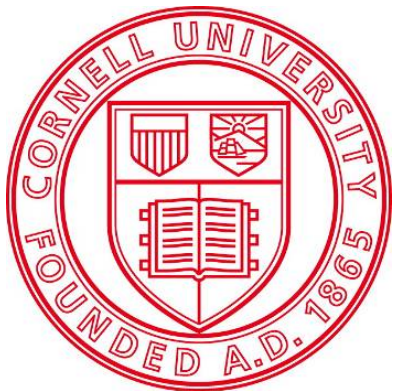


A new fire blight management approach using Apogee

***Anna Wallis &
Kerik D. Cox Cornell AgriTech***

***Plant Pathology and Plant-Microbe Biology Section
School of Integrative Plant Science
Cornell University***



**Cornell
AgriTech**

New York State Agricultural
Experiment Station

2014 – 2017: devastating fire blight epidemics

- Hot weather from bloom to terminal bud set > shoot blight devastating in young, high-density plantings



Shoot Blight Management

- An unnoticeable amount of blossom blight can lead to devastating shoot blight
- Shoot blight is difficult to manage: Ea protected in tissues – triggers unknown
 - Host susceptibility & host vigor?
- Copper (Cueva), Biologicals (Double Nickel) will just protect against new infections
- Systemic acquired resistance (SAR) inducers: work internally & have recently improved

Prohexadione Calcium (PhCa) is effective for managing shoot blight

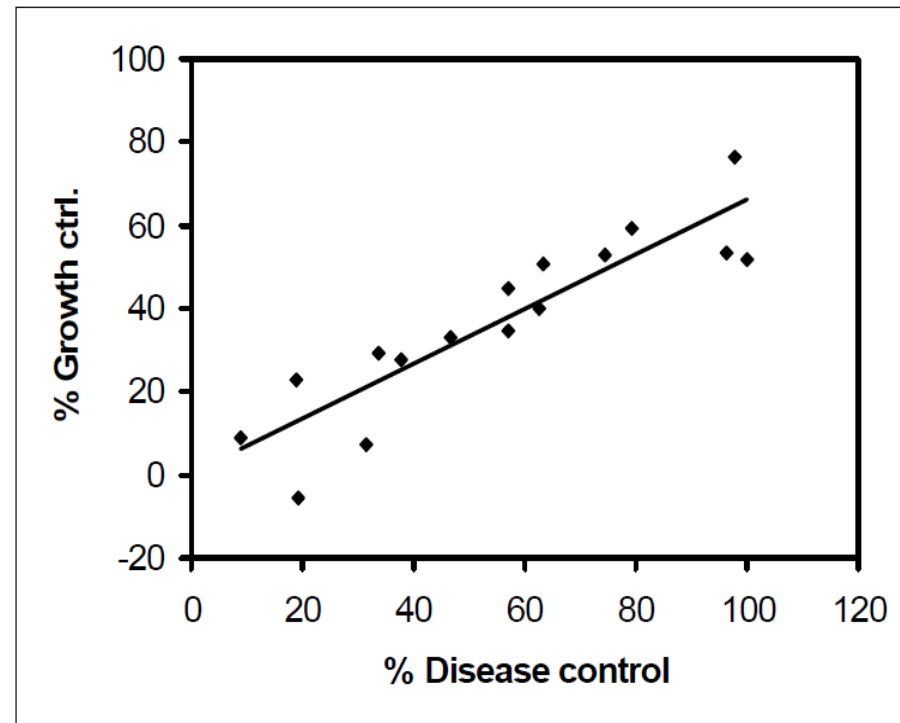


Suppression of shoot blight by Prohexadione Calcium

*Department of Horticulture,
Virginia Tech Agricultural Research and Extension Center*

U.S. Department of Agriculture

Norelli & Miller 2006



Linear correlation between the percent fire blight control based upon the length of fire blight lesions and the percent shoot growth suppression resulting from treatment with prohexadione-calcium (Phd-Ca) ($r=0.8977$, $df=15$, $p<0.001$). Correlation analysis included all Phd-Ca treatments of 'Royal Gala', 'Ramey York', and 'Sun Fuji', but did not include treatment of 'Enterprise' that was considered an outlier because of its high level of fire blight resistance.

R.E. Byers³

Department of Horticulture, Virginia Tech Agricultural Research and Extension Center, Winchester, VA 22602

Shoot Blight Management

- Prohexadione calcium (PhCa; Apogee): **most effective** > works internally > **slows establishment of young trees**
- Could prohexadione calcium help control blossom blight and reduce shoot blight if applied at pink?
- Could we use prohexadione calcium more effectively with low rates and different timings?

2016-18 PhCa Research

- 13 year old 'Gala' on B.9 rootstock
- Artificial inoculum for blossom blight (Ea 273 at 1×10^6 CFUml⁻¹) > serve as inoculum for shoot blight
- Inoculated @ 80% bloom



2018 PhCa Research

- 2nd leaf 'Gala' on G.202 rootstock
- No inoculum: measure effects on fruit set, shoot growth, & TCA only
- Assessments in late June & early Oct



2016-18 PhCa Research

Treatments

- **Untreated:** no control of fire blight, no impact on tree productivity
- **Antibiotics:** Streptomycin and Kasugamycin; impact on fire blight, no impact on tree productivity
- **Natural SAR:** Regalia; organic option, impact on fire blight, no impact on tree productivity
- **Apogee** (prohexadione calcium – growth regulator) pink applications, standard program, season-long programs of low rate applications

2016-18 PhCa Research

Assessments

- Blossom and shoot blight
- Crop load, fruit size, TCA, & shoot length: late June – early Oct

