Management of Soilborne and Foliar Diseases on Ginger

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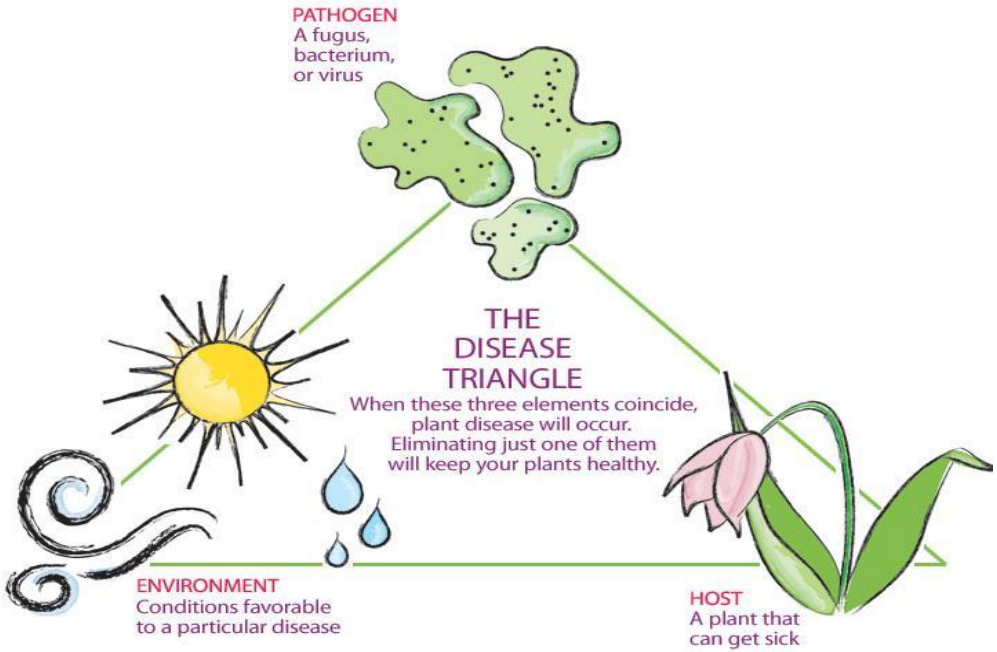
The Basics: Plant Path 101

- Susceptible host
- Conducive environment
- Virulent pathogen



Source: http://www.finegardening.com/how-to/articles/10-ways-to-keep-your-garden-healthy.aspx

The Host: Ginger plant

It all starts from the Seed rhizome!

(Reliable Source!)

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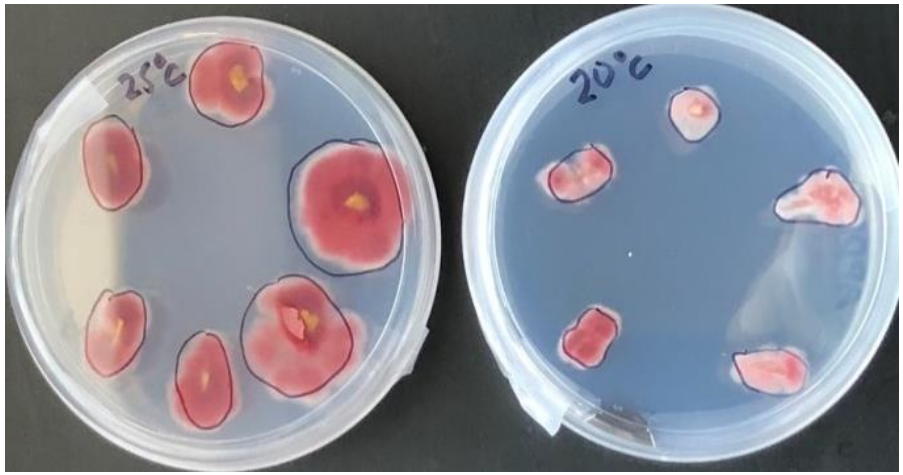
The Environment: weather, soil, location, time, inputs

