



**PennState**

College of Agricultural Sciences



# MANAGING POTATO DISEASES, FROM SEED TO FIELD

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# Starting with the summary first...

➔ Primary strategies for disease management are **proactive and preventative**

– site selection, crop rotation, soil health, sanitation, variety selection, clean seed, etc.

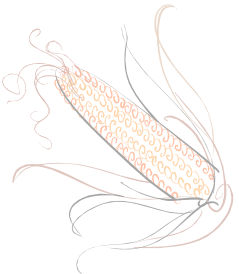
➔ **Knowledge is another key to success!**

✓ Know what diseases can occur on your crops

✓ Know the symptoms and signs

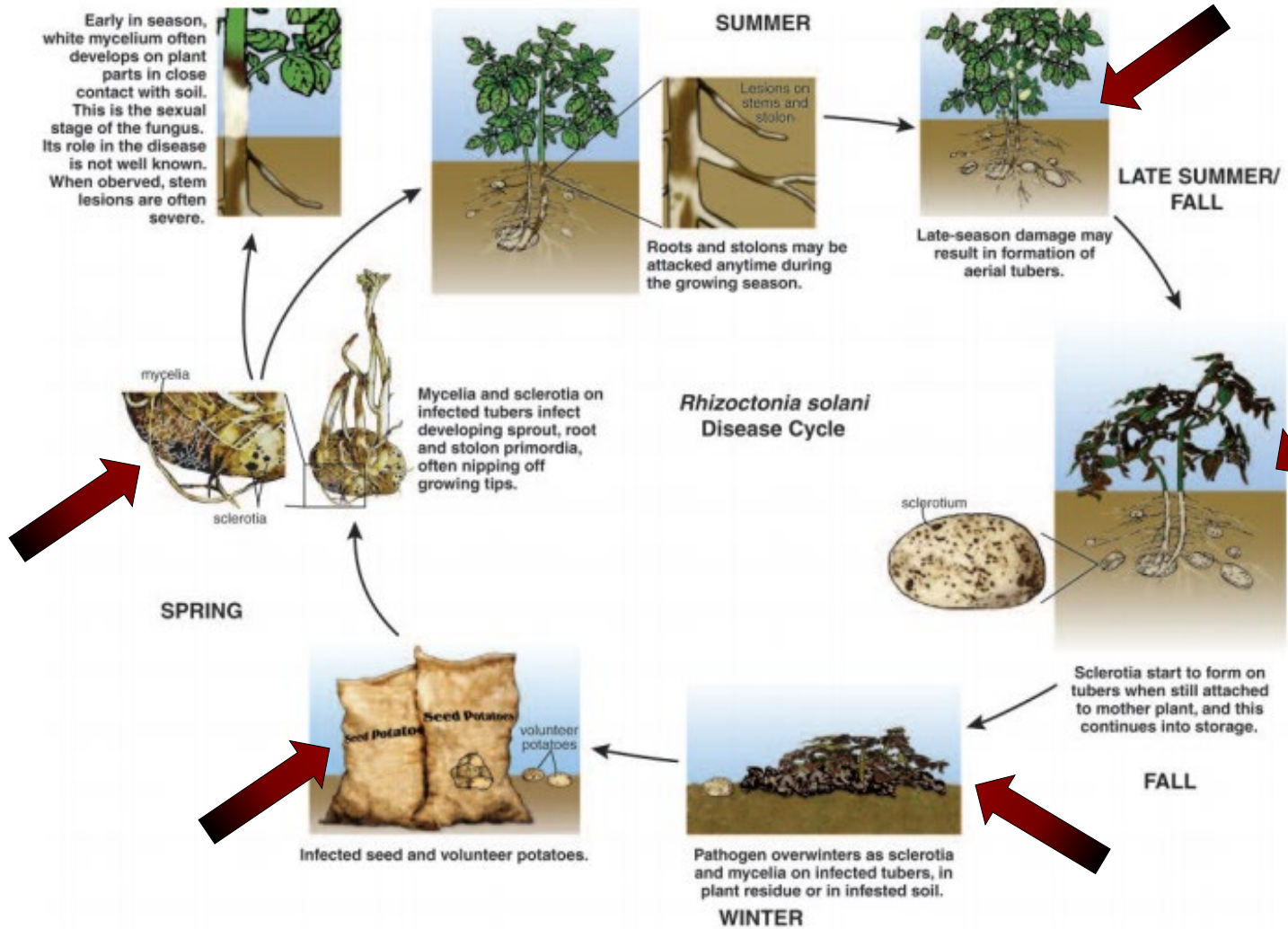
✓ Know the biology of the pathogen (sources of inoculum)

✓ Know the management practices/strategies





# Integrated potato disease management



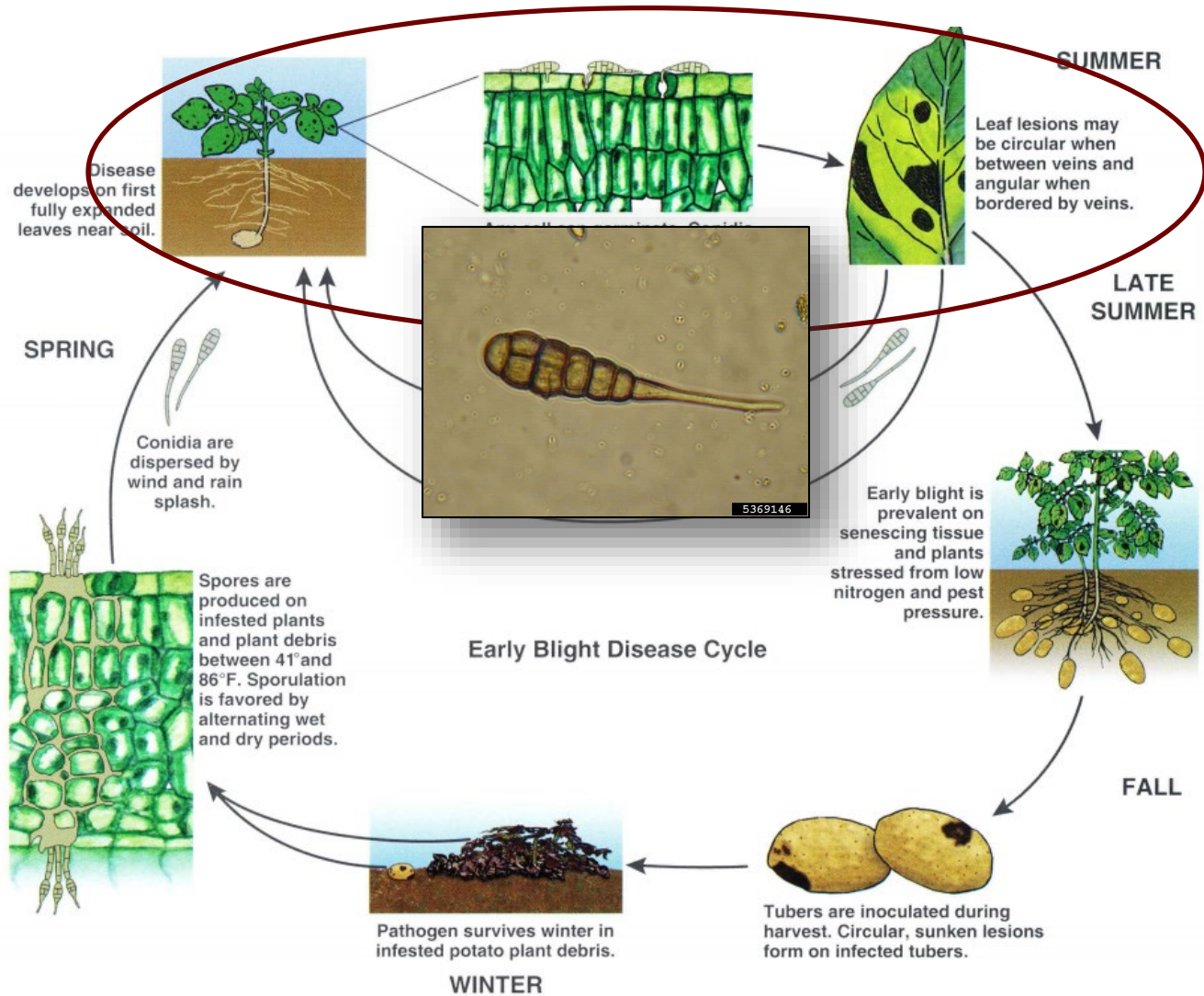
**Focus on primary inoculum production**

