Integrated Pest Management in Montana Apple Orchards

Fire blight management

Ken Johnson, Oregon State University







Topics for this talk

- When does infection occur?
- When is pressure high, and how to know it?
- Discussion of vigor
- How to take care of fire blight once it is present
- Recommended spray programs & timing





Old cankers: This is where the fire blight pathogen overwinters

Sanitation: Cleaning up old cankers in winter delays pathogen buildup in flowers

Floral <u>epiphytic</u> phase of fire blight pathogen



bloom period

A tale of two seasons: Spread of bacteria from tree-to-tree



Pear bloom Apple bloom

When do we find the fire blight pathogen in flowers?

Each year, twelve commercial Bartlett pear orchards in northern California were surveyed during the bloom period

> All orchards received multiple antibiotic sprays



floral epiphytic phase

Rachel Elkins UC-ANR Lakeport



When do we find the fire blight pathogen in flowers?

What exacerbates the process of inoculum buildup in flowers?

- Long bloom periods
- Secondary (rattail) flowers
- Cultivars with overlapping bloom periods
- Change in elevation



Rachel Elkins UC-ANR Lakeport





Flowers are most common site of infection by fire blight pathogen

Epiphytic phase: Pathogen grows and builds Wetting event: population on stigmas. After sufficient cells are Needs to attain present on stigmas, population size greater pathogens needs to slide down than 100,000 cells to outside of style in film of infect flower. water (light rain or dew). **Infection in floral cup:** Pathogen cells from stigmas swim into the small openings from which nectar is secreted.

CougarBlight risk model monitors the epiphytic phase

• Five-day moving sum of heat units (~degree-hour) above 60°F

('moving sum' means: tomorrow we add new temperature data and toss out the data from 5 day ago)

- Example: 85°F for 1 hour is (85°-60°F), which is ~25 heat units.
- Sum up heat units for every hour of the last five days
- This sum reflects the speed of the floral epiphytic phase.



• <u>A high sum</u> = fast bacterial growth and flower-to-flower spread = <u>high risk</u>

CougarBlight thresholds vary with disease history

Scenario 1 <u>'extreme'</u> risk threshold

No fire blight in neighborhood last year

Scenario 2 <u>'extreme'</u> risk threshold

Fire blight in neighborhood last year

Neighborhood = distance a honey bee can fly



Blight History Scenario 1 Thesholds: Low 0 to 300, Caution 301 - 500, High 501 to 800, Extreme 800+.

Blight History Scenario 2 Thresholds:

Low 0 to 100, Caution 100 - 200, High 201 -350, Extreme 350 - 500, Exceptional 500+

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CougarBlight Risk Corvallis, MT 2017



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Summary of infection and disease pressure:

When does infection occur?

- Open flowers in warm weather
- Pathogen becomes more abundant as bloom progresses
- Epiphytic pathogen populations keep increasing well into petal fall
- Young flowers and high epiphytic populations = high likelihood of infection -- This tends to occur in the later half of primary bloom (and during rattail/secondary bloom)

When is pressure high, how to know it?

- Disease nearby last year
 - (= old cankers nearby in spite of best effort to clean them up)
- CougarBlight heat unit sum indicates fast speed of floral epiphytic phase
- CougarBlight thresholds reflect risk from disease nearby
- Forecasted temperatures will be warm and followed by rain/dew conditions



Discussion of vigor

A recipe for disaster:

Most fire blight disaster photos reflect a combination of these ingredients



- Young trees
- Pushed for growth
 - Warm weather
 - Moisture (sprinklers on)during bloom
 - Inadequate spray program

Photo: Tim Smith



Summary of discussion of irrigation and vigor:

Vigor

- For a young vigorous tree, <u>a single fire blight infection</u> can kill it.
- Intense nutritional programs also should mean <u>intense fire blight control</u> <u>programs</u>. I.e. the cost of additional nutrition is more than the fertilizer!
- E.g., Intense nutrition means that in 1- to 3rd-leaf transition orchards, a <u>weekly</u> <u>copper program (spring through summer)</u> is a very good idea.
- In baby orchards, hand removal of flowers lessens risk of fire blight infection.

Irrigation

- Compared to micro-sprinklers, <u>drip irrigation</u> reduces infection risk.
- Avoid micro-sprinkler irrigation when flowers are open (don't do it).
- In spring, trees (and fruit) tolerate deficit irrigation during the bloom and petal fall periods.

Topics for this talk

• How to take care of fire blight once it is present

Blight removal in young orchards is like voting : "Cut early and cut often"!