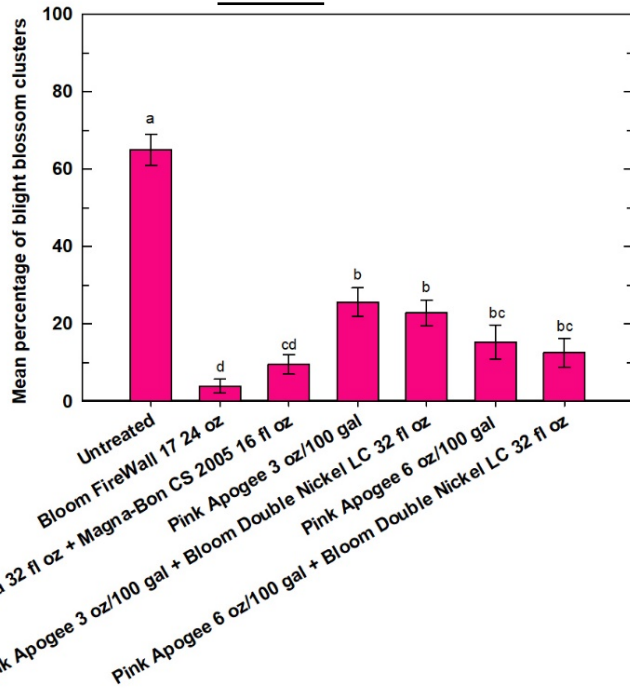


Research Question

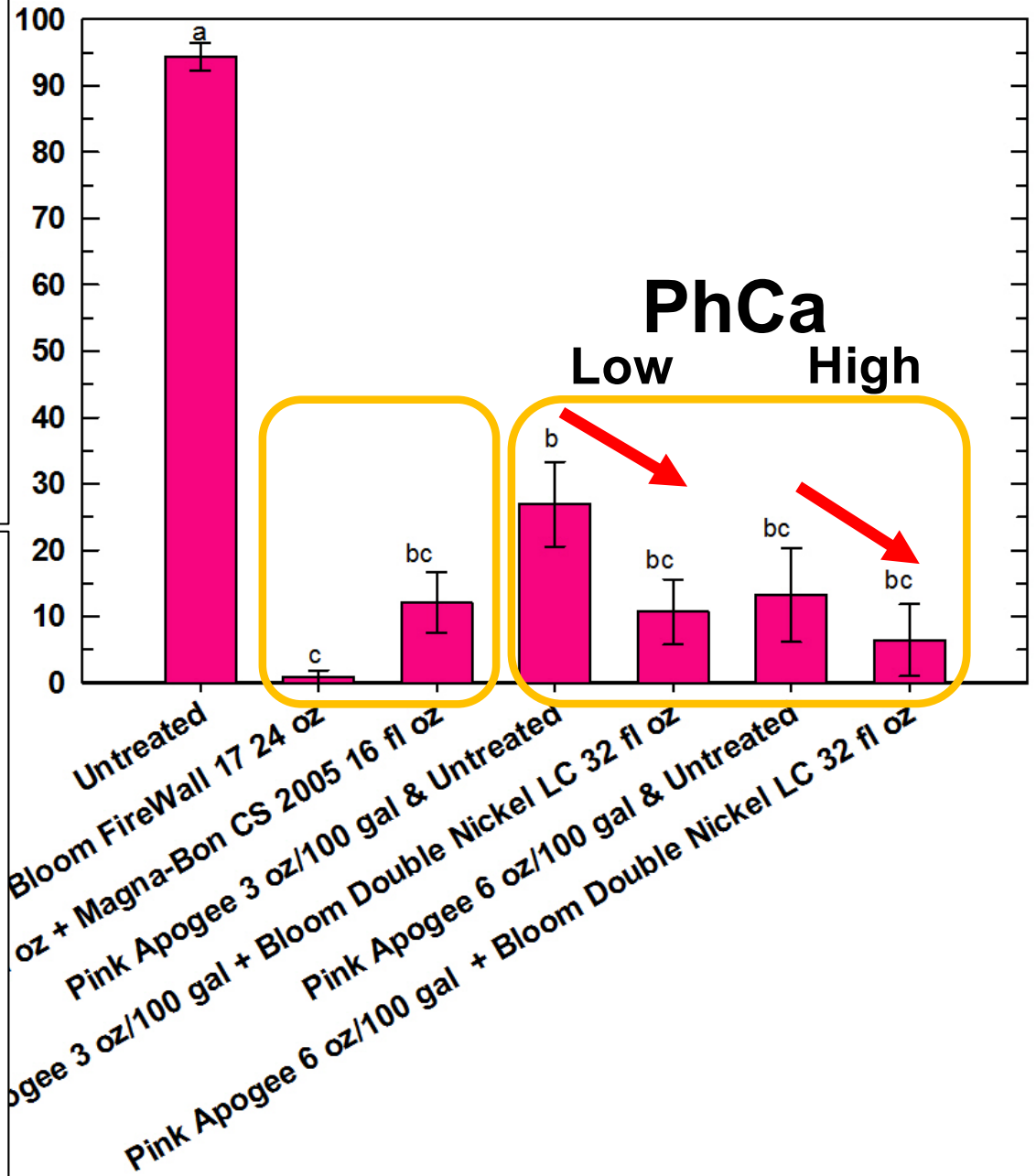
Could prohexadione calcium help control blossom blight and reduce shoot blight if applied at pink?

Considerable number of reports from Europe on using PhCa prior to bloom, but few from peer reviewed literature & not practiced?

