An Overview of Apple Disease Models

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Bacterial Diseases of Apple

Fire Blight: The Phases

Canker Blight

Blossom Blight

Shoot Blight

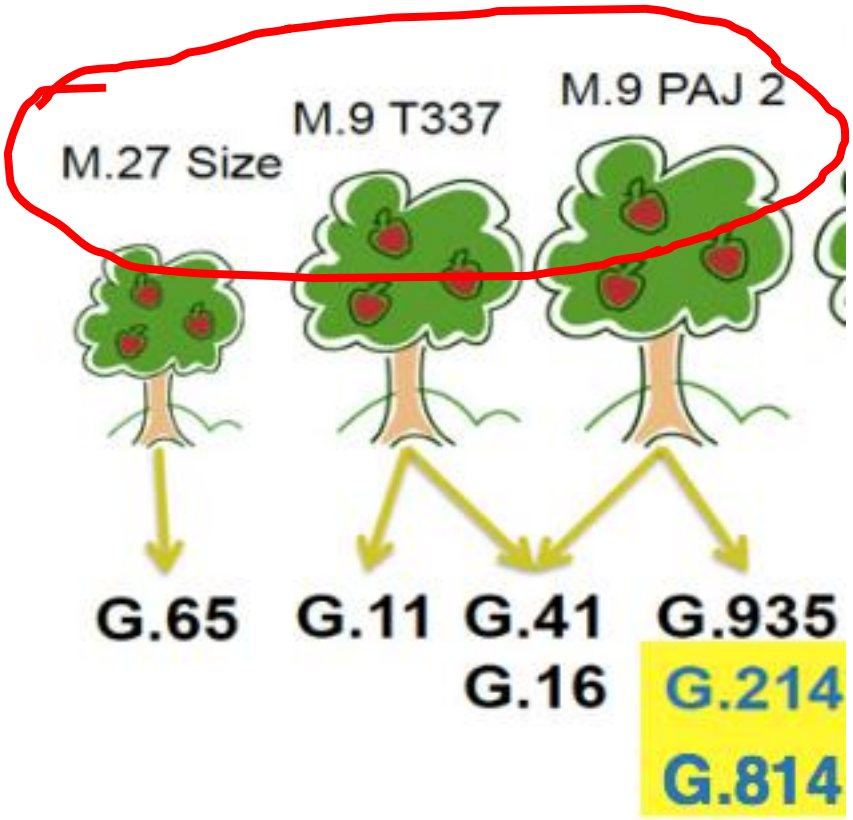
Increasing Fire Blight Concerns in the S.E.

Increasing #s of high density plantings: greater $$$ investment

Increasing Fire Blight Concerns in the S.E.

High Demand for fire blight resistant rootstocks (G-series)

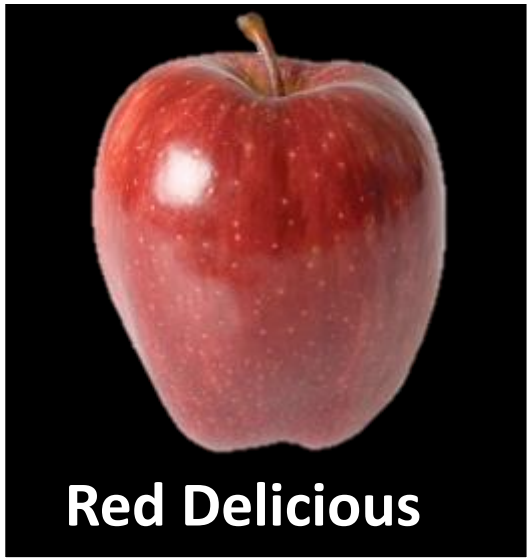
– Grower nursery plantings

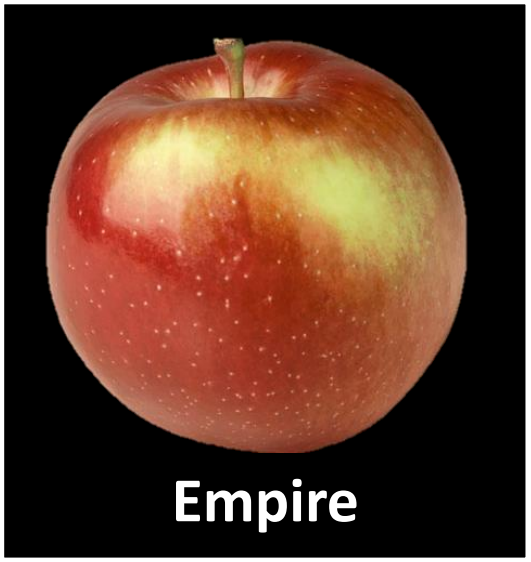


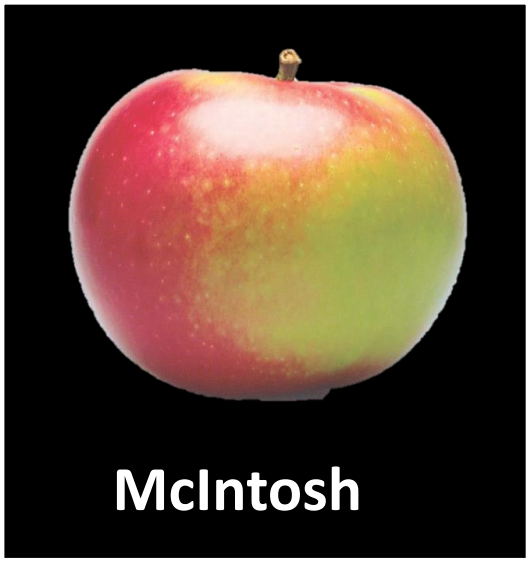
Fire Blight Concerns in the S.E.

Increased planting of popular scion varieties with greater fire blight susceptibility

Res/ Mod S.







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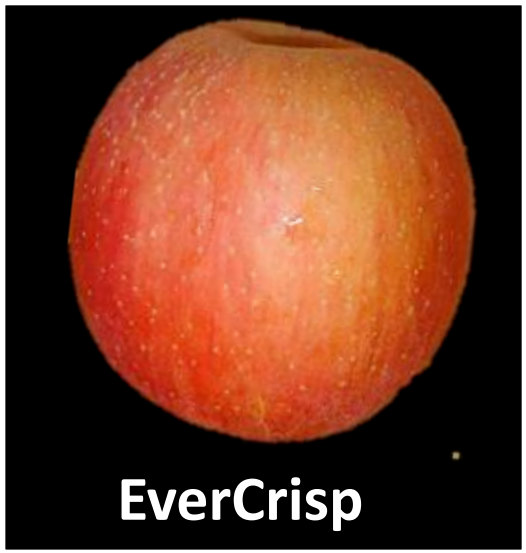
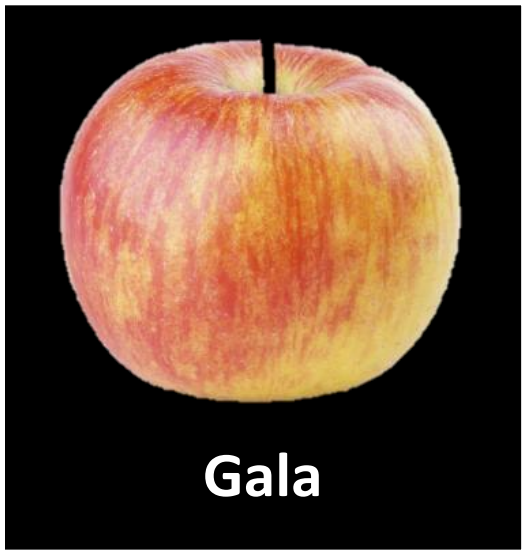
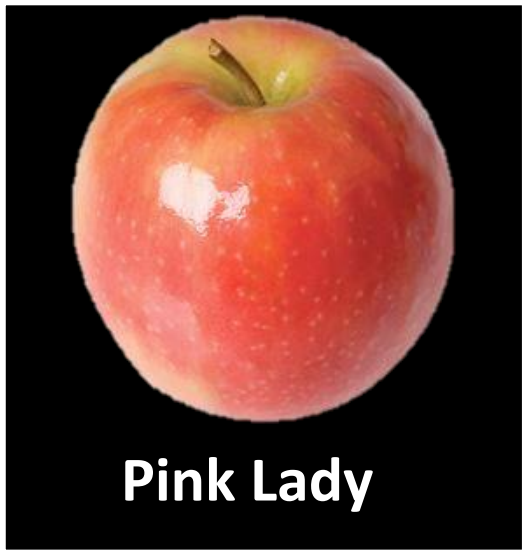


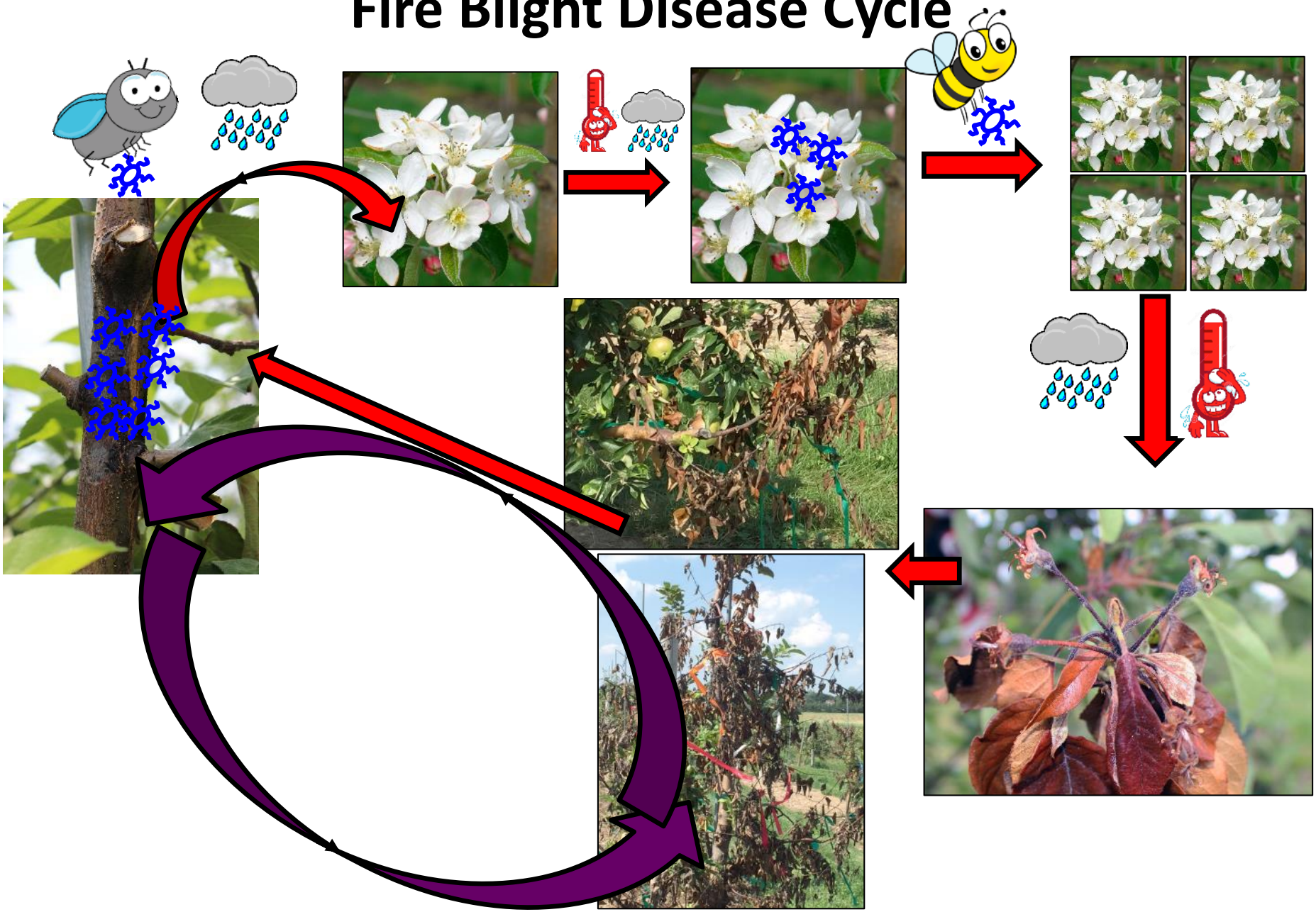




Fire Blight Concerns in the S.E.

