



BioWorks®

How You Grow Matters™

Understanding How to Use Biopesticides for Managing Soilborne Plant Diseases

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BioWorks

2013 Tri-State Greenhouse IPM Workshop



1

True or False?

Biopesticides are a great rescue treatment for disease problems





2

Biopesticides Can Include:

- a. Bacteria***
- b. Fungi***
- c. Virus***
- d. A&B***
- e. All of the above***





3

True or False?

Biopesticides work best at low to moderate disease or pest pressure





4 *What Is Not Regulated as a Biopesticide?*

- a. *Ladybug***
- b. *Genetically modified soybean***
- c. *Bacteria-based plant protectant***
- d. *Petroleum oil-based insecticide***





5 *What is the State Insect of Maine:*

- a. *Honeybee***
- b. *Nine-spotted Ladybug***
- c. *Praying Mantis***
- d. *Brown Marmorated Gangnam Fly***



Our Goals:

- *Learn the basics of managing plant diseases with **Biopesticides***
- *Understand how to use **Biopesticides** for optimum efficacy*

- I. What Are **Biopesticides**?
- II. Suppressing Soilborne Plant Diseases with **Biopesticides**
- III. Discussion and Questions

What are Biopesticides?

Biopesticide

*A type of **registered** pesticide derived from such natural materials as animals, plants, micro-organisms, and certain minerals (US-EPA definition)*

- Plant-Incorporated Protectant*
- Biochemical Pesticide*
- Microbial Biopesticide*

Microbial Biopesticide

A biopesticide that contains a microorganism as its active ingredient

- *Bacterium* – *CEASE*[®], *Serenade*[®], *Actinovate*[®]
- *Fungus* – *RootShield*[®], *SoilGard*[®]
- *Nematode*
- *Virus* – *Agriphage*[™]
- *Protozoan*

What They Do

1. Suppress plant diseases via one or more modes of action (MOAs)
 - *Antagonistic metabolites*
 - *Competition (nutrients and/or niches)*
 - *Rhizosphere or phyllosphere competence*
 - *Predation or (hyper)parasitism*
 - *Non-toxic mechanisms*
 - *Induced resistance*

What They Do

2. Provide effective and safe approaches to plant disease management
 - *Act preventively rather than curatively (most)*
 - *Are effective at low to moderate disease pressure*
 - *Can help prevent and overcome pesticide resistance in conventional IPM*
 - *May be used in bio-organic production (many)*