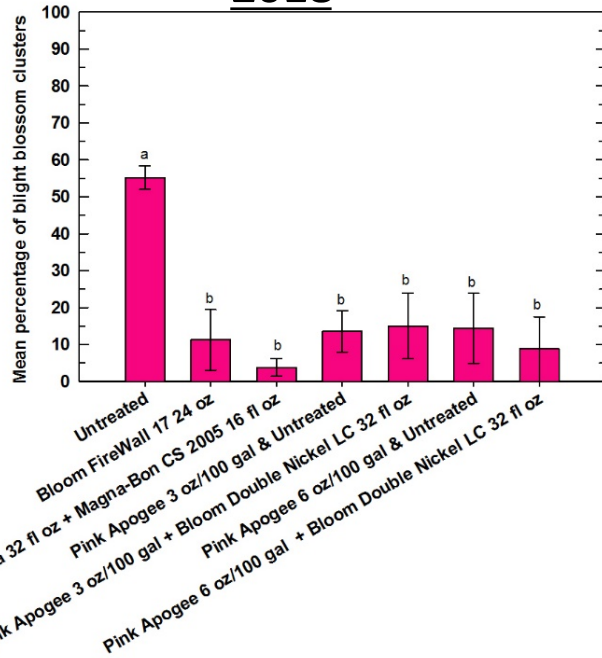
2016



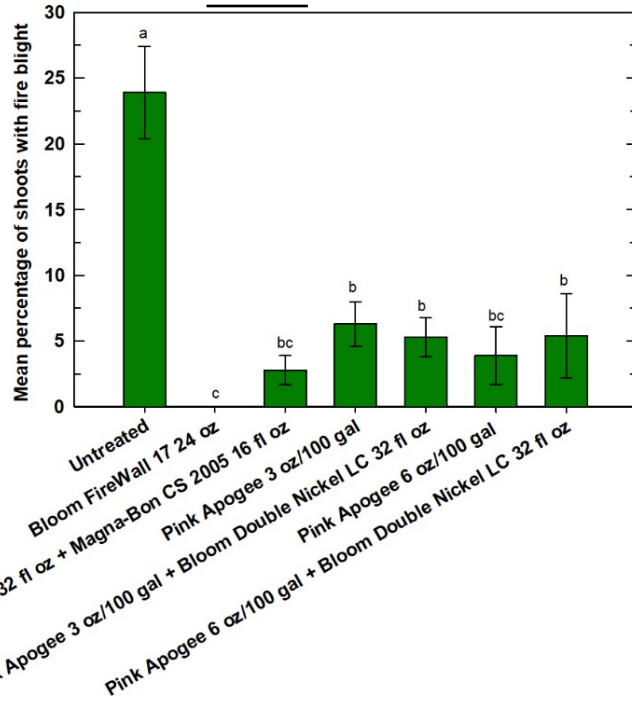
2017



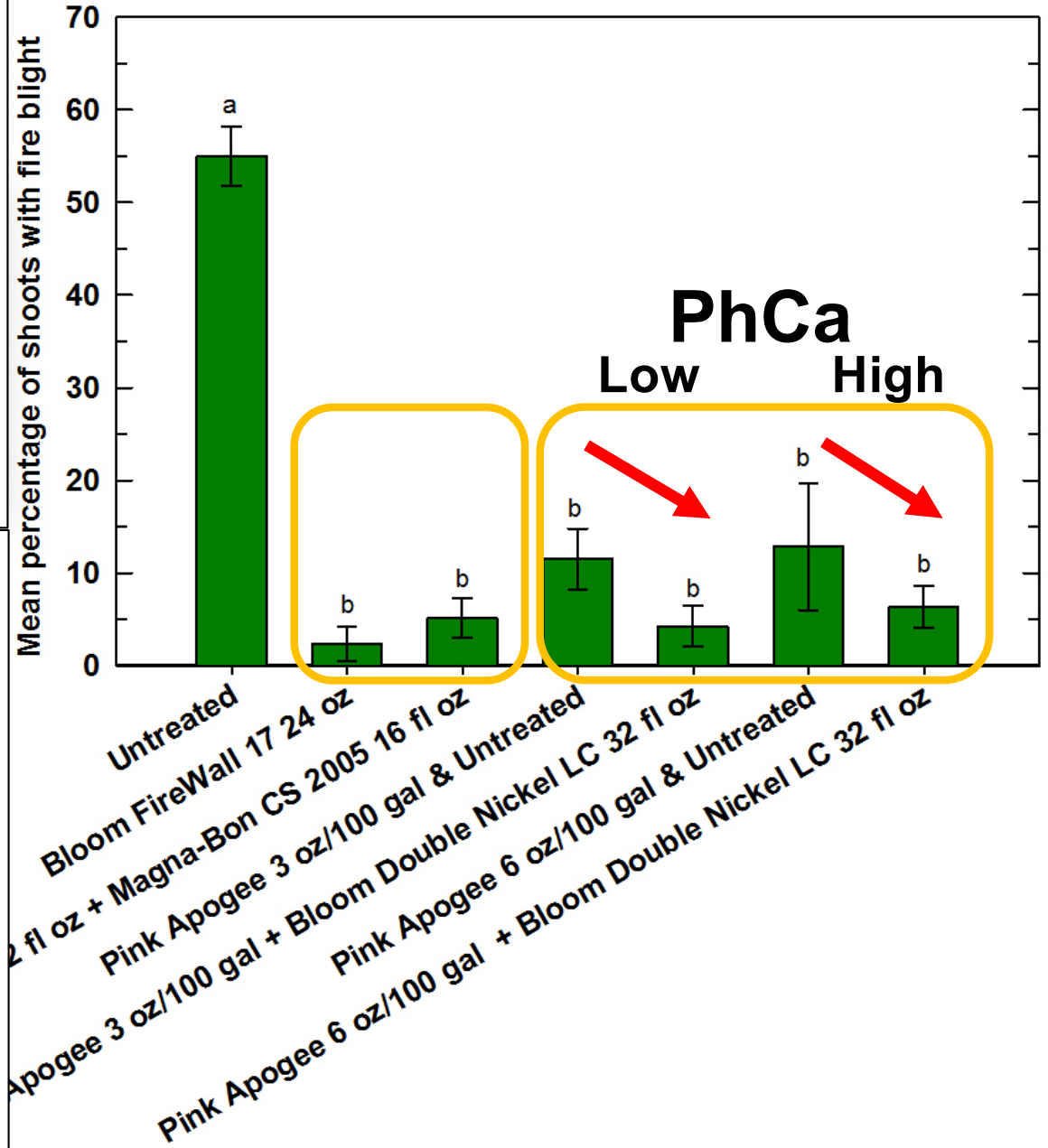
2018



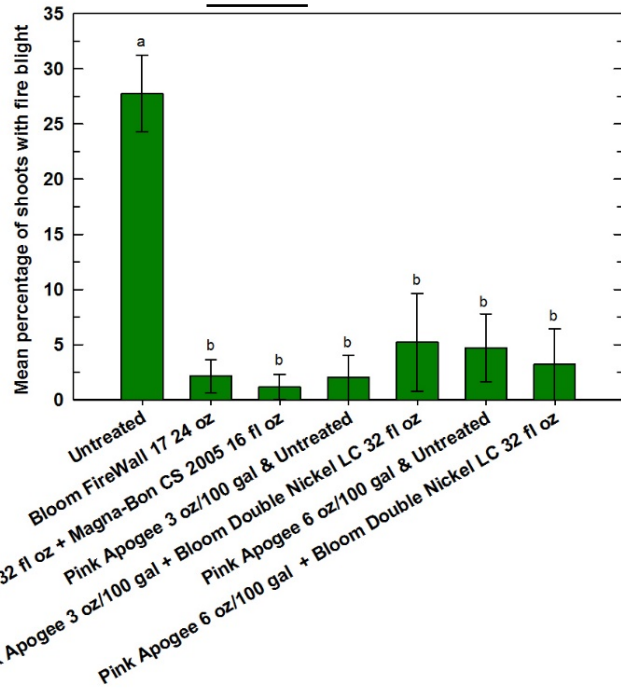
2016



2017



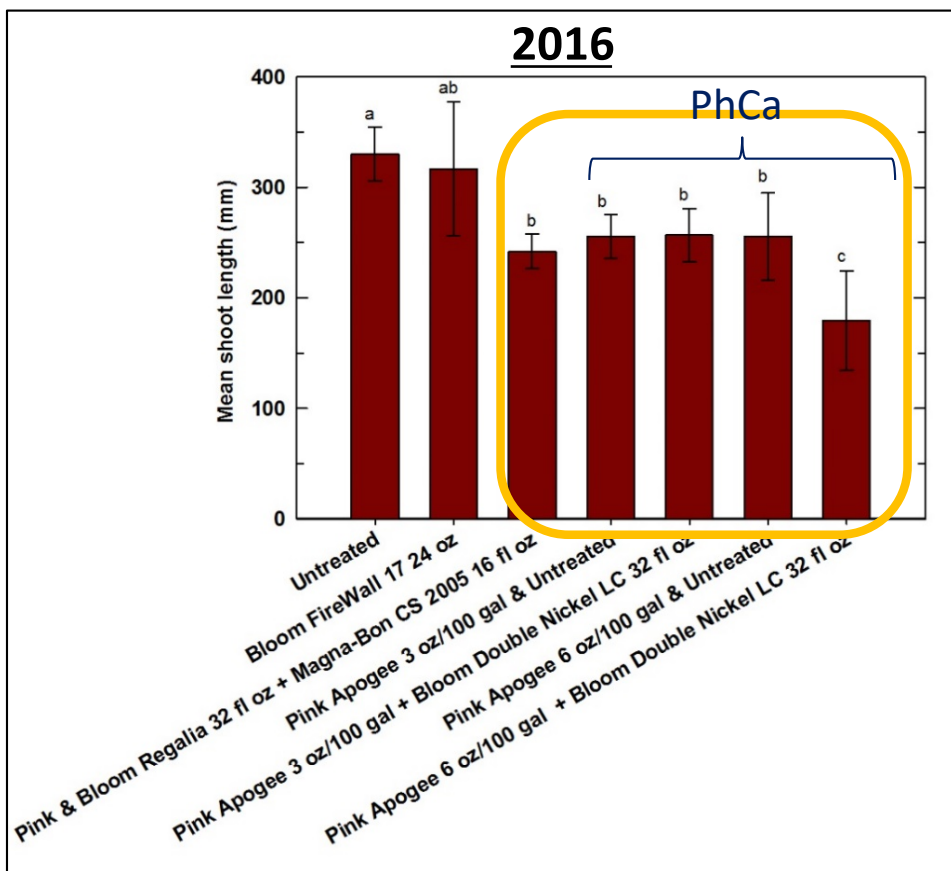
2018



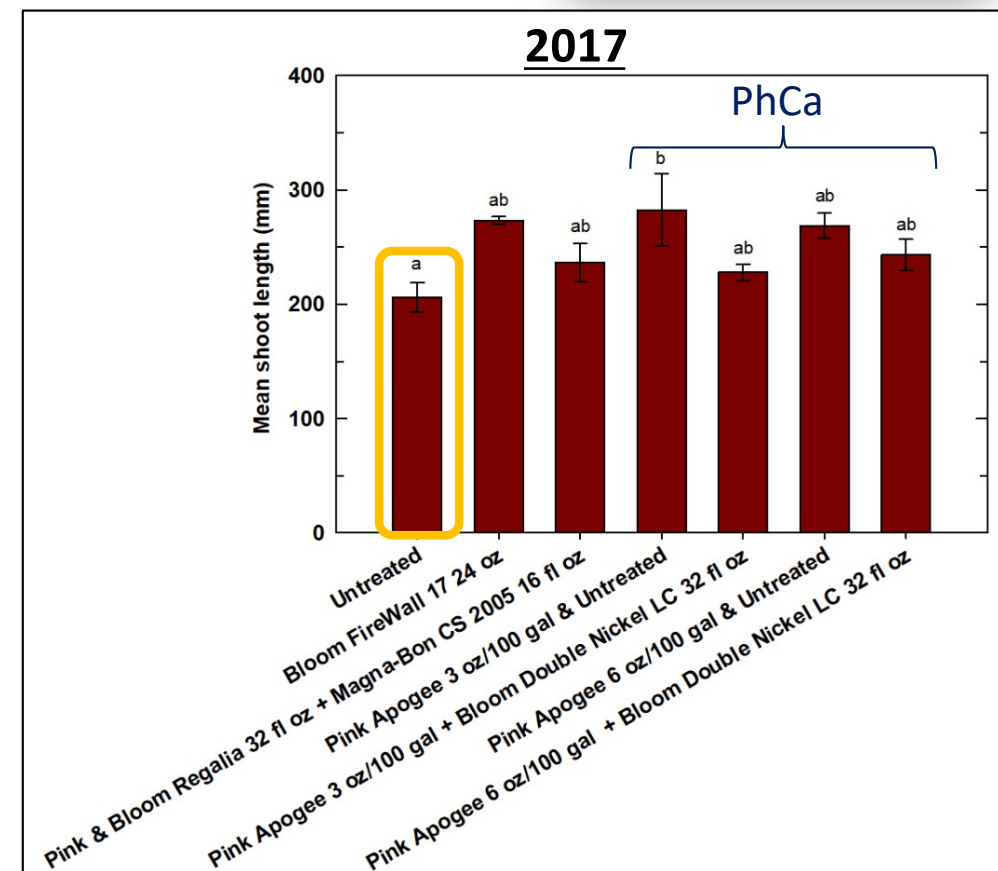
