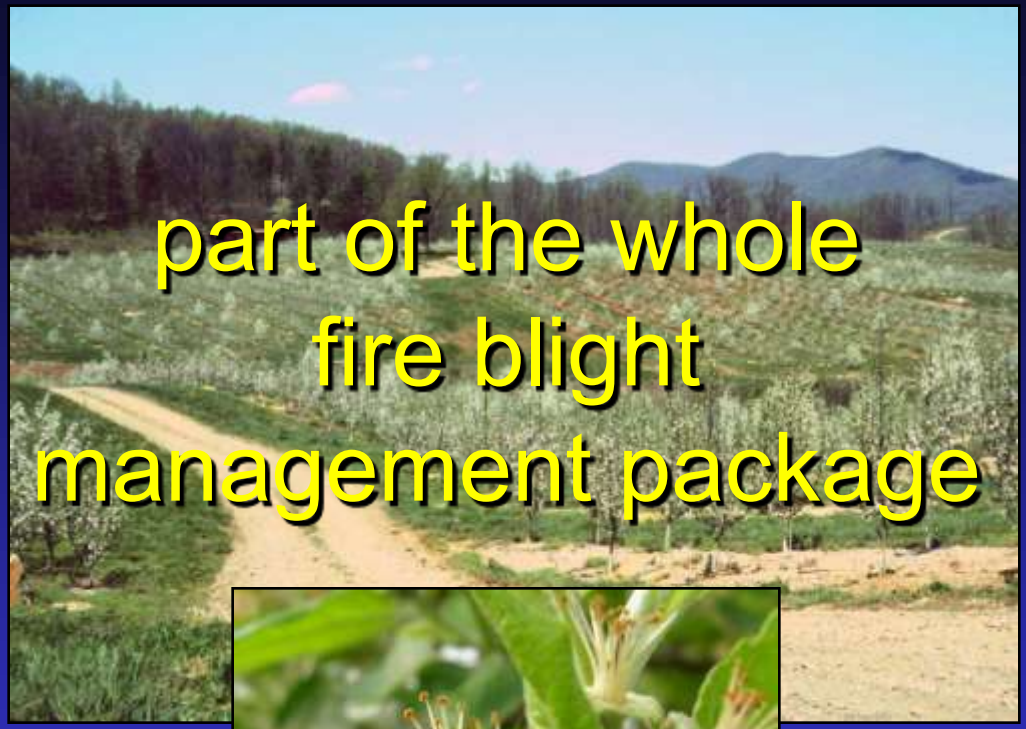
Managing shoot blight-



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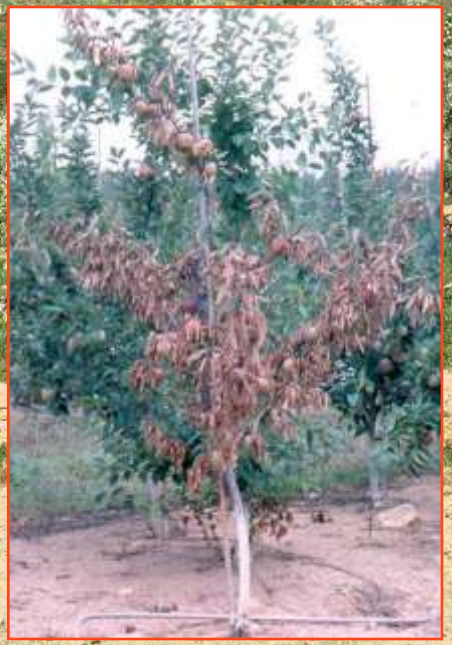
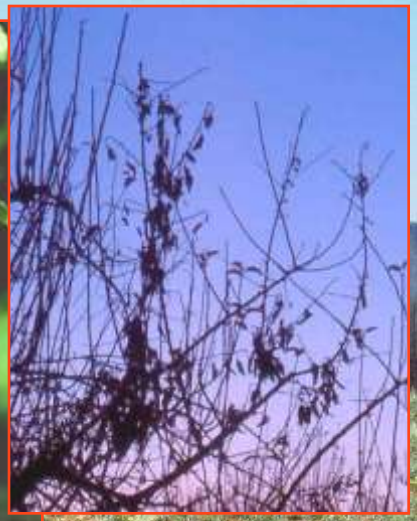
Mid-Atlantic Fruit and Vegetable Convention
Hershey, PA
February 2, 2012

The wake-up call: rootstock blight

Some cultivars more resistant

but are killed when infection reaches the rootstock





- Overwinters in cankers in tree
- Primary blossom infection during warm weather
- Protect blossoms with streptomycin