- Young, new plantings: extended/protracted bloom period, susceptible tissue (esp. during “filling out” period)

Fire Blight Disease Cycle

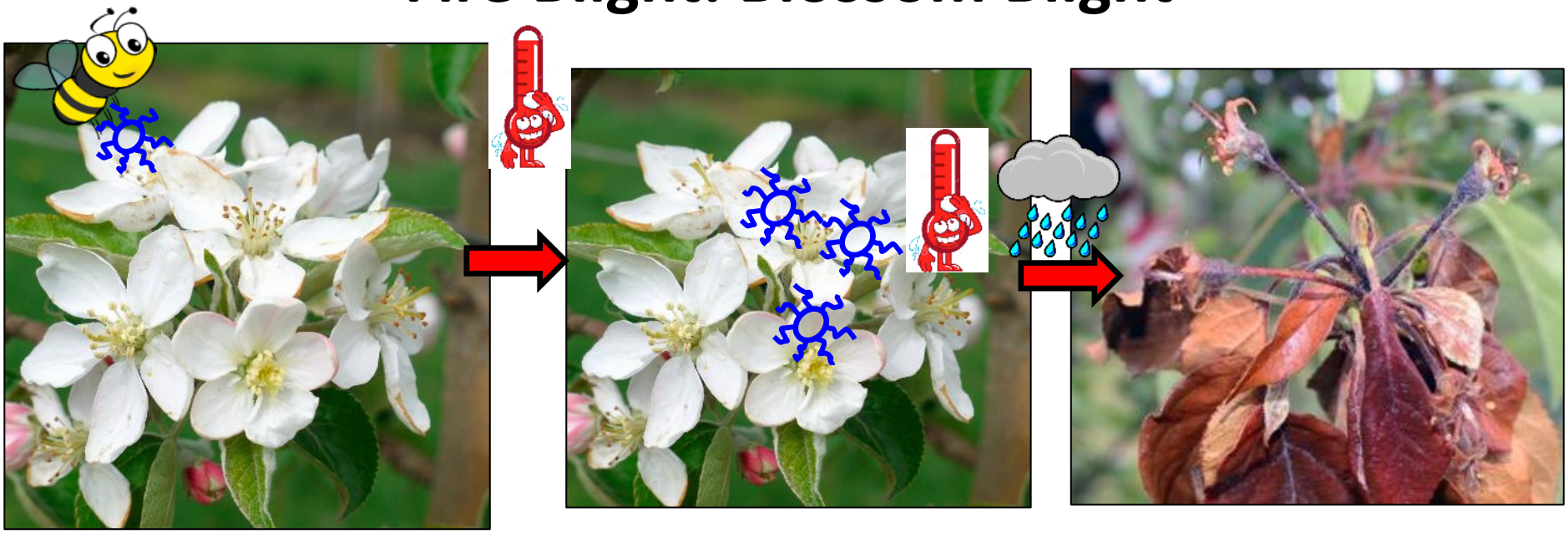


Fire Blight: Canker Blight

- Occurs at site of canker margin, where pathogen overwinters; often responsible for severe epidemics (early pathogen dispersal)

Courtesy of Debbie Breth

Fire Blight: Blossom Blight



Certain conditions must be met....

- Flowers must be open w/ intact petals
- Accumulation of 198 DH above 65° F: Epiphytic Inoculum Potential (EIP)
- Wetting event (dew or rain)
- Avg. temperature ≥ 60° F

Fire Blight: Shoot Blight

- Symptoms: Shepherd's crook, blackening/necrosis of leaf mid-vein and pedicel
- Reduces bearing wood for following season

Other "Types" of Fire Blight

- Rootstock Blight
  - Systemic infection of rootstock from blossom or shoot blight
  - Managed with resistant rootstocks

- Trauma Blight
  - Mechanical injury to tissue caused by wind, hail, frost, dear feeding etc.

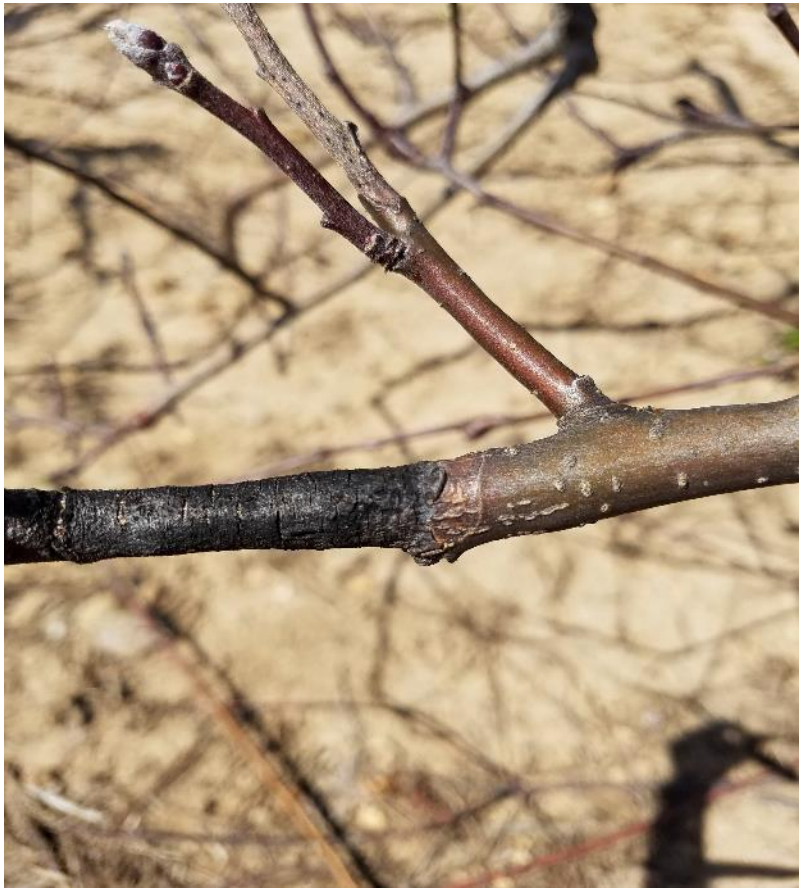
Photo courtesy Alan Biggs

Pre-Season Management of Fire Blight

Target: Cankers

Purpose: Reduce overwintering inoculum to reduce risk of spreading within and across trees

- First Line of Defense: Prune out cankers
  - Large Cankers: in main scaffold/trunk: Normally don't remove
  - Small Cankers: Result from blossom and slowed/aborted shoot infections: Prune and destroy: 12" from canker margin into 2-yr-old wood



Pre-Season Management of Fire Blight

Target: Cankers

Purpose: Reduce overwintering inoculum to reduce risk of spreading within and across trees

- Next Line of Defense: Copper Application
  - Apply full rate of copper at silver/green tip
  - Works only if bacteria are present: Will not get inside
  - Copper Concerns: Phytoxic to fruit and leaves!

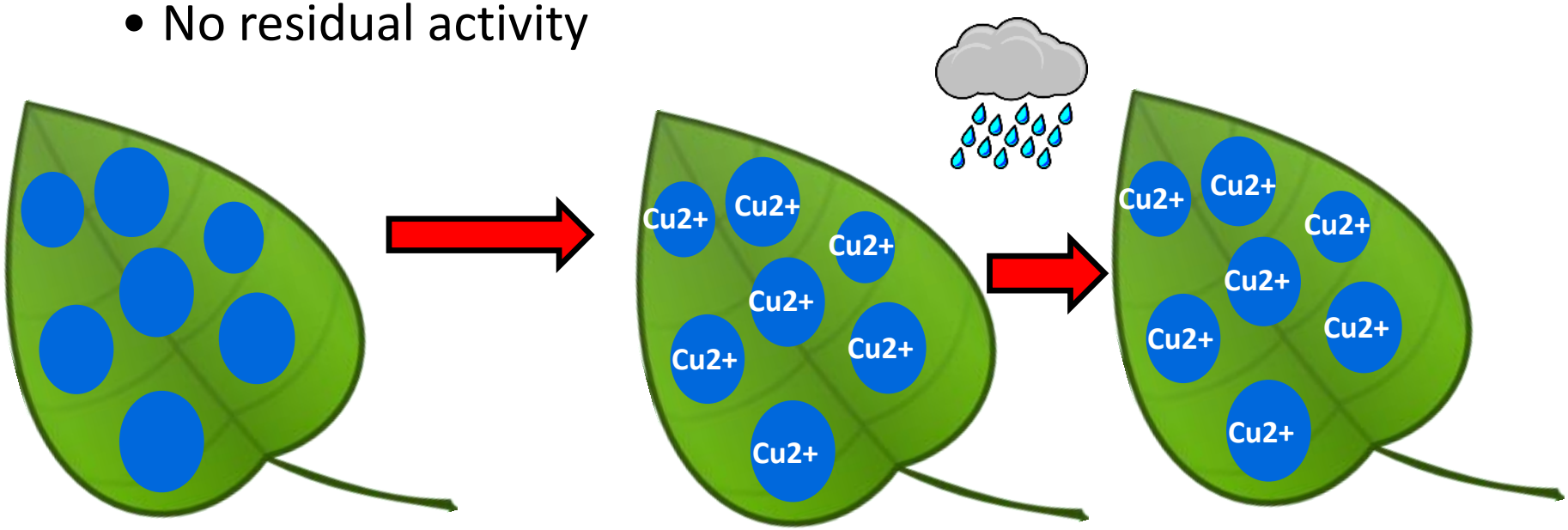
Courtesy of Debbie Breth

Fire Blight Management: Copper

- Copper for disease management
  - Non-discriminatory: Plants, bacteria, fungi, people……
  - Protectant only: Must be applied before pathogen arrives
- How copper works:
  - Contact with water: Cu^{2+} ions released from copper compounds

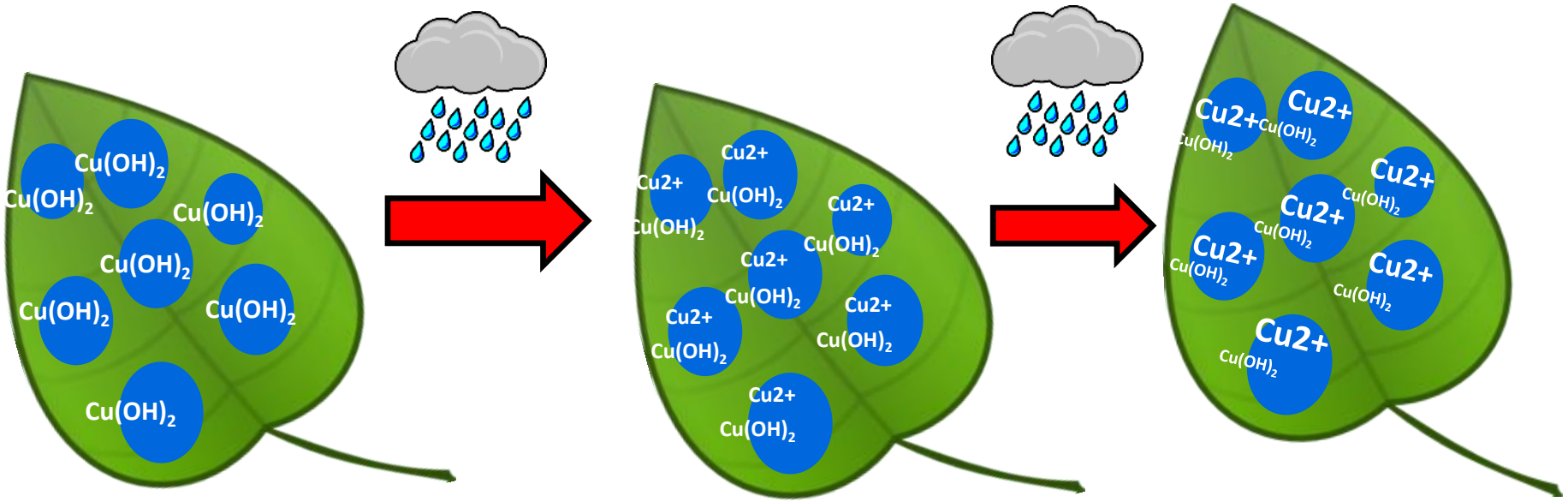
Fire Blight Management: Copper

- 2 types of Copper: Soluble and fixed
- Soluble Coppers: Bluestone Copper/MasterCop
  - Copper Sulfate Pentahydrate
  - All Cu^{2+} available at once upon water contact
    - High phytotoxicity risk + residues removed rapidly by rain
    - No residual activity



Fire Blight Management: Copper

- 2 types of Copper: Soluble and fixed
- Fixed Coppers: Copper particles suspended in water
  - Persist on surface after spray dries
  - Residual activity: Slow release of Cu^{2+} when wet



Fire Blight Management: Copper

- **Copper application advice and warnings**

- Solubility of fixed coppers increases in acidic solutions: Becomes more phytotoxic
  - Choose adjuvants wisely (or don't use at all)
  - Check spray solution pH
  - Do NOT mix with phosphorous acids (e.g.ProPhyt)
  - Avoid applying under slow drying conditions
  - Follow label!