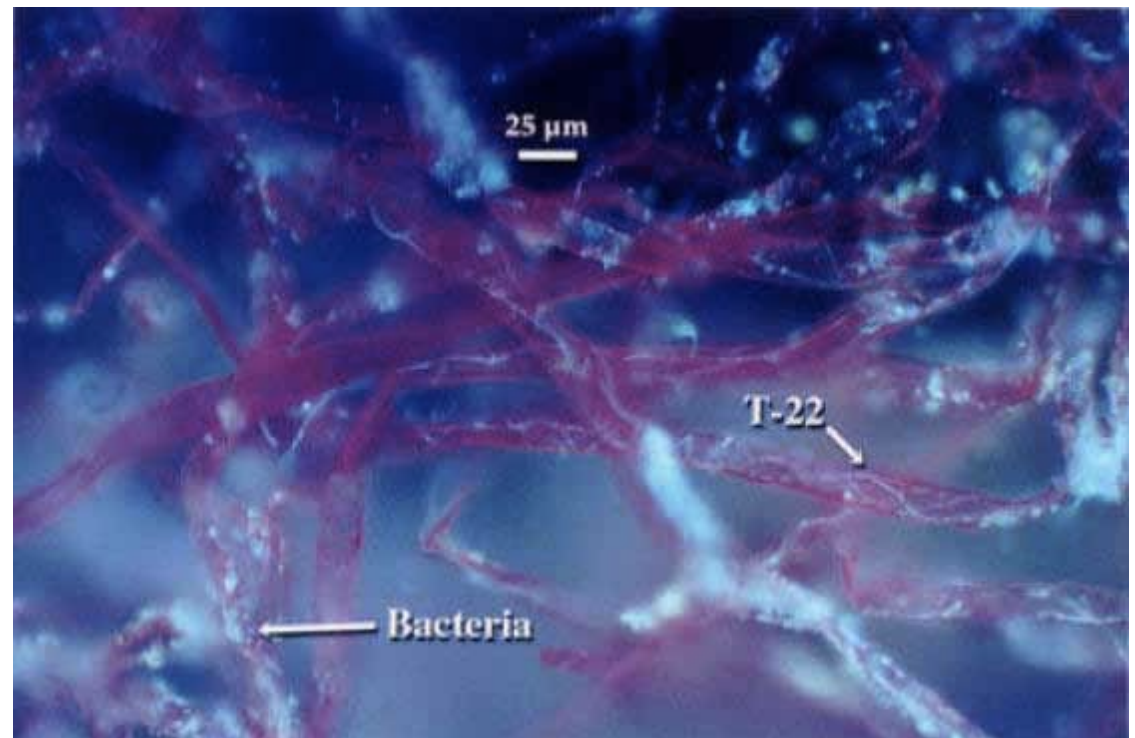
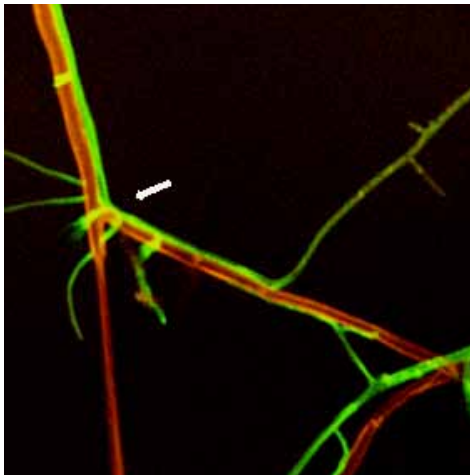
What They Do

3. May provide other beneficial effects
 - *Promote rooting or upper plant growth*
 - *Enhance availability of macro- and micro-nutrients*
 - *Help plants resist or overcome environmental stresses and transplant shock*
 - *Improve soil condition*
 - *Promote other beneficial microorganisms in the rhizosphere*

