Alternaria Late Blight in Pistachios

Statewide Pistachio Day

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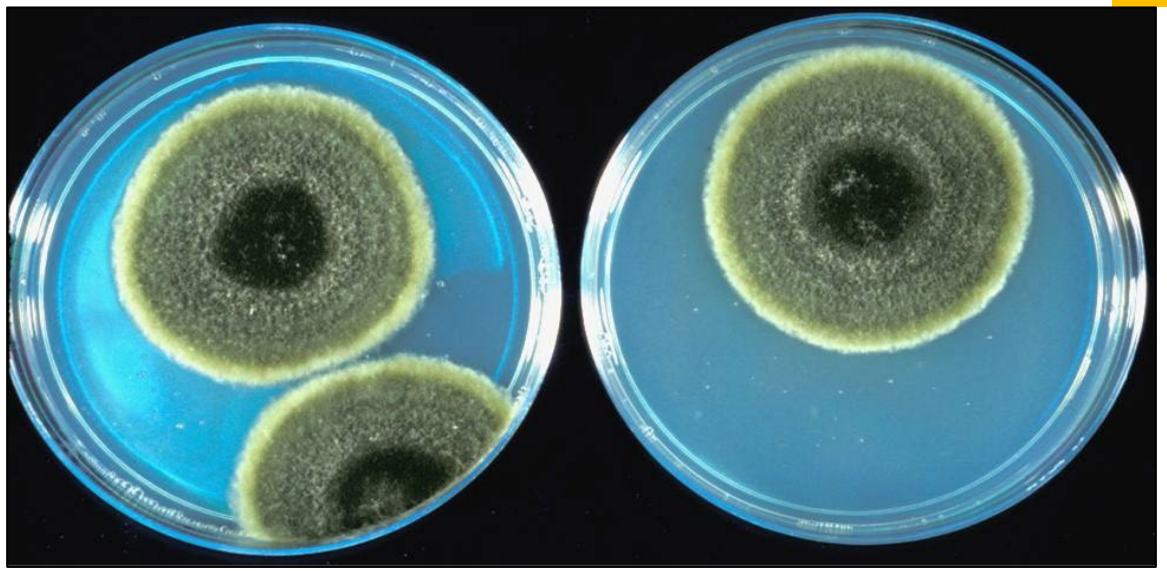
January 20, 2022

Alternaria Late Blight



Pathogens

Alternaria alternata
Alternaria arborescens
Alternaria tenuissima

Alternaria Late Blight

Lesions and severe defoliation

Alternaria Late Blight

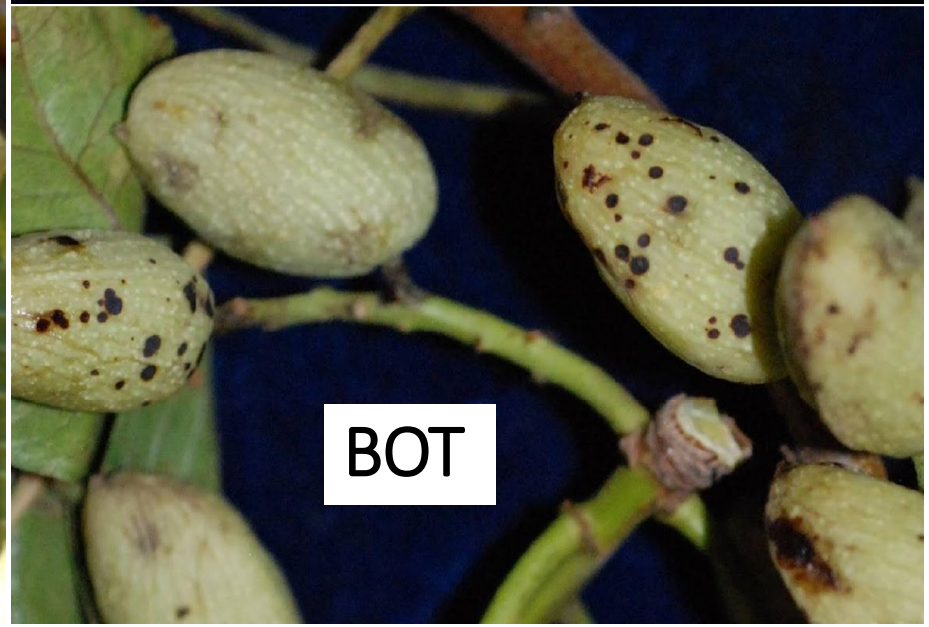
Lesions and severe defoliation

Alternaria Late Blight

Peter's scorch

Alternaria Late Blight

Fruit infections



Alternaria Late Blight

Hull infections

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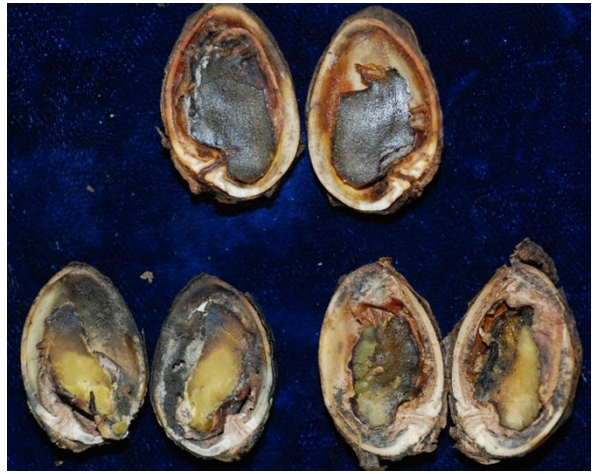
Shell staining and kernel mold