Bloom Management of Fire Blight

Target: Open Blossoms

Purpose: Prevent blossom blight and subsequent shoot infections

- Strategy: Use blossom blight forecasting models to predict infection periods
  - MaryBlyt 7.1
  - CougarBlight
  - NEWA: newa.cornell.edu; uses logic from both models
  - If not using antibiotics- Adjusting EIP and pre-infection interval is essential

Blossom Blight Management: Biopesticides/Reduced Risk Pesticides (RRP)

Applications of Streptomycin are the Gold Standard so Why Use Bio-pesticides/RRP?

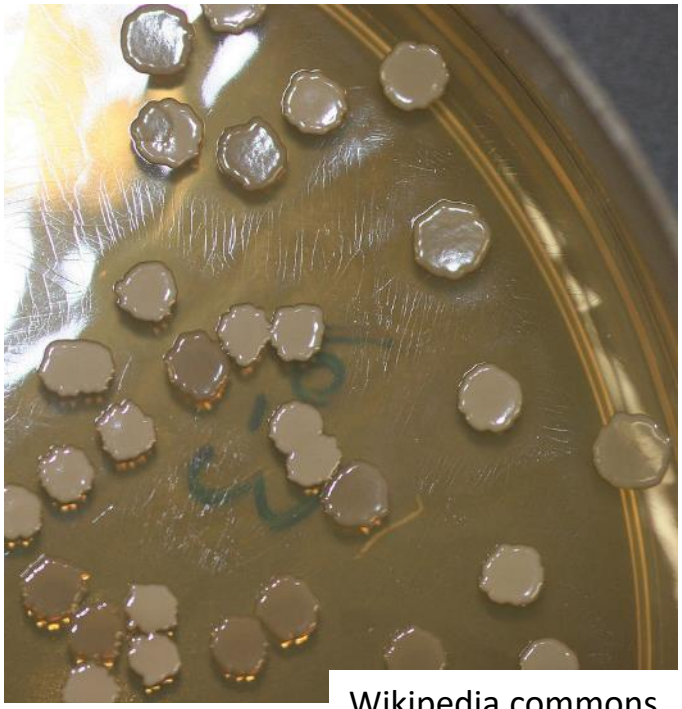
- Consumer demand/marketing
- Residue restrictions
- Organic production
- Extended/rattail bloom
- Low disease pressure: Environment, host resistance, regular incorporation of IPM strategies
- Small orchard allowing for frequent applications
- Antibiotic resistance concerns

Blossom Blight: Biologicals and Reduced Risk Pesticides Options

Serenade Opti: 2 to 7 day application intervals

How it works: Antibiotic metabolites of *Bacillus subtilis*

- Flower colonization is not essential
- (+): Can be tank mixed with other products: coppers, oxidate, antibiotics
- General Opinions: Control of blossom blight consistent, but not great: 18-48% control (Ngugi et al.)



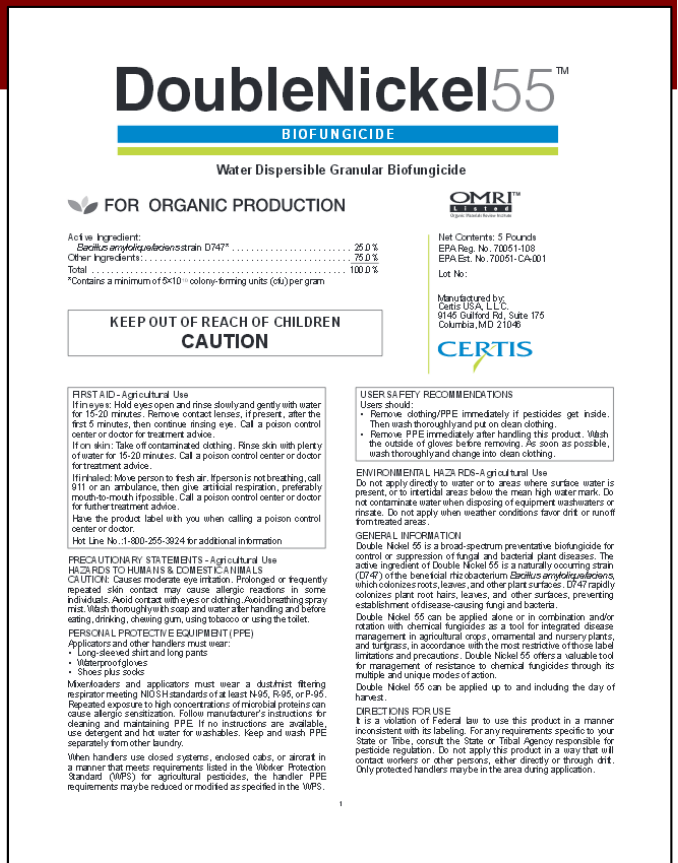
Wikipedia commons

Blossom Blight: Biologicals and Reduced Risk Pesticides Options

Double Nickel55/LC: 3 to 7 day application intervals

How it works: Antibiotic metabolites of *Bacillus amyloliquefaciens*

- Flower colonization is not essential
- (+): Can be tank mixed with other products: coppers, oxidate, antibiotics
- General Observations (NY): >50% blossom blight control under high pressure



DoubleNickel55™

BIOFUNGICIDE

Water Dispersible Granular Biofungicide

FOR ORGANIC PRODUCTION

OMRI Listed

Active Ingredient:
Bacillus amyloliquefaciens strain D747* ..... 25.0 %
Other Ingredients: ..... 75.0 %
Total ..... 100.0 %
*Contains a minimum of 5×10^10 colony-forming units (cfu) per gram

Net Contents: 5 Pounds
EPA Reg. No. 70051-108
EPA Est. No. 70051-CA-001
Lot No:

Manufactured by:
Certis USA, L.L.C.
9145 Guilford Rd, Suite 175
Columbia, MD 21046

CERTIS

KEEP OUT OF REACH OF CHILDREN
CAUTION

FIRST AID - Agricultural Use
If in eyes: Hold eyes open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If on skin: Take off contaminated clothing. Rinse skin with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.
Have the product label with you when calling a poison control center or doctor.
Hot Line No.: 1-800-255-3924 for additional information

PRECAUTIONARY STATEMENTS - Agricultural Use
HAZARDS TO HUMANS & DOMESTIC ANIMALS
CAUTION: Causes moderate eye irritation. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Avoid contact with eyes or clothing. Avoid breathing spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.
PERSONAL PROTECTIVE EQUIPMENT (PPE)
Applicators and other handlers must wear:
- Long-sleeved shirt and long pants
- Waterproof gloves
- Shoes plus socks

Mixer/loaders and applicators must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitization. Follow manufacturer's instructions for cleaning and maintaining PPE. If no instructions are available, use detergent and hot water for washables. Keep and wash PPE separately from other laundry.

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides, the handler PPE requirements may be reduced or modified as specified in the WPS.

USER SAFETY RECOMMENDATIONS
Users should:
- Remove clothing/PPE immediately if pesticides get inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS - Agricultural Use
Do not apply directly to water or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters or rinsate. Do not apply when weather conditions favor drift or runoff from treated areas.

GENERAL INFORMATION
Double Nickel 55 is a broad-spectrum preventative biofungicide for control or suppression of fungal and bacterial plant diseases. The active ingredient of Double Nickel 55 is a naturally occurring strain (D747) of the beneficial rhizobacterium *Bacillus amyloliquefaciens*, which colonizes roots, leaves, and other plant surfaces. D747 rapidly colonizes plant root hairs, leaves, and other surfaces, preventing establishment of disease-causing fungi and bacteria.

Double Nickel 55 can be applied alone or in combination and/or rotation with chemical fungicides as a tool for integrated disease management in agricultural crops, ornamental and nursery plants, and turfgrass, in accordance with the most restrictive of those label limitations and precautions. Double Nickel 55 offers a valuable tool for management of resistance to chemical fungicides through its multiple and unique modes of action.

Double Nickel 55 can be applied up to and including the day of harvest.

DIRECTIONS FOR USE
It is a violation of Federal law to use this product in a manner inconsistent with its labeling. For any requirements specific to your State or Tribe, consult the State or Tribal Agency responsible for pesticide regulation. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Blossom Blight: Biologicals and Reduced Risk Pesticides Options

Blossom Protect: Apply 10, 40, 70, 90% bloom

How it works: *Aureobasidium pullulans* (yeast) strains: Colonization of stigmatic surface

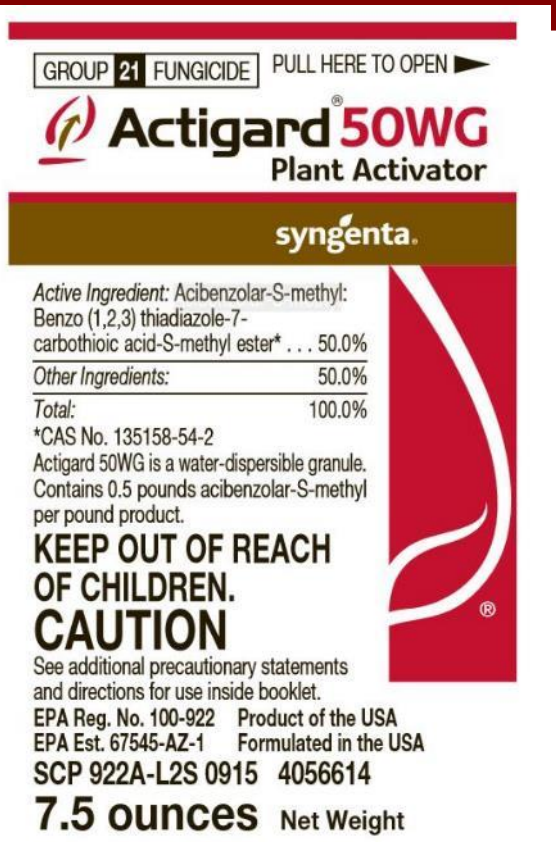
- (-) Russeting concerns?
- (-) Fungicide tank mixes: Limited
- Applied w/ **Buffer Protect**: Makes stigmatic surface less suitable for *E. amylovora*
- General observations (humid regions): 33-88% control

