Common diseases of vegetable crops and their management

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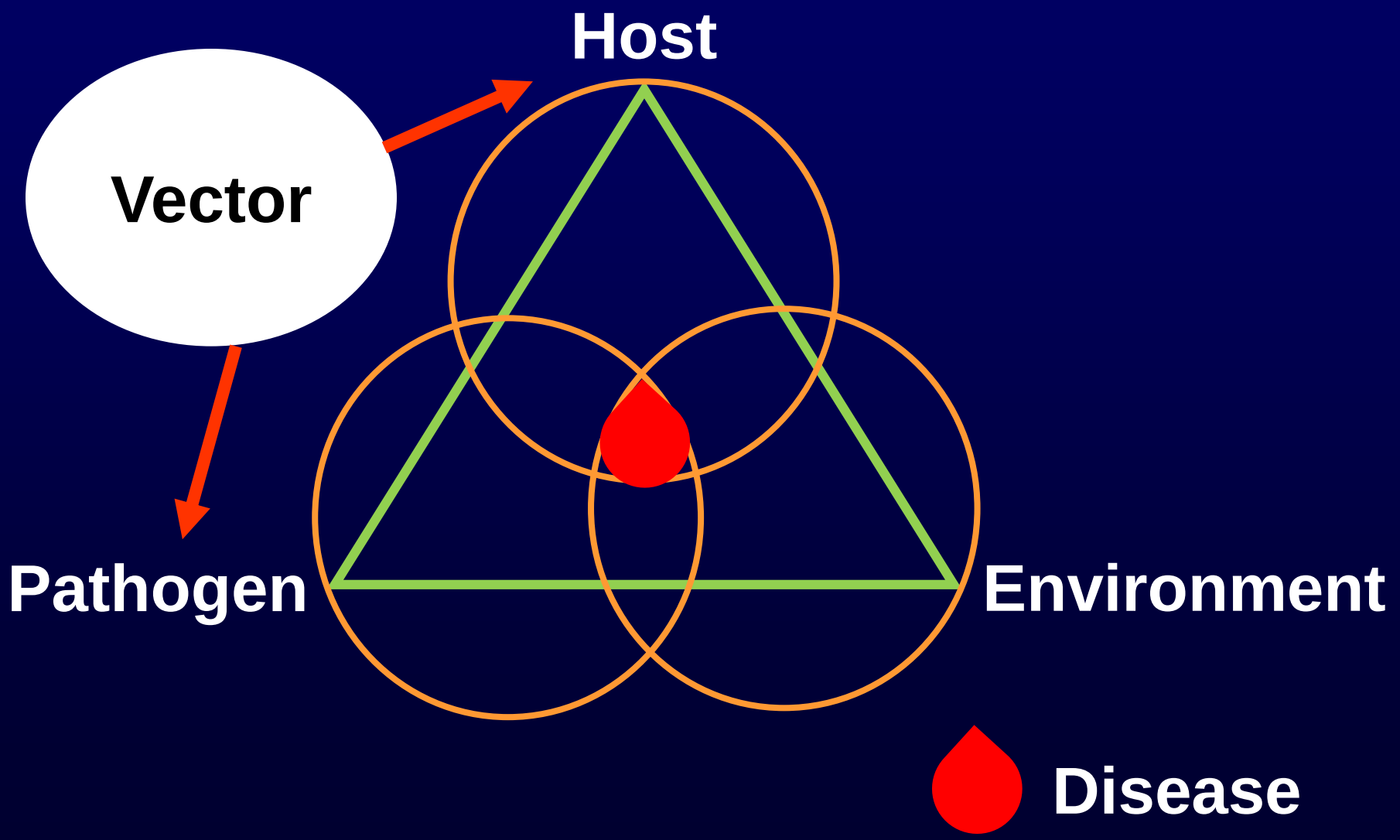
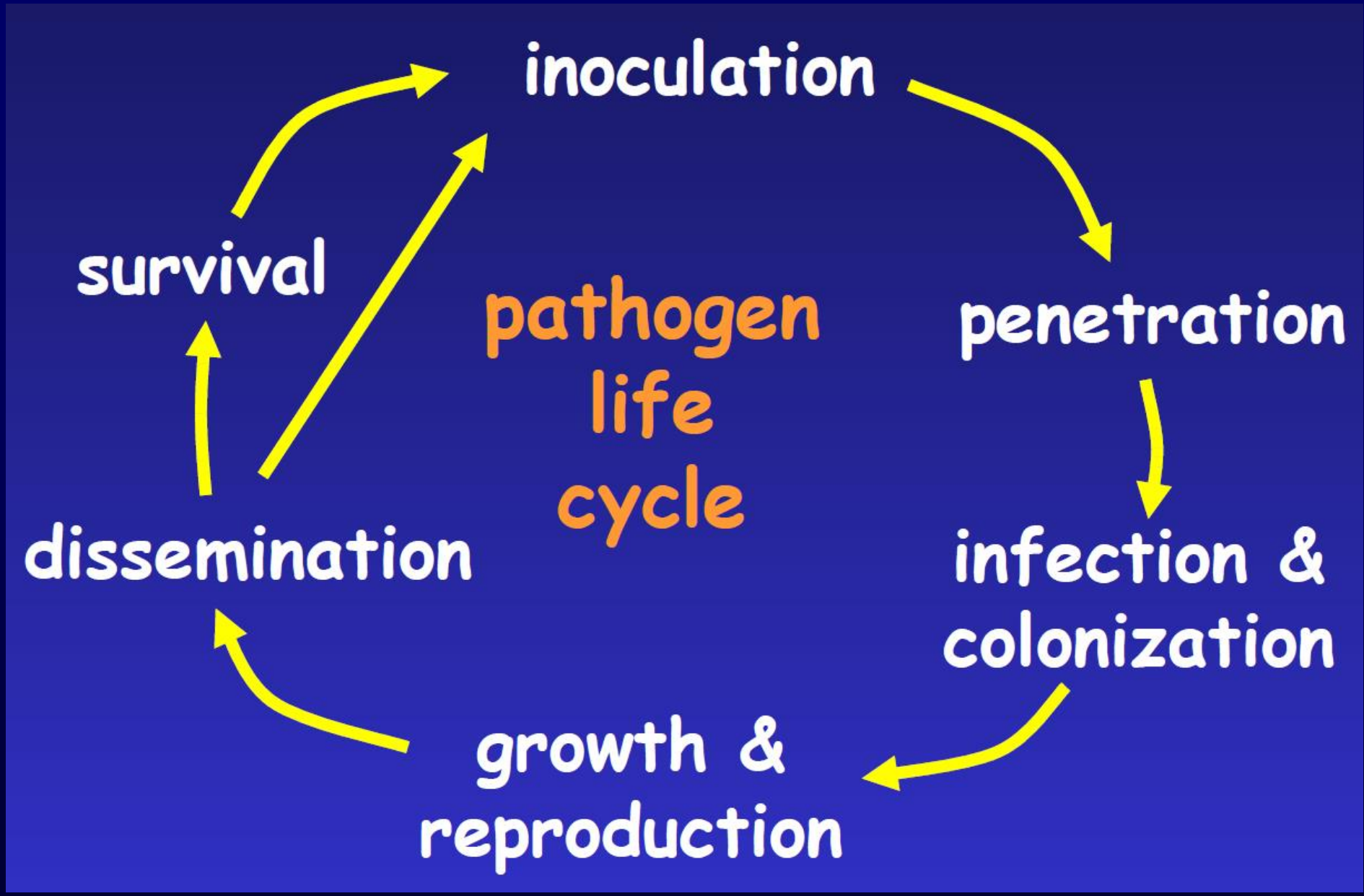
Vegetable production process