Alternaria Late Blight

Appearance of fruit at harvests

First harvest – Sept. 10

Second harvest – Sept. 17

Third harvest – Sept. 24

Fourth harvest – October 1

Reasons for managing Alternaria Late Blight

1. Early defoliation

2. Shell staining

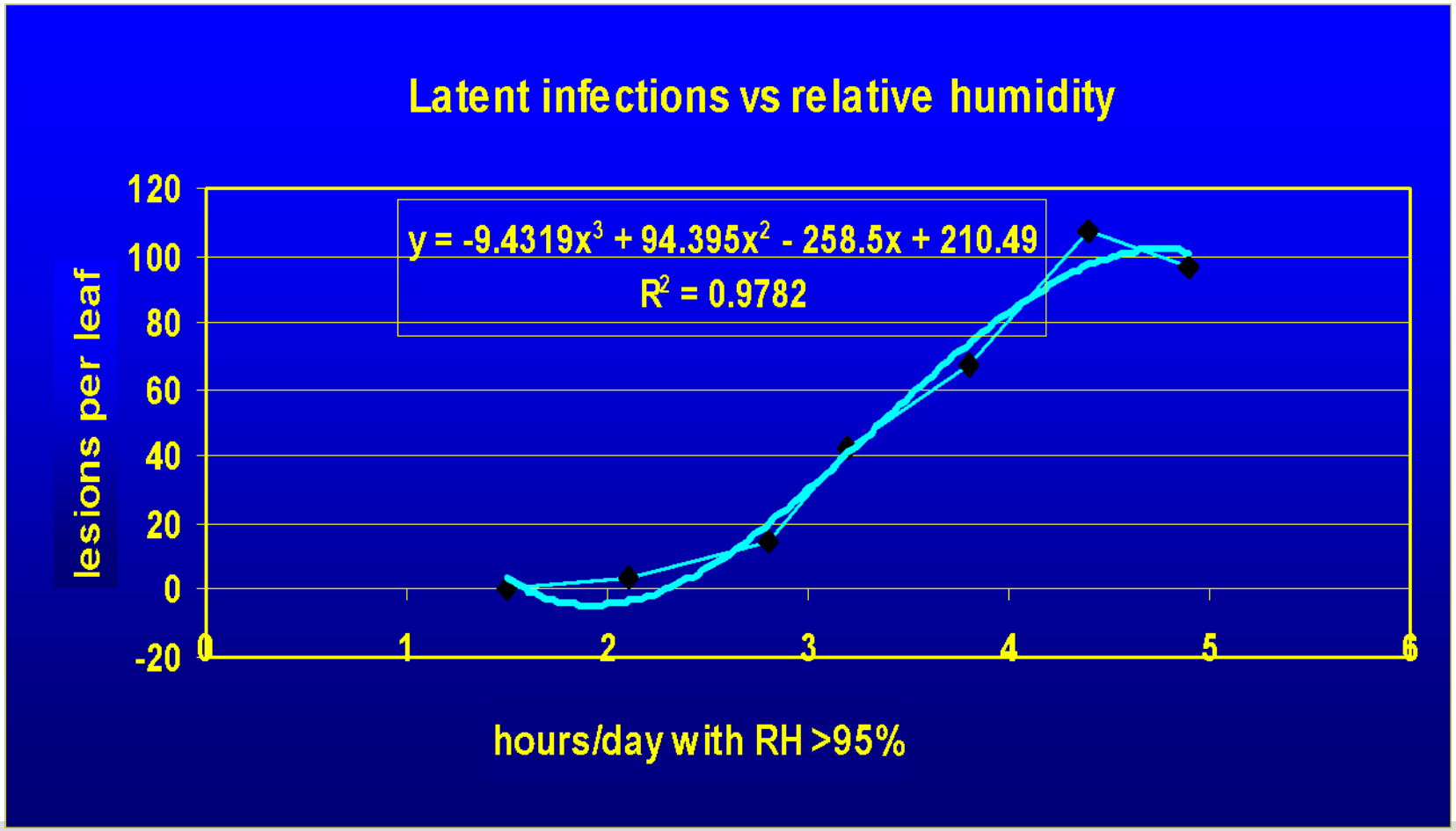
3. Kernel mold

4. Problems at harvest

Factors that influence Alternaria late blight

✓ Inoculum builds up during the season. ✓ Physiological stage of the crop.

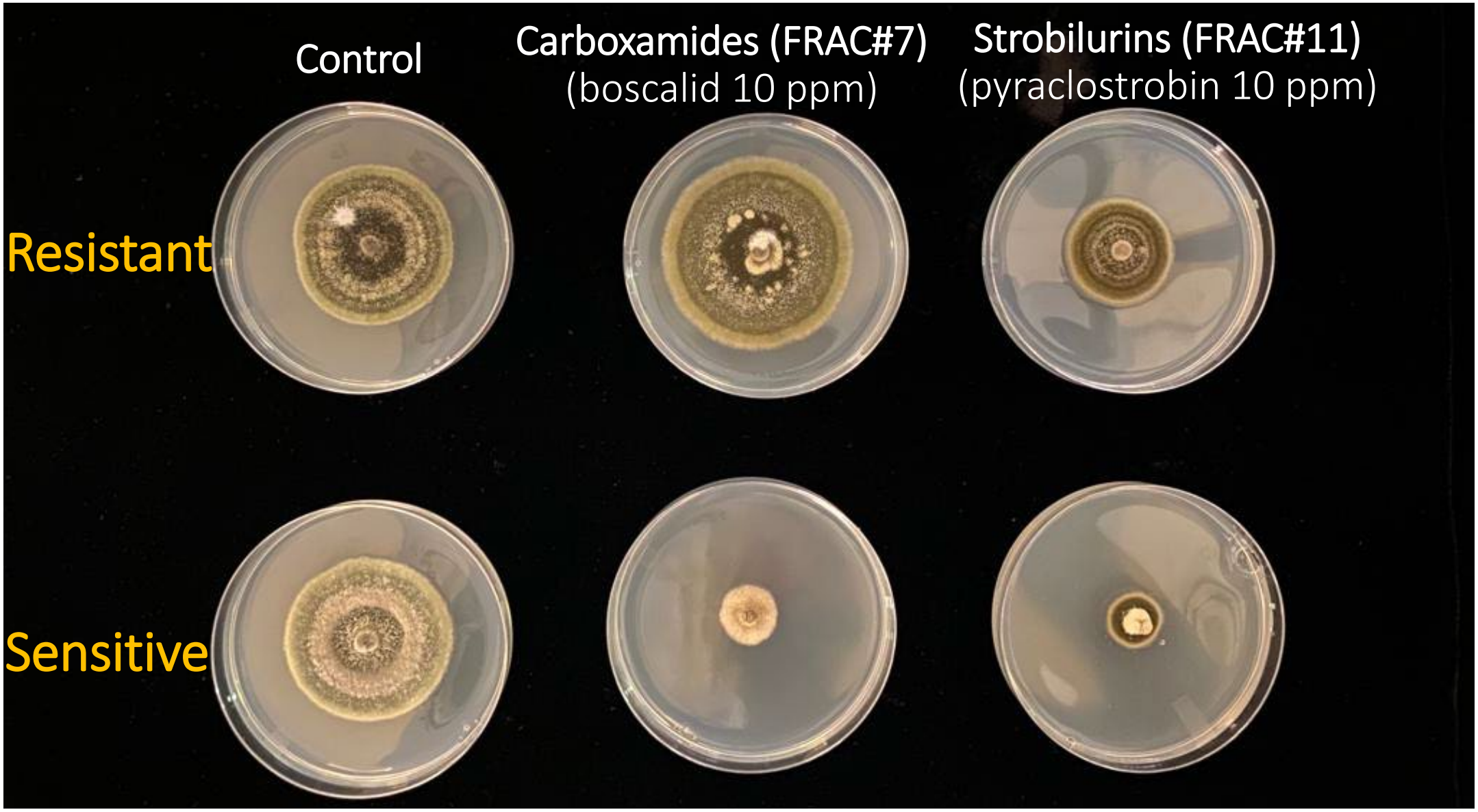
✓ Relative humidity in the orchard.



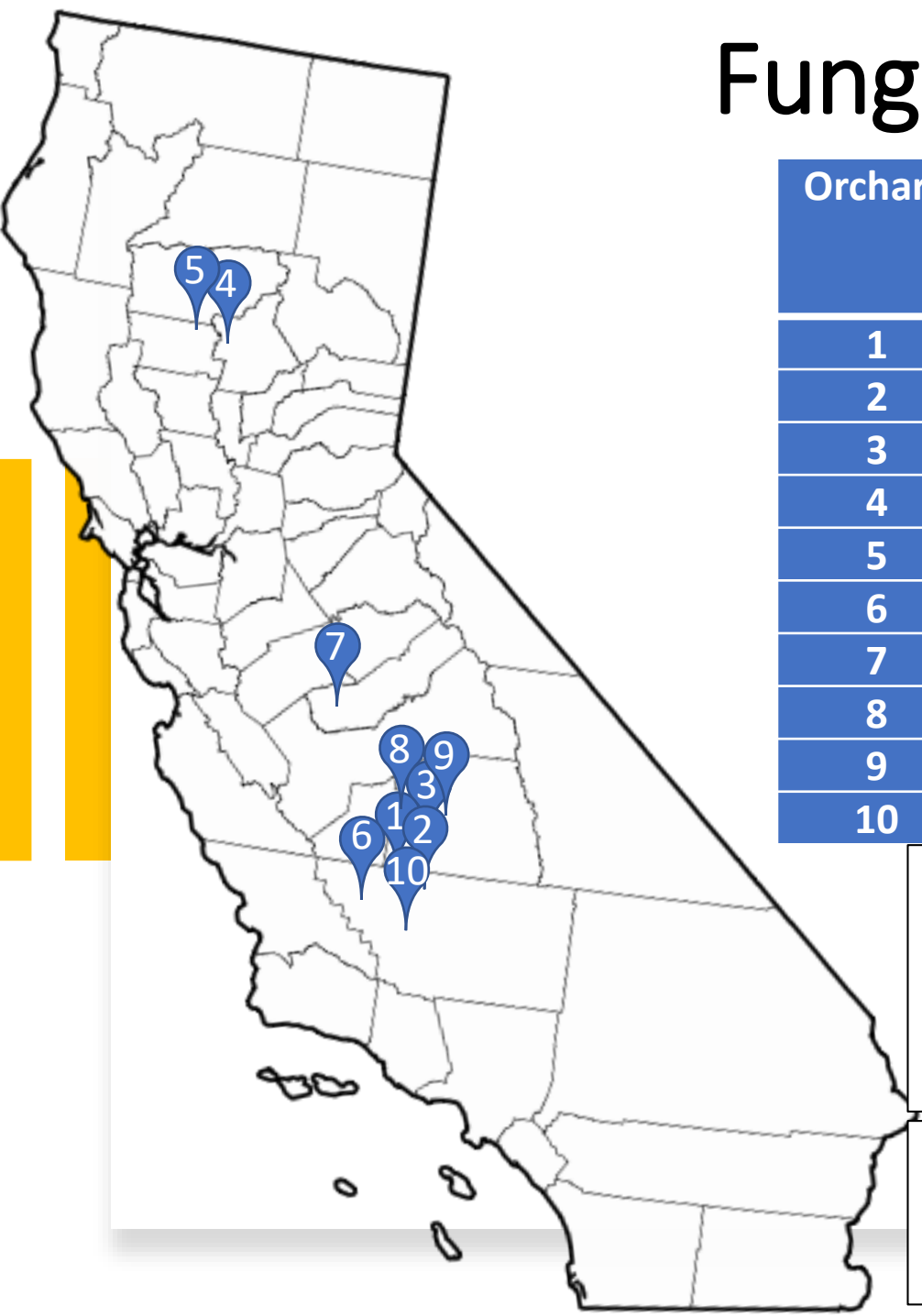
Management of Alternaria Late Blight

- Cultural control (manage irrigation, improve water infiltration, buried drip, hedge trees to increase air movement, no cover crops, disc soil, etc.)
- Chemical control (apply fungicides)… difficult (due to fungicide resistance).
- Integrated disease control (use both cultural & chemical control)……the best effect!

