Fire blight management update: The latest with season-long control and options for hard cider producers

Mid-Atlantic Fruit and Vegetable Convention

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Fire blight management optimization continues…

- Disease cycle review
  - Blossom blight 101
- Mitigating blossom blight with copper and yeast
  - Efficacy trial results 2016 – 2018
- Plant defense elicitors
  - Duration of signal – sweet spot for timing of apps
  - Tree age influence
- Latest with using low rates of ProCa

Reviewing the fire blight disease cycle

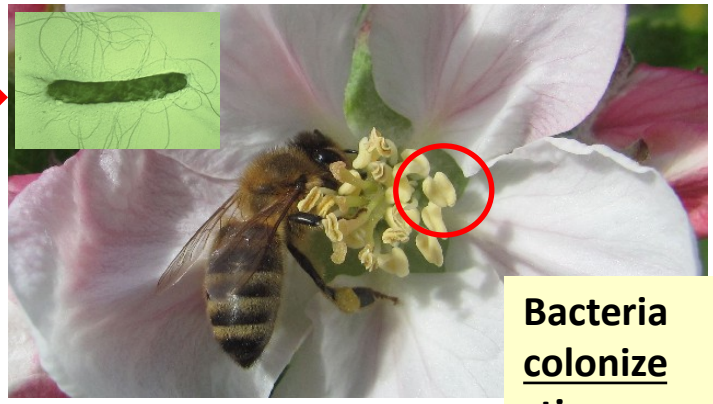
Tight cluster – Pink: Bacteria replicates in cankers

Active canker

www.apsnet.org

Dormant Canker: Bacteria <u>overwinters</u> in bordering living tissue

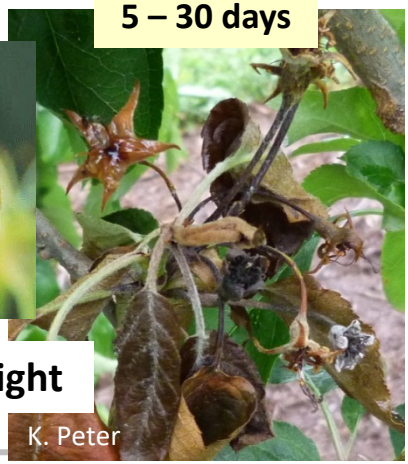
Oozing bacteria: Attracts insects – insects <u>disperse</u> bacteria to flowers (wind and rain also <u>disperse</u> bacteria)



Bacteria <u>colonize</u> stigmas (favors warm temps): does not cause disease (yet)

Wetting event + warm temps

5 – 30 days



K. Peter

Blossom Blight

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Shoot Blight
Canker Blight
Trauma Blight
Rootstock Blight

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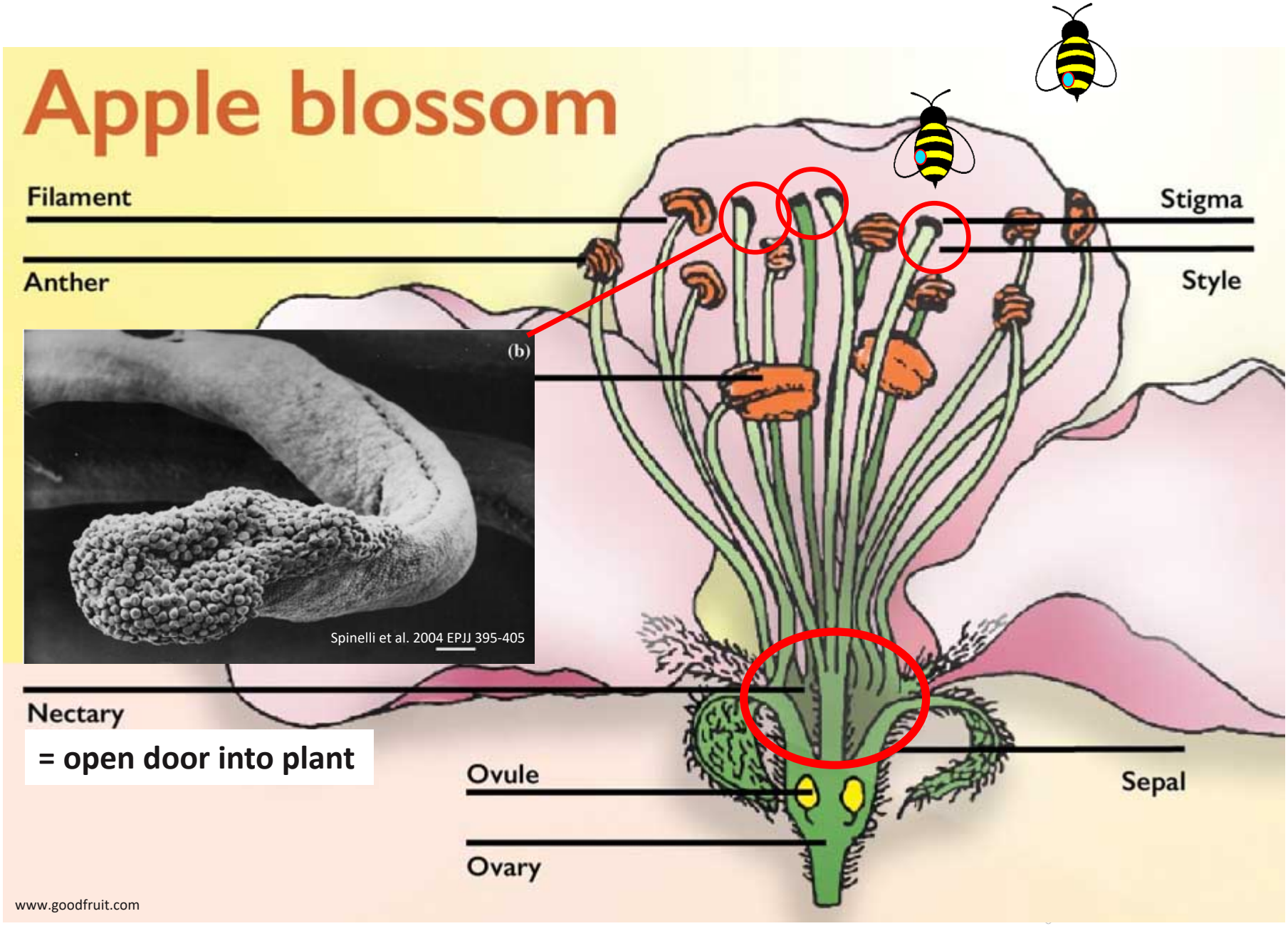
How is the blossom protected from fire blight?



