

# Updates in Tomato Disease Management



**Division of Extension**  
University of Wisconsin-Madison

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Wisconsin Fresh Market Vegetable Growers  
Association - Virtual Education Conference 2021  
January 25, 2021 – 8:30-9:00AM

# Common Tomato Diseases

- **High tunnel/Greenhouse systems**
  - Leaf mold, gray mold, white mold, late blight
- **Field production systems**
  - Early blight, Septoria, late blight, bacterial speck and spot



# Fungicides in the High Tunnel/GH

*A high tunnel = greenhouse (GH)*

*No label standardization for GH use*

- Have a section listing special rates and GH instructions specific to disease
- Mention that a fungicide can be used in GH but with no special instructions
- Have no mention of whether the fungicide can be used in GH or not
- Specifically prohibit greenhouse use



# Fungicides in the High Tunnel/GH

**For most common tomato diseases in the GH in WI**

**Permitted for use in GH**

Kocide, Dithane, Fontelis, Scala, Tanos

**Not permitted for use in GH**

Endura, Quadris, Cabrio, Bravo

**May be used for late blight management specifically in GH**

Curzate, Gavel, Previcur Flex, Ranman





# Common Tomato Diseases

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- **Field production systems**
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# Diseases of Tomato in Open Field Production



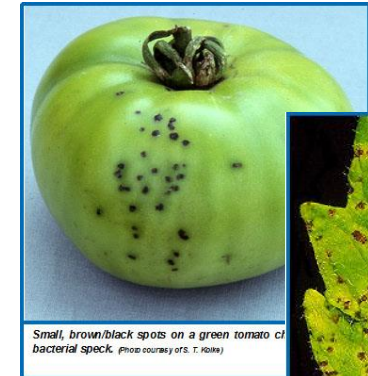
- **Late blight**  
(*Phytophthora infestans*)



- **Septoria**  
(*Septoria lycopersici*)



- **Early blight**  
(*Alternaria solani*)



Small, brown/black spots on a green tomato of bacterial speck. (Photo courtesy of S. T. Rowe)

- **Bacterial speck**  
(*Pseudomonas syringae*)

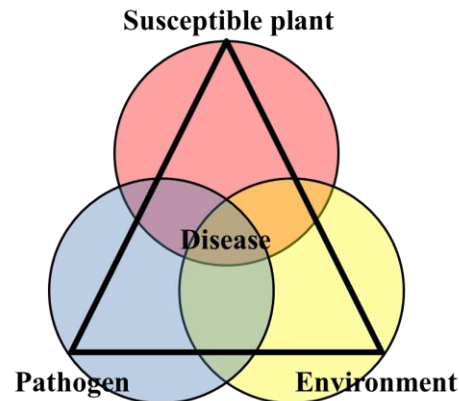


On tomato leaves, bacterial speck leads to small, angular (i.e., straight-edged) spots with yellow halos. (Photo courtesy of Alan Colmer, Cornell University)

- **Bacterial spot**  
(*Xanthomonas spp.*)