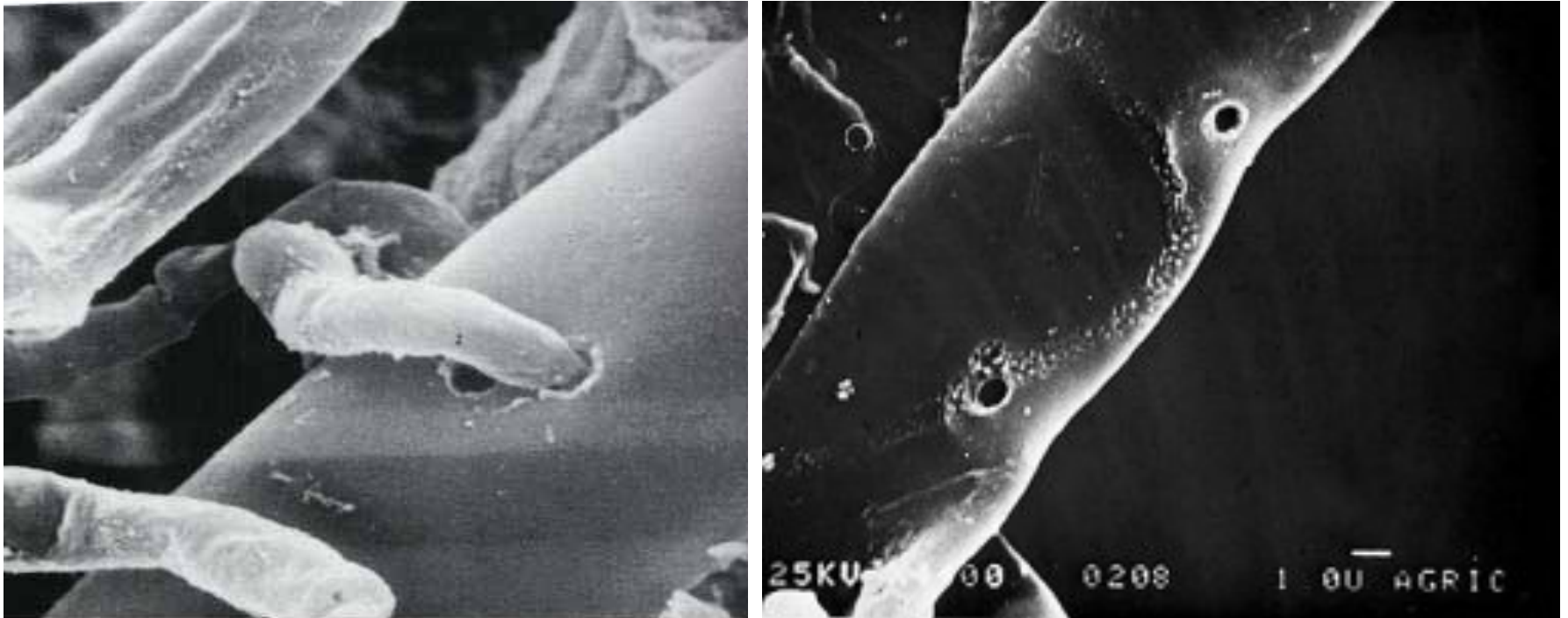
What They Do Not Do

1. Offer 100% protection – *no pesticide does*
2. Cure diseases (few exceptions)
3. Work in environmental extremes
4. Work at high disease pressure
5. Last indefinitely – *have defined shelf lives, storage conditions, and application intervals*
6. Make a bad grower good