Blossom Blight: Biologicals and Reduced Risk Pesticides Options

ISR/SAR Inducers: Actigard, LifeGard, Regalia

How it works: Activates natural defense genes in host

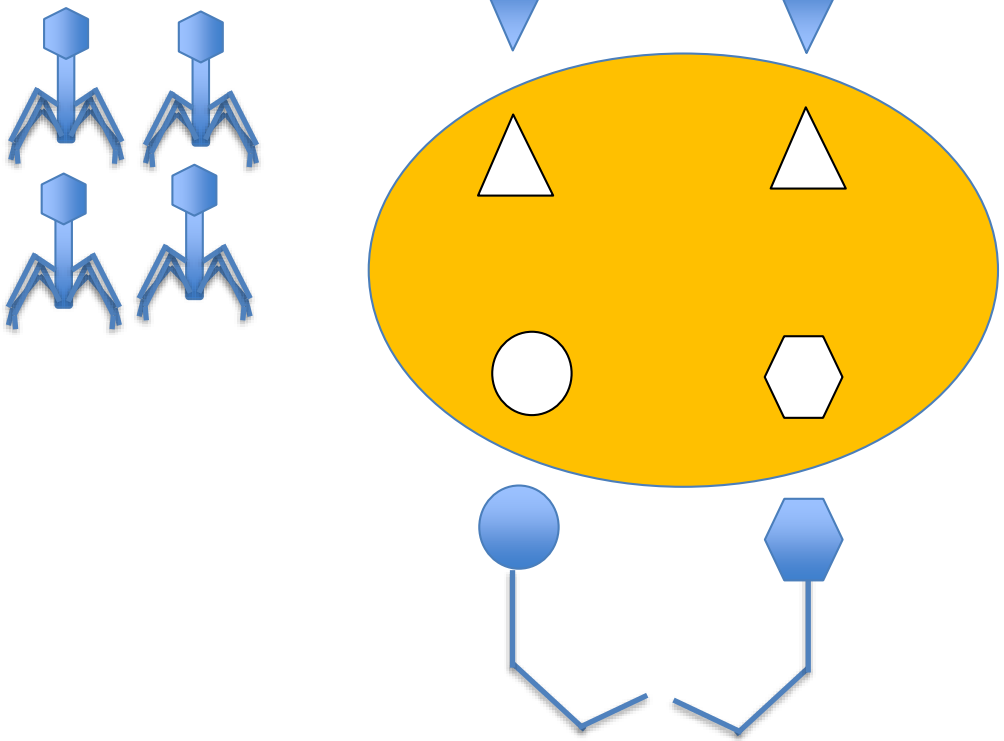
- Must be applied days to weeks in advance of infection event
- Control has been variable
- General observations (humid regions): LifeGard: 54- 72.6% control (2016 and 2017)



Blossom Blight: Biologicals and Reduced Risk Pesticides Options

Bacteriophage “phage”: Agriphage

How it works: Activates natural defense genes in host



Phage Obstacles

- **Survival**: Desiccation
- **Survival:** UV radiation
- **Efficacy:** Local strain specificity
- **Pathogen Accessibility**: Curative only?
- **Pathogen Accessibility**: Delivery method

Disease Forecasting

- IPM tool using predictive models to minimize losses from a disease epidemic
- Generally includes all aspects of the disease triangle
  - Susceptible host
  - Presence of pathogen with ability to infect host
  - Weather conditions that are favorable for infection AND disease development
- Allow growers to make more informed decisions regarding pesticide application timing
  - Might reduce # of pesticide applications and decrease risk of fungicide resistance

Blossom Blight Forecasting: MaryBlyt

- Only compatible with Windows operating systems

Blossom Blight Forecasting: MaryBlyt Inputs

Maryblyt 7.1

File Edit Options Help

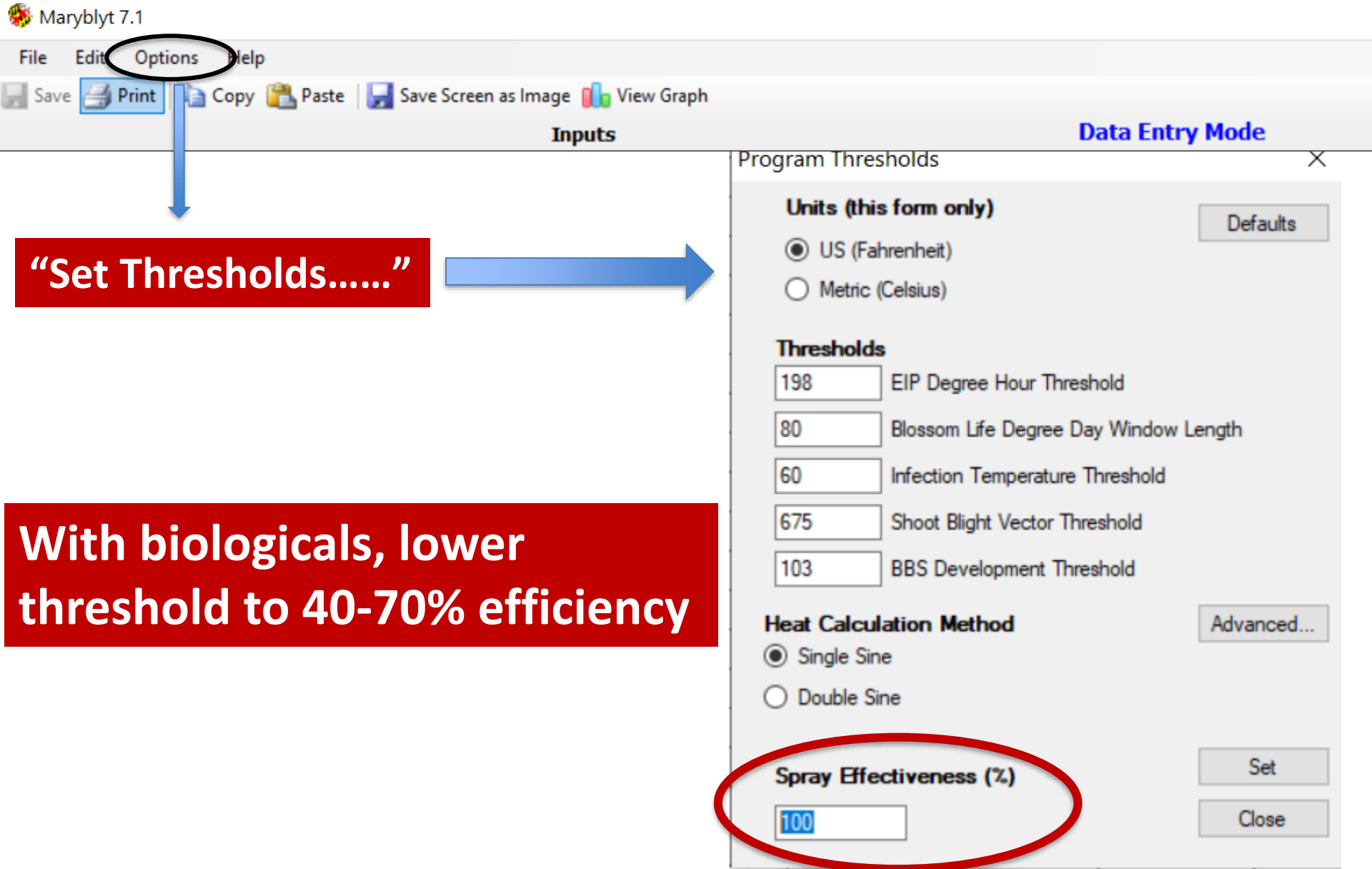
Save | Print | Copy | Paste | Save Screen as Image | View Graph

Inputs — **Data Entry Mode**

Date	Phenology	Max Temp (F)	Min Temp (F)	Wetness (in)	Trauma	Spray	Notes
4/1/2020	PINK	50.5	28.3	0.00			
4/2/2020	PINK	52.2	33.3	0.00			
4/3/2020	PINK	65.0	35.4	0.00			
4/4/2020	PINK	67.2	39.5	0.00			
4/5/2020	PINK	57.0	50.0	0.27			
4/6/2020	PINK	69.6	55.1	0.00			
4/7/2020	PINK	69.9	56.2	0.00			
4/8/2020	BLOOM	73.6	60.8	0.86			
4/9/2020	BLOOM	73.7	59.8	0.01			
4/10/2020	BLOOM	74.2	53.4	0.00			
4/11/2020	BLOOM	73.0	49.5	0.00			

- Inputs: Date, Host Phenology, Max and Min. Temps, Wetness (Rain or Dew)

Blossom Blight Forecasting: MaryBlyt



With biologicals, lower threshold to 40-70% efficiency

Blossom Blight Forecasting: MaryBlyt

B= open flowers

H= EIP > 100

W= wetting from rain, dew, pesticide app. (current day)

T= mean temp >60F

R= Risk level: based on "+ #"

Outputs

Avg Temp (F)	EIP	BHWTR	BBS	CBS	SBS	TBS
68.9	-	-	-	17	-	-
65.0	36	+ - + + H	-	22	-	-
61.8	73	+ - + + H	-	26	-	-
66.2	145	+ + - + H	-	32	-	-
72.0	255	+ + + + I	-	41	-	-
72.4	279	+ + + + I	17 a	49	-	-
70.3	267	+ + + + I	31 a	57	-	-
54.2	105	+ + + - H	34 a	59	-	-

Let's take a look!

https://www.wunderground.com/history

Now You Try!

- 6 groups (2-3 per group)
- Visit: www.weatherunderground.com/history
- Locations:
  - Raleigh, NC
  - Statesville, NC
  - Hendersonville, NC
- 2 Management Paradigms:
  - Conventional (strep, 100% efficiency)
  - Organic (biological products, 50% efficiency)

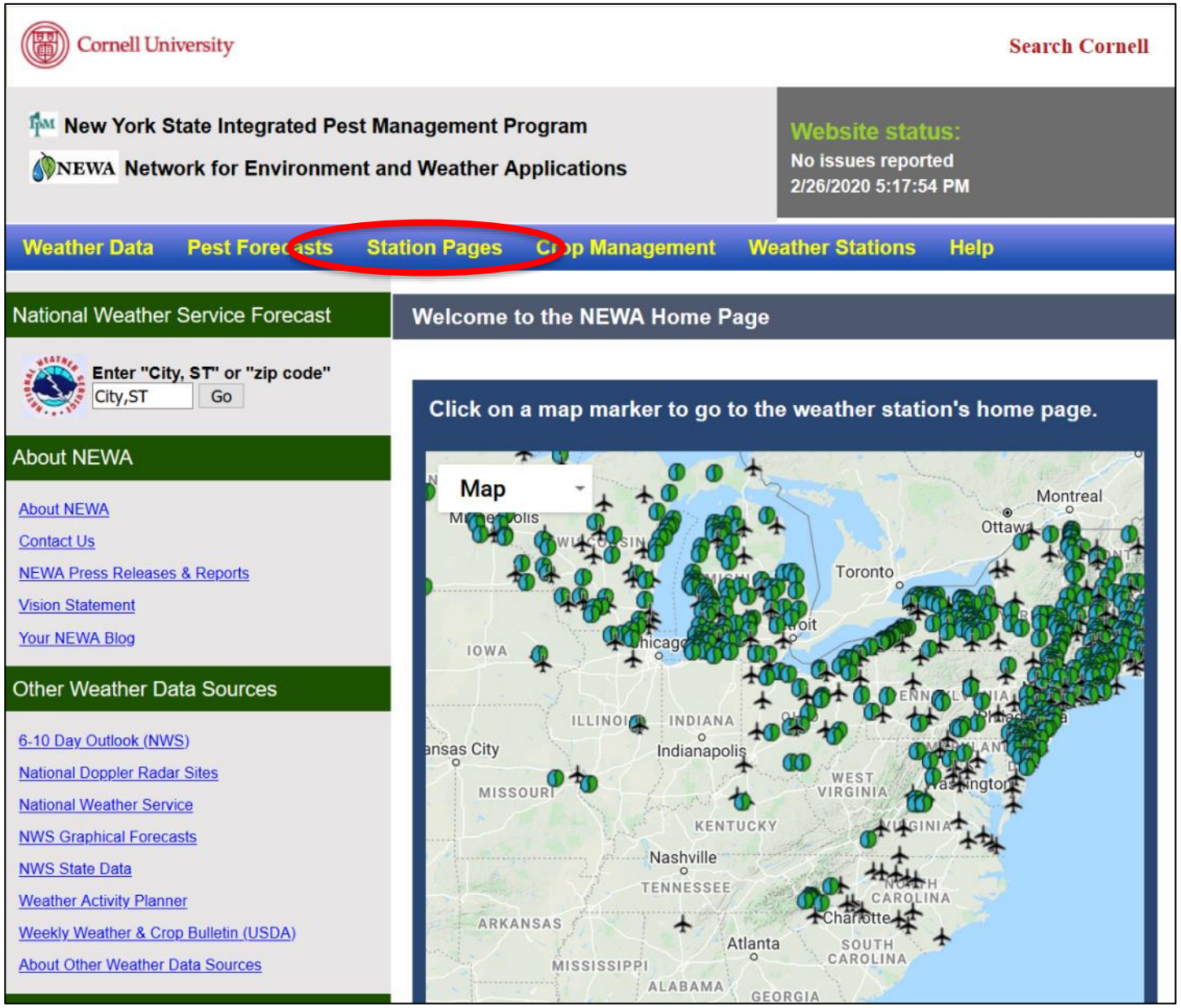
Now You Try!

