Fire Blight - Introduction to the Pathogen, Bloom Infection Prevention with Antibiotics: The Basics

Aina Baro Sabe, Tianna DuPont, WSU Extension

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Control

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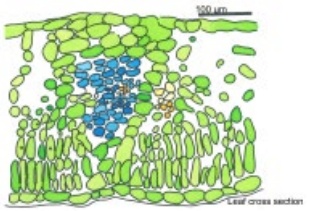
- Sanitation is key.
- Rotate high efficacy products targeted 12-24 hr before moisture.
- Protect young trees with copper and bloom removal.



Sanitation

Fixed copper sanitation at green tip.

Avoid Irrigation

Bactericides before moisture

Petal fall protection

Plant defense compounds

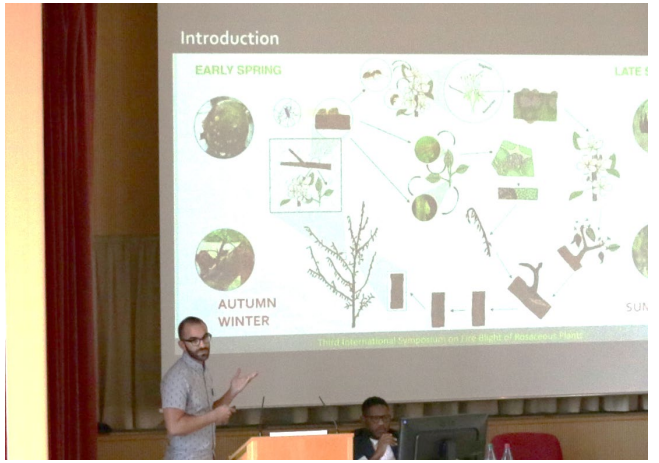
Protect non-bearing trees

Summer sanitation

Sanitation

Sanitation

Between 7 and 62% of cankers initiated in June were positive for fire blight bacteria the following April.



Santander, R. D., Khodadadi, F., Meredith, C. L., Radenovic, A., Clements, J., and Acimovic, S. G. 2022. Fire blight resistance, irrigation and conducive wet weather improve Erwinia amylovora winter survival in cankers. Front. Microbiol. 13.

Remove fire blight prunings from orchard

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- *18 1-5 cm diameter fire blight cuttings from Feb 28, 2019 were left in orchard (in snow) until April 17, 2019.*
- 67% of blight cuttings still had green tissue
- 28% had living fire blight bacteria.

Example

Fixed copper sanitation at green tip.

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Fixed copper at delayed dormant (green tip) leaves a copper residue that can help kill bacteria oozing from cankers.

Dry Flowable

Active Ingredients	***By Weight***
Copper Hydroxide* (CAS No. 20427-59-2)	46.1%
Inert Ingredients	53.9%
TOTAL	100.0%

(* Metallic Copper Equivalent 30%)

EPA Reg. No. 352-662 EPA Est. No._____

Nonrefillable Container

Net: _____

Avoid Irrigation

Cultural Controls

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Don’t irrigate during bloom!

Bactericides before moisture

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- Use products with high efficacy during full bloom when risk is high (many blooms open).
- Target 12-24 hr before moisture
- Rotate to moderate efficacy products late bloom when risk is lower.

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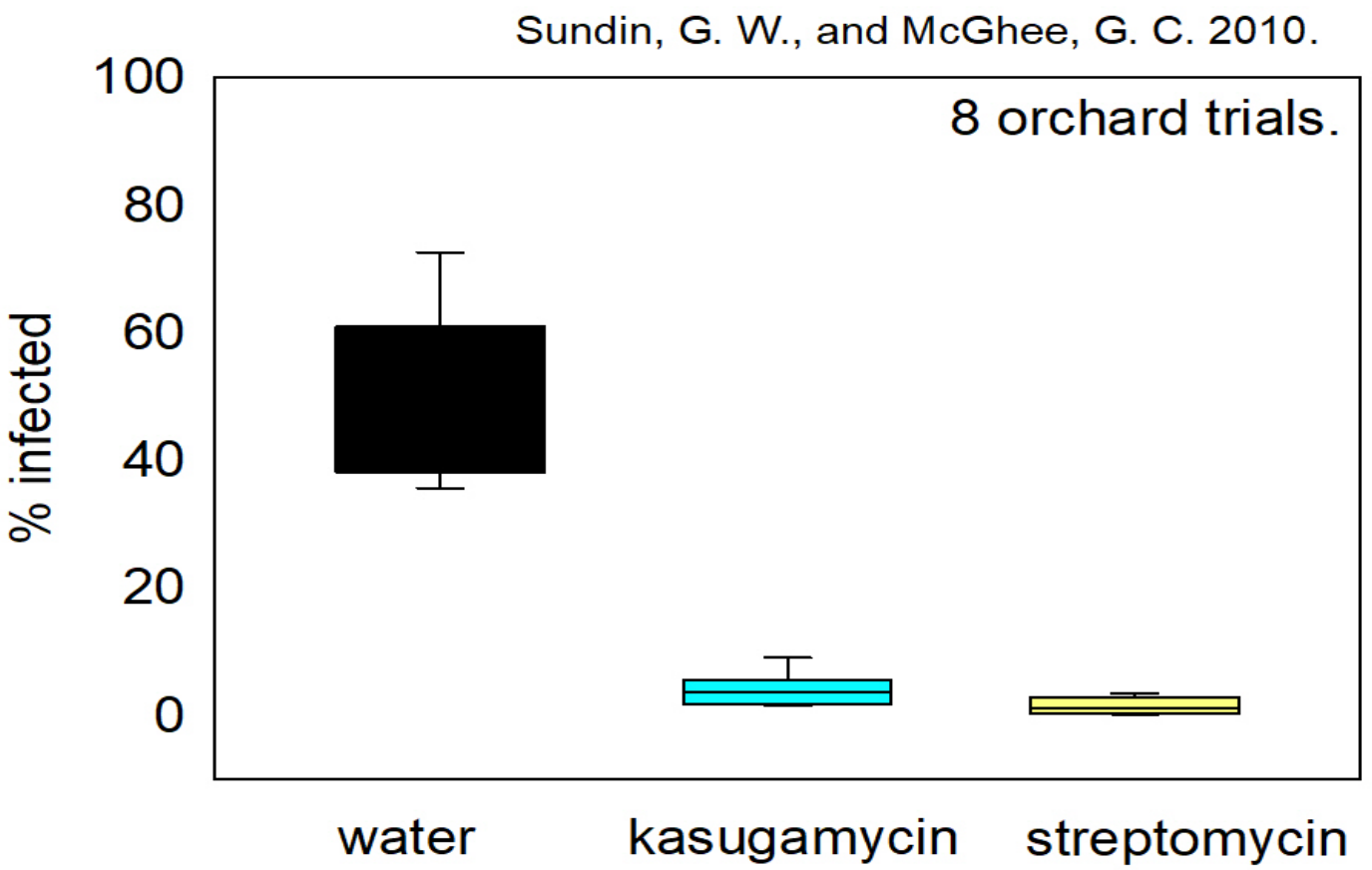
Use products with high efficacy during full bloom when risk is high (many blooms open).