Rhizosphere Competence/Competitive Exclusion



Mycoparasitism/Predation

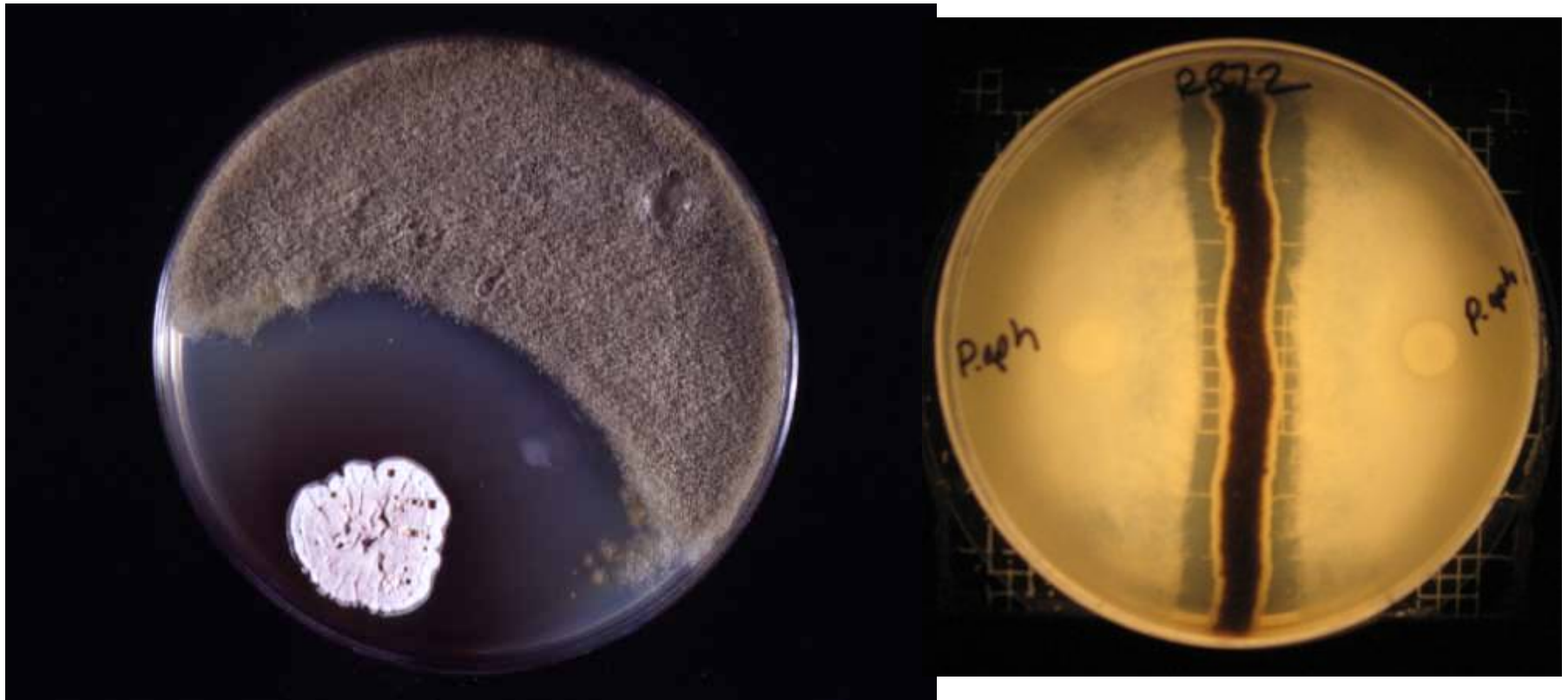


Responsible

Economical

Proven