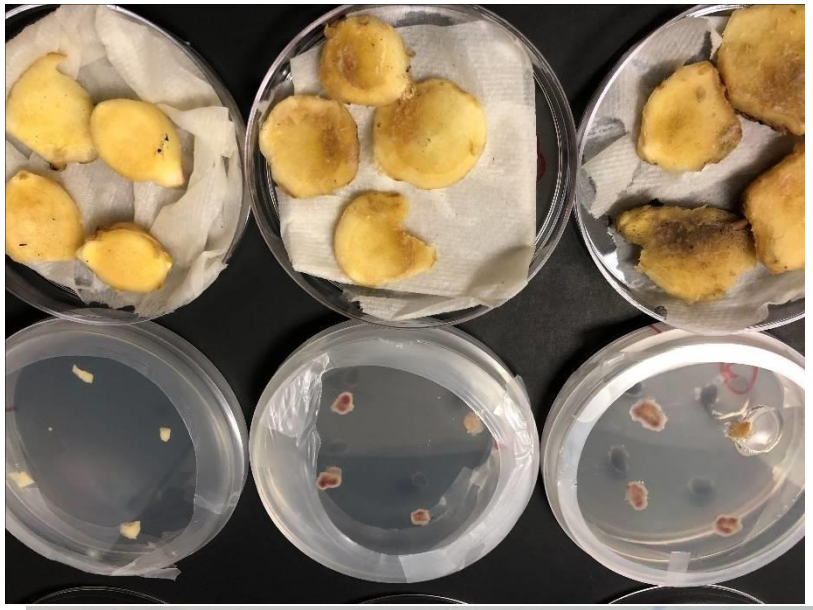
2018

2019

2019

The pathogen: the invisible foes (symptoms and signs)





M. Likins

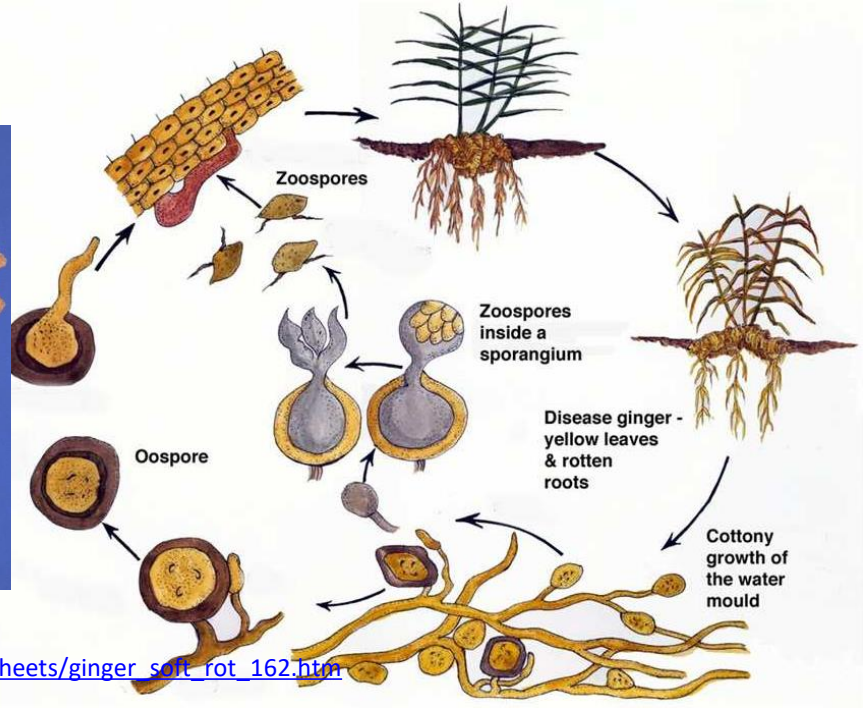
M. Likins

Fusarium yellow

- Creamy brown discoloration of the vascular cylinder (TruJillo E. E. 1964, Hawaii Ag. Expt. Station)
- *Fusarium oxysporum f.sp. zingiberi* (Probhakaran Nair P. K. 2013)
- Small Yellow Fusarium Root Rot caused by *Fusarium solani* in China (Liu et al. 2019)

Soft rot: e.g. Pythium

- *Pythium aphanidermatum* in china (Li et al. 2014)
- *P. myriotylum* in Taiwan (Wang 2003, Prabhakaran N. P. K. 2013)



http://www.pestnet.org/fact_sheets/ginger_soft_rot_162.htm

The *invisible* Foes 2018

Chesterfield country diagnostic lab result: diseased baby ginger from raised bed

1. Sample 1
   a. *Fusarium* sp.
   b. *Plectosporium*-like fungus
2. Sample 2
   a. *Fusarium* sp.
3. Sample 3
   a. Bacterial soft rot
   b. *Gloeosporium* sp. (2°)
4. Sample 4
   a. *Fusarium* sp.
5. Sample 5
   a. *Fusarium* sp.
6. Sample 6
   a. *Fusarium* sp.
   b. Picture shows vascular discoloration
7. Sample 7
   a. Bacterial soft rot

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Major Diseases

Oomycetes: water molds

- Soft Rot (*Pythium spp.*)

Bacteria

- Bacterial wilt (*Ralstonia solanacearum*) Biovar III&IV *Pseudomonas solanacearum* (Pegg et al. 1974)
- Bacterial soft rot (*Erwinia caratovora pv. caratovora*)

Fungi

- Yellows (*Fusarium spp.*)
- Dry rot (*Rhizoctonia solani, R. bataticola)*
- Leaf spots
  - *Phyllosticta zingiberis*
  - *Helminthosporium maydis*
  - *Septoria zingiberis*

Nematodes

- Root knot (*Meloidogyne spp.)*
- *Pratylenchus coffeae*

Major Insects?

