Plant Disease Management

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Plant Disease Management

- **Plant disease = a change in the normal structure, function, or development of a plant.**
- What's **so important about plant diseases?**
  - ✓Diseases affect our food supply,
  - ✓$$-Economy
  - ✓, landscape,
  - ✓health (mycotoxins)
  - ✓and even our culture

Plant Disease Management

- Pathogen – entity capable of causing disease.
- Host plant - plant with the ability to develop a disease caused by a particular pathogen.
- Nonhost plant - plant that cannot be infected by a particular pathogen.
- Host range- all the plant species (cvs./var.) that can be infected by a particular pathogen.

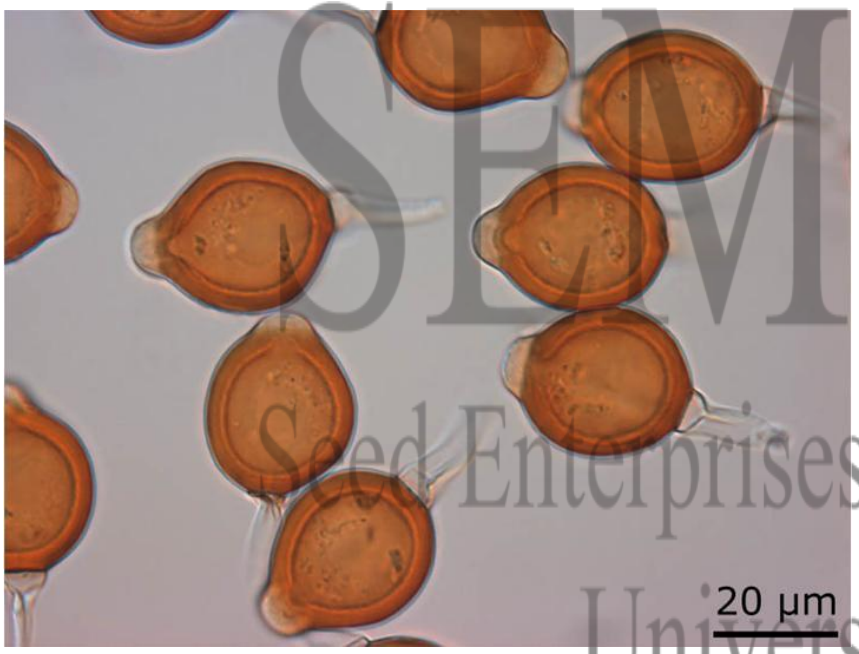
Plant Disease Management

- Resistance - ability of a host plant to resist a pathogen, either partially or completely.
- Susceptibility - inability of a host plant to resist a pathogen, either partially or completely.

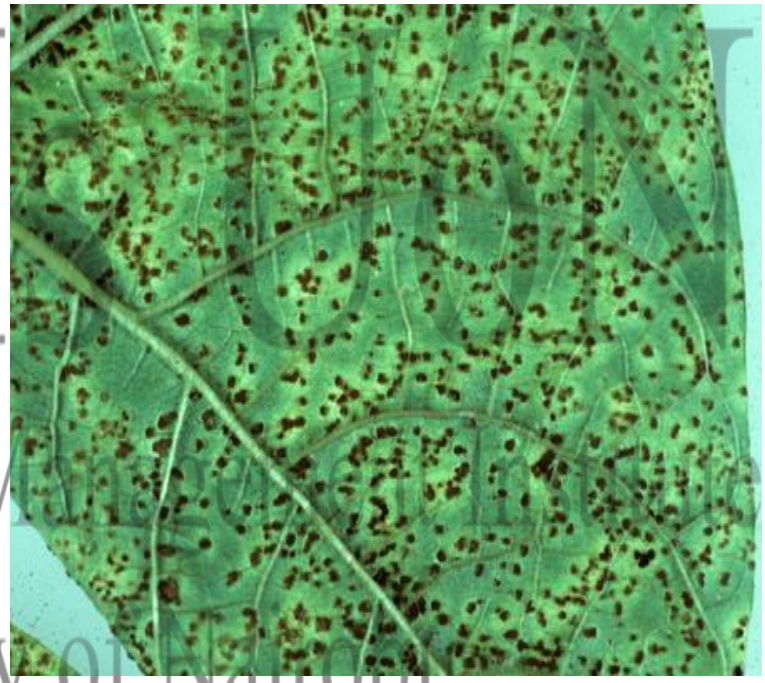
- **Symptom** - abnormal appearance of a plant.
- **Sign** - physical presence of a pathogen.