**Target all steps of the disease and crop production cycle**

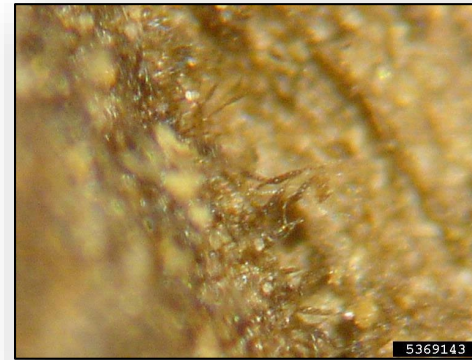


Figure 5. The disease cycle of the stem canker and black scurf pathogen, *Rhizoctonia solani*.

# Integrated potato disease management



## Secondary inoculum production



## Target all steps of the disease and crop production cycle

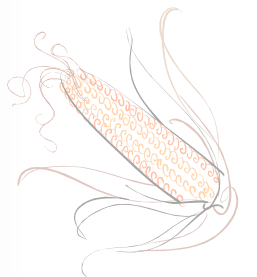
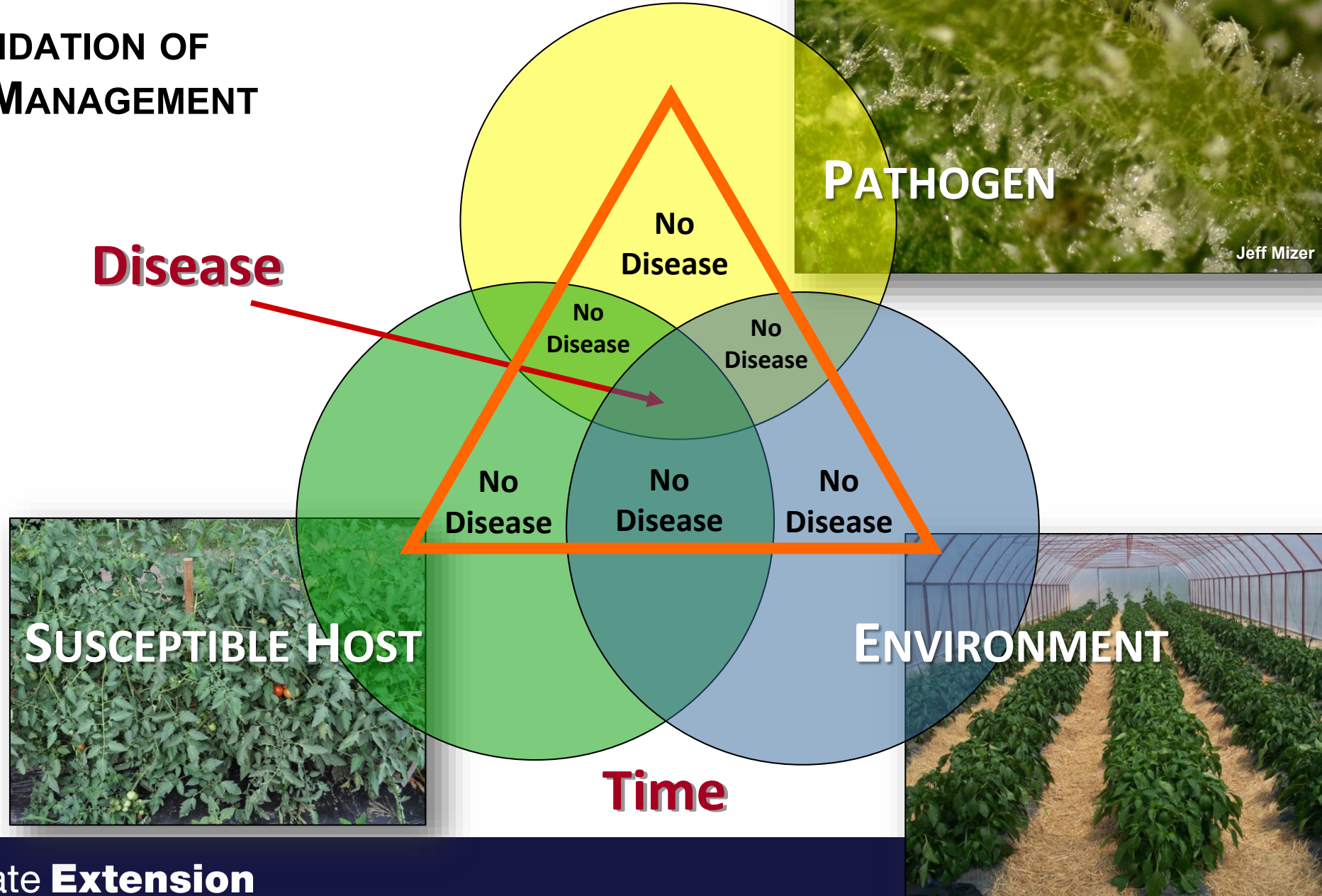


Figure 8. The disease cycle of the early blight pathogen, *Alternaria solani*.