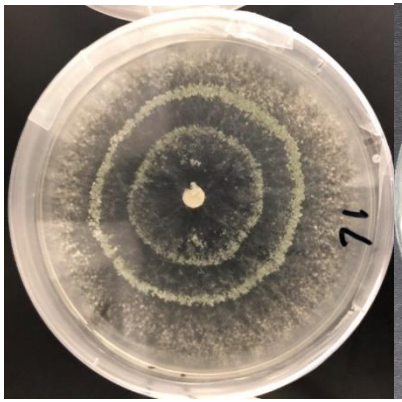
Mostly it is a complex of pests and diseases!

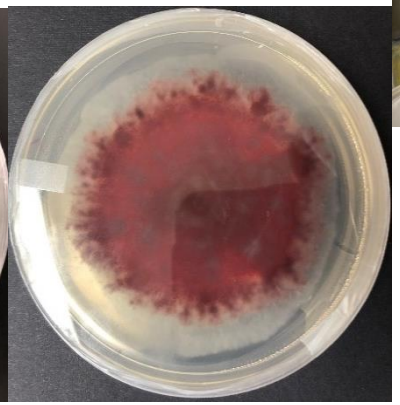
2018-2019
Pilot Projects at VSU

In-vitro growth and dual culture studies

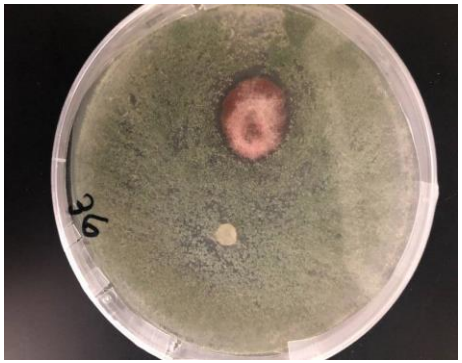
2018-2019

Mono-culture



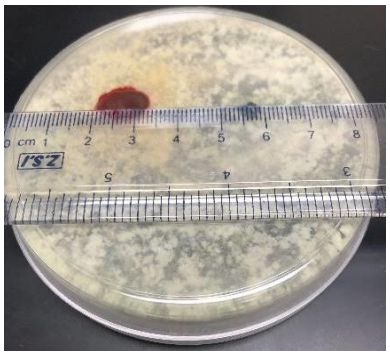