Antibiotics

- **Kasugamycin** (Kasumin)
- **Oxytetracycline** (e.g. Fireline, Mycoshield)
- **Streptomycin** (e.g. Firewall)

Kasugamycin (Kasumin)

- Excellent
- 64 fl oz/ 100 gal/ A
- 2 days forward control
- 12 hrs kickback
- Surfactant/ 5.5 pH
- Spray volume for good coverage
- Uv sensitive. Spraying at night or lowering pH also helpful



Sundin, G. W., and McGhee, G. C. 2010. Kasumin: Field results for fire blight management and evaluation of the potential for resistance development in Erwinia amylovora. Phytopathology 100:S166-S166.

Antibiotics

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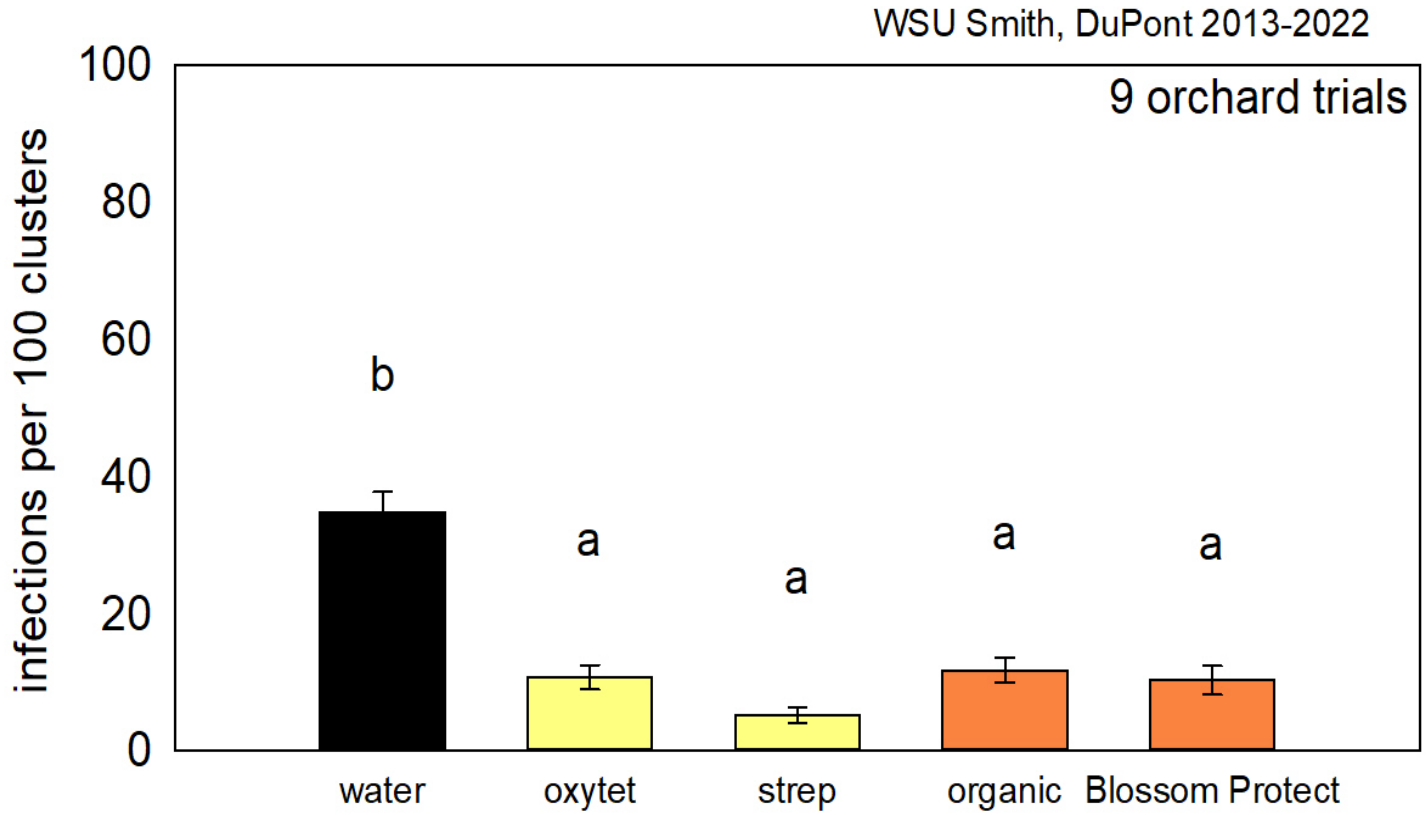
- **Kasugamycin** (Kasumin)
- **Oxytetracycline** (e.g. Fireline, Mycoshield)
- **Streptomycin** (e.g. Firewall)

