Fighting Fire Blight:

An update on blossom blight and shoot blight management

PennState Extension

Kari Peter, Ph.D.
Department of Plant Pathology and Environmental Microbiology
Penn State University Fruit Research and Extension Center
Biglerville, PA
kap22@psu.edu 717-677-6116 Ext 223
@drtreefruit

After 3 interesting seasons…what's the latest about fire blight?

- Disease cycle review
- A stroll down memory lane: The last 3 seasons and fire blight conditions
- Management
  - Blossom blight
  - Shoot blight

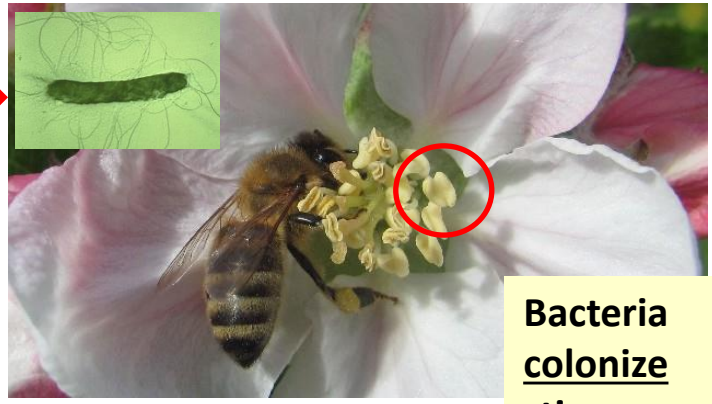
Reviewing the fire blight disease cycle

Tight cluster – Pink: Bacteria replicates in cankers

Active canker

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

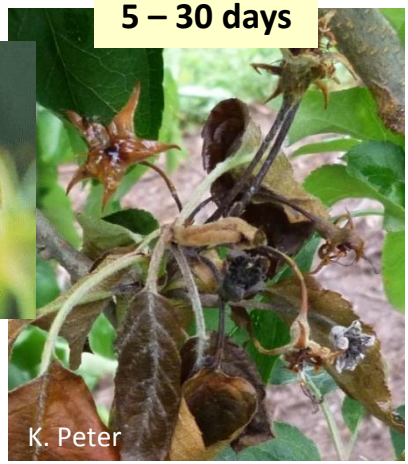
Oozing bacteria: Attracts insects – insects <u>disperse</u> bacteria to flowers (wind and rain also <u>disperse</u> bacteria)



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

Wetting event + warm temps

5 – 30 days



Blossom Blight

Shoot Blight
Canker Blight
Trauma Blight
Rootstock Blight

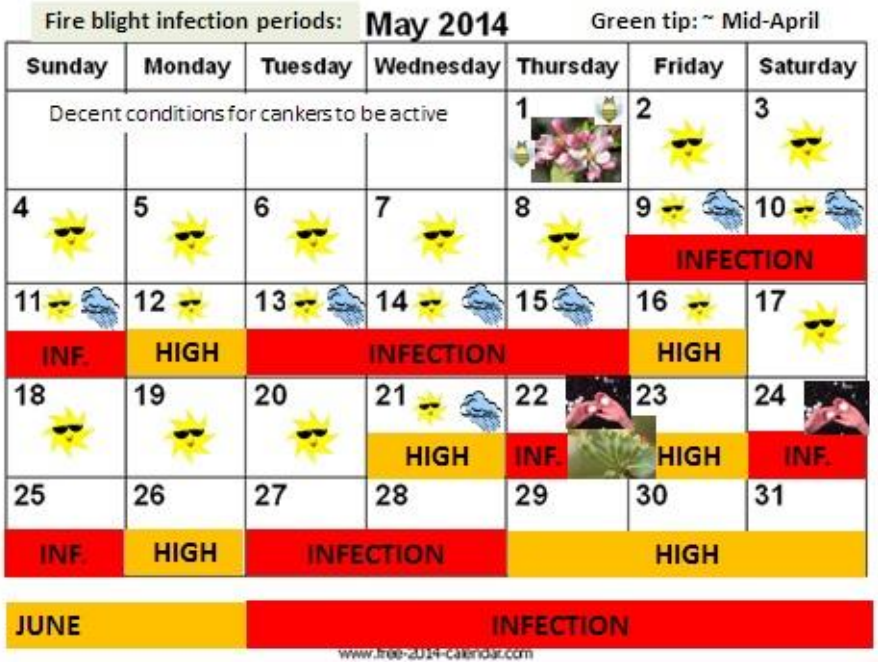
After 3 interesting seasons…what's the latest about fire blight?