Dual-culture



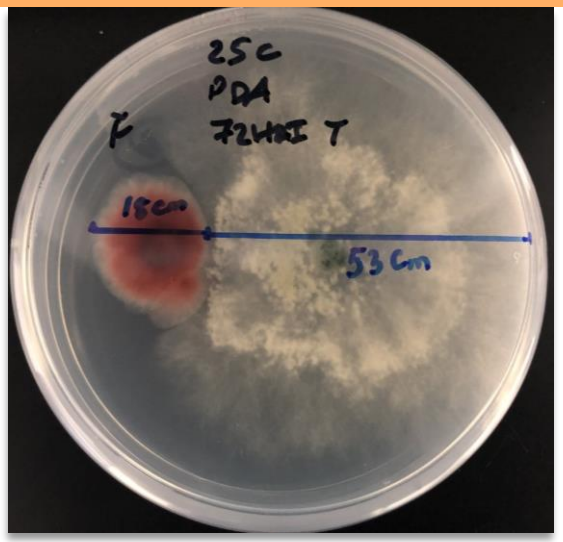
Incubators

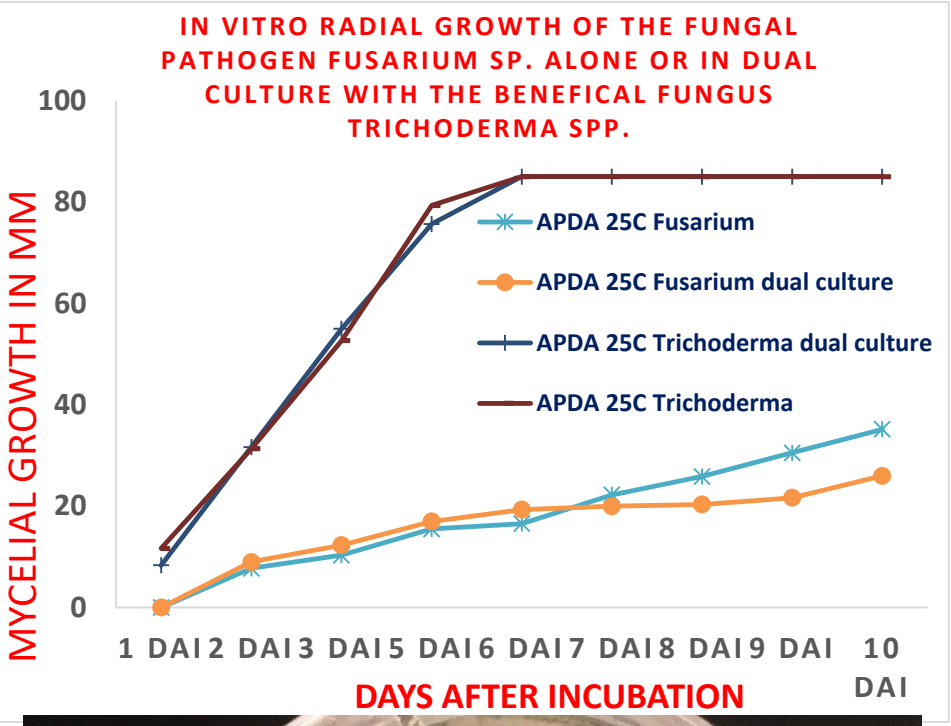
- 68 °F
- 77 °F
- 30°C

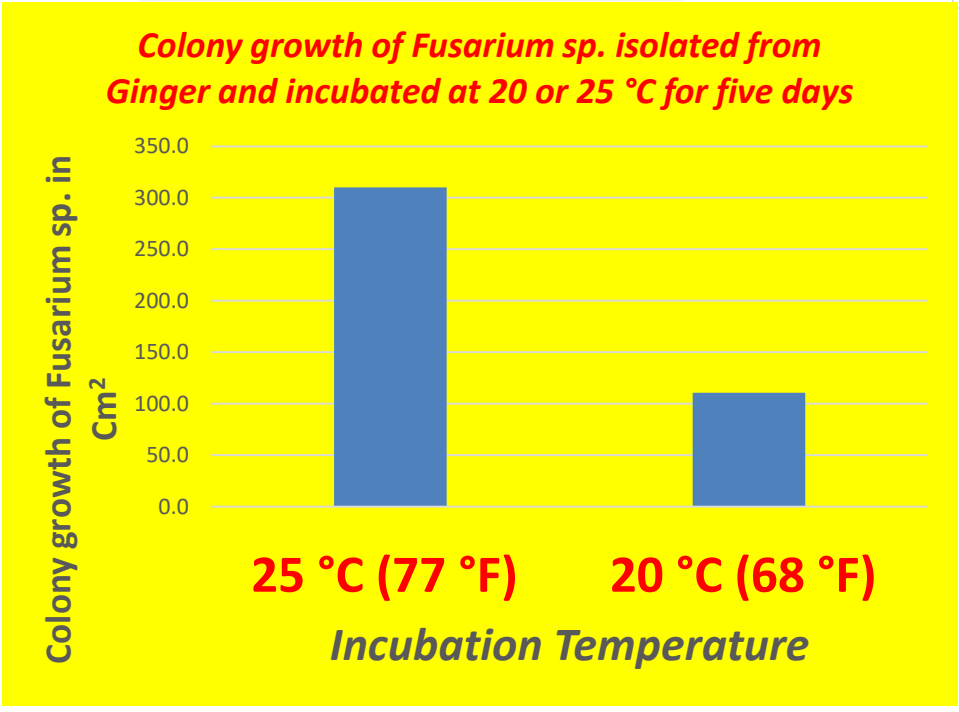


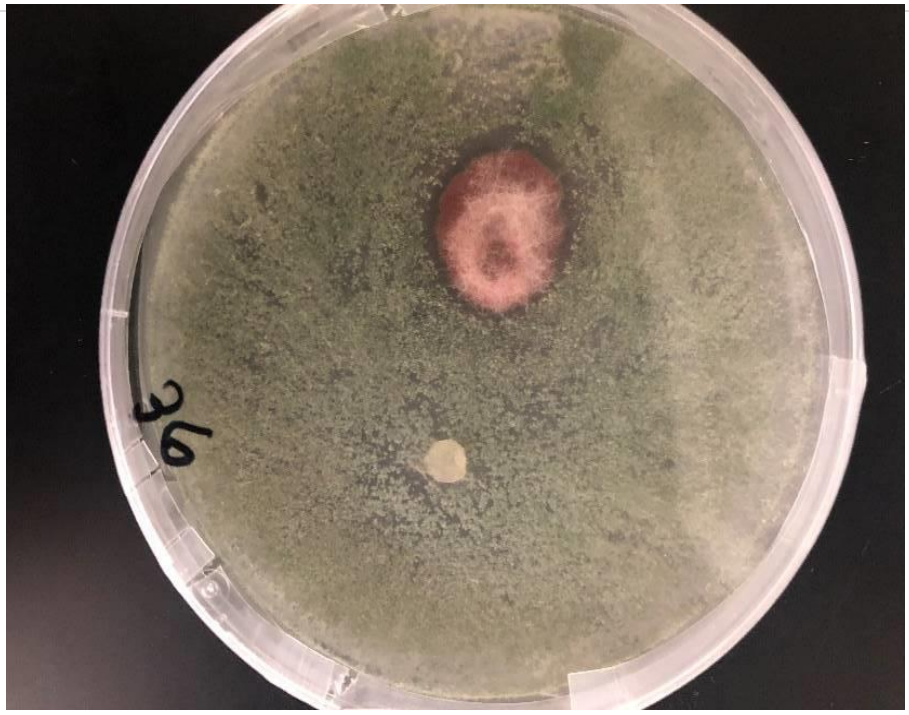
When & Where does Fusarium thrives at best? Dec. 2018 – Apr. 2019