Oxytetracycline

- Good efficacy (avg 74% WA)
- Bacteriostatic – inhibits growth
- UV sensitive
- Acidify to 5.6
- Include non-ionic surfactant

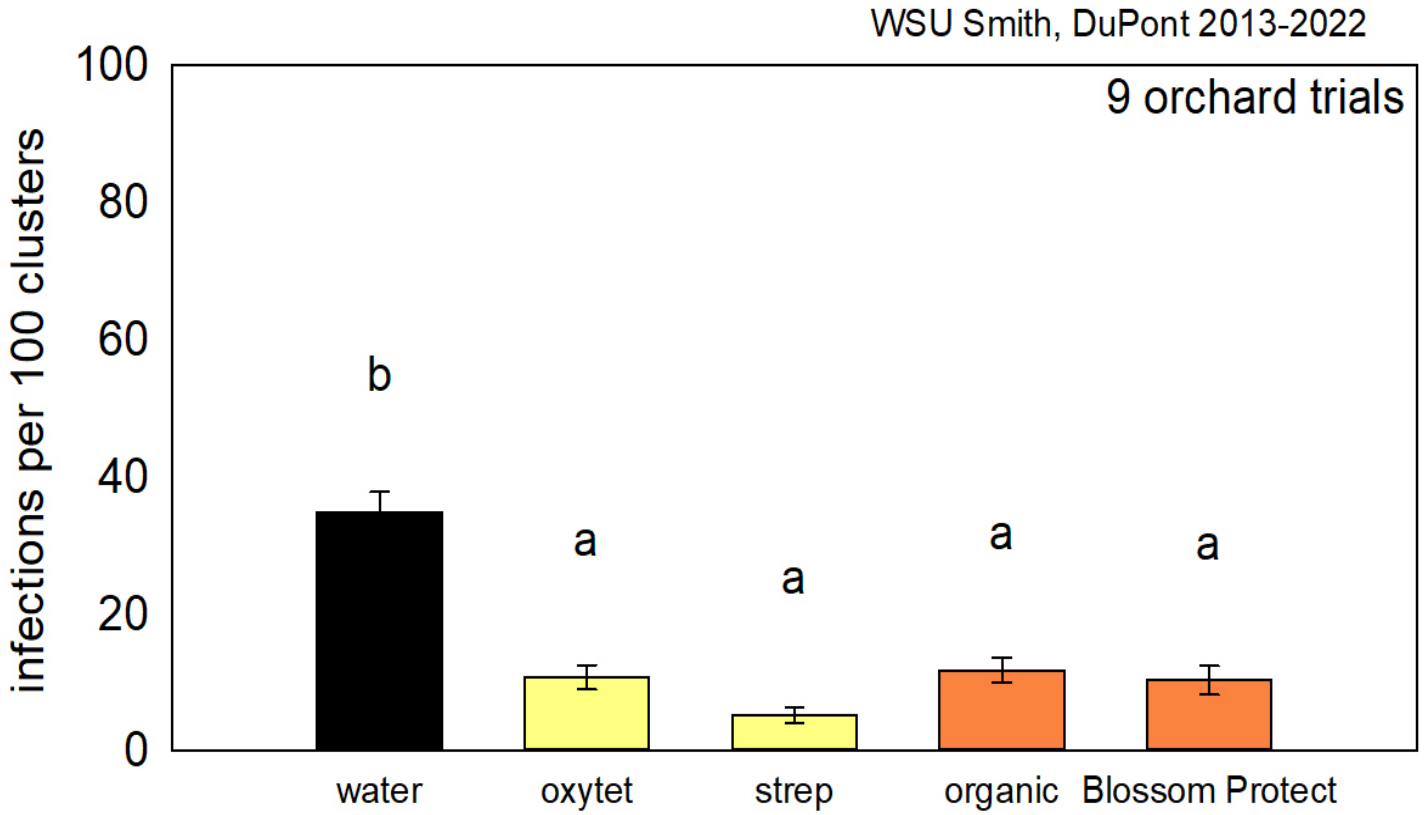


Antibiotics

- **Kasugamycin** (Kasumin)
- **Oxytetracycline** (e.g. Fireline, Mycoshield)
- **Streptomycin** (e.g. Firewall)

Streptomycin

- Excellent control (avg 85% WA)
- Control 2-3 days
- Some control if applied 12-24 hr after rain event (partially systemic).
- Non-ionic surfactant.
- USE ONLY 1x per season.



Buffer spray tank with antibiotics

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Bacterial Growth %

Kasugamycin	pH 5.1	pH 7.3
No antibiotic	100%	100%
5 mg/L	14%	79%
10 mg/L	4%	65%

At higher pH antibiotics are not as effective.

