San Joaquin Valley Grape Symposium January 10, 2018

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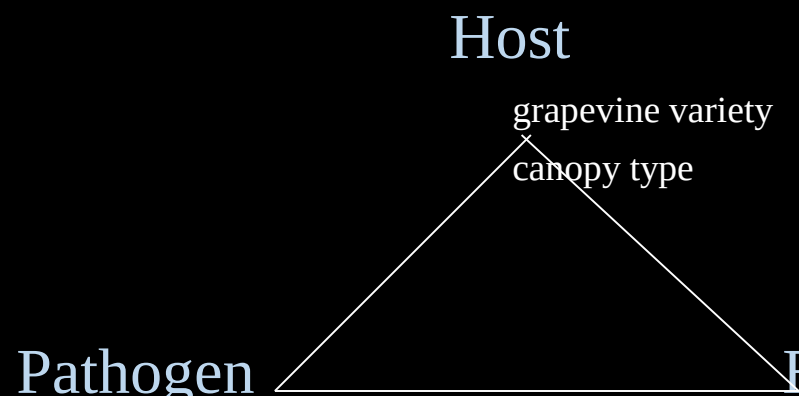
Powdery Mildew

- 3% causes off flavors in wine
- Poor storage of table grapes
- Reduction in sugars
- Increases risk of Botrytis bunch rot
- Increases risk of sour rot

Disease Triangle



Erysiphe necator

Temperature optimum 70-85 F

Free Water=ascospore release

Temps < 60 > 60 but < 70 infection but very slow growth

Temps <50 no growth

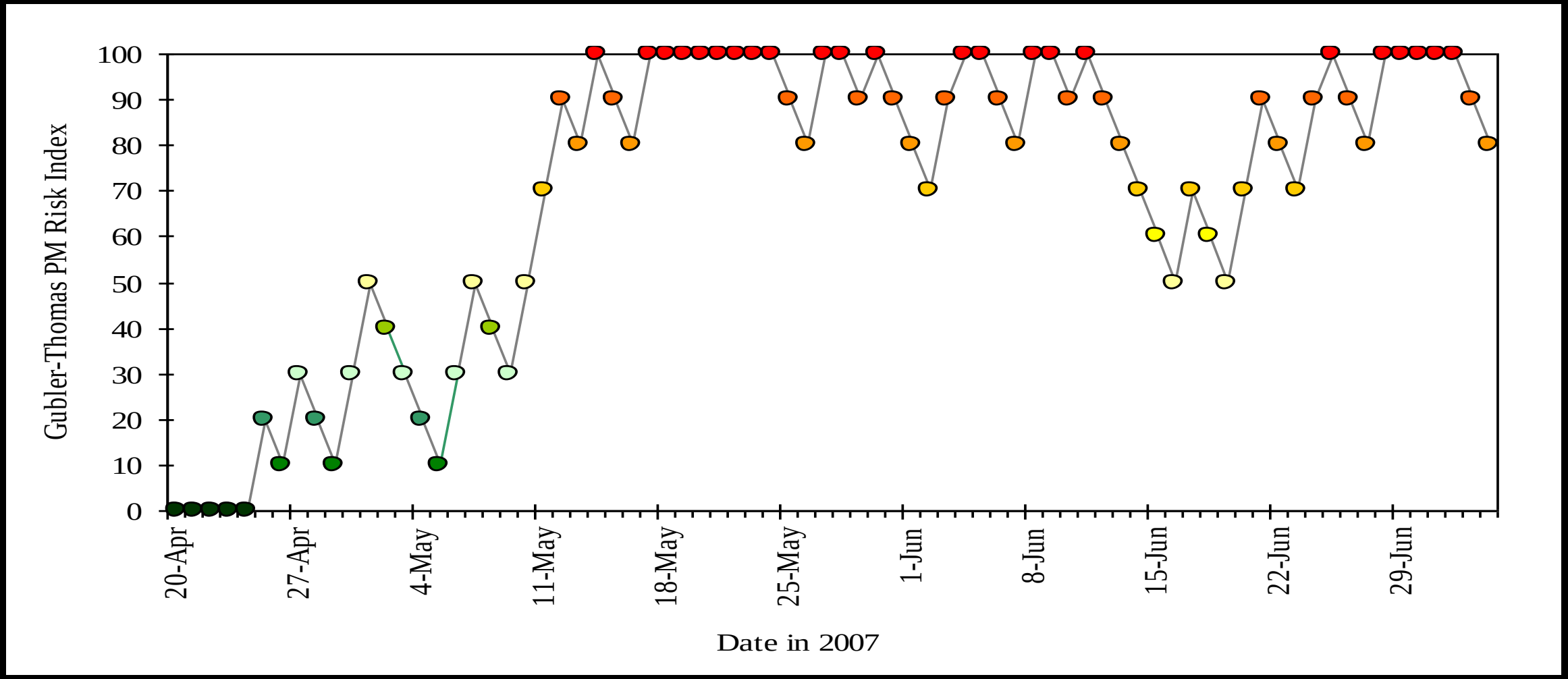
Acclimation > 90!

Sunlight is negative

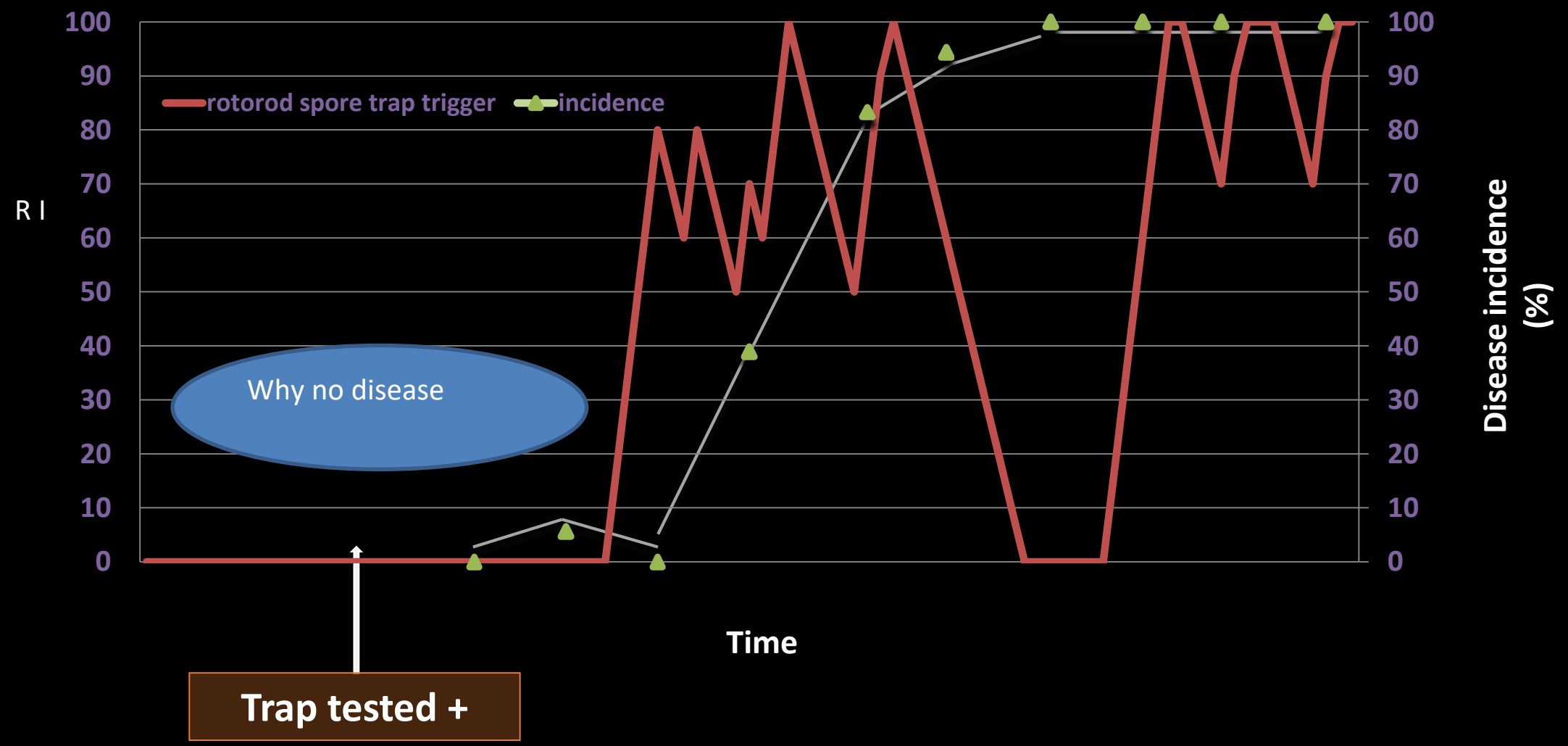
What do we know about powdery mildew?