Plant Disease Management

Sign of a plant disease-Bean rust



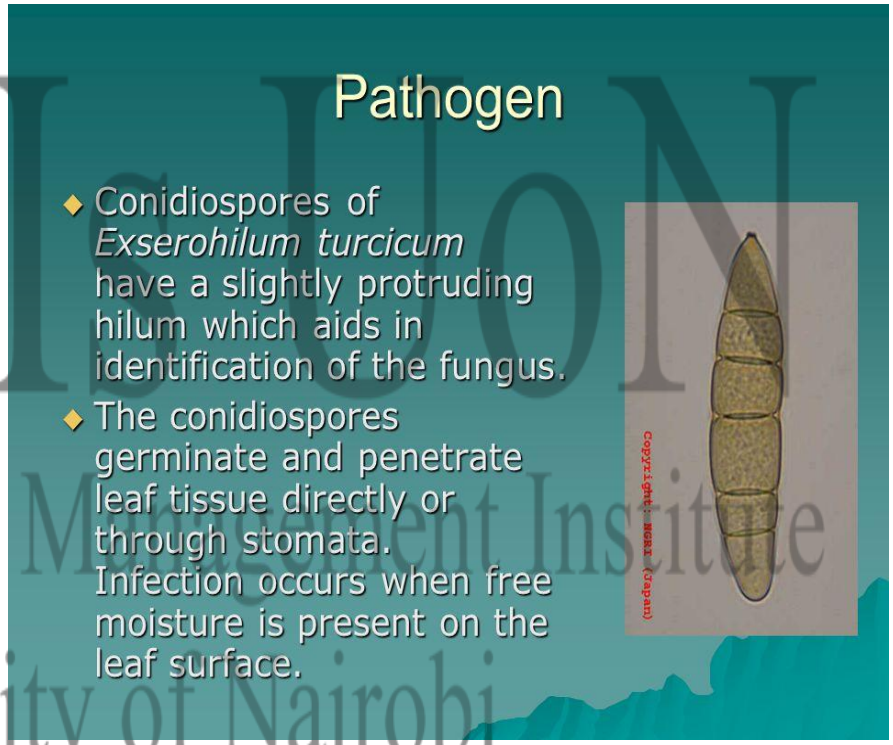
plant disease with visible signs



Plant Disease Management

Symptoms of Northern leafblight

Spore of pathogen for NLB



Plant Disease Management-
The Disease Triangle

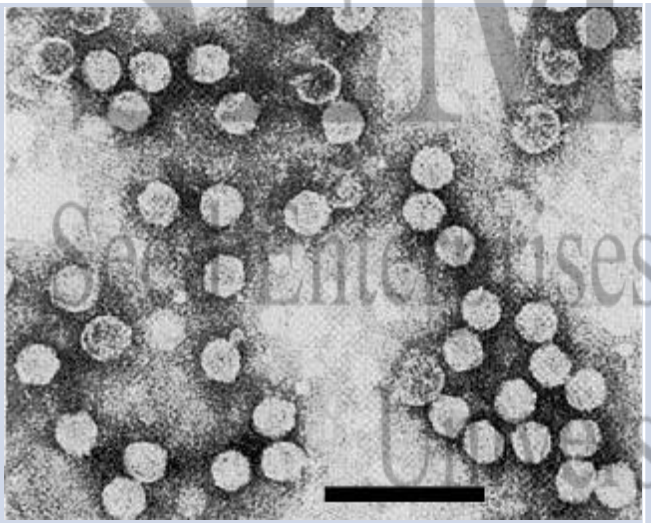
- **Living Causes: pathogens (called diseases, pathogenic diseases, biotic diseases)**
- **Disease Cycle**
  - ✓ Survival
  - ✓ Inoculum produced
  - ✓ Dispersal
  - ✓ Infection
  - ✓ Colonization
  - ✓ Symptoms
  - ✓ Production of survival structures
- **Thus Management = interrupt the disease cycle**
- The basic question: How can you manipulate a component(s) of the disease triangle to favor the host and 'disfavor' the pathogen