Courtesy Jim Adaskaveg, University of California

Buffering oxytet to 4 can improve control

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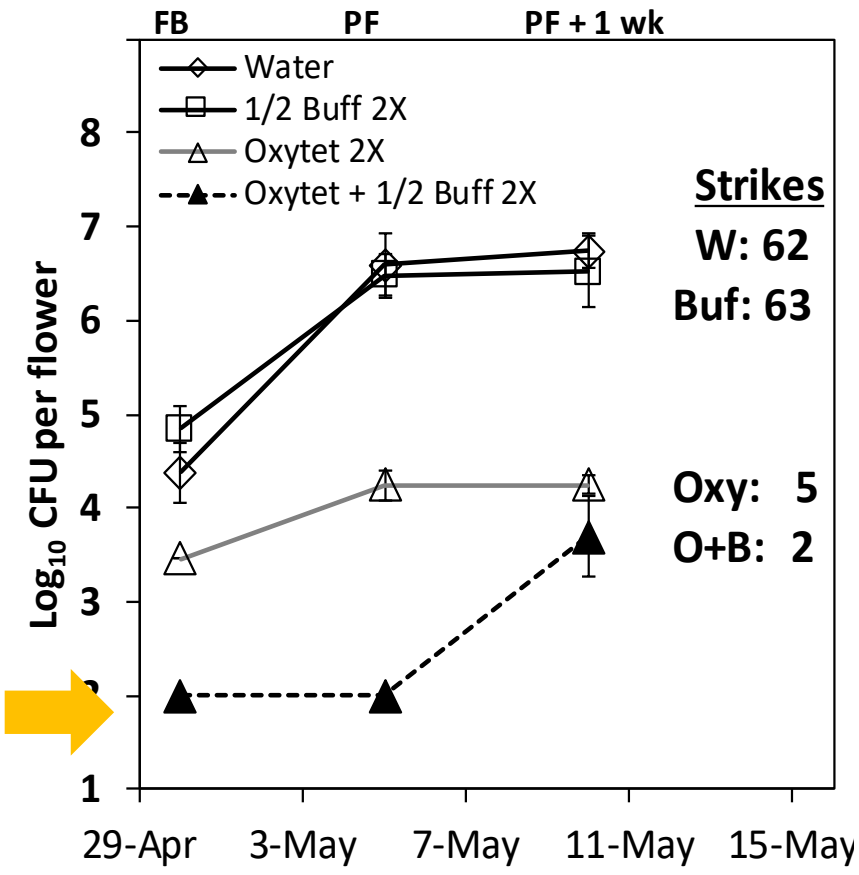
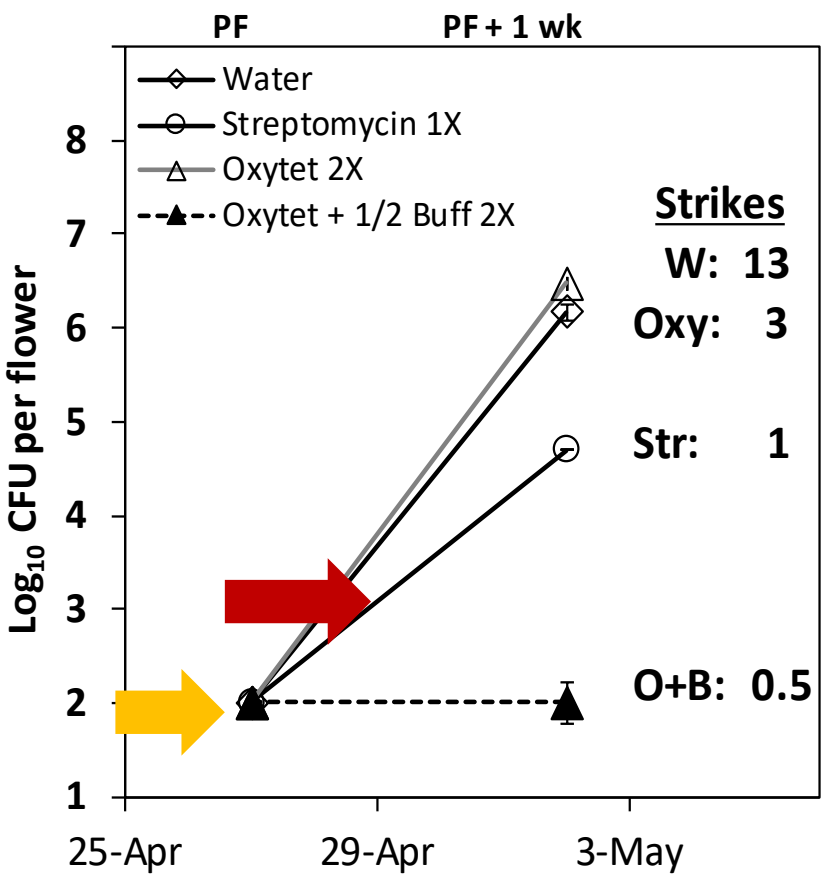
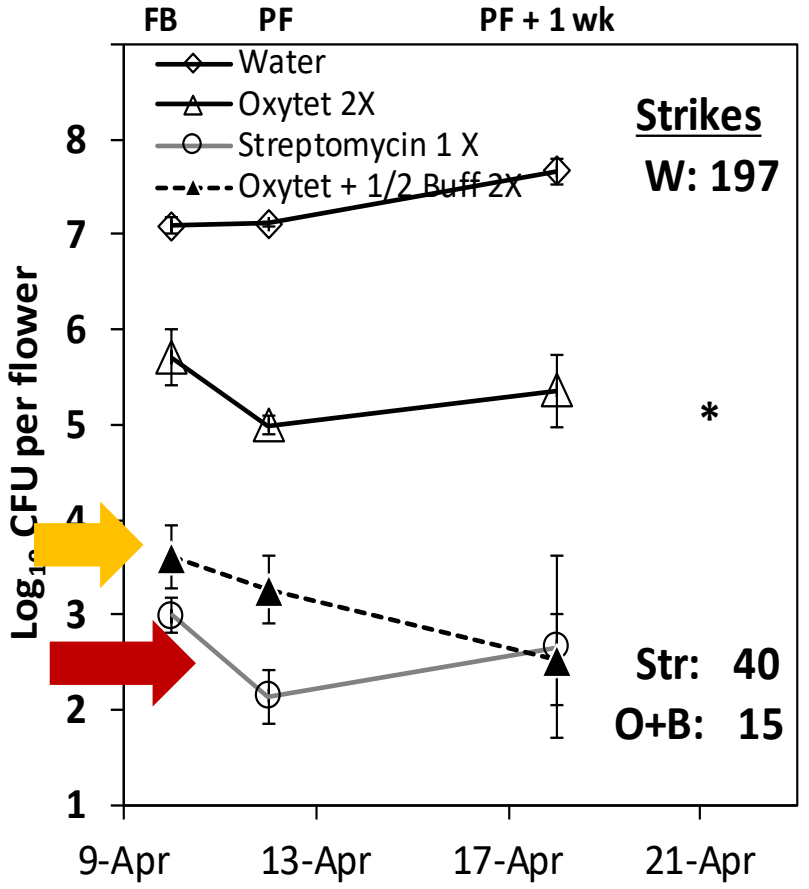
Golden Delicious apple 2017