- Obligate parasite
- Overwinters as chasmothecia (fruiting body) on bark of canes and cordons
- Ascospores released by rainfall (2+ mm)
- Ascospores infect green tissue only (undersides of basal leaves)
- Ascospore colonies give rise to asexual colonies (lesions) and conidia
- Powdery mildew population has developed reduced sensitivity to fungicides, (DMI's yes!!) (Strobilurins?)
    - Never use dmi fungicides early season
    - Never use sequential applications of dmi's
    - Never use more than 2 dmi apps per season
- Disease increase regulated primarily by temperature
- Late season control to reduce chasmothecia numbers ?

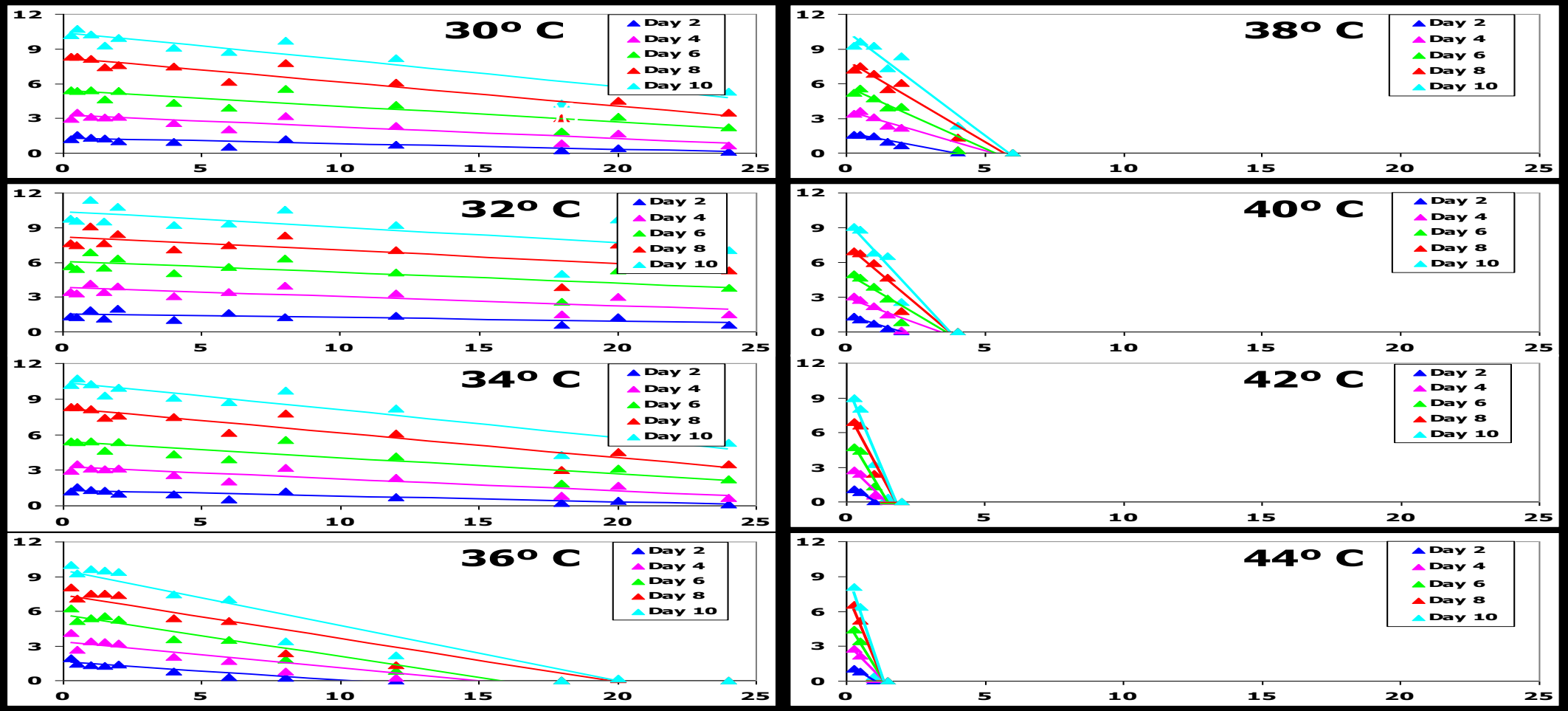
Gubler-Thomas Risk Index (RAI)



Ascospore release X disease onset X disease increase



Colony Diameter (growth x temp)



Fungicide Resistance

Directional= gradual shift

DMI fungicides

Disruptive=whole pop. Shifts

Benzamidazoles, Strobilurins

Dormant and Early Season Control

- Dormant--Delayed Dormant
  - Lime sulfur 10%(100gpa)
  - Sulfur df 5#/a
  - Oil 1-2%, 100gpa
  - Rally 6oz/a+ Topsin M 1.5#/a (Canker control also)
  - Vitiseal 1:9 dilution or RTU (Canker control also)

Early season Control

Early season programs work!

- Plan on disease showing up! When? Where?
  - April-June most years
  - Use the RAI to indicate presence and potential buildup

Budbreak

- Sulfur 5#/a, 100 gpa
  - Application at budbreak = 95% disease control at disease onset
- JMS Oil at budbreak 1-2% 100gpa
- Bud perennation control, systemic + oil 1% at 3 and 6 true leaves
- No triazole (dmi) early season
- Use tight intervals
- Coverage!!