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





Slide source:
Dr. Lindsey du Toit, WSU-Mt. Vernon

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

Inoculum can persist in soil for up to 5 years

Vine decline of cucurbits due to monosporascus root rot

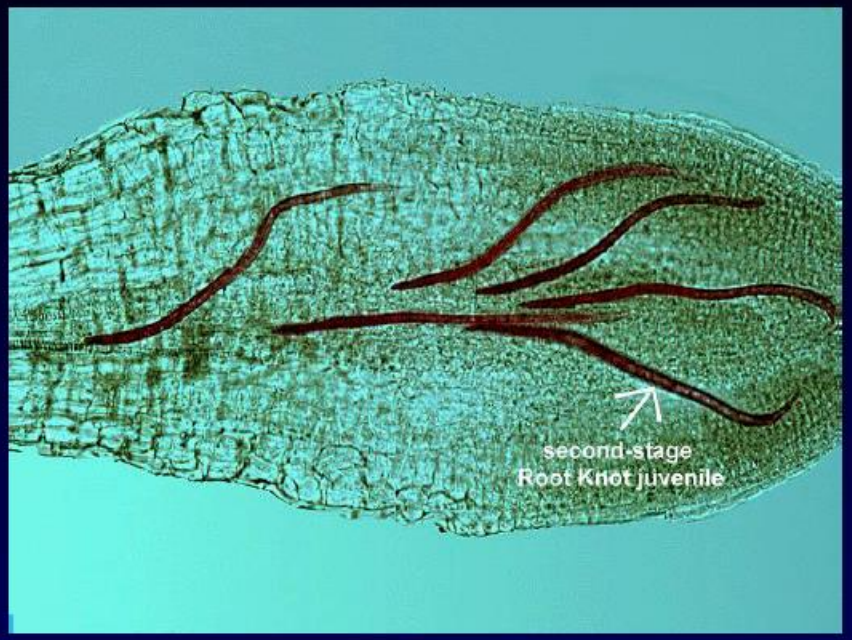
Bacterial speck on tomato due to *Pseudomonas syringae*

Slide source: Dr. Claudia Nischwitz, Utah State University

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

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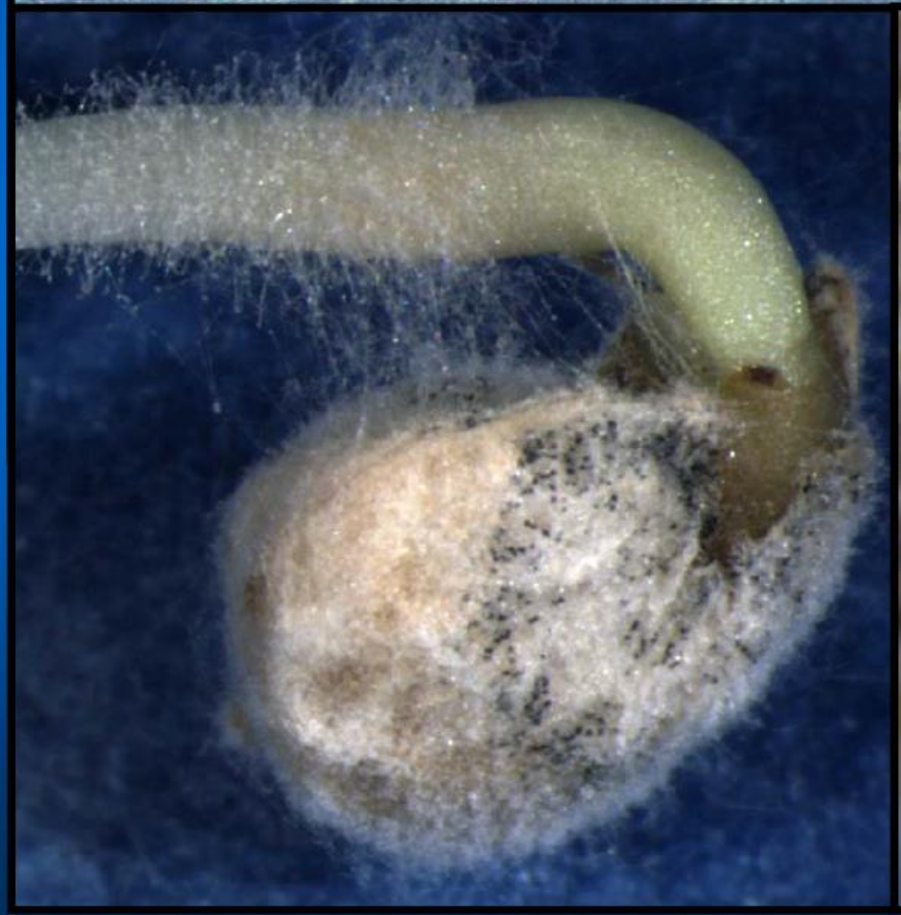
Seed borne *Verticillium dahliae* in spinach