Bartlett pear 2017



Gala apple 2016

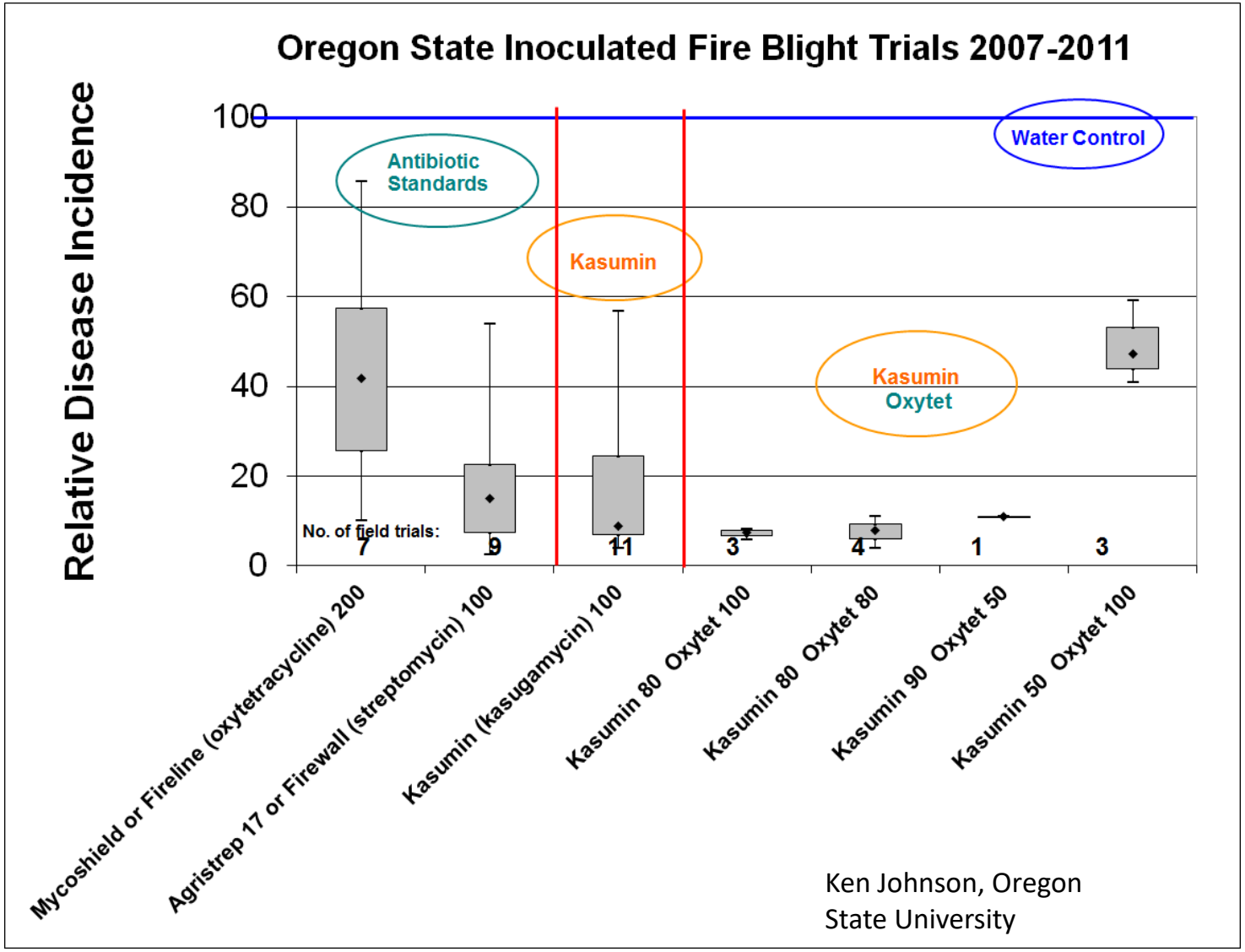


courtesy Ken Johnson, Oregon State University

Tools for High Risk Blocks: Antibiotic Mixes

Kasugamycin +
Oxytetracycline

Streptomycin +
Oxytetracycline
only one time!