Cultural Control

- Reduce RH
- Increase air flow
- Increase sunlight penetration and temperature
- All can be done with use of leaf removal.
  - Leaf removal at cluster set will reduce powdery mildew by over 50% in the absence of fungicides
  - Will increase spray coverage by 200x

Results: Trial I

Treatment	Mean Incidence (%)		Mean Severity (%)	
Antica + SE 5% (v/v) + 5 ml/gal 7d alt Luna Exp + 3SE 6 fl oz + 5 ml/gal 21d	2.00	j	0.04	k
MBI-10612 1 qt 10 - 14d (RI) then Inspire super + JMS Stylet Oil 10.5 fl oz + 0.25% (v/v) 10 - 21d (RI) then Luna Experience 6 fl oz 14 - 21d (RI) then second treatment then third then first treatment.	3.00	j	0.15	k
Sonata 96 fl oz + Sulfur DF 6 Ibs + Sylcoat 4 fl oz Start at Bloom 7-10d	7.00	ij	0.20	k
GC Pro 3.0 lbs start with RI then 7d	8.00	ij	0.33	k
T17 36 fl oz./100gal Start at Bud Break 7-14d	9.68	hij	0.60	ijk
Polymer 2 % (v/v) 10d	11.11	hij	0.38	jk
Polymer 1 % (v/v) 10d	12.00	hij	0.46	jk
WXF-17001 0.25% (v/v) 7d	15.63	ghi	0.58	ijk

Results: Trial I

MBI-10612 1 qt 10 - 14d (RI)	20.62	efgh	2.04	ghijk
OxiPhos 5 qt 7 - 14d	24.18	efg	2.62	ghijk
MBI-10612 1 qt + JMS Stylet Oil 0.25% (v/v) 10 - 14d (RI)	24.21	efg	1.23	hijk
Regalia 4 qt. 7 - 14d	28.00	ef	3.11	ghijk
Probiotic 1% (v/v) 7d	35.05	de	3.34	ghijk
Antica + LactoPlant 5% (v/v) + 50 ml/gal Soil Prep (Prebloom - one-time application) and Antica + Aicon + 3SE 5% (v/v) +5% (v/v) +5 ml/gal Foliar (Prebloom) then Antica+Aicon+LactoPlant+3SE 5% (v/v) +5% (v/v) +50ml+ 5ml/gal after bloom 7-10d	42.00	cd	4.63	fghij
T17 18 fl oz./100 gal start at bud break 7 -14d	42.86	cd	8.32	def
Zivion 500 ppm + Raynox 2%v/v 10-14d	43.00	cd	3.84	ghijk
Antica 10% (v/v) 7d	43.00	cd	6.21	efg

Results: Trial I

Zivion 500 ppm 10 -14d	44.74	cd	5.55	fgh
Fracture 24.4 fl oz 10 - 14d alt Serenade 20 oz 10 - 14d	45.00	cd	4.76	fghi
Antica 5% (v/v) 7d	45.00	cd	13.25	c
Zivion 250 ppm 10 - 14d	47.73	bc	10.23	cde
T17 26 fl oz./100 gal start at bud break 7-14d	48.00	bc	13.76	c
Probiotic 10% (v/v) 7d	48.45	bc	10.86	cd
Zivion 1000 ppm 10 -14d	58.00	b	20.65	b
Untreated Control	76.00	a	41.56	a

Results: Trial II

Treatment	Mean Incidence (%)		Mean Severity (%)	
Merivon 4 fl oz at bloom Vivando + Sylcoat 15 fl oz + 4 fl oz 14d Laguna + Sylcoat 7 fl oz + 4 fl oz 14d Pristine 38 WG + Sylcoat 12.5 oz + 4 fl oz 14d Quintec 2.08 F + Sylcoat 6.6 fl oz + 4 fl oz 14d Laguna + Sylcoat 7 fl oz + 4 fl oz 14d after 5th spray then Sonata + Sulfur DF + Sylcoat 64 fl oz + 3 Ibs + 4 fl oz 14d	0.00	e	0.00	c
Pristine 12.5 oz + Sylcoat 0.125 % (v/v) 10 - 14d	0.00	e	0.00	c
Luna Exp 400SC 8 fl oz + Slycoat 4 fl oz Laguna 7 fl oz + Sonata 64 fl oz + Sulfur DF 3 Ibs + Sylcoat 4 fl oz Quintec 2.08 F 6.6 fl oz + Sylcoat 4 fl oz Laguna 7 fl oz + Sonata 64 fl Oz + Sulfur DF 3 Ibs + Sylcoat 4 fl oz Flint 50 WDG 2.0 oz + Sylcoat 4 fl oz Laguna 7 fl oz + Sonata 64 fl oz + Sylcoat 4 fl oz Sonata 64 fl oz + Sulfur DF 3 Ibs + Sylcoat 4 fl oz.	0.00	e	0.00	c
Prolivo 4 fl oz + NIS 3 fl oz/100 gal 14d (Season long)	0.00	e	0.00	c

Results: Trial II

Luna Exp 6 fl oz 21d Alt Pristine 12.5 oz 21d	0.00	e	0.00	c
A20560 13.5 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d Alt Quintec 2.08 SC 4 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d	0.00	e	0.00	c
SA-0040105 (SC)3.2 fl oz 14d	0.00	e	0.00	c
Aprovia TOP 13.5 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d Alt Quintec 2.08 SC 4 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d	0.00	e	0.00	c
Luna Exp 6 fl oz 21d then Rally 2 oz 14 - 21d then Quintec 6.6 fl oz 21d then repeat sequence	0.00	e	0.00	c
Aprovia 10.5 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d Alt Quintec 2.08 SC 4 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d	0.00	e	0.00	c

Results: Trial II

Luna Exp. 400 SC 8 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d Alt Quintec 2.08 SC 4 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d	0.00	e	0.00	c
Antica 5% (v/v) 7- 14d Alt Luna exp. 6 fl oz 21d	0.00	e	0.00	c
Pyraziflumid SC 3.38 fl oz + Sylcoat 0.25 % (v/v) 21d	0.00	e	0.00	c
Microthiol Dispers 5 Ibs 7d prior to bloom Merivon 4 fl oz (no adjuvant) at bloom 14d Vivando 14 fl oz + Sylcoat 4 fl oz/100gal 14d Pristine 12.5 oz + Sylcoat 4 fl oz/100gal 14d Quintec 4 fl oz + Sylcoat 4 fl. oz/100gal 14d Switch + Sylcoat 14 oz + 4 oz/100gal 14d Torino 3.4 fl oz + Sylcoat 4 oz/100gal 14d	0.00	e	0.00	c
A20560 11.4 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d Alt Quintec 2.08 SC 4 fl oz + Sylcoat 0.125 % (v/v) 14 - 21d	0.00	e	0.00	c
Prolivo 5 fl oz + NIS 3 fl oz/100 gal 14d season long	0.00	e	0.00	c
Pristine 10 oz 14d season long	0.00	e	0.00	c