How is the blossom protected from fire blight?

streptomycin
copper

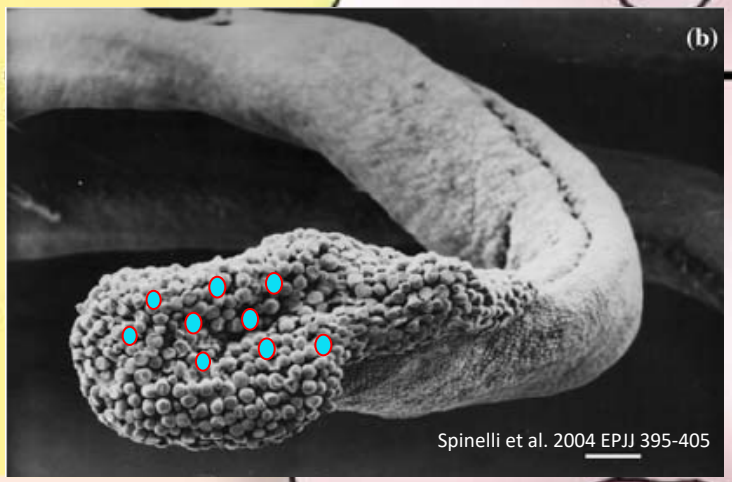
Apple blossom

Filament

Anther

Stigma

Style



Nectary

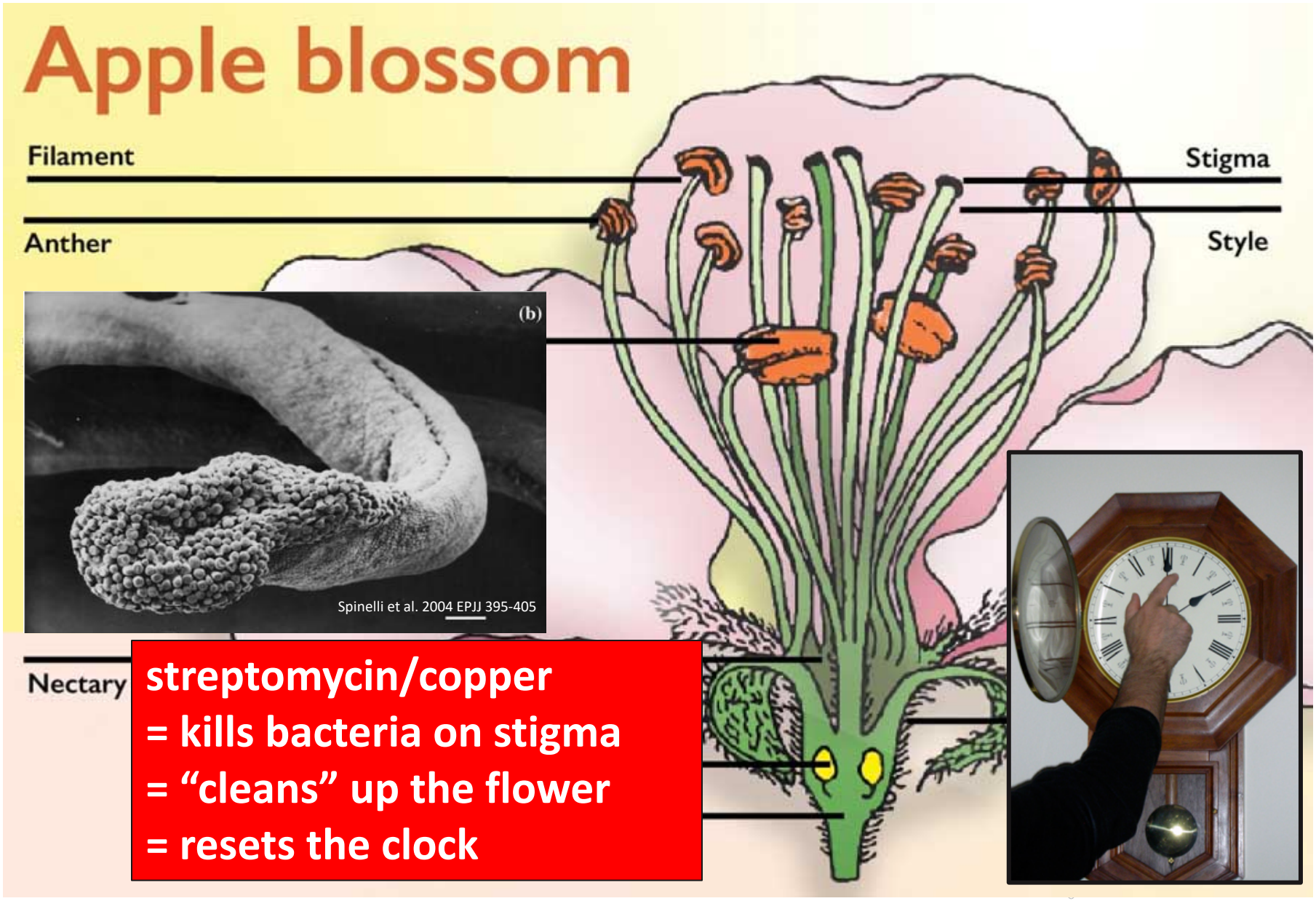
Ovule

Ovary

Sepal

www.goodfruit.com

How is the blossom protected from fire blight?



Streptomycin alternatives for hard cider producers: Copper- and yeast-based products

Copper

- Different formulations
- Different amount metallic Cu rates
- Application timings
- Additional perks of using a copper application at bloom*

Yeast

- Blossom Protect

How does copper work?

Copper is a general biocide: Non-selective (plant, fungi, bacteria)

- Acts as a protectant for fungicide-bactericide treatments
  → Apply before infection

- NO post-infection activity
  → Sticks where it hits
  → No re-distribution post application

While on the leaf/blossom…

- Requires moisture to be present on plant surface to be active
- Copper particles gradually desintegrate releasing copper ions
- Copper is most effective on those diseases that need free water present to develop

Going in for the kill...

- The copper ions destroy critical enzymes important for cell to function

Efficacy of copper spray depends on the amount of elemental copper:

% Metallic Copper

Product Name	Active Ingredient	% Metallic Copper	Amount of Cu per unit
Liquid formulations			
Badge SC	Copper oxychloride + copper hydroxide	20	2.27 lb
Nu-Cop XLR	Copper hydroxide	10	1.0 lb
