# Spotting Diseases

- Dr. William Lester
- UF/IFAS Extension Hernando County

UF | IFAS Extension
UNIVERSITY of FLORIDA

# Learning Goals

Definition of ‘plant disease’

How do we classify diseases?

How to tell if it’s a disease or something else?

How are plant diseases treated?

Examples of common diseases

- Time for questions

# Definition of ‘Plant Disease’

“A disease is the result of a dynamic, detrimental relationship between an *organism* that parasitizes or interferes with the normal processes of cells or tissue, or both, of the plant”

Most plant pathologists only consider biotic pathogens (fungi, bacteria, viruses, etc)

Others include abiotic factors (air pollution, low oxygen, heat or frost, drought, etc.)

# How Do We Classify Diseases?

**By the type of pathogen:**

Fungi, bacteria, viruses,

# Fungi

Members of their own kingdom

About 85% of all plant diseases are caused by fungi

Fungi include molds, mildews, rusts, mushrooms

They can be wind borne, in soil, physically moved and are able to penetrate plant cuticles on their own

Most thrive on high humidity, free water, and warm temperatures

# Fungi

- Diverse and widespread
- Filamentous (hyphae) form a network of mycelium (lots of hyphae)
- Recognized by reproductive structures (mushrooms, rusts, conks, spores, etc.)
- Most of the 100,000 spp. are ***saprophytes***
- Approximately 8,000 species are pathogenic
- Look for signs!!!

# Fungal Diseases

- Reproduction by sexual and asexual means
- Spread through a variety of methods
  - wind/water blown spores
  - Sclerotia (overwintering)
- Include organisms from Kingdom Protista, that are now classified outside the Kingdom Fungi
  - Downy mildews
  - *Pythium*
  - *Phytophthora*
  - Clubroots

# Disease Signs and Symptoms

- With careful observation you may be able to narrow down your disease options by looking for signs and symptoms
- Sign= and actual part of the organism (fungal mycelium or spores, bacterial streaming)
- Symptoms= the effect that the pathogen is having on the plant

# Symptoms

- Initially, similar to drought & starvation:
  - Plants appear off-color
  - Weakened & susceptible to attack
  - Wilting and dieback occur later
  - Younger plants usually killed rapidly
  - Older plants decline over time (years)
  - Roots have brownish streaks

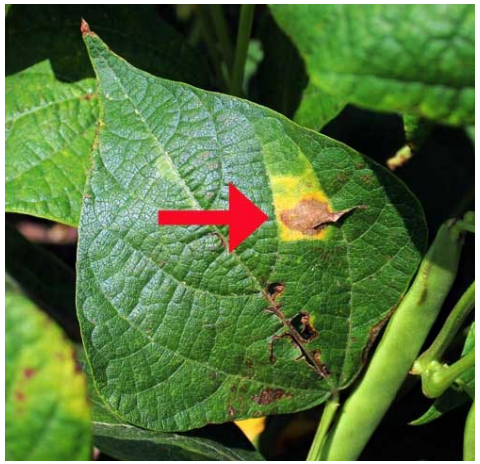
# *Botrytis* sp. (Gray Mold)

# Bacteria

- Bacteria have their own kingdom too
- Can be difficult to control but not as common as fungi (depends)
- Cannot penetrate plants on their own, must be vectored by insects or enter through wounds or natural openings
- Moved mostly by water (aerosols)

# Bacterial Diseases

- Less common than fungal or viral diseases
- They can be either:
  - Parasites, saprobes or autotrophs



- Symptoms include:
  - Cankers, Wilts, Shoot Blights, Leaf Spots, Scabs, Soft Rots, & Galls
- Need wounds or natural openings to infect
- Control methods usually cultural in nature (don’t use antibiotics on large scale)

# Bacterial Diseases

- **Bacterial galls:** In some cases, toxic materials are produced that cause plant tissues of roots, stems or leaves to grow abnormally as in crown gall

- **Bacterial leaf spot disease:** The bacteria usually enter through ***leaf stomata***

- Symptoms include water-soaking, slimy texture, fishy or rotten odor, confined initially between leaf veins resulting in discrete spots that have straight sides and appear **angular**