Pink applications > Shoot Length



Dry Year



Wet Year

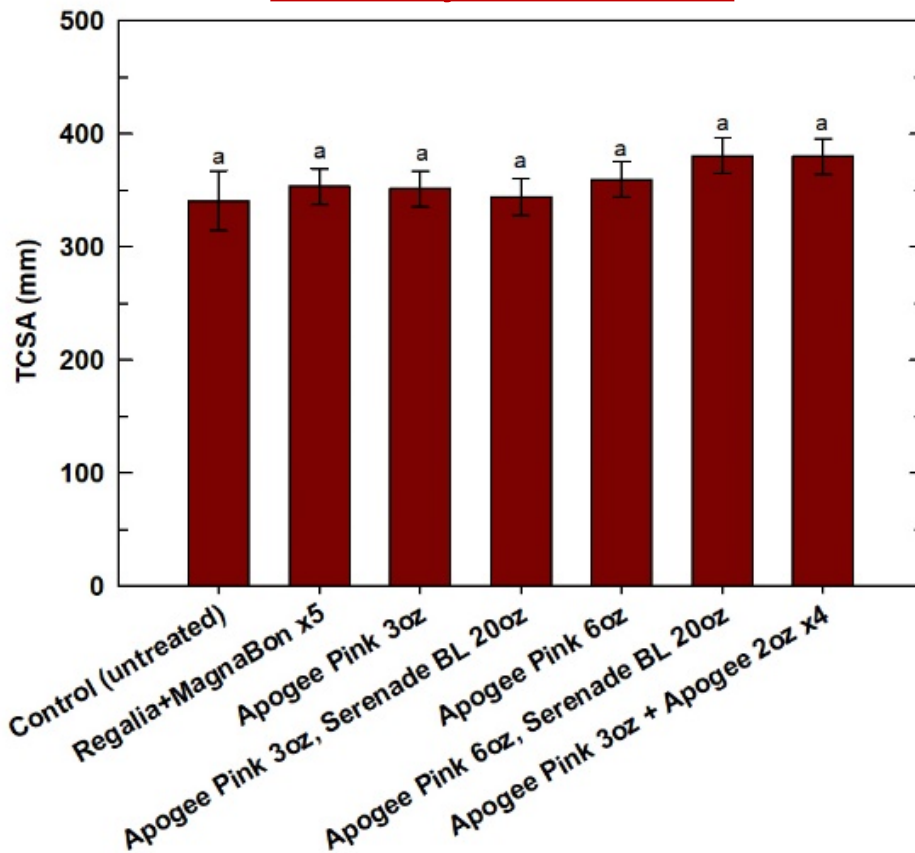


Pink applications > Shoot Length

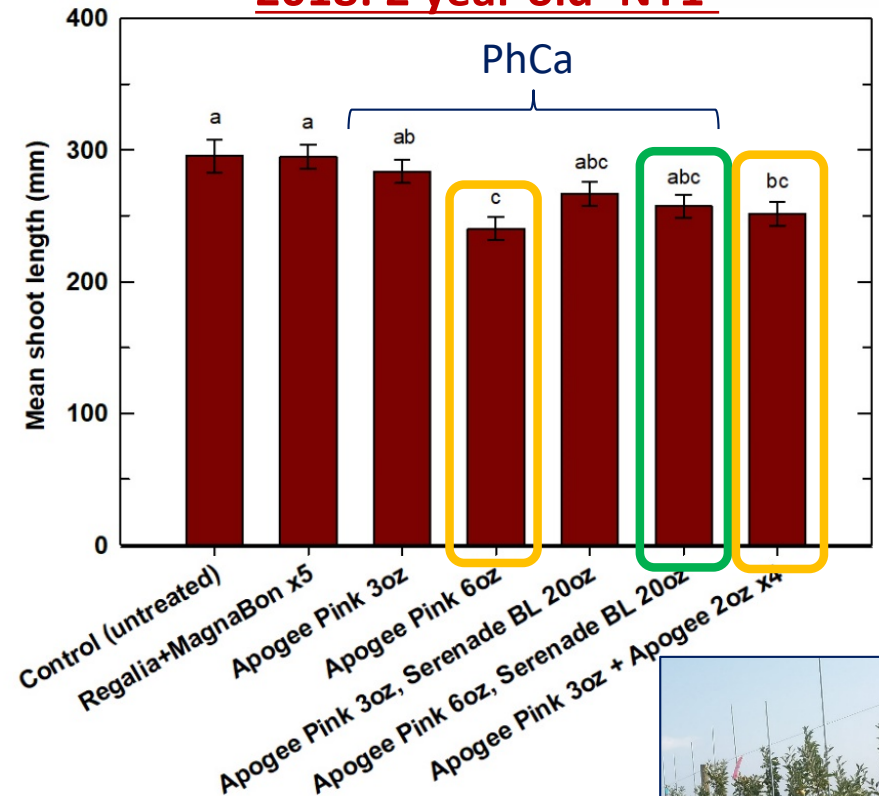
Dry (June) then Wet (August) Year



2018: 2 year old 'NY1'

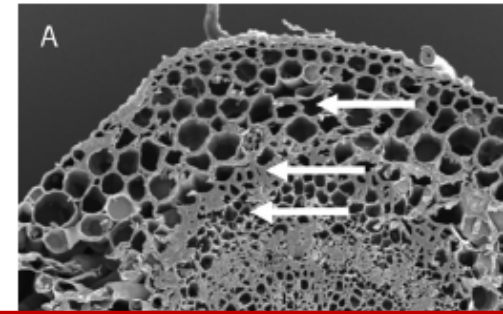


2018: 2 year old 'NY1'