Magna-Bon	Copper sulfate pentahydrate	5	0.418 lb
Previsto	Copper hydroxide	3.3	0.3 lb
Cueva	Copper octanoate	1.8	0.16 lb
Dry formulations			
Nordox 75 WB	Cuprous oxide	75	0.75 lb
Kocide 3000	Copper hydroxide	30	0.3 lb

Efficacy trial evaluations: Copper formulations evaluated at bloom (2016 – 2018)

Product Name	Label rate/A	Rate/A tested	Amount of Cu per unit	Amount Cu applied/app	Total amount of Cu applied
Badge SC	3.5 pt – 7 pt	4 pt	2.27 lb	18.24 oz x 1	18.24 oz
Nu-Cop XLR	1.8 – 12 pt	8 pt	1.0 lb	16 oz x 3	48 oz
Nu-Cop XLR		4 pt	1.0 lb	8 oz x 1	8 oz
Nu-Cop XLR		2 pt	1.0 lb	4 oz x 3	12 oz
Magna-Bon	1.2 – 4 pt	1 pt	0.418 lb	0.8 oz x 3	2.4 oz
Previsto	4 – 8 pt	6 pt	0.3 lb	3.6 oz x 3	10.8 oz
Cueva	Up to 8 pt	4 pt	0.16 lb	1.3 oz x 3	3.9 oz

Copper formulations evaluated when applied at bloom

Product Name	Rate/A	Total amount Cu applied	% Blossom blight control	Year	Disease pressure
Nu-Cop XLR	8 pt	48 oz	81	2017	Low-Mod
Previsto	6 pt	10.8 oz	42	2016	Low-Mod
Magna-Bon	1 pt	2.4 oz	18	2016	Low-Mod
Cueva	4 pt	3.9 oz	17, 14	2016, 2017	Low-Mod
Badge SC	4 pt	18.24 oz	34	2018	High
Nu-Cop XLR	2 pt	12 oz	15	2018	High
Nu-Cop XLR	4 pt	8 oz	12	2018	High
Cueva	4 pt	3.9 oz	6	2018	High

Take home message when using copper at bloom to manage blossom blight:
The MORE metallic copper you apply, the MORE control you will achieve

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Blossom Protect to control blossom blight: Yeast (*Aureobasidum pullulans)*