Ken Johnson, Oregon State University

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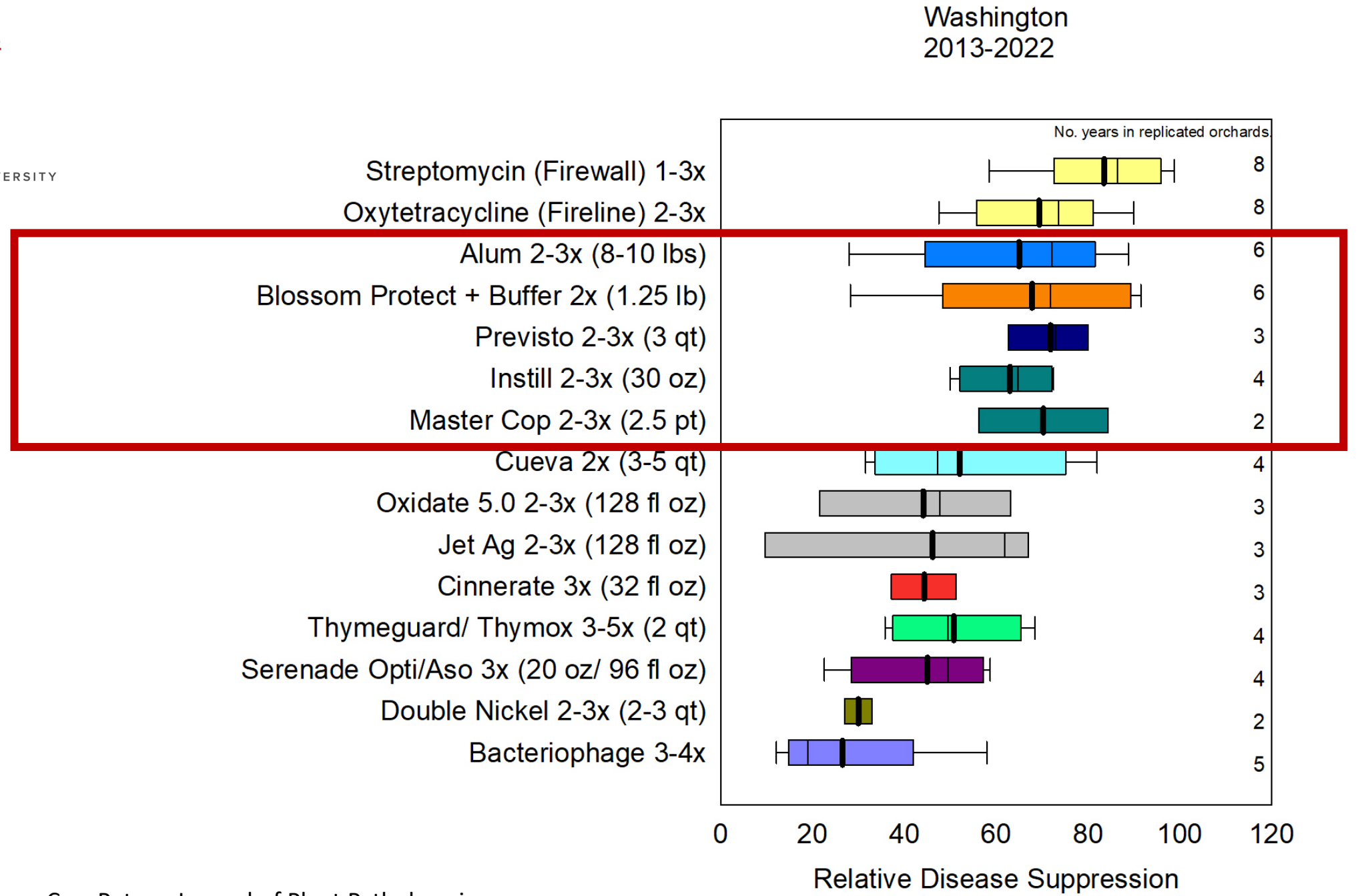

DuPont, Johnson, Cox, Peters. Journal of Plant Pathology in prep.

Target 12-24 hr before moisture

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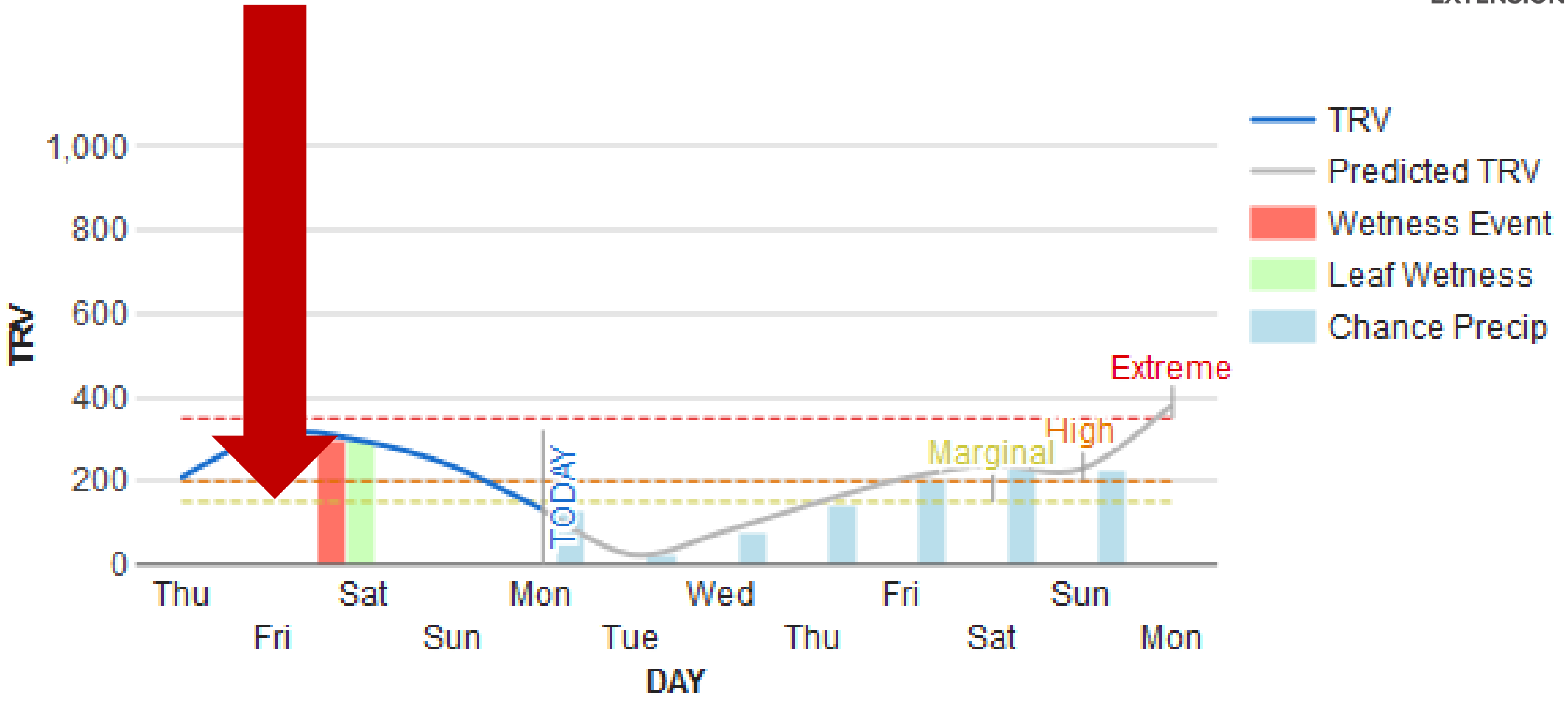