Univ. of MN Extension





# Tomato Late Blight Symptoms





# 2020 Late blight and info sources

UNIVERSITY of WISCONSIN-MADISON

CALS

PLANT PATHOLOGY

AG RESEARCH STATIONS

PLANT DISEASE DIAGNOSTIC CLINIC

VEGETABLE ENTOMOLOGY



**UW VEGETABLE PATHOLOGY**

Vegetable Disease Control Laboratory of Amanda J. Gevens

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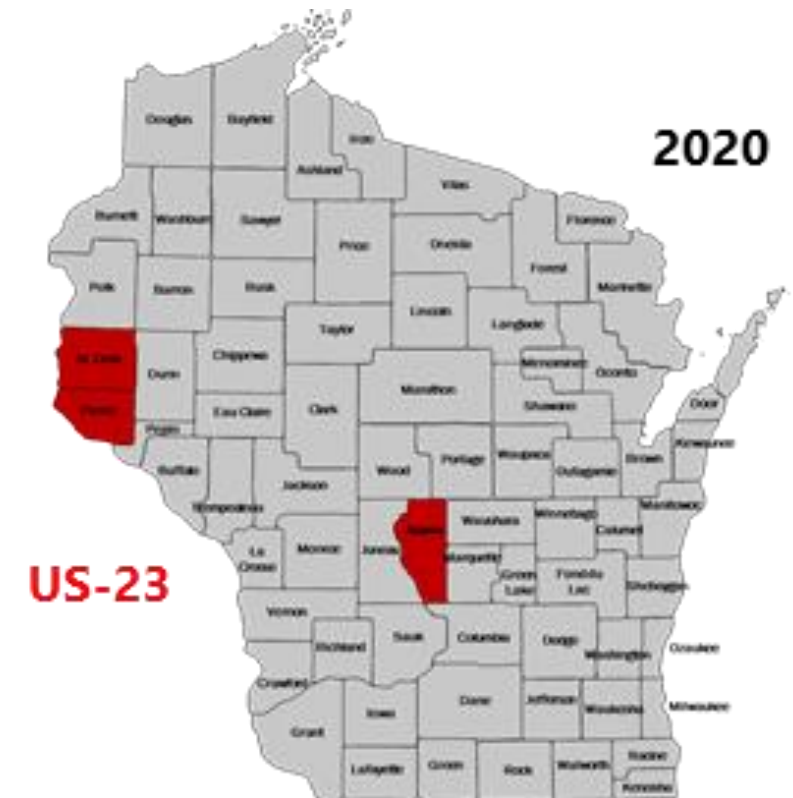
PEOPLE

HOME / DISEASE SEVERITY VALUES AND P-DAYS