# The Disease Triangle

THE FOUNDATION OF  
DISEASE MANAGEMENT



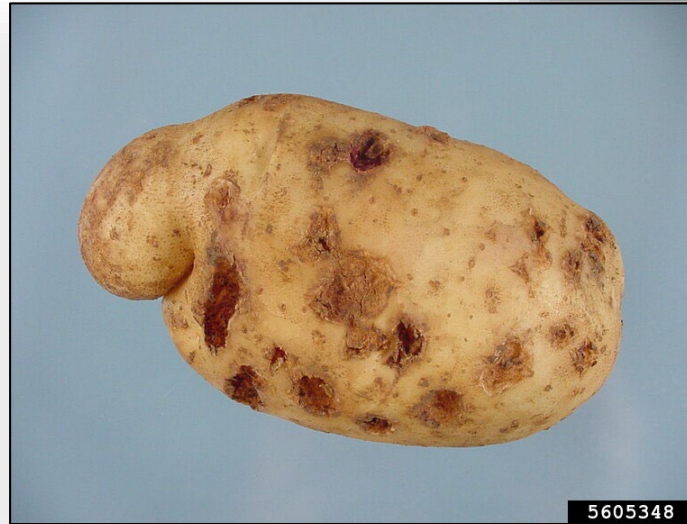


# Today's focus.....

➔ **Rhizoctonia stem canker and black scurf**



➔ **Common scab**



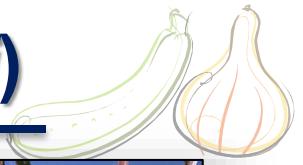
➔ **Black dot**



➔ **Periderm disorder syndrome**



# Rhizoctonia stem canker and black scurf (*Rhizoctonia solani*)



- ➔ Common soilborne pathogen on vegetables
- ➔ 13 subgroups or anastomosis groups

**AG-3 PT** (potato)

AG-3 TB (tobacco)

Also, some binucleate *Rhizoctonia* associated with potato (saprophytes/biocontrols)



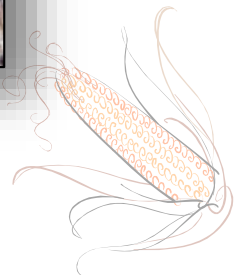
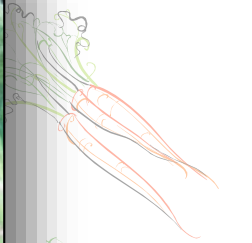


# Stem canker (*Rhizoctonia solani*)

Reddish-brown to black lesions on sprouts, stolons and roots



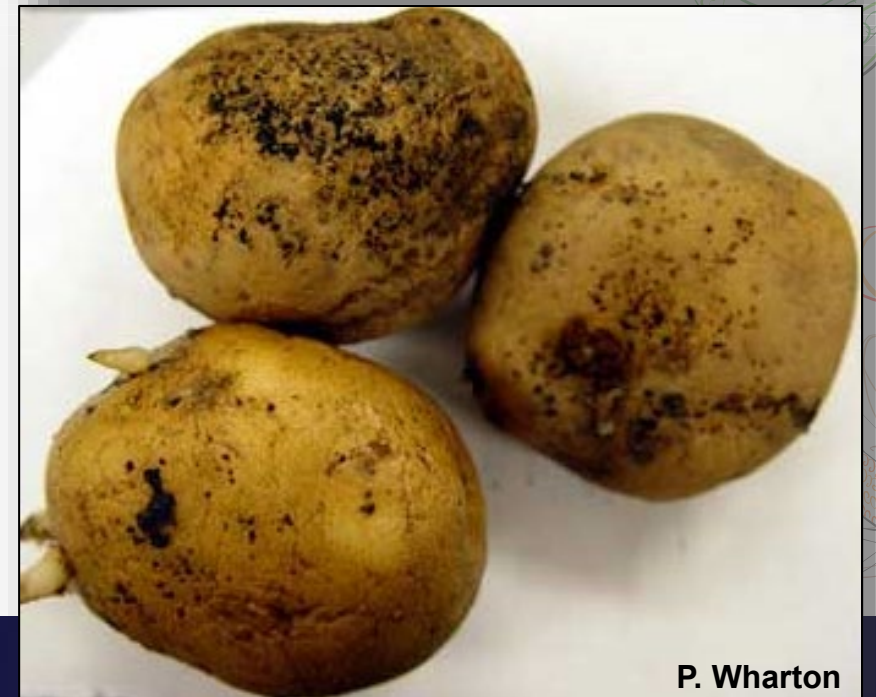
Can girdle affected area





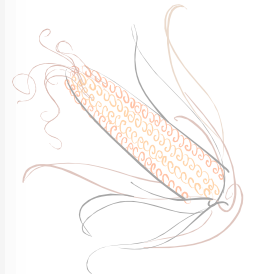
# Black scurf (*Rhizoctonia solani*)

- ➔ Dark brown to black **sclerotia** that are irregularly shaped
- ➔ Resembles soil that does not wash off