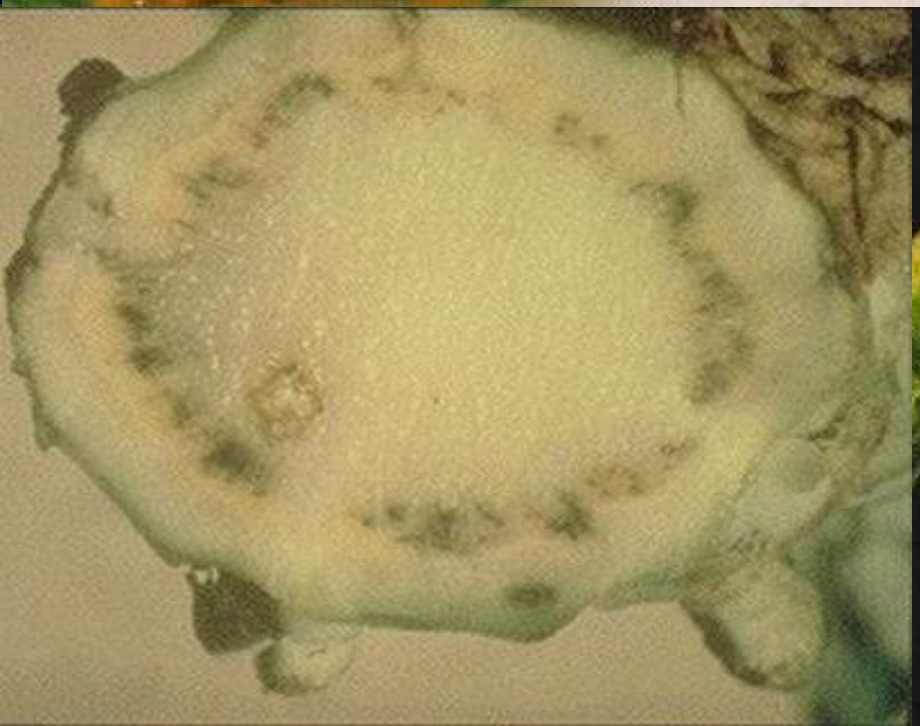
Slide Source: Lindsey du Toit, WSU, Mt. Vernon

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

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

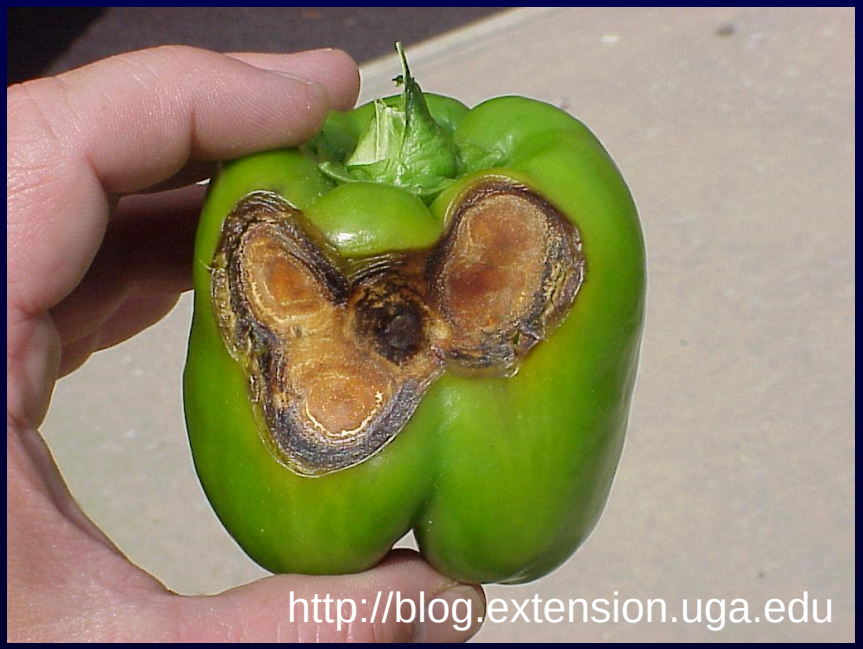
Diseases caused by wind- and/or water-borne pathogens