Registered for sale in Arizona, California, Colorado, Idaho, Iowa, Massachusetts, Michigan, Minnesota, New York, North Carolina, Oregon, Pennsylvania, Utah, Virginia, Washington and Wisconsin

- **Yeast colonizes the flower, competes for space and nutrients with *Erwinia* → *Erwinia* unable to thrive**
- **Fungicides limited during bloom = yeast is "alive"**
- **Blossom blight control: 33 - 40%**

Can causes fruit russet = apple scab coniditions

Photos: K. Peter

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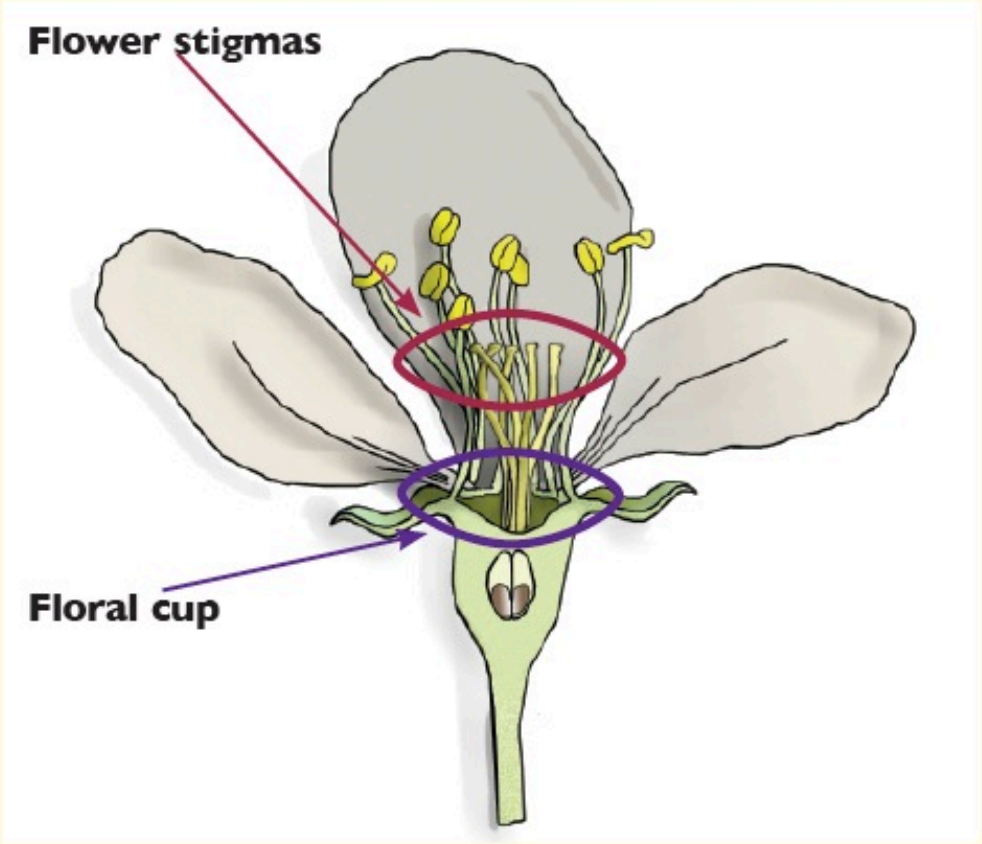
Two-prong approach

To improve fire blight control, use a stigma product during early bloom, followed at full bloom to petal fall by a product that suppresses the pathogen when it reaches the nectary.



SOURCE: Ken Johnson, OSU

Mitigating shoot blight phase of fire blight: Update on understanding plant defense elicitors and optimizing ProCa applications

Plant defense elicitors

- How long does the defense signal Actigard induces persist to limit fire blight?
- Does tree age influence efficacy of plant defense elicitor to limit fire blight?

Prohexadione calcium (ProCa)

