Outline

- Insecticide/Fungicide Modes of Action
- What are biopesticides?
- Keys to making biopesticides work
- Registered Bioinsecticide/Biofungicide options
- Note – mostly focus on field products

**Insecticide MOA targets**

- Cuticle Biosynthesis
- Growth & Development Targets
- Metamorphosis
- Moulting
- Midgut Targets
- Respiration Targets
- Nervous System
- Metabolic Processes
- Other Methods

**Fungal Cell Structure**

- Microtubules
- Mitochondria
- Cell wall
- Nucleic acids
- General Cell Constituents
- Cell membranes
Biopesticides

- Types of pesticides derived from such natural materials as animals, plants, fungi, bacteria, and certain minerals
- Applied similar to conventional pesticides
  - Sprays, drenches, dips, incorporation

Keys to Using Biopesticides

1. Know your enemy
   - Understand the disease/life cycle of the target pest
   - When are they: Exposed / Treatable / Most sensitive & vulnerable
   - Most products work on contact
   - Have to get the product and the pest together

2. Understand how the product works
   - When is it best applied
   - What is it active
   - Recognize that there is a range of efficacy depending on stage of infection/infestation

3. Good coverage is essential
   - Water volume
     - Don’t skimp on the water
     - Some products need up to 700 L/ha of water
**Keys to Using Biopesticides**

3. Good coverage is essential

**B. Droplet size matters**
- 100 microns vs 10 microns = 1000x more coverage

**C. Pressure**
- Higher pressure to reach lower leaves & ↑ coverage
- Upwards of 200psi

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**Bacillus thuringiensis (Bt)**

- Dipel WP / 2X DF
- (Bacillus thuringiensis var kurstaki)
- Thuricide HPC (BTK)
- Bioprotec CAF / 3P (BTK)
- Vectobac 600L (Bt subsp israelensis)
- XenTari WG (Bt subsp aizawi)

- Naturally occurring bacterium
- Very wide registered crop list

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**Bacillus thuringiensis (Bt)**

- How it works
- Controls Lepidopteran pests (caterpillars)
- Combo of toxins and spores
  1. Insect ingests the product
  2. Toxins act quickly on the gut, stopping feeding and perforating the gut
  3. Spores grow within the midgut and insect
  4. Feeding cessation = rapid
  5. Rapid death

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**Beauveria bassiana**

- How it works
- Spores adhere to the target insect
- Grow and release enzymes, dissolving the cuticle of the insect
- Penetrates and grows to fill entire body cavity
Metarhizium anisopliae
- Met52 / Met52 EC
- Soil pathogenic fungus
- Greenhouse crops and pests

How it works
- Spores applied as a foliar spray
- Contact the insect
- Grow and penetrate the exoskeleton
- Grow internally
- 3-7 days until death

BIOFUNGICIDES

Bacillus subtilis
- Serenade MAX / SOIL
- Kodiak
- Taegro (B subtilis var amyloliquefaciens)
- Range of registered crops (depending on product)

How it works
- Attacked pathogen spores
- Colonizes areas around the roots, providing competitive protection
- Releases secondary metabolites that suppress soil-borne pathogens (fungi/bacteria)
- Activates natural plant defense response, making plants tougher

Trichoderma harzianum
- Rootshield HC / WP / Granules
- Bora HC / WP
- Fungal spores
- Greenhouse crops, strawberries, lettuce, tomato

How it works
- Spores colonize roots, etc.
- Toxins released by fungus attack the cell walls of the pathogens
- Suppresses spores

Streptomyces lydicus
- Actinovate SP
- Naturally occurring bacterium
- Suppression of disease and symptoms of PM and other diseases
- Range of field/greenhouse crops

How it works
- Applied to plant
- Grows over the plant surface
- Parasitizes fungal pathogens
- Produces antibiotics

Coniothyrium minitans
- Contans WG
- Naturally occurring fungus
- Works with a range of crops

How it works
- Attacks and colonizes the sclerotia of Sclerotinia
- Increases over time
- Breaks the disease cycle
- Gradual reduction of disease levels
**Pseudomonas syringae**
- Bio-Save 10LP
- Commonly occurring bacterium
- Post-harvest spray for suppression of storage diseases (Fusarium dry rot and Silver scurf) of seed/storage potato

**How it works**
- Enters wounds where pathogens would live and develop
- Competes for nutrients
- Outgrows the pathogen in ideal conditions

**Pseudomonas fluorescens**
- Blightban A506
- Commonly occurring bacteria
- Suppresses fireblight on apples

**How it works**
- Sprayed on the plant (blooms, etc.)
- Colonizes areas where fireblight pathogen would develop
- Also produces antibacterial compounds that suppress disease

**Aureobasidium pullulans**
- Blossom Protect
- Live strains of yeast + citric acid buffer
- Suppresses fireblight on apples

**How it works**
- Sprayed on blooms
- pH of blooms lowered
- Growth of pathogen ↓
- Yeast colonizes the blossom
- Blocks infection sites
- Competes for nutrients

**Pantoea agglomerans**
- Blightban C9-1
- Orchard bacterium (non-pathogenic)
- Fireblight suppression

**How it works**
- Sprayed on the plant (blooms, etc.) prior to infection
- Preventative, NOT curative
- Colonizes areas where fireblight pathogen would develop, without damaging plant
- Also produces antibacterial compounds that suppress disease

**Extract of Reynoutria sachalinensis**
- Regalia MAXX
- Giant knotweed extract
- PM / DM / Botrytis
- Greenhouse/field cucurbits; tomato; pepper; strawberry

**How it works**
- Apply prior to disease symptoms
- Triggers the natural defense mechanisms of plants
- Inhibits the development of certain plant pathogens

**Potassium bicarbonate**
- Sirocco / Milstop
- Controls/suppresses Powdery Mildew on:
  - Greenhouse vegetable crops; Field cucurbits (cucumbers, melons, pumpkins, squash); Field peppers; greenhouse/field herbs & spices

**How it works**
- Contact fungicide
- Pulls waters from the pathogen spores & walls
- Alters pH of leaf surface, inhibiting enzymes needed for formation of fungal cell walls
Citric & Lactic Acid

- Tivano
- From fermentation of Lactobacillus casei
- Suppresses:
  - PM on squashes and pumpkins
  - Bacterial canker on tomatoes
  - PM & angular leaf spot on strawberries

**How it works**
- Applied to the plant
- Form a physical barrier on the leaf surface, preventing infection
- Cause water loss, causing cell membranes to tear away from cell wall, killing cells

Garlic powder

- Buran
- Suppresses Powdery mildew on squash and pumpkins

**How it works**
- Inhibits the germination of fungal spores
- Interferes with growth of mycelium

QUESTIONS???

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