(Kyle & Mersha, unpublished)









June 13, 2019

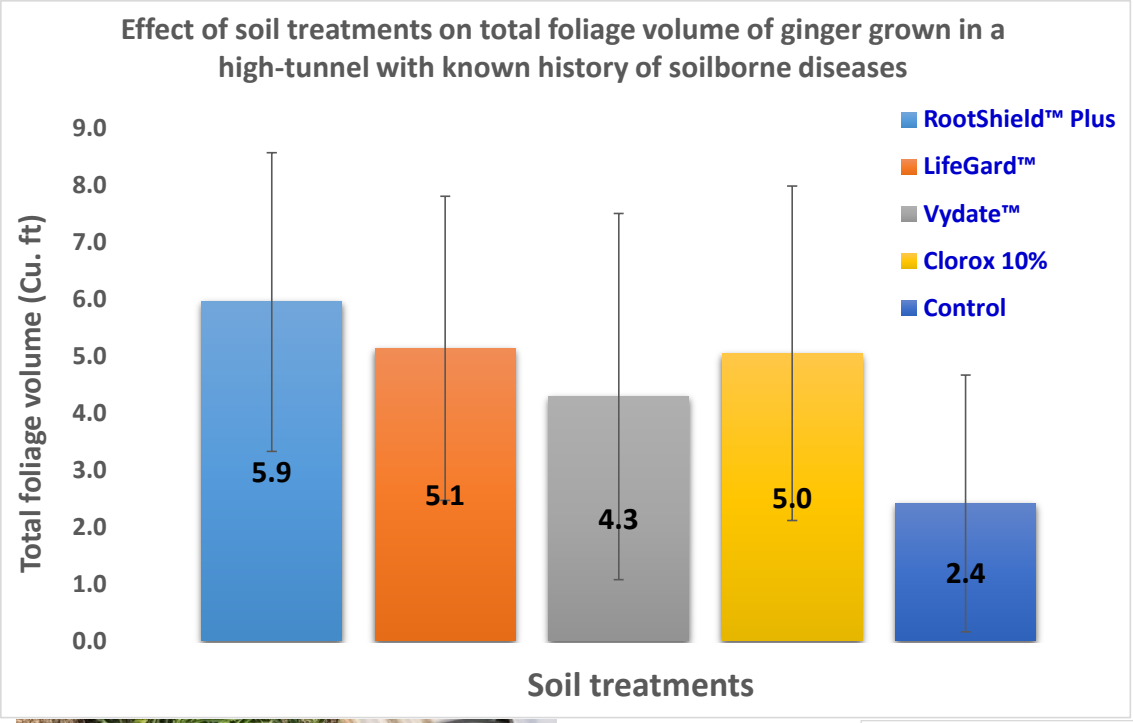
June 10, 2019

June 15, 2019

June 13, 2019

June 18, 2019