Fungicide resistance (2021)



Fungicide resistance (2021)



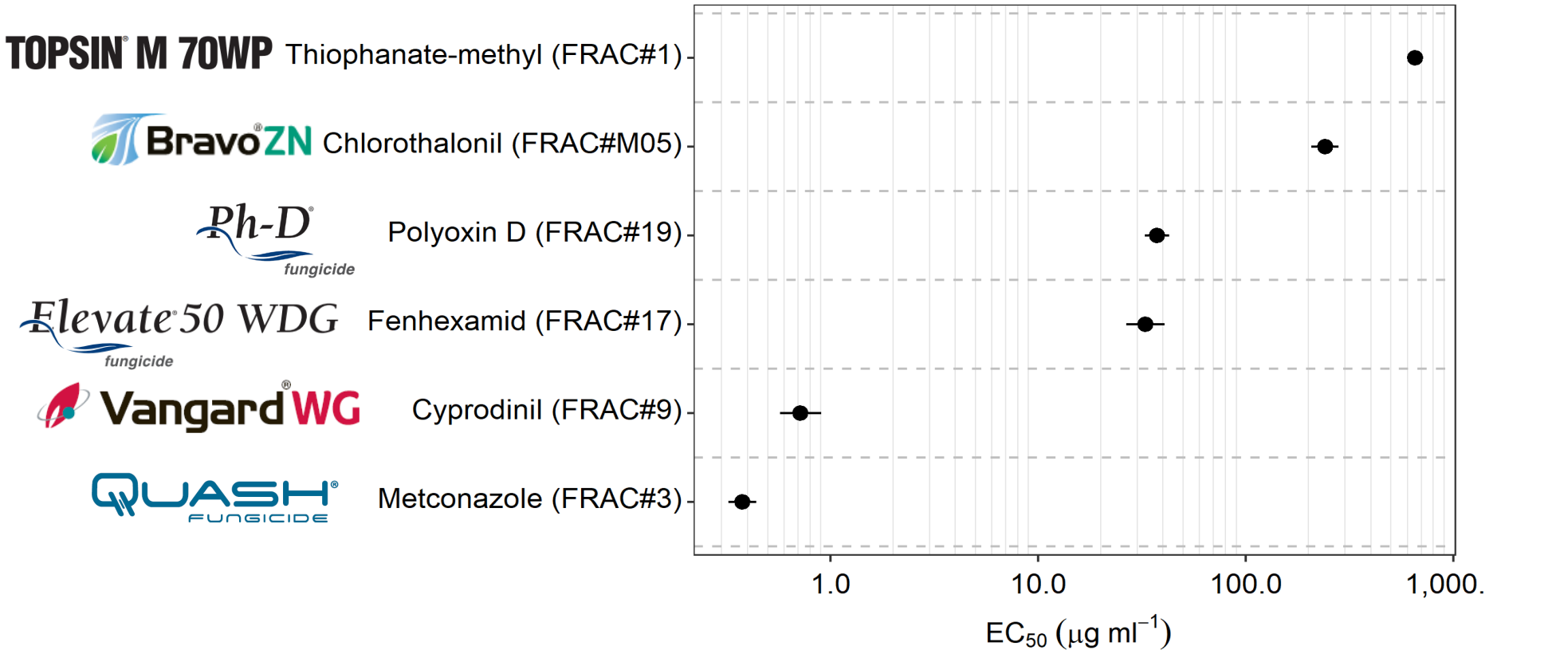
Orchard	Carboxamides (FRAC#7)			Strobilurins (FRAC#11)	
	H277Y mutant	H134R mutant	Conventional	G143A mutant	Conventional
1	0.01	0.67	0.98	1.00	0.98
2	0.09	0.65	0.98	0.99	1.00
3	0.02	0.49	1.00	1.00	1.00
4	0.02	0.63	0.71	0.82	0.94
5	0.00	0.88	0.96	1.00	0.98
6	0.11	0.16	0.49	0.25	0.94
7	0.10	0.74	0.90	1.00	0.98
8	0.01	0.69	0.95	1.00	0.96
9	0.09	0.49	0.95	0.91	1.00
10	0.01	0.11	0.52	0.89	0.69

Resistance to strobilurins (FRAC#11) and carboxamides (FRAC#7) is widespread in California.

Molecular methods to determine fungicide resistance levels.

Efficacy of fungicides against isolates carrying dual resistance (carboxamides and strobilurins)

A. alternata (*n*=24)



More effective → Less effective

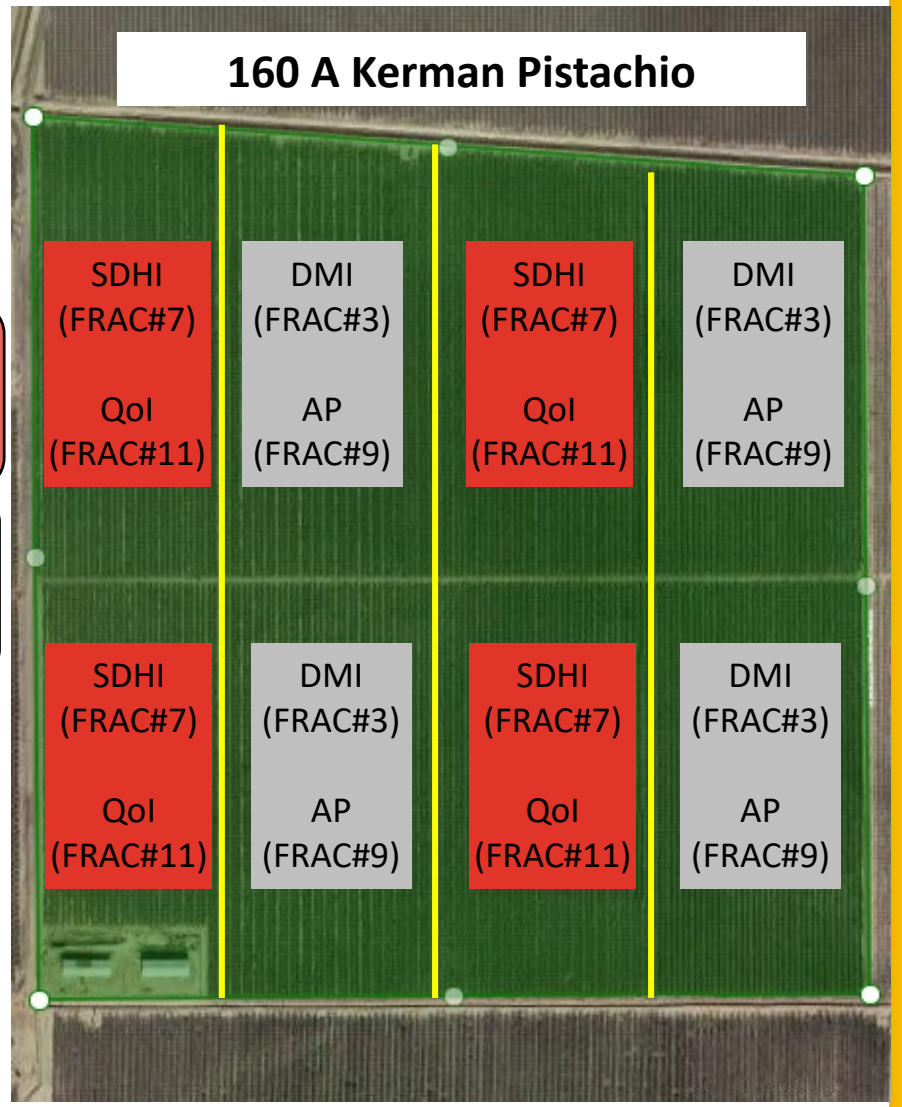
Comparison of two fungicide programs

FRAC#7/FRAC#11 *vs* FRAC#3/FRAC#9 (2019 and 2020)

