Baseline Sensitivity of California Isolates of White Rot to Fungicides

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Overview

*INTRODUCTION TO WHITE ROT

*FIELD EXPERIMENTS

*PHYTOTOXICITY ISSUES ASSOCIATED WITH FUNGICIDES

*IMPORTANCE OF ESTABLISHING A BASELINE SENSITIVITY

*RESULTS OF EXPERIMENT

*DISCUSSION OF RESULTS
Importance of White Rot of Onion and Garlic

- Caused by the soil fungal pathogen *Sclerotium cepivorum*, which spreads and overwinters as sclerotia.

- White rot is a monocyclic disease. Disease symptoms are often not present until just a few weeks before harvest, sometimes forcing growers to abandon fields.

- White rot is the typically the limiting factor to production when it is present, and can cause devastating losses, anywhere from 50-100% total loss.
What makes white rot so devastating?

- Sclerotia can remain viable for over 30 years in the soil, even in the absence of hosts.

- Sclerotia are small enough that they can easily be moved any time dirt, or propagative materials (especially garlic cloves) are transported.

- A very small number of sclerotia can cause significant disease.
Effect of Inoculum Density on white rot incidence

**Sclerotium cepivorum**

- Plants in the *Allium* family are the only hosts, and onions and garlic are especially susceptible.

- Sclerotia germinate in response to chemicals exuded by *Allium* roots, especially Allicin and other diallyl sulfur compounds.
Sclerotia Germination Stimulants

- Diallyl disulfide (DADS) (which mimics natural garlic and onion sulfur compounds) or garlic or onion extracts are sprayed on fallow fields and incorporated.
- Sclerotia germinate, expecting host presence, and lacking a carbohydrate source, mycelium dies.
- DADS, and other similar compounds can easily reduce sclerotia levels in the soil by 90-98%.
Chemical Control/Plant Protection

- DADS (or other sclerotia stimulants) must be combined with fungicides for adequate disease control

- Currently registered:
  - Folicur (tebuconazole)
  - Maxim, Cannonball, and Switch (fludioxonil)
  - Endura (boscalid)

- New Fungicide Chemistries
  - Luna Privilege (fluopyram)
  - LEM17-20 (penthiopyrad)
Phytotoxicity of tebuconazole

**Average dry plant weight in response to tebuconazole**

- Concentration of tebuconazole (X standard rate):
  - 0X
  - 0.5X
  - 1X
  - 2X
  - 4X
  - 10X

**Response of seedling germination to tebuconazole**

- Concentration of tebuconazole (Folicur):
  - 0X
  - 0.5X
  - 1X
  - 2X
  - 4X
  - 10X

The graphs show the effect of different concentrations of tebuconazole on plant weight and seedling germination. Letters (a, b, c) indicate significant differences among the treatments.
Reliance on fungicides for the control of disease increases the chance of the development of resistance.

Baseline sensitivities provide a standard for monitoring for resistance.

EC$_{50}$ and 80- the fungicide concentration required to reduce mycelial growth by 50 and 80%.

LD$_{50}$ and 80- the fungicide concentration required to prevent spore germination by 50 and 80%.
Effective concentration to reduce mycelial growth
Effect of tebuconazole on sclerotia formation

0.01 ppm tebuconazole

0.1 ppm tebuconazole

1 ppm tebuconazole
Lethal Dose to Prevent Germination of Sclerotia
Phytotoxicity of fungicides

- Phytotoxicity of all other fungicides was tested in greenhouse studies.
- Fungicide application method sequence and soil type did not have a significant effect on the phytotoxicity of tebuconazole.
- None of the fungicides (other than tebuconazole) showed significant phytotoxicity at concentrations up to 10X normal concentration.
- No phytotoxicity was observed either in the field plots at Tulelake, or in greenhouse studies when applied at the recommended rate.
Future Research

- Determine how long tebuconazole remains active in soil
- Determine whether tebuconazole slows mycelial growth at plant roots or in the soil before mycelia reaches plant roots.
- Determine the best recommended practices for combining DADS and fungicides in fields with varying numbers of sclerotia.
Questions

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