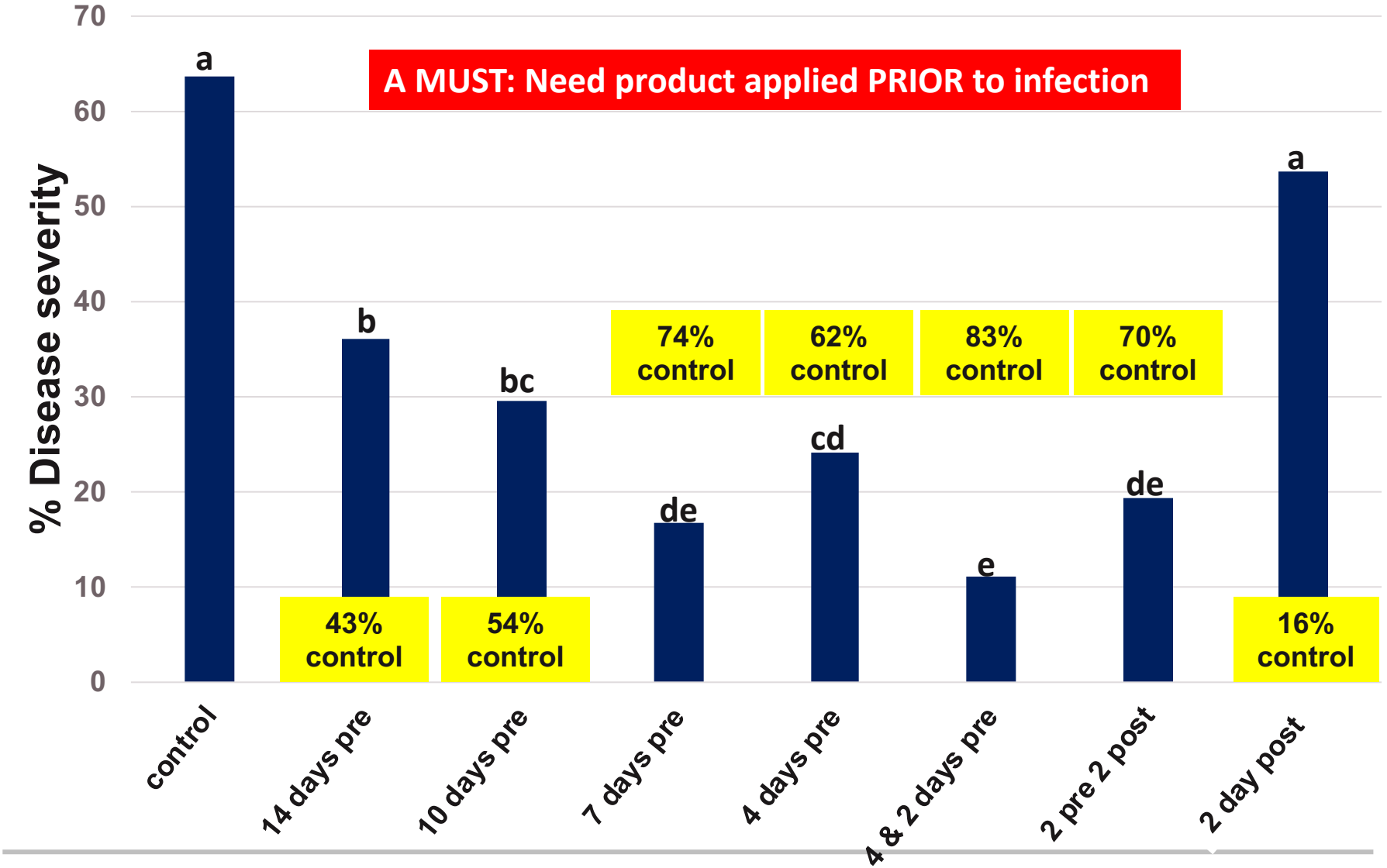
- Can adding a plant defense elicitor to a low rate of ProCa enhance the efficacy of mitigating shoot blight?

Plant defense elicitors:
Products evaluated on Gala trees: greenhouse vs. field

Active Ingredient	Trade Name	Rate/A	Comments
Acibenzolar-S-methyl	Actigard	2.0 oz	"Standard SAR inducer"
Laminarin	Vacciplant	3.2 fl oz	"Stimulant of plant defense reactions"
Reynoutria sachalinesis extract	Regalia	2 qt	"Accumulates reactive oxygen species (ROS) and lignification (aka strengthening) of cell walls" In PA: 20% Blossom blight control (pressure not high)

- Cueva + plant defense elicitor = more control? (field trials only)

2018 Greenhouse: Understanding optimal timing of Actigard applications: Pre- and post- infection timings are not equal



Supported by SHAP, 2018; Published in Pennsylvania Fruit News February 2019

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Does tree age influence efficacy of plant defense elicitor to limit fire blight?

	Actigard	Regalia	Vacciplant
Tree age	% Disease control		
Greenhouse (= Newly planted)	78 – 95	21 -35	8
5 – 6 yr	60	22	19
10 yr	45	1	28

Take home message:

- Actigard, Regalia = younger the tree, the better the product will work
- Vacciplant = better option for older trees?

Supported by SHAP, 2016 -2018; Published in Pennsylvania Fruit News 2017 - 2019

Plant defense elicitors and mitigating shoot blight: Considerations and questions

- Age of tree important
  - Young dwarf trees
    - Best chance of defense elicitor efficacy?
  - Influence of rootstock (tree vigor)?

- Timing and number of applications
  - When, how many, and for how long?
  - Optimization needed?
- Persistence of signal?

Regalia? Glycerol? Vacciplant? Cueva + glycerol?

Can adding a plant defense elicitor to a low rate of ProCa enhance the efficacy of mitigating shoot blight?

- ProCa: Apogee, Kudos
- Controls tree vigor by reducing terminal growth
- Shoots harden off = not susceptible to shoot blight caused *E. amylovora* infection
- Typically applied when 3 inches of vegetative shoot growth present
  - → ~ King bloom petal fall
  - → 10 – 14 days to see the effect of ProCa

Fire blight management on dwarf trees: Evaluation of low doses of ProCa in PA

- 2016 – 2017 research
  - 2 and 4 oz/A suppressed growth ~40-50%
  - 2 and 4 oz/A suppressed fire blight severity ~40-50%

- Too much growth suppressed…is there a happy medium??

