



NDSU | EXTENSION

2025

field to fork



www.ag.ndsu.edu/food

NDSU EXTENSION

EXTENDING KNOWLEDGE >> CHANGING LIVES

Upcoming Webinars

- **April 9 - All About Alliums: Garlic, Green Onion, Dry Bulb Onion, Leeks and Shallots**
- Harlene Hatterman-Valenti, NDSU Department of Plant Sciences professor
- **April 16 - Ghosts in Your Gardens**
- Janet Knodel, NDSU Extension entomologist and professor



Presenter

Audio Settings ^



Chat



Raise Hand



Q&A

Leave

- **Please complete the short online survey** that will be emailed to you after today's webinar. It will take just a couple minutes!
- Be sure to sign up for an opportunity to win a prize in the drawing. After submitting the survey, a form to fill out with your name/address will appear.

Acknowledgement: This project was supported by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service through SCBG24-246. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.



April 2

Plant Pathology 101: Common Plant Diseases

Sam Markell, NDSU Department of Plant Pathology professor and interim department chair



Take home messages

Think: 'Disease Triangle'

Look for: 'Signs' & 'Symptoms'

Act: IPM 'Manage the corners'

Help!: 'Plant Diagnostic Lab'

Outline

Disease



Plants get sick?!?!

Plant Disease

Any malfunctioning of host cells and tissues that results from continuous irritation by pathogenic agents or environmental factors (Agrios, 2005)



Plants get sick?!?!

Plant Disease

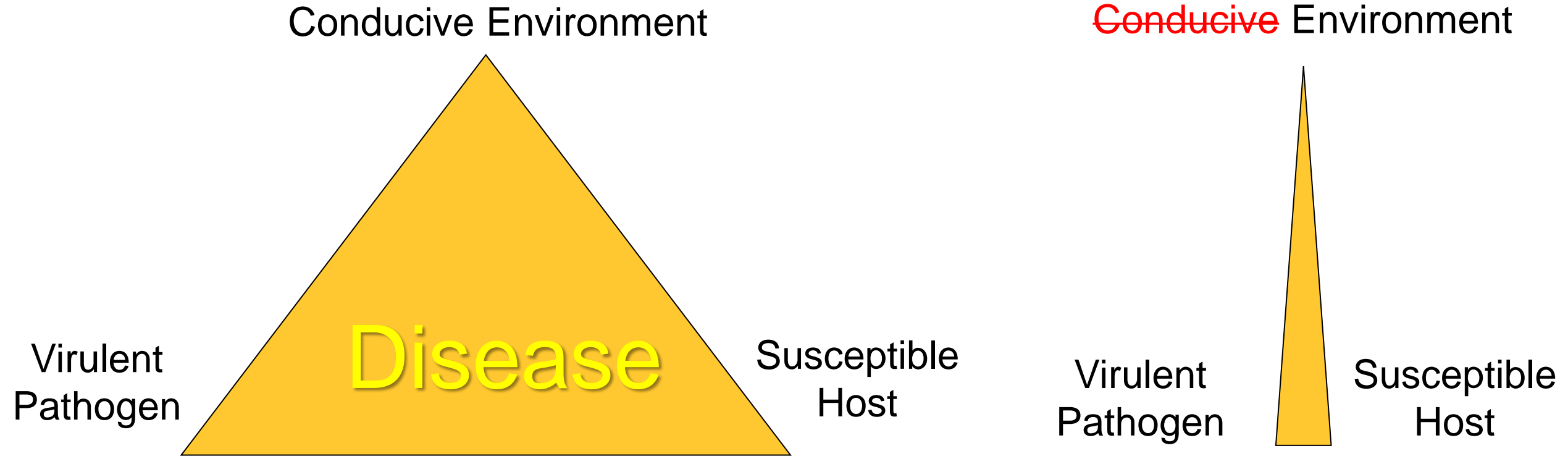
Any malfunctioning of host cells and tissues that results from continuous irritation by **pathogenic agents or environmental factors** (Agrios, 2005)



Plants get sick?!?!