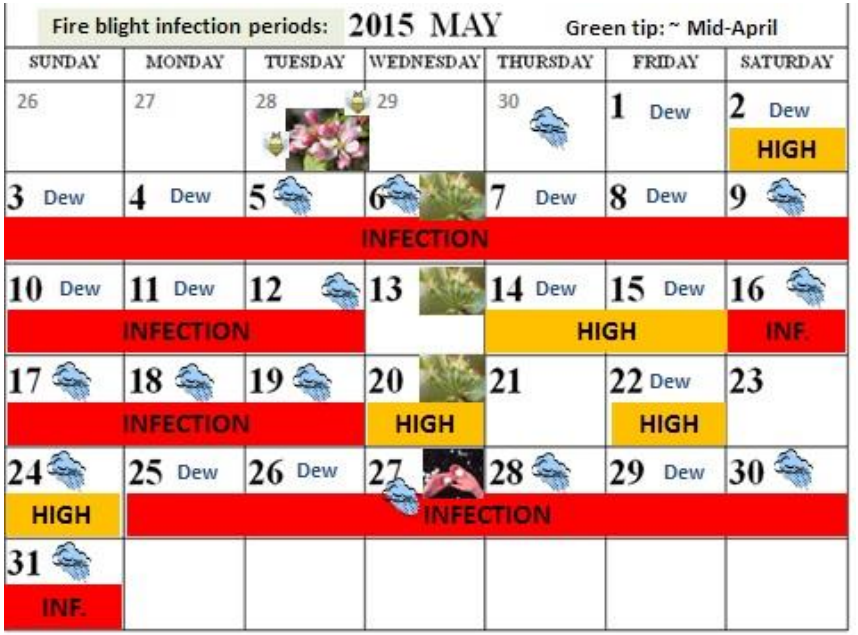
- A stroll down memory lane: The last 3 seasons and fire blight conditions

Using MaryBlyt to monitor conditions during bloom:

- Blooms open +
- Average temp 60 - 65°F +
- Wetting event (rain, humidity, dew) =
  - Infection event

The Pennsylvania Fire Blight Saga: 2014 - 2015 = rough





2014:

- May: Ideal disease conditions (long bloom period)
- June: Ideal disease conditions
- July: Dry conditions

= Trees stopped growing and disease spread stops

➢ **Epidemic year**

2015:

- May: Ideal disease conditions during bloom (warm and humid)
- June: 13 – 20 inches of rain fell the second half of the month
- July: Several inches of rain during the first half

= Due to high amounts of rain, trees never stopped growing and disease continued to spread through September