# Viruses

Not really alive so they don’t get a kingdom

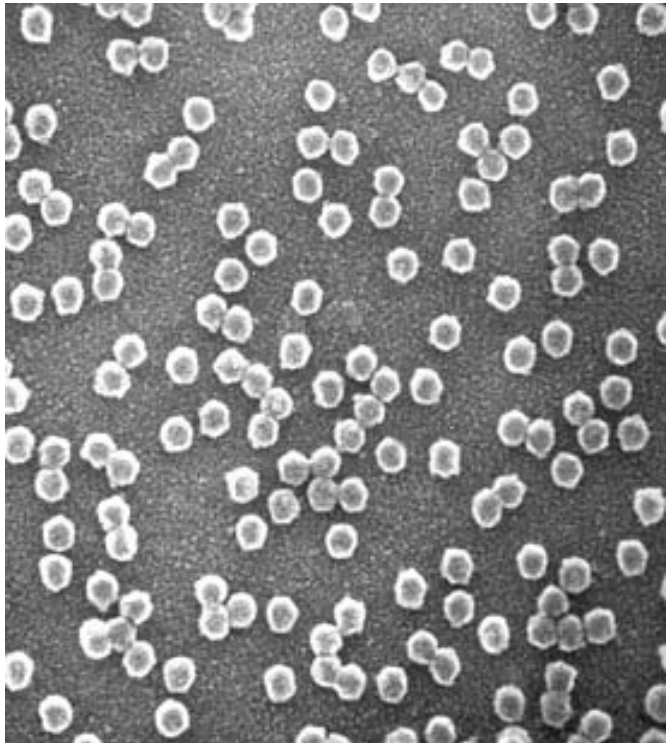
Viruses are a strand of DNA or RNA surrounded by a protein coat

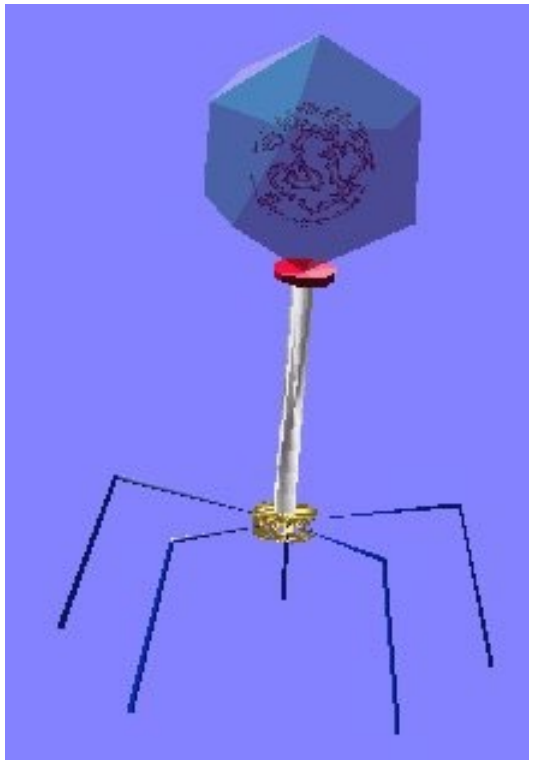
Some are important vegetable crop diseases, others just cause unusual symptoms without killing the plant