Disease Triangle



HOST



PATHOGEN



ENVIRONMENT







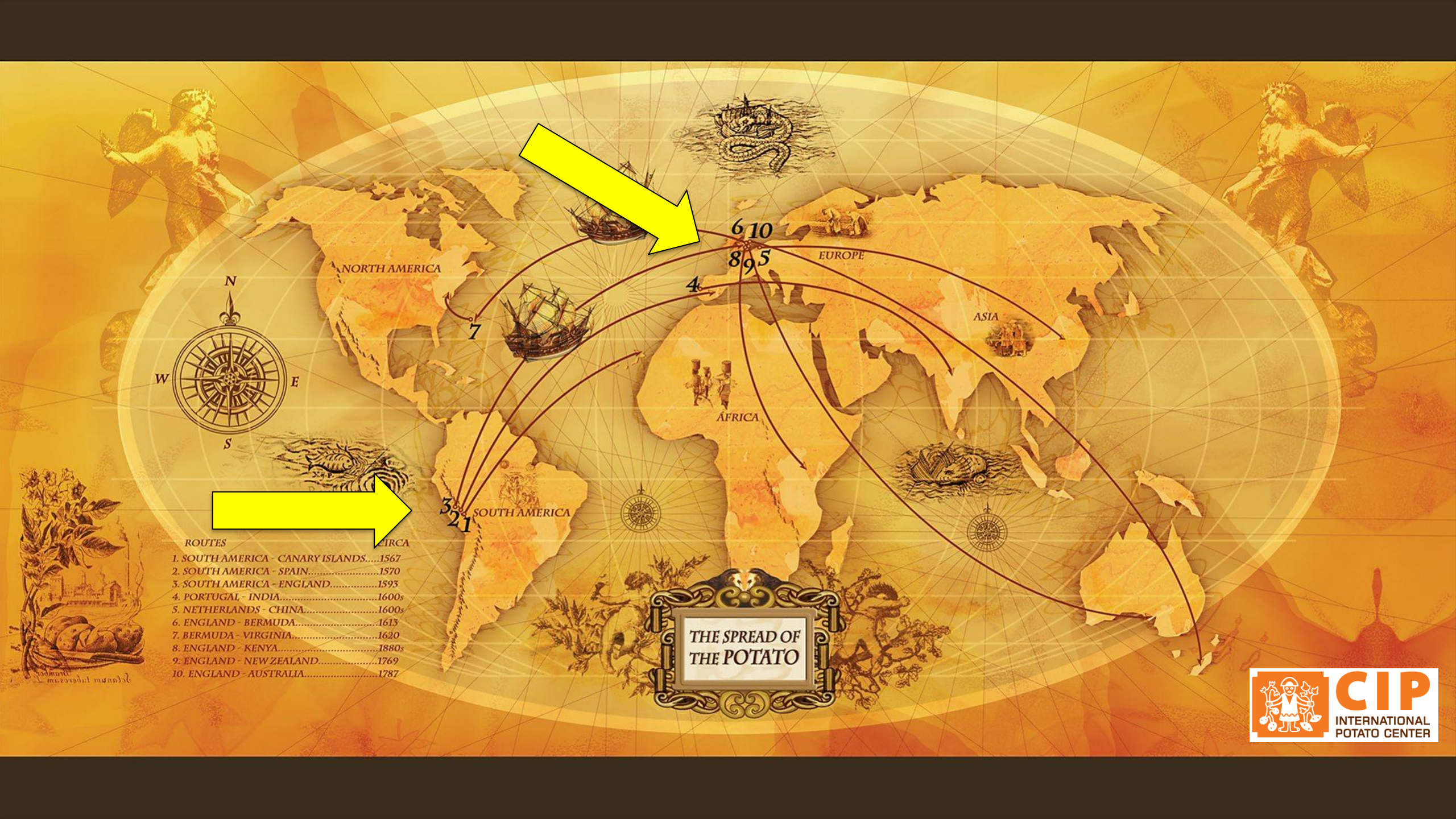






HOST





ROUTES

- | ROUTES | CIRCA |
|--|-------|
| 1. SOUTH AMERICA - CANARY ISLANDS..... | 1567 |
| 2. SOUTH AMERICA - SPAIN..... | 1570 |
| 3. SOUTH AMERICA - ENGLAND..... | 1593 |
| 4. PORTUGAL - INDIA..... | 1600s |
| 5. NETHERLANDS - CHINA..... | 1600s |
| 6. ENGLAND - BERMUDA..... | 1613 |
| 7. BERMUDA - VIRGINIA..... | 1620 |
| 8. ENGLAND - KENYA..... | 1880s |
| 9. ENGLAND - NEW ZEALAND..... | 1769 |
| 10. ENGLAND - AUSTRALIA..... | 1787 |

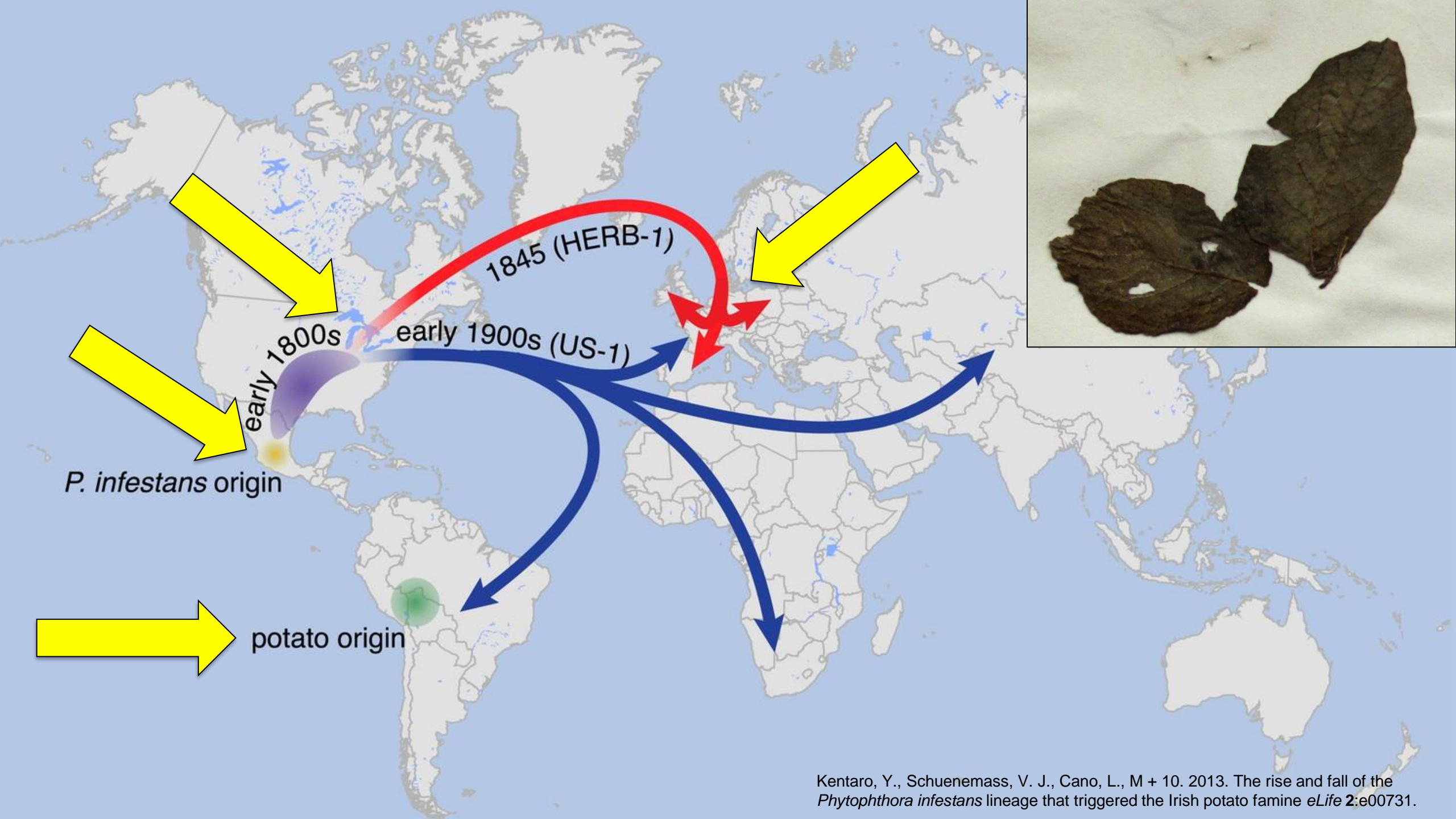
THE SPREAD OF
THE POTATO



The Daily Edge. 1/21/2014. The 11 levels of Irish Rain.