The Pennsylvania Fire Blight Saga: We caught a break in 2016…

(And, no: fire blight wasn't a problem in 2016 because the last 2 years were bad…)

Green tip: March 11
Bloom: April 18 - 25

APRIL 2016

SUN	MON	TUE	WED	THU	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	HIGH 19	20	HIGH 21	22	23
24	25	INFECTION 26	27	28	29	30

Green tip: March 11
Bloom: April 18 - 25

MAY 2016

Cold and wet: Late April - ~mid-May (Ave temp 46 – 60F

SUN	MON	TUE	WED	THU	FRI	SAT
1	HIGH 2	3	4	5	6	7
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Little rain during summer…


E. Winzeler

After 3 interesting seasons…what's the latest about fire blight?

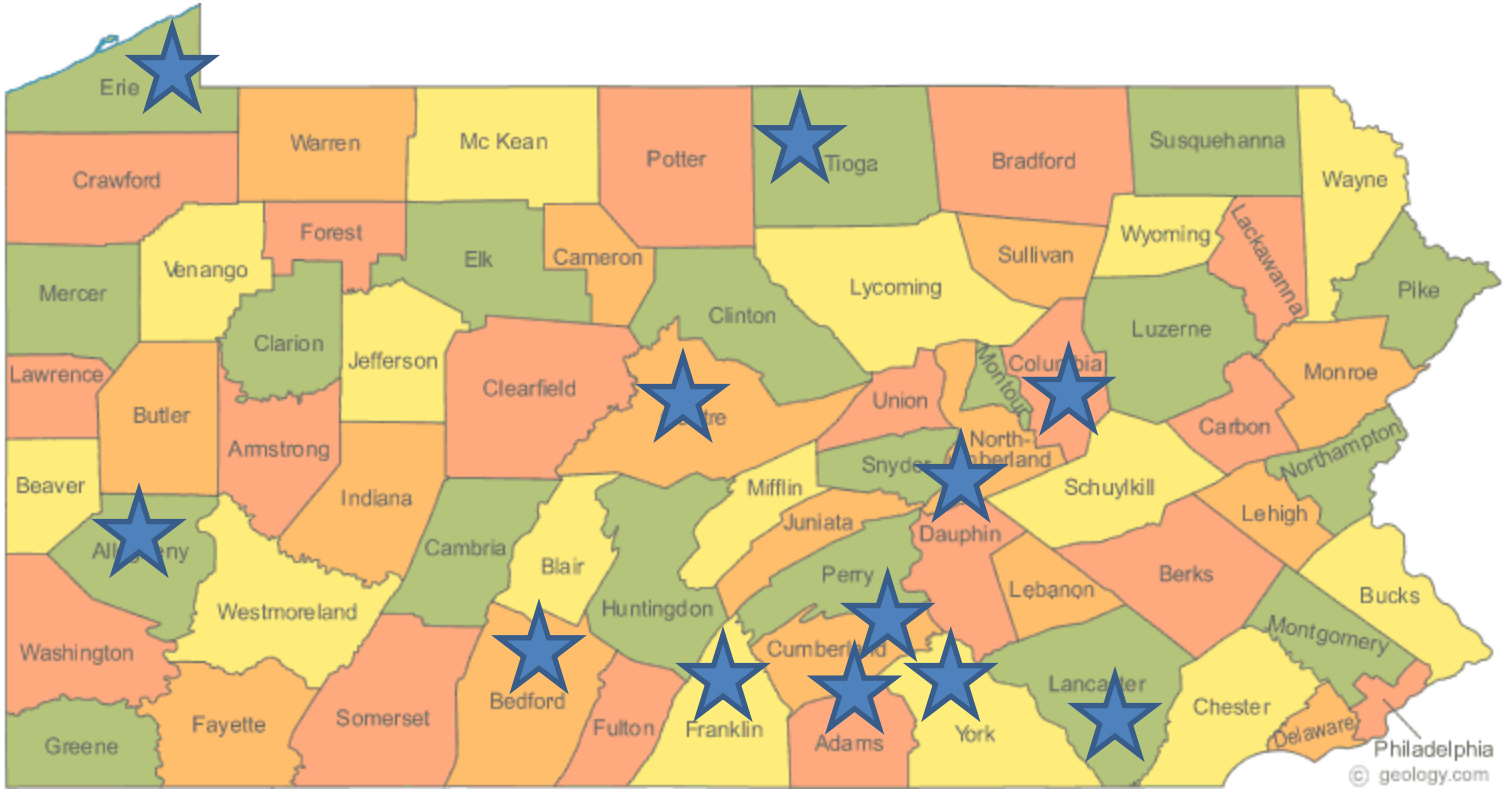
Tools to manage blossom blight:

Antibiotic update
- Streptomycin resistance
- Streptomycin usage
- Other antibiotics

Highlights of alternatives evaluated
- Biologicals
- Plant-based
- Copper


K. Peter

Streptomycin resistant *Erwinia amylovora:* state-wide evaluation (Poster in hallway!)



- Multi-year evaluation (2014 – 2016)
- Funded by State Horticultural Society of Pennsylvania (2016)
- 12 counties; 26 locations (multiple cultivars); 747 isolates

No streptomycin resistant *E. amylovora* found

Blossom blight management with antibiotics: 2014 – 2016 Evaluation of antibiotics (alone and in rotation w/ Serenade Optimum)

Gala/M.7 (~14 yr old)

Resistance management tool?

2014 Treatments @ Bloom: 20%, 50%, 100%
FireWall – FireWall - FireWall
Serenade Optimum – FireWall – FireWall
FireWall – Serenade Optimum – FireWall
Untreated

2016 Treatments @ Bloom: 50%, 100%, Late Bloom
FireWall – FireWall – FireWall
FireWall – FireWall – Serenade Optimum
FireWall – Serenade Optimum – FireWall
Kasumin – Kasumin – Kasumin
Untreated

Blossom blight management:
2014 – 2016 Evaluation of antibiotics (alone and in rotation)

Being proactive to keep strep resistance at bay

- **Limit strep applications during bloom (fewer the better, no more than 4 apps/season)**
- **Antibiotic alternative early in bloom shows promise**

Future research: Evaluating other biologicals and products that induce plant resistance tank mixed with strep

Blossom blight management:
2014 – 2016 Evaluation of alternatives

2014

Blossom Protect (*Aureobasidium pullulans*)

Actinovate (*Streptomyces lydicus*)

2015

Serenade Optimum (*Bacillus subtilis*)

Blossom Protect (*Aureobasidium pullulans*)

Bloomtime (*Pantoea agglomerans*)

Cueva (copper octanoate) + Double Nickel (*Bacillus subtilis)*

Fire Quencher (bacteriophage cocktail)

2016

Serenade Optimum (*Bacillus subtilis*)

Blossom Protect (*Aureobasidium pullulans*)

Fire Quencher (bacteriophage; w/ and w/o UV protectant)

Oxidate (Hydgrogen peroxide + Peroxyacetic acid)

Regalia (Extract of *Reynoutria sachalinensis,* aka Giant knotweed)

Magna Bon (copper sulfate pentahydrate)

Cueva (copper octanoate)

Blossom blight management: 2014 – 2016 Evaluation of alternatives

2014 Treatments @ Bloom: 20%, 50%, 100%
FireWall x 3
Blossom Protect x 3
Untreated

2016 Treatments @ Bloom: 50%, 100%, Late Bloom
FireWall x 3
Blossom Protect x 3
Regalia 2 qt/A x 3
Regalia 1 qt/A + MagnaBon 1 pt/A
MagnaBon 1 pt/A
Cueva 2 qt/A
Untreated

Downside of using Blossom Protect during very wet bloom time (and thereafter): Russet

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

- ***Aureobasidum pullulans*** **can cause fruit russeting under certain environmental conditions**
- **Good scab weather = russet conditions (*Fungicides are limited when using BP during bloom)**

2014 – 2016: Shoot blight resulting from blossom blight infections → effect of blossom blight treatments

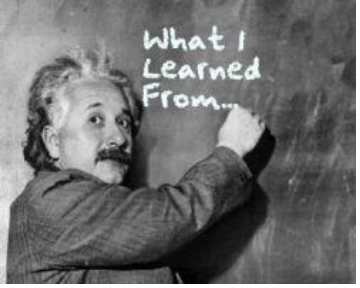
Strep applications: Trees with the fewest instances of shoot blight

Copper (Cueva and MagnaBon):

- **Regardless of blossom blight control (depending on year) – trees treated with copper have fewer instances of shoot blight than trees not treated or treated with products where blossom blight control was poor**

Alternatives limiting blossom blight → shoot blight:

- **Blossom Protect**
- **Regalia and Serenade Optimum – shoot blight is reduced (most noticeable during low pressure years)**



Take home messages for blossom blight management…

- **Be judicious when using strep: Don't let you guard down even though we haven't found SmR *E. amylovora***

- **Alternatives have promise in an integrated program (no strep replacements just yet…)– timing is critical (not much forgiveness as we see when using strep)**
  - **Blossom Protect has been consistent (*some issues)**
  - **Efficacy: Disease pressure makes a HUGE difference**
  - **Timing is very important: Still need more research to fine tune**

- **Antibiotics + alternatives at bloom = potential for season long control**

Want more detail about the data for each year?