Goal:

Achieving fire blight suppression without slowing the development of the bearing surface in trees still filling their space

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@ UMD Orchards, 2018: Using low rate of Apogee + defense elicitor on dwarf trees to manage fire blight

- 2 cultivars: Brookfield Gala and Cripps Pink; each on Geneva rootstocks trained to tall spindle training system (2010 planting; trees had moderate vigor)
  - Completely random block design with four multi-tree replications
- Three treatments and three spray application timings
  - Apogee (2 oz/A)
  - Apogee + Regalia (2 qt/A)
  - Apogee + Actigard (2 oz/A)
    - May 7 (petal fall)
    - May 18
    - May 29
- Shoots inoculated: June 1 (Total: 16 shoots/treatment)
- Evaluated: June 28

Supported by MSHS 2018; Published in 2018 University of Maryland Horticulture and MSHS Technology Newsletter:
https://issuu.com/umegrapesandfruit/docs/2018_htn_onlineversion

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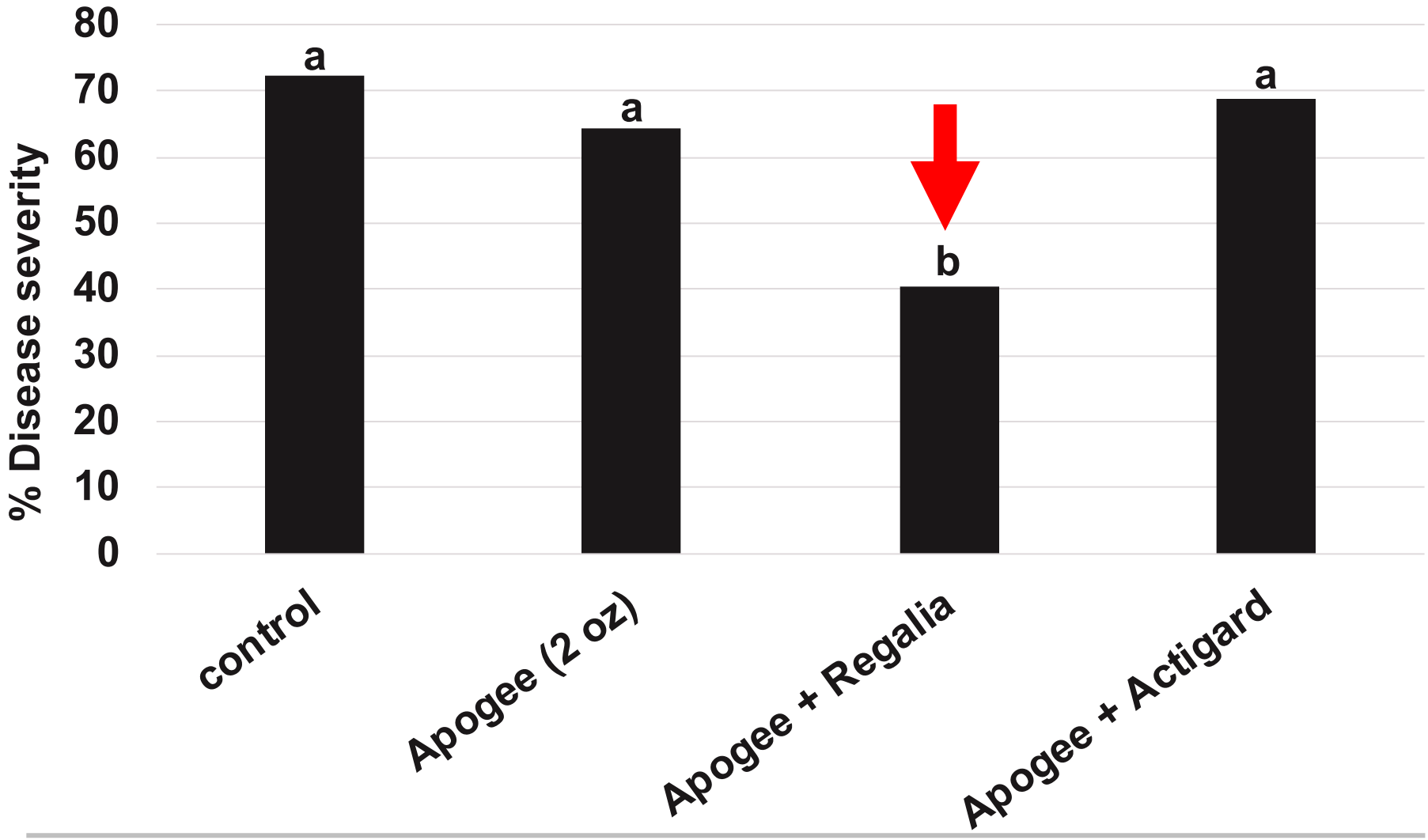
Brookfield Gala: Fire blight severity reduced when mixing low rate of Apogee + Regalia



Published in 2018 University of Maryland and MSHS Horticulture Technology Newsletter: https://issuu.com/umegrapesandfruit/docs/2018_htn_onlineversion