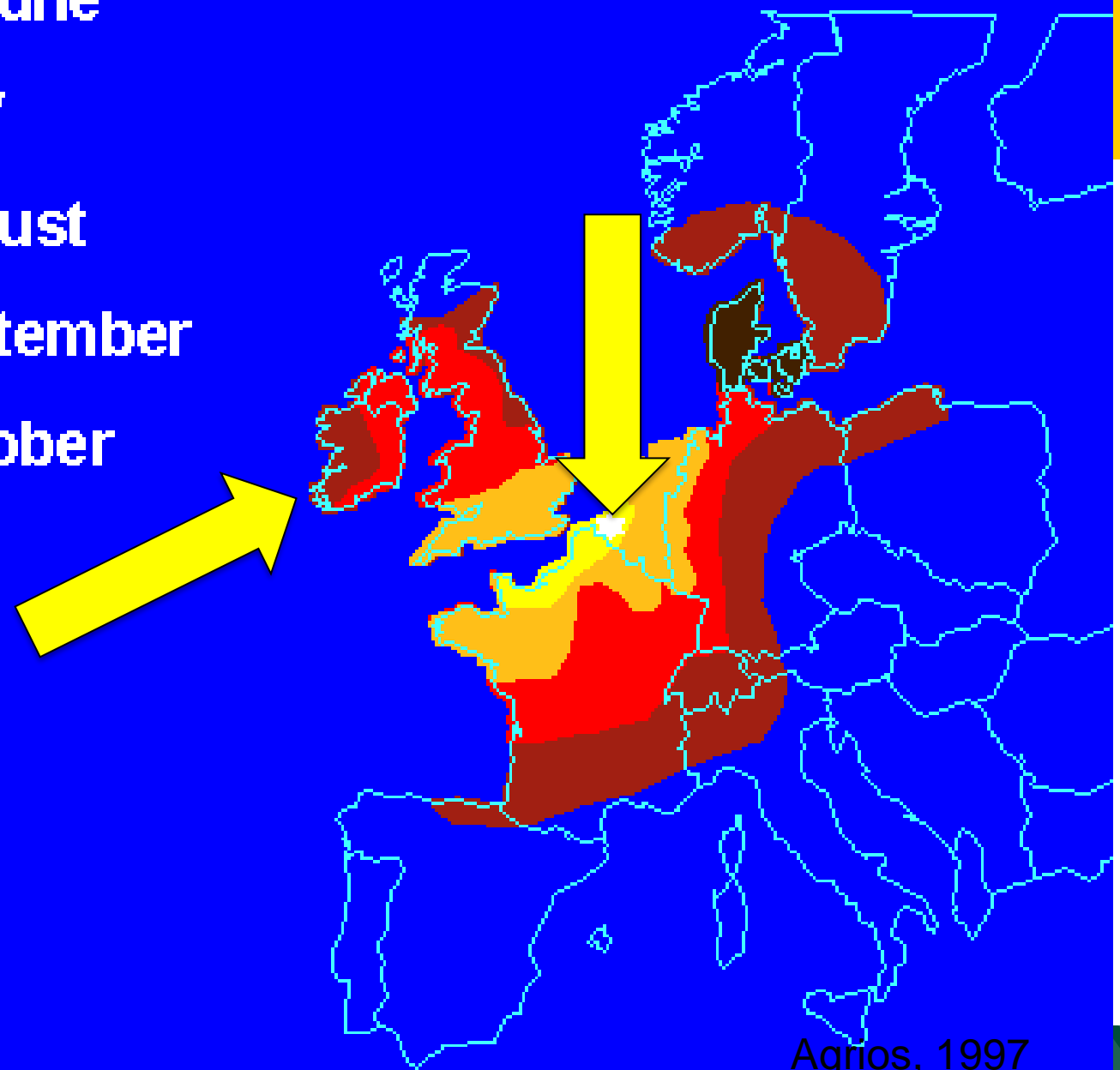
Phytophthora infestans
‘Plant Destroyer’





1845

- * End of June
- Mid-July
- Mid-August
- Mid-September
- Mid-October



Agrios, 1997





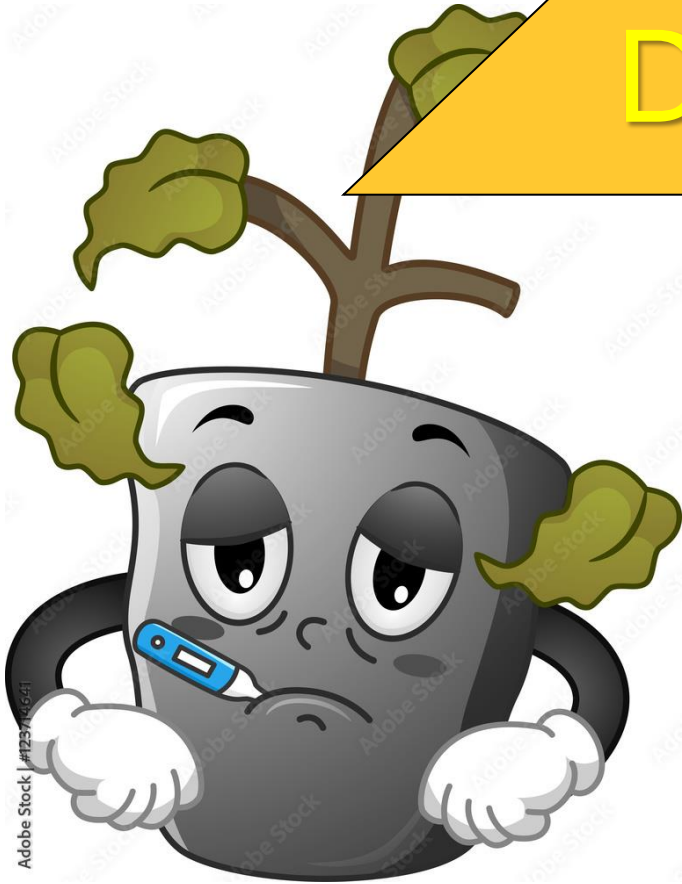
Photo: G. Secor & V. Rivera



Photo: G. Secor & V. Rivera

Outline

Disease



How do you identify diseases?

- Observe the pathogen / disease
 - Signs and Symptoms
- Signs
 - Structures or products of a pathogen on or in diseased plants
- Symptoms
 - Are the expression of disease by a plant as a response to a pathogen