Email: kap22@psu.edu → I'll send you the reports

or

Call: 717 – 677 – 6116 x 223 → I'll mail you the reports

After 3 interesting seasons…what's the latest about fire blight?

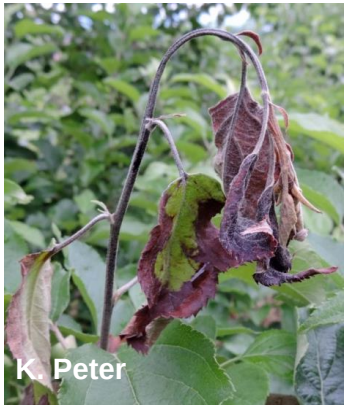
Tools to manage shoot blight:

Cover sprays

- **Copper**

Low rates of prohexadione calcium for dwarf trees

- **Apogee**: W/ UMD WMREC (Geneva rootstock demo blocks)
- **Kudos**: W/ PSU FREC Horticulture



Review of conditions during 2016…

FB Data inconclusive due to weather… However, Apogee reduced growth

May 4, UMD: FB Inoculations for Apogee trial

2nd week of May, PSU: Started copper cover sprays in blossom blight trial block

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Bloom: April 18 - 25

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April 20 – 27, PSU: Blossom blight trial

Green tip: March 11
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MAY 2016

Cold and wet: Late April - ~mid-May (Ave temp 46 – 60F

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May 20, PSU: Inoculations for Kudos trial

Cover sprays to manage shoot blight that occurs from blossom blight: … Cueva showed promise in 2016

14 yr Gala/M.7

- Used "buffer" trees in blossom blight trial (***blossoms not treated***)
- Treated prior to symptom development
- "natural infection"

2016 Treatment and Rate/A	Timing
Untreated	--
Cueva 2 qt	Late petal fall – mid-July
Cueva 2 qt + Double Nickel 1 qt	Late petal fall – mid-July

- **Numbers of shoot blight still high due to no blossom blight control; however, Cueva does reduce shoot blight**
- **No russet observed (but, it was a dry summer…)**
- **Integrated approach: Good blossom blight management plus shoot blight management→ important during years with severe pressure**

Using low rates of Kudos on dwarf trees to manage fire blight

- How does it affect the rate of shoot growth throughout the season?
- How does it affect the severity of fire blight (whether or not shoot growth is affected)?

Using low rates of Kudos on dwarf trees to manage fire blight

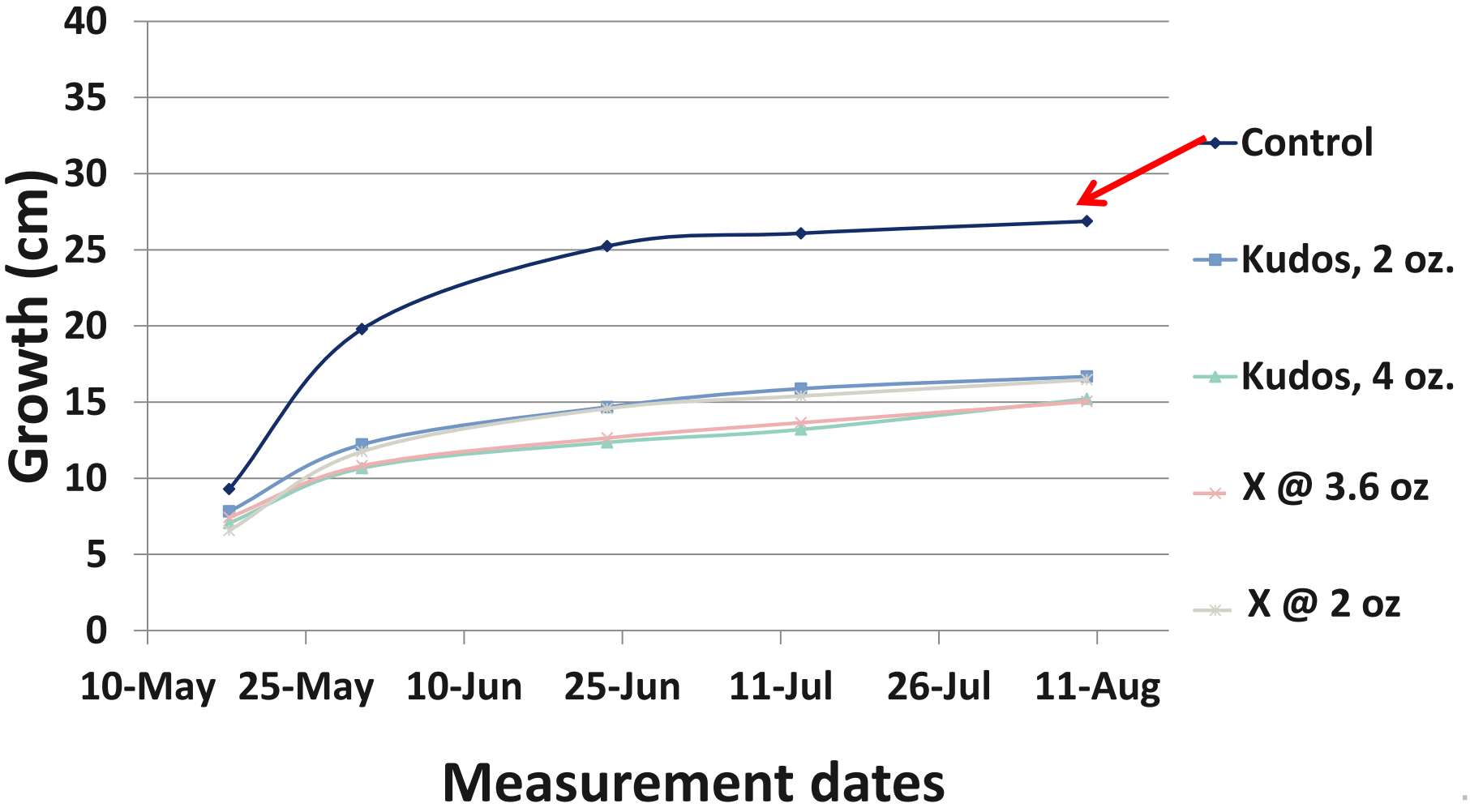
- Crimson Crisp on M.9 rootstock trained to tall spindle training system (2011 planting; trees had moderate vigor)