Results: Trial II

Luna Exp. 6 fl oz then 2wk later SP2700 at 2500 times dilution soil app + SP2700 at 7.8 oz foliar spray + Capsil 12 fl oz/100 gal 1wk later SP2700 7.8 oz + Capsil 12 fl oz/100gal (foliar) 1wk later Luna Exp 6 fl oz then the rest 2wk after SP2700 7.8 oz + Capsil 12 fl oz/100gal (foliar) 7-10d	1.00	de	0.01	c
Mettle 5.0 fl oz + Sylcoat 4 fl oz Alt Torino SC 3.4 fl oz + Sylcoat 4 fl oz Season long - RI	1.00	de	0.10	c
Regalia 4 qt 7 - 14d Alt Luna exp 6 fl oz 21d	1.00	de	0.01	c
Sovran 4 oz Alt Rhyme 5 fl oz Alt Quintec 4 fl oz Alt 14d	1.00	de	0.01	c
Torino SC 3.4 fl oz + Sylcoat 4 fl oz Season long - RI	2.00	cde	0.06	c
Tolendo 45 WP 4.0 oz 14d	2.00	cde	0.06	c
Mettle 125 ME 4.0 fl oz 14d	2.00	cde	0.04	c

Results: Trial II

Pristine 12.5 oz + 3SE 5 ml/gal 10 - 14d	2.00	cde	0.07	c
Merivon 4 fl oz (No adjuvant) bloom then 21 d	2.00	cde	0.03	c
GWN 10511 3.4 fl oz + Sylcoat 4 fl oz	2.08	cde	0.05	c
1st app SP2700 at 2500 times dilution soil app + SP2700 at 7.8 fl oz (foliar) + Capsil 12 fl oz/100-gal rest of applications: SP2700 7.8 oz (foliar) + Capsil 12 fl oz/100 gal 7 d	2.11	cde	0.16	c
Pyraziflumid SC 1.7 fl oz + Sylcoat 0.25 % (v/v) 21d	4.00	cd	0.13	c
Fervent 8.5 fl oz 14d (Season long)	5.00	c	0.06	c
Luna Experience 6 fl oz (2x) 2nd app 4wks after 1st	20.21	b	5.80	b
Untreated Control	80.00	a	35.81	a

What’s Coming down the road?

- Heat treatment
- Spore trapping

Airborne Particle Classification & Monitoring

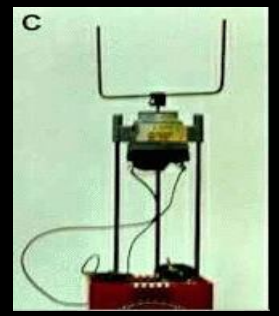
Pete Manautou
pete@scanit-tech.com
www.scanittech.com

Vineyard Particle (Spore) Collection

SCANIT SPORECAM 100

Continuous 24/7
In-situ Optical Data Extraction
Simultaneous Particle analysis in Cloud
Data every 15 minutes
Characterization & Classification

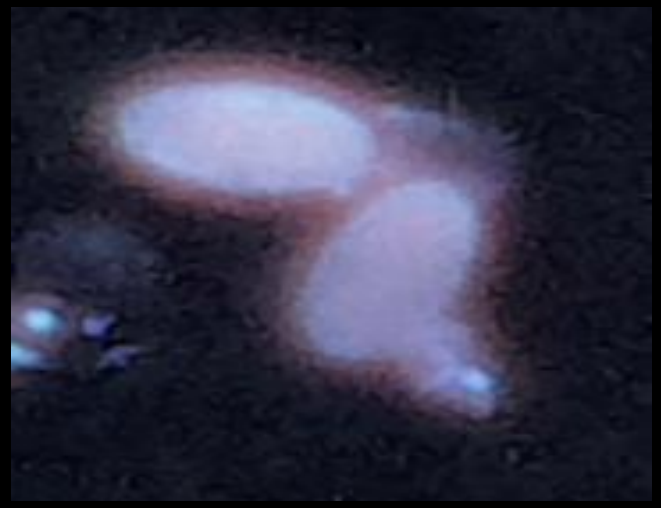
Rotorod & Burkard Spore Traps



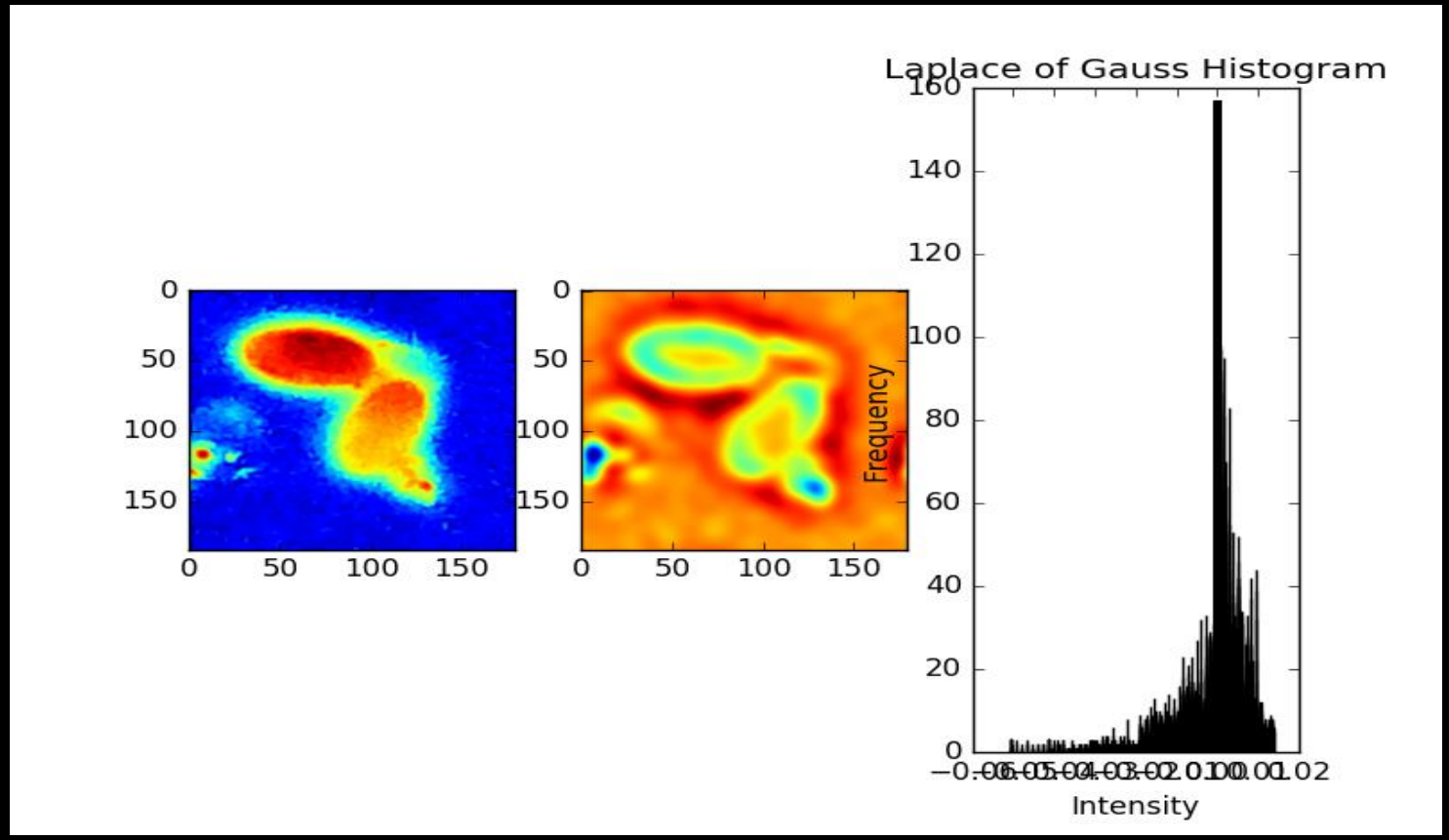
24 hour sample collection
Requires physical sample removal
Microscope and/or DNA Bio-assay in Lab
1 trap per particle type/test
Results in 3-7 days