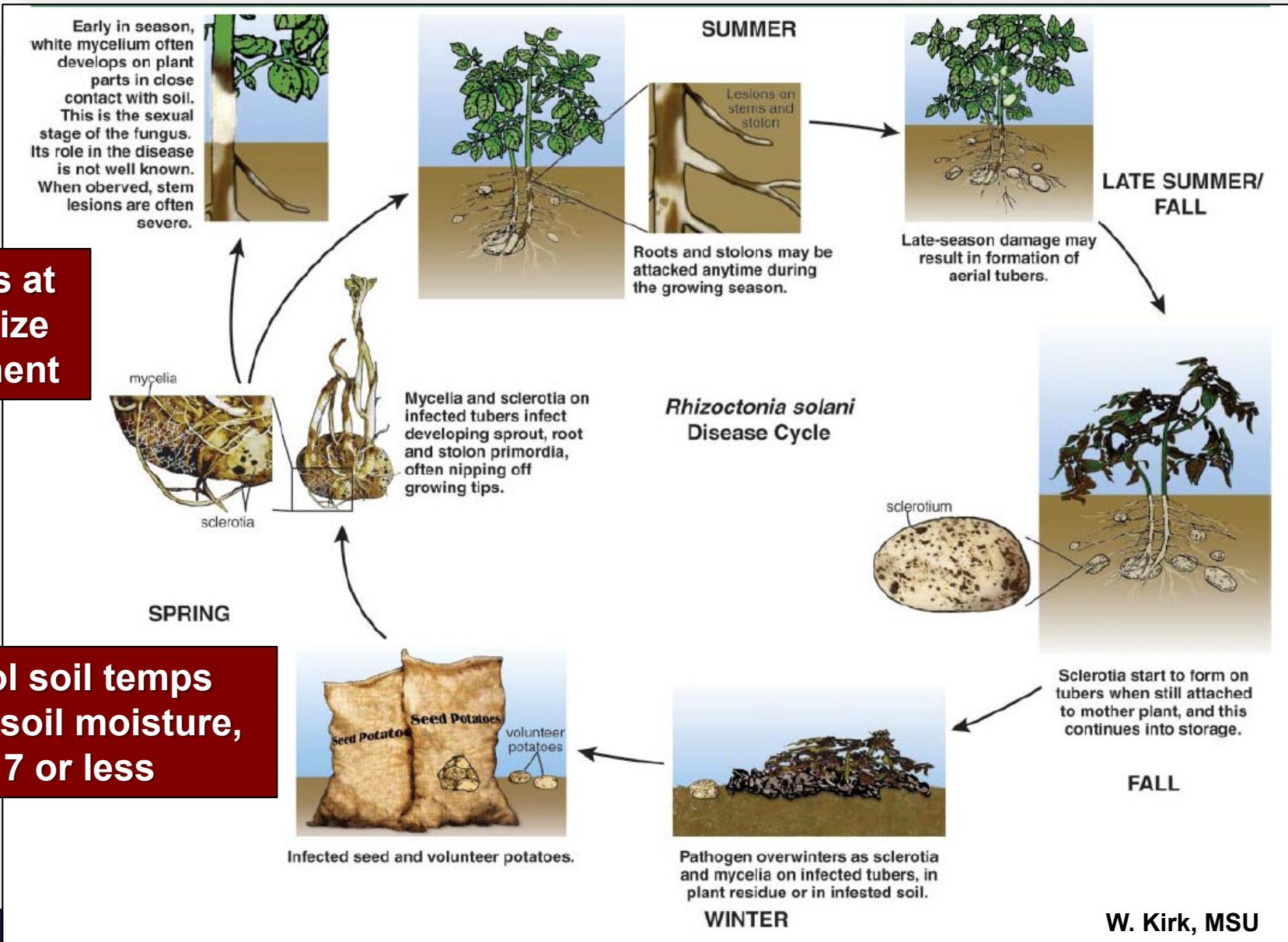


# Rhizoctonia stem canker and black scurf disease cycle



High temperatures at emergence minimize disease development

Favored by cool soil temps (41-77°F), high soil moisture, fertility and pH 7 or less





# Integrated management for Rhizoctonia

➔ **Certified seed** - less than 20 sclerotia visible on one side of washed tuber

➔ **Seed treatments (not exhaustive)**

✓ Flutolanil + mancozeb (MonCoat MZ; 7+M3)

✓ Fludioxonil + thiamethanoxam (Cruiser Maxx Potato; 12+M3)

✓ Penflufen + prothioconazole (Ernesto Silver; 7+3)

✓ Sedaxane + others (Vibrance – 7; Vibrance Ultra – 7, 3, 40 )

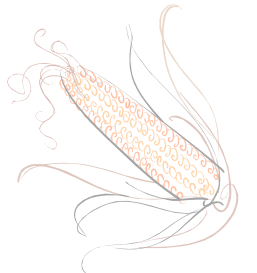


# Integrated management for Rhizoctonia

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## ➔ In-furrow application options:

- ✓ Azoxystrobin (Quadris; FRAC 11)
- ✓ Benzovindiflupyr + azoxystrobin (Elatus; 11+7)
- ✓ Fluoxastrobin (Evito; 11)
- ✓ Flutolanil (Moncut MZ; FRAC 7)
- ✓ Fluxapyroxad + pyraclostrobin (Priaxor; 7+11)
- ✓ Penthiopyrad (Vertisan; 7)
- ✓ Extract of *Reynoutria sachalinensis* (Regalia Max)
- ✓ *Bacillus subtilis* QST (Serenade Soil)





# Integrated management for Rhizoctonia

- ➔ Promote **rapid shoot emergence** in spring – warm soils (<46°F), plant shallow, plant coarse textured soils first (better drainage)
- ➔ **Harvest** as soon as skin has set to minimize development of sclerotia



B. Christ

# Common scab (*Streptomyces* spp.)

- ➔ Caused by several *Streptomyces* spp. which are bacteria in the actinomycete group
- ➔ Infection is limited to tubers
- ➔ Corky brown lesions that are circular and often then coalesce
- ➔ Other hosts – spinach, red clover and root crops (carrot, turnip, etc.)





# Common scab management

- ➔ Incidence and severity vary annually as well as between fields
- ➔ Type of lesion dependent on the cultivar, timing of infection, virulence of strain, and environmental conditions

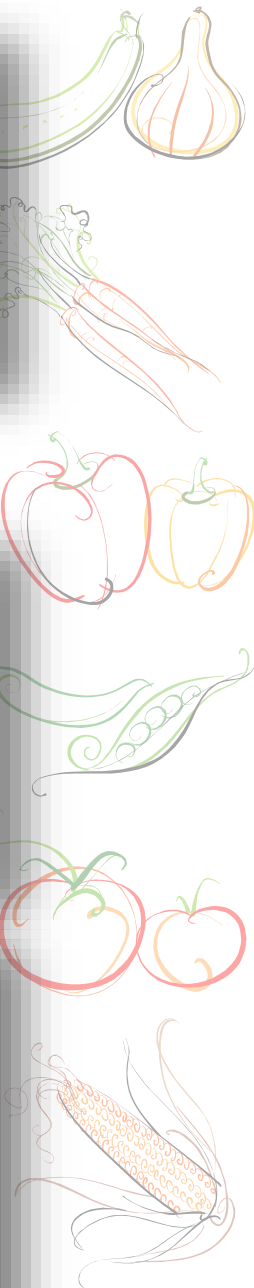
Thus, an **integrated approach** that combines **host resistance** and **cultural practices** is needed.



