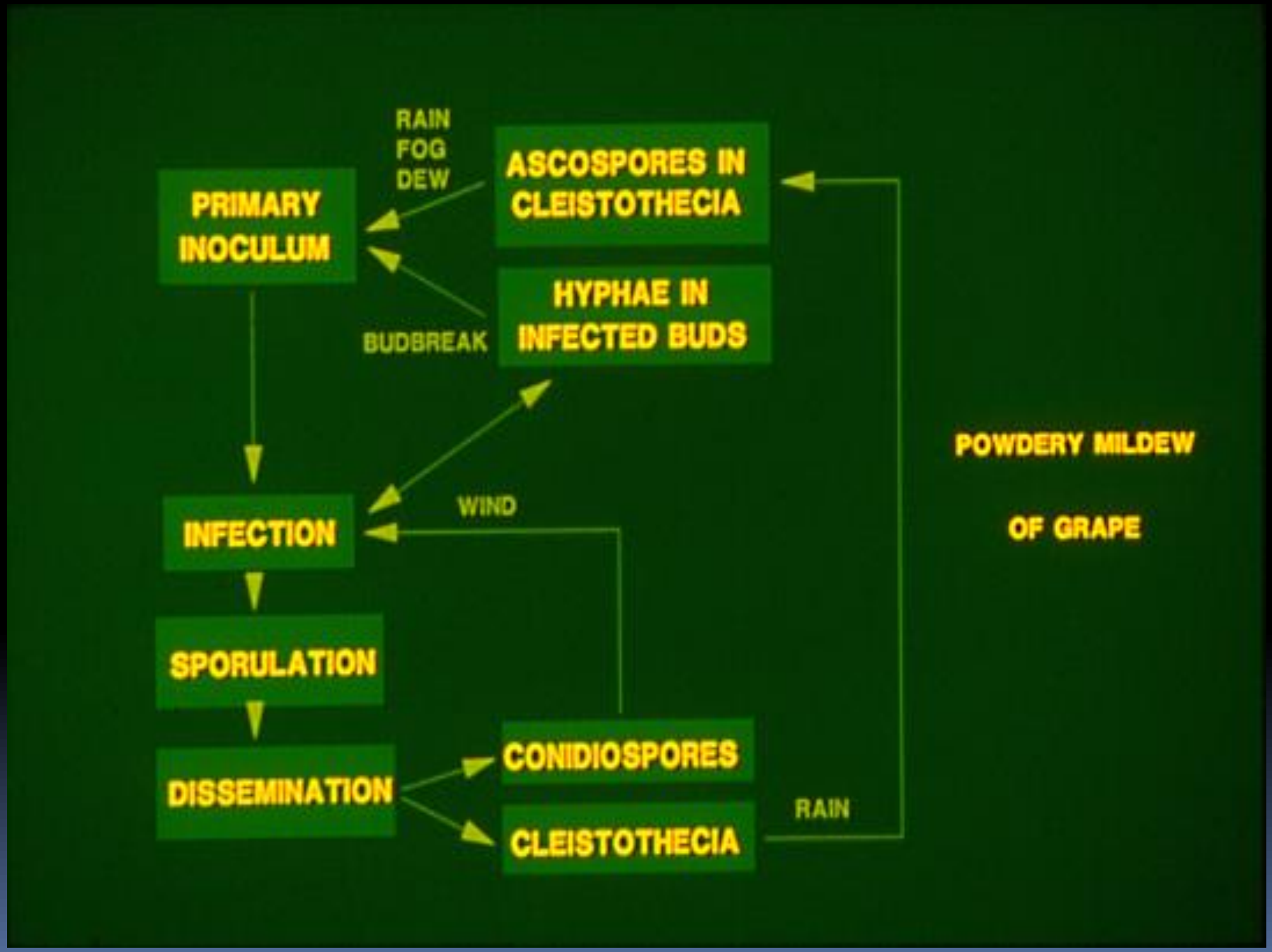
TEMPERATURE	% GERMINATION	% INFECTION
10	50 B	40 A
15	75 A	36 A
20	70 A	38 A
25	59 A B	41 A
30	24 C	11 B

Resistance Management

- Aim- Reduce Selection pressure to prevent further buildup of resistant strains.
- Use mixes or alternate use of fungicides with different modes of action i.e. DMI's and Strobilurin's, Quinoxyfen, Boscalid etc.
- Should not use within class chemistry for mixes or alternations.
- Make sure spray coverage is not an issue

What does Mildew Index mean???

- Index = 0 to 30
  - Spray interval lengthened
  - Stop applications
  - No reproduction
- Index = 40 to 50
  - Spray interval normal
  - Reproduction 15 days
- Index = 60-100
  - Spray interval shortened
  - Reproduction 5 days


RAIN
FOG
DEW
ASCOSPORES IN CLEISTOTHECIA
PRIMARY INOCULUM
HYPHAE IN INFECTED BUDS
BUDBREAK
POWDERY MILDEW
OF GRAPE
WIND
INFECTION
SPORULATION
CONIDIOSPORES
DISSEMINATION
CLEISTOTHECIA
RAIN