The background features several large, overlapping, semi-transparent swirls in shades of purple, green, and blue. Scattered throughout are numerous small, yellow, triangular shapes, some pointing upwards and some downwards, resembling stylized sun rays or confetti.

Evaluation of Delayed Dormant Copper to Reduce Inoculum of *Erwinia amylovora* in Bartlett Pears

Rachel Elkins, Ken Johnson, Todd Temple, Franz Niederholzer, Steve Lindow, Broc Zoller and Bill Oldham



Why did we do this?

- old recommendation (green tip)
- based on counting strikes only (early-mid 1900's)
- new interest due to resistance to antibiotics, new copper materials (e.g. Kocide 3000)
- LAMP available to determine presence of bacteria on blossoms *rapidly*



2010 Trial

- 3 orchards in Sutter County (Sacramento Valley)
- 5 orchards in Lake County
- treated vs. untreated blocks (4-5 acres)
- Kocide 3000 applied at bud swell (just before green tip – slightly earlier than old literature/recommendations), 6 lbs./acre
- blossom samples mid-bloom, full bloom, petal fall (2x in Lake) to OSU for LAMP
- russet samples pre-harvest to Lindow lab (none)
- blight counts in early July (only holdovers in 2010)

Percent positive 100-cluster flower LAMP samples and average Log₁₀ *E. amylovora* CFU per flower at mid-bloom, full bloom, and petal fall, 2010.

Bloom Stage (Avg. no./30 samples per sample date)

Treatment	Mid bloom 3/22-25/10 (n=29)		Full Bloom 3/29-4/1		Petal Fall 1 4/16-26		Petal Fall 2 5/12 (n=5)		Total n=95	
	%	Log ¹⁰	%	Log ¹⁰	%	Log ¹⁰	%	Log ¹⁰ ₀	%	Log ¹⁰
Copper + oil	3.3	0.5	0	0.0	13.3	1.2	60.0	2.6	8.4	1.8
Oil alone	6.9 ¹	1.4	0	0.0	26.7	1.0	100.0	3.7	16.0	1.6
P-value ²	0.54	(insufficient data)			0.20	0.28	0.14	0.15	0.11	0.69

¹ One additional positive sample omitted from the Sacramento Valley location due to lack of dilution plate confirmation.

² Means analyzed using T-test, P ≤ 0.05. Data normalized with (SQRT+1) transformation.



Accumulated Cougarblight degree-hours (base 60 degrees) on (sampling dates) in Sutter County versus Lake County, 2010.

Bloom Stage

Location	Mid Bloom	Full Bloom	Petal Fall 1	Petal Fall 2
Sutter County	330¹ (3/22)	163 (3/29)	124 (4/16)	-
Lake County	192 (3/25)	0 (4/1)	576¹ (4/26)	155¹ (5/12)



¹ **LAMP detection of *E. amylovora***

Table 3. Accumulated Zoller ‘California’ Model degree-hours (base 65F) on (sampling dates) in Sutter County versus Lake County, 2010.