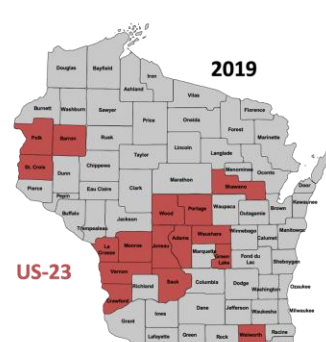
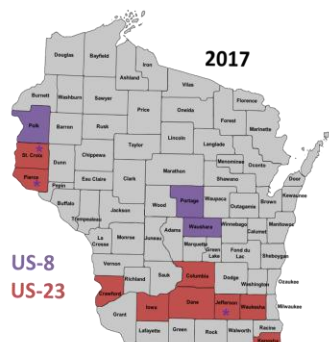
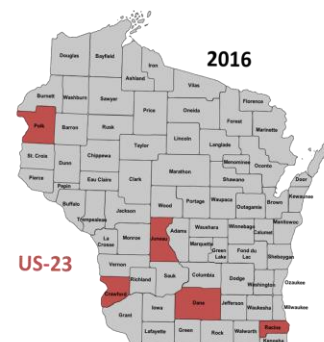
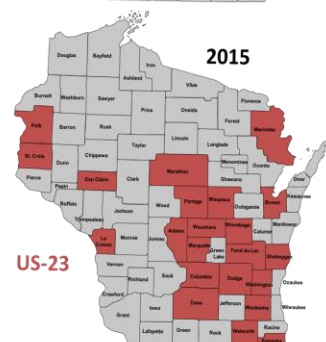
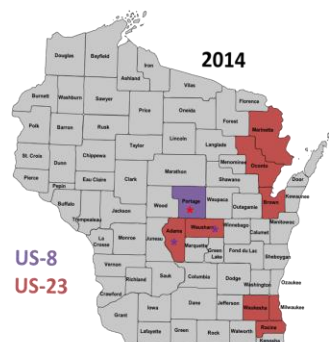
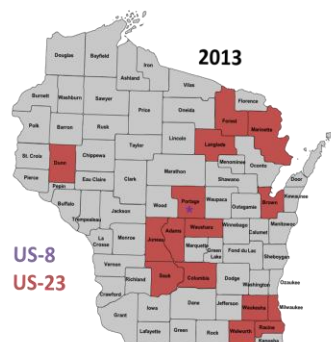
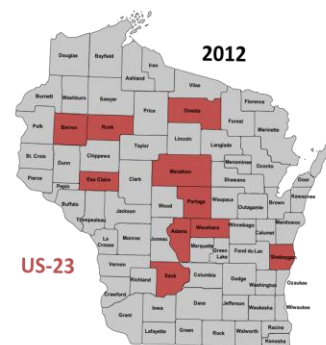
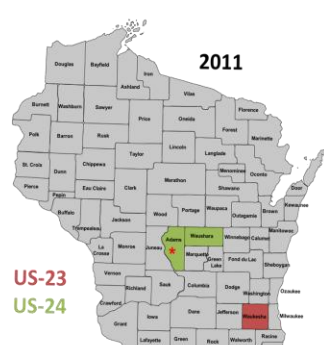
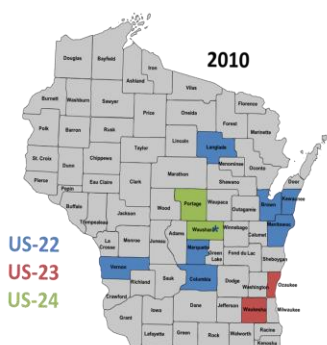
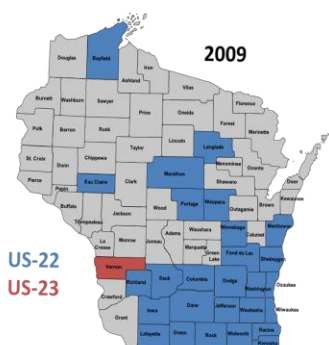
## We confirmed US-23 late blight in 3 counties in 2020