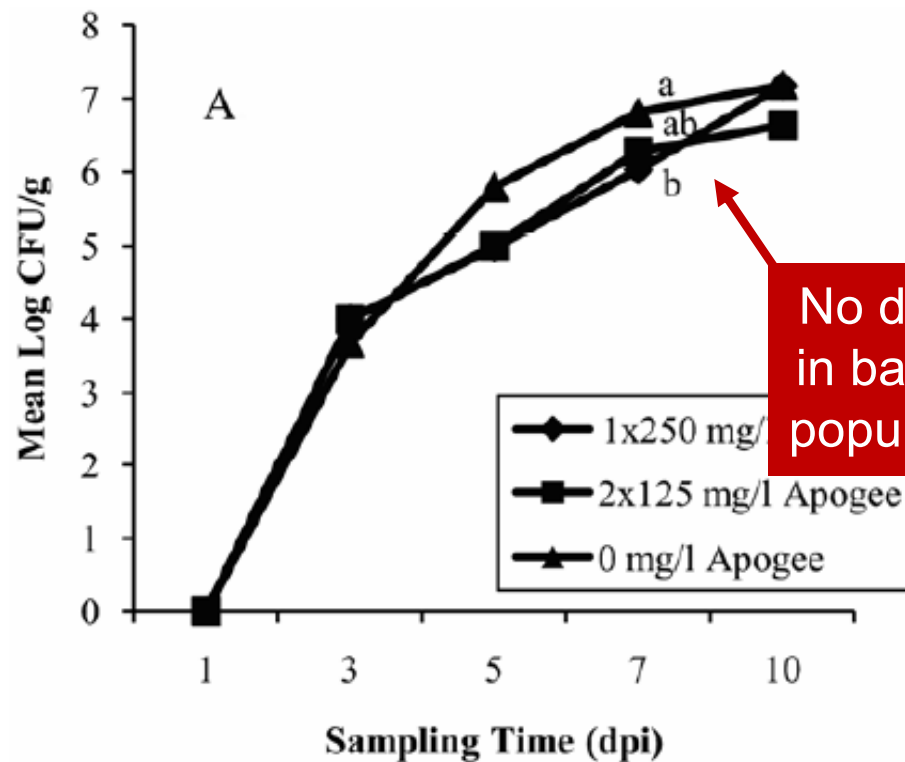


PhCa Mechanism

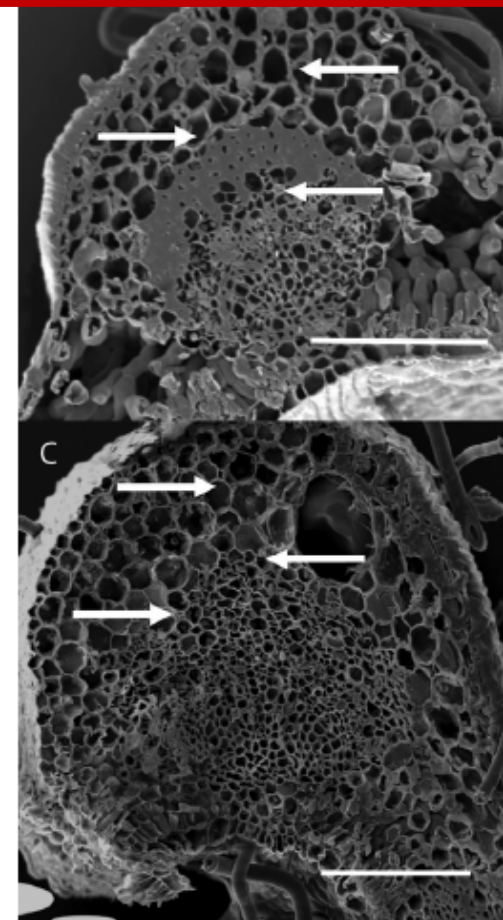
physical barrier to pathogen



True for blossoms
pedicels?



No decline
in bacterial
populations



McGrath et. al 2009

Pedicels of an Asian pear at 40 days after bloom

Adapted from:

Park 2017 *Scientia Horticulturae* 222 (2017) 1–6, Fig. 4.

C, cork layer

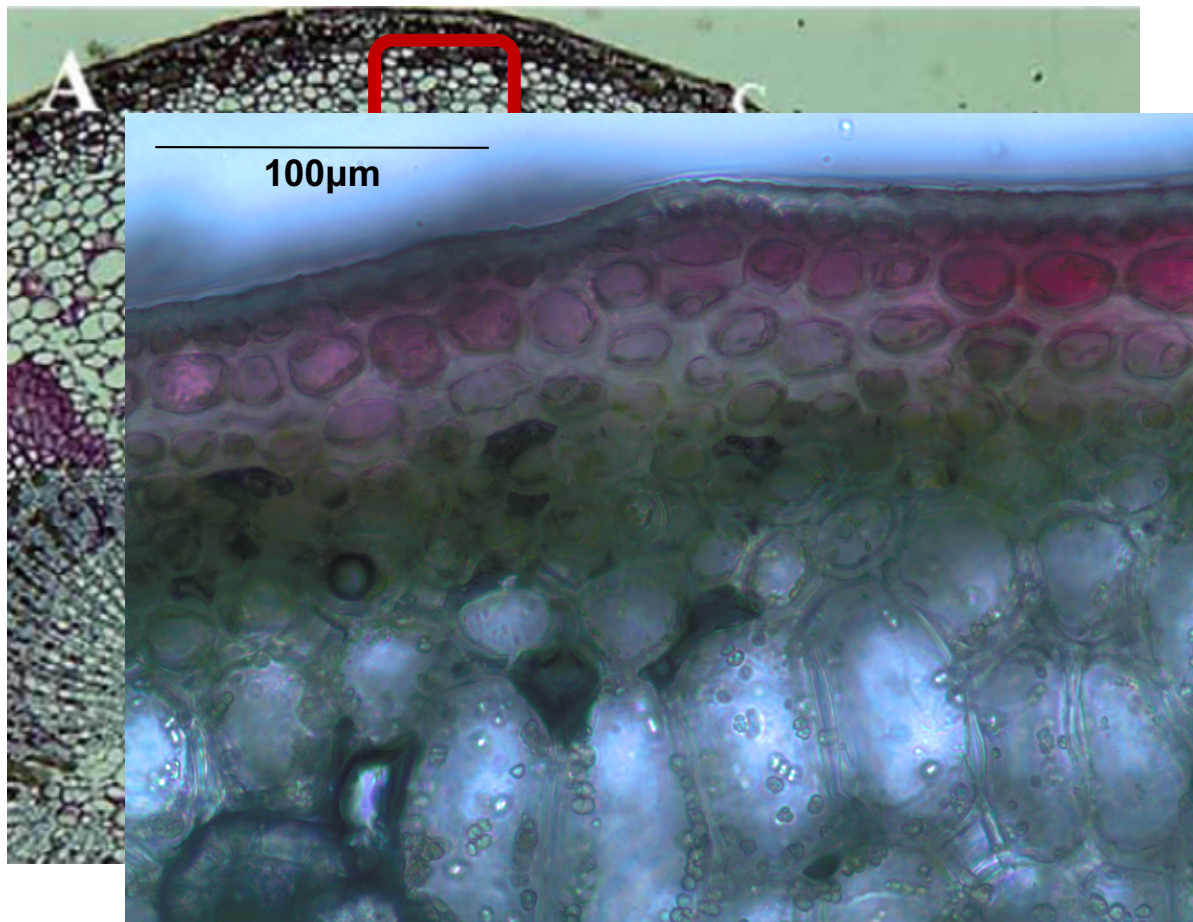
Ct, cortex

Ft, fibrous tissue

P, phloem

Pi, pith

X, xylem



Hand Cross Section
Gala petiole 40 DAFB
A. Wallis

Cell wall widths in cortical parenchyma of petiole cross sections

Treatments

5/11

Full Bloom

5/18

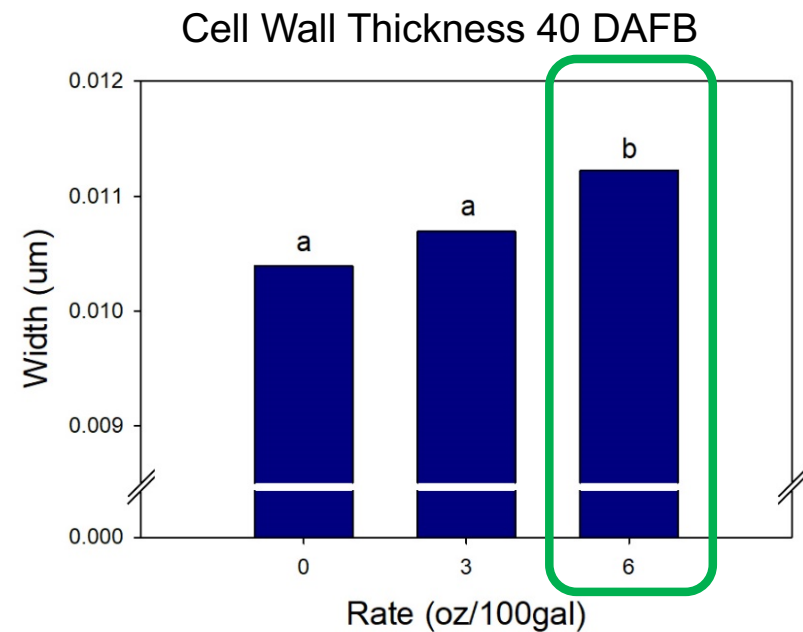
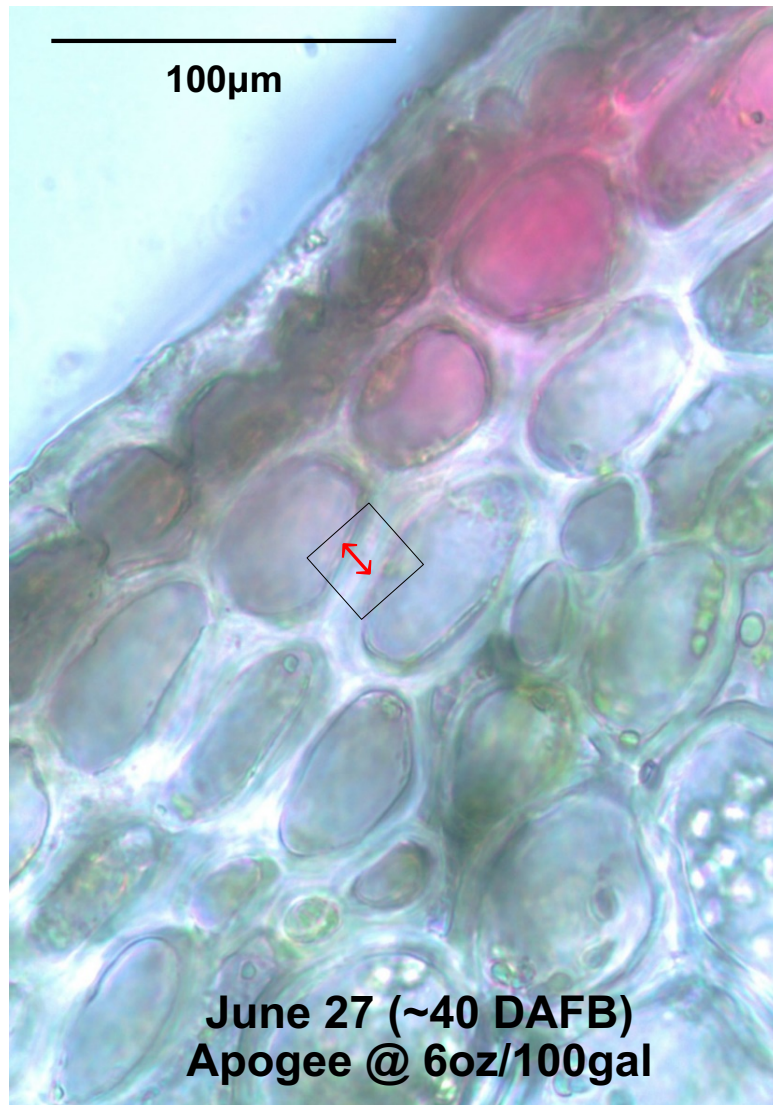
Sampling

