Common diseases of vegetable crops and their management

Olufemi J. Alabi

Assistant Professor & Extension Specialist
Department of Plant Pathology & Microbiology
Texas A&M University
alabi@tamu.edu
Vegetable production process

- Site selection
- Seed selection
- Land preparation
- Planting
- Crop maintenance
- Harvest
Important terminologies

- **Pathogens**: biological agents that cause disease
- **Symptoms**: visible reaction of plant to infection by disease-causing pathogen
- **Inoculum**: part of a pathogen capable of infecting the host plant to cause the disease (e.g. spore, mycelium, bacterial cell, virus particle)
- **Vector**: an organism capable of pathogen transmission
Concept of disease triangle

- Host
- Pathogen
- Environment
- Vector
- Disease
Pathogen life cycle:

- Inoculation
- Penetration
- Infection & colonization
- Dissemination
- Growth & reproduction
- Survival
Modes of pathogen spread

• Common modes of spread include
  – Soil: mostly fungi, bacteria and nematodes
  – Seeds (including vegetative propagules)
  – Insect and nematode vectors: mostly virus and virus-like organisms
  – Wind: mostly fungi, wind-driven pollen- and insect-transmitted viruses
  – Water: mostly fungi and bacteria
  – Human activity
Diseases caused by soilborne pathogens
Major attributes

• Pathogen inoculum can survive in soil for many years
• Inoculum may also persists in debris from infected plants but not in soil
• Pathogen groups involved: fungi (including oomycetes), bacteria, nematodes
• Viruses may be ‘soilborne’ when vectored by soilborne organism
• Can affect all plant parts
• Field distribution of disease often patchy
Common examples

- Fungal rots caused by species of Phytophthora, Rhizoctonia, Fusarium, Verticillium, Macrophominia, etc.
- Bacterial rots caused by species of Erwinia, Streptomyces, Xanthomonas, Pseudomonas, etc.
- Nematodes such as Pratylenchus, Xiphenema and Meloidogyne
- Nematode-transmitted viruses such as tomato and tobacco ringspot viruses
Fusarium wilt of watermelon
Onion pink root

- Causative organism: Phoma terrestris
- Primary symptoms: Pink roots, reduced root mass, tip necrosis
- Inoculum sources: Contaminated soil
- Predisposition: Soil compaction, temp. and moisture stress

Inoculum can persist in soil for up to 5 years
Vine decline of cucurbits due to monosporascus root rot
Bacterial speck on tomato due to *Pseudomonas syringae*
Early blight of tomato

Slide source:
Dr. Claudia Nischwitz, Utah State University
Root-knot nematodes

http://nematology.umd.edu/rootknot.html

Slide source:
Dr. Claudia Nischwitz
Utah State University
Management

- Pay attention to cropping history of soil
- Plant resistance or tolerant cultivars
- Plant in well-drained soils
- Avoid overwatering especially during warm weather
- Practice proper field sanitation
- Practice crop rotation
- Apply pre-plant fungicides or fumigants
Diseases caused by seedborne pathogens
Major attributes

• May affect seed storability, appearance, viability and germination
• May cause disease in emerging seedling or plant
• Not all seedborne pathogens are seed-transmitted
• Seedborne microorganisms:
  – include fungi, bacteria, viruses and nematodes
  – may be saprophytic, pathogenic or opportunistic
Common examples

• Fungal rots caused by species of Phytophthora, Rhizoctonia, Fusarium, Verticillium, Macrophominia, etc.
• Bacterial rots caused by species of Erwinia, Streptomyces, Xanthomonas, Pseudomonas, etc.
• Nematodes such as Pratylenchus, Xiphenema and Meloidogyne
• Nematode-transmitted viruses such as tomato and tobacco ringspot viruses
Seed borne Verticillium dahliae in spinach

Slide Source: Lindsey du Toit, WSU, Mt. Vernon
Bacterial leaf blight of carrot

*Xanthomonas campestris pv. carotae*

Slide Source: Lindsey du Toit, WSU, Mt. Vernon
Black rot of crucifer

*Xanthomonas campestris* pv. *campestris*
Alternaria leaf blight of carrot
Cucumber mosaic virus on spinach

Asymptomatic plant
Symptomatic plant #539 (female) = CMV II positive

Slide Source: Lindsey du Toit, WSU, Mt. Vernon
Potato zebra chip

Slide source:
Dr. Claudia Nischwitz, Utah State University
Management

• Disease avoidance:
  – Buy seeds from certified sources
  – Seed health testing