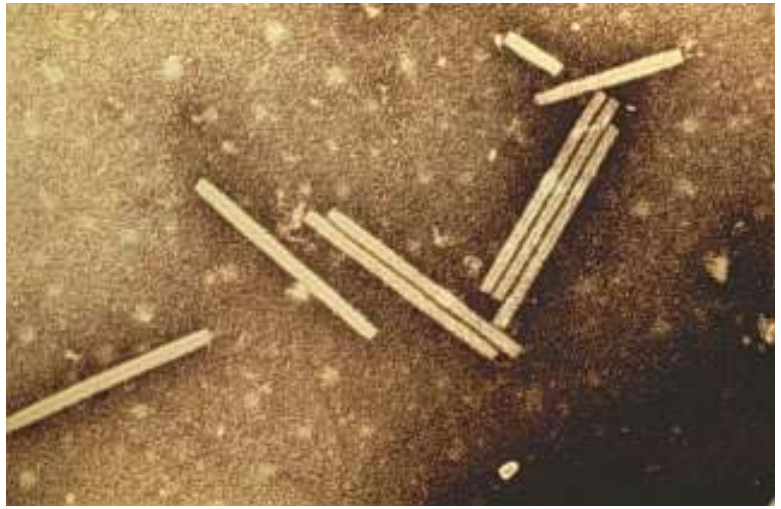
# Viruses

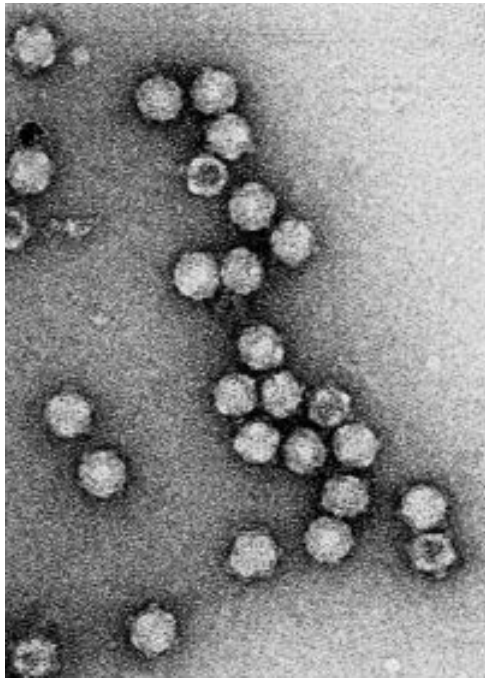
Tulip Breaking Virus

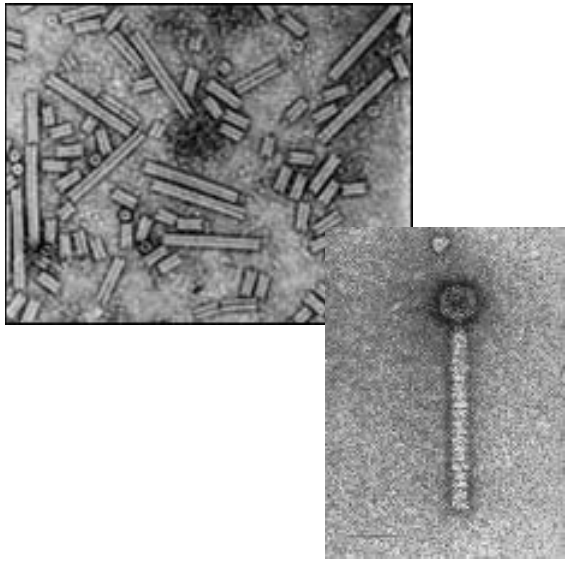
- Viruses are "submicroscopic" entities that infect individual host plant cells
- Viruses are obligate parasites: ***They can only <u>replicate</u> themselves within a host's cell***
- In the virus infected plant, production of chlorophyll may cease (chlorosis, necrosis)
- Cells may either grow and divide rapidly or may grow very slowly and be unable to divide











# Viral Diseases

> 400 viruses infect plants; few are economically important pathogens

The infection remains forever

Viruses are transmitted from plant to plant by living factors: insects, mites, fungi and nematodes

Or non-living factors: rubbing, abrasion or other mechanical means (including grafting or other forms of vegetative propagation)

Occasionally transmitted in seed

# Virus Disease Symptoms

Four categories of viral symptoms:

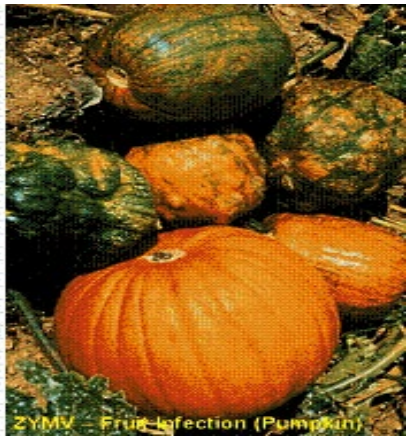
1. Lack of chlorophyll formation in normally green organs