Ascospore Detection

It is important to spray vineyards within a few days of Ascospore detection. This will allow precise spraying to nearly coincide with ascospore release and could save up to 4-5 apps in spring.

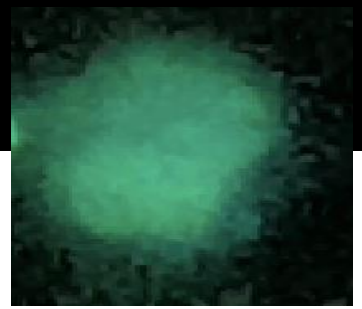


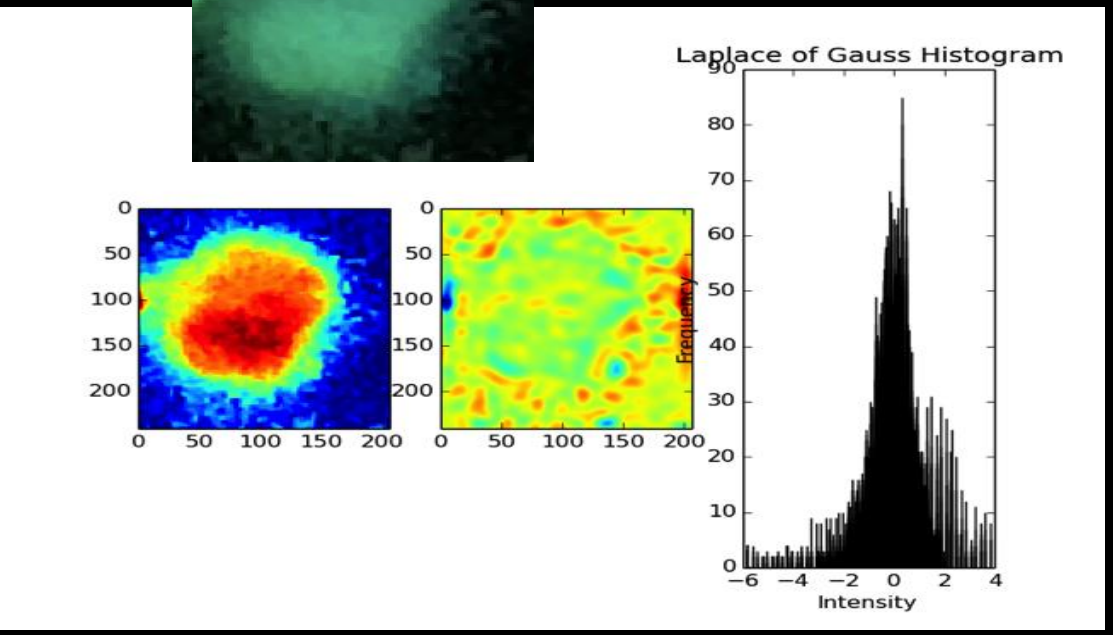
Example of two large spores inside an ascus. Each spore is approximately 23um long x 15um wide.

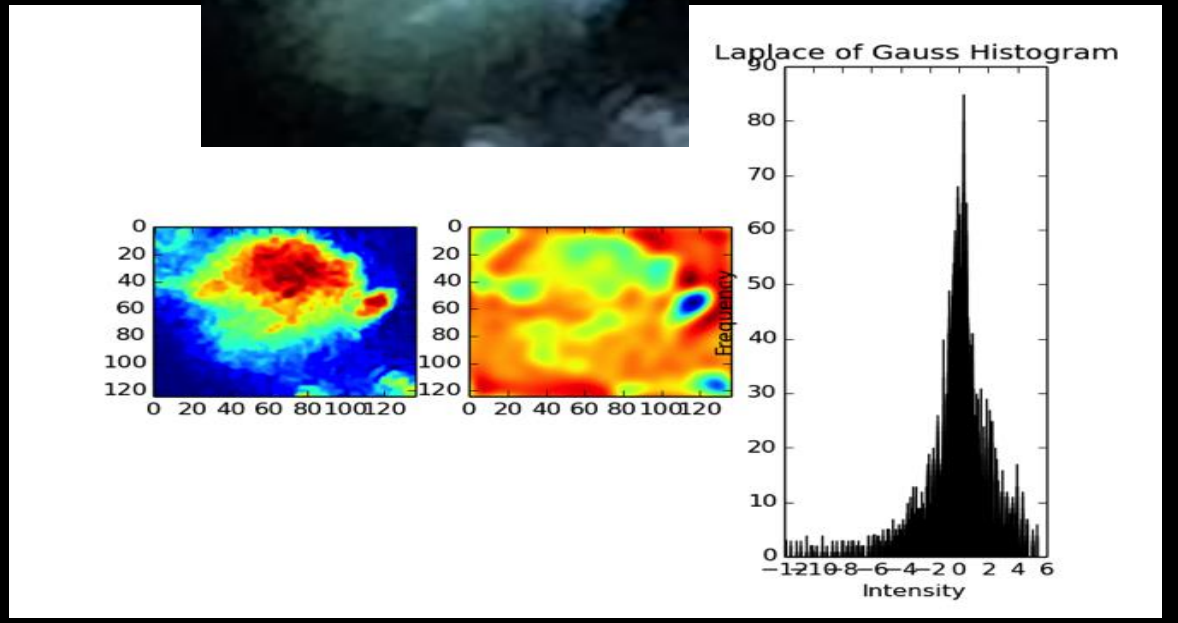


Botryosphaeria / Neofusicoccum.

Despite being different sizes, internal structure analysis gives us similar signatures and reveal healthy, thriving Bot spores.