Signs vs. Symptoms

Symptoms

- It dies!
- Wilt
- Chlorosis (yellowing)
- Damping off
- Colored streaks

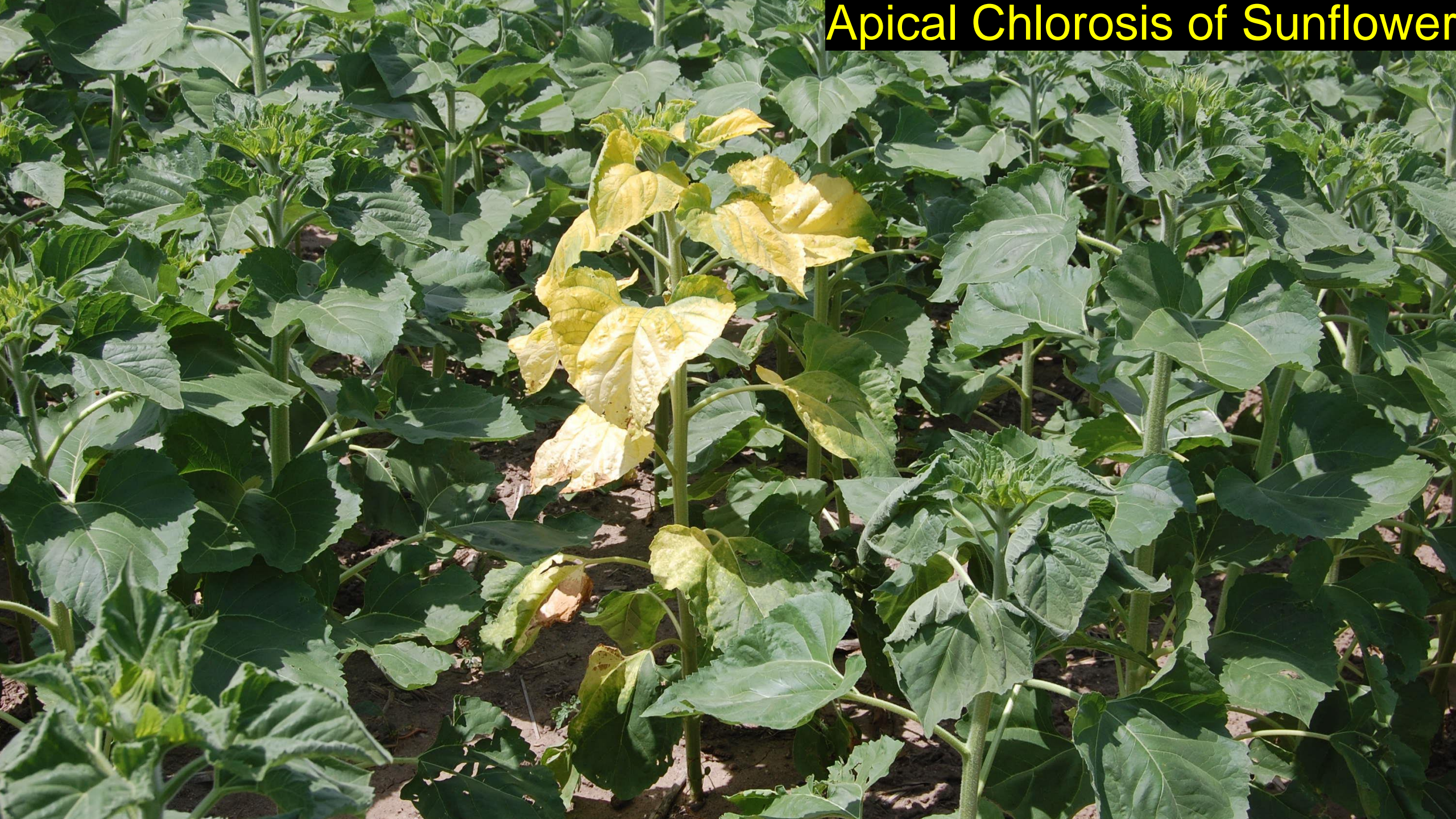
Signs

- Fungal growth
- Fungal structures (black dots, etc.)
- Ooze from bacteria
- Spores

Downy Mildew of Sunflower



Apical Chlorosis of Sunflower



Common Blight of Bean



Common Bean Rust



White mold of sunflower



A few common types of diseases (and examples)

FU



NDS

Fungi (75% of all plant pathogens)

Powdery Mildew

- Very 'host specific'
- Obligate
 - White growth is fungal mycelium
 - Black survival structures
- Warm and dry, high humidity, shade



Fungi

Root Rots

- Often fungi
- Numerous pathogens
- Damp off to wilt







Fungi

Root Rots

- Often fungi
- Numerous pathogens
- Damp off to wilt
- Commonly 'wet'



Fungi

White Mold

- White fluffy growth
- Hard black structures



Wunsch



Markell

Fungi

White Mold

- White fluffy growth
- Hard black structures
- Cool and wet
- Broad host range





Fungi

Fungal Leaf Spotters

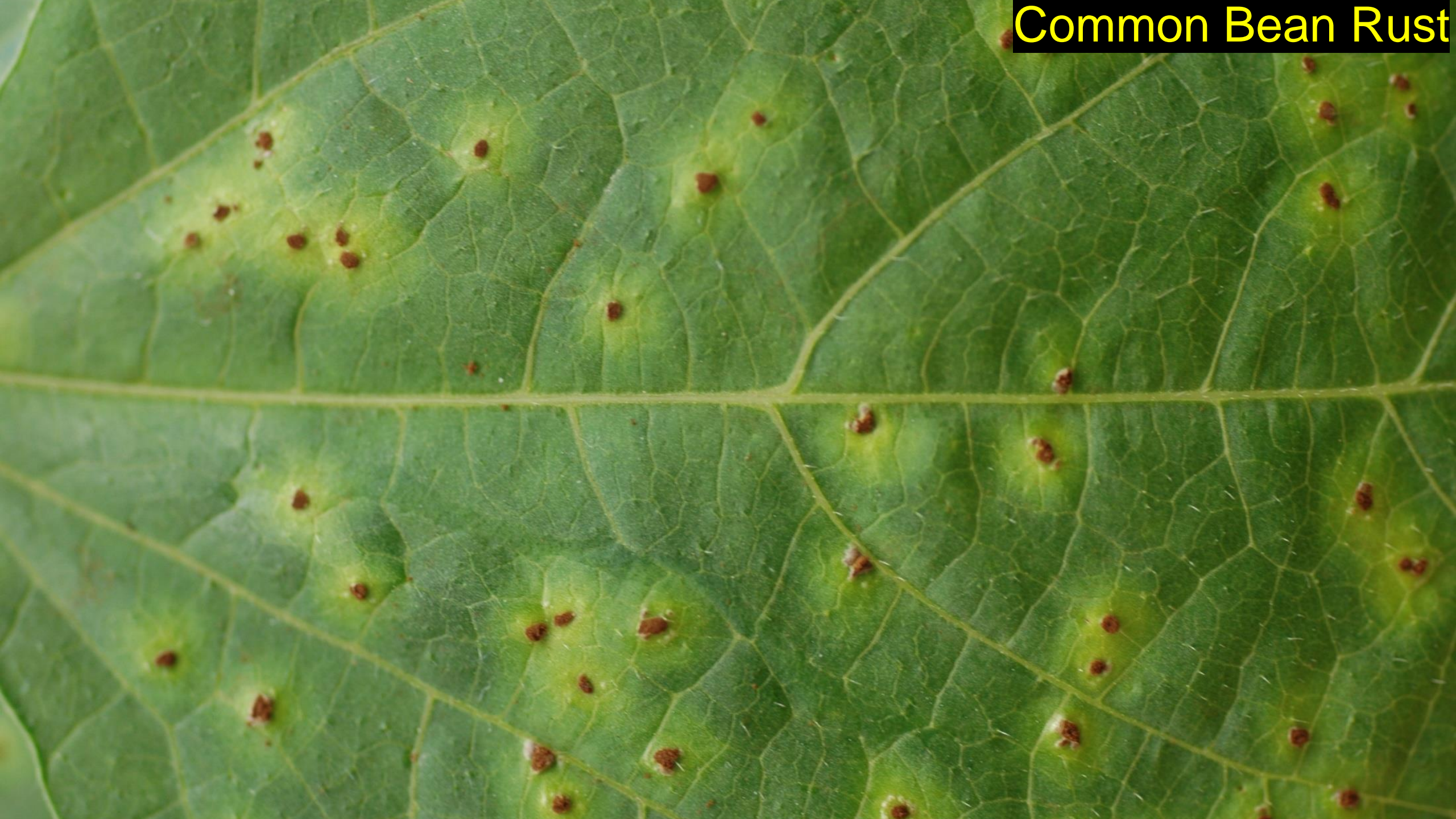
- Most plants have multiple
- *Many have Signs*
 - *Black specs, pustules, etc.*