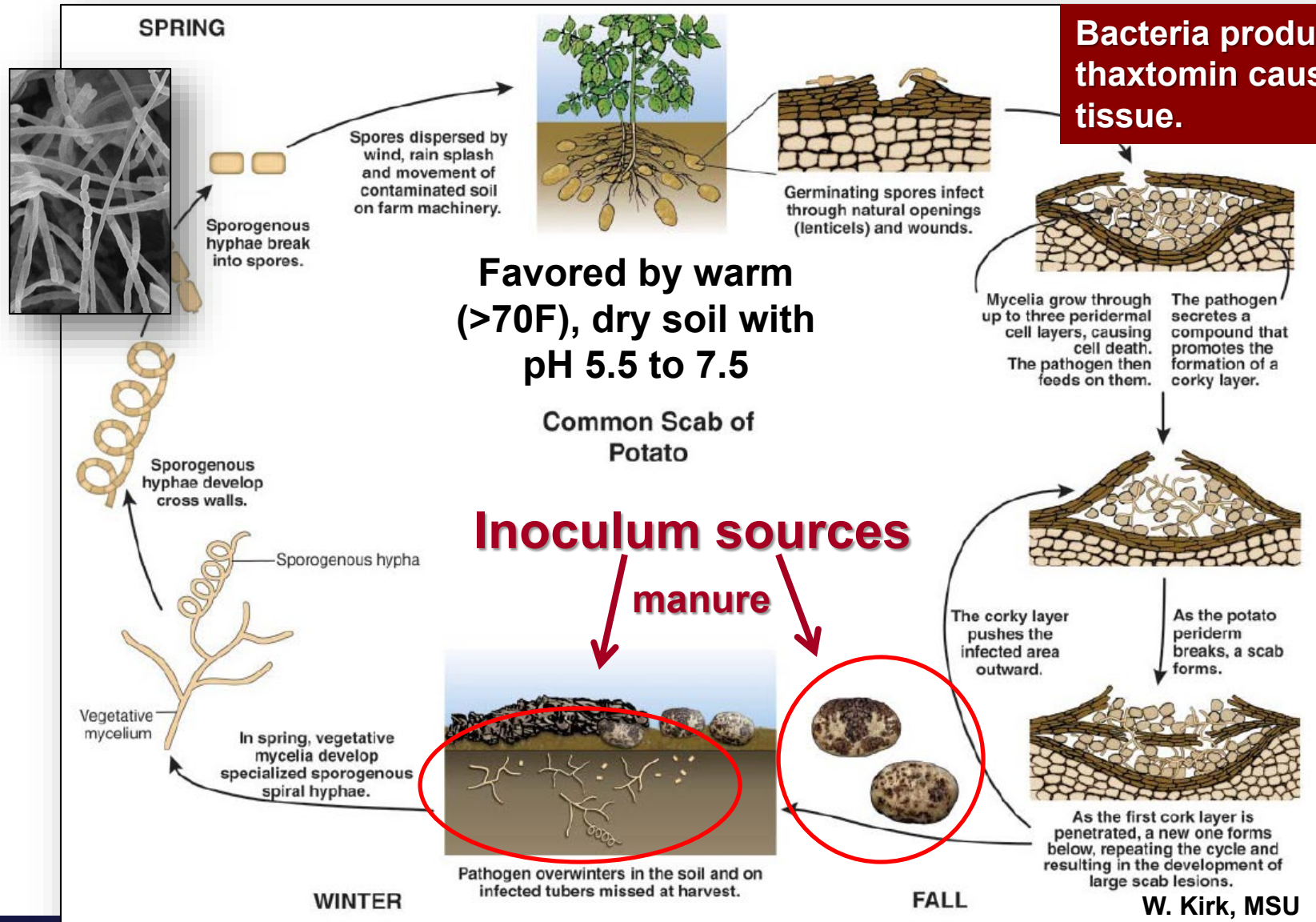
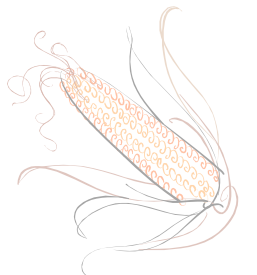
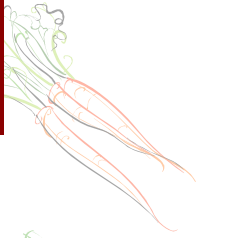
$9.2 \times 10^6$  vs  $10^8$



B. Christ



# Common scab (*Streptomyces* spp.)





# Common scab management

➔ Select **less susceptible cultivars**

## Some resistance

Nooksack  
Russet Burbank  
Superior  
Dark Red Norland

## More susceptible

Yukon Gold  
Kennebec  
Katahdin  
Norwis  
Shepody  
Russet Norkotah  
Defender



**Resistance does not equal immunity!**

➔ **Fungicides** have limited efficacy

Seed treatments containing captan or mancozeb may help manage inoculum potentially coming in on infected seed



# Common scab management



➔ **Soil moisture** – maintain soils near field capacity for 2 to 6 weeks after tuber initiation

➔ **Soil pH** – reduced with pH levels of 5.2 and below

....working with lime can be tricky

➔ **Cropping sequences** –

**Avoid:** red clover, radish, carrot, beet, spinach

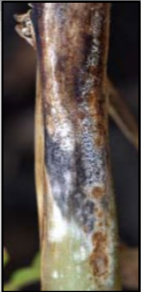
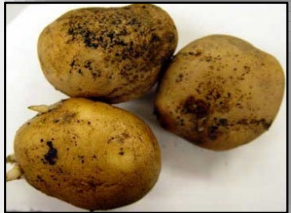
**Consider:** alfalfa, rye, soybean

**Biofumigants:** brassicas & sudan grass

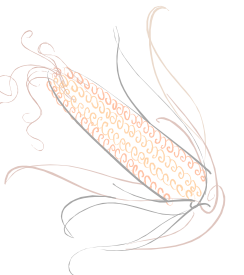




# Potato rotations for disease suppression



Potato Disease	Rotational/ Cover Crops To...	
	Consider	Avoid
<b>Common scab</b>	Alfalfa, rye, soybean	Red clover, carrot, beet, radish, spinach
<b>Rhizoctonia</b>	Grasses, wheat, oats, rye, barley	Tomato, soybean
<b>Black dot</b>	Wheat, barley, rye, alfalfa, corn	Soybean, tomato, oat, mustard, canola
<b>Silver scurf</b>	--	Crop residue of oat, corn, wheat, rye, red clover, alfalfa
<b>Pink rot</b>	Legumes	Wheat, barley, tomato



**Accurate diagnosis is important!**

# Black dot (*Colletotricum coccodes*)

- ➔ Host range includes Solanaceous crops & weeds
- ➔ Affects roots, stems, stolons

