2019 Spring Webinar Series
2 p.m. CST

Field to Fork

Extending Knowledge  Changing Lives

NDSU Extension
Upcoming Webinars

• April 3 – Pollinator Gardens
  – Janet Knodel, Professor, NDSU Plant Pathology Department
  – Esther McGinnis, Associate Professor, NDSU Extension Horticulturist

• April 10 – Getting Started with Herb Gardening
  – Yolanda Schmidt, NDSU Extension Agent, Ag and Natural Resources, Pierce County
Zoom Controls

Meeting Topic: Field2Fork - Tom Kalb Growing Vegetables
Host: Extension FCW
Invitation URL: https://zoom.us/j/609371435
Participant ID: 22

- Join Audio
- Share Screen
- Invite Others

Question/Answer Controls

Chat box

Mute/unmute
Open chat box
Please Complete the Survey

• 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 grant 14-SCBGP-ND-0038.
Common Diseases in ND Gardens

Jesse Ostrander, Plant Diagnostician, NDSU Extension Plant Diagnostic Lab
Blight of tomato and potato:

- Two blights:
  - Early blight
  - Late blight
- Early Blight:
  - Caused by a fungus, *Alternaria tomatophilia* and *A. solani*
  - Easily identifiable
Early Blight

• Can affect leaves
• Very common pathogen
• Occurs earlier in the growing season
Early blight:

• Can affect stems:
Early blight:

- Can affect fruit/tubers
Theory of the Disease Triangle
Managing early blight

- Sanitation
- Buy quality seed
- Move your planting site
- Drip irrigate
- Stake plants
- Mulch
- Host resistance
Managing early blight

- Sanitation
- Buy quality seed
- Move your planting site
- Drip irrigate
- Stake and space plants
- Mulch
- Host resistance –
- Susceptible host

Pathogen (abundance)

Environment
Managing early blight

- Sanitation
- Buy quality seed
- Move your planting site
- Drip irrigate
- Stake and space plants
- Mulch
- Host resistance –

Pathogen (abundance)

Environment

Diagram: Triangle with Pathogen and Environment as factors.
Chemical control:

<table>
<thead>
<tr>
<th>Fungicide AI</th>
<th>Application Interval</th>
<th>Examples of Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorothalonil</td>
<td>7 to 14 days</td>
<td>Daconil, Fung-onil</td>
</tr>
<tr>
<td>Mancozeb and Maneb</td>
<td>7 to 14 days</td>
<td>Dithane, Penncozeb</td>
</tr>
<tr>
<td>Bacillus strains</td>
<td>5 to 7 days</td>
<td>Garden Friendly Fungicide</td>
</tr>
<tr>
<td>Copper products</td>
<td>7 to 14 days</td>
<td>Bordeaux mixtures, Bonide copper fungicide</td>
</tr>
</tbody>
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Late blight

- Caused by a fungal-like organism, *Phytophthora infestans*
- Not quite as easy to identify as early blight, especially to start with
Late blight

• Historically significant
• Can be immensely destructive
  – Typically occurs later in the summer
• Can affect leaves, stems, and fruits of tomato and potato
  – Can also infect hairy nightshade, a weed
Late blight on stems
Late blight on fruit and tubers
Late blight

• Sources: late blight doesn’t overwinter well this far north but…
  – Infected tuber seed pieces
  – Infected tomato transplants from other regions
  – Spores can move north from southern states
Late blight management

• Destroy any residue by burying, removing from area or burning
  – Remove plants immediately from garden if infection is localized
• Control volunteers and weedy hosts
• Only use commercial seed, do not save your own seed
  – If you do save seed, wash or heat treat
• Inspect transplants at garden centers for signs of infection
Late blight management

• Host resistance

• Chemical control
  https://ag.purdue.edu/btny/midwest-vegetable-guide/Pages/default.aspx
  For homeowners: copper products, chlorothalonil (Daconil, Bonide Fung-onil, Ortho Multi-Purpose)
Anthracnose of tomato and potato

- Caused by the fungus *C. coccodes* and others
  - Black dot
  - Wide host range (68 weedy hosts)
- Can be quite destructive
  - Primarily affects ripe fruit
  - Can affect tubers
- Fruit may be infected early season, and symptoms show up late in season
  - Makes fungicidal control difficult
Sporulation
Management

• Soil borne, so moving to a new location is key
  – Mulching can help
• Avoid overhead irrigation
  – Staking can help
• Control weeds if possible
• Remove fruit regularly
• Fungicides can be effective, but must be applied periodically from fruit set to harvest
• Slower-to-ripen cultivars are somewhat resistant
  – Smaller lesions, develop later and slower
Septoria

- Caused by a fungus, *Septoria lycopersici*
- Highly destructive to foliage
  - Doesn’t often directly affect fruit
  - Can affect all vegetative parts of plant
Septoria identification

- Lower leaves often affected first
- Lesions are 1 - 3 mm in size, dark margin, tan-gray centers
- Fruiting bodies will be visible
Septoria cont.

- Pathogen will spread upwards
- Heavily infected leaves will turn yellow → brown
Septoria cont.

