Multi-Pronged Strategies to Provide Efficient Sustainable and Durable Control to Sclerotinia Stem Rot – Progress Report 1

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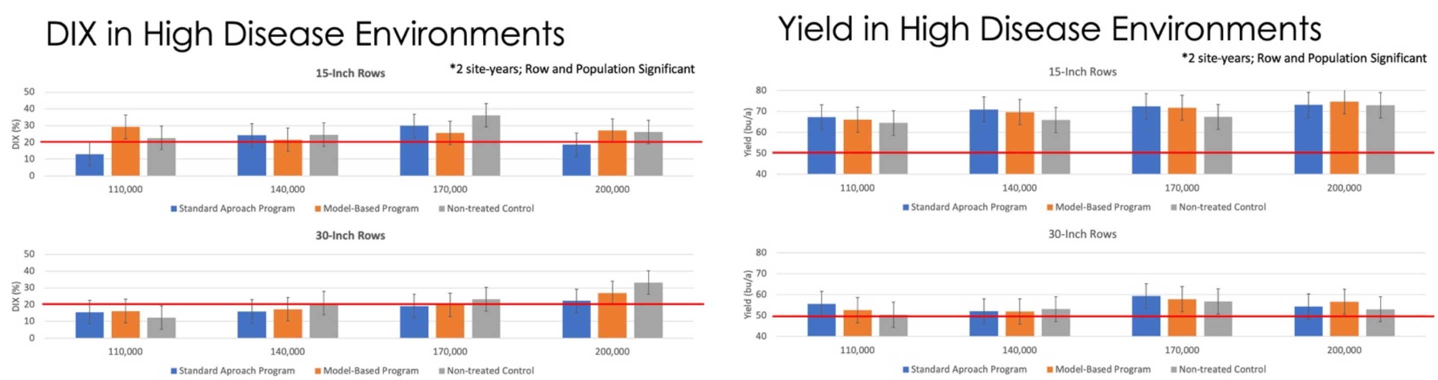
Objective 1) To evaluate current, standard soybean management practices, including irrigation, row spacing, population density, and fungicide treatment applied using an advisory tool, for use in integrated Sclerotinia stem rot management.

Goal: To develop modern, integrated management recommendations for white mold that have been vetted across multiple sites and years. Recommendations should include row spacing, population density, and fungicide treatment in the approach.

Planting at 140,000 seed per acre, balances seeding rate and yield potential in both 15 and 30” row spacing. Yield is typically high in 15” row spacing, however, white mold can be as high as 50% greater in a 15” row spacing compared to 30” row spacing.

Figure 1. Disease index (DIX) and yield in integrated management trials for two site-years where white mold index was high enough to limit yield (WI, 2017 and MI, 2018).

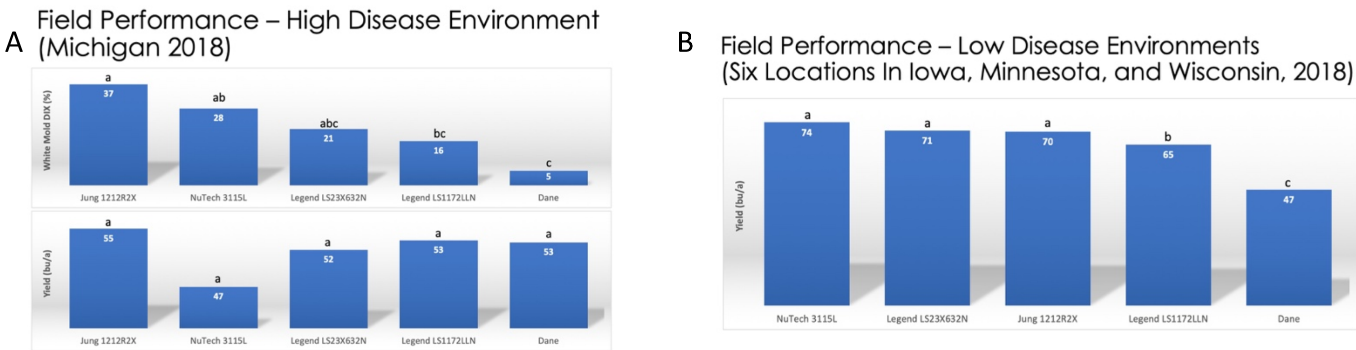


Objective 2.a) To identify new germplasm lines resistant to Sclerotinia sclerotiorum that can be incorporated into integrated management programs or into soybean breeding programs.

Goal: To identify soybean varieties with a high level of resistance to white mold, which are stable across locations in the North Central region.

Figure 2 illustrates results of field screening of resistant lines compared to a susceptible check (Jung 1212R2X). Several commercial varieties have been identified that appear to have good physiological resistance in the greenhouse and acceptable field resistance in multiple environments.