- Adams, commercial conventional potato
- St. Croix, commercial organic tomato
- Pierce, commercial organic tomato





# Wisconsin Late Blight 2009-2020



**2009:** 1<sup>st</sup> detection since 2002  
**2010:** last detection of US-22  
**2011:** last detection of US-24  
**2013 & 2017:** US-8 detected

**2012 forward:** US-23 has been predominant lineage in WI and nation

# Late Blight Reporting in the US


## USABLIGHT

A NATIONAL PROJECT ON LATE BLIGHT OF TOMATO AND POTATO IN THE UNITED STATES

[About Late Blight](#) [Occurrence Map](#) [Reporting Outbreaks](#) [Managing Late Blight](#) [Cornell DSS](#) [About Us](#) [Internal Users](#)

### Current Disease Map

Click the map for more information




### Quick Links

**Alerts System is now operational!** Click [here](#) or under the "Reporting Outbreaks" menu.

**New user account system is operational!** Sign up for a CRONOS account [here](#). Required for reporting, alerts systems, and other user-defined content!

### Welcome to USAblight

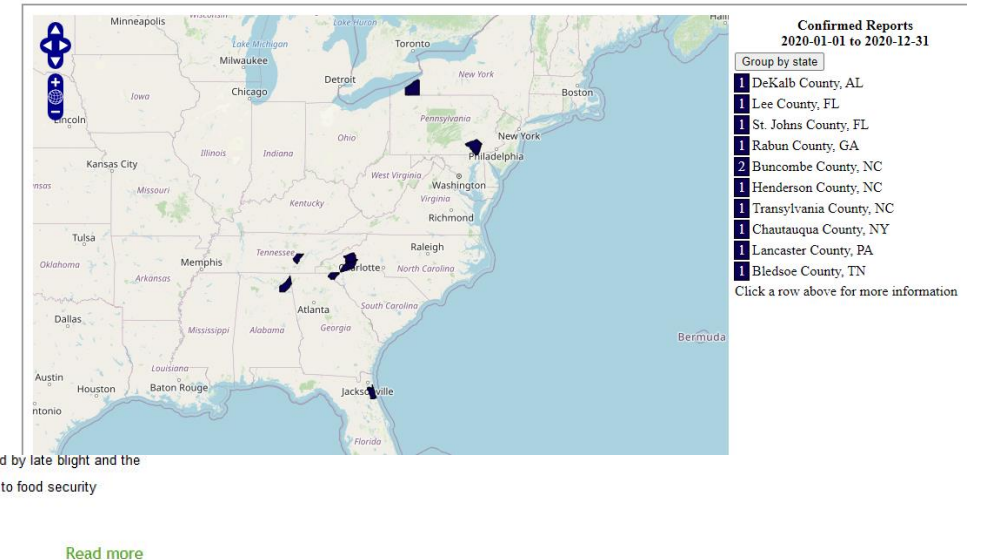


Potato late blight lesion. Image courtesy of Jean Ristaino, NC State University.

Welcome to USA blight, a new national website that will act as an information portal on late blight. You can report disease, submit a sample online, observe disease occurrence maps, and [sign up](#) for text disease alerts. There are also useful [support system](#), and information about identification and management of the disease.

Late blight of potato and tomato caused by *Phytophthora infestans* is a devastating disease worldwide and led to the Irish Potato Famine in 1845. Under favorable weather conditions, tomato and potato crops can be destroyed within days. Yield losses caused by late blight and the cost of control measures have been estimated to exceed 6.7 billion dollars annually and the disease is a major threat to food security worldwide.

## 2020 Map



# Tomato Late Blight Control

Varietal resistance

- ie: Iron Lady, Mountain Magic, Plum Regal, Defiant
- look for ph resistance genes (2 and 3)

Bring only disease-free material into high tunnel or field

Preventative fungicides when disease is present in your region

High tunnel/greenhouse: copper hydroxide (Kocide), mancozeb (Dithane), mandipropamid + difenoconazole (Revus Top), famoxadone + cymoxanil (Tanos), cymoxanil (Curzate), mancozeb+zoxamide (Gavel), propamocarb hydrochloride (Previcur Flex), cyazofamid (Ranman)

CANNOT use chlorothalonil (ie: Bravo), fluopicolide (Presidio)  
dimethomorph (Forum formerly Acrobat) in GH



# Late Blight Resistance in Red Slicer Tomatoes

Variety	Type	Resistance	Source	Resistance
Brandywise	Red slicer	Ph2 + Ph3 heterozyg	Fruition Seeds	Very good resistance. Also resistance to EB + Sep
Stellar	Red slicer	Ph2 + Ph3 heterozyg	Totally Tomato	Very good resistance. Also resistance to EB + Sep
Iron Lady	Red slicer	Ph2 + Ph3 heterozyg	High Mowing Org Seeds	Very good resistance. New in 2013
Defiant PHR	Red slicer	Ph2 + Ph3 heterozyg	Johnny's Selected Seeds	Very good resistance
Mountain Merit	Red slicer	Ph2 + Ph3 heterozyg	Seedway	Very good resistance

<https://eorganic.org/node/10822>

# Late Blight Resistance in Plum, Campari, & Heirloom Tomatoes

Variety	Type	Resistance	Source	Resistance
JTO-545	Red plum	Ph3	Johnny's Select Seeds	Good resistance
Rote Zora	Small paste	Unknown		Very good resistance
Quadro	Small red plum	Unknown	Adaptive Seeds	Good resistance
Plum Regal	Red plum	Ph4 homozyg	Seedway	Good resistance but variable to US23
Mountain magic	Red Campari	Ph2 + Ph3 heterozyg	Several	Very good resistance
Clou OP	Yellow Campari	Unknown		Good resistance
Mr. Stripey Tigerella	Heirloom	Unknown	Several	Fairly good resistance
Pruden's Purple	Heirloom	Unknown	Johnny's Select Seeds	Good resistance
Wapsipinicon Peach	Yellow peach	Unknown	Totally Tomatoes	Good resistance

