ENHANCING SCLEROTINIA STEM ROT RESEARCH CAPACITY AND EXPLORING NEW AVENUES OF MANAGEMENT THROUGH SOYBEAN CANOPY ARCHITECTURE TRAITS

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1. Goal: Define the relationship between canopy architecture and Sclerotinia Stem Rot (SSR) development

- Plant architecture may be an important component of avoiding infection by *S. sclerotiorum*
- Apothecia production is influenced by temperature, moisture, and light (quality and quantity): UVB (276-319 nm)
- Peak apothecia production occurs at ~50% canopy coverage
- Current management: fungicides R1-R3, wider row spacing (30" rather than 15"), changing planting density

2023 Trials

- 20 lines selected from ~130 lines in an architecture panel: high, low, and middle intensity of UVB light through the canopy and architecture traits such as internode slope, petiole slope, leaf area, and time to canopy closure (2022 data)
- Trials are being completed in a randomized complete block design (RCBD) with 5 blocks in 2 locations, Crookston (planted 5/25) and St. Paul (planted 5/19) in disease nurseries
- Apothecia counts and light measurements are being collected as well as disease incidence and severity.

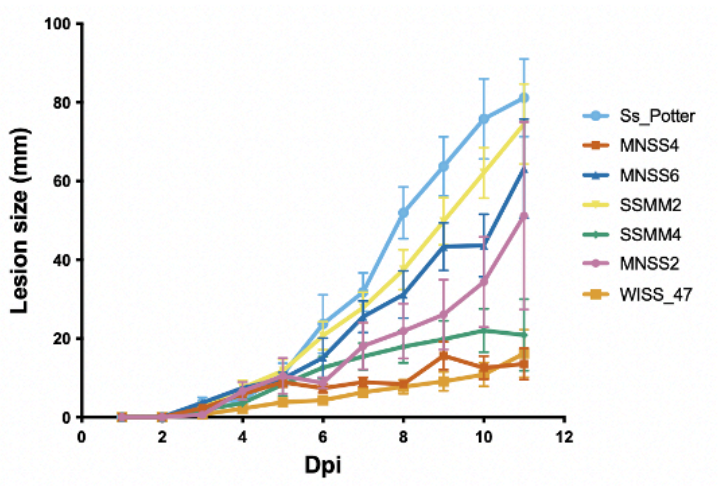
The slope of internode length and slope of petiole length from the top of the plant to the 4th and 5th nodes defines the top shape of the canopy as steep (left) or rounded (middle). Leaf area due to different leaf shape such as lanceolate vs rounded also determines canopy architecture.

We aim to identify architectural traits that are associated with reduced incidence of SSR that will lead to opportunities to combine genetic resistance with disease escape.

2. Goal: Develop reliable *S. sclerotiorum* nurseries for future SSR trials

- In Crookston, we are working to evaluate disease infestation methods for uniform disease pressure and to conduct future SSR trials

3. Goal: Understand Differential Aggressiveness of *Sclerotinia sclerotiorum* Isolates to Develop Crop Resistance Tools



Several MN isolates show consistently low, moderate, or high levels of aggressiveness in soybean.

- In total 22, isolates from MN were evaluated.
- This fall we are testing the three Minnesota isolate panel on known soybean check lines to evaluate their usefulness in differentiating resistance.

We aim to provide a tool that breeders can use to screen for SSR resistance in MN

DETERMINING THE CURRENT POPULATION OF WATER MOLD CAUSING STEM & ROOT ROT IN MINNESOTA SOYBEANS

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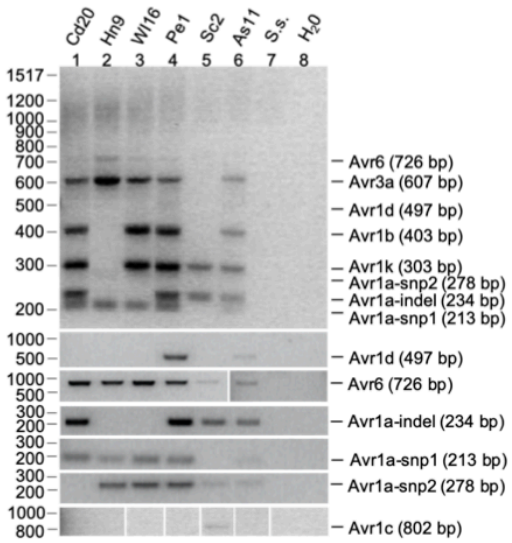
Objective: Identify which pathotypes of *Phytophthora sojae* (the pathogen that causes Phytophthora stem & root rot in soybeans) are present in Minnesota in order to help growers decide which resistant varieties of soybeans to use.

Approach 1: Test a recently-developed molecular assay designed to efficiently and accurately pathotype *Phytophthora sojae*.