- 6 groups (2-3 per group)
- Visit: www.weatherunderground.com/history

Questions to Ponder

- How many high risk infection events were you able to manage (e.g. how many “high” went to medium or low)?
- How many severe infection events were you able to manage (e.g. how many “I” went to high or medium or low)?
- How did environment impact control?
- Biological Groups: Did any applications actually increase likelihood of infection? Why??

A Quicker and Easier Method?: NEWA!

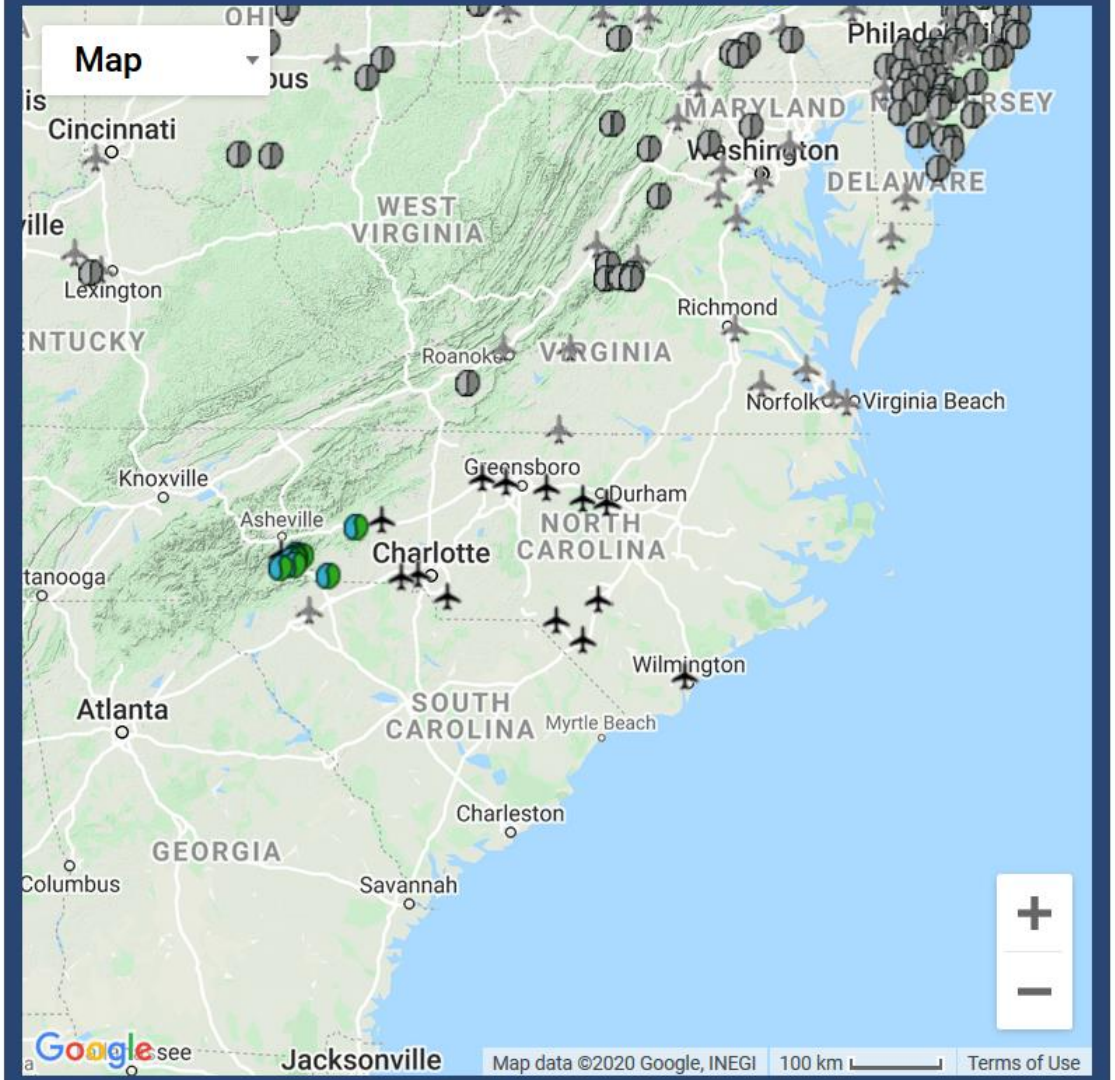


Weather Stations in North Carolina

Weather Stations
Asheville
Burlington
Chapel Hill
Charlotte
Edneyville (Apple Wedge)
Edneyville (Lewis Creek)
Edneyville (M&M Berry Farm)
Edneyville (Sugarloaf Mtn)
Fayetteville
Flat Rock (Richmind)
Gastonia
Green Creek (Polk Co Ag)
Greensboro
Hendersonville (Klimstra)
Hendersonville (St Paul)
Hickory
Laurinburg
Lumberton
Monroe
Morganton (Apple Hill Orchard)
Raleigh-Durham
Wilmington
Winston-Salem

23 records found.

Click on a map marker to go to the weather station's home page.



Weather Data Quick Links

Past 12 months shown. Current month highlighted.

Daily Summary
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Hourly Data
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Growing Degree Days (Base 50F)
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Growing Degree Days (Base 50F BE)
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Growing Degree Days (Base 86/50F)
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

National Weather Service Forecast

Enter "City, ST" or "zip code"
City,ST Go

This Station's 7-Day Forecast

National Doppler Radar Sites

Helpful Links

How to Use and Interpret Pest Forecasts
Select a link from list...

Pest Management Guidelines
Select a link from list...

University Cooperative Extension Programs
Select a link from list...

Edneyville (Apple Wedge), NC Weather Station Page

These Station Page forecasts are most accurate when you use your own biofix dates. Otherwise, the current results displayed will use NEWA's default biofix dates. **Enter your biofix dates on the forecast page, where prompted, for more accurate model predictions.** After getting the Station Page forecast results, use the interface on the left to get query results for prior years, dates, and locations.

Edneyville (Apple Wedge) Pest Forecasts

Apple Scab
Fire Blight
Sooty Blotch/Flyspeck
Leaf Wetness Events
Spotted Tentiform Leafminer
Oriental Fruit Moth
Codling Moth
Plum Curculio
Obliquebanded Leafroller
Apple Maggot
San Jose Scale
Grape Diseases
Grapevine Downy Mildew
Grape Berry Moth
Cabbage Maggot
Onion Maggot
Onion Diseases
Potato Diseases
Tomato Diseases

Station Location

Lat/Lon: 35.4/-82.35
Elevation: 2248 ft.

Last Download

2/26/2020 5 PM

Station Sensors

Temperature
Leaf Wetness
Precipitation
Relative Humidity
Wind Speed
Wind Direction
Solar Radiation

Fire Blight

State:
North Carolina

Weather station:
Edneyville (Apple Wedge)

Date of Interest:
04/08/2019

Calculate

Fire Blight Risk Predictions for Edneyville (Apple Wedge)

Orchard Blight History: Fire blight occurred in your neighborhood last year.

Select the fire blight history in your orchard block of interest and the tool will calculate risk. Toggle orchard blight history to recalculate risk.

First blossom open date: 4/8/2019 Click if bloom has not occurred

The first blossom open date above is estimated based on degree day accumulations. Enter the actual first blossom open date for your orchard block of interest and the tool will calculate the protection period during bloom more accurately.

Accumulated degree days (base 43°F) through 4/8/2019: 711 (0 days missing)

	Past	Past	Current	Ensuing 5 Days				
Date	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Cougarblight 4-Day DH	- -	- -	- -	Caution* 185*	High* 315*	High* 444*	Extreme 580	Extreme 574
Infection Potential EIP value	- -	- -	- -	High 83	Infection 117	High 151	Infection 143	Infection 140
Wetness Events								
Rain Amount	0.00	0.00	0.85	0.02	0.00	0.00	0.06	0.02
Dew	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Leaf Wetness (hours)	0	3	11	12	0	0	6	5
Hours >90% RH	12	10	19	12	1	0	2	15
RH max/min	97/51	99/76	100/78	99/65	91/29	88/41	93/53	100/69
Temp avg F	62	63	67	66	64	61	67	68

NA - data not available

View Cougarblight Charts

Download Time: 4/14/2019 23:00

** Indicates incomplete accumulation of the 4-day DH total. The DH value may reach "Caution", "High" or "Extreme" levels before spanning the 4-day accumulation cut-off time of Cougarblight.*

Streptomycin Spray Date: Click to enter date

If you applied streptomycin before all flowers were open, enter the date of the streptomycin application to recalculate

Blossom Blight Forecasting: NEWA

Low risk	If none of these conditions is met during bloom, risk is **'Low'** and bactericides are not needed.
Caution or Moderate risk	If only the heat units are met during bloom, Cougarblight risk is **'Caution'** and it is advisable to watch the forecast closely for continuing warm weather and rain. If only one of these conditions is met during bloom, Infection Potential risk is **'Moderate'** and it is advisable to watch the forecast closely for continuing warm weather and rain.
High risk	If two conditions are met during bloom, risk is **'High'** and forecasted wetting events should be carefully considered and a bactericide applied just before (or after) a rain.
Extreme or Infection risk	If all three conditions are met, risk is **'Extreme'** or **'Infection'** and an antibiotic should be applied just before (or after) a rain.

Fire Blight

State: North Carolina

Weather station: Edneyville (Apple Wedge)

Date of Interest: 04/08/2019

Calculate

Fire Blight Risk Predictions for Edneyville (Apple Wedge)

Orchard Blight History: Fire blight occurred in your neighborhood last year.

Select the fire blight history in your orchard block of interest and the tool will calculate risk. Toggle orchard blight history to recalculate risk.

First blossom open date: 4/8/2019 Click if bloom has not occurred

The first blossom open date above is estimated based on degree day accumulations. Enter the actual first blossom open date for your orchard block of interest and the tool will calculate the protection period during bloom more accurately.

Accumulated degree days (base 43°F) through 4/8/2019: 711 (0 days missing)

	Past	Past	Current	Ensuing 5 Days				
Date	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Cougarblight 4-Day DH	- -	- -	- -	Caution* 185*	High* 315*	High* 444*	Extreme 580	Extreme 574
Infection Potential EIP value	- -	- -	- -	High 83	Infection 117	High 151	Infection 143	Infection 140
Wetness Events								
Rain Amount	0.00	0.00	0.85	0.02	0.00	0.00	0.06	0.02
Dew ?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Leaf Wetness (hours)	0	3	11	12	0	0	6	5
Hours >90% RH	12	10	19	12	1	0	2	15
RH max/min	97/51	99/76	100/78	99/65	91/29	88/41	93/53	100/69
Temp avg F	62	63	67	66	64	61	67	68

NA - data not available

View Cougarblight Charts

Download Time: 4/14/2019 23:00

** Indicates incomplete accumulation of the 4-day DH total. The DH value may reach "Caution", "High" or "Extreme" levels before spanning the 4-day accumulation cut-off time of Cougarblight.*

Streptomycin Spray Date: Click to enter date

If you applied streptomycin before all flowers were open, enter the date of the streptomycin application to recalculate

- Open flowers
- Heat unit accumulation
- Wetting event
- Avg. temp > 60F

First blossom open date: 4/8/2019 Click if bloom has not occurred

The first blossom open date above is estimated based on degree day accumulations. Enter the actual first blossom open date for your orchard block of interest and the tool will calculate the protection period during bloom more accurately.