June 8th	June 24th	July 10th
GEM®	Luna® SENSATION	Fontelis®
QUASH® FUNGICIDE	Vangard® WG	InspireSuper®

Evaluations

✓ Disease severity ✓ Defoliation

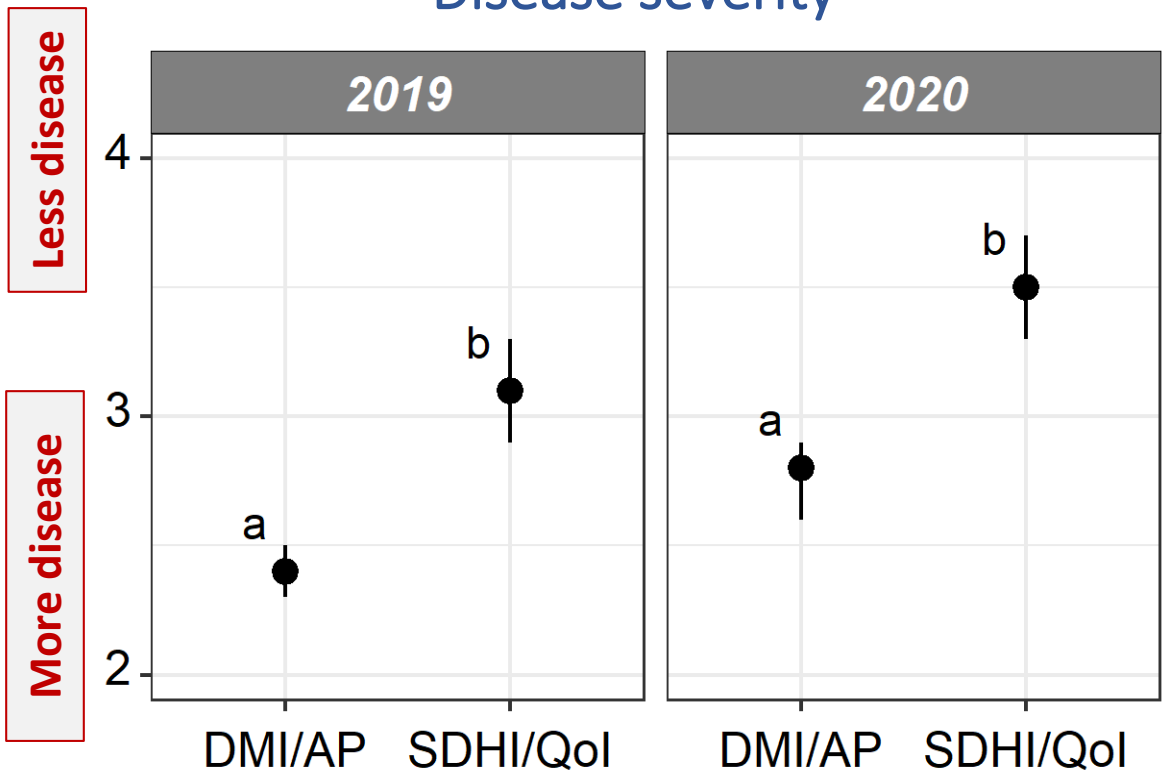


Comparison of two fungicide programs

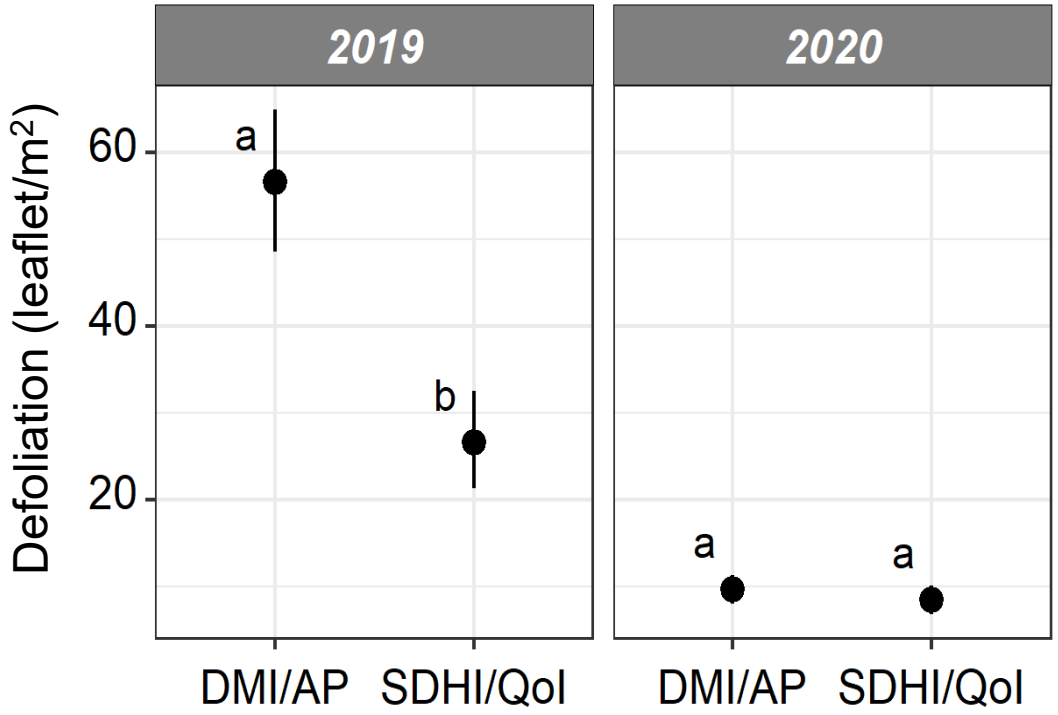
FRAC#7/FRAC#11 *vs* FRAC#3/FRAC#9 (2019/2020)

2019 > 2020

Disease severity



Defoliation



Fungicide efficacy (2021)

Fungicide screening

17 Fungicide Treatments

Calendar-based fungicide program

Jun-3, Jul-2, Aug-5

Resistance levels

- Strobulurins = 0.88 (high)
- Carboxamides = 0.42 (moderate)

