Fire Blight Control in Organic Pome Fruit Systems Under the Proposed Non-antibiotic Standard

Ken Johnson, Oregon State University

March 13, 2012

http://www.extension.org/organic_production

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Ken Johnson
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This webinar is about fire blight suppression without antibiotics:

Antibiotics:	< Prohibited under EU organic standard
Streptomycin	< 2014 NOP expiration (set by NOSB in 2011)
Oxytetracycline	< 2014 NOP expiration (set by NOSB in 2011)

My focus: **Floral infection in susceptible cultivars***

***Strategies and data shown are most applicable to semi-arid production regions of the western U.S.**

This webinar is not about:

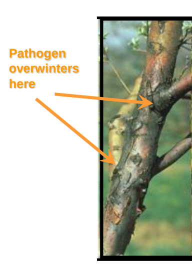
– **Host resistance** (**ideal but longer-term goal**)
– **Management of host susceptibility** (**nutrition**)

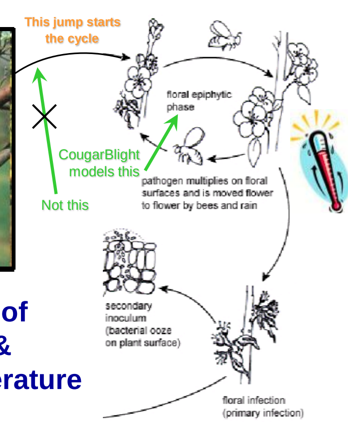
Materials registered and marketed for organic fire blight control

Biologicals:	Product effectiveness
BlightBan A506	poor to fair
Bloomtime Biological	poor to good
Blossom Protect (2012)	very good
Antibiotic-like biological:	
Serenade Max	fair to good

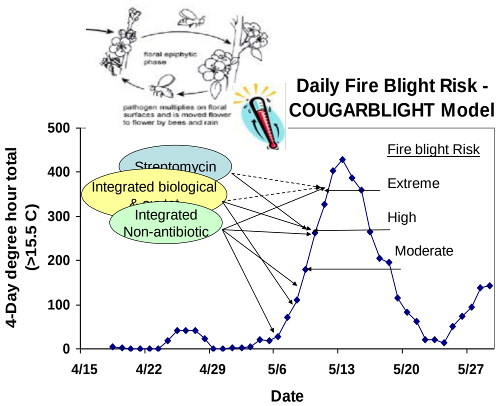
Other potential materials for organic fire blight control

Resistance inducer: (registered, NOP approved but little data)	
Regalia	?
Copper in organic acids: (NOP approval ??)	
Phyton 27AG	?
Gowan GWN 9979	very good





Significance of old cankers & bloom temperature



Systems Approach to non-antibiotic control

Four questions:

- When is the fire blight pathogen active in orchards?
- Does delayed dormant copper effect pathogen activity?
- How does bloom thinning effect fire blight control?
- Can effective non-antibiotic control be achieved?

Q1: When is the fire blight pathogen active in orchards?

Is the fire blight pathogen in this bag of flowers?

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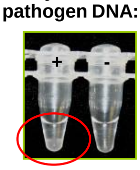
Answered by 'LAMP' assay that detects pathogen DNA:



Q1: When is the fire blight pathogen active in orchards?

Is the fire blight pathogen in this bag of flowers?

Answered by 'LAMP' assay that detects pathogen DNA:

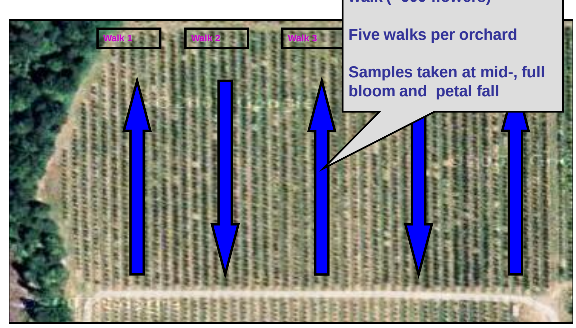
< 1 hour to get an answer

LAMP Surveys in Commercial Orchards

100 blossom clusters per walk (~600 flowers)

Five walks per orchard

Samples taken at mid-, full bloom and petal fall

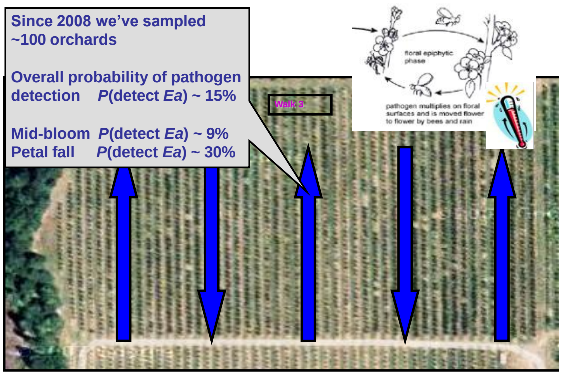


LAMP Surveys in Commercial Orchards

Since 2008 we've sampled ~100 orchards

Overall probability of pathogen detection *P*(detect *Ea*) ~ 15%

Mid-bloom *P*(detect *Ea*) ~ 9%
Petal fall *P*(detect *Ea*) ~ 30%



LAMP Survey Results:

Year	State	Production area	Host	No. of orchards	Mid-bloom	Full bloom	Petal fall
2009	OR	Rogue Valley	Pear	3	3 of 20	0 of 20	2 of 20
		Hood River Valley	Pear	6	6 of 30	6 of 30	7 of 25
		Hood River Valley	Apple	2	0 of 8	2 of 8	4 of 8
		Walla Walla Valley	Apple	4	0 of 20	4 of 20	11 of 20
	CA	Lake County	Pear	4	2 of 15	2 of 15	1 of 15
	WA	Okanogan Valley	Pear	1	0 of 4	0 of 6	2 of 4
		Wenatchee Valley	Pear	2	0 of 10	0 of 10	0 of 10
		Columbia Basin	Apple	3	0 of 15	0 of 15	0 of 10
					11/122	14/124	27/112

This is where the probabilities on the previous slide come from

Pathogen positive walks / Total walks

LAMP Survey Results:

Dirty Orchard

Year	State	Production area	Host	No. of orchards	Mid-bloom	Full bloom	Petal fall
2009	OR	Rogue Valley	Pear	3	3 of 20	0 of 20	2 of 20
		Hood River Valley	Pear	6	6 of 30	6 of 30	7 of 25
		Hood River Valley	Apple	2	0 of 8	2 of 8	4 of 8
		Walla Walla Valley	Apple	4	0 of 20	4 of 20	11 of 20
	CA	Lake County	Pear	4	2 of 15	2 of 15	1 of 15
	WA	Okanogan Valley	Pear	1	0 of 4	0 of 6	2 of 4
		Wenatchee Valley	Pear	2	0 of 10	0 of 10	0 of 10
		Columbia Basin	Apple	3	0 of 15	0 of 15	0 of 10
					11/122	14/124	27/112

Clean Orchard

Pathogen positive walks / Total walks

Use of LAMP to re-examine the value of delayed dormant copper for blight control

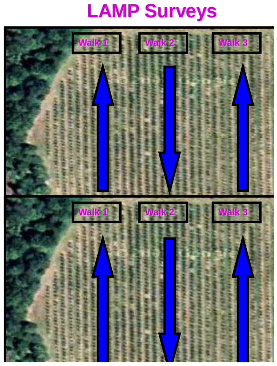
Q2: Does delayed dormant copper effect pathogen activity?

LAMP Surveys

- Delayed dormant oil plus **CuOH+CuOCl** (4 lbs/A)

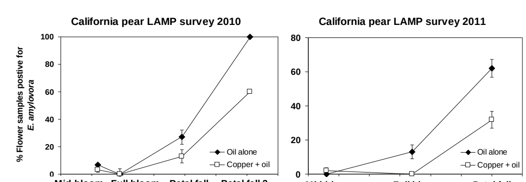
In 2010 & 2011 we split fourteen ~10-acre blocks

- Delayed dormant oil



Rachel Elkins
Pomology Farm Advisor
UC Lake County

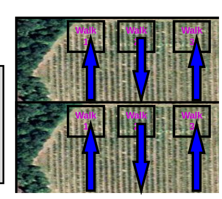
Does delayed dormant copper effect pathogen build-up?



Overall probability of pathogen detection ~ 16%

Mid-bloom *P*(detect *Ea*) < 5%
Petal fall *P*(detect *Ea*) ~ 50%

***P*(detect *Ea*) in 'Copper + Oil' ½ of 'Oil alone'**

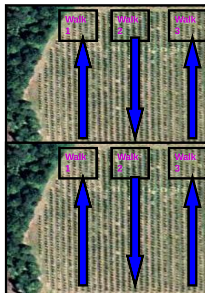


Does delayed dormant copper effect pathogen activity?

Treatment[1]	Average Russeting	Russet Severity (greater than 7%)	Russet Severity (less than 3%)
Copper + oil	2.7	10.5	76.0
Oil alone	2.7	10.2	76.1

Rachel Elkins and Steve Lindow have obtained fruit finish data from all plots

No difference in Russet Severity among the 'Copper & Oil' and 'Oil only' plots



Summary of LAMP Surveys

- When is the fire blight pathogen active in orchards?
  Depends on orchard, but late (PF) is more the norm
- Does delayed dormant copper effect pathogen activity?
  Yes, it delays time to when the pathogen is detectable (PF)
- Can I get LAMP scouting done in my orchard?
  The technology still requires a bit of skill (pipetting, DNA extraction)

Summary

- When is the fire blight pathogen active in orchards?
  Depends on orchard, but late (PF) is more the norm
- Does delayed dormant copper effect pathogen activity?
  Delays time to when the pathogen is detectable (PF)
- Can I get LAMP scouting done in my orchard?
  The technology still requires a bit of skill (pipetting, DNA extraction)

but this is rapidly changing:

Andreas Bühlmann of Agriscope is using the OptiGene Genie II LAMP analyzer

Think about Questions
on 'LAMP'
and
'Delayed Dormant Copper'

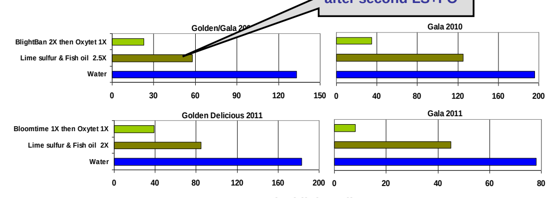
Q3: How does bloom thinning effect fire blight control?