Antagonistic Metabolite Production



Responsible

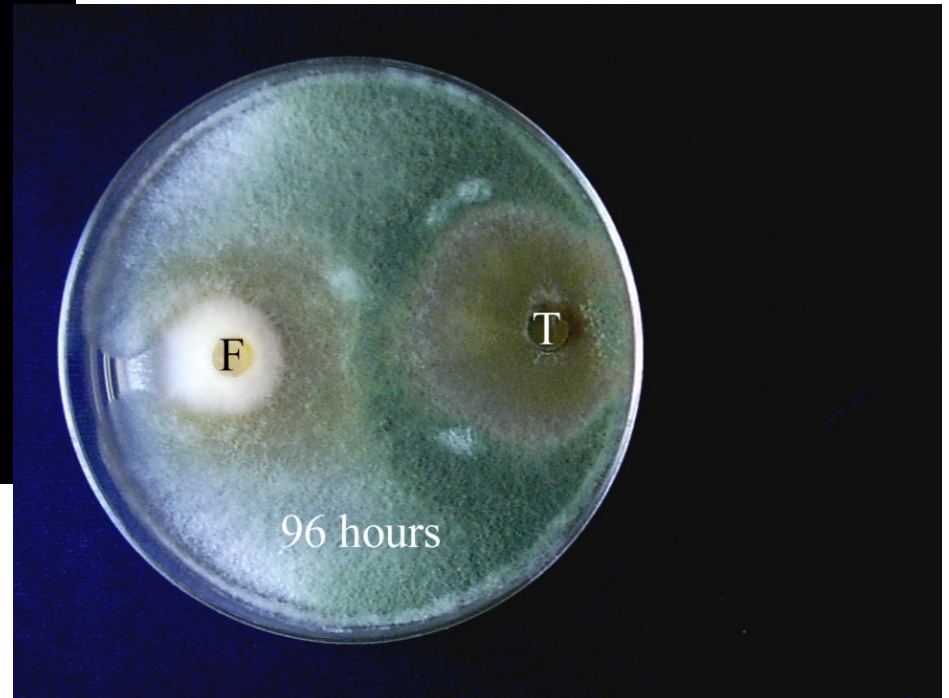
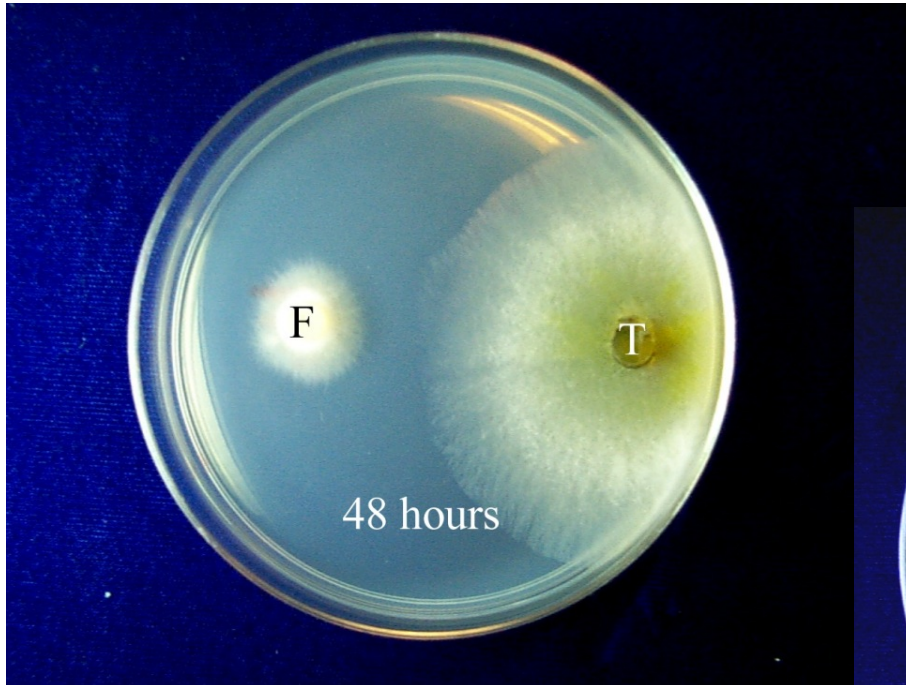
Economical