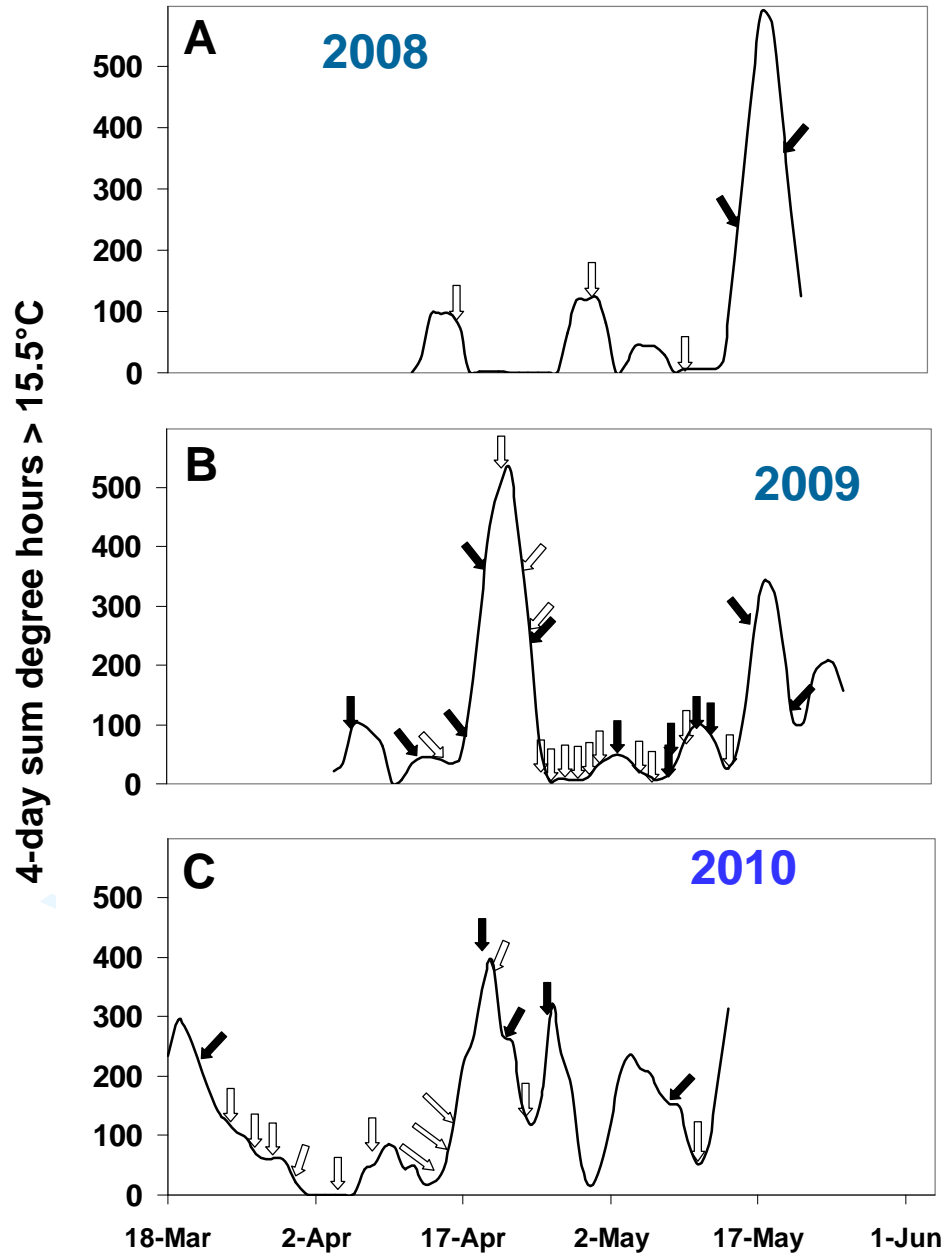
Location	<u>Bloom Stage</u>			
	Mid Bloom	Full Bloom	Petal Fall 1	Petal Fall 2
Sutter County	226 ¹ (3/22)	354 (3/29)	41 (4/16)	-
Lake County	264 (3/25)	0 (4/1)	399 ¹ (4/26)	467 ¹ (5/12)

¹ LAMP detection of *E. amylovora*. Note that the detection threshold of this model in Sutter County is 150 degree-hours versus a detection level of 250 degree-hours in Lake County. (Source: Broc Zoller, personal communication).

Summary of LAMP assay results from 100-flower cluster samples collected from commercial pear and apple orchards in the Pacific Northwest region of the United States from 2008 to 2010

Year	State	Production area	Host	No. of positive LAMP of total samples					Media isolation ^b	Mean Log (CFU) per flower ^c	No. of orchards with fire blight	Disease severity in orchards with fire blight ^d
				No. of orchards	Mid-bloom	Full bloom	Petal fall					
2008	OR	Rogue Valley	Pear	3	0 of 15	0 of 14	n.s. ^e	No	-	0	-	
		Hood River Valley	Pear	3	0 of 15	3 ^f of 15	7 ^f of 15	Yes	1.6	2	Light to moderate	
2009	OR	Rogue Valley	Pear	3	3 of 20	0 of 20	2 of 20	Yes	3.3	1	Light	
		Hood River Valley	Pear	6	6 of 30	6 of 30	7 of 25	Yes	3.3	2	Light	
		Hood River Valley	Apple	2	0 of 8	2 of 8	4 of 8	Yes	2.2	1	Light	
		Walla Walla Valley	Apple	4	0 of 20	4 of 20	11 of 20	Yes	3.3	3	Light	
	CA	Lake County	Pear	4	2 of 15	2 of 15	1 of 15	Yes	1.2	1	Light	
	WA	Okanogan Valley	Pear	1	0 of 4	0 of 6	2 of 4	Yes	3.8	1	Light	
		Wenatchee Valley	Pear	2	0 of 10	0 of 10	0 of 10	No	-	0	-	
		Columbia Basin	Apple	3	0 of 15	0 of 15	0 of 10	No	-	3	Light to moderate	
UT	Utah County	Apple	6	11 of 19 ^f	19 of 25 ^f	10 of 18 ^g	Yes	3.4	7	Moderate to heavy		
2010	OR	Rogue Valley	Pear	2	0 of 12	0 of 12	0 of 12	No	1.5	0	-	
	CA	Sutter County	Pear	6	4 of 30	0 of 30	0 of 30	Yes	2.0	0	-	
	CA	Lake County	Pear	5	0 of 30	0 of 30	20 of 40	Yes	-	0	-	
	WA	Okanogan Valley	Pear	1	2 of 3	0 of 5	n.s.	No	-	1	Light	
		Yakima Valley	Apple	9	0 of 30	2 of 30	n.s.	Yes	1.6	6	Light	
		Summary			60	28 of 276 10%	38 of 285 13%	64 of 227 28%		2.8	28	