July 3, 2019



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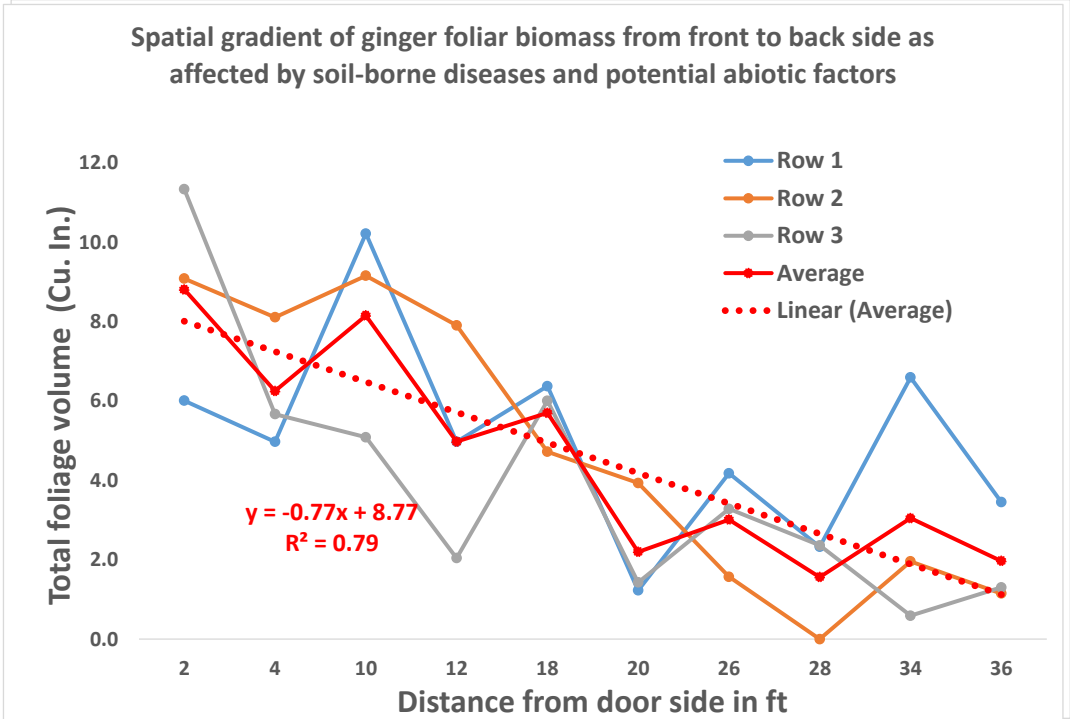
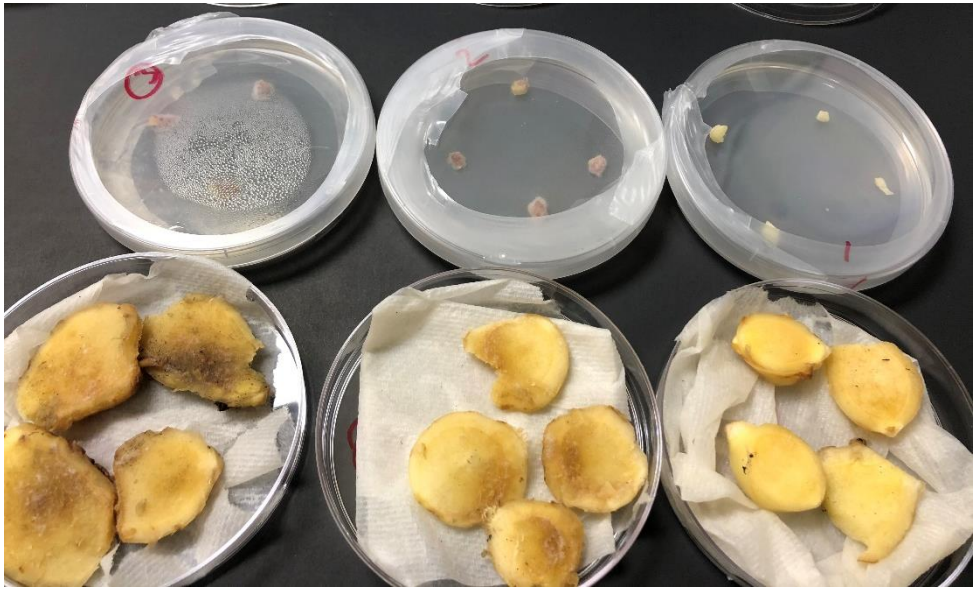