Figure 2. Field performance of 5 soybean lines tested in: A. a high disease environment (Michigan, 2018) and B. in 6 low disease environments across the North central region.



Objective 2.b) To refine the existing soybean SSR advisory tool to incorporate model output for different forms of resistance.

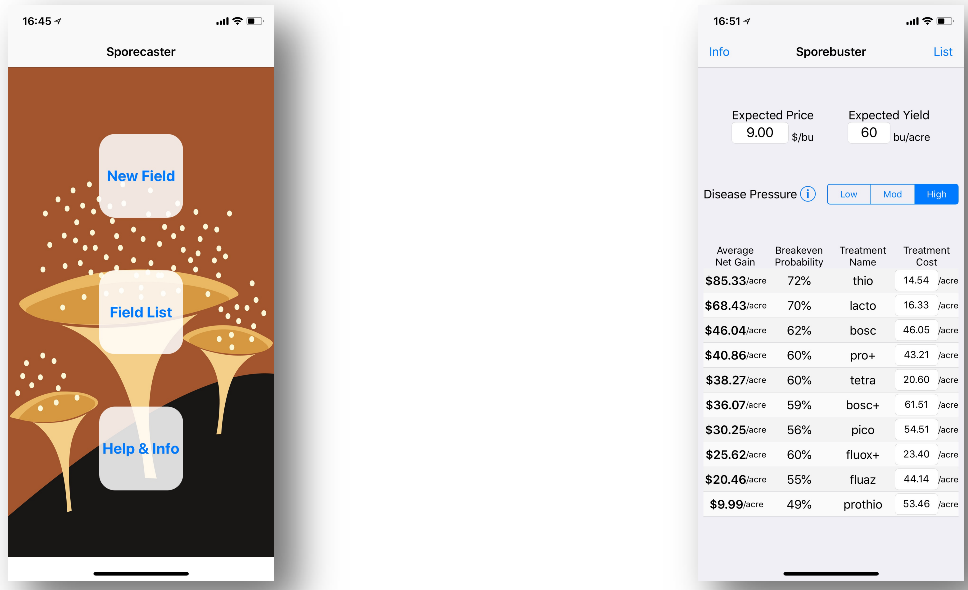
Goal: To improve the accuracy of a fungicide application decision tool for controlling white mold, by accounting for varietal resistance in soybean.

In 2018 we developed two (2) smartphone applications. Sporecaster was made available to the public as a free download on the Google Play Store and iPhone app store in May of 2018. As of this report, Sporecaster was downloaded over 1,600 times from the Apple and Android stores. Daily use rates during the major "white mold season" (July and August) averaged 250 users per day. Sporebuster has been available for just two months (since October 2018). This application has been downloaded approximately 70 times. Sporecuster is used to determine if a crop is at risk for white mold and advises if a fungicide application should be made. This app is meant to be run in-season and uses site-specific weather information to provide the risk prediction. Sporebuster is meant to complement Sporecaster. Sporebuster is a return on investment application that uses research-based economic models to determine if a particular fungicide program for white mold control, will result in a high probability of success on a case-by-case basis. Users can input their costs for programs and uses their own yield and soybean pricing scenarios to get tailored recommendations.

Sporecaster was previously validated (2016 and 2017) in commercial fields and research trials. In those validations, Sporecaster was over 80% accurate in predicting yield-limiting epidemics of white mold. Additional field validations were performed in 2018. While white mold severity was much less compared to 2016 and 2017, epidemics were present in some fields. In the 2018 validations of 16 commercial fields, Sporecaster was accurate ~80% of the time in predicting yield-limiting epidemics. This level of accuracy is good, however, we believe that incorporating varying levels of resistance into the model, such as illustrated in objective 2a, could further improve the accuracy. This could be done by modifying the action thresholds based on resistance type. Work is underway to understand how this could be implemented.

Finally, Sporecaster received the 2018 American Society of Agronomy (ASA) Extension Education Community Educational Award in the category of digital decision aids (software, web-based, smartphone and tablet apps). This was awarded at the annual meeting of the ASA in Baltimore, MD in November 2018.

Figure 3. Screenshots of the Sporecaster and Sporebuster Smartphone Applications



Objective 3) Exploitation of transgenic soybean silenced in NADPH oxidases to achieve abiotic and biotic stress tolerance.

Work will be underway in Spring of 2019 to address this objective.

Objective 4.a) Develop outreach publications and tools based on results generated here and disseminate through the national Crop Protection Network portal.

Objective 4.b) Develop an electronic book compiling information about Sclerotinia stem rot and management of the disease for a diverse audience.

Work will be underway in Spring and summer of 2019 to address Objectives 4 a and b.