- Crabapples and pears also susceptible
- Prolonged bloom on the cultivar or crabapples adds to overall susceptibility of orchard

Hailstorms, etc. in May-June, aggravate serious secondary shoot blight epidemics

Fire blight blossom testing

General blossom blight test protocol

TEST STRATEGY:

- Treat in morning; inoculate same evening before a warm day
- Select 4 limbs/tree and inoculate by spraying bacteria

RATINGS:

- Count total clusters / inoculated limb
- Rate clusters infected (about 2 wk after first inoculation)
- Cluster rated as infected if at least one blossom showed blight symptoms
- Basis for % cluster infection / % control

Products in Blossom Blight Tests

Antibiotics

- Streptomycin standard

Biopesticides

Coppers

Phosphites

Antibiotics

Streptomycin -still the test standard

Oxytetracycline - FireLine, Mycoshield

Kasugamycin (Kasumin 2L) - Arysta experimental

Gentamicicn (GWN 9350) - previous experimental, had Sec. 18 in Michigan; not likely to be registered

Annual fire blight development at VT-AREC, Winchester

EIP>100 was reached in 4 days or less in 8 of 10 years;
3 days or less in 6 of 10 years
2 days or less in 5 of 10 years
First infection occurred in 4 days or less in 6 of 10 years
3 days or less in 4 of 10 years
In 2011 infection conditions occurred the day of first bloom!!

Antibiotics - outlook?

Streptomycin -registration and activity ok for now

Mycoshield, FireLine (was FlameOut, oxytetracycline)

- federal registration.
- Not as effective as streptomycin unless there is resistance to streptomycin

Kasumin 2L (kasugamycin)

- experimental, favorable registration outlook

Gentamicin (GWN 9350) - experimental

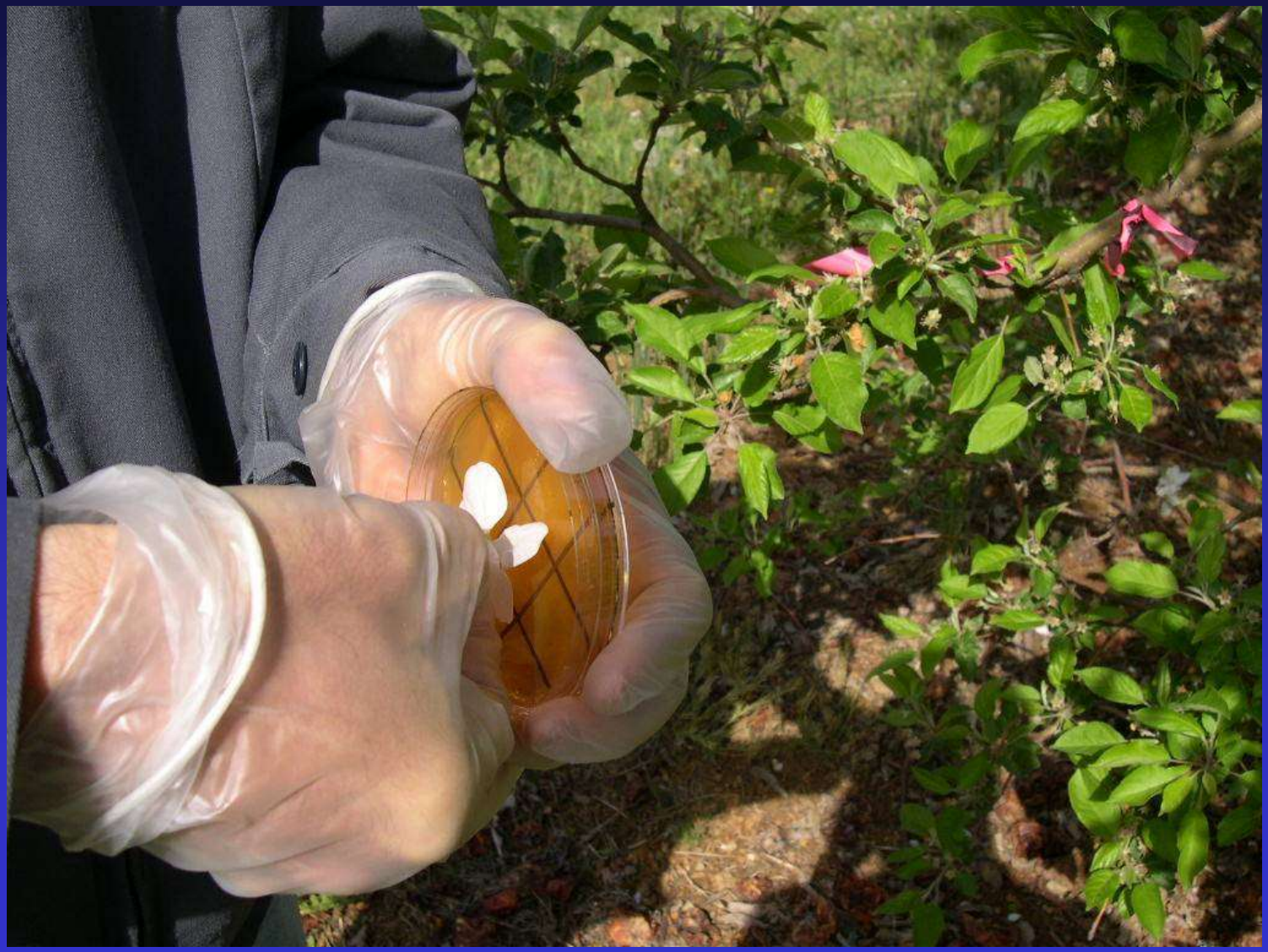
- had Section 18 permit in Michigan
- used more in human medication
- probably will not be registered