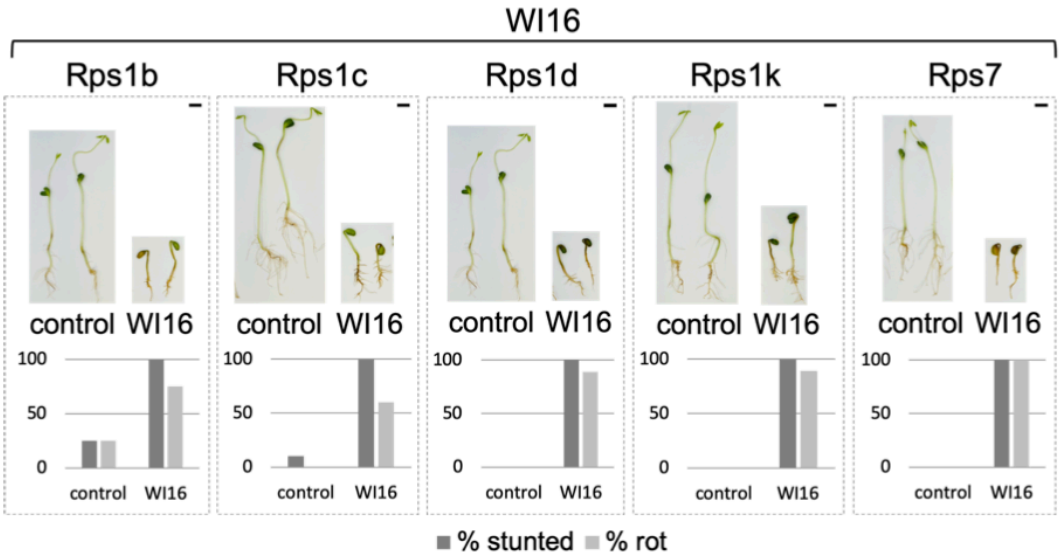
(a) We first perform a molecular assay that detects specific genes that contribute to *P. sojae* virulence



(b) We can then determine the *P. sojae* pathotype from the molecular assay.

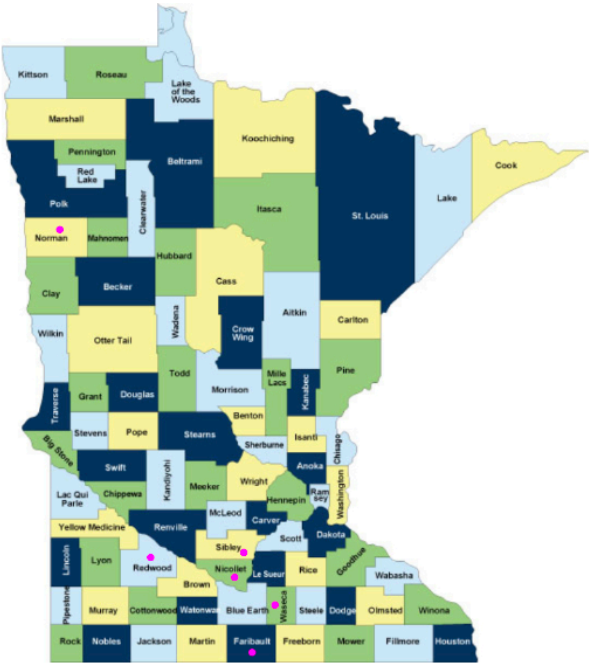
Isolate	Molecular-based Pathotype (2023)	Plant-based Pathotype (2013)	Plant-based Pathotype (2023)
Cd20	1a, 1c, 1d	1a, 1c, 1d, 7*	1c, 1d, 7 (not screened: 1a)
Hn9	1a, 1b, 1c, 1d, 1k	1a, 1b, 1c, 1d, 1k, 7*	
WI16	1a, 1c, 1d	1a, 1b, 1k, 7*	1b, 1c, 1d, 1k, 7 (not screened: 1a)
Pe1	1c	1a, 1c, 7*	
Sc2	1a, 1b, 1d, 3a	1b, 1d, 2*, 3a, 4*, 5*, 6	
As11	1c	5*, 7*	1c, 7 (not screened: 5)

(c) Next, we cross-validate the molecular-based pathotype with classic pathotyping methods.



Approach 2: Isolate *Phytophthora sojae* from soil or diseased soybeans collected around MN and determine their pathotype using above molecular method.

soil samples we have received or anticipate to receive



MN counties

Understanding the impact of cover cropping on disease development and soil health in Minnesota

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Objective: Quantify the effect of winter rye and brown mustard cover crops on disease. We aim to assess the impacts of different cover crops on: **1.** Disease in soybean and dry bean, **2.** The viability and degradation of sclerotia over time and **3.** Soil health and structure.

Approach: Establish disease nurseries in Saint Paul and the NWROC in Crookston, one nursery of *Rhizoctonia solani* and one of *Sclerotinia sclerotiorum,* per site. To achieve our objectives, we will induce disease in fields of soybean and dry bean under different treatments of cover cropping and chemical control. We will also bury bags containing sclerotia, which will be removed at different time points to assess degradation.

Outcomes: UMN extension personnel will be able to recommend specific combinations of strategies to reduce disease pressure for stakeholders. If winter rye does increase disease pressure in seedlings, different strategies (seed treatment, fungicide) may be recommended. If brown mustard or winter rye proves to promote soil communities that degrade sclerotia, this information will be made public and considered when planning crop rotations.

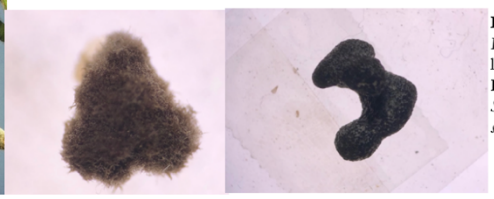
Example Plot Map

401	402	403	404	405	406
301	302	303	304	305	306
201	202	203	204	205	206
101	102	103	104	105	106

Fall cover
None
Mustard
Rye

Above: Dry bean plot. Replicates for dry bean and soybean are in preparation both in STP and Crookston. There are two identical parts per plot for fungicide treatments

Left: Rhizoctonia root root and stem canker in soybean; varied degrees of severity.
Right: Sclerotinia stem rot in soybean.



Left: Sclerotia of *Rhizoctonia solani* under light microscope, 1.5x, **Right** Sclerotia of *Sclerotinia sclerotiorum,*0.8x