Septoria of pea



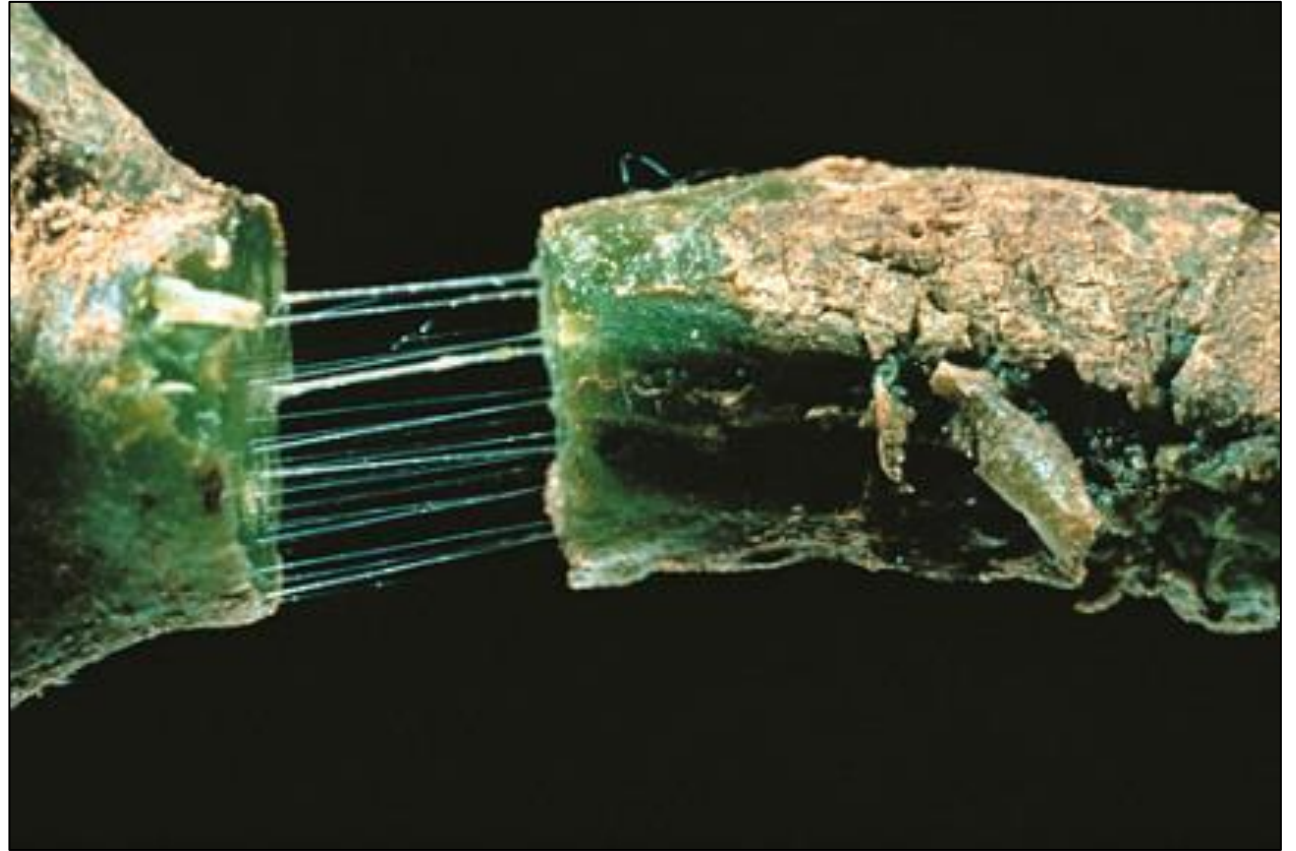


Common Bean Rust



Bacteria

- Lack of fungal signs
- Bacterial ooze
- Shiny
- Shothole appearance
- Wounding + water



<http://www.apsnet.org/edcenter/intropp/pathogengroups/pages/bacteria.aspx>



Common Blight of Bean



Photo: Julie Pasche





Viruses, Nematodes, and more!!!





Abiotic

Blossom end rot

- Related to Calcium
- Even watering can help

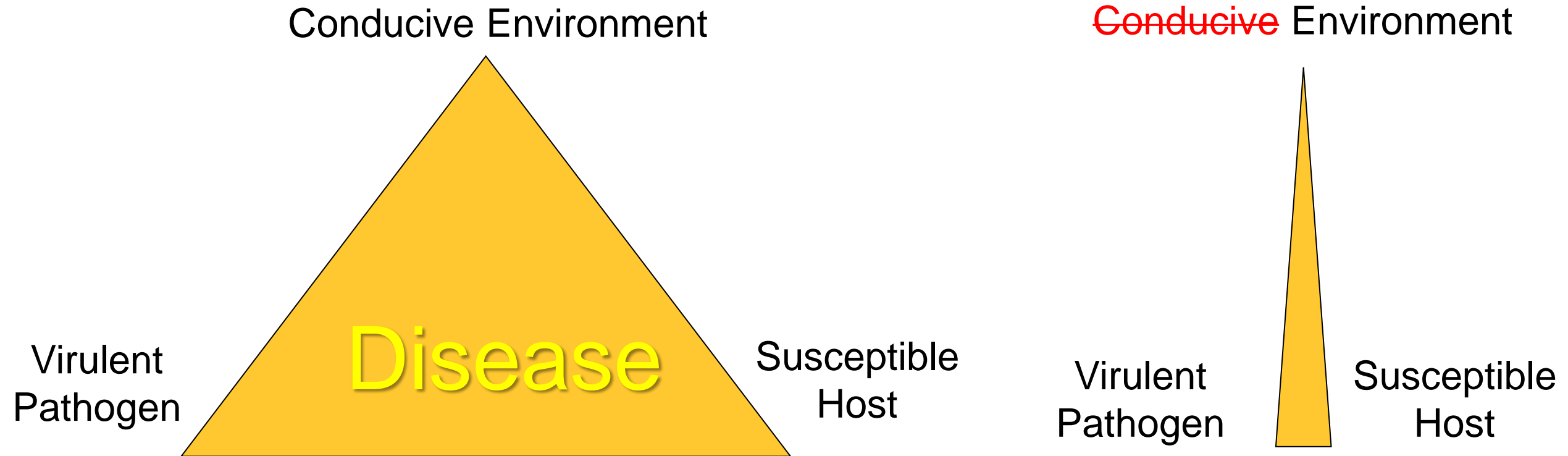


Outline

Disease



Management: Disease Triangle



Integrated Pest Management (IPM)

- Manage the corners
- Use multiple control strategies
 - Reduces risk of management failure
- The tool box
 - Genetic resistance, Cultural control, Fungicides, Others



Manage the corners

Environment

- Water
 - Rainfall, watering, fog
 - Proximity to fences, trees
 - Canopy density
- Temperature
- Human activities
 - new soil, fertilizer.....