10-Years-old experimental Kerman Pistachio Orchard

Evaluation

✓ Disease severity

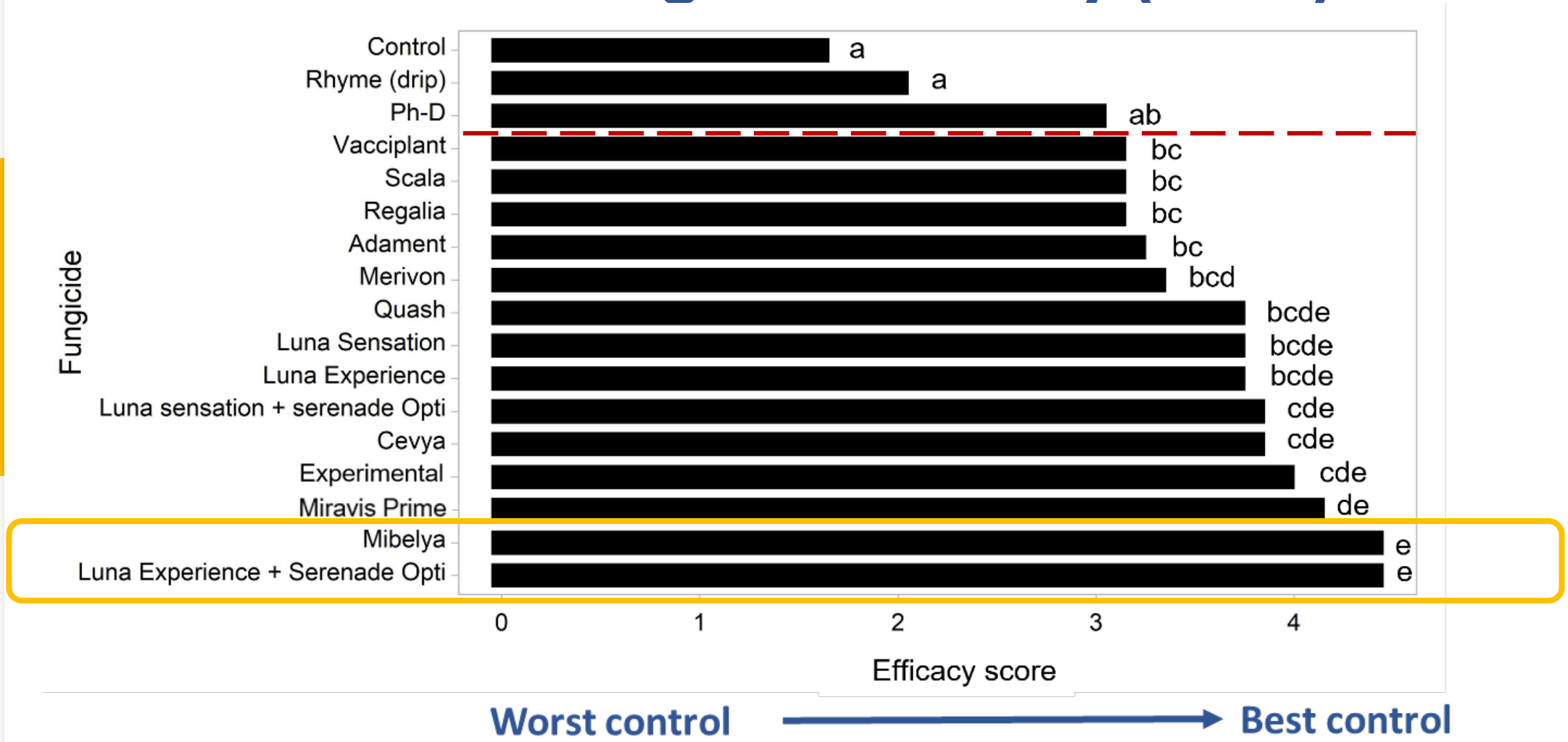
1 = least control

:

5 = best control

Chemical control

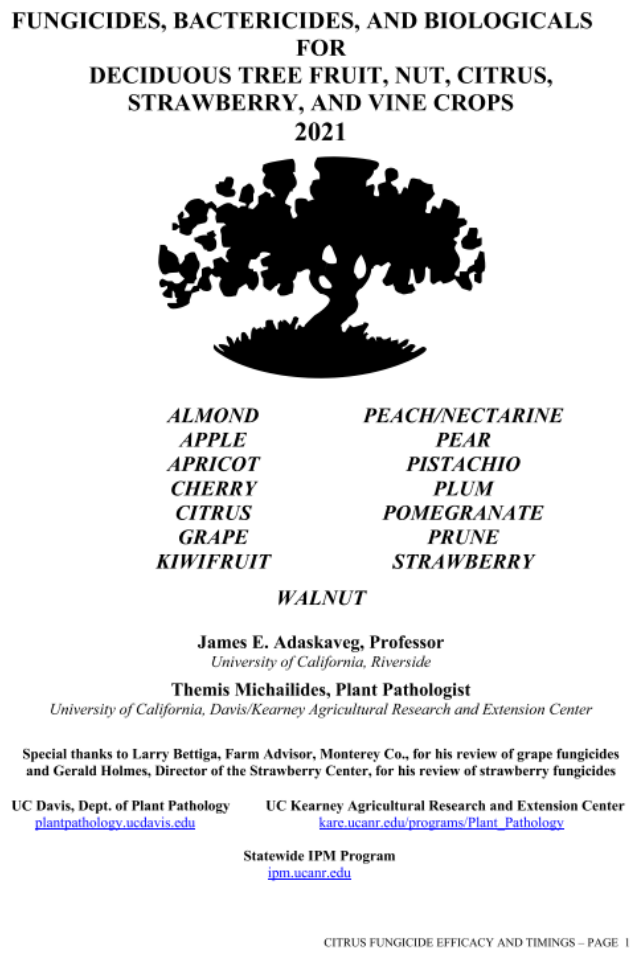
Fungicide efficacy (2021)



Fungicide efficacy

Fungicide	Resistance risk (FRAC#)	Efficacy
Fontelis	high (7)	++++
Luna Experience	medium (3/7)	++++
Luna Sensation	medium (7/11)[3]	++++
Merivon	high (7/11)	++++
Miravis Duo	medium (3/7)	++++
Miravis Prime	medium (7/12)	++++
Pristine	high (7/11)[3]	++++
Cevya	high (3)	++++
Quash	high (3)	++++
Adament	medium (3/11)[3]	++++
Quilt Xcel,Avaris 2XS	medium (3/11)[3]	++++
Viathon	medium (3/33)	++++
Abound	high (11)[2,3]	+++
Cabrio	high (11)[2,3]	+++
Flint Extra	high (11)[2,3]	+++
Ph-D	medium (19)	+++
Quadris Top	medium (3/11)[3]	+++
Switch	high (9/12)[3]	+++
Tebucon,Teb,Toledo, Tebuconazole[6]	high (3)	+++
Vangard	high (9)[3]	+++
Bravo,Chlorothalonil,Echo, Equus**	low (M5)	++
Bumper,Tilt,	high (3)	++
Scala	high (9)[3]	++
Inspire Super	medium (3/9)	++
Actinovate	low	++
Regalia	low (natural product)	++
Copper	low (M1)	+

++++ = excellent; +++ = good; ++ =moderate; + = limited



FUNGICIDES, BACTERICIDES, AND BIOLOGICALS
FOR
DECIDUOUS TREE FRUIT, NUT, CITRUS,
STRAWBERRY, AND VINE CROPS
2021

ALMOND
APPLE
APRICOT
CHERRY
CITRUS
GRAPE
KIWIFRUIT
PEACH/NECTARINE
PEAR
PISTACHIO
PLUM
POMEGRANATE
PRUNE
STRAWBERRY

WALNUT

James E. Adaskaveg, Professor
University of California, Riverside

Themis Michailides, Plant Pathologist
University of California, Davis/Kearney Agricultural Research and Extension Center

Special thanks to Larry Bettiga, Farm Advisor, Monterey Co., for his review of grape fungicides and Gerald Holmes, Director of the Strawberry Center, for his review of strawberry fungicides

UC Davis, Dept. of Plant Pathology
plantpathology.ucdavis.edu

UC Kearney Agricultural Research and Extension Center
kare.ucanr.edu/programs/Plant_Pathology