Accumulated degree days (base 43°F) through 4/8/2019: 711 (0 days missing)

	Past	Past	Current	Ensuing 5 Days				
Date	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Cougarblight	-	-	-	-	Low*	Caution*	High*	Extreme
4-Day DH	-	-	-	-	130*	259*	395*	574
Infection Potential	-	-	-	High	High	Moderate	High	Infection
EIP value	-	-	-	0	34	67	97	140
Wetness Events								
Rain Amount	0.00	0.00	0.85	0.02	0.00	0.00	0.06	0.02
Dew ?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Leaf Wetness (hours)	0	3	11	12	0	0	6	5
Hours >90% RH	12	10	19	12	1	0	2	15
RH max/min	97/51	99/76	100/78	99/65	91/29	88/41	93/53	100/69
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Streptomycin Spray Date: 4/9/2019

If you applied streptomycin before all flowers were open, enter the date of the streptomycin application to recalculate fire blight risk predictions.

Edneyville (Apple Wedge)

Date of Interest:
04/08/2019

Calculate

First blossom open date: 4/8/2019 Click if bloom has not occurred

The first blossom open date above is estimated based on degree day accumulations. Enter the actual first blossom open date for your orchard block of interest and the tool will calculate the protection period during bloom more accurately.

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Cougarblight 4-Day DH	- -	- -	- -	Caution* 185*	High* 315*	High* 444*	- -	Caution* 178*
Infection Potential EIP value	- -	- -	- -	High 83	Infection 117	High 151	High 0	High 43
Wetness Events								
Rain Amount	0.00	0.00	0.85	0.02	0.00	0.00	0.06	0.02
Dew	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Leaf Wetness (hours)	0	3	11	12	0	0	6	5
Hours >90% RH	12	10	19	12	1	0	2	15
RH max/min	97/51	99/76	100/78	99/65	91/29	88/41	93/53	100/69
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View Cougarblight Charts

Download Time: 4/14/2019 23:00

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Streptomycin Spray Date: 4/12/2019

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Date of Interest:
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Dew	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
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View Cougarblight Charts

Download Time: 4/14/2019 23:00

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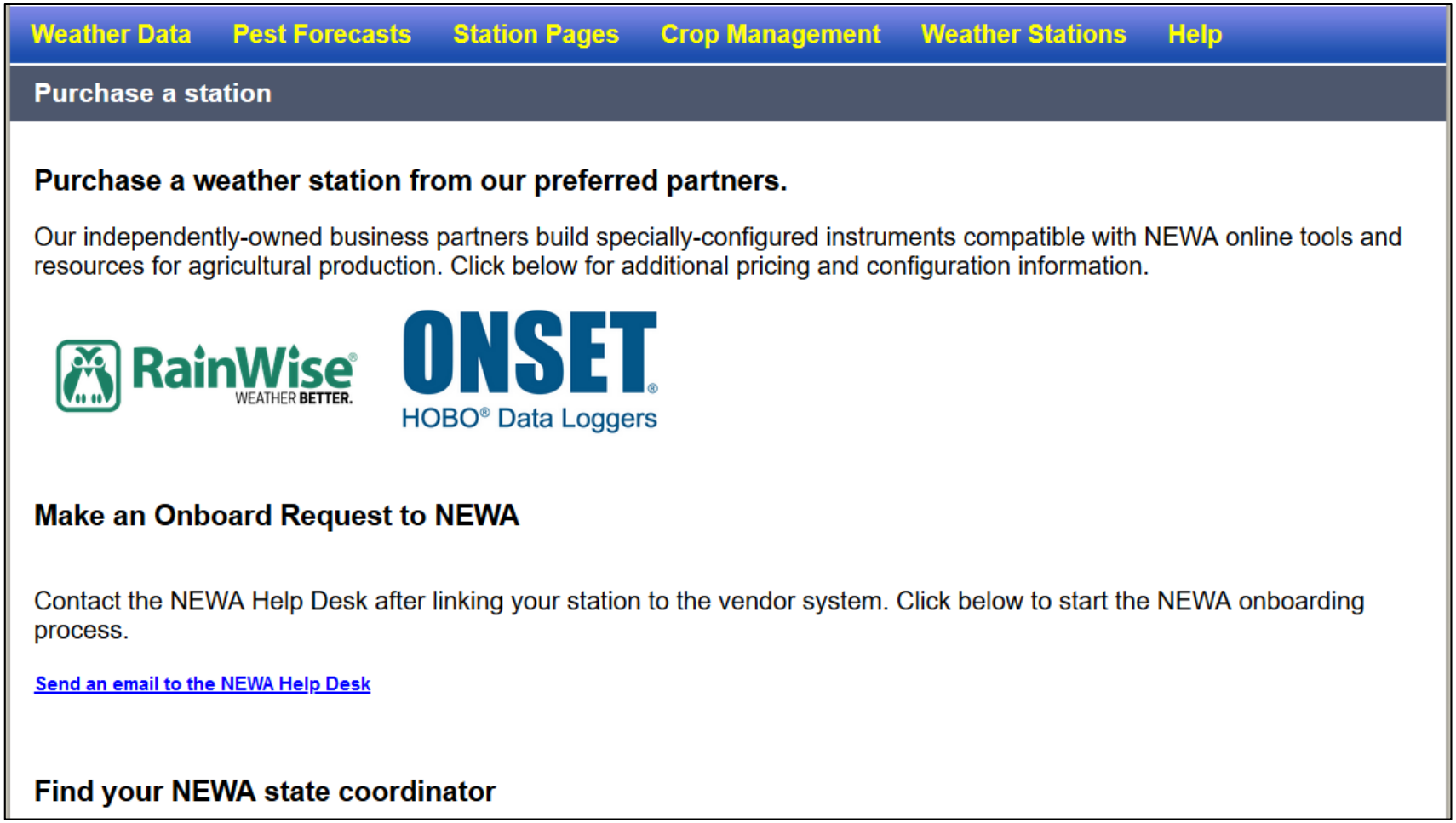
Streptomycin Spray Date: 4/12/2019

If you applied streptomycin before all flowers were open, enter the date of the streptomycin application to recalculate fire blight risk predictions.

Acquiring a NEWA Weather Station



- Onset: Annual state fee paid for by NC Apple Growers Association
- Contact Mike Parker (State Coordinator) for station purchase

Acquiring a NEWA Weather Station

- AgroMET Rainwise Weather System
- Records temperature, leaf wetness, relative humidity, precipitation, solar radiation, wind speed, wind direction
- Cost: $1890

Acquiring a NEWA Weather Station

- RX3000 series
- Connection options: cellular (data plan w/ annual cost, wifi, ethernet
- Base Cost: $1896 but highly configurable with several upgrade/add-on options available
  - For example, set wireless sensors in “problem areas”

Shoot Blight Management

Target: Actively growing shoots

Purpose: Prevent infections of shoots and slow migration of bacteria

- First line of defense: Chemical Management
  - Prohexadione Calcium
  - Copper (young and/or organic plantings)
  - ISR/SAR inducers: Young plantings?

Shoot Blight: Biologicals and Reduced Risk Pesticides Options

Prohexadione calcium: Apogee, Kudos

How it works: Thickens xylem cell walls + stops terminal growth

- Best protection against shoot blight
- Make two applications: 6-12 oz/100 gal (3-6 oz/100 gal for tree <5 years): 1-3” shoot growth & 14-21 days later
- “Trickle” program 1-3 oz/100 gal: beginning late bloom every 14-21 days till terminal bud set

Shoot Blight: Biologicals and Reduced Risk Pesticides Options

Coppers: Kocide 3000, Cueva, Badge SC/X2 + others

How it works: Protectant: Reduces bacteria on surface and prevents against new infections only

- Can cause fruit russet: not a concern in nursery or during establishment - survival
- Apply with adequate drying time
- Terminals can outgrow protective residues of copper
- Low rate fixed copper program: 7-10 day schedule until terminal bud set

Shoot Blight Management

Target: Actively growing shoots

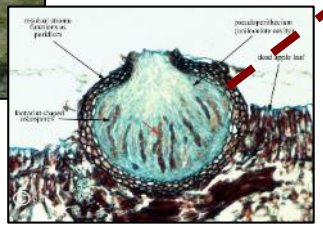
- 2nd Line of Defense: Pruning newly developed strikes
  - Remove ASAP on cool, dry day
  - Cut into previous season's growth: ~12 inches into healthy tissue
  - Young trees: If infection is in the main scaffold or close, remove tree
  - Rescue: Apogee 6-12 oz/100 gal, wait 5 days, then prune every two weeks until terminal bud set

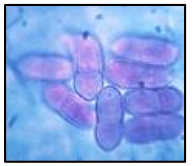
There are models on NEWA for apple scab as well!

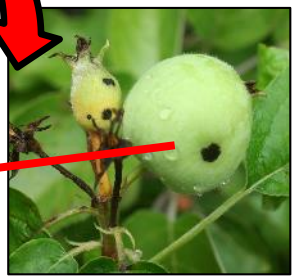
Apple Scab: *Venturia inaequalis*

"Early Season Disease"

- Early: Causes lesions on leaves and fruit
- Late: Premature defoliation, fruit cracking
- Cool, humid spring climate + highly susceptible cultivars: favorable infection conditions
- Management: Green Tissue through 1st cover (primary infection, then scout)





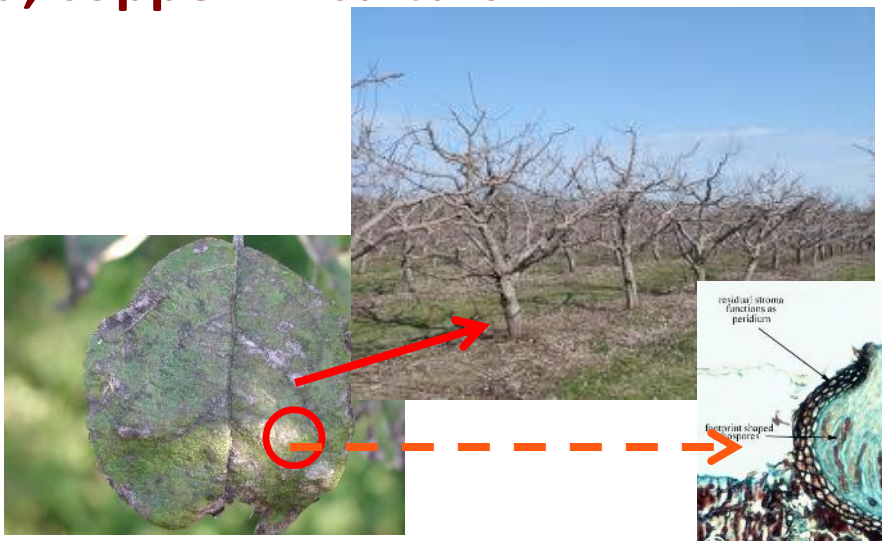


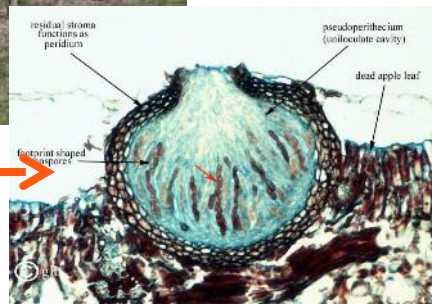
Apple Scab: Preseason/Cultural

- 5% urea to orchard floor + trees
- Flail mow to increase leaf surface area

Apple Scab Chemical Management

Dormant / silver: urea, copper + "cultural control"





http://www.uoguelph.ca/~gbarron/Misc2009/applemic.htm

Green tip, ½ inch green, tight cluster: captozeb, dodine, SDHIs?