• Seed treatment:
  – physical e.g. hot water, steam (hot or dry)
  – chemical e.g. chlorine, fungicides
  – Biological agent formulations

• Maintain proper seed storage conditions
Diseases caused by wind- and/or water-borne pathogens
Major attributes

• Mostly fungi and oomycetes
• Inoculum sources include:
  – debris of previous crop
  – contaminated seeds and irrigation waster
• Spores can travel several miles aided by wind and/or rain
• Excessive and prolonged moisture conditions may promote disease
• Capable of causing significant crop loss under favorable conditions
Powdery mildew
Anthracnose fungi

https://plantpathology.ces.ncsu.edu

http://mtvernon.wsu.edu/

http://blog.extension.uga.edu
Phytophthora (late) blight disease
Downy mildew of spinach
Management

- Plant resistant/tolerant varieties
- Site selection and proper field sanitation
- Adequate spacing
- Crop rotation
- Scout early, rough and dispose symptomatic plants
- Avoid overhead irrigation
- Chemical control
  - apply based on timely disease scouting
Powdery mildew - Cantaloupe

Untreated plot

Treated plot
Diseases caused by insect-vectored pathogens
Major plant pathogen insect vectors
Major attributes

• Mostly viruses and virus-like organisms, some fungi and bacteria
• Active or passive transmission
• Inoculum source could come from within or outside the field plot
• Weeds and other crops may serve as pathogen reservoirs
• Pattern of spread often linked to vector behavior/activity
• Vector may retain ability to transmit for life
Mode of vector transmission key to effective management

<table>
<thead>
<tr>
<th>Mode</th>
<th>Acquisition time</th>
<th>Inoculation time</th>
<th>Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-persistent</td>
<td>Short (seconds to minutes)</td>
<td>Short (seconds to minutes)</td>
<td>Mostly aphid-borne viruses</td>
</tr>
<tr>
<td>Persistent</td>
<td>Long (min to days) Latency following acquisition</td>
<td>Long (min to days) Retains ability to transmit for life</td>
<td>Some aphids Mostly leaf, plant and tree hoppers</td>
</tr>
<tr>
<td>Semi-persistent</td>
<td>Medium (few min to hours)</td>
<td>Medium (few min to hours)</td>
<td>Some aphids, whiteflies, psyllids, mealybugs, scale insects</td>
</tr>
</tbody>
</table>
Common examples

- Whitefly-transmitted tomato yellow leaf curl virus complex
- Thrips-transmitted tospoviruses
- Aphid-transmitted potyviruses
- Nematode-transmitted nepoviruses
Whitefly-transmitted TYLCV
Thrips-transmitted tospoviruses
Aphid-transmitted viruses on peppers
Management

- Plant resistant/tolerant varieties
- Vector control
- Practice proper field sanitation
- Host-free period
- Use of reflective mulch
- Use of ‘trap’ crops
- Crop rotation
- Planting in protective structures
Managing TYLCD (Weslaco, 2016)

Parameters evaluated included planting dates, mulch type, variety, vector exclusion using net houses.
Abiotic diseases of vegetables
Major attributes

- May be due to:
  - nutrient deficiencies or toxicities
  - mechanical damage
  - abnormal environmental condition
  - excessive drought or moisture
  - chemical injury

- Sudden appearance of symptoms
- Uniformity of infection on the field
- May predispose plant to pathogen infection
Common examples

• Foliar discolorations due to deficiencies of macro and micro nutrient elements
• Wilting due to excessive heat, drought or cold stress
• Edema due to excessive moisture
• Sunscald due to exposure of fruit to excessive sunlight
• ‘Burn’ due to sulfur application at elevated temperature
• Herbicide drift injury
Nutrient deficiency symptoms

- N  - P  - K  - S  - Mg  - Ca  - Zn

http://www.haifa-group.com
Management

• Conduct soil and leaf tissue tests prior to decision on nutrient application
  – deficiency in plant may be due to lack of nutrient in soil or impaired uptake by plant
• Choice of planting date
• Use of mulch (plastic or organic) to reduce moisture loss
• Do not apply herbicides during high wind currents
Disease management – a process

- Site selection
- Seed selection
- Land preparation
- Planting
- Crop maintenance
- Harvest
- Disease management – a process