Proven



For effective competition,

Speed is important



Key Strengths of Commercial Biopesticide Strains (*NOT UNIVERSAL*)

- Adaptable to growing in diverse soils, substrates, and environments
- Compatible with a broad range of crops, production systems, and inputs
- Competitive and persistent in highly competitive environments
- Able to utilize SOM at different decomposition levels
- Can suppress disease via multiple modes of action
- Quickly respond to fast-growing pathogens

Key Limits of Commercial Biopesticide Strains (*DEPENDS ON STRAIN*)

- Limited Spectrum of Activity (Few Modes of Action)
- Persistence: Too Low / High
- Narrow Host Compatibility and Crop Range
- Incompatibility with Soils, Environmental Conditions, and Other Products
- Production of Toxins
- Shelf Life and Quality of Formulation
- Manufacturer Experience with Product vs. Rates vs. Claims



CSC

Advantages of Integrating Biopesticides in Growing Systems

- Alternative Modes of Action
- Chemical Compatibility
- Resistance Management
- Cost Effective Control
- Worker & Environmental Safety
- Align with market trends toward *Sustainability*

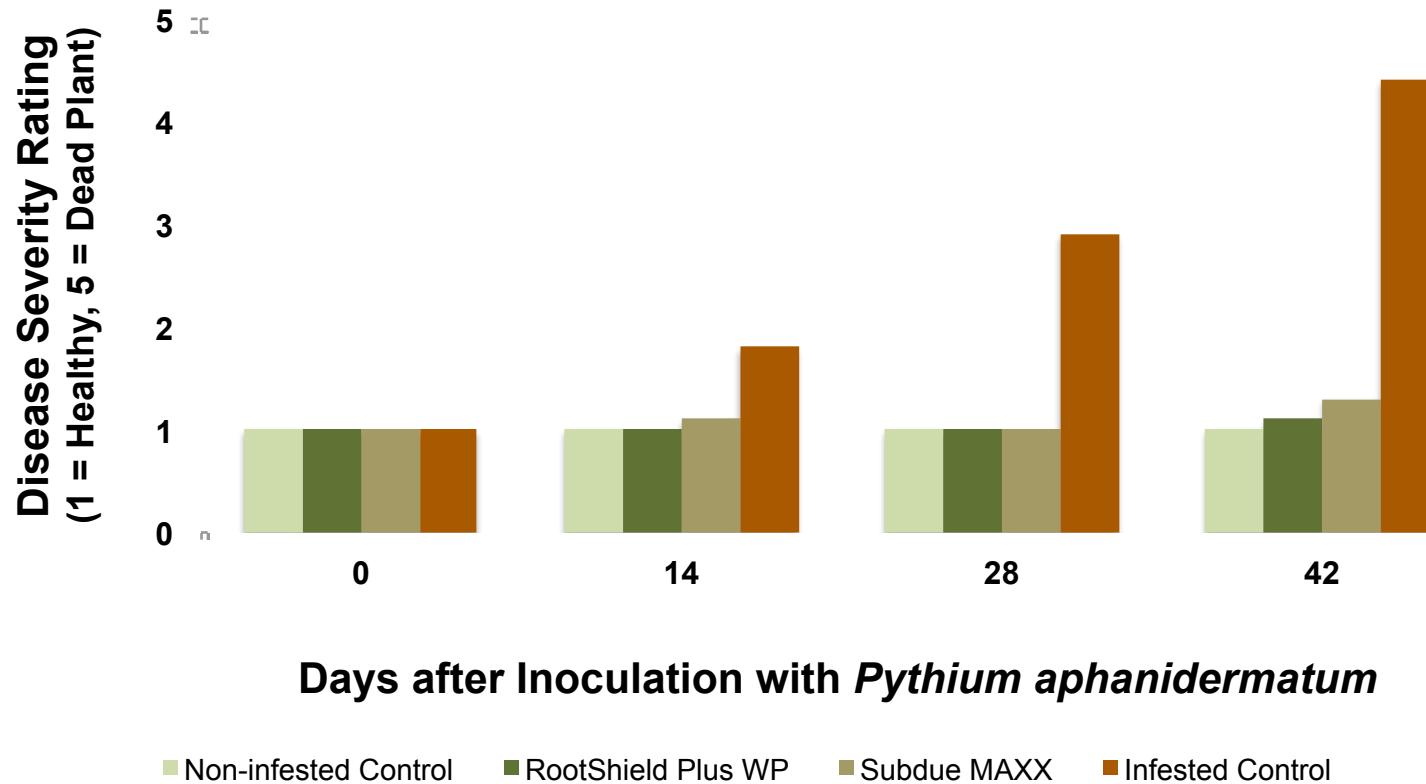
The Host Plant

- Provides aerial and submerged (in soil, water, potting media, etc.) microenvironments for microorganisms
- Both living and dead plants provide food for microorganisms: pathogens and beneficials
 - Root, fruit and leaf exudates
 - Dead plant tissues
 - Live plant tissues

Suppressing Soilborne Plant Diseases with Biopesticides



Efficacy of RootShield Plus+ WP vs. Pythium Root Rot of Poinsettia



Days after Inoculation with *Pythium aphanidermatum*

■ Non-infested Control ■ RootShield Plus WP ■ Subdue MAXX ■ Infested Control

Responsible

Economical

Proven

Components of a Good Foundation

1. Limit exposure to pathogens via good cultural practices
 - *Use good plant hygiene*
 - *Remove prior crop residues*
 - *Manage adjacent alternate hosts*
 - *Use crop rotation whenever possible*
 - *Use pathogen-free soil amendments or growing media*

Components of a Good Foundation

2. Reduce favorable conditions for disease development
 - *Environmental conditions*
 - *Irrigation water quality and water management*
 - *Soil / growing medium*