Biopesticide fire blight blossom test
Idared apple, Winchester, VA 2006

Treatment list

- BlightBan A506 *Pseudomonas fluorescens*
- BlightBan C9-1 *Panteoa agglomerans*
- Bloomtime Special FD E-325 *P. agglomerans*
- Serenade Max *Bacillus subtilis*
- Agri-Mycin 17 - streptomycin
- Also bio-treatments alternated with Agri-Mycin

Monitoring for presence of biocontrols



Biopesticide summary

<u>Biopesticides</u>

- some positive but less consistent results than with strep
- generally have performed better in western U.S.

BlightBan A506 (*Pseudomonas fluorescens*)

BlightBan C9-1 (*Pantoea agglomerans*)

Bloomtime Biological FD (*Pantoea agglomerans*)

Serenade Max and ASO (*Bacillus subtilis*)

- inconsistent, if applied alone, compared to streptomycin
- interesting results when alternated with streptomycin

* Monitoring of bacteria on trees: tree to tree movement suggests potential natural spread

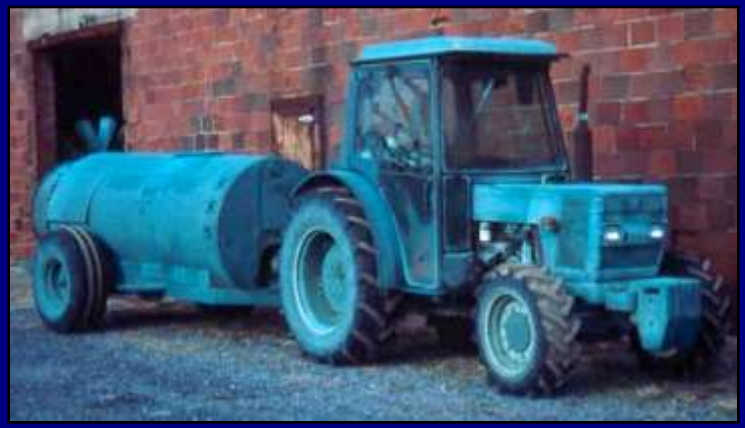
CONSIDERATIONS FOR COPPER USAGE FOR FIRE BLIGHT MANAGEMENT

Purpose

- Fire blight inoculum reduction
- Resistance management (esp. for processing)
- Fungicidal benefits

Limitations

- Doesn't eliminate need for streptomycin
- Label status (crop, timing, and rate)
- Phytotoxicity to fruit and leaves
- Compatibility factors?



Latest safe early timing for copper spray?

- Fresh market fruit- 1/4” green

- Processing fruit- 1/2" green- TC

- Highest risk: rapid growth, no rain

- Bloom; lower rates; expect russet

Russet ratings (0-5), Nittany apple, 2005

Fire blight management outlook

Streptomycin standard in blossom tests
- so far, nothing consistently better
- potential for resistance
  (not yet seen in mid-Atlantic region)
- need to protect its longevity

Should integrate all possible management practices to protect the longevity of streptomycin.