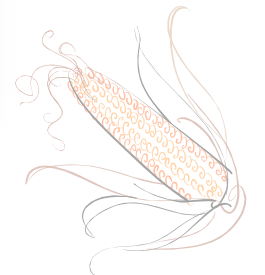


**Pigmented  
flecks**

**Coalesce w/  
white centers;  
girdle stem**

**Microsclerotia  
form**

**Microsclerotia cover  
plant base late in season**



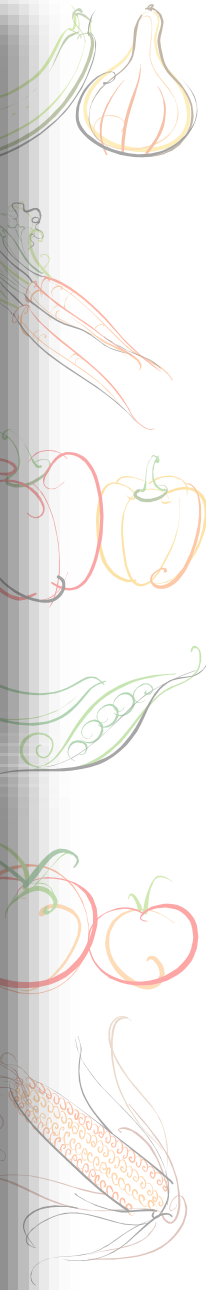
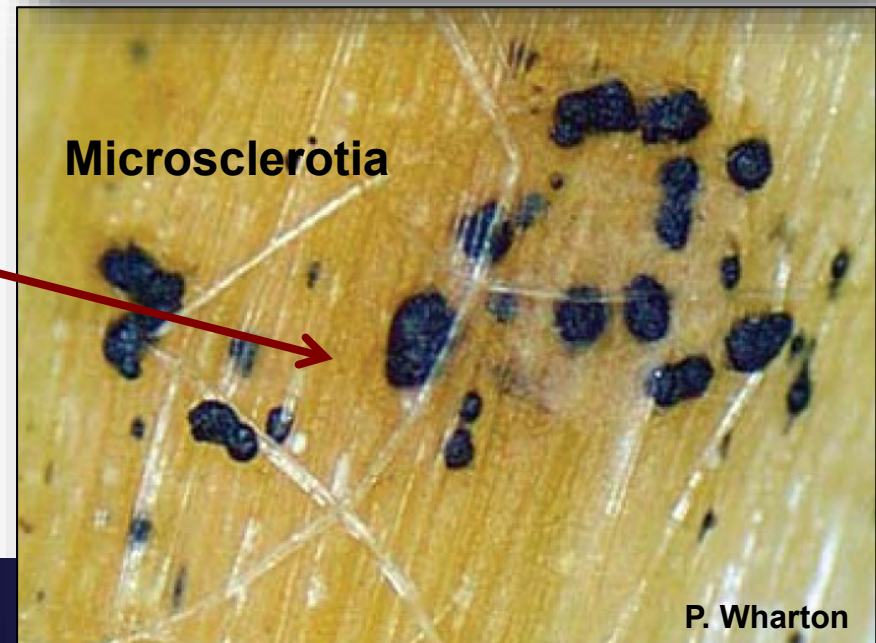
P. Wharton



# Black dot (*Colletotricum coccodes*)

- ➔ **Tuber symptoms** are hard to distinguish from silver scurf
- ➔ **Tan to gray lesions** on infected periderm tissue with **no defined margin**

- ➔ **Sclerotia** develop on upper surface of tubers



# Black dot and Silver scurf



## Silver scurf

(*Helminthosporium solani*)

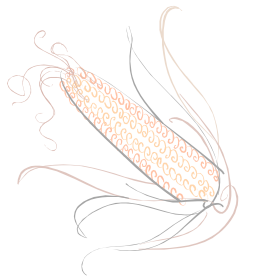
Infects tubers only- seed piece primary inoculum for daughter tubers and spreads primarily in storage

**Commonly occur on  
the same tuber!**

## Black dot

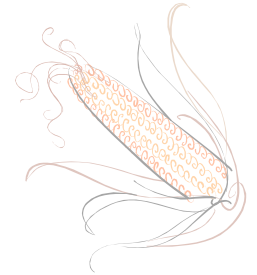
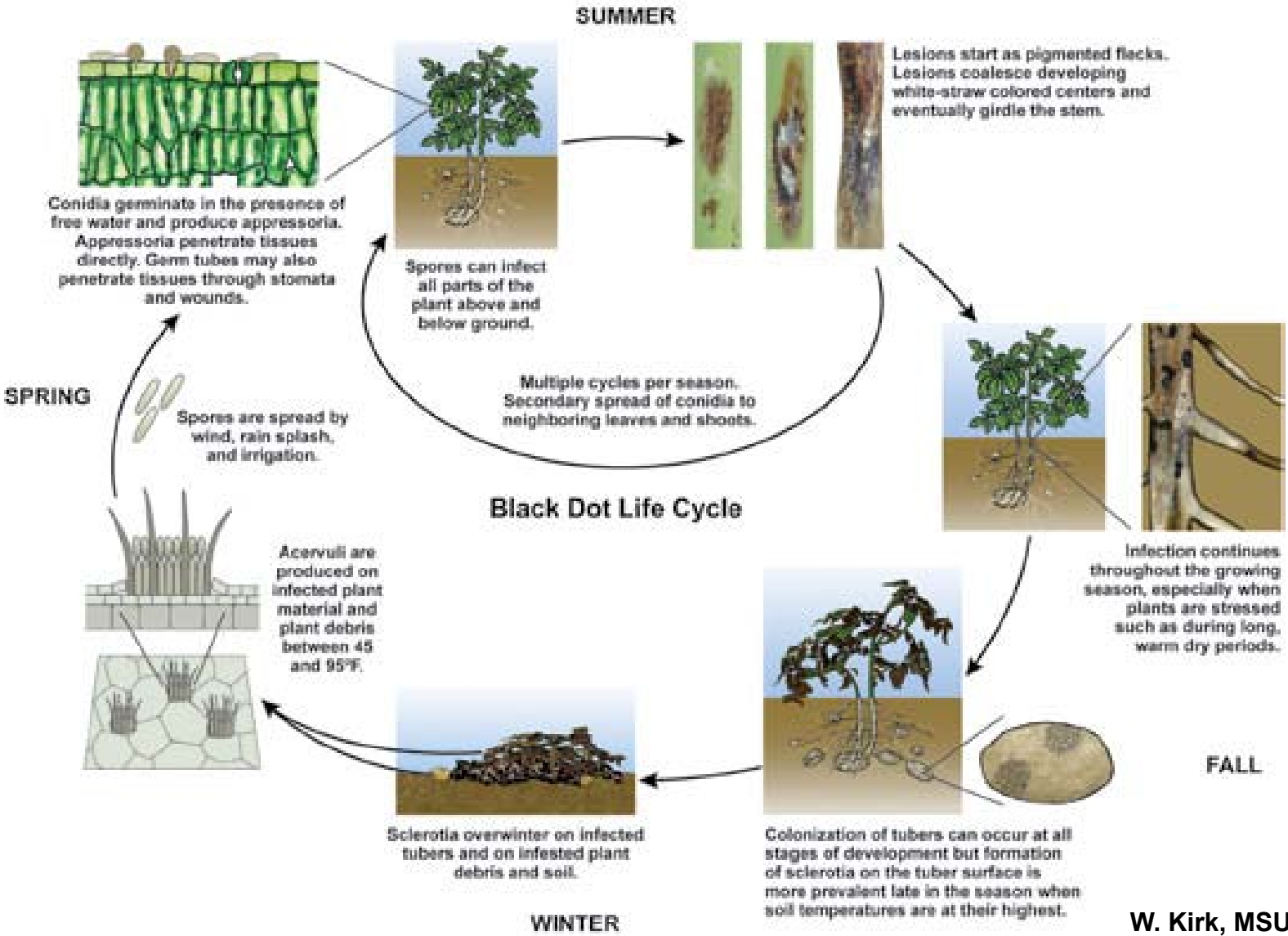
(*Collectotricum coccodes*)