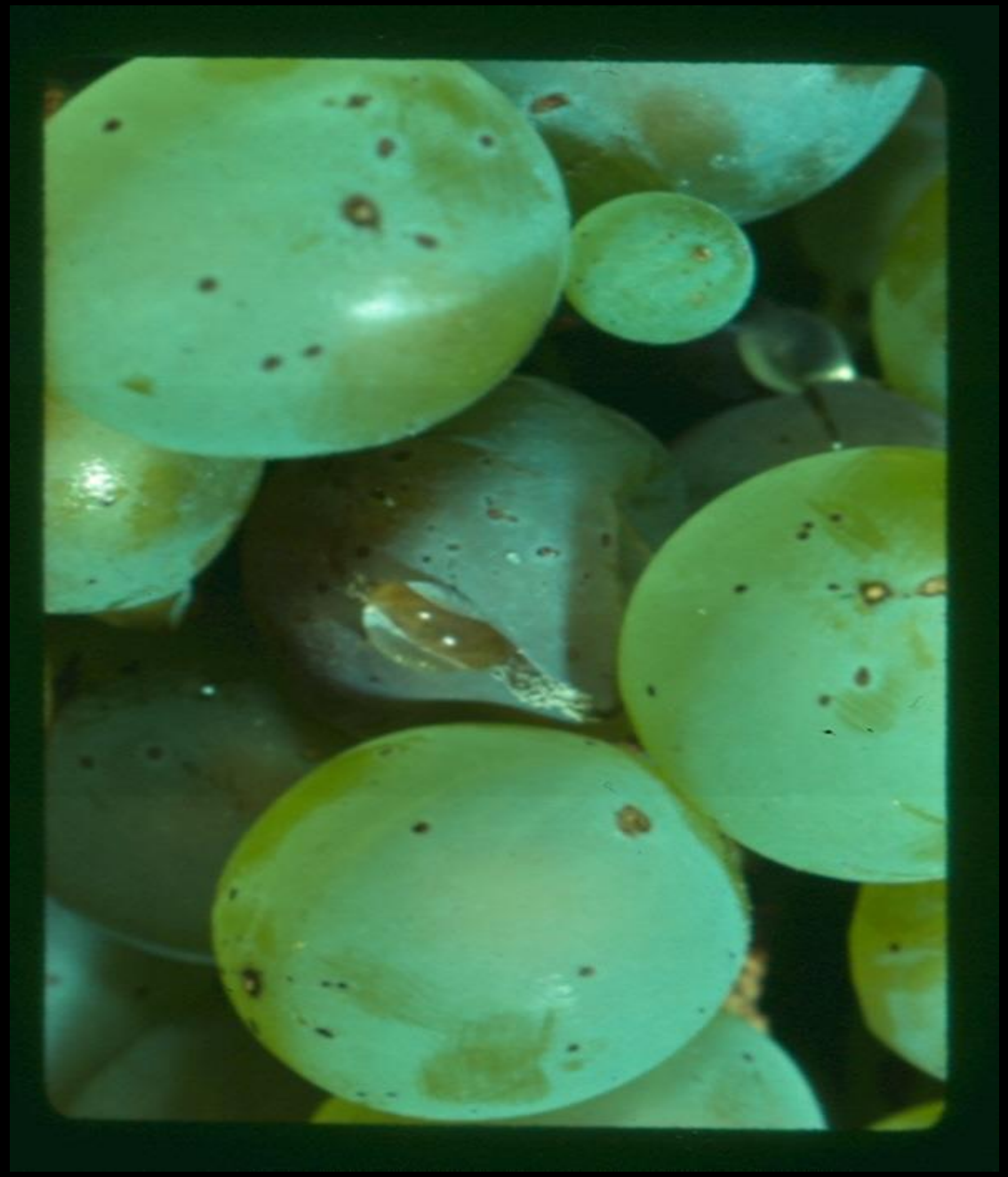




Botrytis bunch rot

Infection

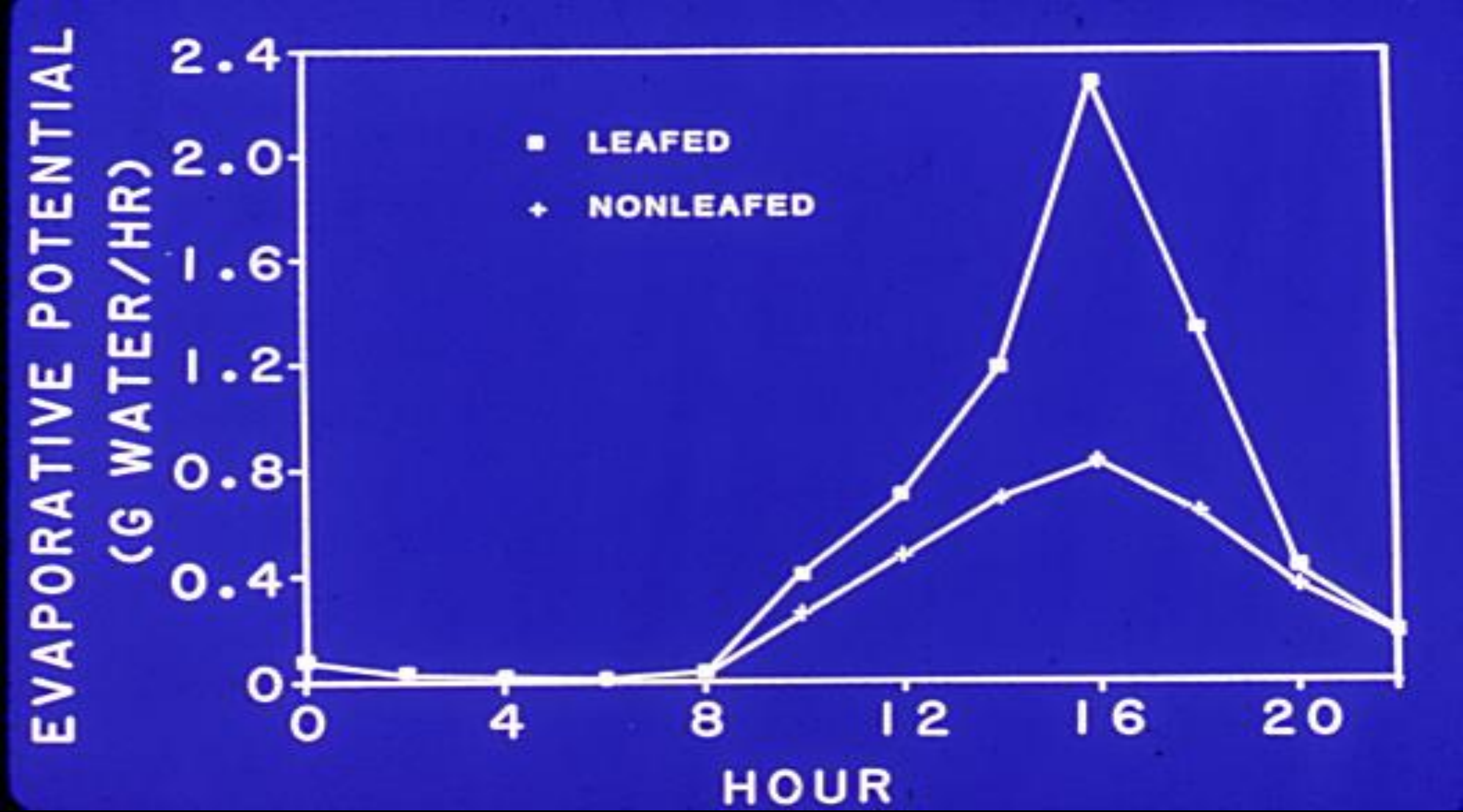
- Early infection occurs at bloom .
  - Infection occurs in dead and senescing flower parts and invades through the stamens into the receptacle.
  - Pathogen can also invade the necrotic areas around the abscission layer of the shredded calyptra on the receptacle.
  - Young berries are resistant to infection due to epicuticular wax.
  - Blossoms become latently infected
- Later from pea-sized berries through harvest
  - Blossom debris is a source of inoculum
  - Berry leakage provides moisture
  - Starts as browning of the skin of the fruit and invades other berries through cracks and wounds.
  - Dry weather=lesions cease expansion unless berry splitting and leakage occur (usually occurs in tight clustered varieties)
  - Wet weather=lesions continue to expand and fungus moves to other berries.
  - Sporulation – requires at least 2 wet periods to increase sporulation