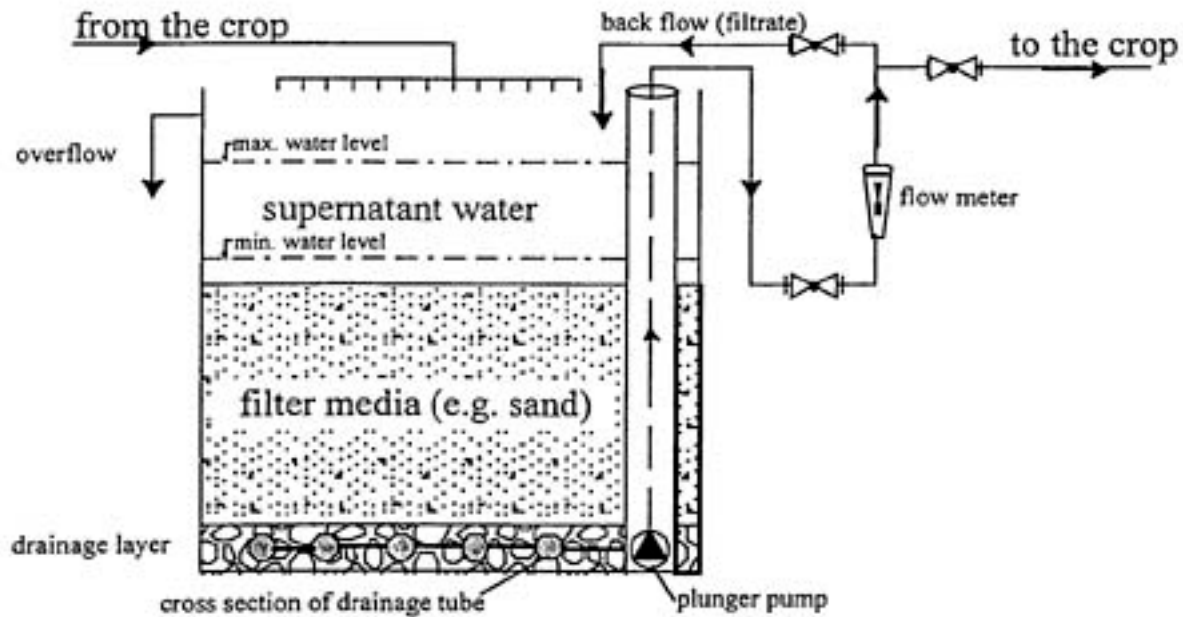




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Slow Sand Filter Concept for Pathogen Removal



Components of a Good Foundation

3. Start with Healthy Plant Material

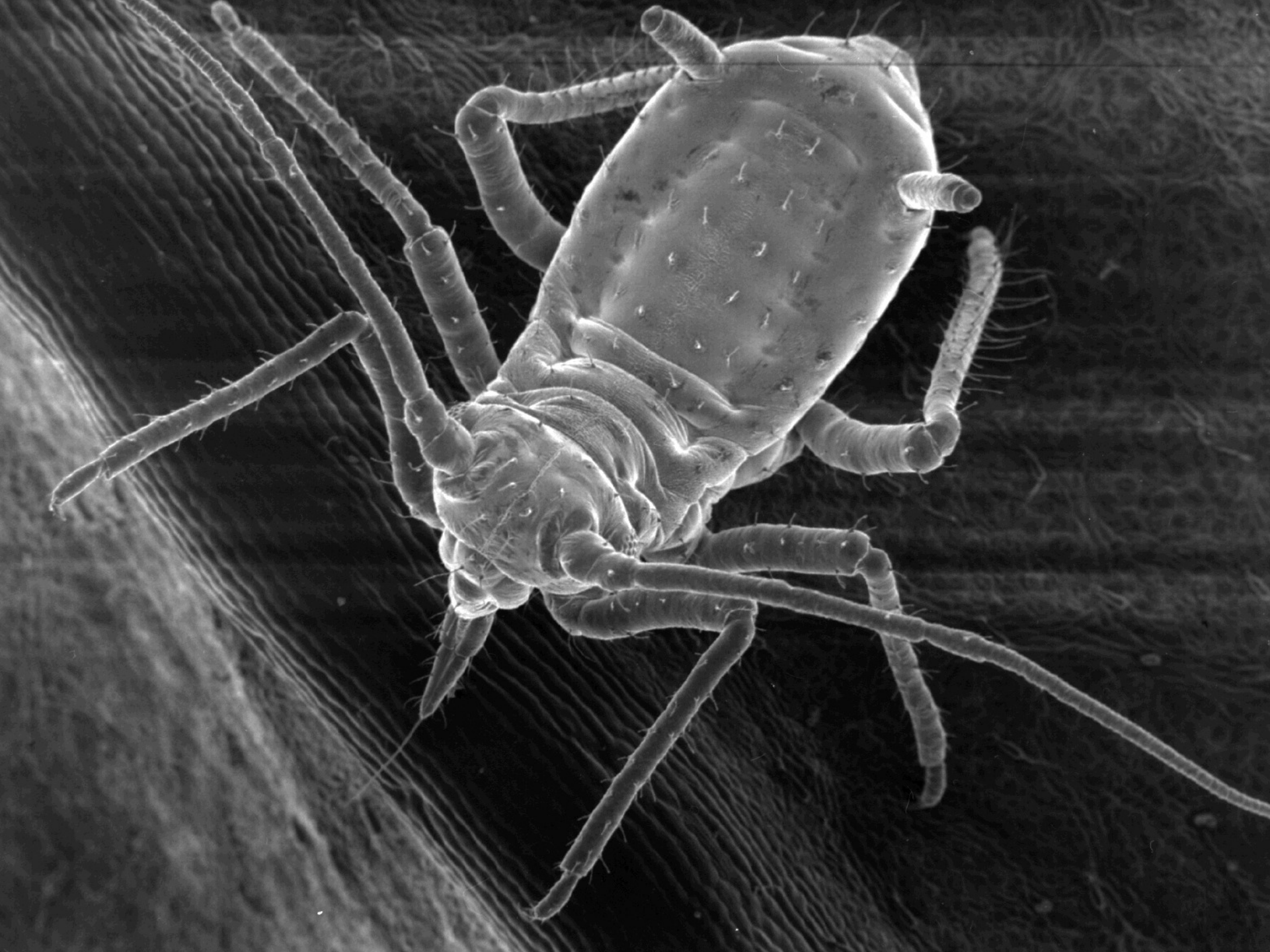
- *Insist on treated, “clean” or indexed seeds, cuttings, and transplants from suppliers*
- *When healthy plant material cannot be assured*
 - *test for known pathogens (via diagnostic kits or recognized diagnostic lab)*
 - *treat physically (bio-organic and conventional) or chemically (conventional)*
 - *reject severely diseased/infested plant material*