Plant Disease Management-Biotic agents

Fungi

Bacteria

Viruses



Nematodes

Plant Disease Management-
Management Practices

- **GOAL: interrupt the disease cycle**
  - ✓Variety selection
  - ✓Manage insects, weeds, and nematodes
  - ✓Cultural practices (rotation, tillage, planting date, etc.)
  - ✓Reduce plant stress (population, weed management, fertility)
  - ✓Fungicides (seed treatments, foliar fungicides)

Management Practices-Variety selection :Resistance - prevents colonization and disease development

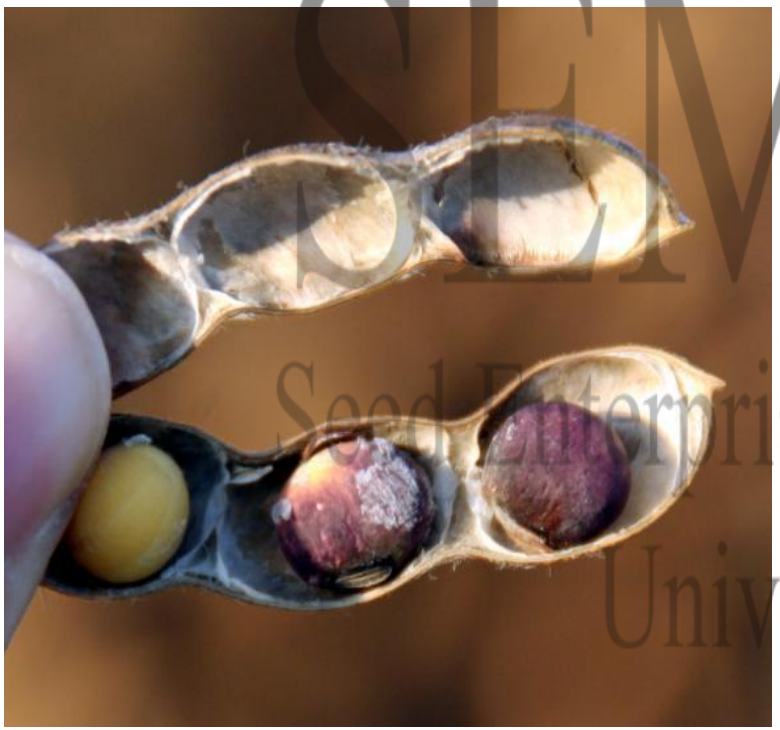
Management Practices-Variety selection: Resistance -reduces build up of inoculum

Susceptible variety has large lesions

Resistant variety has smaller and yellowish-green color lesions

Management Practices: Variety selection-Seed quality - plant seed that is high quality.

Note: Planting infected seed can inhibit germination, slow seedling growth, or introduce new pathogens into a field.



Management Practices : Manage weeds, insects, and nematodes

- Weeds –
  - ✓ increase inoculum - “improve” microclimate for spore production
  - ✓ Serve as alternate hosts
- Insects –
  - ✓ source of inoculum - provide entry wounds for pathogens
  - ✓ Viruses are very dependent on insects as vectors
  - ✓ *BCMV* and BYMV are most commonly *spread* by aphids.
  - ✓ Aphids *spread* the *viruses* by feeding on infected *plant*s.

Management Practices : Manage weeds, insects, and nematodes

- Manage weeds, insects, and nematodes
- Nematodes - interact with other pathogens
- Eg: *Ralstonia solanacearum* and *Meloigyne spp* in potatoes-The presence of nematodes reduces inherited resistance to *R. solanacearum.*

Management Practices-Quarantine measures

- Exclude the pathogen - prevent inoculum from coming into an area where the pathogen does not occur (e.g., quarantines, inspections, certifications).

Management Practices

- **Cultural practices** :
  - ✓Crop rotation - prevents build up of inoculum
- Tillage - decreases surface residue (foliar disease inoculum) and in addition conservation tillage increases soil moisture.

Management Practices: Cultural practices-Tillage

Good tillage

No tillage:

Management Practices

- **Cultural practices**:
  - ✓Planting date - escape infection - escape severe disease
  - ✓Harvest date - remove plants from field before disease becomes problematic

Management Practices

- **Cultural practices**: Reduce plant stress
  - ✓ High populations - compete for light, water, and nutrients;
  - ✓ Heavy weed pressure – competition;
  - ✓ Fertility - adequate nitrogen and potassium;

Management Practices: Fungicides or Chemicals

- **Chemical Management**
- Chemical **barrier to protect the host plant and/or eradicate an existing infection.**
- Pesticides typically cannot “cure” heavily diseased plants
- Types of pesticides: fungicides, bactericides, nematicides, insecticides, biocides.
- **Contact fungicide: effective only at the site of application (protectant)**
  - ✓ must be applied BEFORE pathogen infects the plant; new growth emerging after application is not protected. examples: mancozeb, coppers, chlorothalonil, captan.

