DIAGNOSIS AND MANAGEMENT OF CROWN AND ROOT ROTS OF STRAWBERRY

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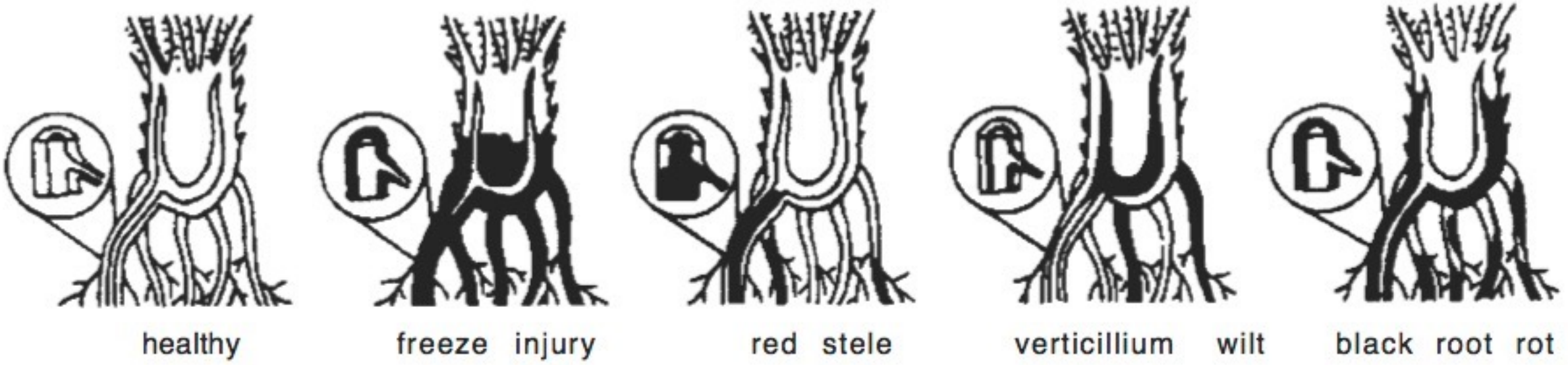
Different Types of Crown & Root Rots



- Symptoms
- Disease cycle/pathogen spread
- Control

+ Neopestalotiopsis

When Diagnosing…

Above-ground symptoms can look very similar

Need to consider:

- Soil conditions
- Time of the year that symptoms appear
- Age of planting
- Symptoms on roots and crowns

Red Stele of Strawberry

- *Phytophthora fragariae*
- Prolong periods of **saturated soils**
- Plant **symptoms develop before and during fruiting period**
- Core of the root (stele) turns brick-red in color
- Main root appears like a “rat tail” due to sparse lateral roots
- **Plants are stunted**, new leaves have bluish hue
- Severe infections lead to plant death before harvest

Image credit: ONfruit

Red Stele of Strawberry

- Pathogen usually introduced on plants
- Can persists in soil for 10-15 years
- Favored by cool, wet spring or fall
- Common in low spots in the field
- Symptoms appear during bloom of second year or after
- Outward symptoms can’t be distinguished from Black Root Rot

Managing Red Stele

- **More resistant varieties** include Annapolis, Brunswick, Cavendish, Mesabi, Mira, and Winona
- **More susceptible varieties** include Glooscap, Honeoye, Jewel, and Kent
- There are some fungicides that are effective against *Ph. fragariae,* but they will not be effective if applied to plants in poorly drained soils

Table 9-1. Fungicide application at planting[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose crown	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	5-8 fl oz	5-8 fl oz	4h	61.5 fl oz
azoxystrobin		G[r]	E	0d	NA
Aliette WDG	33	x	2.5 lb/100 gal	12h	30 lb
aluminum tris		x	E	1d	NA
Phostrol	33	x	2.5–5 pt/100 gal	4h	NA
phosphorous acid		x	E	NA	NA
Prophyte	33	x	2 pt/100 gal	4h	varies
phosphorous acid		x	x	NA	4
Switch 62.5WG	9+12	5-8 oz /100 gal	x	12h	56 oz
cyprodinil + fludioxonil		G	x	0d	NA

Site selection and drainage are critical!