2% Lime sulfur plus 2% fish oil

- As used for bloom thinning in apples, does it provide a benefit to fire blight suppression?
- It's not compatible in tank mix with any of the other fire blight control products.

Q3: How does bloom thinning effect fire blight control?

Replicated, inoculated orchard trials:

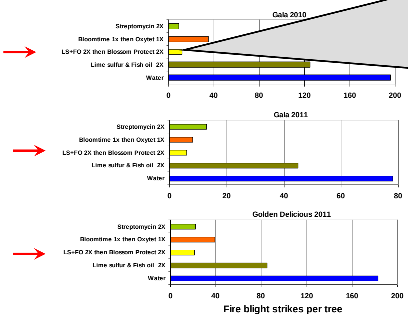


Primary effect of LS+FO is fewer flowers

But LS+FO is toxic to epiphytic pathogen cells (and epiphytic biologicals)

Speculation: LS+FO makes orchard somewhat less attractive to bees

Integrated control ✓
Frequency of treatment ✓
What is this new yeast product ✓
Lime sulfur plus fish oil ✓



LS+FO shortens the period when fire blight products are needed

Fire blight treatments started after 2nd bloom thinning:

20&70% bloom LS & FO

FB, PF fire blight products

Non-antibiotic Systems Approach:

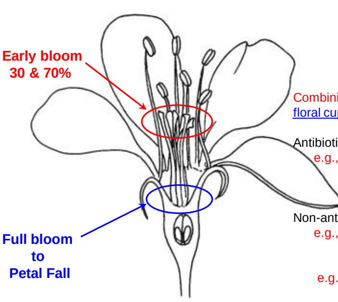
- How does bloom thinning effect fire blight control?

LS+FO shortens period when fb products are needed

Effects of various rates of lime sulfur alone and of ATS will be evaluated in 2012

Think about Questions on 'Bloom Thinning'

Q4: Can effective non-antibiotic control be achieved?



Combining a stigma product with a floral cup product improves control

Antibiotic approach:
e.g., Bloomtime Biological then Oxytetracycline

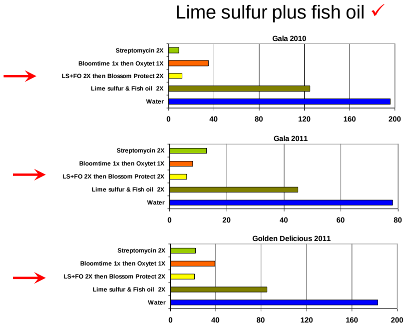
Non-antibiotic approach:
e.g., Bloomtime Biological then Serenade Max

e.g., Lime sulfur & fish oil then Blossom protect

'Integrated control'

very good to excellent control

Integrated control ✓
Frequency of treatment ✓
What is this new yeast product ✓
Lime sulfur plus fish oil ✓



Q4: Can effective non-antibiotic control be achieved?

Integrated control ✓
Frequency of treatment ✓

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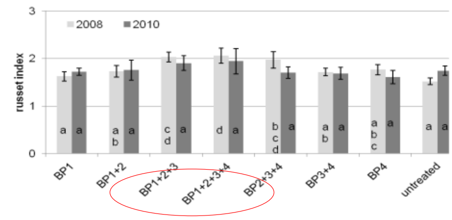
Integrated control ✓
Frequency of treatment ✓

Drawback of Blossom Protect:
A potential for fruit russet

Stefan Kunz 2011 – German scientist and inventor of Blossom Protect



Russet index on fruit of apple cv. ´Santana´ 2008 and 2010 after treatment with Blossom Protect (BP).

The numbers 1-4 represent the number and timing of applications.

Higher numbers of application and wetter conditions during and after bloom raise the concern

Non-antibiotic Systems Approach:

Can effective non-antibiotic control be achieved?

Yes, via 'integrated control':

… utilizing delayed dormant copper sanitation

… in apples, using bloom thinners to further delay pathogen 'build-up' in flowers

… in pear, using bacterial stigma colonizers to further delay pathogen 'build-up' in flowers

… utilizing Blossom Protect or Serenade Max @ full and late bloom to protect floral cup

Compared to antibiotics, treatments are increased

eOrganic

Questions?

- LAMP scouting
- delayed dormant copper
- bloom thinning
- integrated, non-antibiotic control

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