A new fire blight management approach using Apogee

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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 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.

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.

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 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 $1 \times 10^6 \text{ CFU ml}^{-1}$) > 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
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
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

Results:

Blossom Blight

2017

PhCa

Low

High

2018
Results:

Shoot Blight

2016

2017

PhCa

Low

High

2018
Pink applications > Shoot Length

**Dry Year**

2016

**Wet Year**

2017
Pink applications > Shoot Length

Dry (June) then Wet (August) Year

2018: 2 year old ‘NY1’

- Control (untreated)
- Regalia + MagnaBon x 5
- Apogee Pink 3oz
- Apogee Pink 6oz
- Apogee Pink 3oz, Serenade BL 20oz
- Apogee Pink 6oz, Serenade BL 20oz
- Apogee Pink 3oz + Apogee 2oz x4

Mean shoot length (mm)

PhCa
PhCa Mechanism
physical barrier to pathogen

No decline in bacterial populations

True for blossoms pedicels?

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

June 27 (~40 DAFB)
Apogee @ 6oz/100gal
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 copper)
  – 2) No impact on shoot growth
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

Mean percentage of shoots with fire blight

- Shoot Blight 2016
- Shoot Blight 2017

Untreated
Bloom FireWall 17 24 oz
Bloom Kasumin 64 fl oz
Petal Fall & 14 days Apogee 6 oz oz/100 gal
Petal Fall, 14, 28 days Apogee 2 oz/100 gal
Petal Fall, 14, 28 days Regalia 32 fl oz
Petal Fall, 14, 28, 42 days Apogee 1 oz/100 gal
Pink, Petal Fall, 14, 28, 42 days Apogee 2 oz/100 gal

Petal Fall programs: Double Nickel LC 32 fl oz @ Bloom
PF+ on shoot length in Sept

2016 Dry Season

Mean shoot length (cm)

- Untreated
- Bloom FireWall 17 24 oz
- Bloom Kasumin 64 fl oz
- Petal Fall & 14 days Apogee 6 oz oz/100 gal
- Petal Fall, 14, 28 days Apogee 2 oz/100 gal
- Petal Fall, 14, 28 days Regalia 32 fl oz
- Petal Fall, 14, 28, 42 days Apogee 1 oz/100 gal
- Pink, Petal Fall, 14, 28, 42 days Apogee 2 oz/100 gal

2017 Wet Season

Mean shoot length (cm)

- Untreated
- Bloom Kasumin 64 fl oz
- Bloom FireWall 17 24 oz
- Petal Fall & 14 days Apogee 6 oz oz/100 gal
- Petal Fall, 14, 28 days Apogee 2 oz/100 gal
- Petal Fall, 14, 28 days Regalia 32 fl oz
- Petal Fall, 14, 28, 42 days Apogee 1 oz/100 gal
- Pink, Petal Fall, 14, 28, 42 days Apogee 2 oz/100 gal

Prolonged use programs of Apogee most impact on growth both years
PF+ programs on Shoot blight

2018 Dry Early & Wet Late Season

Mean percentage of shoots with fire blight

- Untreated
- Bloom Kasumin 64 fl oz
- Bloom FireWall 17 24 oz
- Petal Fall & 14 days Apogee 6 oz oz/100 gal
- Petal Fall, 14, 28 days Apogee 2 oz/100 gal
- Petal Fall, 14, 28 days Regalia 32 fl oz

Petal Fall programs: Double Nickel LC 32 fl oz @ Bloom
PF+ on shoot length in Sept

2018 Dry Early & Wet Late Season

- Untreated
- Bloom Kasumin 64 fl oz
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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
Further refine prohexadione calcium applications at “pink” & season-long prohexadione calcium programs on young trees with no fire blight
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Questions