BioIPM Strawberry Workbook A4080,
Midwest Fruit Pest Management Guide

Managing Phytophthora

- **Site selection**
  - Well drained soils, avoid low spots and fields with history of disease, break up compacted soils
- **Use disease-free plants**
  - Check plantlets for symptoms, send samples for diagnostic testing, learn what type of production practices your supplier uses
- **Monitor your plantings**
  - Do not overwater, avoid using water from surface ponds if possible
  - Quickly address symptomatic plants by getting a diagnosis

Managing Phytophthora with Fungicides

- Role of pre-plant dips is inconsistent
- Fungicides will be most effective when cultural management practices are used
- **Ridomil products (**Mefenoxam; **FRAC 4)**
  - See label for application timing
  - **High risk for fungicide resistance development
- **Phosphorous acids (FRAC 33)**
  - Ex. Aliette, Phostrol, ProPhyte
  - Incompatible with copper
- Timing – in the spring after ground thaws but before bloom; in the fall before the ground freezes

Black Root Rot

- Disease complex
  - Fungi (clay soils)
  - Nematodes (sandier soils)
  - Freeze injury
  - Water logging
  - Soil compaction
  - Herbicides
  - Continues berry production at same site
- Factors associated with decline vary from site to site

Image credit: NC State Extension

Black Root Rot

- **Stunted** root system
- Main roots with dark lesions feeder roots either absent or dry, brittle, and dark
- Cross sections of the tips or entire main roots show **blackened tissue** throughout
  - Stele remains white
- Shows up after 3-4 years
- Susceptible varieties – ‘Honeoye’ and ‘Jewel’

Managing Black Root Rot

- **Rotate** a site out of strawberries for at least three years
- Use **tolerant varieties** or varieties that tolerate stress
- Reduce compaction at planting site
- Nematode and fungal **pathogen analysis**
  - This will indicate if and what chemical treatments are available
- Prior to planting cut into the root system of several plants to look for discoloration
- Fumigation – good for the first year but pathogenic organisms rebound quickly

Verticillium Wilt

Image credit: UC ANR

- Fungus **resides in the soil for years** and infects vascular tissue
- The pathogen is active during cool weather, but symptoms appear in early summer
- Outer leaves wilt and dry <u>at the margins and between veins</u>
- Few new leaves emerge
- Severely infected plants are **susceptible to winter injury**

Verticillium Wilt

In new plantings, dieback appears when runners form

In older plantings, outer leaves turn brown at margins and between veins about at time of harvest; younger leaves remain green

Resistant/tolerant: Allstar, DelMarvel, Earliglow, Mesabi
Susceptible: Jewel, Kent

Verticillium Wilt Management

- The fungus can **persist for many years in the soil** and has a broad host range (over 300 plant hosts)
- Do not plant in soils recently planted to hosts of the fungus – ex. Solanaceous plants, cucurbits, and raspberries
  - Instead use monocots such as rye, wheat, corn, grasses
- Plant field to non-hosts or less susceptible plants for 4 years before planting strawberries
- Avoid excess Nitrogen applications

Neopestalotiopsis

- Newer disease of strawberry
- Infects all plant tissues
- Roots darken and crowns turn orange-brown necrosis
- Stunting or poor establishment after transplanting
- Only 2 reports in Wisconsin since 2021
  - Likely came in on planting material