Infects tubers, roots, stolons, above- and below-ground stems





# Black dot disease cycle

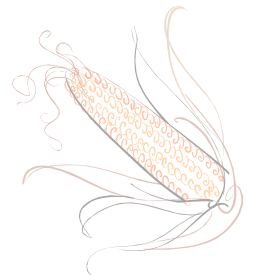


W. Kirk, MSU

# Black dot management

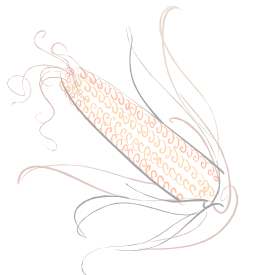
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- ➔ **Rotate 3 to 4 years** with non-host crops
  - Avoid** - soybean, tomato, oat, mustard, canola
  - Consider** - wheat, barley, rye, alfalfa, corn, orchard grass
- ➔ Avoid **poorly drained** fields (reduce plant stress)
- ➔ **Incorporate crop residue** in fall to encourage decomposition
- ➔ **Harvest** as soon as skin has set to minimize development of sclerotia (early maturing cultivars)
- ➔ **Seed and soil chemical treatments**



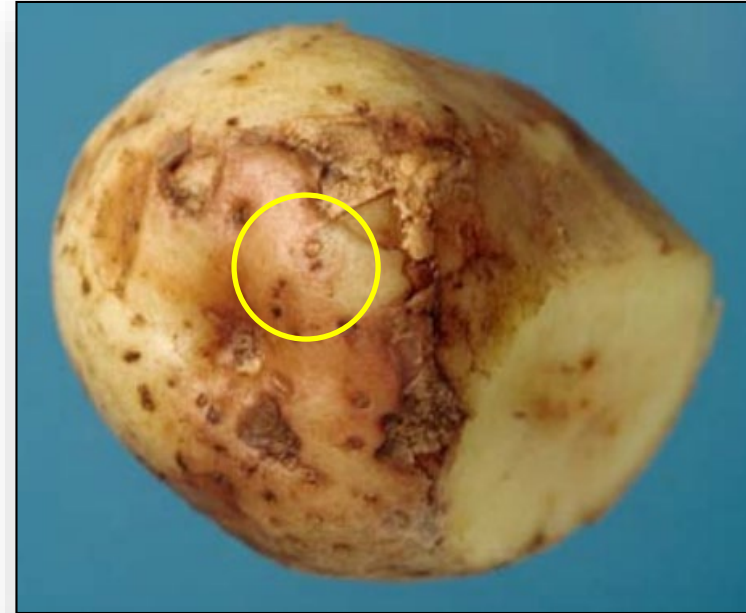


# Periderm disorder syndrome (formerly Pink eye disorder)

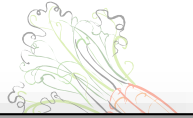


➔ Characterized pink skin tissue around the eyes from the middle to bud end of the tubers (although not diagnostic)

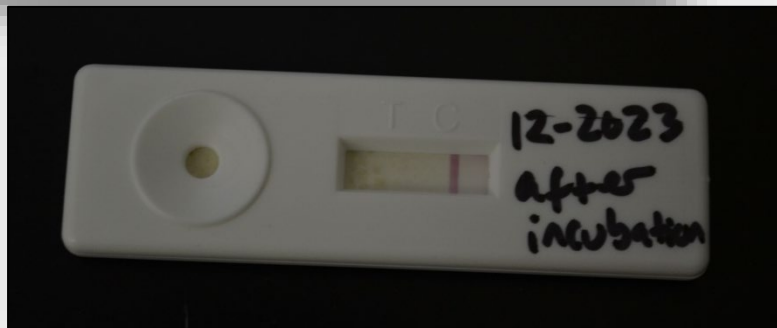
➔ Once associated with several pathogens but never been able to demonstrate Koch's postulates



# PSU Plant Disease Clinic sample



cv. Eva



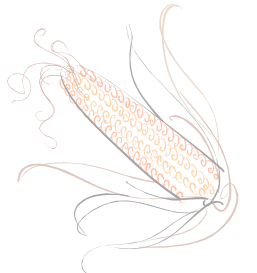
Negative for late blight






# Periderm disorder syndrome

➔ Connected to a “stressful” growing season with above normal heat, dry conditions followed by wet conditions that result in anaerobic conditions around tubers – very unpredictable





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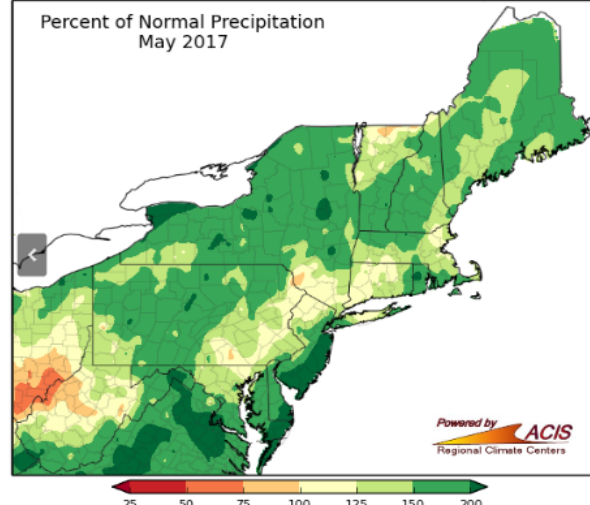
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### Percent of Normal Precipitation May 2017



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### New York-Central Park Area, NY (ThreadEx) - January 28, 2020

	Observed	Normal	Record Highest	Record Lowest
<b>Daily Data</b>				
Maximum temperature	43	39	66 in 1916	10 in 1888
Minimum temperature	37	27	46 in 2018	-2 in 1925
Average temperature	40.0	32.8	53.0 in 2002	6.0 in 1925
Precipitation	0.00	0.11	1.87 in 1994	0.00 in 2020
Snowfall	0.0	0.3	7.5 in 1897	0.0 in 2020
Snow depth	0	-	20 in 2011	0 in 2020
<b>Month-to-Date</b>				
Average temperature	39.6	32.6	43.7 in 1932	21.4 in 1918
Total precipitation	1.91	3.31	10.52 in 1979	0.53 in 1969
Total snowfall	2.3	6.2	36.0 in 2011	0.0 in 1890
<b>Year-to-Date</b>				
Average temperature	39.6	32.6	43.7 in 1932	21.4 in 1918
Total precipitation	1.91	3.31	10.52 in 1979	0.53 in 1969
Snowfall since July 1	4.8	11.3	56.1 in 2011	T in 1973