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Rotate to minimize antibiotic resistance

Streptomycin Resistance in US

HIGH RESISTANCE – *rpsL*-mediated

Mutation in the chromosomal *rpsL* gene (HR)

[Only known mechanism in OR, WA. **UT, ID** Low incidence in CA, MI]

MODERATE RESISTANCE – *strA-strB*-mediated

1. *strA-strB* resistance genes on transposon

strA-strB on *Tn5393a* (MR-L) → Located on plasmid → pEU30 CA

strA-strB on Tn*5393* (MR-H) → Located on plasmids → pEa34 MI

pEa34 → pEa29 MI, NY

strA-strB on Tn*5393* integrated in the chromosome [Low incidence in MI]

2. *strA-strB* resistance genes not on transposon

strA-strB on plasmid pEa8.7 [Low incidence in CA,

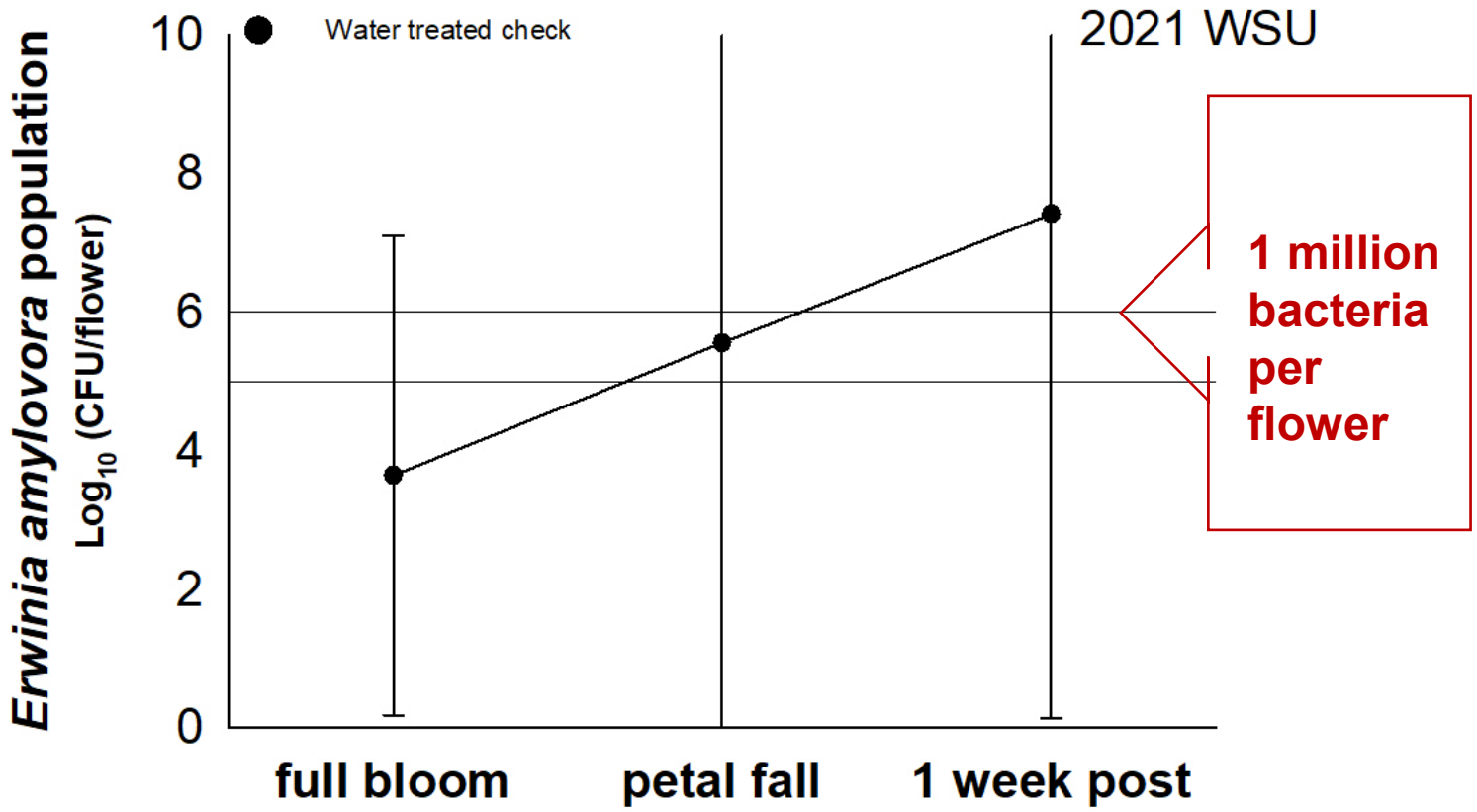
Forster et al. 2016 Phyto

- **Did not find any resistant strains in orchards surveyed in 2022 in WA**
- **A point of concern is that 100% *Erwinia amylovora* bacterial populations can grow at 50 ppm kasugamycin**

Frank Zhao, WSU

Petal fall protection

Continue programs 1-2 weeks past petal fall



Erwinia populations continue to build through late bloom.