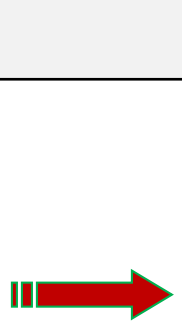
Statewide IPM Program
ipm.ucanr.edu

https://cfn-fungicides.ucr.edu

Fungicide spray timing for Alternaria late blight

Calendar-based program

Disease	Dormant	April May	June	July	August
Alternaria Late Blight	----		+++	+++	

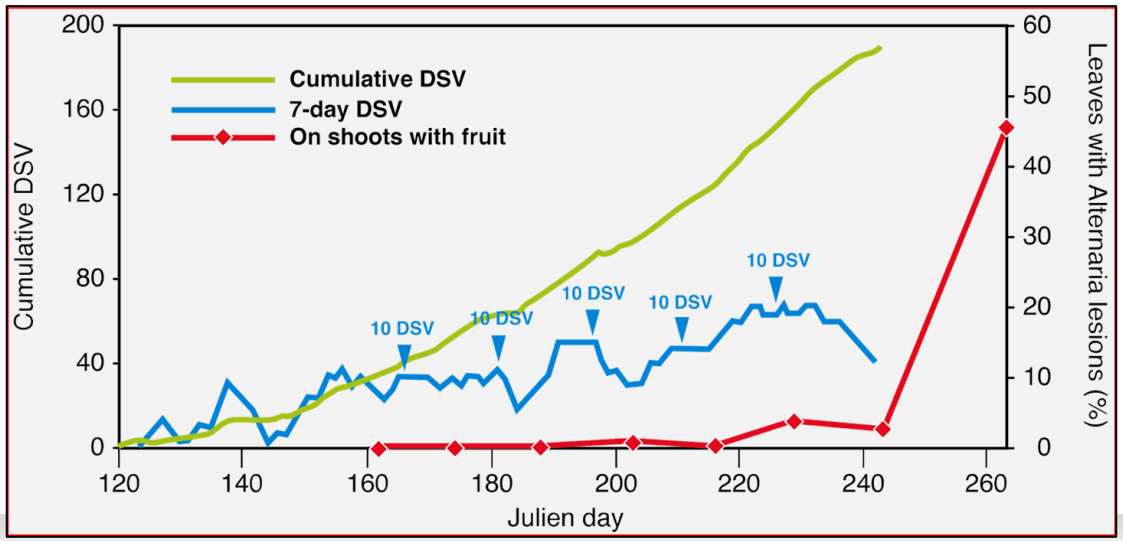


Best timing

Fungicide spray timing for Alternaria late blight

Disease severity value (DSV) model

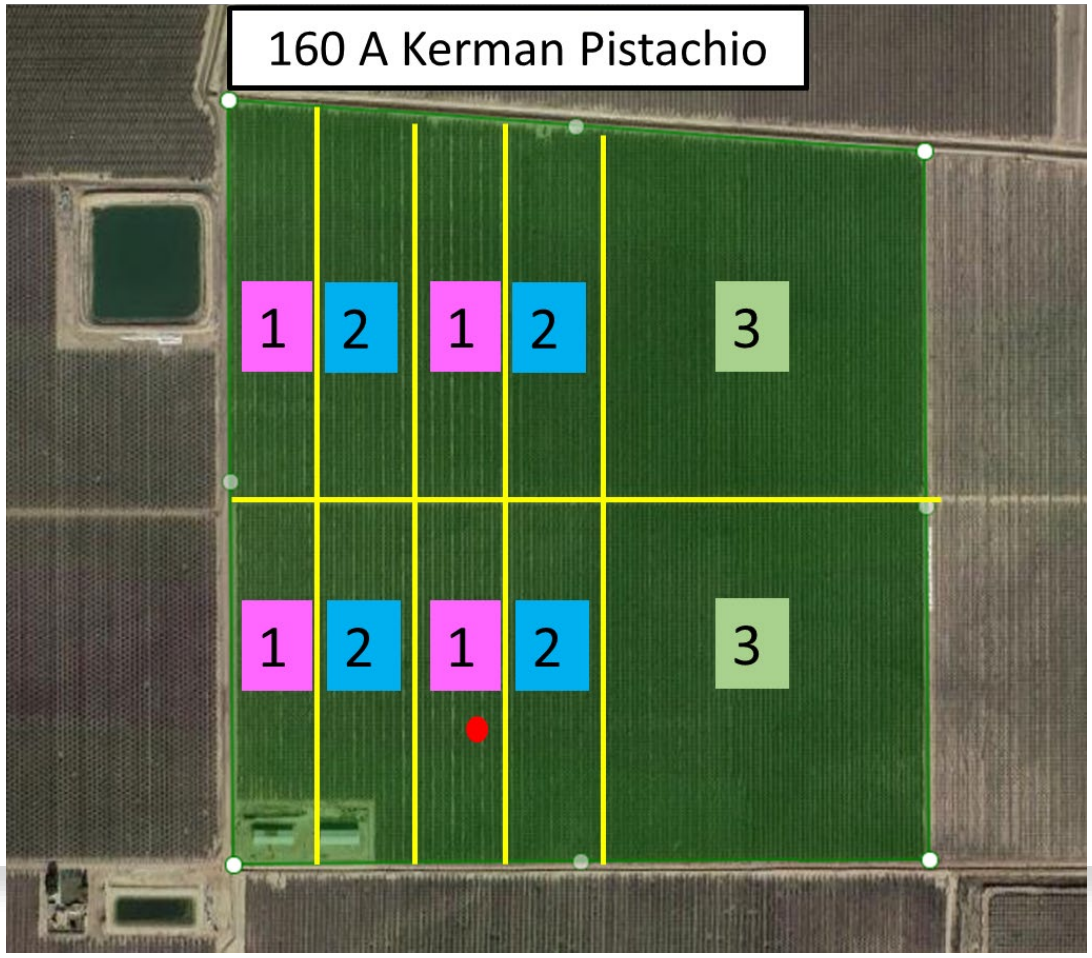
	Leaf wetness hours required to produce disease severity values (DSV) of:				
Mean air temp ºF	0 value	1 value	2 value	3 value	4 value
55-63	0-6	7-15	16-20	21+	
64-68	0-3	4-8	9-15	16-22	23+
69-78	0-2	3-5	6-12	13-20	21+
79-84	0-3	4-8	9-15	16-22	23+



- ✓ Mean air temperature and leaf wetness duration
- ✓ Fungicide sprays applied when the 7-day DSV exceed 10 units
- ✓ Effective approach in fungicide trials

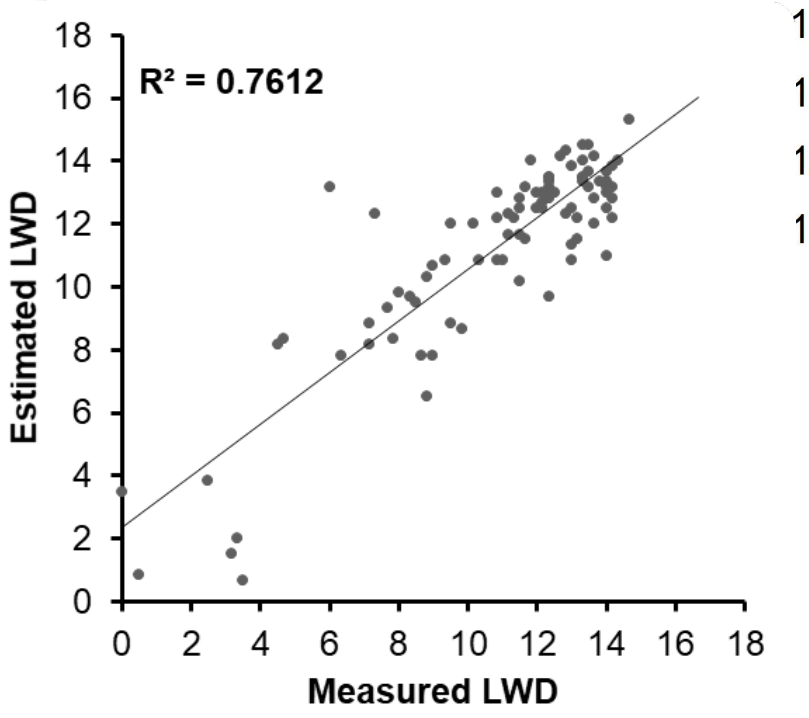
Field trial: DSV vs Calendar-based program (2021)