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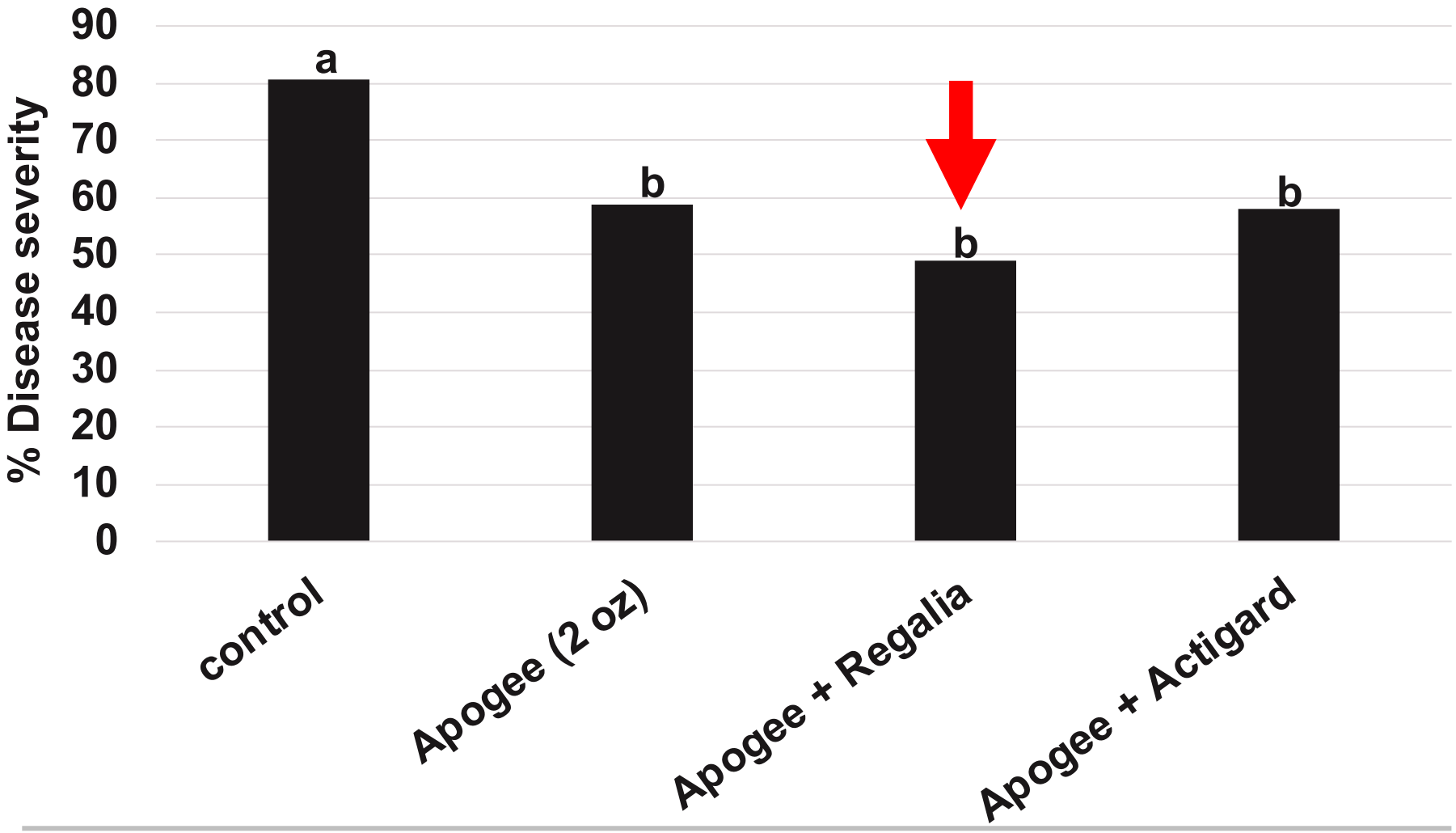
Cripps Pink: Low rate of Apogee reduces fire blight



Published in 2018 University of Maryland and MSHS Horticulture Technology Newsletter: https://issuu.com/umegrapesandfruit/docs/2018_htn_onlineversion