From: Britannica

Manage the corners

Host

- Variety (ies)
 - Resistant/susceptible to a certain disease

SKU	NAME	RESISTANCE & NOTES
52001A	AMISH PASTE	NO RESISTANCE, HIGH ACID
54350A	ATLAS HYBRID	V F, SOME HEAT TOLERANCE
50280A	BABY BOOMER HYBRID	U / U ED
60190A	BAXTER'S BUSH CHERRY ORG	Cr, H ANCE
60620A	BEEFSTEAK ORGANIC	U / U ED
50724A	BETTER BOY HYBRID	V F N

CODE	DISEASE TYPE
Asc	ALTERNARIA STEM CANKER
BS	BACTERIAL SPECK
BER	BLOSSOM END ROT
Cr	CRACKING
EB	EARLY BLIGHT
F	FUSARIUM WILT (3 Strains)
LB	LATE BLIGHT
N	NEMATODES
St	STEMPHYLIUM
T	TOBACCO MOSAIC VIRUS
TSWV	SPOTTED WILT VIRUS
V	VERTICILLIUM WILT (3 Strains)



Manage the corners

Host

- Variety (ies)
 - Resistant/susceptible to a certain disease
- Multiple varieties





Manage the corners

Host

- Variety (ies)
 - Resistant/susceptible to a certain disease
- Multiple varieties
- Stress



Manage the corners

Pathogen

- Proximity to residue from previous year?
- Soil movement?
- Did you plant infected seed?





IT'S TIME TO CALL IN THE
BIG GUNS.

Plant Diagnostic Lab(s)

NDSU

- Operated by NDSU Extension
- County Extension Agents
- Minimal cost associated
- Days to Weeks

Plant Diagnostic Laboratory

Walk-ins: NDSU campus – 206 Waldron Hall
Website: www.ag.ndsu.edu/pdl
Staff emails at: <https://www.ag.ndsu.edu/pdl/staff>
Telephone: 701-231-7854 Fax: 701-231-7851

Diagnostic Sample Submission Form

Email will be used unless other communication method is requested

Please provide first, last names, a full mailing address, email/phone number(s), and sample location:

Submitter: _____	Submitted For (Client): _____
Company: _____	Company: _____
Address: _____	Address: _____
City/State/Zip: _____	City/State/Zip: _____
Phone: _____ Fax: _____	Phone: _____ Fax: _____
Cell: _____	Cell: _____
DOB: _____	DOB: _____
E-mail: _____	E-mail: _____
Sample Origin (zip code or State/County) _____	Location: _____

Fee: This is a fee-based lab, and a nominal fee may be applied to your sample. Pre-payment may be required. Current fees are available online at <http://www.ag.ndsu.edu/pdl>. Bulk rates may be appropriate for your sample, please contact us with questions.

Address samples to: <i>Postal Service</i> NDSU Plant Diagnostic Lab NDSU Dept 7660, PO Box 6050 Fargo, ND 58108-6050 <i>Private carrier:</i> NDSU Plant Diagnostic Lab 1402 Albrecht Blvd. 306 Walster Hall, Fargo ND 58102	Services requested: <input type="checkbox"/> Routine Diagnosis <input type="checkbox"/> Plant ID <input type="checkbox"/> Culture/ELISA <input type="checkbox"/> Insect ID <input type="checkbox"/> Special Test <input type="checkbox"/> Mold ID <input type="checkbox"/> Other: _____	Results and Billing: Send results to: <input type="checkbox"/> Submitter <input type="checkbox"/> Client Send bill to: <input type="checkbox"/> Submitter <input type="checkbox"/> Client
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Sample collection instructions: See <https://www.ag.ndsu.edu/pdl/submit-a-sample> for details.

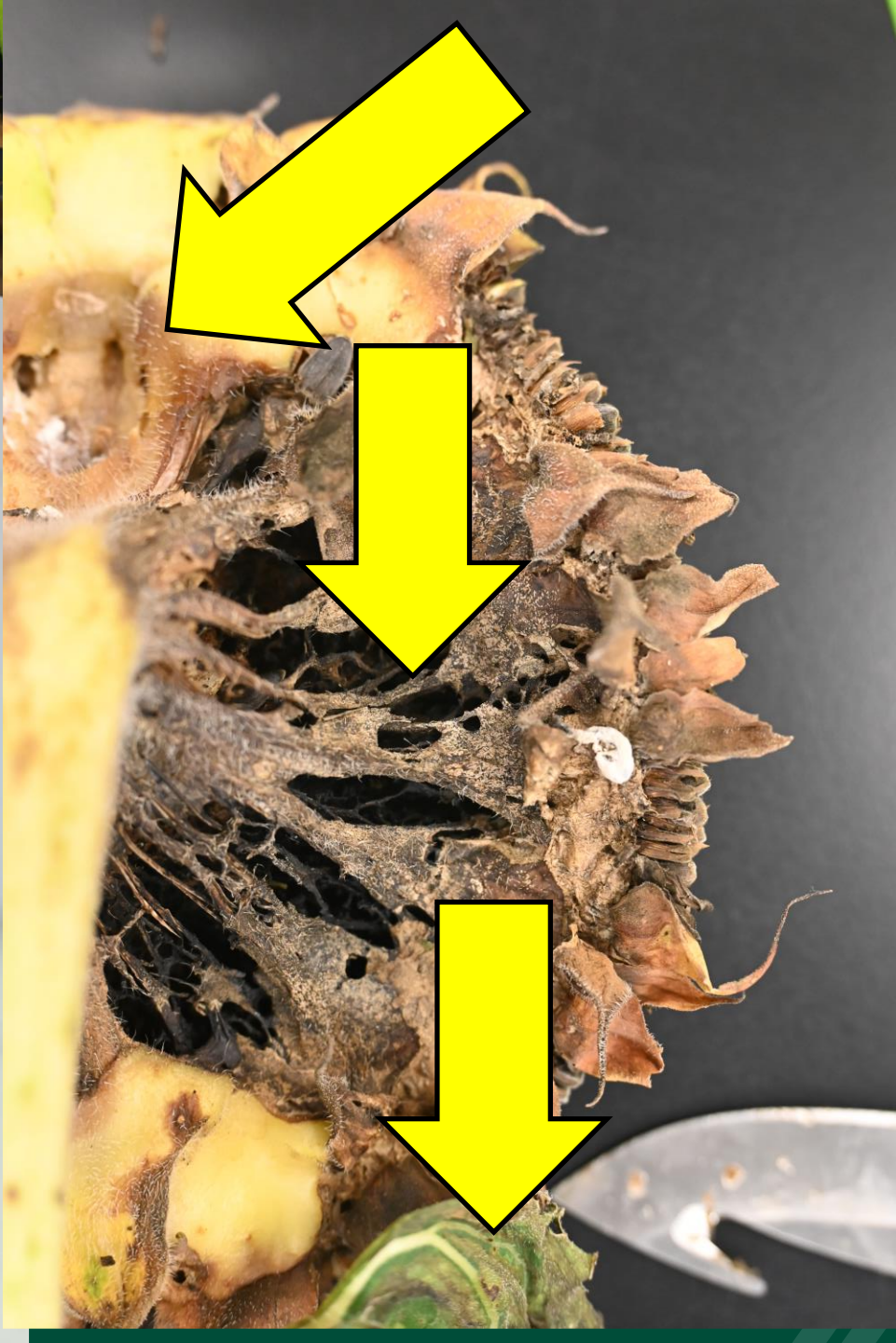
Host: _____	Planting Date: _____	Symptom development: <input type="checkbox"/> Days <input type="checkbox"/> Weeks <input type="checkbox"/> Months <input type="checkbox"/> Occurred in previous years Date symptoms noticed: _____
Variety: _____	Date sample collected: _____ Date sample sent: _____	
Turfgrass: Year established: _____ <input type="checkbox"/> Sod <input type="checkbox"/> Seed <input type="checkbox"/> Plugs	Trees: Approx. age: _____ Height: _____ Years at site: _____	