Major attributes

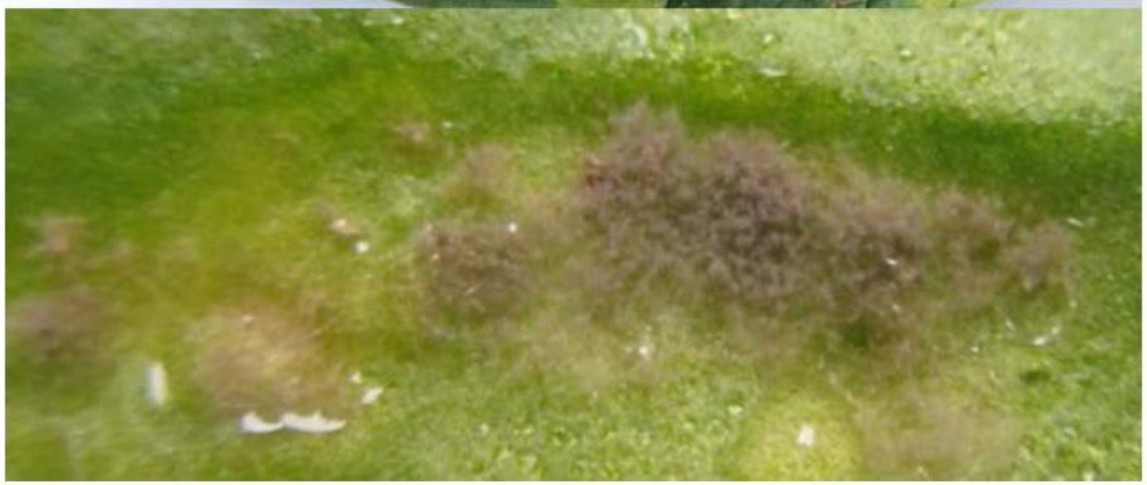
- Mostly fungi and oomycetes
- Inoculum sources include:
  - debris of previous crop
  - contaminated seeds and irrigation waster
- Spores can travel several miles aided by wind and/or rain
- Excessive and prolonged moisture conditions may promote disease
- Capable of causing significant crop loss under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


http://livegpath.cals.cornell.edu
http://livegpath.cals.cornell.edu
Powdery mildew
https://nhvegfruitnews.wordpress.com
http://www.ohmyfungi.com/fungi/