2. Stunting or other growth inhibition

3. Distortions

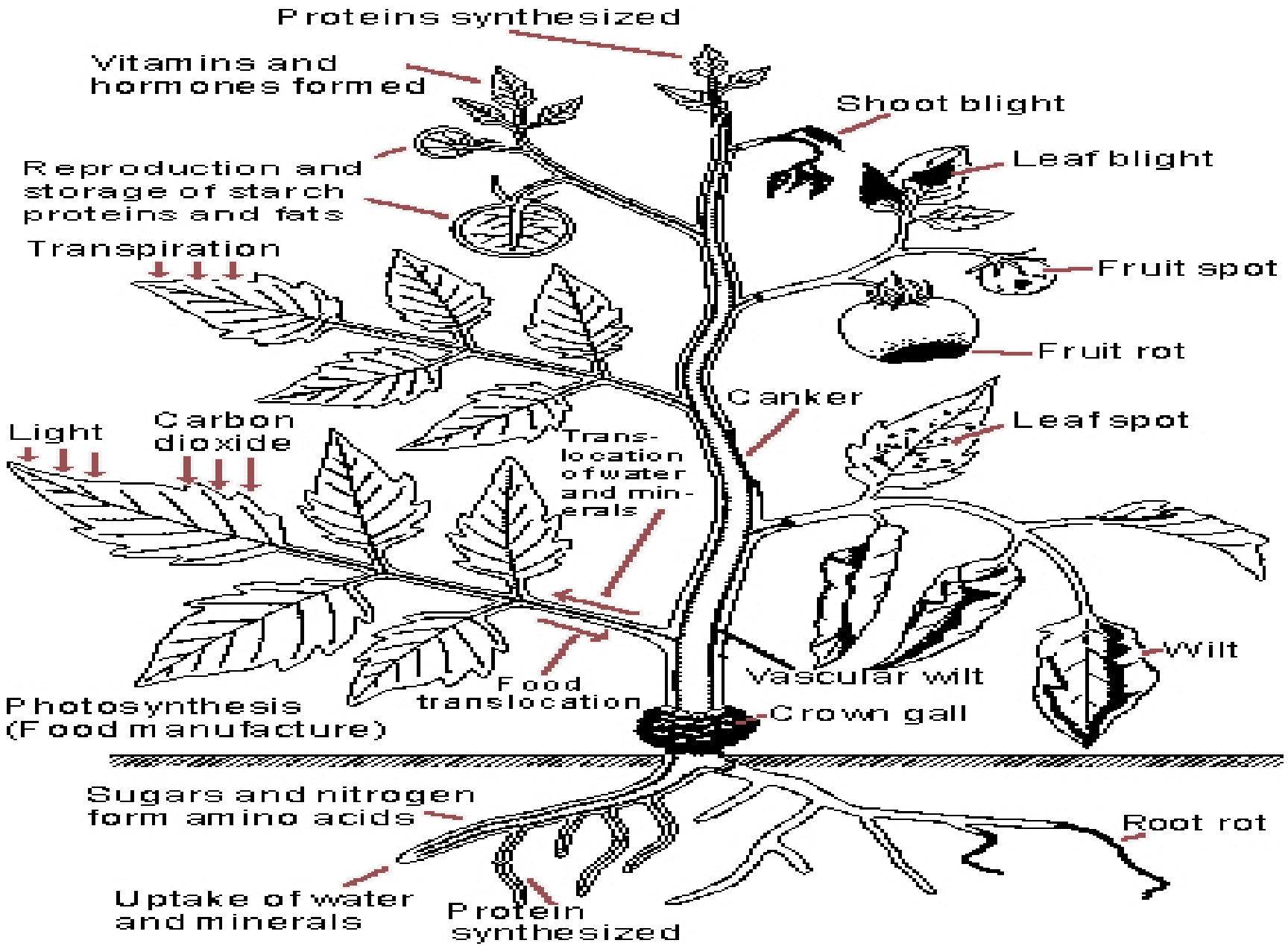
4. Necrotic areas or lesions





# How Else do we Classify Diseases?

- **By the type of symptoms the disease causes:**
- Leaf spots, blights, root rots, branch or stem girdling, chlorosis (yellowing)