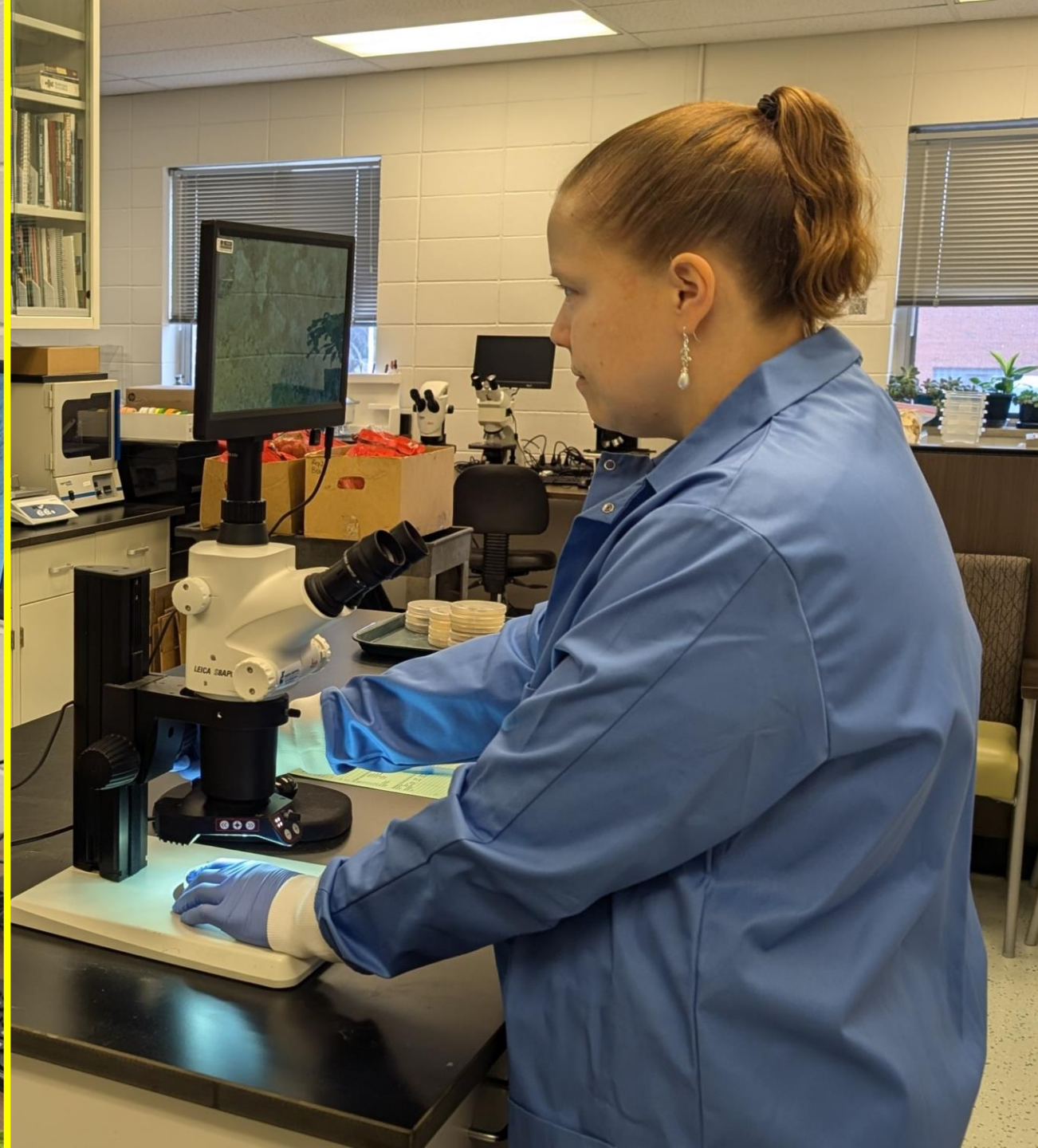
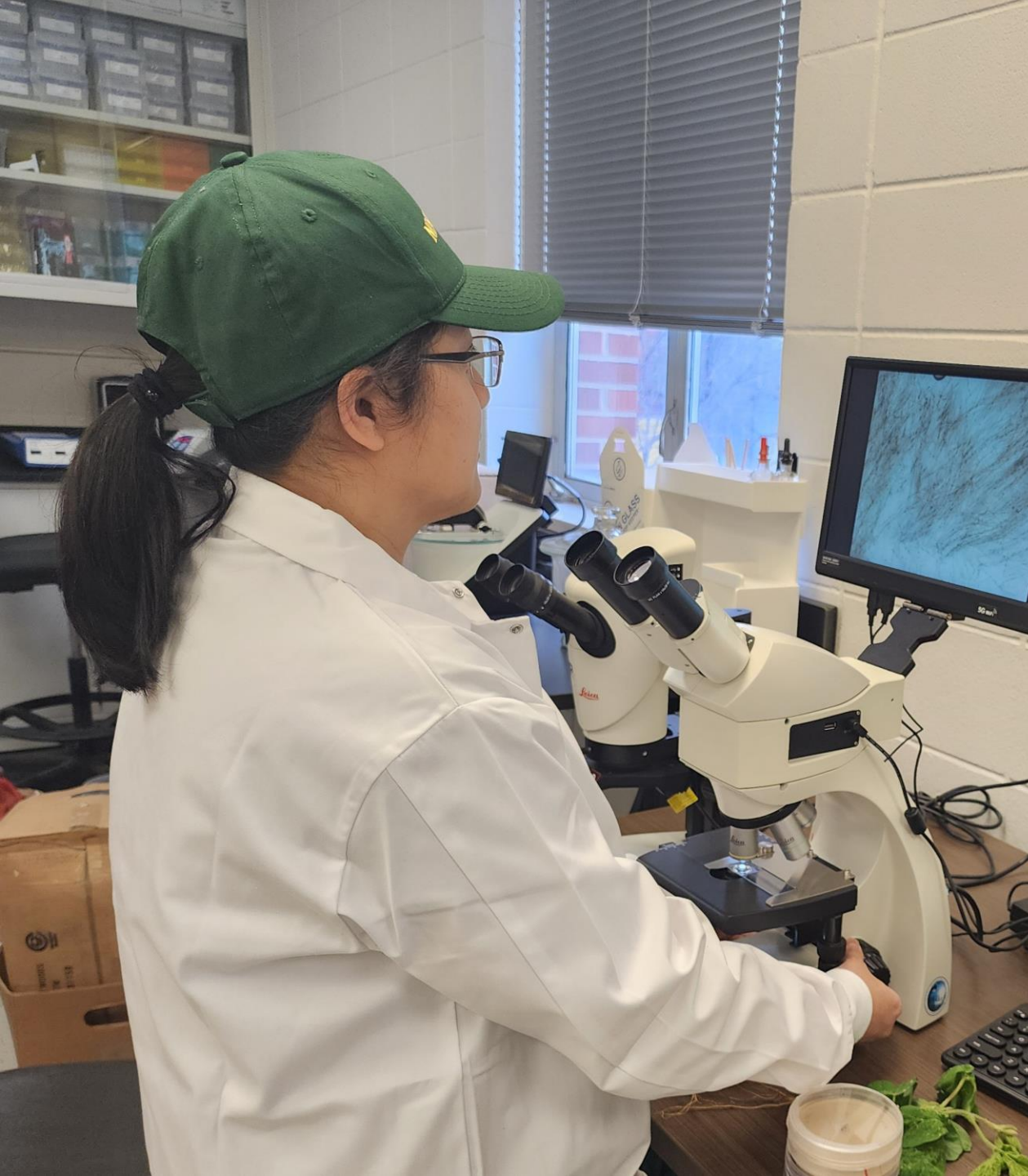
Location <input type="checkbox"/> Crop/Field <input type="checkbox"/> Greenhouse <input type="checkbox"/> Golf course <input type="checkbox"/> Lawn/Turf <input type="checkbox"/> Landscape <input type="checkbox"/> Home - Interior <input type="checkbox"/> Nursery/Orchard <input type="checkbox"/> Pasture <input type="checkbox"/> Garden <input type="checkbox"/> Shelterbelt <input type="checkbox"/> Other: _____	Size of Planting ____ Total Acres, or ____ Total # of plants Incidence ____ # Acres affected ____ sq. ft. affected ____ % of area affected -- Or -- ____ # of plants affected ____ % of plants affected	Symptoms <input type="checkbox"/> Yellowing <input type="checkbox"/> Browning <input type="checkbox"/> Stunting <input type="checkbox"/> Wilting <input type="checkbox"/> Rot <input type="checkbox"/> Dead areas <input type="checkbox"/> Tip Dieback <input type="checkbox"/> Leaf drop <input type="checkbox"/> Bending or Twisting <input type="checkbox"/> Abnormal growth <input type="checkbox"/> Other: _____	Parts Affected <input type="checkbox"/> Stems/trunk <input type="checkbox"/> Roots <input type="checkbox"/> Leaves <input type="checkbox"/> Flowers <input type="checkbox"/> Fruits/seeds <input type="checkbox"/> Entire plant <input type="checkbox"/> Branches ___ % <input type="checkbox"/> Other: _____	Distribution in Site <input type="checkbox"/> High areas <input type="checkbox"/> Low areas <input type="checkbox"/> Scattered plants <input type="checkbox"/> Groups of plants <input type="checkbox"/> Uniform <input type="checkbox"/> Wet areas <input type="checkbox"/> Sunny spots <input type="checkbox"/> Shady spots <input type="checkbox"/> Edge of planting <input type="checkbox"/> Other: _____	Site History Soil pH: _____ Soil drainage: <input type="checkbox"/> Good <input type="checkbox"/> Moderate <input type="checkbox"/> Poor Previous crops: Yr 1: _____ Yr 2: _____ Yr 3: _____
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Cultural practices: See reverse side to give details on fertilization, seed treatments, pesticide applications, tillage practices, soil type and drainage/slope, irrigation practices, and other site activity.