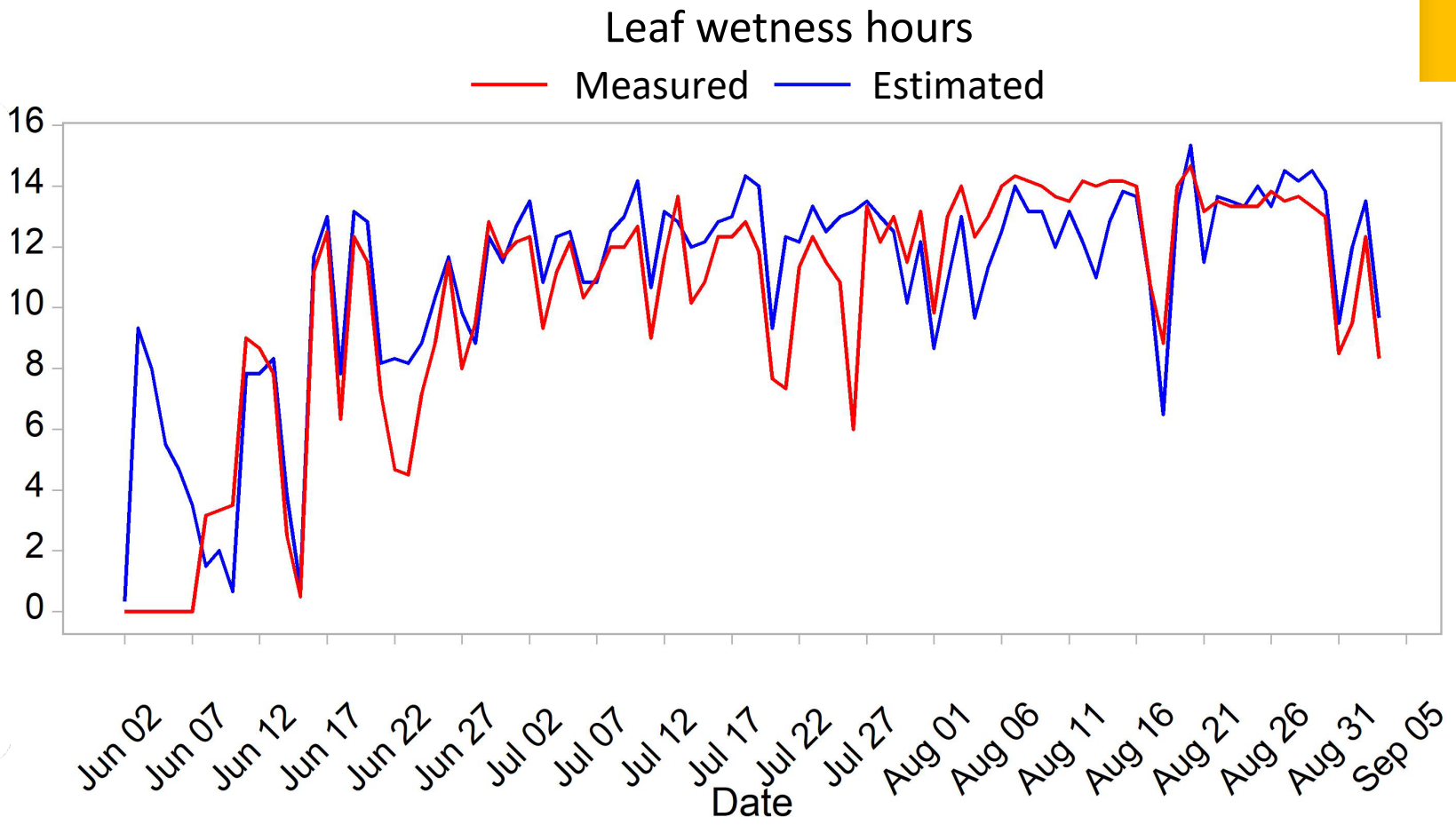
Treatment	Flag	Description	Early spray	Sprays		
				1st	2nd	3rd
1	Pink	Early spray + DSV	May	**?**	**?**	**?**
2	Blue	Early spray + Calendar	May	Early June	Early July	Late July
3	Green	Calendar	NO	Early June	Early July	Late July



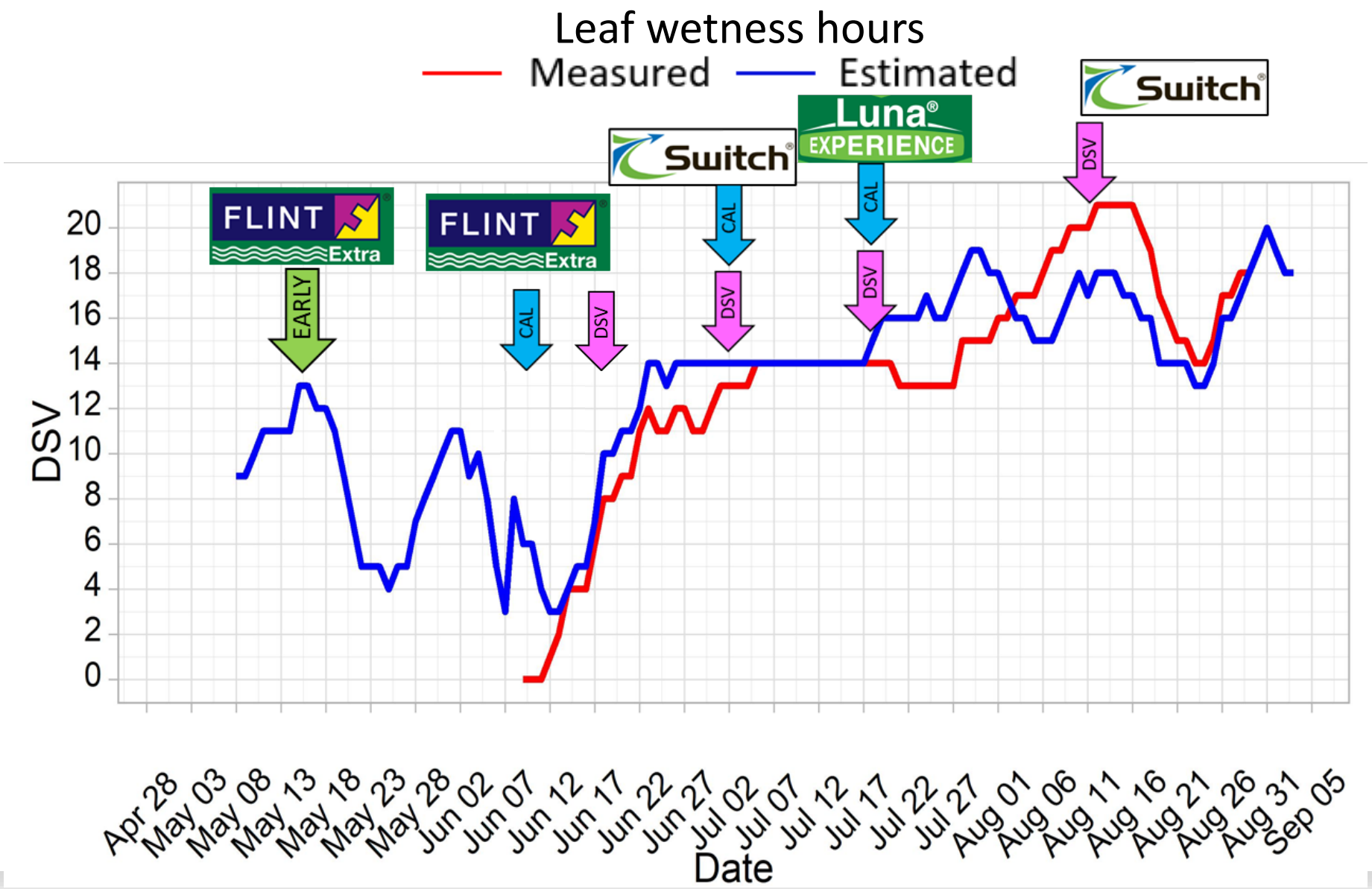
Fungicide spray timing for Alternaria late blight

Leaf wetness sensors vs Empirical method (H°>80%)