Components of a Good Foundation

4. Provide proper nutrition management
 - *Nutrient deficiencies cause poor plant vigor & yield*
 - *Excess nutrients typically lead to*
 - *production of softer/weaker tissue*
 - *toxicities*
 - *greater salinity in soil and irrigation water*
 - *Proper nutrition provides balanced growth and vigor = resistance to stress and pathogen attack*

Components of a Good Foundation

5. Use resistant varieties whenever possible
6. Know the enemies of the crop
 - *Potential pathogens and insect pests*
 - *Disease or developmental cycles*
 - *Vectors or sources of pathogens and pests*
 - *Available treatment options/control methods*
 - *Limitations/vulnerabilities of pathogens and pests*



When Using Composts in Container Mixes:

- Buy only high quality composts from reputable producers
- Maturity can be determined with Solvita[®] test kits and basic laboratory analyses or ask for results
- Suggested composted materials
 - Yard waste compost
 - Aged conifer barks
 - Hardwood bark composts
 - Horse and Cattle Manure Composts (< 5% /v)
 - Vermicompost (very few of consistent producers)

Solvita[®] Test Kit and Analyzer



Responsible

Economical

Proven

High Quality Aged Pine Bark





Mixed Waste Compost

1. Use only registered biopesticides

- Only registered biopesticides can be legally sold and used for disease control
- By law, biopesticide manufacturers are obliged to:
 - guarantee product quality and purity
 - undergo safety, environmental, and efficacy testing and federal review
 - pay all independent testing and regulatory costs
- Beware of unregistered disease control products
 - quality control, safety, and traceability are not documented
 - buyer has little to no recourse if something goes wrong
 - *“If it’s good enough to claim, it’s good enough to register.”*

2. Consult with local extension staff or consultants about availability of registered biopesticides suited to diseases of your crops
3. Apply biopesticides from the beginning
4. Apply each biopesticide according to label instructions
 - Application method(s)
 - Mixing or preparation instructions
 - Application/reapplication rates and intervals

5. Learn how each biopesticide can be used effectively in rotation or combination with other products
 - Check manufacturer resources for compatibility
 - Consult manufacturer literature about possible synergies (or complications) with other products
6. Use high-quality mature composts to compliment biopesticides in soils and growing media

Notes about Compost Extracts and Teas

- Use only compost teas/extracts made with high quality mature composts:
 - Great sources soluble organic nutrients to roots and foliage as well as humic and fulvic acids
 - Frequently support the activities of biopesticides
 - Used alone, do not provide consistent disease control (including induced resistance) – products that claim disease control **must** be registered with US-EPA
- Avoid compost extracts and teas fermented with sugars and molasses
 - they can amplify human and plant pathogens