# Late Blight Resistance in Cherry Tomatoes

Variety	Type	Resistance	Source	Resistance
Golden Currant	Yellow cherry	Unknown		Very good resistance
Resi	Red cherry	Unknown		Very good resistance
Rote Murrel	Small red cherry	Unknown		Very good resistance
Matt's Wild Cherry	Small red cherry	Unknown Ph3?	Several	Very good resistance
Cherry Bomb	Red cherry	Unknown	Johnny's Select Seeds	Very good resistance
Jasper	Red cherry	Unknown	Johnny's Select Seeds	Very good resistance
Cerise rot	Red cherry	Unknown		Some resistance



# Fungicides for Late Blight control

- Multi-site protectants also effective on Early Blight, Septoria
- Copper also controls bacterial diseases

Fungicide	a.i.	FRAC	PHI tomato	PHI potato	Activity
Bravo, Equus, Echo	chlorothalonil	M5	0 days	7 days	protectant
Dithane, Penncozeb, Mancozeb	mancozeb	M3	5 days	3 days	protectant
Kocide, Champ	copper (not all coppers OMRI approved)	M1	0 days	0 days	protectant

# Fungicides for Late Blight control

## Conventional – oomycete specific fungicides

Fungicide	a.i.	FRAC	PHI tomato	PHI potato	Activity
Curzate	cymoxanil	27	3 days	14 days	locally systemic
Forum	dimethomorph	40	4 days	4 days	systemic
Fosphite	potassium phosphite	NC	0 days	0 days	systemic
Gavel	mancozeb + zoxamide	M3+22	5 days	3 days	protectant
Micora	mandipropamid	40	GH transplants only	Not labeled	systemic
Omega	fluazinam	29	Not labeled	14 days	protectant
Orondis Opti	oxathiapiprolin + chlorothalonil	49+M5	0 days	7 days	systemic+protectant
Orondis Ultra	oxathiapiprolin + mandipropamid	49+40	1 day	14 days	systemic
Presidio	fluopicolide	43	2 days	Not labeled	systemic
Previcur/Promess/Br uin	propamocarb hydrochloride	28	5 days	14 days	systemic
Ranman	cyazofamid	21	0 days	7 days	protectant, limited systemic
Revus	mandipropamid	40	1 day	14 days	systemic
Revus Top	difenoconazole + mandipropamid	3 + 40	1 day	14 days	preventative, systemic, curative
Ridomil Gold Mz	mefenoxam + mancozeb	4 + M3	5 days	14 days	systemic
Tanos	cymoxanil + famoxadone	27	3 days	14 days	locally systemic, curative
Zampro	ametoctradin + dimethomorph	45+40	4 days	4 days	systemic
Zing!	chlorothalonil + zoxamide	M5+22	5 days	7 days	protectant

# Tomato Septoria Leaf Spot





# Tomato Septoria Leaf Spot Management

- Pathogen: *Septoria lycopersici*
- Survives over winter on infected plant debris, and also on equipment, stakes and cages
- Spores dispersed by splashing water (rain, irrigation), workers or equipment moving through wet plants
- Favored by moist, warm weather
- Symptoms generally appear first on lower leaves



# Tomato Septoria Leaf Spot Management

## Multi-site, broad spectrum fungicides

Fungicide	Active Ingredients	FRAC Group	PHI Tomato	PHI Potato	Activity
Badge SC/Kocide	copper	M1	0 days	0 days	protectant
Bravo Ultrex/Echo	chlorothalonil	M5	0 days	7 days	protectant
Dithane M45/Mancozeb	mancozeb	M3	5 days	3 days	protectant