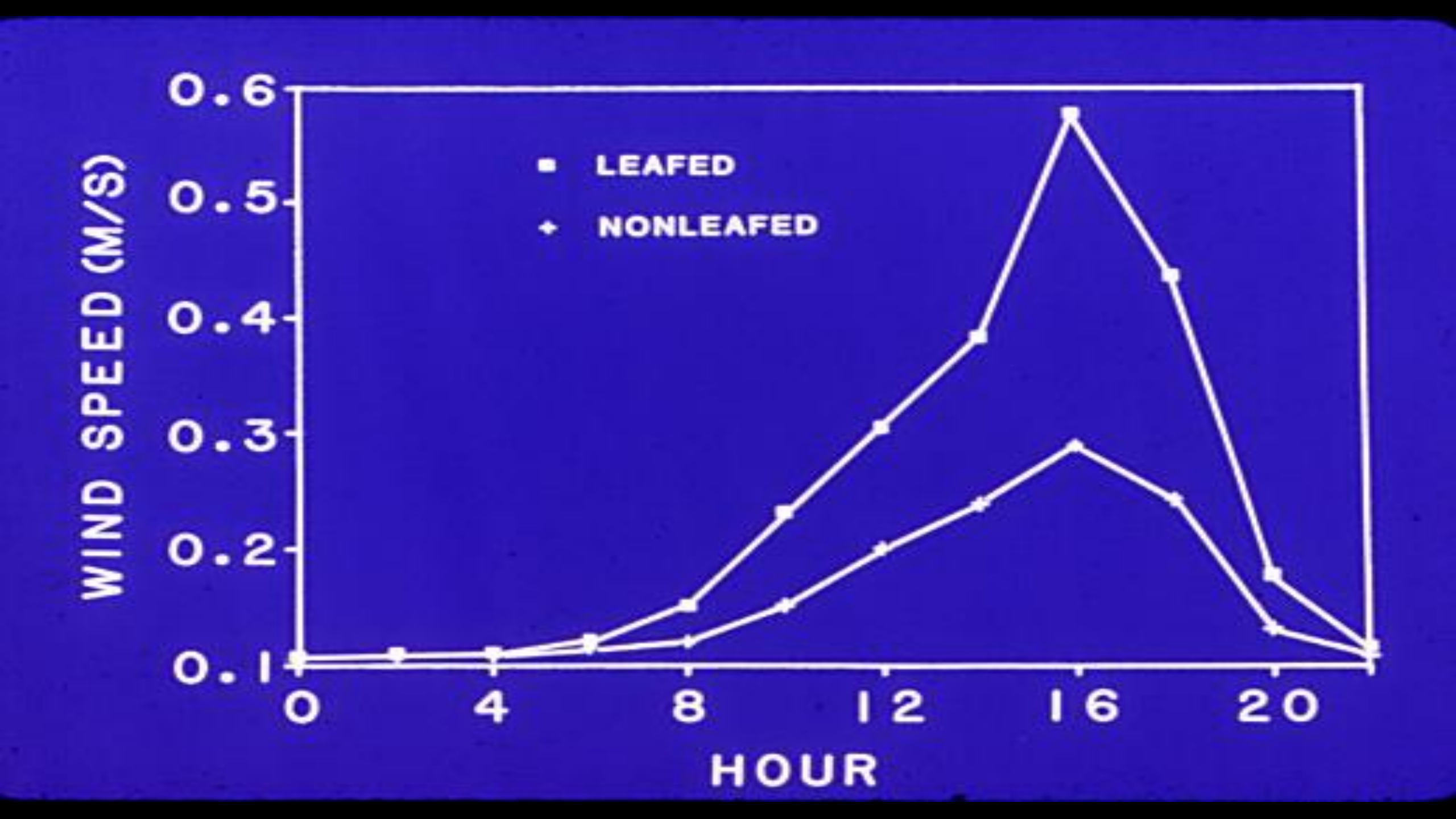


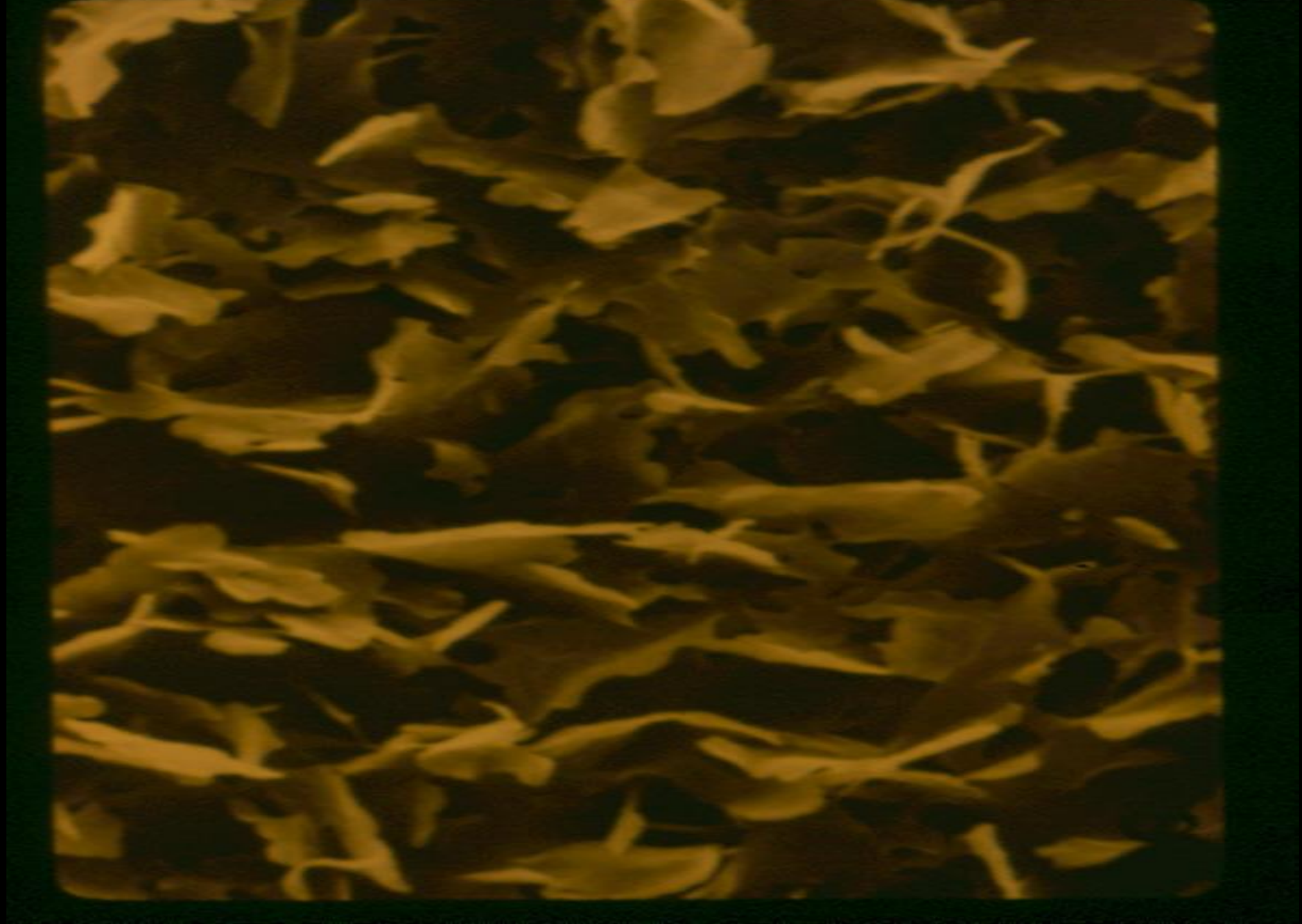

Flower blossom

Cultural Control

- Leaf removal (opening up the canopy), Timing is cluster set – BB size
  - Decreases RH,
  - Increases wind speed, light, temperature, epicuticular wax, fungicide to target
  - Blossom debris removal
- Decreased fertilizer
  - Reduce succulence
- Cluster Architecture
  - Prevent berry touch


EVAPORATIVE POTENTIAL
(G WATER/HR)
2.4
2.0
1.6
1.2
0.8
0.4
0
LEAFED
NONLEAFED
0
4
8
12
16
20
HOUR


WIND SPEED (M/S)
0.6
0.5
0.4
0.3
0.2
0.1
LEAFED
NONLEAFED
0
4
8
12
16
20
HOUR



Effects of canopy management and fungicide applications on botrytis bunch rot in Chenin blanc, Napa County, 1985

	TIMING OF FUNGICIDE APP.				
	Control	Bloom	Preclose	Bloom+ Preclose	Mean
	Incidence (% diseased clusters)				
Leaf Removal	6.2	7.1	4	5.1	5.6
No removal	30.5	29.2	29.2	20.7	27.4
Mean	18.4	18.1	16.6	12.9	NS
	Severity (% rot per cluster)				
Leaf Removal	0.3	0.4	0.1	0.3	0.3
No removal	3.4	5.1	3.7	3.1	3.8
Mean	1.9	2.3	1.9	1.7	NS
	Yield (tons per acre)				
Leaf Removal	4.7	5.1	4.7	3.8	4.6 NS
No removal	5.8	5.2	5.4	5.4	5.4

Bettiga, Gubler, Marois, Bledsoe. California Agriculture, 1989

Results

Treatment	Mean Incidence (%)		Mean Severity (%)	
Zivion 1000 ppm Bloom then 14 Days	k	2.00	g	0.23
Miravis Prime 3.33 SC 13.5 fl oz + SylCoat 0.125 % (v/v) [A, B, C]	jk	4.00	fg	0.40
#1: Miravis Prime 3.33 SC 13.5 fl oz + SylCoat 0.125 % (v/v) #2: Elevate 50 WG 1 Ib + SylCoat 0.125 % (v/v) #3: Switch 62.5 WG 14.0 fl oz + SylCoat 0.125 % (v/v) [A, B, C]	jk	4.00	g	0.17
#1: MBI-110AF5 2 qt #2: Switch 14 oz #3: Luna Experience 8.6 fl oz [A, B, C]	ijk	5.00	defg	0.95
Pyraziflumid SC 3.38 fl oz + SylCoat 0.25% (v/v) [A, B, C]	hijk	6.00	g	0.37
