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# 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



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#### 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







- Cercospora leaf spot
- Charcoal rot
- Foliar blight
- EFusarium
- Fusarium blight
  Fusarium root rot
- Hemp downy milde
- High soluble salt
- Meloidogyne
  No pathogen found
- Peronosporales
- Physarum
- Pseudomonas
- Pythium
  Pythium root and/or
- Rhizoctonia
- Sclerotinia
- Sclerotium
  Septoria
- Setosphaeria
- Sooty mold
- Unidentified Bacteria
- Unidentified Bacterium
- Unknown Bacterial Disease



#### 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





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#### 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., *Xanthamonas* 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*)



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### 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





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#### 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









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#### Fusarium 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/toxicitiy







#### 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



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# 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



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# 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



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#### What is labeled?

#### Brandt Organics Aleo

48813-17002 Brandt Organics Aleo 20180419 56 48813 .pdf

78%

..<u>22%</u> ..100%

#### Bactericide and Fungicide

#### ACTIVE INGREDIENT:

Garlic Oil.... OTHER INGREDIENT\* TOTAL:

ecithin

vecum This product has not been registered by the United States Environmental Protection Agency, Brandt Consolidated, Inc. represents that it is exempt from registration under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA § 25(b)) as a minimum risk pesticide. For use on low-THC cannabis or medical cannabis by approved Florida Dispensing Organizations.

KEEP OUT OF REACH OF CHILDREN

**WARNING** 

#### PRECAUTIONARY STATEMENTS

PRECAUTIONARY STATEMENTS HAZAROS TO HUNANS AND DOMESTIC ANIMALS Harmful If swallowed. Causes skin irritation, and serious eye irritation. Mey cause an allergic skin reaction and respiratory irritation. Wear protective eyewear and gloves when mixing or handling concentrate. Avoid breathing vapors/story. Use only outdoors or in a well-ventilated area. Nash thoroughly with outdoors or in a well-ventilated area. Nash thoroughly with and water after handling and before eating, drinking, chewing using tobacco, or using the toilet. Take off contaminated clo



DIRECTIONS FOR USE Read the entire label before using this product. Use only according to label instructions.

OMRI

SITES: BRANDT ORGANICS ALEO is used on amenity/ornamental plants, and plants/crops grown for their reproductive and/ or vegetative components used for feed, food, fuel, fiber and medicinal purposes. This includes use on cannabis (marijuana and industrial hemp) in states where cannabis (marijuana and industrial hemp) is plantal to the state of the state of the state of the state state of the state o industrial hemp) is legal.

Industrial hemp) is legal. PESTS: BRANTO RGRAINES ALEO has been shown effective in controlling bacterial pests such as: Pseudomonas spp. Xanthomonas spp. Rolstonia spp. and Erwinia amylavara. In addition, this product has shown or diseases caused by: Alternaria Chereca, Cladosporium Phytophthan Infest Rhizoctania spi-MIXING

#### **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 be 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



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# Cuestions? Lindsey Thiessen Idthiess@ncsu.edu 919-515-3905 Hemp Portal: https://industrialhemp.ces.ncsu.edu/ Website: https://fieldcropspathology.wordpress.ncsu.edu/ Image: Comparison of the portal of