# Tomato Septoria Leaf Spot Management

## Single active ingredient fungicides

Fungicide	Active Ingredients	FRAC Group	PHI Tomato	Activity
Azoxystar/Quadris	azoxystrobin	11	0 days	systemic
Cabrio EG	pyraclostrobin	11	0 days	systemic
Flint Extra	trifloxystrobin	11	0 days	systemic
Fontelis	penthiopyrad	7	0 days	preventative+curative+systemic
Gem 500 SC	trifloxystrobin	11	3 days	preventative+curative+systemic
Mettle 125 ME	tetraconazole	3	0 days	protectant+systemic+curative
MilStop	potassium bicarbonate	NC	0 days	preventative+curative
Reason 500 SC	fenamidone	11	14 days	preventative+curative+systemic



# Tomato Septoria Leaf Spot Management

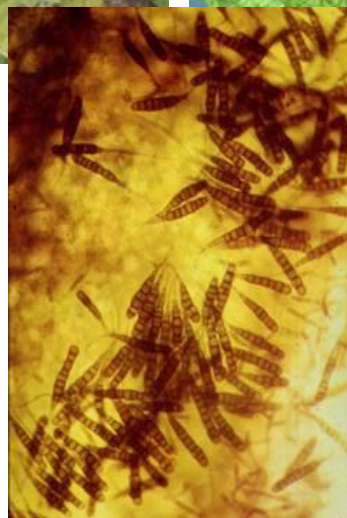
## Pre-mix, multiple active ingredient fungicides

Fungicide	Active Ingredients	FRAC Group	PHI Tomato	Activity
Aprovia Top Fungicide	benzovindiflupyr+difenoconazole	7+3	0 days	preventative+curative
Luna Sensation	fluopyram+ trifloxystrobin	7+11	3 days	preventative+curative+systemic
Luna Tranquility	fluopyram+pyrimethanil	7+9	1 day	preventative+curative+systemic
Miravis Prime	fludioxonil+pydiflumetofen	7+12	0 days	preventative+curative+pre-mix fungicides
Mural	azoxystrobin+benzovindiflupyr	11+7	0 days	preventative+systemic+curative
Pageant Intrinsic brand fungicide/Pristine	boscalid+pyraclostrobin	7+11	0 days	preventative+systemic
Priaxor Xemium	fluxapyroxad+pyraclostrobin	7+11	0 days	preventative+curative+systemic
Quadris Top	azoxystrobin+difenoconazole	11+3	0 days	preventative+curative+systemic
Tanos	cymoxanil+famoxadone	27+11	3 days	preventative+curative+systemic
TopGuard EQ Fungicide	azoxystrobin+flutriafol	11+3	0 days	preventative+curative+systemic

# Tomato Septoria Leaf Spot Management

- Rotation (at least 1-2 years)
- Thorough sanitation of equipment, stakes, etc.
- Stake plants, prune lower lateral branches
- Plastic mulches
- Fungicide sprays
  - Many effective fungicides available (ie: azoxystrobin, chlorothalonil, mancozeb)
  - Apply every 7 days, as necessary
  - Good coverage, especially of lower leaves, crucial
  - Carefully read label directions

