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|  **MSR&PC Production Action Team FINAL Report 2018-2019** * **MSR&PC Award Number:** 150-4120-18-05-7527
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| * **Principle Investigator:** Dean Malvick
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| * **Department/Organization**: Department of Plant Pathology, University of Minnesota, St. Paul, MN
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| * **Project Title: Optimizing Management of White Mold, SDS, and BSR in Minnesota**
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| * **Dates of Reporting**: May 1, 2018 – April 30, 2019

The project objectives are listed below, and the activity and outcomes for each objective are summarized. Please let me know if additional results and information are requested beyond what is shown in this brief summary. Thank you.**1**. **Optimize Management of White Mold** **Goal A: Determine the efficacy of genetic resistance, fungicides, and plant**  **population reduction for white mold management.*** Three field studies for white mold management in soybean were established at Rosemount, MN in May 2018. The studies were planted and all experimental steps were executed using methods that have been consistently effective in previous years. All studies were inoculated with the white mold pathogen at early flowering stages and irrigated twice per week in July and August to supplement natural rainfall. It was disappointing that very little white mold developed in the plots. This is the lowest level of white mold that has developed in our soybean white mold studies over the past 10 years. We do not know why white mold failed to develop, but we suspect that temperatures were too warm when the plants were most susceptible to infection. The treatments of reduced row spacing (15” rows), higher population rate (170,000 seeds/Ac), and fungicide applications at R1 and R3 all increased the percent of green leaves retained at R7. The white mold pressure was low in these fields and none of the treatments had a measurable effect on disease. Yield was higher with 30” row spacing and higher population rates (170,000 seeds/Ac). Some fungicide treatments on a susceptible cultivar inconsistently increased yields across the trials under the low disease pressure. There were not any differences in yield between the susceptible, moderately resistant, and resistant cultivars under low white mold disease pressure.
* We conducted studies on methods to evaluate resistant to white mold among soybean entries in the greenhouse. The type of inoculation method used had an influence disease severity. Adding inoculum at the top of the plant resulted in severe leaf and stem infections that can kill plants. Spray inoculation methods at the side of the plants results in leaf infections, where infected leaves may drop off, resulting in mild to moderate disease. Using the best method, a resistant cultivar had significantly less disease (67% of plants infected on leaves and stems) than a susceptible cultivar (100% infection with plant death) under high white mold pressure in the greenhouse.

  **Goal B**: Determine the value of Contans® for white mold management in on-farm trials.Six fields in southern/central MN were included in this study, where Contans was applied to 3 replicate strips (45-200 acre total application area) in the spring at 2 lb/acre. Challenges with the project included rain delays for application, timing of product delivery, and low levels of white mold that developed in the fields. The results were inconclusive overall due to the low levels of white mold that developed. Four of the locations had little to no white mold develop. Two locations had low to moderate levels of white mold. One of those yielded 1.8 bu/ac more in Contans strips; the other @3 bu/ac more in Contans strips; but more effect on yield was not expected due to the overall low severity of white mold in those fields.**2**.  **Optimize management and risk analysis for BSR and SDS.** **Goal A:** **Determine the effects of pathogen populations in soil and crop residues**  **on development and management of BSR and SDS.*** We collected soil samples from 20 plots in Waseca that have been part of a long-term rotation study. These rotation plots have had different lengths of times between soybean crops. The samples were collected in October to study BSR pathogen populations in soil. The causal pathogen of BSR can be detected and quantified in soil after soybean harvest. In heavy textured soil, 106 conidia/g of soil or greater can be detected. Lower concentrations, 104 conidia/g of soil, can be detected in lighter textured soils. At these concentrations in a field, BSR symptoms on susceptible cultivars could be severe. In our analysis, and although BSR was common in the plots, it appears to date that most of the samples have low populations of the pathogen, perhaps below the limit of detection for the laboratory assay that we are using.

Several commonly used fungicides were tested against the two main types of the BSR pathogen *Cadophora gregata* (types A and B) in plate studies. Ethaboxam at typical concentrations had no effect on either genotype. Pyraclostrobin, azoxystrobin, and Clariva CruiserMaxx Vibrance showed ability to reduce growth of both genotypes. Type B was slightly more sensitive to these three fungicides than type A, but evidence is still lacking to indicate that seed treatments can be effective for managing BSR.* Studies were established in Rosemount and Waseca, MN in May 2018 to determine the effects of pathogen populations and soil organic matter on development of SDS. SDS developed to moderate severity and incidence levels based at the Waseca field location. Additional analysis has been completed, and the results confirm that SDS developed based on the population of the fungal pathogen *Fusarium virguliforme* in the soil. This is the first time this has been shown in field studies to our knowledge. The results suggest (again) that using a resistant variety is very important aspect for managing SDS regardless of the pathogen population. Increasing population levels of the causal agent of SDS (Fv) may be important for disease development in the susceptible variety. No clear effect was seen by the addition of substrates (residue) on disease severity. Overall, these results suggest that SDS pathogen population size in soil is a risk factor, and one that we can potentially measure in soil in the fall or spring prior to planting soybean.

  **Goal B: Evaluate soybean breeding lines and varieties for resistance to BSR.**We conducted greenhouse studies to determine the effect of pathogen isolate and inoculation method on BSR severity on a test set of soybean lines from Aaron Lorenze’s soybean breeding project at the U of MN. Several advanced breeding lines were tested for BSR resistance in the greenhouse to multiple isolates of both types (A and B) of the BSR pathogen. Isolates differed in pathogenicity, causing moderate to severe stem browning. The most aggressive isolates caused an average stem browning severity score of 93% and the least aggressive was 7%. Breeding lines differed in susceptibility and ranged from 28 to 63% stem browning. BSR did not have any effect on biomass. The occurrence of foliar BSR symptoms were more dependent on the pathogen isolate than the breeding line, suggesting that the lines could perform differently in different regions based on the prevailing populations of the BSR pathogen in soil. In the future we will use our proven methods from this study for more extensive studies of resistance to BSR among lines from the soybean breeding program.     **3.** **Carry out extension education and soybean disease diagnostic activities that address important and unusual soybean disease problems in Minnesota.**  **Goal A: Disseminate information, and teach and organize specialized meetings and** **workshops to address soybean disease information needs.** * I have conducted outreach and information delivery on soybean diseases via multiple phone and email contacts and conversations throughout this grant period.
* Results from this project and on other soybean disease management issue were presented at 12 meetings, workshops, and conferences to audiences of approximately 750 attendees. The locations include Rosemount, Waseca, Minneapolis, Rochester, Lamberton, Morris, Wilmar, Austin, and Pine City, MN.

 **Goal B:** **Perform specialized diagnosis of unusual soybean disease problems and address problem fields when special disease situations occur.**  My lab. received soybean samples for diagnosis, which included sudden death syndrome, frogeye leaf spot, and pod and stem blight caused by *Diaporthe* spp. We also assisted with sample diagnosis in the U of MN Plant Disease clinic, and worked on improvement of diagnostic procedures. **Specific project achievements during this reporting period.** Described above**Challenges encountered.** Only those noted above, mostly related to an unfavorable field environment for disease development in some of the studies.**Specific request for assistance from the Production AT on any challenges listed above.** None at this time**Information Dissemination of data/information from this research during this reporting period.*** This is noted above under objective #3.
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