Plant growth regulators:

A novel approach to managing fire blight of apple shoots

Suppression of Fire Blight by Daminozide (ALAR)

Treatment*	Greenhouse, 1 app., canker length (cm)	Natural fire blight infection, commercial Jonathan orchard	
		canker length (cm)	strikes per tree
Non-treated	6.6	29.5	14.8
ALAR 1000 ppm	1.0	23.9	6.7

* Dilute applications 3 June and 16 July. Data recorded 7 Aug. 1970. Unpublished data. E. J. Klos & K. S. Yoder, Mich. St. Univ. 1969-70

Apogee /Shoot Blight Research Protocol

- First tested on moderately vigorous 22-yr-old trees
- Cultivars Rome Beauty and Golden Delicious
- Five replications in a randomized block design
- Treatments applied dilute to runoff
- Regulaid included with all P-Ca treatments at 0.03%
- Streptomycin applied separately as indicated
- Shoot tips inoculated in the last leaf node with a needle holding one droplet of an *E. amylovora* suspension containing approximately $1X10^8$ cfu/ml
- Shoots rated for perceived vigor (Scale 1-5) at inoculation.
- Shoot infection and canker length rated after 12 weeks

Summary of Early P-Ca (Apogee) Results 1994-97
Virginia Tech AREC, Winchester

- P-Ca treatment reduced non-inoculated shoot length by about 50%.
- Suppression of shoot infection incidence starts to take effect between one and two weeks after P-Ca application.
- When inoculated two weeks after treatment, all P-Ca treatments significantly reduced total mean canker length.
- Streptomycin applied separately suppressed fire blight incidence on inoculated shoots when applied the day before inoculation; but only a slight effect on shoots inoculated one week after application.
- P-Ca followed with streptomycin gave a synergistic effect: 97% suppression of shoot blight incidence; 83% by P-Ca 250 ppm; 33% control by streptomycin applied separately at the same time.

Prohexadione-Calcium (Apogee)

- Registered for use on apples Apr. 2000
- Trade name: Apogee 27.5DF (BAS 125 W)
- Plant growth regulator; inhibits gibberellin biosynthesis
- Reduces cell elongation and vegetative growth
- Absorbed by foliage; translocated to growing point of individual shoots (not from limb to limb)
- Decreases length between leaf nodes
- Length of effects vary with app. timing and crop load
- Reduces shoot tip susceptibility to fire blight infection

Summary of orchard demo plots 2001-02

Virginia Apple Research Program

- Nine of 33 plots were hit by hail
- In reps where there was blight, there was an average of 85% suppression of shoot blight by Apogee treatment
- Significant reduction in over-wintering cankers
- In practice, two applications may be needed to reduce susceptibility of growing shoot tips during critical periods of the growing season.
- More apps. at lower rates might be more practical.
- Shoot blight incidence in other plot areas was low; re-emphasizes importance of other fire blight management practices (timely strep apps. during bloom) and significance of trauma blight events in secondary spread.

Ideal timing for shoot blight suppression

- ASAP after full bloom
- For fire blight

- Maintain growth suppression for as long as shoot tip infection would be expected to occur

Apogee for fire blight management

- **Fairly predictable response**
- **More reliably effective for shoot blight than some other approaches are for blossom blight**
- **Synergistic effects when used with streptomycin**
- **Works for shoot blight (shoot tip protection)**
- **Cost / value of Apogee treatment**

  Depends on location-- rates, no. apps., other considerations
- **The approach works; price and materials may change**

Avoiding streptomycin resistance

- Streptomycin has shown a significant reduction in shoot tip infection in some tests, especially Golden Delicious
- We discourage use of streptomycin for shoot blight control
- Continue with strep use to late bloom
- Alternate with new alternatives as they come available?

  - Antibiotics? (NR), OTC,
  - biologicals (Serenade, BlightBan, etc.) inconsistent
  - coppers on processing fruit
  - new schedules need more testing but usually none is more effective than streptomycin where resistance is not a problem

Fire blight management in new plantings

- Trees may bloom soon after planting
- May bloom later in season than bearing orchards
- Some have long bloom periods
- Many have been on susceptible rootstocks
- Less tree loss on resistant rootstocks

Control program:

- Protective copper soon after planting
- Remember that the trees are there!
- Streptomycin at bloom as needed through late bloom
- Continue following program to predict risk
- Difficult to reduce tree susceptibility without limiting growth
- Focus on keeping blight out of planting
- Consider inoculum sources from adjacent older plantings

Integrated Fire Blight Management

- Remove primary inoculum sources (cankers)
- Consider apple cultivar and rootstock susceptibility
- Cultural practices- avoid encouraging excessive vigor

Control program:

- Copper at 1/4 in green (can be later for processing)
- Streptomycin (if effective) at bloom as needed
- Use program such as *MARYBLYT* to predict risk
- Shoot blight- Considering risk for season and block, apply Apogee + streptomycin at mid-bloom (first petal fall on king bloom)
- Follow first Apogee application with streptomycin as needed to protect late bloom; wetting from a maintenance spray can trigger infection if other conditions are favorable
- Apply Apogee again, if needed, to stop late shoot re-growth

Questions/comments??