- Quebec study of blight pruning strategies:
 <u>Early and fast</u> was best treatment (no disinfectant of tools between cuts)
- Small blight strikes require a keen eye, but <u>early cutting</u> gives much greater chance of tree health restoration



 Blight strike symptoms appear from incubation at different times – thus a need for <u>repeated inspections</u> Cells of pathogen diffuse through healthy-appearing wood ahead of expanding canker

After initial pruning cut, fire blight frequently 're-ignites' at the cut site or at the graft union (M.9 rootstock) owing to residual cells of the pathogen in tree after the canker has been removed

'Early and fast' pruning results in less time for cell diffusion process



Pathogen cells that have diffused ahead of the expanding canker, down the branch and into the central leader. At the time of the cut, the branch and leader are symptomless and <u>appear healthy</u>

Pathogen ooze drives secondary phases of fire blight



- Ooze is highly concentrated and potent inoculum
- Summer temperatures are always high risk
- Organic orchards are soft on insects
- Wind, hail, wires, insects create susceptible wounds
- Insects are attracted to ooze, shoot tips, and flowers

How many cells? - enough to ruin an orchard

How to take care of fire blight once it is present

• Cutting blight

- Cells of pathogen diffuse through healthy-appearing wood well ahead of expanding canker
- The <u>younger the tree, the deeper the cut</u>: 2- to 4-feet below canker in very young, susceptible cultivars. Twelve- to 18-inches in older trees
- <u>Repeat tree inspections</u> frequently.
- Tree replacement
 - Rootstock blight: (M.9, EMLA 26)-
 - 1st- and 2nd-leaf trees with fire blight: the rule is <u>pull and replace</u>
 - High density orchards: Fire blight can move root-to-root (M.9, EMLA 26)
- Need for more intensive protection
 - Summer copper programs in young orchards with blight



Topics for this talk

Recommended spray program & timing



Fire blight product review



Recommended spray programs & timing

- Antibiotics are not allowed in <u>organic</u> fire blight control programs
- In young orchards (organic in particular), spray programs need to :
 - Be more <u>phenology-based</u> (strategic) as opposed to weather-based (tactical)
 - Utilize weather-based risk models (CougarBlight) to <u>guide spray interval</u> and <u>material choice</u> (as opposed to determine need for spray)
 - <u>Sequence materials</u> correctly within recommended programs
 - Understand <u>risks of fruit russeting</u> from non-antibiotic fire blight programs: -- material, apple or pear cultivar, spray drying time, and weather

In general, antibiotics are better at inoculum sanitation than other materials



Under high temperatures, materials varied in ability to reduce *E. amylovora* populations on flowers



Integrated, non-antibiotic fire blight control:

Example PNW non-antibiotic spray program with considerations for fruit safety:

Early bloom

Full bloom

- Prebloom (just prior to green tip):
 <u>Fixed copper</u> sanitation <u>if</u> fire blight was in orchard last year (5 to 6 lb/A)
- 2) Early bloom apple: (crop load thinning)
 <u>Lime sulfur</u> (plus oil) early bloom at 20 and 70% bloom
 Reapply biological if lime sulfur goes on after biological

2017

- 3) Early bloom apple and pear: <u>Blossom Protect</u>
 One full, or two half apps, or two full apps if blight in orchard last year cover every row
 In apple, Blossom Protect immediately after 2nd lime sulfur.
 In smooth-skinned pears in wetter areas, russet risk might be unacceptably high
 Bloomtime Biological is an alternative, fruit-safe biological material
- 4) Full bloom to petal fall, depending on cultivar russet risk/CougarBlight model risk: <u>Serenade Opti</u> every 2 to 4 days (<u>most fruit safe</u>) Improved control: mix Serenade Opti with Cueva (2 to <u>3 qts</u>/A) Previsto (3 qts/A) or <u>Cueva</u> (3-4 qts/A) every 3 to 6 days (<u>least fruit safe</u>) Apples at petal fall: lime sulfur (2 to 4%) to clean up bacteria, yeast, mildew and rot fungi

Relative fire blight suppression from 17 pathogen-inoculated pear and apple orchard trials conducted near Corvallis, Oregon from 2013 to 2017.





Comments on material mixtures:

- Kasumin (100 ppm) with Oxytet (100 ppm) ✓
- Strep (100 ppm) with Oxytet (200 ppm) − only once per season ✓



Questions?

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Ken Johnson johnsonk@science.oregonstate.edu