LAMP detection of *E. amylovora* over 3 years and correlation with Cougarblight model



Correlation with LAMP samples with Degree hours (base 65 degrees) and presence of *E.amylovora*

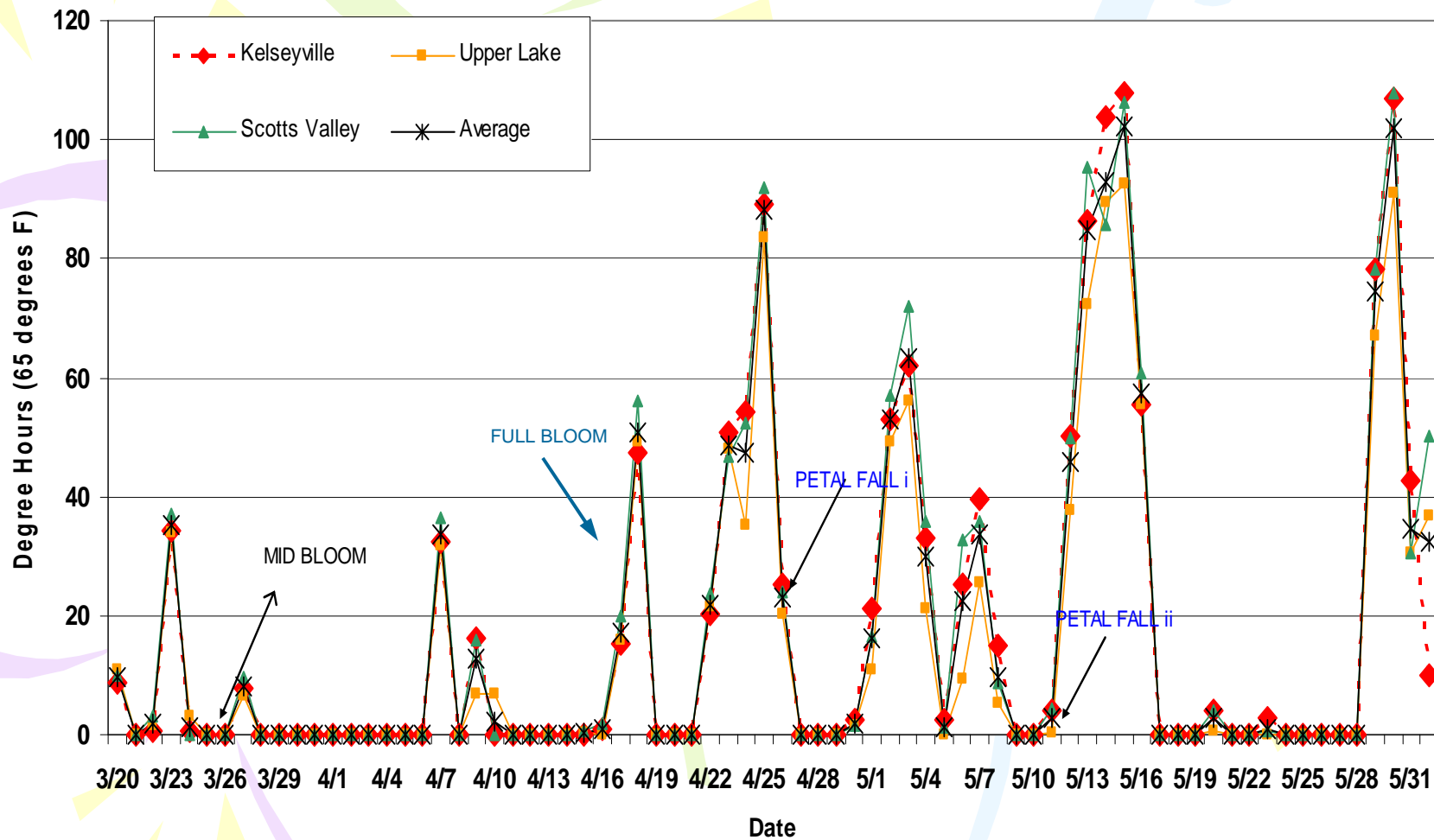


Figure 1: Degree hours (base 65°F) for Kelseyville, Scotts Valley (Lakeport) and Upper Lake, Lake County, California, March 20 to June 1, 2010



Conclusions

- appears (statistical *trend only*) that delayed dormant copper may help
- need more orchards tested (2011 goal)
- LAMP a good tool to confirm bacterial presence (shows need to keep spraying at/past petal fall?!)
- will use cheaper copper in 2011 (2010 costs = 2 antibiotic sprays, but 2011 antibiotic prices will be higher)



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