Pre-treatment:

5/11

Post 1: 5/22

Post 2: 6/27



Pink > Fire blight & Growth

- **PhCa at Pink:**
 - 1) Decent BB & SB control (best at 6 oz)
 - 2) Reduce bitter pit too? Pink application is recommended for cultivars prone to bitter rot
 - 3) Manage high vigor varieties – holding tree training



Pink > Fire blight & Growth

- **PhCa at Pink:**

- 4) Better with biological at bloom reduce inoculum;
- 5) No impact on shoot growth by end of season (early on yes)
- 6) Thickened pedicel cell walls 40 DAFB – apply earlier, Tight Cluster?

- **Regalia (natural SAR):**

- 1) Decent BB & SB control (best with co)
- 2) No impact on shoot growth

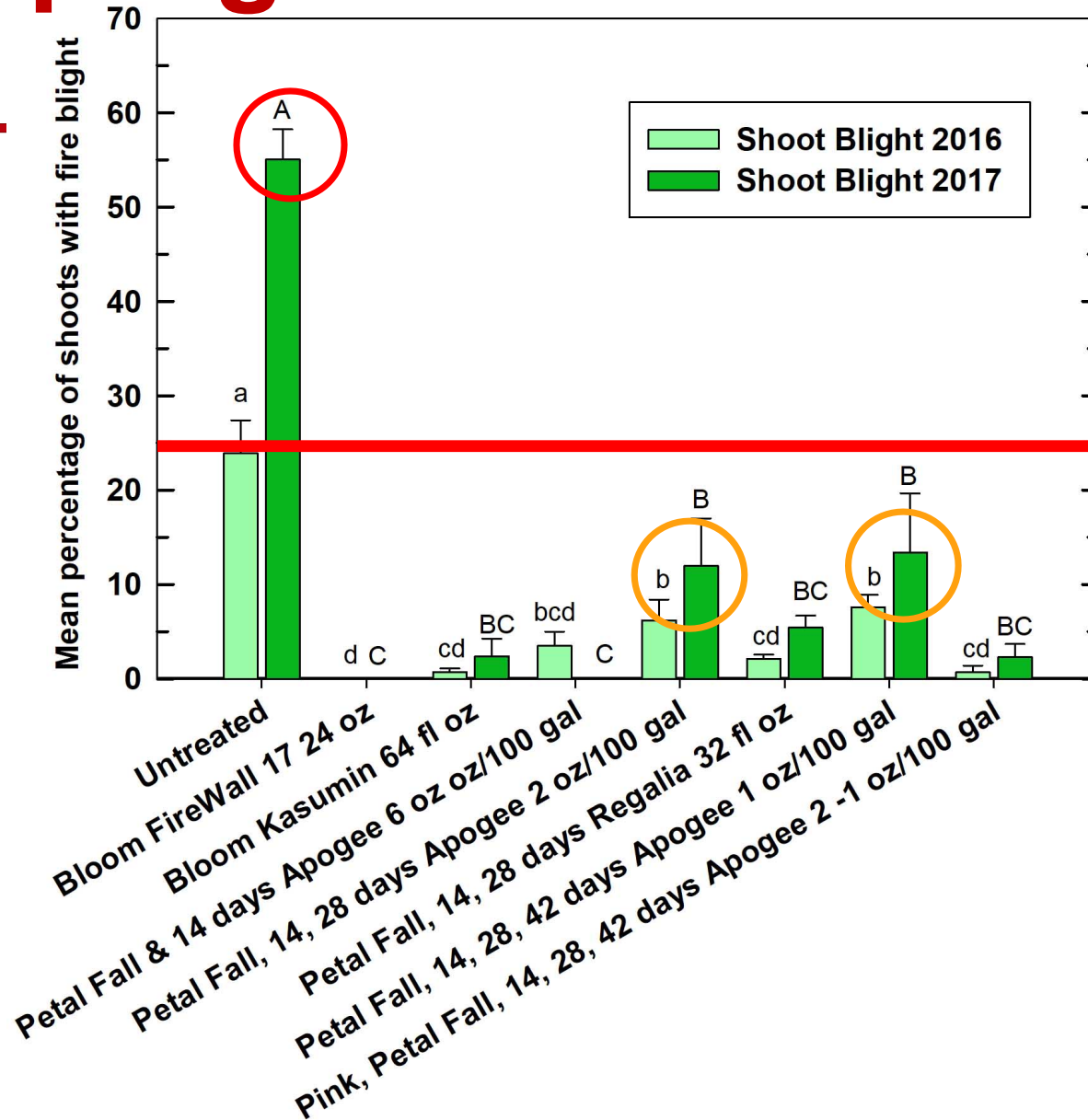


Research Question

Can we use prohexadione calcium more effectively with low rates and multiple timings after petal fall?

Considerable number of reports from consultants using PhCa at low rates with multiple applications?