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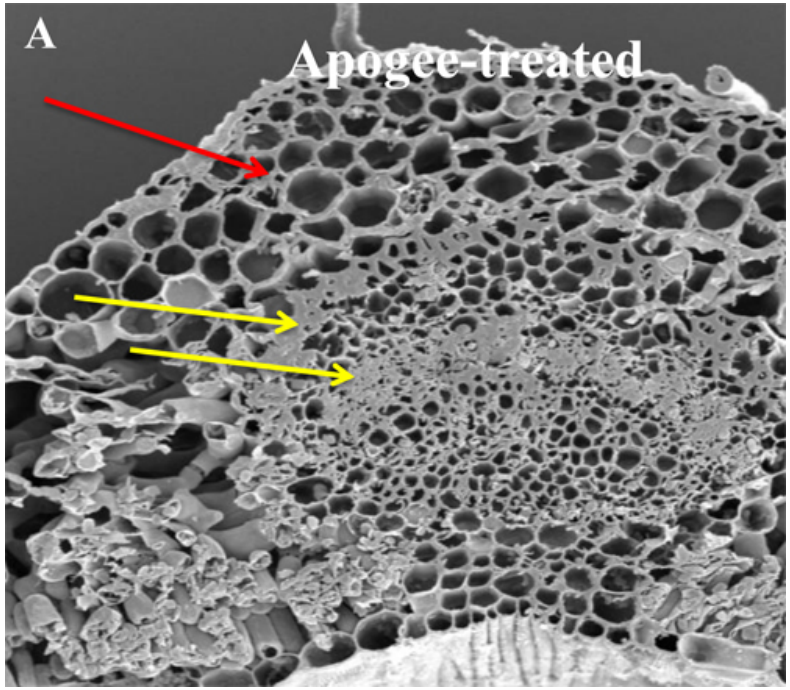
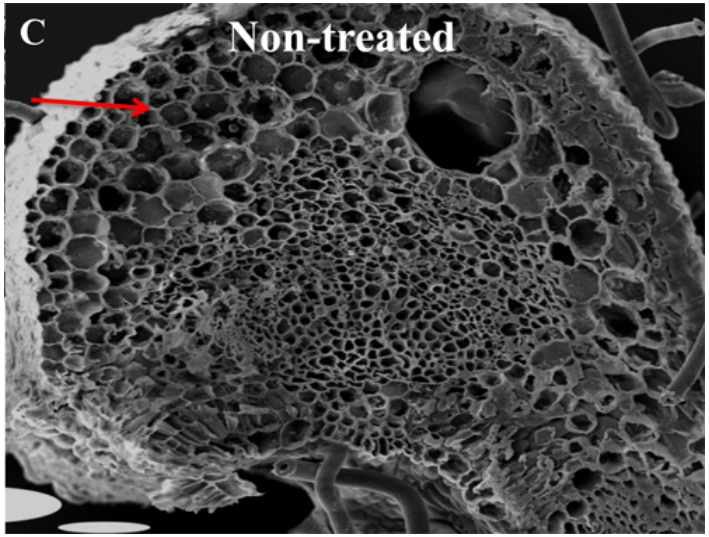
Mitigating shoot blight through plant growth regulators: How it works

- **Dr. George Sundin at Michigan State: "Apogee effect" 10 – 14 days post application of shoot tips/leaves (Full rate at 12 oz/A)**
  - **→ Thickened plant cell walls (red arrows)**
  - **→ Extra layer of material (yellow arrows)**
  - **→ "Physical barrier" hypothesis**

Regalia: Increases lignification of cell walls = synergistic with ProCa?





http://msue.anr.msu.edu/news/the_apogee_effect_examination_of_the_mode_of_action_of_prohexadione_calcium

So…what have we learned…?

- Timing (and duration) and number of applications need to be further analyzed for both ProCa and defense elicitors
  - Synergy when mixing ProCa + defense elicitor?
    - ➢ + others?
  - Cultivar influence?
  - Vigor influence?

- Integrated approach with regard to what product(s) are used and when: early in tree's life vs. later

- Results to date: promising

Management considerations (based on what we've observed to date*)

Timing	Applications
10-20% Bloom	Serenade ASO (4 qt), Opti (20 oz) Double Nickel (2 qt) + Actigard
80 – 100% Bloom, Petal Fall	Strep or Copper (hard cider) + Actigard (at petal fall)
Some time during bloom? Plus 10 days later…Plus 10 days later… monitor disease pressure	Apogee (+ Regalia in second application)
OR Petal Fall →	Cueva

During high pressure years (2014, 2015, 2018):
Be aggressive with management from the start of bloom until the end of May to keep fire blight at bay

*Testing specific schedules 2019 Season

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Catastrophic fire blight damage: Contact your nearest FSA Service Center

United States Department of Agriculture
Farm Service Agency

Related Topics

- Disaster Designation Information
- Emergency Assistance for Livestock, Honey Bees, and Farm-raised Fish (ELAP)
- Emergency Forest Restoration Program (EFRP)
- Livestock Forage Program (LFP)
- Livestock Indemnity Program (LIP)
- Noninsured Crop Disaster Assistance Program (NAP)
- Tree Assistance Program (TAP)
- Loss Adjustment Standards Handbooks (LASH)
- Wildfires and Hurricanes Indemnity Program (WHIP)

Home /Programs and Services /Disaster Assistance Programs /Tree Assistance Program (TAP)

Tree Assistance Program (TAP)

The Agricultural Act of 2014 (the 2014 Farm Bill) authorized the Tree Assistance Program (TAP) to provide financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes and vines damaged by natural disasters. The 2014 Farm Bill makes TAP a permanent disaster program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011.

The Bipartisan Budget Act of 2018 made several changes to TAP, including removing the per person and legal entity program year payment limitation ceiling of $125,000. It also increased the acreage cap, and growers are eligible to be partly reimbursed for losses on up to 1,000 acres per program year, double the previous acreage.

Related Information:

- Final Rule (April 14, 2014)
- Fact Sheet
- Florida Citrus Greening Fact Sheet

Also contact:
<u>For PA</u>: Your Tree Fruit Extension Educator and Dr. Kari Peter
<u>Other states</u>: Your state specialist/Extension agent

Acknowledgements

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Photo: K. Peter

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