• Primary inoculum comes from
  – Infected seed
  – Debris
  – Solanaceous weeds
  – Misc. equipment such as pots, stakes, other gardening equipment

• Spread by:
  – Rainfall
  – Wind
  – Humans and other animals/insects moving through wet foliage
Management

• No resistant hosts available
• Move the plants to a new location for 1 year (2 recommended)
• Control horsenettle, a weedy host
• Clean up or incorporate debris
• Avoid overhead irrigation and water early in the day
• Fungicides – homeowners can protect uninfected leaves with Chlorothalonil
  – Do not eat fruit that has been sprayed with this without washing very thoroughly
Bacterial diseases of tomatoes

- Bacterial diseases that occur in ND include:
  - Bacterial canker
  - Bacterial speck
  - Bacterial spot
Bacterial canker symptoms

• Depend on age of the plant
  – Early season:
    • Systemic infection from seed-borne bacterial may cause young plants to die
    • Infected transplants will show blistering on the petiole and browning of the midvein
      – But may be asymptomatic
Infected transplants showing signs of wilting
Bacterial canker symptoms

Early Season
- Systemic infection from seed-borne bacterial may cause young plants to die
- Infected transplants will show blistering on the petiole and browning of the midvein
  - But may be asymptomatic

Later Season
- ½ of a leaf or stem will die, become scorched
  - Individual leaves develop white spots, marginal burning
- Interior stem will have brown vascular tissues
- Developing fruit will acquire white spots
- Stems may develop a canker and split
- Whole plant may wilt

Photo from University of Michigan
Bacterial canker
Bacterial speck

- Small, round and smooth lesions occur on the leaves
  - Each lesion can be seen on both sides of leaf
  - Lesions have chlorotic halo
  - Many lesions will cause entire leaf to turn yellow
  - On fruit, lesions are even smaller and become sunk over time
  - May be confused with Septoria
Bacterial Spot

• Comparatively larger, more distinct lesions on vegetative tissues
  – Later season, leaves may have scorched appearance
• May be confused with fungal pathogens when first forming
  – Early blight
• Chlorosis is extremely diffuse
  – Compared to bacterial speck
• Certain species will create a shot-hole
• Mature lesions on fruit are scab-like
Bacterial wilt of cucurbits

• Caused by *Erwinia* sp.
  – Overwinters in and spread by cucumber beetles

• Cucumbers and muskmelons susceptible
  – Watermelons are not affected
  – Pumpkin and other squash less affected
Symptoms of bacterial wilt

- Leaves will dull; plant will wilt during day and may recover at night
- Eventually the plant will have scorched leaves, leaves will die, plant will wilt and die
  - May only affect runner depending on feeding pattern of beetles
Identifying bacterial wilt

• Look for cucumber beetles
Check for bacterial gummosis
Managing bacterial wilt

• Control the insects
  – You can pick them off into a bin and dispose of them
  – Systemic, soil-applied insecticides are typically effective
  – Other products include Sevin and permethrin-based but are toxic to bees
    • Late day applications help avoid injury to non-target pollinators
  – Zucchini and Blue Hubbard squash can be used to pull beetles off of cucumbers/melons

• Remove any plants showing signs of infection (day wilting and night recovery)

• Do not use a fungicide for this pathogen
Common viruses

• Tomatoes and Cucurbitas can get many of the same viruses
  – Common ones include:
    • Tobacco mosaic virus (TMV)
    • Tomato spotted wilt virus (TSWV)
    • Cucumber mosaic virus (CMV)
  – Potatoes may have Potato Leaf Roll or Potato Virus Y (PLRV and PVY) as these are spread through vegetative propagation
Common symptoms of viruses

- Chlorosis is a common sign of viruses
  - May be confused with nutrient deficiency
  - Will be more randomized

Note how random/mosaic-like the chlorosis is
Common symptoms of viruses

- Chlorosis is a common sign of viruses
  - May be confused with nutrient deficiency
  - Will be more randomized
- Leaf distortion is a common symptom
  - This can be confused with chemical/herbicide spray damage
  - As yourself: What makes sense, what has occurred recently
Common symptoms of viruses

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• Some viruses will include necrosis
TSWV infected tomato
Common symptoms of viruses

• Chlorosis is a common sign of viruses
  – May be confused with nutrient deficiency
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• Leaf distortion is a common symptom
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  – As yourself: What makes sense, what has occurred recently
• Some viruses will include necrosis
• Overall, plants will be unthrifty, stunted, fail to perform
Identifying virus

• It can be hard to identify a virus
  – Symptoms depend on: host/virus interactions, when infected, environment

• It is best to get confirmation of virus

• Some viruses are spread by insect vectors, others are not; confirmation will help identify the origin of the virus and specific management

• Any produce produced will still be safe to eat (but may lack flavor since plant was sick).
Abiotic disorders

• Herbicide damage – may be confused with viral pathogens
  – Solanaceous plants are extremely sensitive to

![Image of plants showing herbicide damage]
Abiotic disorders
Questions?
www.ag.ndsu.edu/fieldtofork