Plant Diagnostic Lab(s)

<u>Symptoms</u>	<u>Parts Affected</u>	<u>Distribution in Site</u>	<u>Site History</u>
<input checked="" type="checkbox"/> Yellowing	<input checked="" type="checkbox"/> Stems/trunk	<input type="checkbox"/> High areas	Soil pH: _____
<input type="checkbox"/> Browning	<input checked="" type="checkbox"/> Roots	<input checked="" type="checkbox"/> Low areas	Soil drainage:
<input type="checkbox"/> Stunting	<input checked="" type="checkbox"/> Leaves	<input type="checkbox"/> Scattered plants	<input type="checkbox"/> Good
<input checked="" type="checkbox"/> Wilting	<input type="checkbox"/> Flowers	<input type="checkbox"/> Groups of plants	<input checked="" type="checkbox"/> Moderate
<input type="checkbox"/> Rot	<input type="checkbox"/> Fruits/seeds	<input type="checkbox"/> Uniform	<input type="checkbox"/> Poor
<input type="checkbox"/> Dead areas	<input type="checkbox"/> Entire plant	<input checked="" type="checkbox"/> Wet areas	Previous crops:
<input type="checkbox"/> Tip Dieback	<input type="checkbox"/> Branches ___%	<input type="checkbox"/> Sunny spots	Yr 1: _____
<input type="checkbox"/> Leaf drop	<input type="checkbox"/> Other:	<input type="checkbox"/> Shady spots	Yr 2: _____
<input type="checkbox"/> Bending or Twisting		<input checked="" type="checkbox"/> Edge of planting	Yr 3: _____
<input type="checkbox"/> Abnormal growth		<input type="checkbox"/> Other:	
<input type="checkbox"/> Other:			





Take home messages

Think: 'Disease Triangle'

Look for: 'Signs' & 'Symptoms'

Act: *IPM* 'Manage the corners'

Help!: 'Plant Diagnostic Lab'

Thank You!

- Andrew Friskop, Gary Secor and Ms Viviana Rivera
- Dr. Julie Garden-Robinson, Scott Swanson, Ana Erlandson

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EXTENSION



United States Department of Agriculture

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mail:
U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410; or

fax:
(833) 256-1665 or (202) 690-7442;

email:
program.intake@usda.gov.

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correo postal:
U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410; o

fax:
(833) 256-1665 o (202) 690-7442;

correo electrónico:
program.intake@usda.gov.

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Form AD-3027-A, Revised/Revised/Revised, July 2019



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