Conventional Programs

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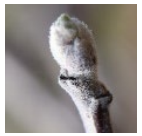
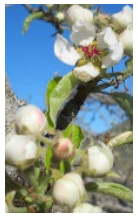
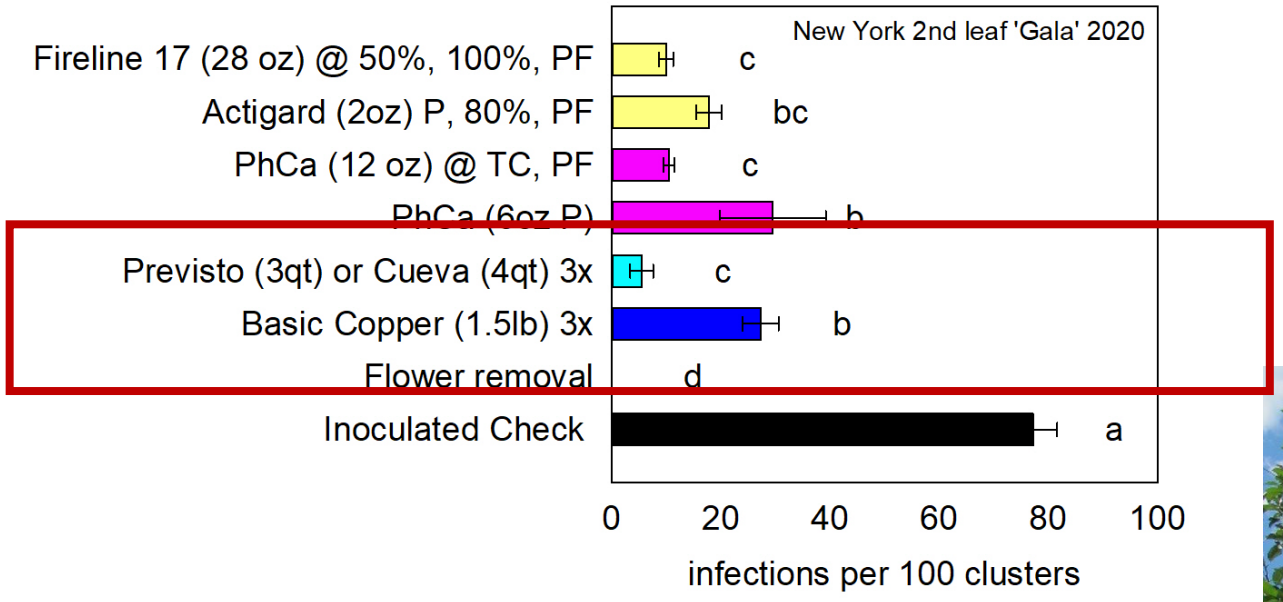
		Low to moderate risk	High risk blocks
Dormant		• Cut and remove cankers	
DD			• Fixed copper if fire blight was in block last year.
Early Bloom			• Blossom Protect + Buffer
		• Antibiotics when there is risk (warm wet from model) • Acidify spray tanks to improve antibiotic efficacy (5.5).	
Full Bloom to Petal Fall		Antibiotics when there is risk (warm wet from model)	• Use antibiotic mixes • New research shows pH 4.0 may improve efficacy.
Petal Fall to +1-2 weeks		• Continue weekly apps 1-2 weeks post petal fall if warm and wet.**	

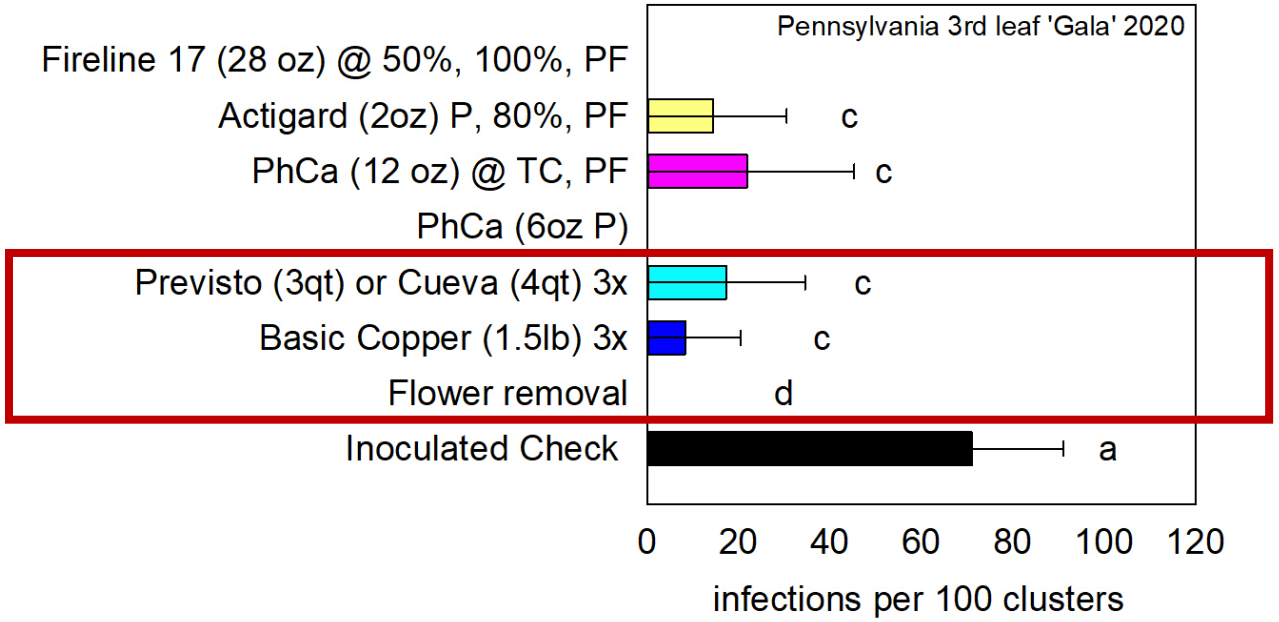
**Rotate.

http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/

Protect non-bearing trees

Coppers and flower removal protect susceptible young tissue.





Flower removal removes the infection point.

Flower removal example

- Grower in Pasco
- Flower removal for non bearing trees is standard.
- Half-way finished when started to rain.
- Half the block was fine (where removed) half with blossoms ‘a mess.’

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Summer sanitation

Control

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References

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Questions?

Thank you

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http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/

Product efficacy trials at end of page.

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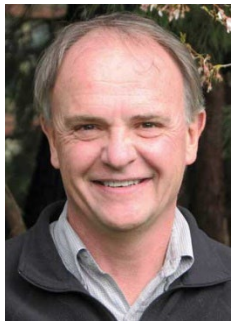
The IR-4 Project

Sara Villani
NC State University



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