Effect of Biofumigation and Soil Solarization on *Sclerotinia sclerotiorum* in High Tunnel Vegetable Production Systems of Kentucky

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Production System: High Tunnels

High Tunnels ("hoophouses") are unheated greenhouses used by growers to extend the growing season.
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*What is grown in high tunnels?*

- Early and late vegetables: tomatoes in May or October
  - Winter greens: lettuce, mustards
  - Winter vegetables: beets, carrots, radish
  - Early or late fruits: brambles, strawberry
    - Seedlings or nursery plants
Production System: High Tunnels

“Disease is the #1 problem.”

-Sculerotinia sclerotiorum

-Soil-borne disease
-Broad spectrum
-Favors cool, moist conditions

-Paul Wiediger, high tunnel grower, Smith’s Grove, Kentucky
Soil Borne Disease Management Tactics

*Suitable for certified organic farm fields and high tunnels*

**Biofumigation:**
uses natural chemicals of brassicas, glucosinolates, to suppress soil-dwelling pests.

**Soil Solarization:**
soil is covered with clear plastic, and heated to temperatures that are lethal to pest organisms.
Testing the Effect of Biofumigation and Soil Solarization on *Sclerotinia sclerotiorum* in a High Tunnel at the Kentucky State University Research Farm

- 16 4x8’ plots inside a high tunnel
- 8 planted with Biofumigant crop: Pacific Gold Mustard
- 8 planted with non-Biofumigant crop: Buckwheat (control)
- Sclerotia grown and bagged in the lab
- Placed in soil at 0, 5, 10, and 15 cm depths, in each plot, for duration of study
Testing Biofumigation and Soil Solarization in a High Tunnel at the Kentucky State University Research Farm

Rate of Biofumigation: \(606\text{g/m}^2\)

Target Rate Based on Exposure Studies: \(16\text{kg/m}^2\)

Less than 4% of target rate.
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- Bags of sclerotia removed after 48 hours and 4 weeks of treatment.
- Sclerotia plated onto sterile soil and incubated.
- Germination counts performed to assess survival.
Results

Viable sclerotia proportion

Depth (cm)

Biofumigation
Biofumigation + Solarization
Buckwheat
Buckwheat + Solarization

5-from planting
Results

Viable sclerotia proportion

Depth (cm)

5-from planting
Average Hourly Soil Temperatures

Temperature (°C)

Time of Day
Number of Germinating Sclerotia (of 40) after 6 Weeks in the Soil
Looking Ahead: What We Know, What We Don’t about Biofumigation, Soil Solarization, and Soil-borne Diseases in Kentucky

We Know: Soil Solarization, where temperatures remain around 30°C for a 6 week period, is very effective at killing sclerotia of *S. sclerotiorum*. At 4 weeks, the effect is significantly less.

We Know: Biofumigation, by methods of growing Pacific Gold Mustards, chopping biomass finely at flowering, and immediately incorporating into soils, has not shown an effect on the survival of bagged sclerotia.

We Don’t Know: Why growers saw a reduction in *S. sclerotiorum* damage following Pacific Gold cover crops...glucosinolate exposure, increased organic matter, disruption by tillage, etc.?

We Don’t Know: How age/life stage or exposure to soil effects the susceptibility of sclerotia to solarization or biofumigation.

We Know: *S. sclerotiorum* and *Phytophthora capsici* exhibit lower survival rates after exposure to higher concentrations of glucosinolate extracts taken from Pacific Gold Mustards.

We Don’t Know: How to grow, chop, and incorporate Mustard cover crops in a way that exposes bags of *S. sclerotiorum* to lethal concentrations of glucosinolates.