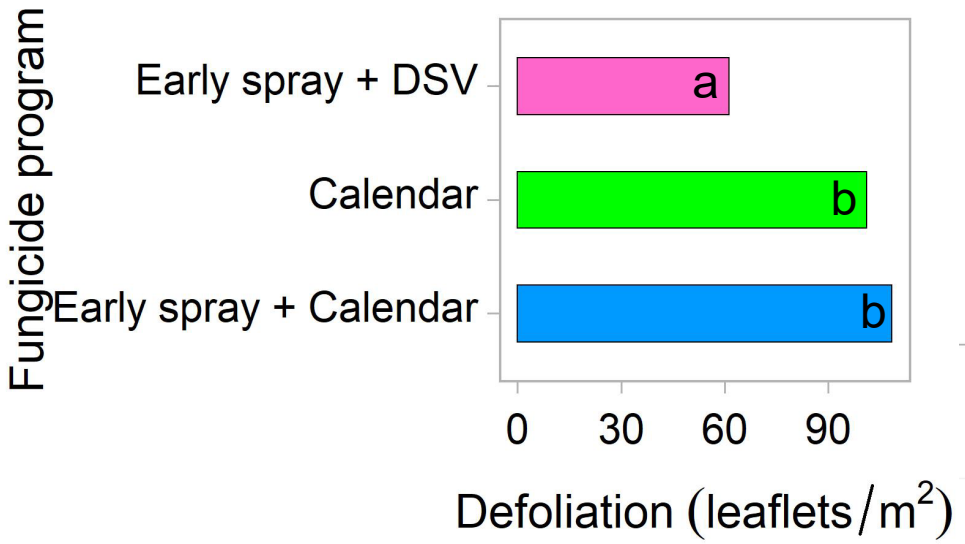


Fungicide spray timing for Alternaria late blight

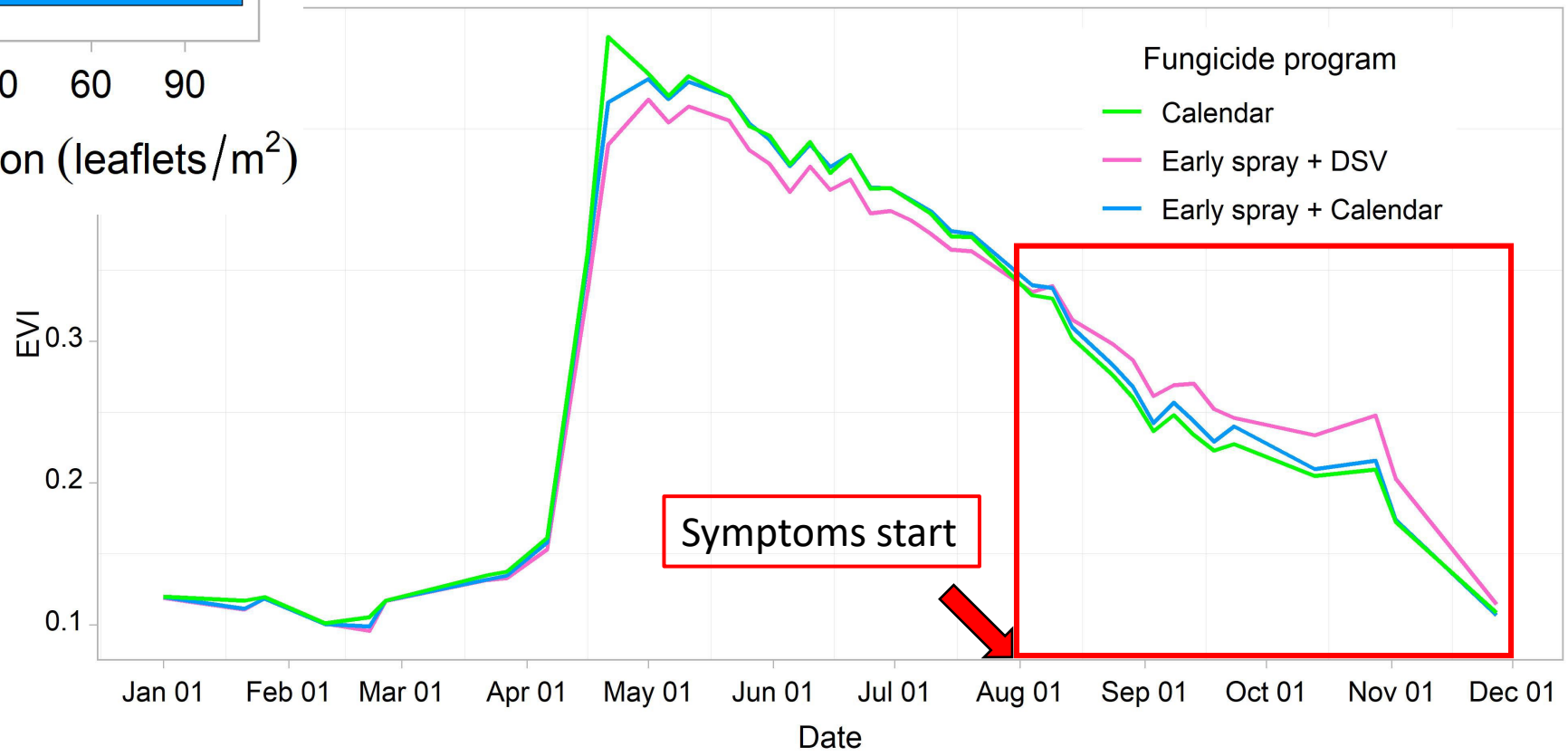


Fungicide spray timing for Alternaria late blight

Defoliation



Vegetation index



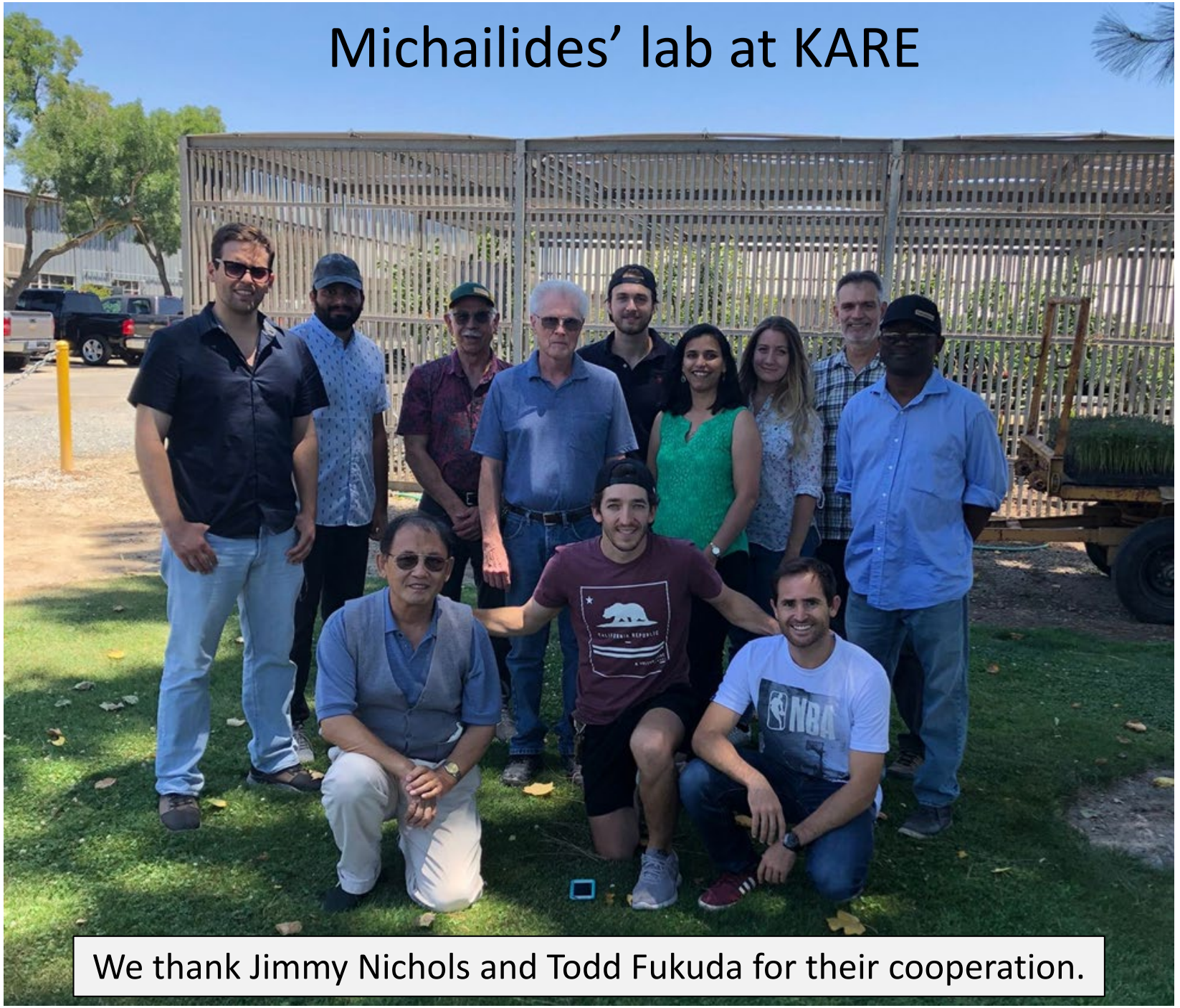
Conclusions

- It is important to diagnose the disease in the orchard correctly – know the history of the orchard.
- Resistance to strobilurins (FRAC#11) and carboxamides (FRAC#07) is widespread in California.
- Presence of multiple and cross resistance.
- Monitor resistance levels in your orchards.
- Alternate fungicides that belong to different classes (fungicide rotation).

Final remarks

- Sprays in April/May and August are not effective.
- Start sprays in early June and finish by the end of July (calendar-based programs).
- Late June/early July is the best timing for single-spray treatments (calendar-based programs).
- Consider the used of the DSV model to time fungicide sprays.
- The relative humidity (80%) can be a good estimator for leaf wetness duration.

Michailides' lab at KARE



We thank Jimmy Nichols and Todd Fukuda for their cooperation.

Thank you!

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