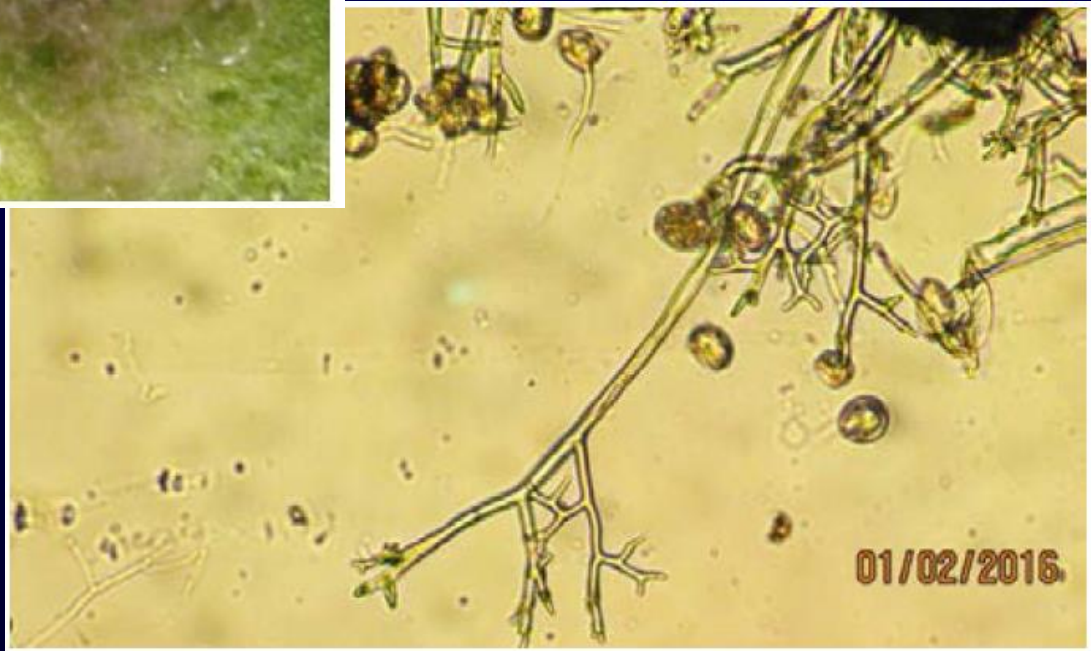
Anthracnose fungi



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

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

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

www.sardi.sa.gov.au

pnwhandbooks.org

Aphid-transmitted viruses on peppers

Potato zebra chip

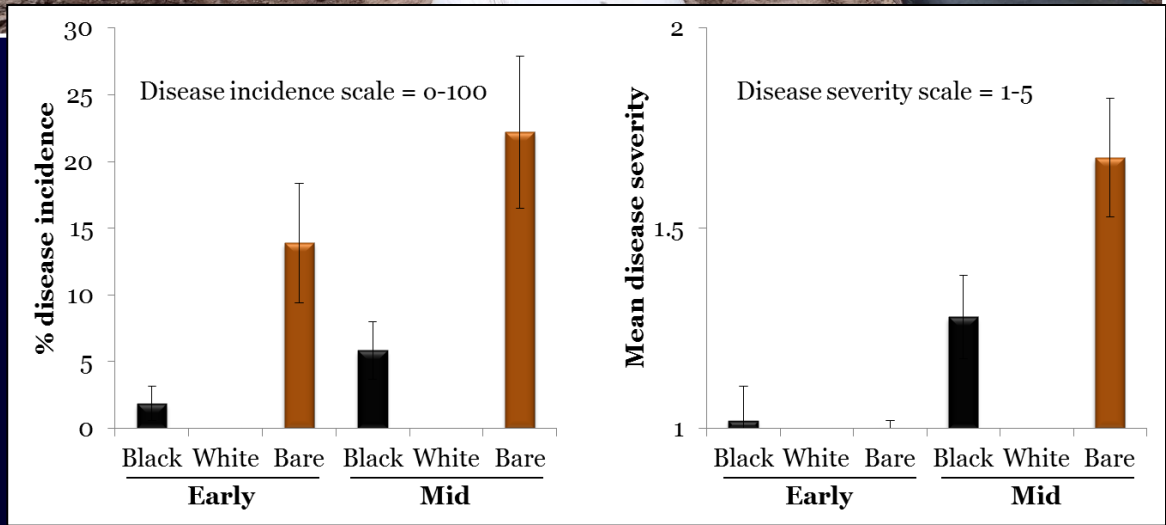
Management

- 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)