# Early blight on tomato and potato



*Alternaria solani*

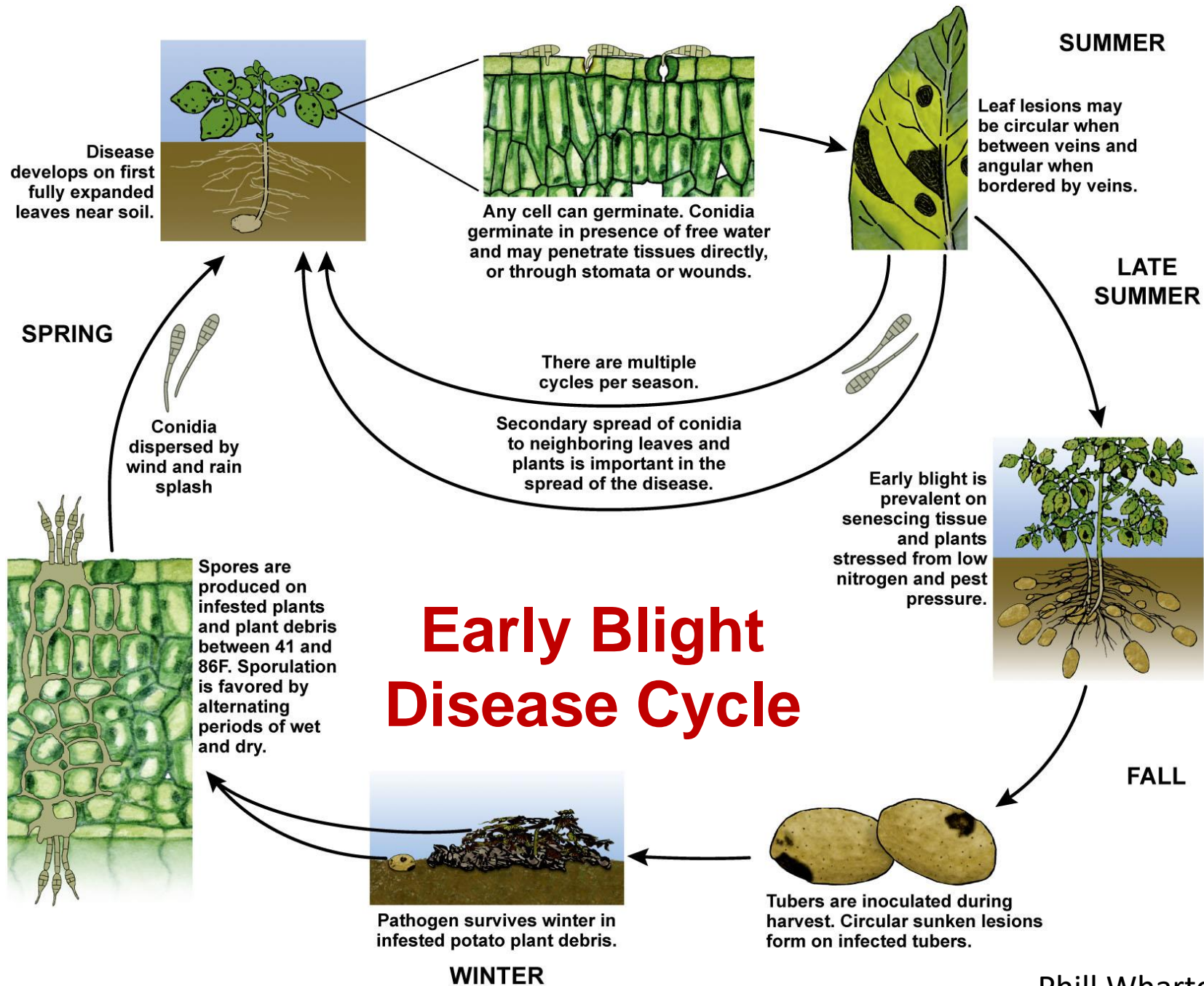




# Early blight on tomato and potato







# Early blight disease characteristics

- Pathogen: *Alternaria solani*
- Survives on infected plant debris - partially buried debris is an excellent source of inoculum
- Spores wind dispersed, can be carried long distances
- Greatest threat of infection:
  - Fields with short rotations
  - Planting adjacent to fields infected previous year where debris not completely buried
- Infection occurs first on oldest leaves





# Early blight disease management

- Plant rotation - minimum of at least 2-3 years between solanaceous crops
  - Potato, tomato, weeds in nightshade family excellent hosts
- Completely bury plant debris after harvest
- Some varietal resistance
- Fungicide applications
  - Several effective fungicides available (fungicides for EB and Septoria control are the same)
  - Carefully read label directions
- Provide adequate nitrogen
- Avoid excessive irrigation