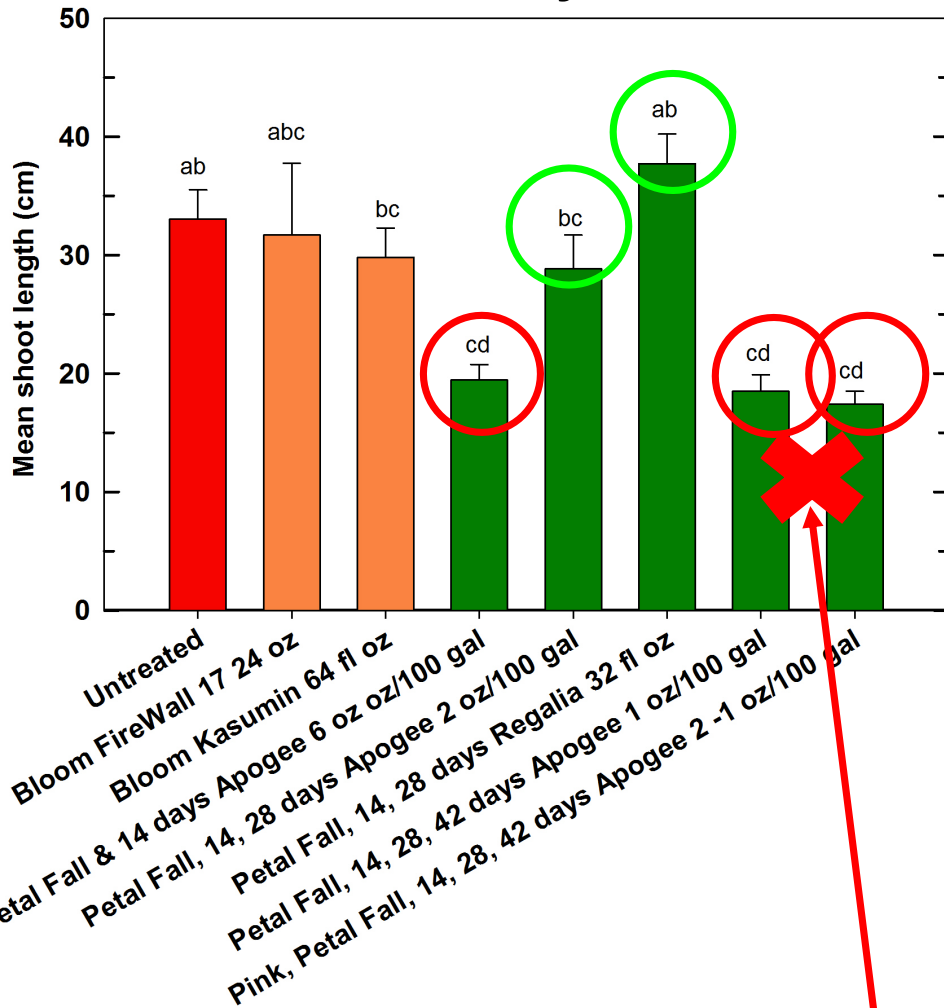
PF+ programs on Shoot blight



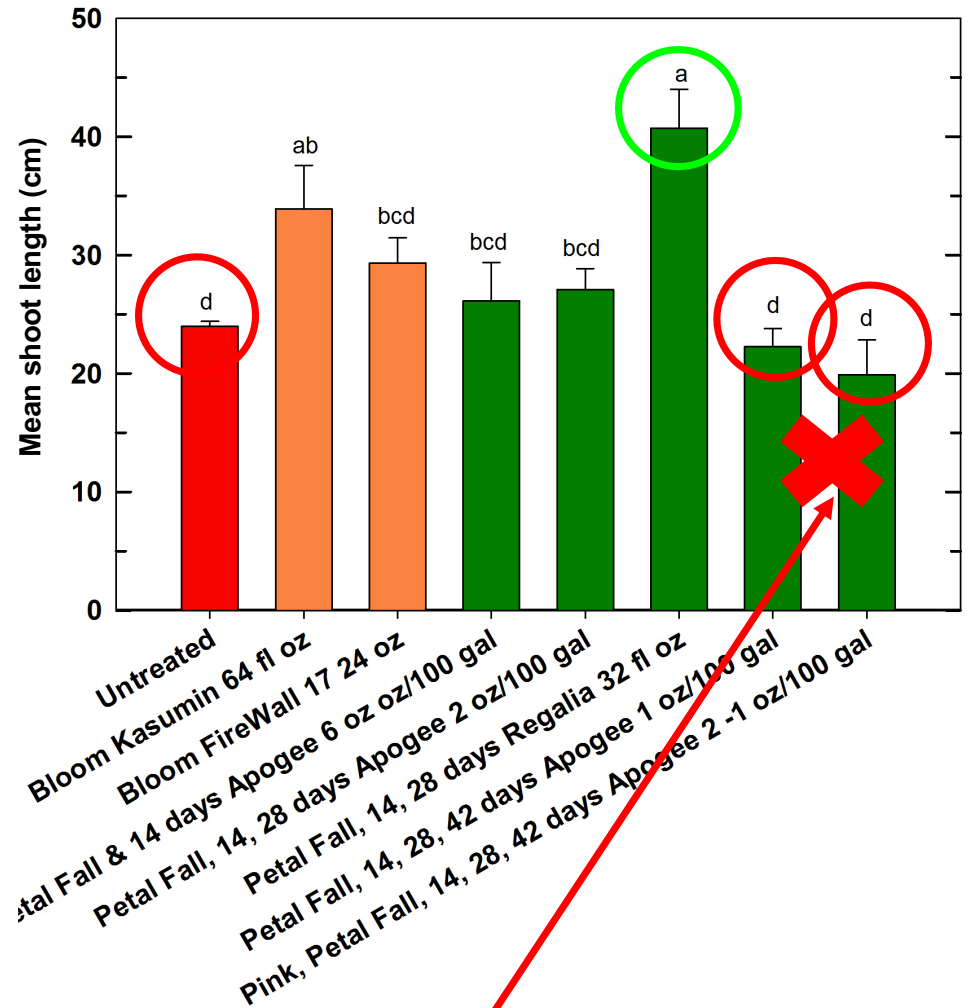
Petal Fall programs: Double Nickel LC 32 fl oz @ Bloom