Proteins synthesized
Vitamins and hormones formed
Shoot blight
Leaf blight
Reproduction and storage of starch proteins and fats
Transpiration
Fruit spot
Fruit rot
Canker
Leaf spot
Light
Carbon dioxide
Trans-location of water and min-erals
Wilt
Vascular wilt
Food translocation
Photosynthesis (Food manufacture)
Crown gall
Sugars and nitrogen form amino acids
Root rot
Uptake of water and minerals
Protein synthesized

# Leaf Spot (Bacterial)

# Leaf Spot (Fungal)
# Turning to Leaf Blight

# Stem Canker

# Root Rots (Damping Off)

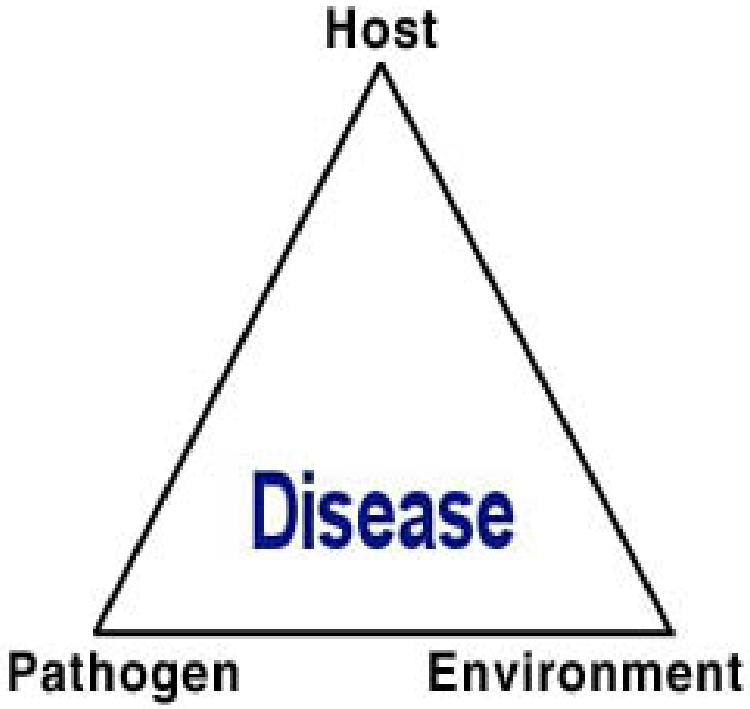