- Four spray applications (@ 2 oz/A or 4 oz/A):
  - Pink: 18 Apr
  - Petal fall: 11 May
  - First cover: 25 May
  - Third cover: 10 June

- Completely random block design with four multi-tree replications

- W/in treatment: Shoots inoculated for fire blight evaluation were on separate trees from the shoot growth evaluation

Kudos at high and low rates reduces terminal shoot growth 40 – 50%



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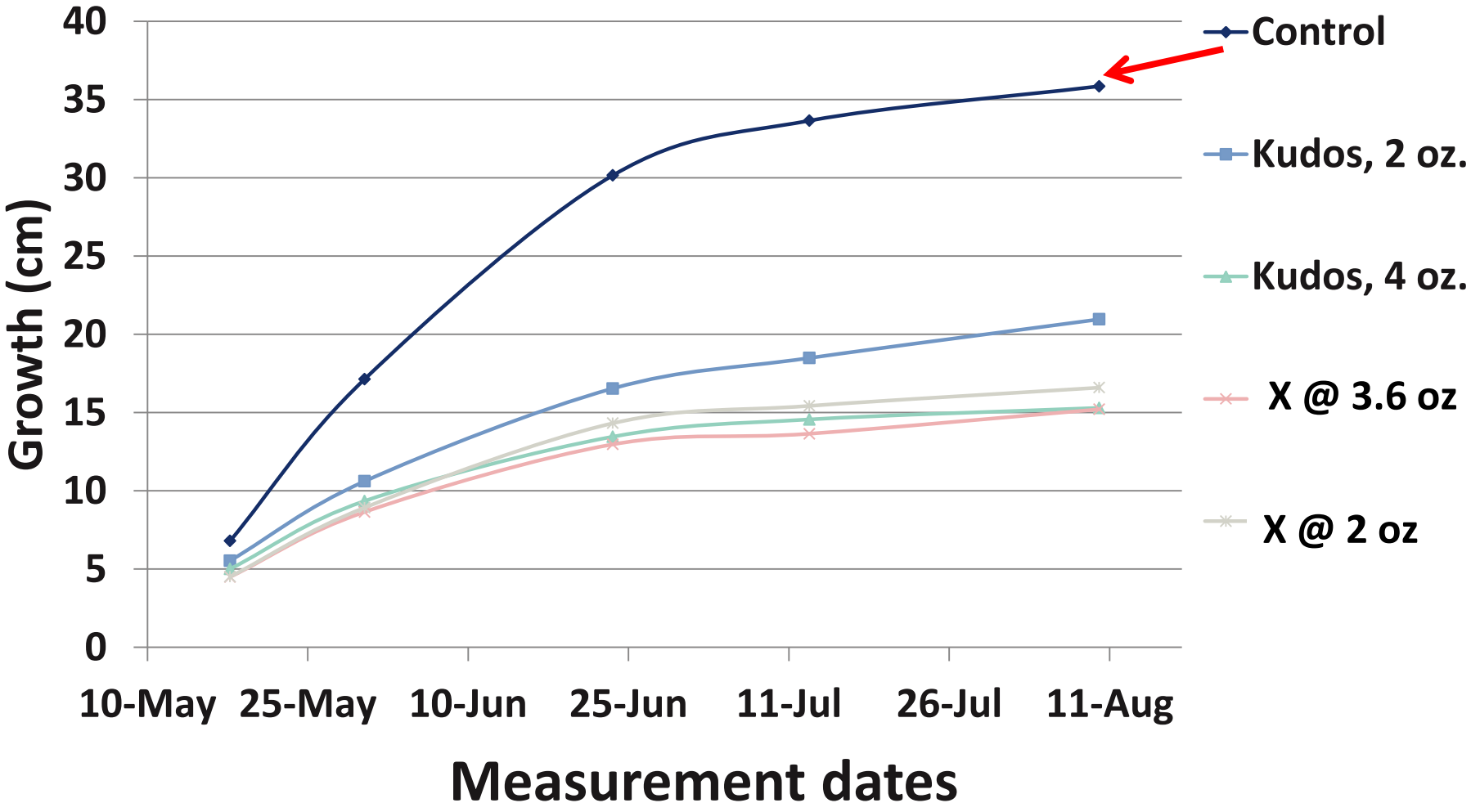
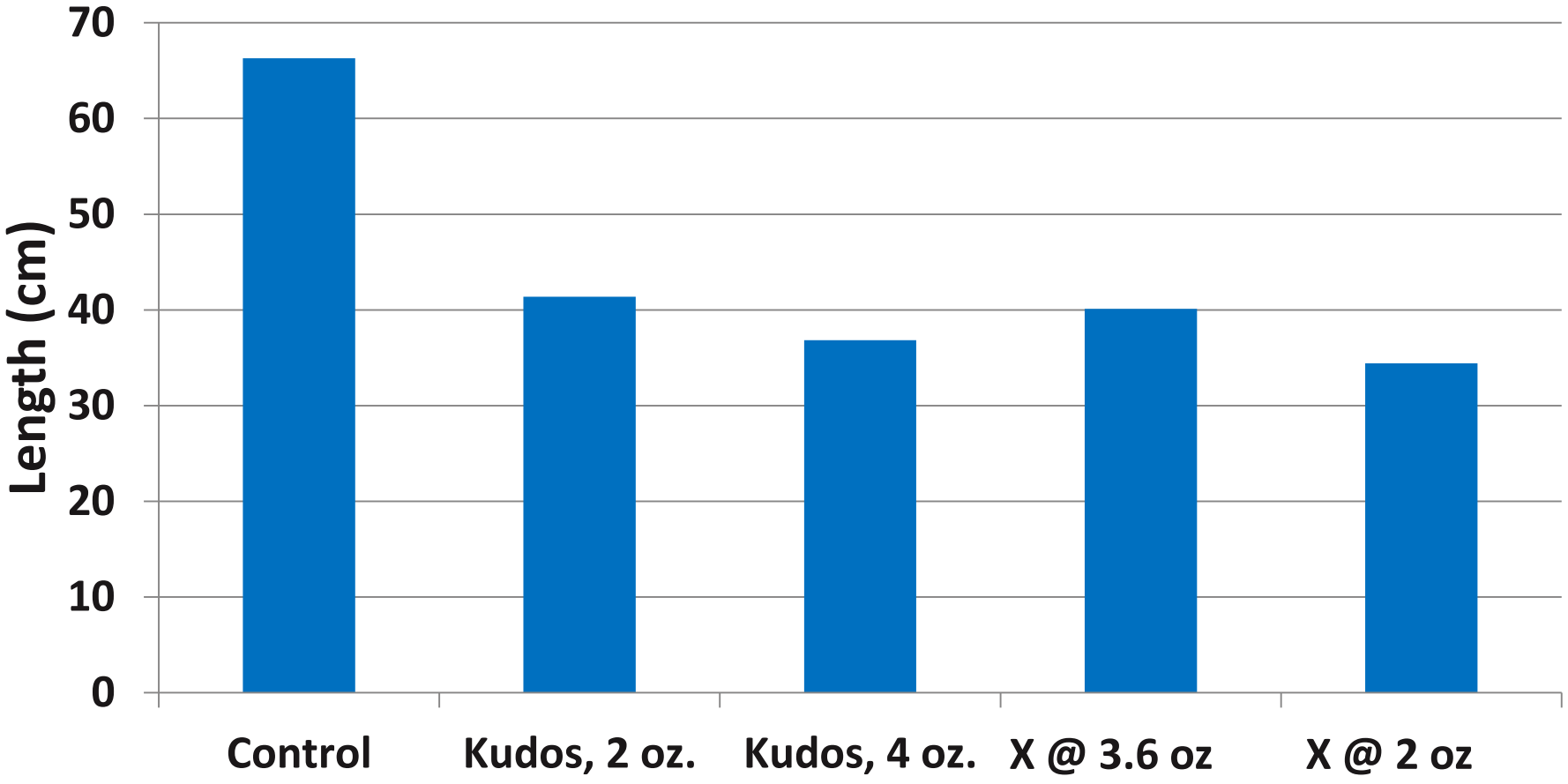
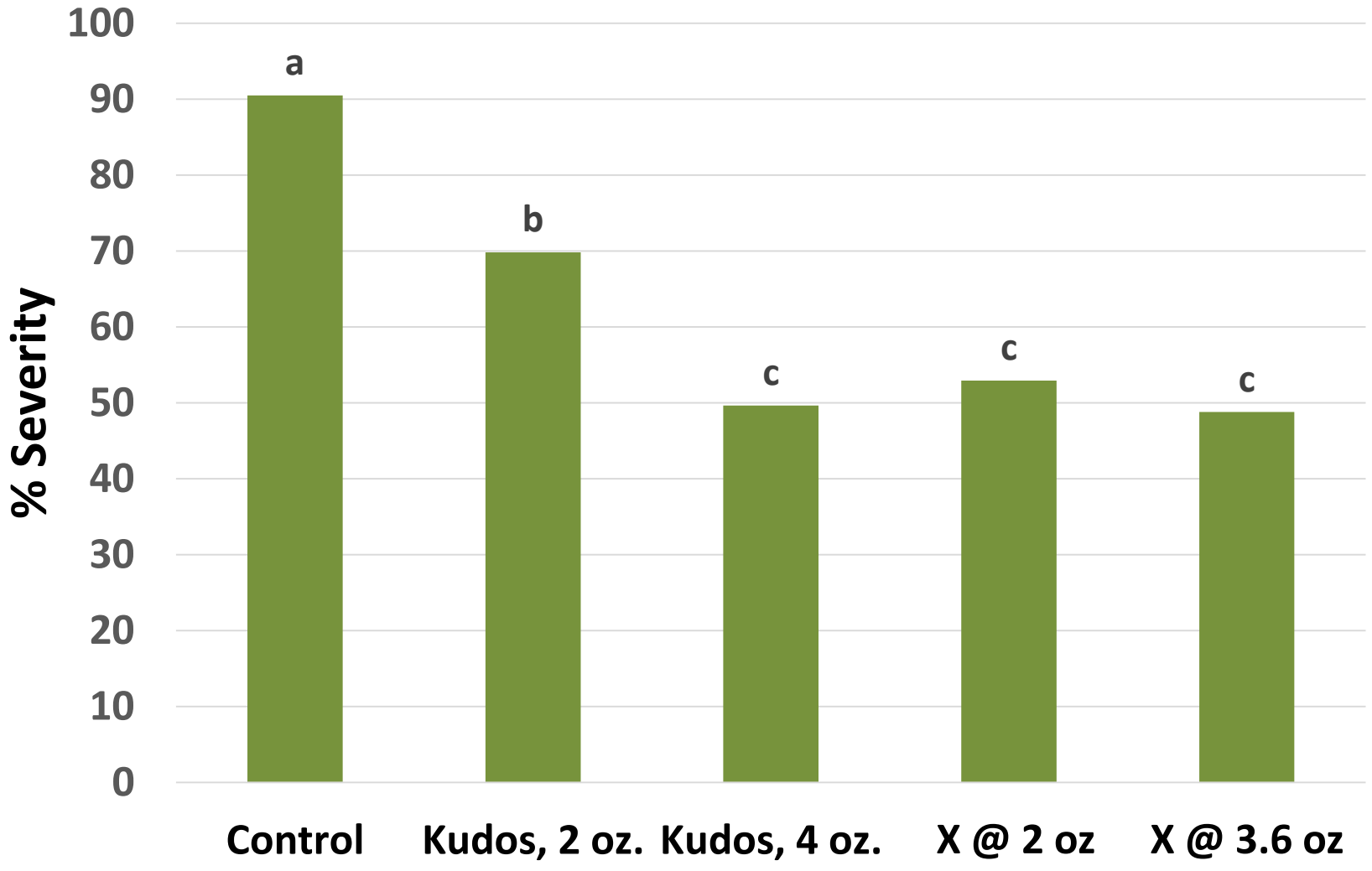