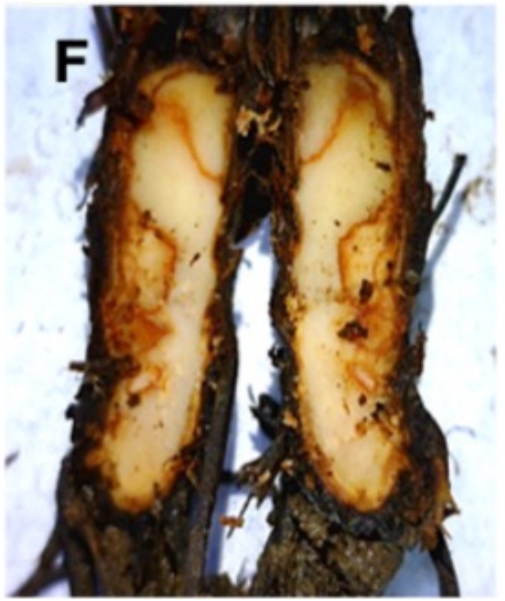
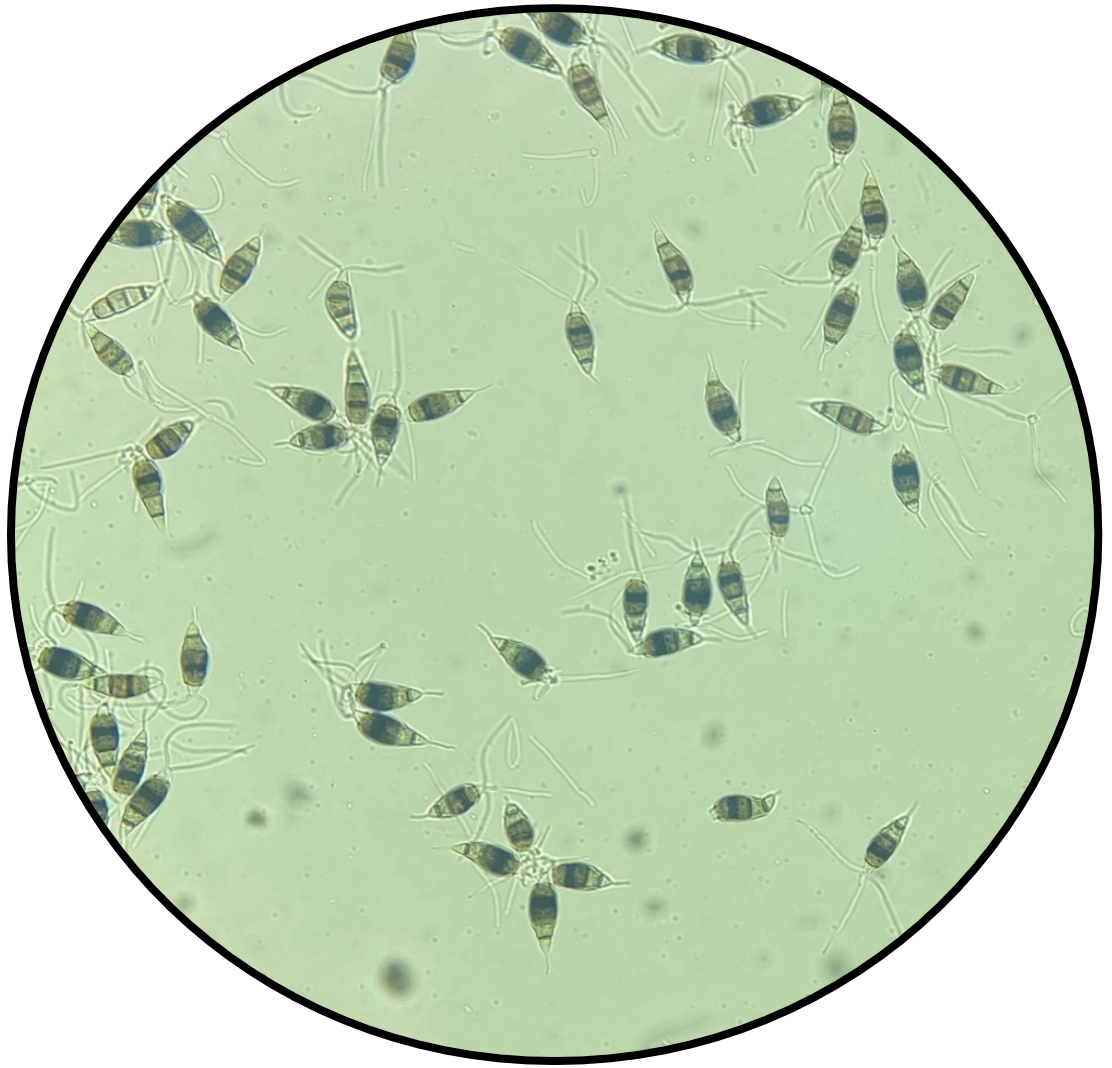


Photo credits: UF/IFAS GCREC, ONfruit

Neopestalotiopsis Biology & Spread

- Pathogen likely overwinters in crop residues
- **Spreads easily and rapidly in the field**
- Disease is favored by extended rain events and temperatures > 50°F (10°C)
- Optimal temperatures for infection and spread are 77 to 86°F (25 to 30°C)
- **Leaf wetness** important for infection and disease development