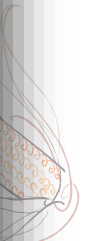
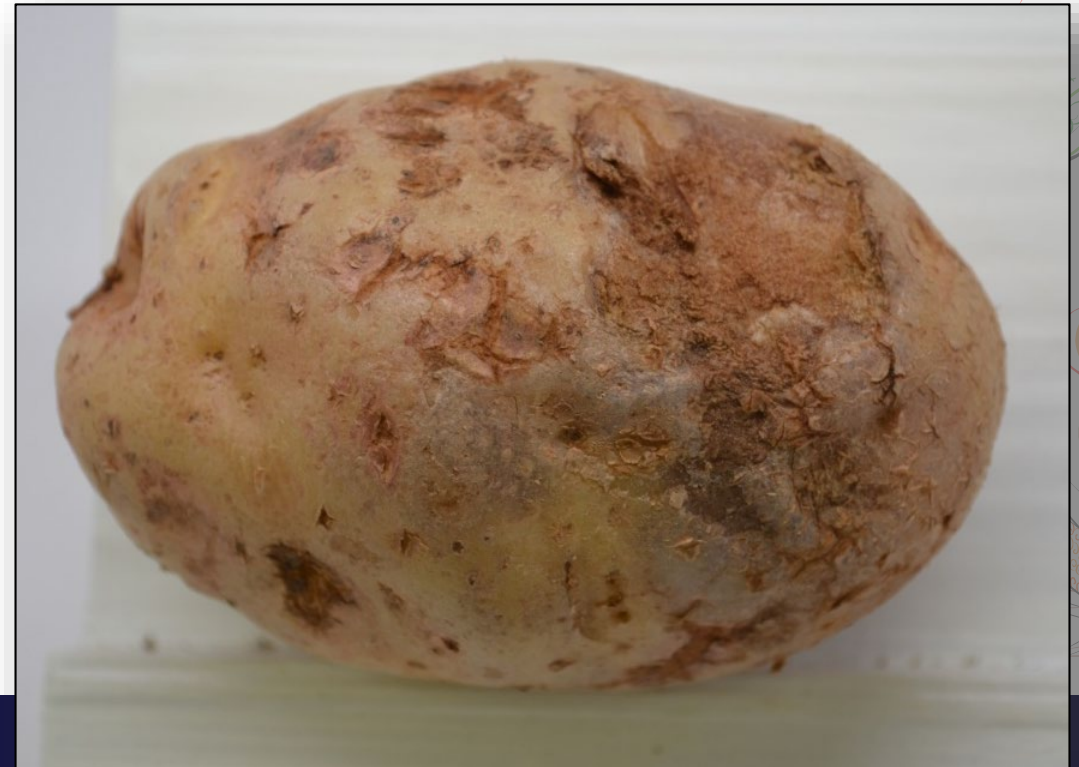
**WEBSITE HIGHLIGHTS**

# Periderm disorder syndrome

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- ➔ Symptoms observed around harvest and 7 to 10 days after a significant rain event
- ➔ Pink symptoms advance into a corky elephant hide symptom so renamed
- ➔ Yukon Gold, Superior, Shepody, Snowden, Russet Burbank, Russet Norkotah are more susceptible

## Periderm disorder syndrome





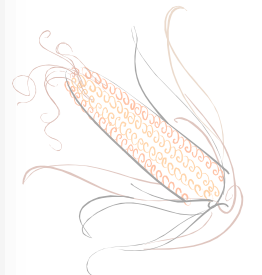
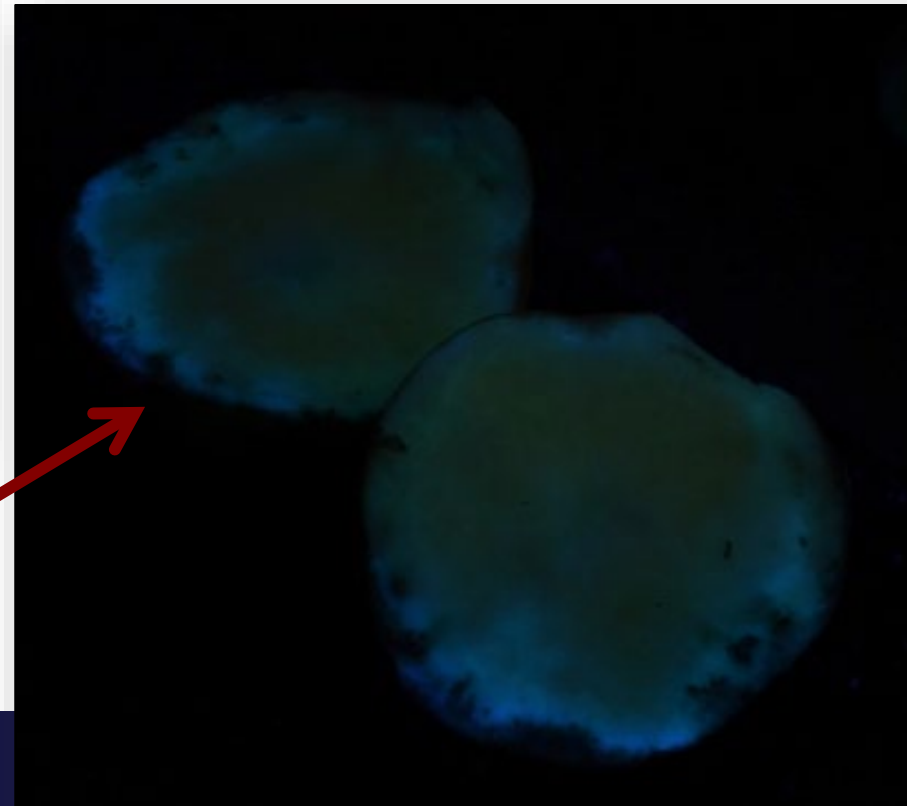
# PSU Plant Disease Clinic sample



cv. Norwis

**Expose to UV light**

**Bluish fluorescence**

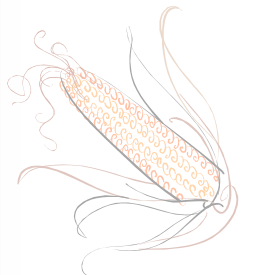


# Periderm disorder syndrome

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➔ **Environmental modification** = reduce compaction to improve water drainage and reduce soil temperatures, promote overall plant health to reduce stress but it is often out of our control

Tubers are susceptible to infection by other pathogens due to compromised skin







**PennState**

College of Agricultural Sciences



**Have a happy,  
healthy and  
successful 2023  
growing season!**

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