Weather Data Quick Links

Past 12 months shown. Current month highlighted.

Daily Summary
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Hourly Data
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Growing Degree Days (Base 50F)
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Growing Degree Days (Base 50F BE)
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

Growing Degree Days (Base 86/50F)
Mar | Apr | May | Jun | Jul | Aug
Sep | Oct | Nov | Dec | Jan | Feb

National Weather Service Forecast

Enter "City, ST" or "zip code"
City,ST Go

This Station's 7-Day Forecast

National Doppler Radar Sites

Helpful Links

How to Use and Interpret Pest Forecasts
Select a link from list...

Pest Management Guidelines
Select a link from list...

University Cooperative Extension Programs
Select a link from list...

Edneyville (Apple Wedge), NC Weather Station Page

These Station Page forecasts are most accurate when you use your own biofix dates. Otherwise, the current results displayed will use NEWA's default biofix dates. **Enter your biofix dates on the forecast page, where prompted, for more accurate model predictions.** After getting the Station Page forecast results, use the interface on the left to get query results for prior years, dates, and locations.

Edneyville (Apple Wedge) Pest Forecasts

Apple Scab
Fire Blight
Sooty Blotch/Flyspeck
Leaf Wetness Events
Spotted Tentiform Leafminer
Oriental Fruit Moth
Codling Moth
Plum Curculio
Obliquebanded Leafroller
Apple Maggot
San Jose Scale
Grape Diseases
Grapevine Downy Mildew
Grape Berry Moth
Cabbage Maggot
Onion Maggot
Onion Diseases
Potato Diseases
Tomato Diseases

Station Location

Lat/Lon: 35.4/-82.35

Elevation: 2248 ft.

Last Download

2/26/2020 5 PM

Station Sensors

Temperature
Leaf Wetness
Precipitation
Relative Humidity
Wind Speed
Wind Direction
Solar Radiation

Disease Forecasting: Apple Scab

State: North Carolina

Weather station: Hendersonville (Klimstra)

Date of Interest: 03/31/2016

Calculate

Apple Scab Results for Hendersonville (Klimstra)

The Ascospore Maturity degree day model begins at 50% green tip on McIntosh flower buds and provides an estimate of the potential for ascospore discharge in the next rain. To recalculate ascospore maturity for your orchard, enter your green tip date:

Green Tip Date: 3/1/2016

Ascospore Maturity Summary

	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 29	Mar 30	Mar 31	Apr 1	Apr 2	Apr 3	Apr 4	Apr 5
Ascospore Maturity	78%	81%	84%	88%	90%	91%	93%	94%

Ascospore Maturity Graphs

Spores available for primary infection

Infection Events Summary

	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 29	Mar 30	Mar 31	Apr 1	Apr 2	Apr 3	Apr 4	Apr 5
Infection Events	No	No	Combined	Combined	Yes	No	No	No
Days to Symptoms	-	-	-	-	12-13	-	-	-
Average Temp (F) for wet hours			59	61	52	43	60	39
Leaf Wetness (hours)	0	0	16	19	10	2	1	1
Rain Amount	0.00	0.00	0.22	0.50	0.08	0.00	0.00	0.00
Rain Prob (%) Night|Day			60 | 60	92 | 53	83 | 5	1 | 1	0 | 7	13 | 0

- Minimal user input: Susceptible host tissue!
- Disease forecast only as good as weather forecast

Disease Forecasting: Apple Scab

Ascospore Maturity Summary

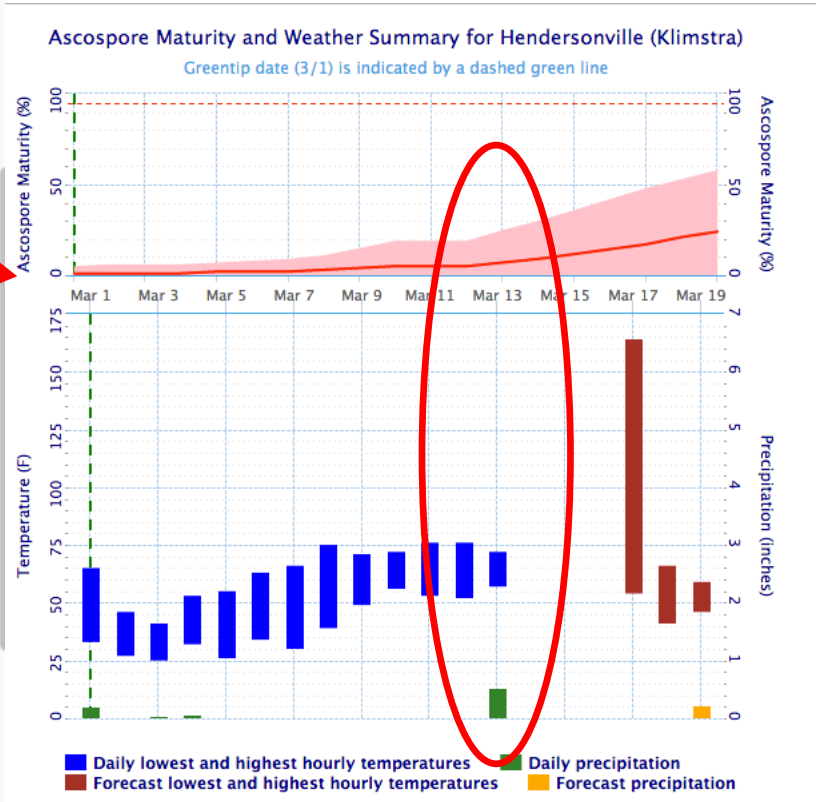
	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 11	Mar 12	Mar 13	Mar 14	Mar 15	Mar 16	Mar 17	Mar 18
Ascospore Maturity	5%	5%	7%	9%	-	-	17%	21%

Ascospore Maturity Graphs

Infection Events Summary

	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 11	Mar 12	Mar 13	Mar 14	Mar 15	Mar 16	Mar 17	Mar 18
Infection Events	No	No	No	No	No	No	No	No
Days to Symptoms	-	-	-	-	-	-	-	-
Average Temp (F) for wet hours			59					51
Leaf Wetness (hours)	0	0	6					2
Rain Amount	0.00	0.00	0.53	0.00			0.00	0.00
Rain Prob (%) Night|Day			36 | 0	- | 0	- | -	- | -	- | 0	10 | 7

Download Time: 3/13/2016 23:00



- Environment: Rainfall amount, wetting duration (leaf wetness), and average temp during wet hours important for apple scab model

Disease Forecasting: Apple Scab

Ascospore Maturity Summary

	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 11	Mar 12	Mar 13	Mar 14	Mar 15	Mar 16	Mar 17	Mar 18
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Ascospore Maturity Graphs

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Days to Symptoms	-	-	-	-	-	-	-	-
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Leaf Wetness (hours)	0	0	6					2
Rain Amount	0.00	0.00	0.53	0.00			0.00	0.00
Rain Prob (%) Night|Day			36 | 0	- | 0	- | -	- | -	- | 0	10 | 7

Download Time: 3/13/2016 23:00

- Generally more wetting hours required when cooler temperature

Revised Mills Table for primary apple scab infections

Temperature (˚F)	Hours [1]	Lesions Appearance (days) [2]
34	41	-
36	35	-
37	30	-
39	28	-
41	21	-
43	18	17
45	15	17
46	13	17
48	12	17
50	11	16
52	9	15
54-56	8	14
57-59	7	12-13
61-75	6	9-10
77	8	-
79	11	-

Disease Forecasting: Apple Scab

- Apple scab ascospore maturity degree day model

Ascospore Maturity Summary

	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 25	Mar 26	Mar 27	Mar 28	Mar 29	Mar 30	Mar 31	Apr 1
Ascospore Maturity	58%	62%	68%	73%	77%	80%	84%	88%

Ascospore Maturity Graphs

Infection Events Summary

	Past	Past	Current	5-Day Forecast				Forecast Details
	Mar 25	Mar 26	Mar 27	Mar 28	Mar 29	Mar 30	Mar 31	Apr 1
Infection Events	No	Combined	Combined	Yes	No	No	Combined	Combined
Days to Symptoms	-	-	-	14	-	-	-	-
Average Temp (F) for wet hours		58	54	54		50	58	61
Leaf Wetness (hours)	0	4	18	10	0	2	21	19
Rain Amount	0.00	0.00	0.20	0.09	0.00	0.00	0.33	0.51
Rain Prob (%) Night|Day			60 | 60	63 | 2	0 | 0	1 | 4	30 | 77	92 | 53

Temperature (˚F)	Hours [1]	Lesions Appearance (days) [2]
34	41	-
36	35	-
37	30	-
39	28	-
41	21	-
43	18	17
45	15	17
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Apply fungicide?

Fungicide should have been applied

Disease Forecasting: Apple Scab

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77	8	-
79	11	-

Apply fungicide?

Fungicide should have been applied

The New and Improved

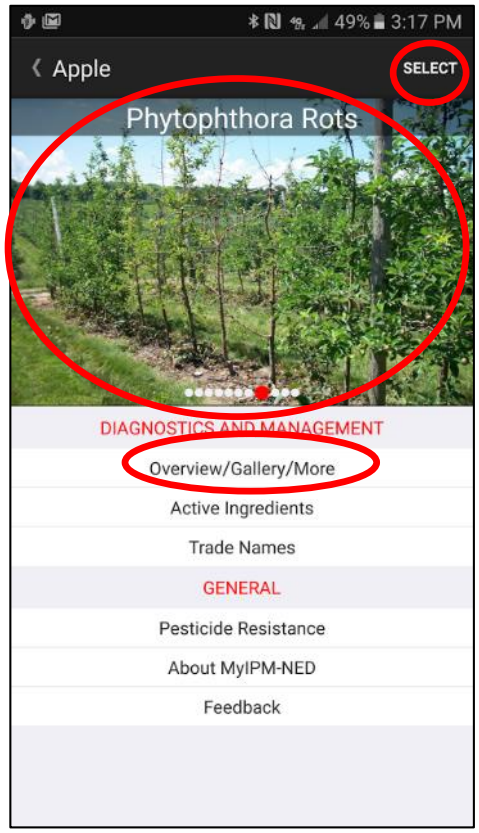
MyIPM App

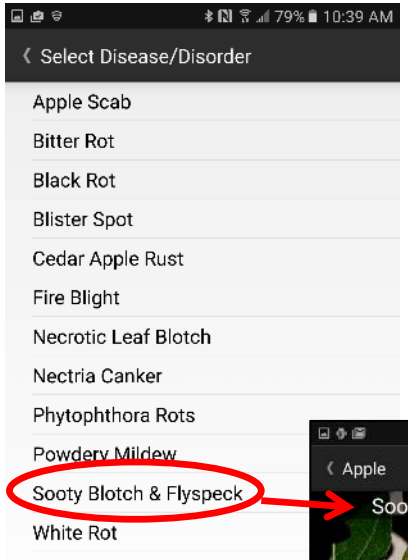
- Apples: Disease, Insect
- Pears: Disease, Insect
- Strawberry: Disease, Insect, Weeds
- Pecan: Insect
- Pear: Disease, Insect
- Cranberry: Disease
- Cherry: Disease, Insect
- Bunch Grape: Disease, Insect
- Blueberry: Disease, Insect
- Blackberry: Disease