Neopestalotiopsis Management

Cultural Control

- Disease-free transplants
- Avoid field operations when plants are wet
- Clean and disinfect equipment
- No resistant varieties have been identified

Chemical Control

There are **no fungicides currently labeled** for Neopestalotiopsis control on strawberry

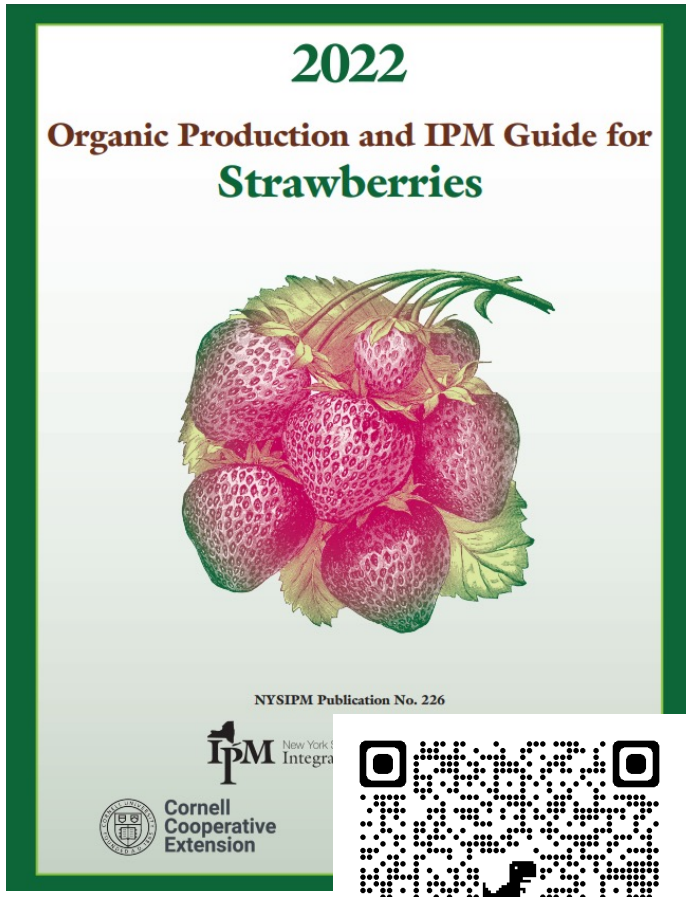
Fungicide screening studies and field trials is ongoing at the University of Florida

- Some chemistries show partial suppression of fruit and leaf infections

Fumigation field studies are also ongoing

Organic Management of Root/Crown Rots

- Resistant or tolerant varieties
- Disease-free plants from plant supplier/facility
- Rotation with non-host crops
- Bio-fumigation (ex. mustards)
- Pages 30-31 of Guide – control information for Red Stele and Black Root Rot



Getting an Accurate Diagnosis

Submit samples to UW Plant Disease Diagnostic Clinic

- https://pddc.wisc.edu/
- Send samples of different stages of infection
- Samples should include above- and belowground plant parts
- Make note of when symptoms appeared and history of the site

Take Home Message

- ✓Wet conditions favor infection
- ✓Symptoms appear when water demands are high (i.e., warmer weather and/or fruit growth)
- ✓If planting a new site, select one with **good drainage**
- ✓Understand the **disease history** of your field
- ✓Select **resistant or tolerant** varieties
- ✓Avoid planting or rotating with plants that are also hosts of root and crown pathogen
- ✓Get an **accurate diagnosis** of the disease before attempting to manage with chemicals (oomycetes vs. true fungi)

High Tunnel Berry Production Webinar Series

12:00 PM CST | Zoom

- **Purchasing a High Tunnel**
  February 16
- **How to Choose a Berry Crop for Your High Tunnel - Strawberries, Raspberries, and Blackberries**
  March 2
- **Day Neutral Strawberries**
  March 16
- **Brambles**
  March 30
- **Controlling the Environment in a High Tunnel**
  April 13

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Thank you! Questions?

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Wisconsin Fruit News - https://fruit.wisc.edu/

2023 Berry Webinars - https://fruit.wisc.edu/webinars/berries/

WI Fruit YouTube (https://www.youtube.com/c/WisconsinFruit/videos) – **Watch our Berry Playlist!**