Zivion 500 ppm Bloom then 14 Days	hijk	6.02	g	0.33

Results

Pyraziflumid SC 1.7 fl oz + SylCoat 0.25% (v/v) [A, B, C]	ghijk	8.00	efg	0.81
Pristine 23 oz [A, B, C]	ghijk	8.00	bcdefg	1.31
MBI-110AF5 2 qt [A, B, C, D]	fghijk	9.00	fg	0.58
Luna Exp. 400 SC 8 fl oz + SylCoat 0.125 % (v/v) [A, B, C]	fghijk	9.00	g	0.37
#1: Switch 14 oz #2: Luna Experience 8.6 fl oz #3: MBI-110AF5 2 qt [A, B, C]	fghijk	9.00	efg	0.73
SA-0650001 (SC) 54 fl oz [A, B, C]	efghijk	10.00	abc	2.41
#1: Switch 14 oz #2: MBI-110AF5 2 qt #3: Luna Exp 8.6 fl oz [A, B, C]	efghij	11.00	defg	0.98

Results

Vintec 161.9 g Cluster Closure	defghij	12.00	efg	0.88
#1: Luna Exp 8.6 fl oz + SylCoat 4 fl oz/100gal #2: Flint Extra 3.8 oz + SylCoat 4 fl oz/100gal #3: Scala 6.6 fl oz + SylCoat 4 fl oz/100gal [A, B, C]	defghij	12.00	efg	0.87
Vintec 83 g Bloom and Cluster Closure	defghij	12.00	abcdef	1.79
Vintec 20.2 g Bloom and Cluster Closure	defghi	13.00	efg	0.79
Miravis Prime 3.33 SC 11.4 fl oz + SylCoat 0.125 % (v/v) [A, B, C]	defghi	13.00	bcdefg	1.20
Elevate 50WDG (Standard) 1.0 lb [A, B, C]	defghi	13.00	bcdefg	1.21
Zivion 500 ppm + Raynox 2% (v/v) Bloom then 14 Days	defgh	14.00	cdefg	1.02

Results

Zivion 250 ppm Bloom then 14 Days	cdefg	16.28	bcdefg	1.22
SA-0650001 (SC) 54 fl oz + Elevate 50WDG 1.0 lb [A, B, C]	cdef	17.00	ab	2.57
#1: Luna Exp 18 fl oz + SylCoat 4 fl oz/100gal #2: Flint Extra 3.8 oz + SylCoat 4 fl oz/100gal #3: Serenade Opti 16 oz + SylCoat 4 fl oz/100gal [A, B, C]	cde	18.00	abcdef	1.80
SA-0650001 (SC) 54 fl oz + SA-0670001 (WP) 2.5 lb [A, B, C]	bcd	20.00	a	3.17
Fracture 36.6 fl oz [A, B, C, D]	bc	23.00	abcde	2.05
Botector 8 oz 7-day schedule (start 10% bloom)	ab	28.00	abcd	2.34
Untreated	a	33.00	abcde	2.01

- THANK YOU!!