***Pythium* sp.**

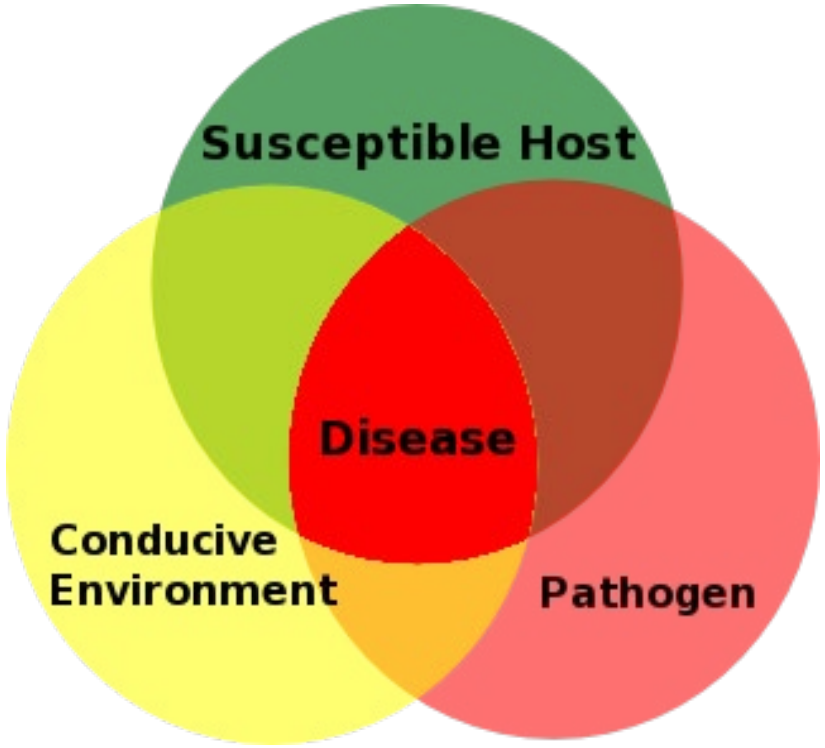
***Rhizoctonia* sp.**

# Differences between diseases, nutrient deficiencies, spray damage, etc.

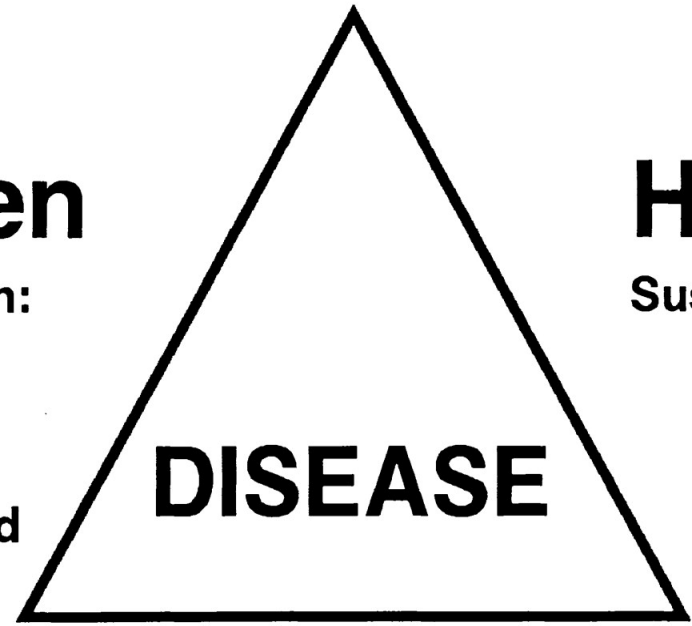
- Many times it is **very** difficult to determine the exact cause of a problem
- Commercial growers and homeowners can use the U.F Plant Disease Clinic in Gainesville
- http://plantpath.ifas.ufl.edu/Clinic/index.shtml

# Disease Triangle



# Plant Disease Triangle




## Pathogen

Virulent pathogen:
Fungi, Bacteria,
Viruses,
Nematodes,
Mycoplasmas and
Spiroplasmas