Management Practices: Fungicides or Chemicals

- **Systemic fungicide: absorbed & translocated (moved from application site) by the plant**
  - ✓ locally systemic = moves short distances (towards leaf margin) within the plant from the site of application (e.g., benomyl, triforine)
  - ✓ systemic = moves further within the plant from the site of application (e.g., metalaxyl moves from roots up to shoots and foliage).

Management Practices: Fungicides or Chemicals

- READ and FOLLOW THE LABEL!
- pesticide timing can be crucial
- pathogen/vector present (or potential) & susceptible: know life cycles, monitor diligently
- repeat applications may be necessary: protectant vs. systemic, new growth, rain/irrigation
- time dormant applications carefully, e.g., lime sulfur will burn young foliage of most plants
- avoid conditions leading to phytotoxicity (climate influences, antagonistic tank mix)

Management Practices: Fungicides or Chemicals

- AVOID Resistance to Pesticides:
- Reduce the chance of resistant strains of a pathogen developing by 1) using integrated management strategy, 2) minimal applications of narrow-spectrum pesticides, & 3) alternating classes of pesticides

Management Practices : Fungicides-
Seed treatments - protect roots from soilborne pathogens eg. *Pythium spp, Rhizoctonia spp.*

Management Practices : Fungicides-

Fungicides
Foliar fungicides - stop infection and colonization of host Penetration

Management Practices : Fungicides :Foliar fungicides

- CONSIDERATIONS
  - ✓ Cropping history and percent surface crop residue affect the risk of disease. Many pathogens survive in crop residue, which can be a source of inoculum.
  - ✓ Varieties vary in their susceptibility to diseases.
  - ✓ Disease presence early in the season may result in greater yield loss than diseases that occur later in the season.
  - ✓ Fungicides do not affect diseases caused by bacteria, viruses, or nematodes.
  - ✓ Profitability of a fungicide application depends on the price of grain and the cost of application.

Management Practices: Physical management

- **Physical Management**
- Heat treatment – steam sterilization of soil/materials; soil solarization, heat treatments
- Cold treatment - refrigeration (postharvest).
- Moisture management: reducing humidity; drying out of bulbs, tubers, etc. for winter storage

Management Practices: Biological management

- **Biological Management = using a parasite to manage a pathogen**
- Limited options available at the moment.
- Example: Crown gall caused by Agrobacterium tumefaciens, can be reduced by using a product containing the competitive bacteria Agrobacterium radiobacter strain 84 (Galltrol or K-84)

Management practices: In **Summary**

- The disease cycle for all pathogens is essentially the same.
- Effective management strategies break the disease cycle.
- An understanding of the disease cycle will help implement management strategies.

HOW TO A CHOOSE FIELD FOR SEED PRODUCTION

Criteria for Selecting Appropriate Field for seed production

CHOICE OF FIELD

Determine:

i. Site Cropping History

ii. Land Features

iii. Check Soil Records or Perform Soil Assays

Criteria for Selecting Appropriate Field for seed production

Site Cropping History

- Identify previous crops that are known hosts to pests
- Past incidences of soil-borne pests/ diseases
- Types and levels of weeds
- Crops grown in neigbouring fields
- Previous of herbicides that may have residual effects

Criteria for Selecting Appropriate Field for seed production

Land Features

- Topography - Uneven fields may require extensive land leveling for proper drainage.
- Drainage- Check site for adequate irrigation and tail-water drainage.
- Water - Evaluate the quantity and quality of available irrigation water at the site

Criteria for Selecting Appropriate Field for seed production

Soil Quality

- Nutrient balance - Assay for phosphorous and potassium.
- pH. A pH of 6.2 to 7.5 is recommended. Lower pH does not support Rhizobium growth.
- Salinity - Electrical conductivity (EC_e) should be 2.0 mmhos/cm or less.
- Toxic elements - Check for excess of boron or sodium.
- Soil type – textures etc
- Soil depth - A site should provide adequate and unrestricted rooting depth.

Even the crop's statement seems to imply "Thank you" for producing quality seed!!!