Kudos at high and low rates reduces renewal shoot growth 40 – 50%

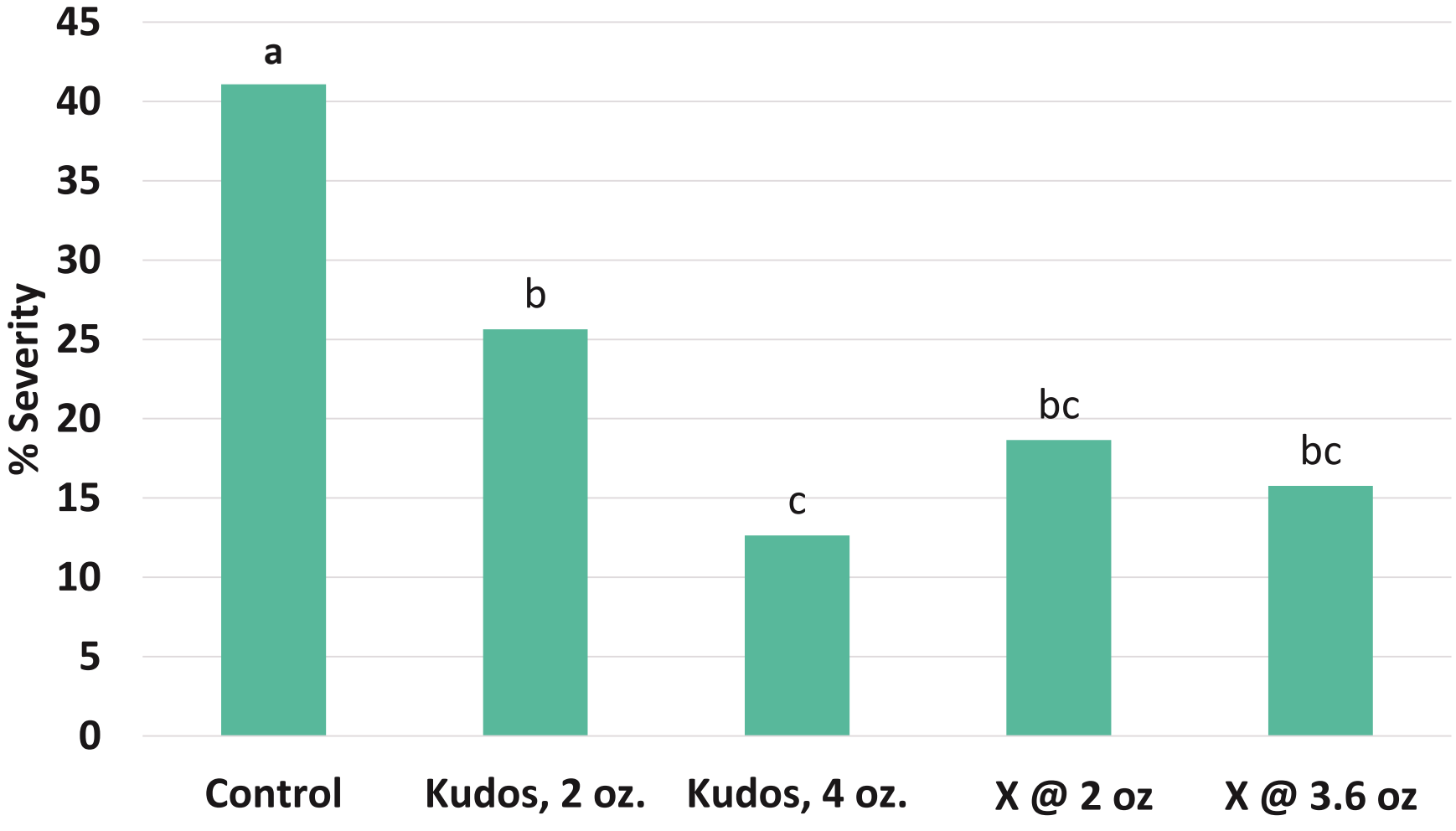


- Overall: Too much growth reduced for a horticulturalist's liking…
  However, for the plant pathologist…

Kudos at high and low rates reduces severity of fire blight on current year's growth



Kudos at high and low rates reduces severity of fire blight on previous year's growth



- Did not progress into central leader
- Overall: Terrific news for the plant pathologist…

True test: Does Kudos prevent infection of renewal shoots…?

- **Only 4 shoots were available for evaluation/inoculation**

Unfortunately… Neither Kudos rate prevented fire blight from advancing to the spindle on renewal shoots

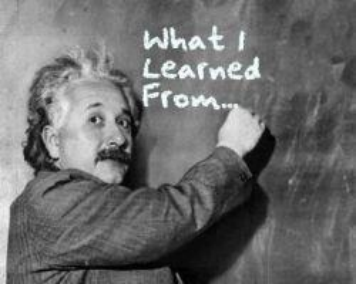
What's next for limiting fire blight on dwarf trees…?

- Goal: Adequate growth AND disease control
  - Fewer ProCa applications?
  - Adjust timing of applications?

- Non-plant growth regulator products for fire blight management on dwarf trees…
  - Greenhouse experiments using SAR products limit fire blight on young, growing trees (but not growth) – Timing is very important… (Poster in hallway!)

  - Taking to the field for 2017 season (*dwarf trees)


B. Butler



Take home messages for shoot blight management…

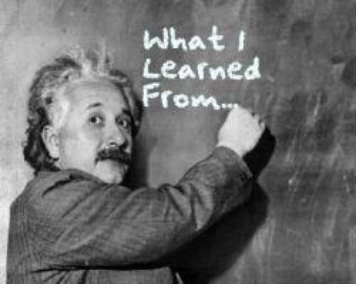
- **Copper sprays limit shoot blight – mindfulness of phytotoxicity (weather conditions) and type of copper used (coppers are not created equal)**

- **Low rates of ProCa in dwarf trees:**
  - **Reduces growth in dwarf trees significantly**
  - **Reduces fire blight severity significantly (renewal shoots=vulnerable)**
  - **More research needed (timing, number of applications) for determining benefits of using ProCa in dwarf trees**

- **Semi-dwarf trees: ProCa encouraged (especially those with a history of fire blight…canker blight suppression)**

- **Dwarf trees: Shoot blight management may lie in products that induce resistance**
  - **Smaller trees show better responses than larger (semi-dwarf) trees**

- **Timing is everything…!**



Overall take home messages…

- **Fire blight management has to be an integrated approach**
  - **Sanitation: Canker removal**
  - **Blossom blight management (monitoring disease pressure: important)**
  - **Shoot blight management (may start during blossom blight management – disease pressure will be a factor for management decisions)**

Not only will you get control for the current season, but for future seasons

ACKNOWLEDGEMENTS

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Support
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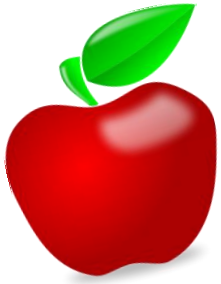

Growers of Pennsylvania and Maryland

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Questions?

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