Vector exclusion using net houses

Parameters evaluated included planting dates, mulch type, variety



Abiotic diseases of vegetables

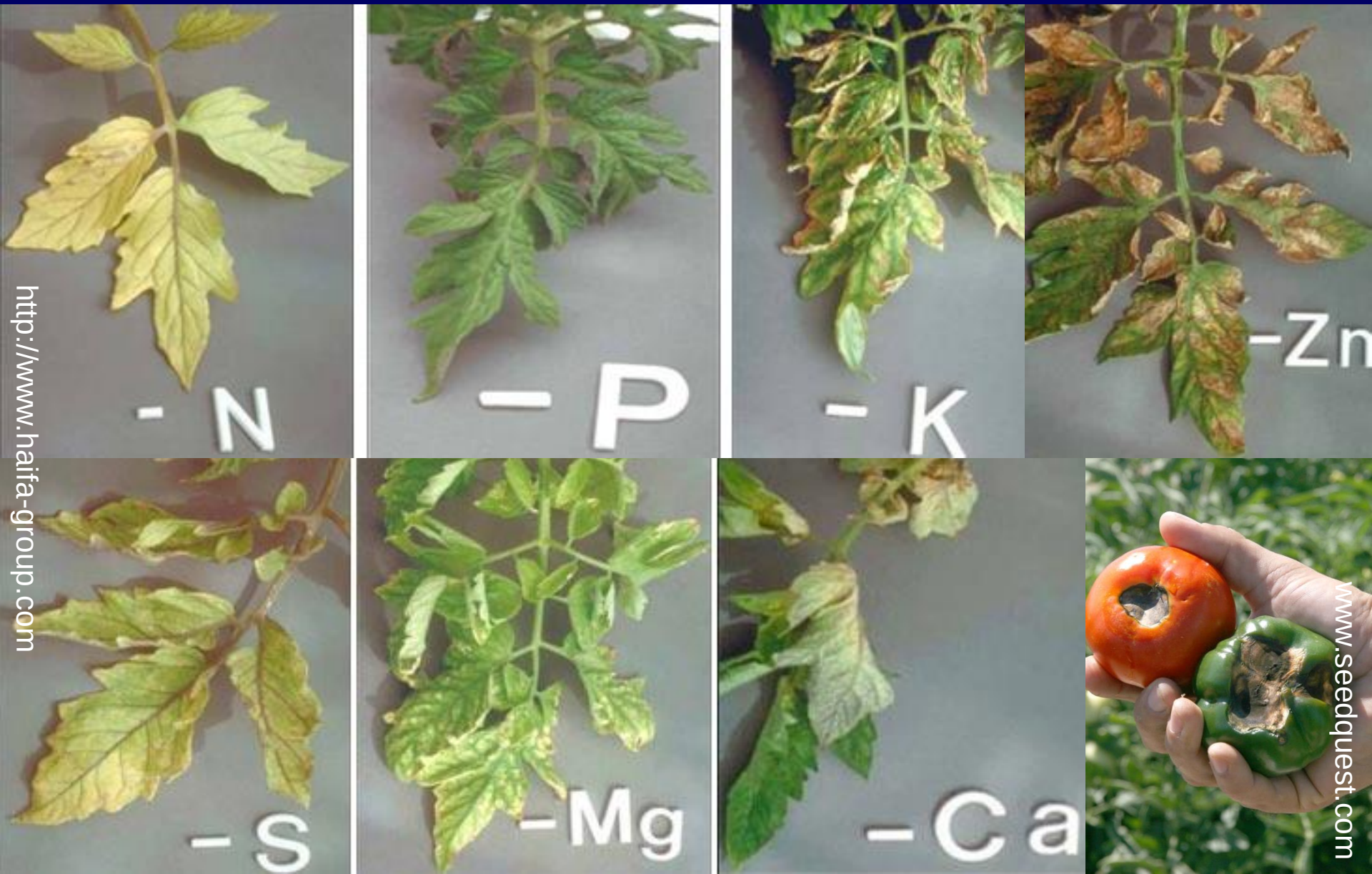
Major attributes

- 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



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