PF+ on shoot length in Sept

2016 Dry Season



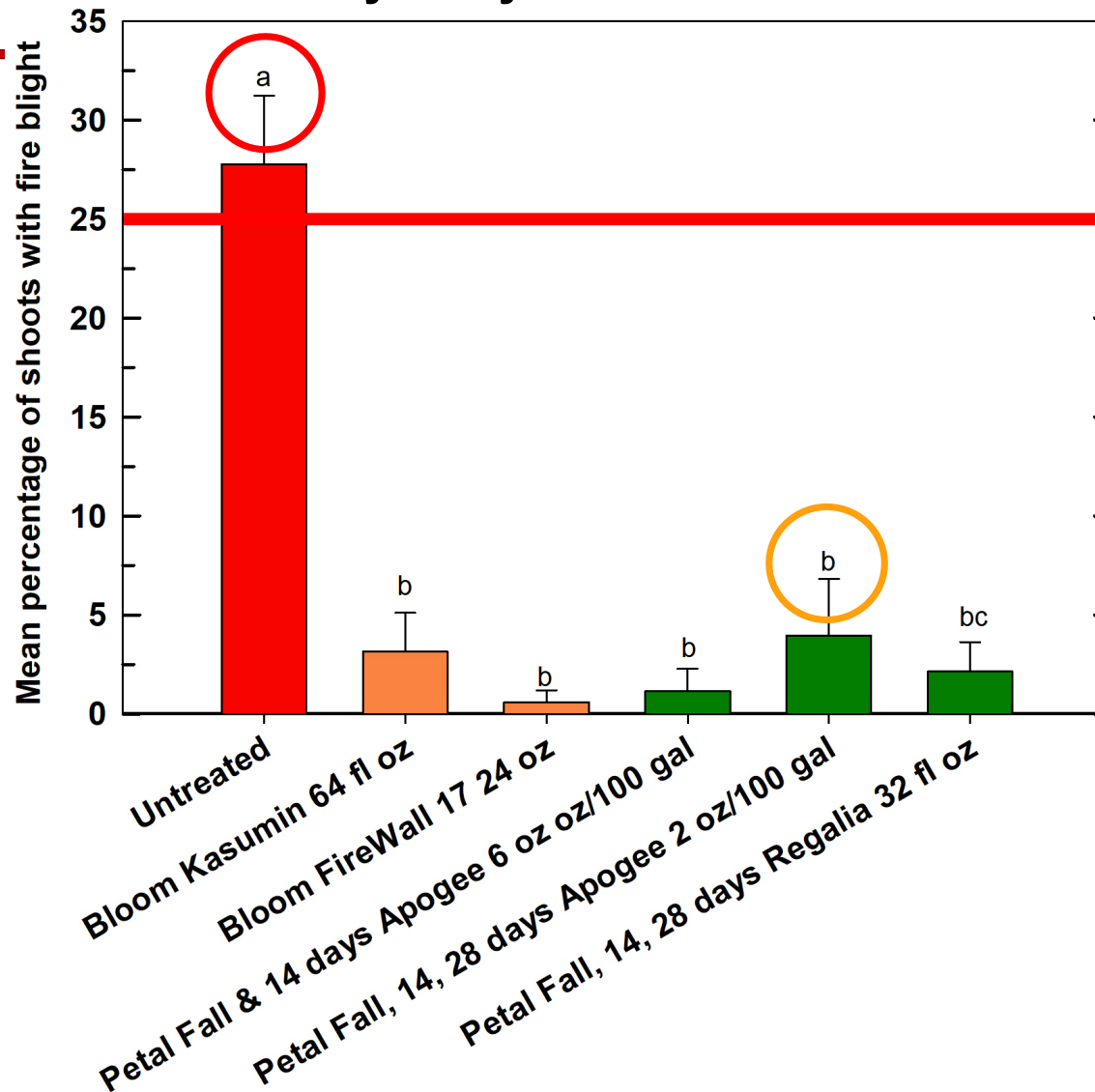
2017 Wet Season



Prolonged use programs of Apogee most impact on growth both years

PF+ programs on Shoot blight

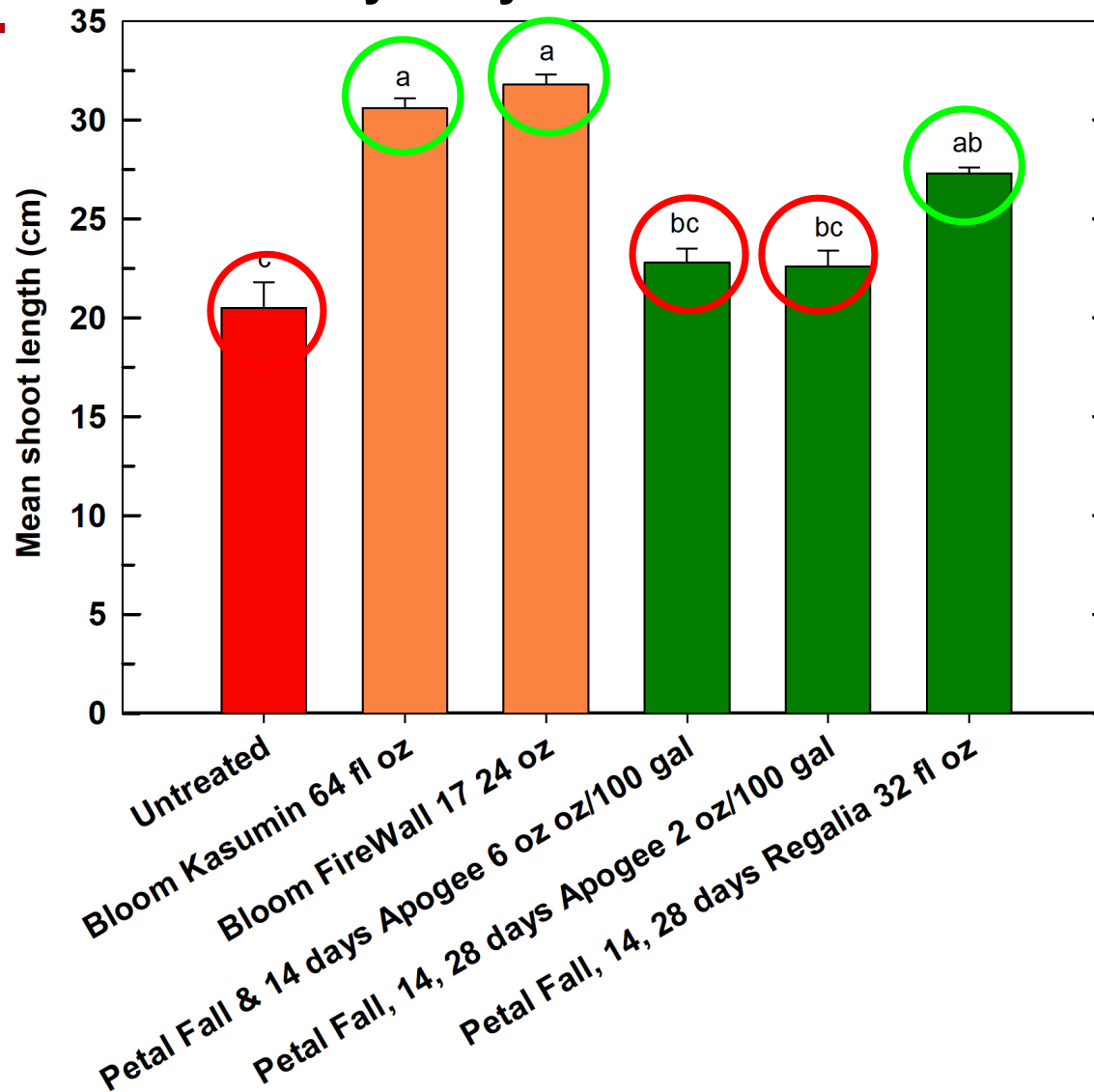
2018 Dry Early & Wet Late Season



Petal Fall programs: Double Nickel LC 32 fl oz @ Bloom

PF+ on shoot length in Sept

2018 Dry Early & Wet Late Season

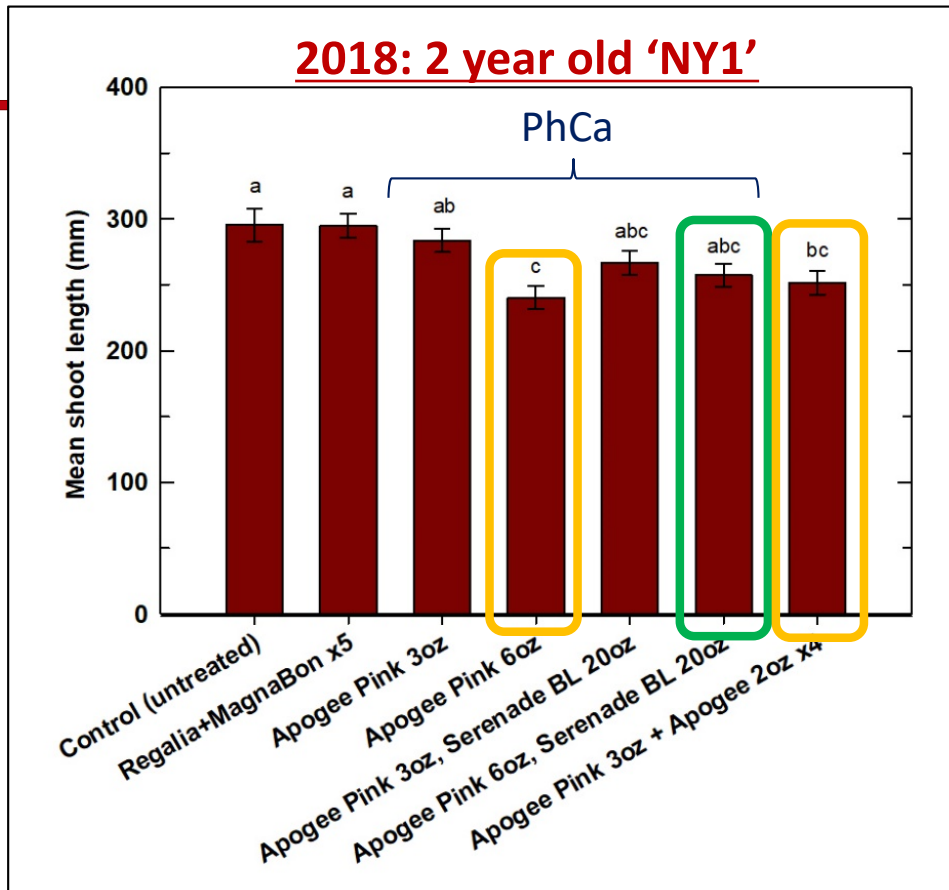


Both std and low rate apogee similar in impact on growth in 2018

PF + on Shoot blight & Growth

- **Low rates of PhCa after petal fall:**
 - 1) Can effectively manage shoot blight > not always be improved over std program
 - 2) Start early with low rate programs
 - 3) Prolonged programs of low doses > slightly impede trees
- **Regalia (natural SAR):**
 - 1) Good control of SB infections
 - 2) No impact on shoot growth

2019 PhCa Research



Further refine prohexadione calcium applications at “pink” & season-long prohexadione calcium programs on young trees with no fire blight

Acknowledgements



Lab Members, Undergraduates, & Technicians

Katrin Ayer
David Strickland
Stephanie Smart
Daniel Kaplan
Matthew Siemon
Mei Wah Choi

Funding Sources

Apple Research and Development Program

North American Agrichemical Industry:

Syngenta, BASF, Bayer, Dow, & Dupont, Marrone Bio
Innovations, Certis

Cornell
AgriTech

New York State Agricultural
Experiment Station

Questions