## Host

Susceptible
-crop
-cultivar

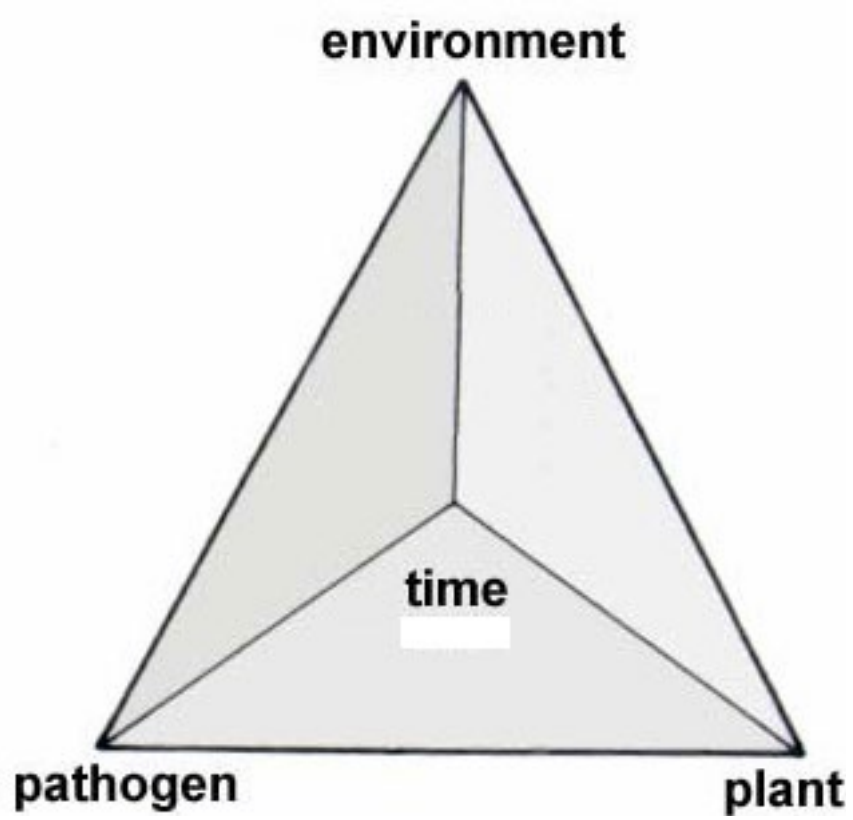
## Favorable Environment

Air temperature
Soil temperature

Soil fertility
Soil type
Soil pH

Rainfall
Relative humidity
Soil moisture

# Mazz's Disease Pyramid


- Expanded to include time
- Four components together can quantify the amount of disease

# Good Example!

# Cures for Plant Diseases

There are no silver bullets!!

Prevention is the best (and by far the cheapest) way to control diseases

Fungal pathogens can be controlled with fungicides

Bacterial pathogens with copper

Viral diseases are not curable so they must be avoided

# Fungicides

Most are protectants- they must be applied before the disease outbreak, stay on the outside of the plant and they won’t cure diseased plant parts (copper, chlorothalinil)

Some are systemic- move into the plant and can stop an existing  fungal infection

# Cultural Controls

- Irrigation
- Sanitation
- Host resistance
- Planting/ harvest times (avoidance)
- Weed control
- Insect control

# Examples of Common Plant Diseases

# *Alternaria* sp.

- Brown Spot on citrus
- Leaf spots on cucurbits, tomatoes, crucifers
- Stem End Rot in citrus
- Stem cankers on tomatoes
- Leaf Blight of carrot
- Can also affect many annuals and landscape plants

# Citrus Canker

- Caused by the bacterium *Xanthomonas citri* subsp. *citri*
- Leaf, fruit, and stem blemishing disease that affects most citrus
- Spread by windborne rain and contaminated equipment

# Citrus Greening

- Caused by *Candidatus* Liberibacter asiaticus
- Bacterial disease that attacks the vascular system of citrus trees
- Vectored by the Asian Citrus Psyllid *Diaphorina citri*

# Tomato Spotted Wilt Virus (TSWV)

- Problem for commercial tomato, pepper and peanut growers, but it has a huge host range (includes ornamentals)
- Vectored by several species of thrips
- Small brown flecks first appear on leaves (leaf spot)
- Followed by brown leaves that droop on the stem (wilt)

# Tomato Yellow Leaf Curl Virus (TYLCV)

- Problem with commercial and home tomato production
- Vectored by the Silverleaf Whitefly (*Bemisia argentifolii*)
- Symptoms include yellow (chlorotic) leaf edges, upward leaf cupping, leaf mottling, reduced leaf size, and flower drop.

# Mango Decline

- Occurs in all mango production regions
- Disease syndrome involving many pathogens
- Fruit yields can be reduced by more than 50%
- Researchers have not identified specific cause

# Symptoms

- Die back of terminal shoot
- Gummosis on branches and limbs
- Vascular discoloration
- Marginal chlorosis
- Root degeneration

# Pathogens

- *Alternaria alternata*
- *Cladosporium* sp.
- *Colletotrichum gloeosporioides*
- *Fusarium* spp.
- *Phomopsis* spp.
- Many others, including some that are normally endophytes
- *Hemicriconemoides mangiferae*

# Possible Causes of Mango Decline

- Iron and manganese deficiencies
- Cold damage
- Drought
- Poor fertility

# Real World Example

# Real World Example

- I am a homeowner in North Florida and it is mid October. “I have a beautiful hydrangea hedge and the leaves are falling off”.
- Leaves have brown spots with a purplish ring around them


S. Vann

# Why Do Some People Suffer With Plant Diseases??

- Wrong plant for Florida
- Diseases can be seasonal
- Poor management (irrigation, sanitation, pruning, etc.)

# Questions?

**UF/IFAS Hernando County Extension Service**

**16110 Aviation Loop Dr., Brooksville, FL 34604**

**(352) 754-4433**

**wlester@ufl.edu**

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