2019 Preliminary Diagnostic Results



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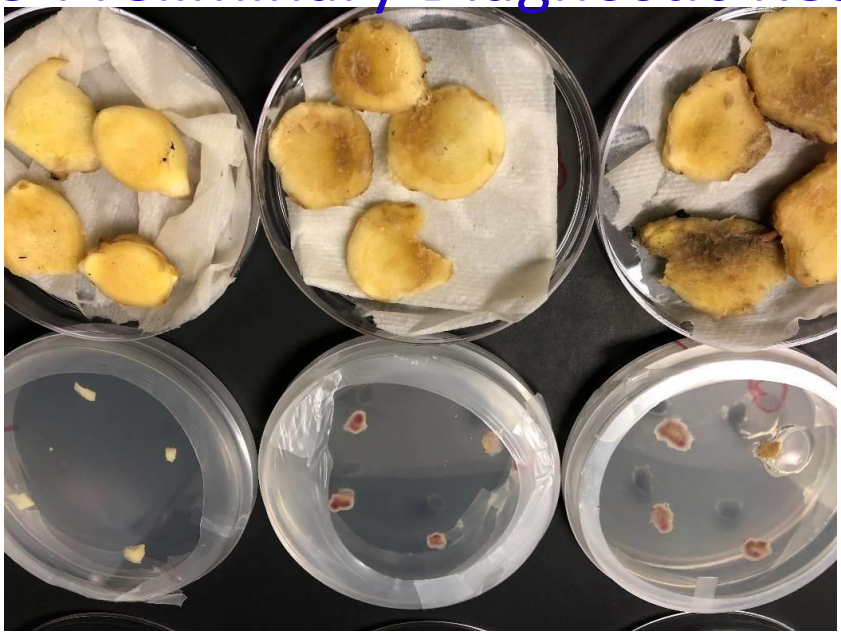
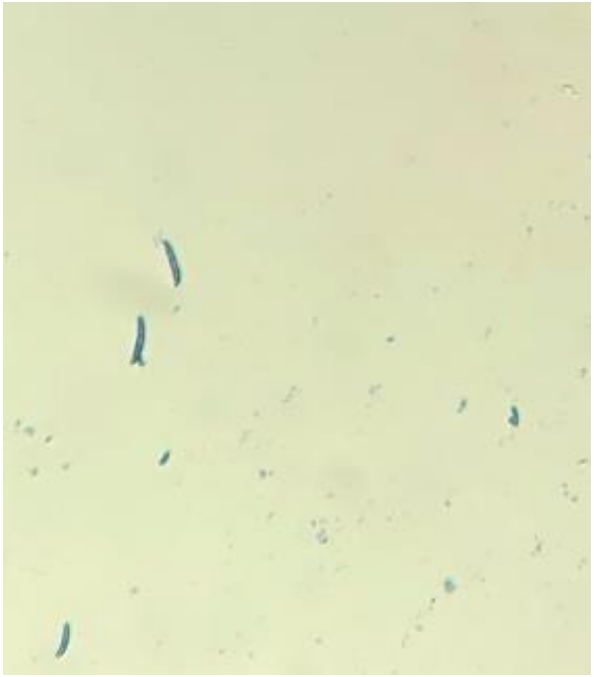
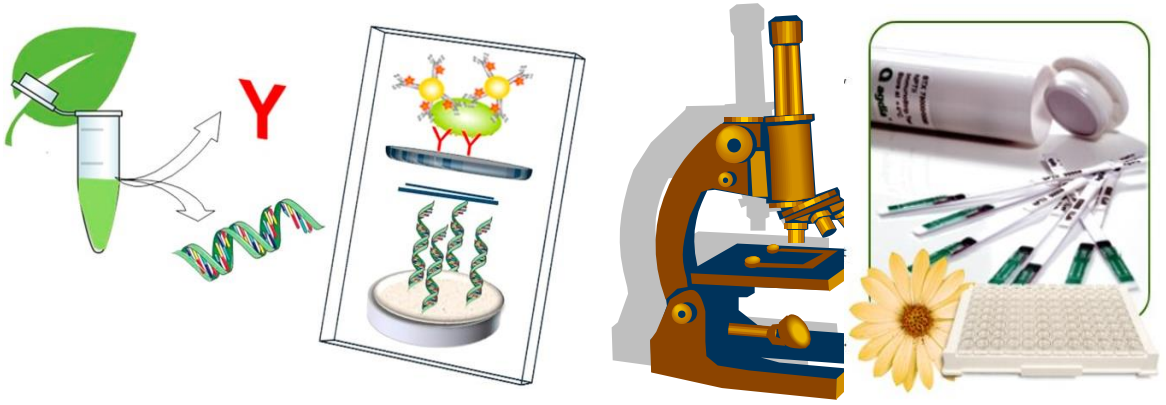


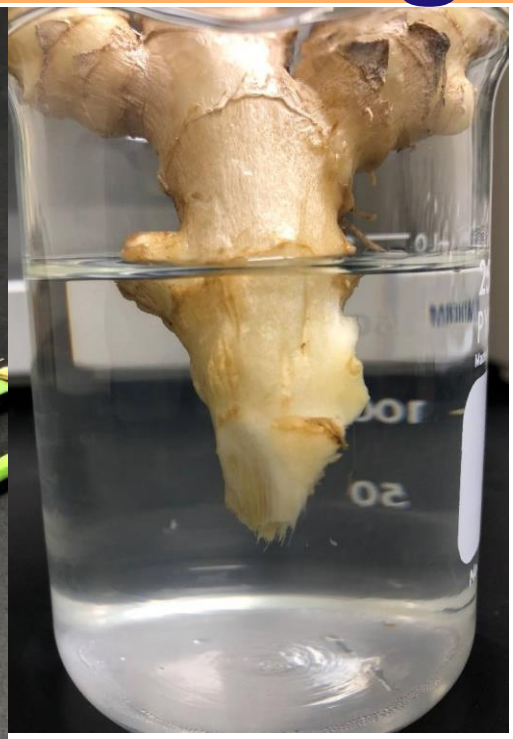




Diagnosis:

- Case history information,
- Signs & symptoms,
- Microscopy,
- Culturing,
- Serological,
- **Molecular detection**

Plant Diagnostic Skills



Diagnostics … Seek help

Contact

Plant Disease Clinic

Department of Plant Pathology, Physiology, and Weed Science

Virginia Tech

106 Price Hall

170 Drillfield Drive

Blacksburg, VA 24061-0331

Phone: (540) 231-6758

Fax: (540) 231-7477

Email: clinic@vt.edu

https://www.ppws.vt.edu/extension/plant-disease-clinic.html

Contact

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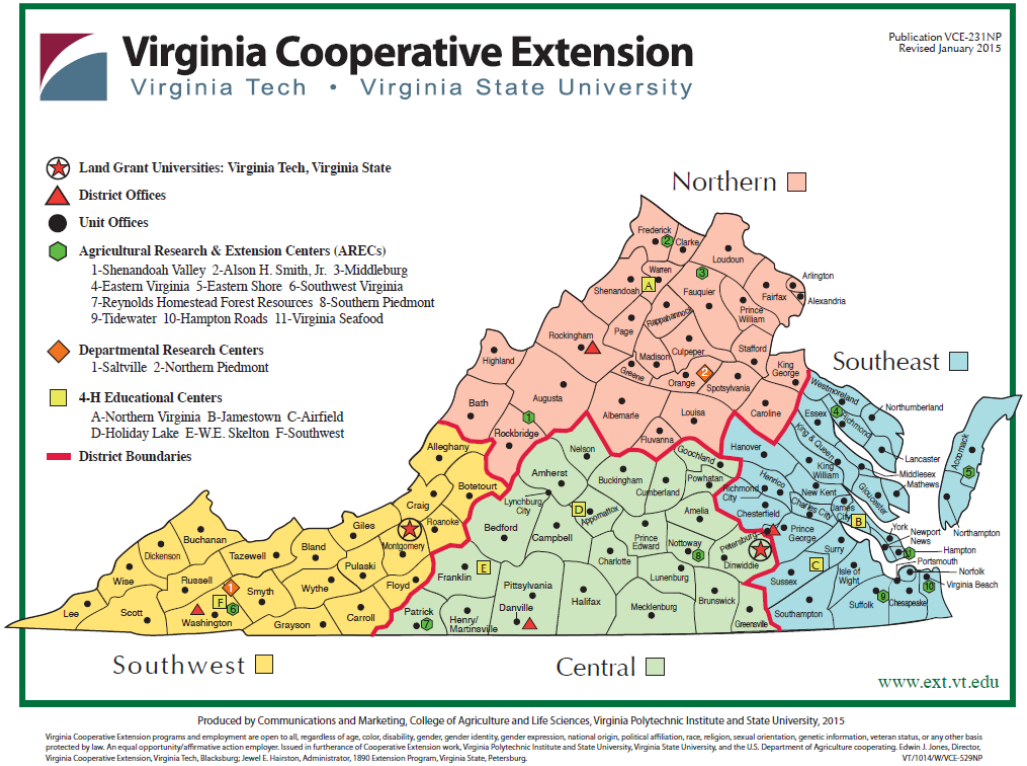

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Yellows, Wilts and Dry and Wet Rots

PREVENTION PREVENTION PREVENTION

- **Seed rhizome selection and treatment:**
  - Select healthy/disease free rhizomes for planting
  - Treat the seed rhizomes e.g. for soft rot with Mancozeb (0.3%) or carbendazim (0.3%), also for Fusarium yellow and Pythium soft rot
  - Rhizome hot water treatment 51 °C (124 °F) for 10 minutes

- **Proper drainage**
  - Sandy loam soil: avoid any form of water accumulation.
  - Mounding practice improves drainage.
  - **Raised beds are excellent so that water percolates faster**

- **Crop rotation**: depends on the host range of the pathogen and space availability (very challenging in protected systems)

Yellows, Wilts and Dry and Wet Rots

PREVENTION PREVENTION PREVENTION

- **Soil drenching:** with recommended fungicides

- **Soil solarization**: (e.g. Ravindra K. K. 2012)

Table 2: Effect of soil solarization on population of *Pythium aphanidermatum* (cfu g^{-1} soil x $10^{5)}$

S.No	Days	Solarized soil	Non-solarized soil
1	0	35.42	36.22
2	15	28.64	38.41
3	30	12.37	39.12
4	45	1.94	41.56
5	60	1.32	42.81

- **Biological control:** using beneficial fungi (***Trichoderma spp.***) and bacterial isolates (***Bacillus & Pseudomonas flourescens***)

- **Integrated Disease Management (all compatible options that work best for the particular farm and situation)**

Useful Resources

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Thank you!!

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