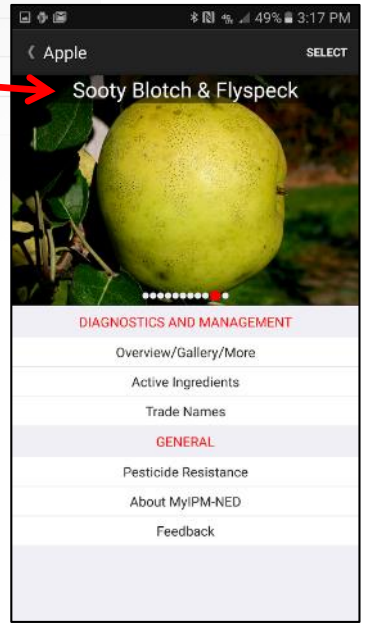
Information Provided by MyIPM App

- Diseases: 9 fruit crops
- Insects: 8 fruit crops + beneficials
- Diagnostics
  - Insect/Pathogen biology
  - Disease signs/symptoms
  - High quality, zoomable photo gallery
- Chemical, biological, cultural control
- Audio from specialists

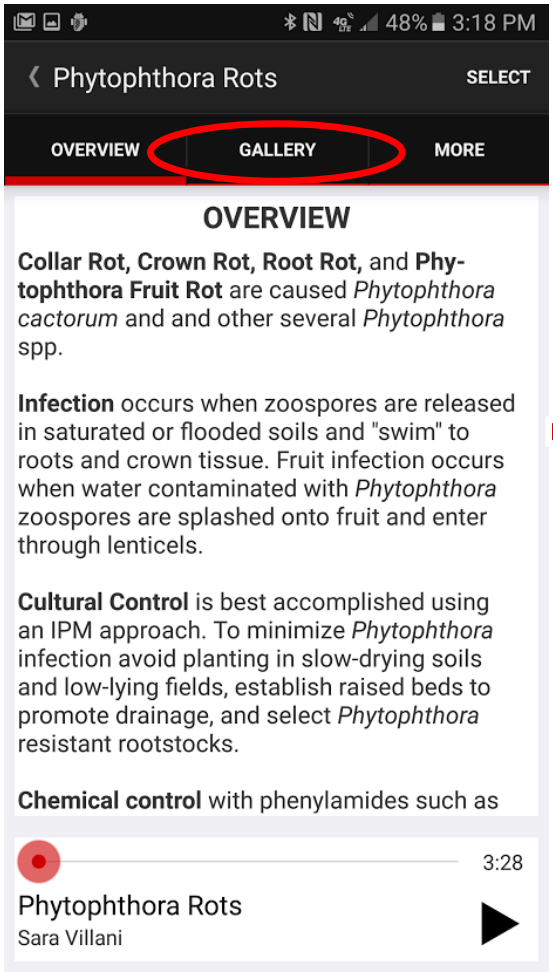
MyIPM App: Apple

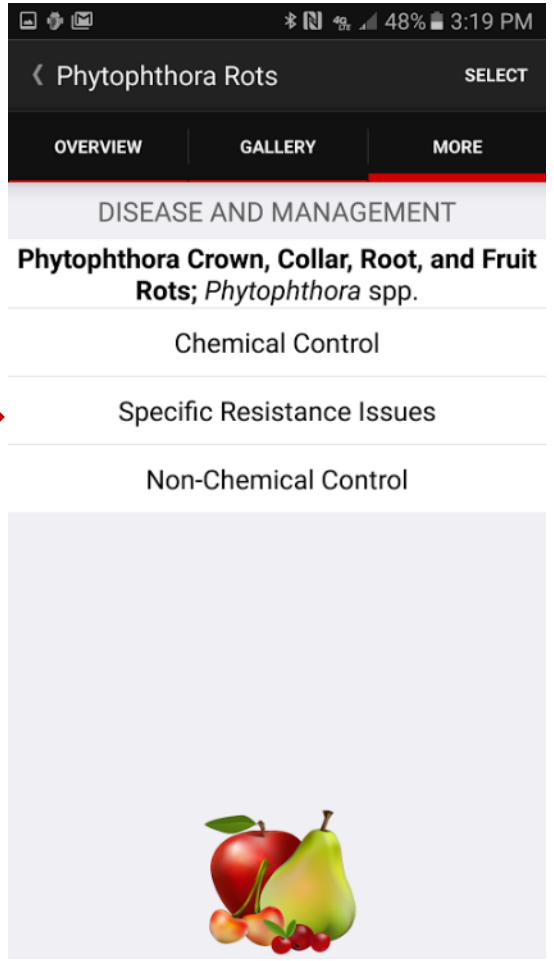






Scroll between diseases or click on “select” to help with identification and access more information

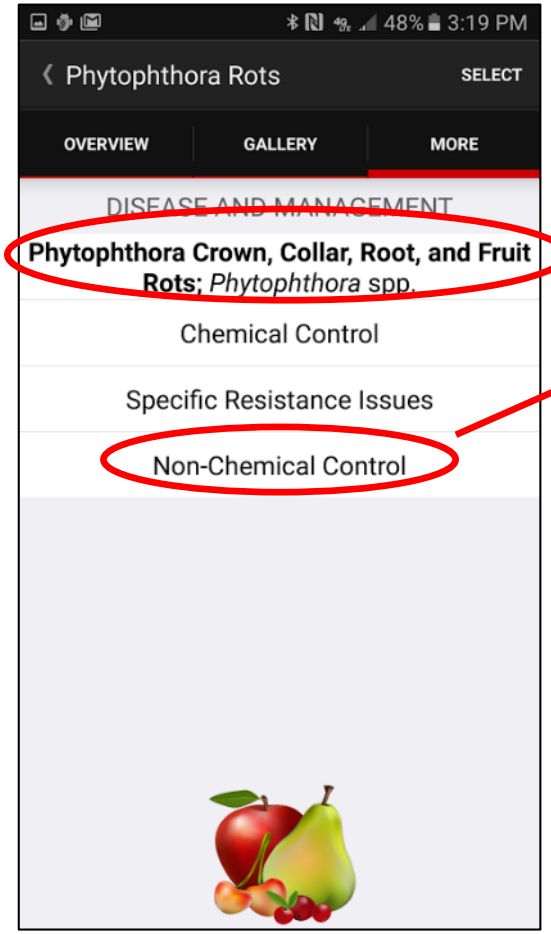


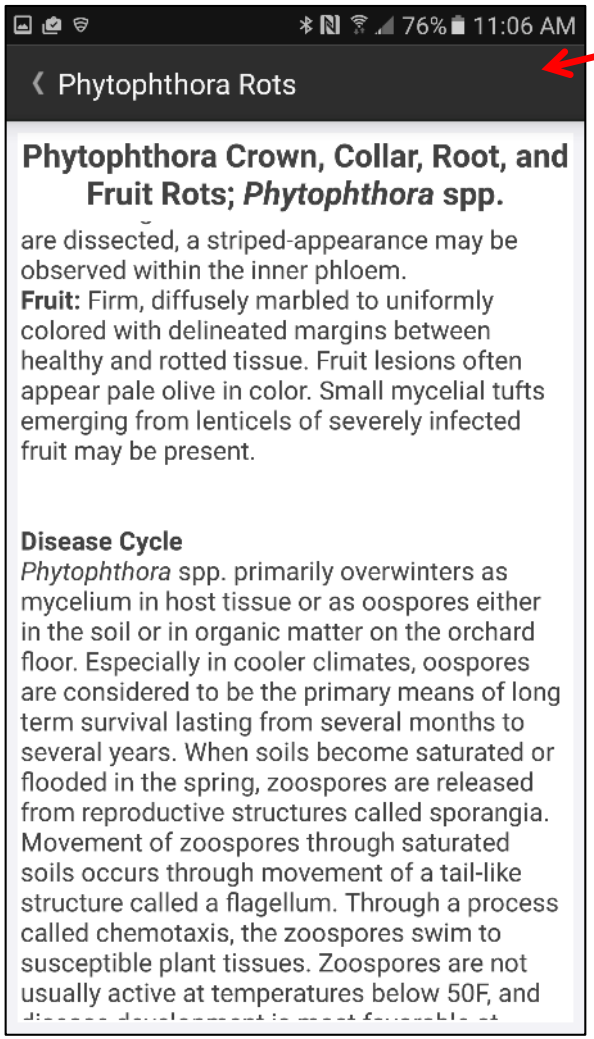


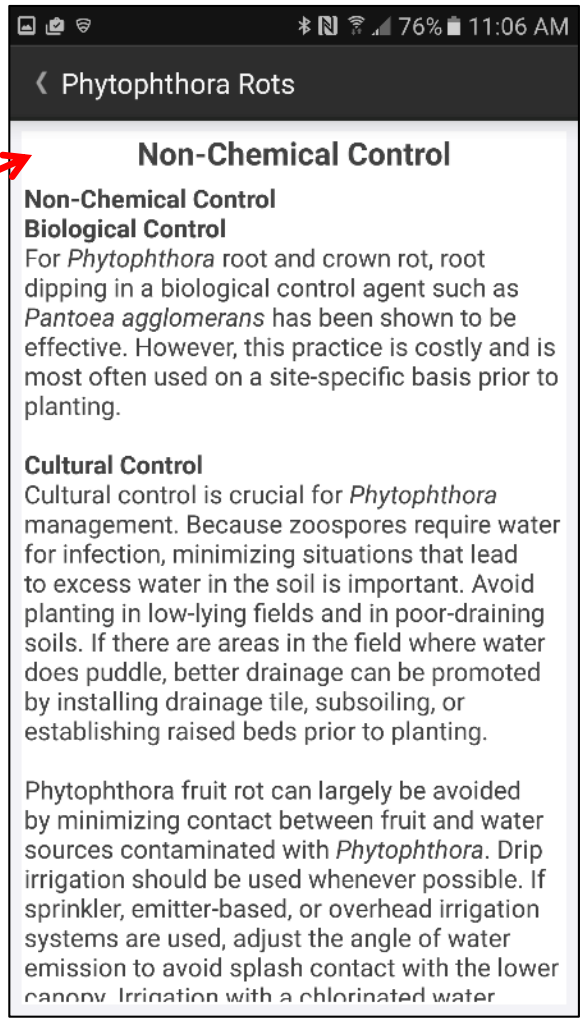
Basic biology, control, short audio clip

Additional photos of disease symptoms

In-depth information on disease and control


48% 3:19 PM
Phytophthora Rots
SELECT
OVERVIEW
GALLERY
MORE
DISEASE AND MANAGEMENT
Phytophthora Crown, Collar, Root, and Fruit Rots; Phytophthora spp.
Chemical Control
Specific Resistance Issues
Non-Chemical Control


76% 11:06 AM
Phytophthora Rots
Phytophthora Crown, Collar, Root, and Fruit Rots; Phytophthora spp.
are dissected, a striped-appearance may be observed within the inner phloem.
Fruit: Firm, diffusely marbled to uniformly colored with delineated margins between healthy and rotted tissue. Fruit lesions often appear pale olive in color. Small mycelial tufts emerging from lenticels of severely infected fruit may be present.
Disease Cycle
Phytophthora spp. primarily overwinters as mycelium in host tissue or as oospores either in the soil or in organic matter on the orchard floor. Especially in cooler climates, oospores are considered to be the primary means of long term survival lasting from several months to several years. When soils become saturated or flooded in the spring, zoospores are released from reproductive structures called sporangia. Movement of zoospores through saturated soils occurs through movement of a tail-like structure called a flagellum. Through a process called chemotaxis, the zoospores swim to susceptible plant tissues. Zoospores are not usually active at temperatures below 50F, and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Phytophthora Rots
Non-Chemical Control
Non-Chemical Control
Biological Control
For Phytophthora root and crown rot, root dipping in a biological control agent such as Pantoea agglomerans has been shown to be effective. However, this practice is costly and is most often used on a site-specific basis prior to planting.
Cultural Control
Cultural control is crucial for Phytophthora management. Because zoospores require water for infection, minimizing situations that lead to excess water in the soil is important. Avoid planting in low-lying fields and in poor-draining soils. If there are areas in the field where water does puddle, better drainage can be promoted by installing drainage tile, subsoiling, or establishing raised beds prior to planting.
Phytophthora fruit rot can largely be avoided by minimizing contact between fruit and water sources contaminated with Phytophthora. Drip irrigation should be used whenever possible. If sprinkler, emitter-based, or overhead irrigation systems are used, adjust the angle of water emission to avoid splash contact with the lower

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