Hemp Diseases in North Carolina

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Two years of pilot program...

- Things learned:
  - Potential disease problems for producers in NC
  - Good/bad growing conditions for hemp

- Things still unknown:
  - Chemical management options
    - Can use labeled chemistries under FIFRA 25b list until more added
    - Environmental condition impact in 2019
Diseases of 2017

- Foliar diseases most prevalent
  - Fusarium foliar/flower blight
  - Setosphaeria leaf spot
  - Bacterial leaf spots
- Season started late
  - Plants transplanted quickly after receiving clones
Diseases of 2018

- *Fusarium* spp.
- Root bound plants
- Excess water
- Other root rots
Pythium Root Rot

• Several *Pythium* spp. capable of causing disease
  • All have a wide host range and are shared with tobacco, field crops, vegetable crops
• Water mold (Oomycete)
  • Zoospores travel in water to new host plants
  • Produces oospores to overwinter and infect new hosts
Pythium Root Rot

• Causes roots to rot, whereby the root epidermis slides off easily from the endodermis
• Causes wilting and damping off of seedlings/small plants
  • Larger plants may have chlorosis of the leaves from the margins inward
Powdery Mildew

• Caused by two different species
  • *Podosphaera macularis*
  • *Golovinomyces cichoracearum*

• Causes fluffy white lesions under moderate temperatures and high humidity

• Stylet/horticultural oils can reduce incidence (smother mildew), but are not preventative
Bacterial Leaf Spots

- Caused by *Pseudomonas* spp., *Xanthomonas* spp., and other bacteria
- Favored by high humidity and often the result of damage to leaves
- Lesions appear water-soaked and limited to the leaf veins or margins
  - When cut under a microscope, profuse bacterial streaming occurs from lesions (looks like sand pouring out)
Botrytis Blight

• Also called “Gray Mold”
• Caused by *Botrytis cinerea*
  • Same pathogen as fruit gray mold
• Fluffy, gray spores can be seen on the surface of affected tissues
  • Easily confused with Fusarium blight
• Causes leaf/flower yellowing and decay
Damping Off and Root Rot

• Caused by *Rhizoctonia solani*, *Pythium* spp., *Macrophomina phaseolina*, *Fusarium* spp., and *Botrytis cinerea*

• Roots and lower stems of young plants rot and become girdled causing plants to lodge and die
  • Pythium damping off causes a wet rot of roots
  • Rhizoctonia hyphae may be seen on rotting roots
  • Fusarium hyphae on roots appears fluffy and with a pink-hue (*F. oxysporum*) or reddened roots (*F. solani*)
Southern Blight

- Caused by *Sclerotium rolfsii*
- Causes wilting and chlorosis of upper portions of plants
- Often can find a white hyphal mat surrounding the base of the plant and the roots
  - Sometimes BB-shaped sclerotia are present
Hemp Canker

• Caused by *Sclerotinia sclerotiorum*
• Easily confused with Southern Blight (*Sclerotium rolfsii*) or Gray Mold (*Botrytis cinerea*)
  • Often can find a white hyphal mat surrounding the base of the plant
    • Produces irregularly-shaped sclerotia, no gray spores
• Causes wilting and chlorosis of upper portions of plants
Fusarium Root Rot and Wilt

- *Fusarium solani*
  - Roots and stems turn brown at the soil line causing wilt symptoms and lodging

- *Fusarium oxysporum f. sp. vasinfectum/cannabis*
  - Wilting and yellowing of plants from the bottom up
  - Reddish-brown discoloration of xylem tissue
Fusarrium Stem Canker and Flower Rot

- Caused by *Fusarium graminearum*
- Causes a rot of the stems and leaves
  - Stem swell at site of infection, and if girdled plants fall over
  - Leaf spots are circular and dark to black
Fusarium Stem Canker and Flower Rot

- Flower infections
  - Browning of flower tissues
  - Fluffy white to pink mycelia on surface of flowers
- Potential mycotoxin production
  - DON (vomitoxin)
Abiotic Disorders

- Bound roots
- Excess water
- Nutrient deficiency/toxicity
Management of Diseases

- Reduce humidity where possible to limit leaf diseases and sporulation from pathogens overwintering in soil
- Reduce water saturation of soil (raised beds, drain tiles, etc.)
  - Oomycetes and nematodes travel in water
  - Plants are not adapted to wet feet, and stress increases susceptibility to diseases and pests
- Provide adequate nutrition and maintain ideal soil pH to reduce plant stress
Management of Diseases

- Avoid rotations with winter wheat, corn, sorghum to reduce *Fusarium graminearum* incidence
- Avoid rotations with soybeans and peanut to limit southern blight and hemp canker
- Limit distance to hop yards to reduce incidence of downy and powdery mildews
Management of Diseases

- Cultivation quickly after previous crops
  - Destroy overwintering inoculum quickly
- Remove diseased plant debris from fields quickly
  - Cull dead plants during the growing season to reduce inoculum buildup
- To limit virus transmission, clean pruners and hands with milk between plants
What is labeled?

Minimum Risk Pesticides:
“25b pesticides that are labeled for industrial hemp can be used in North Carolina. In addition, 25b pesticides labeled broadly enough that industrial hemp can be considered to be covered by the label can also be used in North Carolina.”
Submitting a Sample to the PDIC

- Submit whole plants
  - Leaf spots and symptoms are often secondary to root issues!
- Bag roots in a plastic bag and secure, then place whole plants in plastic bag and secure
- If plants are not immediately transported to the clinic, store in a refrigerator
Questions?

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