

Breeding for White Mold Resistance

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Management of White Mold

Crop Rotation: Small grains

Crop Canopy Management:

- **Plant Population/Row Spacing**

Chemical Control: Fungicides/Herbicide

Biological Control: Contans

Variety Selection:

- **Adjust variety to canopy mgt. system**
- **Adjust canopy mgt. system to variety**



Why Aren't There More White Mold Resistant/Tolerant Varieties?

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Phenotypic Variation in Reaction to *Sclerotinia sclerotiorum*

Soybean Reaction to White Mold

- **Escape**
  - **Height, maturity grouping (flowering date), plant architecture = crop canopy structure**
- **Physiological (True) Resistance**
  - **No complete resistance reported**
  - **Many genes associated with resistance**
  - **Modified by environment**
  - **Difficult to transfer white mold resistance to high yield potential varieties**

Variety/line reactions = % plant mortality
Both in Field and Greenhouse Trials

Contribution by Environment?
Genetics?

Commercial Varieties and White Mold Resistance

- **No varieties with complete resistance**
- **Varieties differ based on plant mortality**
- **Are varieties genetic mixture of R and S plants?**
- **Form of resistance modified by environment?**
- **Disease escape vs. resistance?**

Research Goals

- Develop methods and selection protocol to develop experimental lines with physiological and stable resistance to white mold
- Provide guidance on how to move resistance into high yield potential varieties
- Allow growers to select high yield varieties for high yield potential management systems

White Mold Resistance Activities

- Determine methods to identify sources of resistance
- Develop soybean populations derived from crosses between resistant and susceptible soybean lines
- Determine methods to identify highly resistant soybean lines within segregating soybean populations
- Utilize resistant and susceptible lines within populations to understand genetics of resistance
- Understand function of resistance genes

Where to Conduct White Mold Variety Trials?

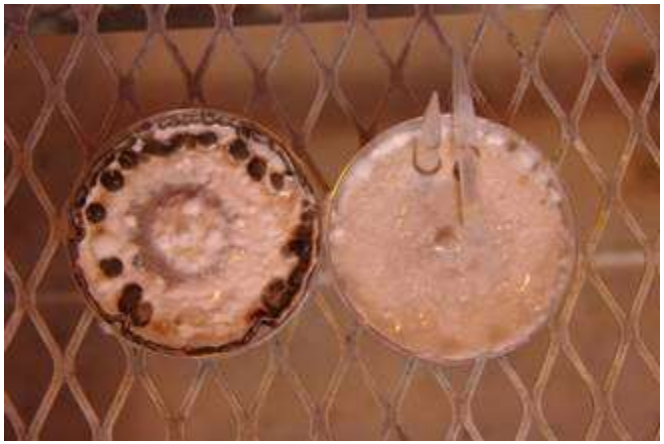
- **Field**
  - **Most relevant**
  - **Cannot separate escape from physiological resistance**
  - **Severity of white mold varies from year to year**
- **Greenhouse**
  - **Ensures white mold to occur**
  - **Separate escape from physiological resistance**
  - **Conduct trials year round**
  - **Does greenhouse performance relate to field performance?**

Evaluation vs. Selection

- **Evaluation of lines/varieties can be performed in field trials**
- **Selection for resistance within segregating breeding populations**
  - **Field: high risk due to inconsistent development of white mold**
  - **Greenhouse: Controlled inoculation reduces the risk of disease escape resulting in susceptible plants being advanced to next generation**

Greenhouse Inoculation Methods

R1 growth stage



Incubation: 10-14 days

Terminal stem

Lower stem

Terminal Stem Method Identifies Resistant and Susceptible Plants

Lower Stem Method Identifies Resistant and Susceptible Plants

Search for Resistance

Sources of White Mold Resistance

- **Commercial varieties**
  - **NK S19-90**
  - **AG2506**
- **Ancestral varieties**
  - **Plant introductions**
  - **USDA soybean germplasm collection**
  - **Most are “primitive” for agron. traits**
- **GMOs**
  - **Limited success**

NK S19-90 White Mold Standard

Capable of expressing low plant mortality in field

Field performance not consistent

High plant mortality in greenhouse

Common source of field tolerance

W04-1002: Experimental Line

Breeding Approach: cross resistant line to susceptible lines

X

Progeny of Parents

Ratio of Resistant and Susceptible Plants

R to S = 1:3

Resistant and Susceptible Plants Needed to Identify Genetic Markers

DNA of resistant and susceptible plants are compared for genetic differences (markers)

Genetic markers used to select resistant plants without inoculation

Project Summary

- Project started in 2006
- 6,000 lines have been selected from field nurseries
- 24,000 plants inoculated in greenhouse trials
- 900 lines are currently under evaluation
- Final greenhouse selections in 2012
- Field evaluations begin in 2012
- Report methods and experimental lines to industry in 2012

White Mold Research

- Wisconsin Soybean Marketing Board
- North Central Soybean Research Program
- United Soybean Board
- State Agricultural Experiment Stations
- Seed and Ag Chemical Companies