# Early blight disease management

- Managed with same fungicides as Septoria
- Additional fungicides with labels for Early Blight
- Both diseases could be present at same time

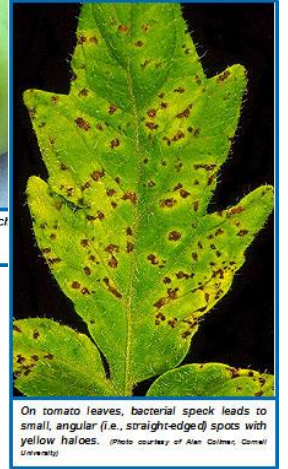
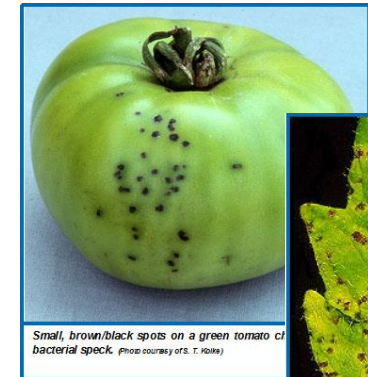
Fungicide	Active Ingredient	FRAC Code	PHI Tomato	Activity
Aftershock/Tepera	fluoxastrobin	11	3 days	systemic
Endura	boscalid	7	0 days	preventative+systemic+curative
Inspire Super	cyprodinil+difenoconazole	9+3	0 days	preventative+systemic+curative
Rhyme	flutriafol	3	0 days	preventative+systemic+curative
Scala	pyrimethanil	9	1 day	preventative+systemic
Spirato	fludioxonil	12	0 days	preventative
Switch 62.5WG	cyprodinil+fludioxonil	9+12	0 days	preventative+systemic
Tebucon	tebuconazole	3	7 days	preventative+systemic+curative

# Bacterial Disease Control

- Copper-containing fungicides are best treatments
- Start with clean seed, or hot water seed trts
- Crop rotation
- Do not re-use untreated stakes
- Stake, prune to promote airflow

- **Bacterial speck**  
(*Pseudomonas syringae*)

- **Bacterial spot**  
(*Xanthomonas spp.*)







Welcome to the Gevens lab!

My research program investigates the ecology of fungus and fungus-like plant pathogens for enhanced and integrated disease management to support commercial agriculture in Wisconsin potato and vegetable crops in field and storage and development of integrated disease management key soilborne diseases. As the University of Wisconsin-Madison, we provide research-based recommendations into my extension work.



#### In This Issue

Potato production updates  
Disease forecasting and updates for early and late blight in potato, cucurbit downy mildew updates

#### Calendar of Events

**December 1-3, 2020** – Midwest Food Producers Association Annual Convention/Processing Crops Conference – *Virtual – details to follow*  
**January 24-26, 2021** – WI Fresh Vegetable Growers Association Educational Conference, Kalahari, Wisconsin Dells, WI (possible remote options)  
**February 2-4, 2021** – UW-Madison Div. of Extension & WPVGA Grower Education Conference, Holiday Inn, Stevens Point, WI (possible remote options)

**Yi Wang, Assistant Professor & Extension Potato and Vegetable Production Specialist, UW-Madison, Dept. of Horticulture, 608-265-4781, Email: [wang52@wisc.edu](mailto:wang52@wisc.edu).**

As growers are harvesting the crops, the 2020 growing season is close to the end. Overall, this season has relatively normal weather conditions, and yield and quality is about to be the average depending on the varieties. Some varieties behave very well but others such as Russet Burbank is lower than expected. Late June and early July had several large rain events that caused leaching issues, petiole numbers from several varieties were lower than the sufficiency range, and therefore supplemental nitrogen application became

**Thank you!**  
**[gevens@wisc.edu](mailto:gevens@wisc.edu)**

# Vegetable disease information resources

## UW-Madison Division of Extension Vegetable Pathology

<https://cdm.ipmpipe.org/>

<https://usablight.org/>

