



## **North Central Soybean Research Program**

### **Developing an integrated management and communication plan for soybean SDS**

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The foundational management strategy for sudden death syndrome (SDS) is using resistant cultivars. However, in years when environmental conditions are favorable for disease development, resistance alone does not provide adequate control or reduce farmer risk sufficiently. Also, SDS continues to move into new areas. The main goal of this project is to investigate management options that will help ensure resistant cultivars will be as effective as possible even in unusually conducive SDS conditions.

### **Project Objectives**

1. Evaluate if soybean root health can be improved to reduce SDS or be used as an indicator of SDS risk;
2. Determine how shifts in soybean production practices affect the risk of SDS development; and
3. Communicate research results with farmers, agribusinesses and other soybean stakeholders.

### **Results**

- Fluoyram (ILeVO, Bayer CropScience) seed treatment was found effective to manage SDS and increase yield in our previous evaluations (Plant Disease 100:1339-1350). We compared new products including biological fungicides and nematicides with basic seed treatment, untreated control, and ILeVO in their ability to reduce SDS. In 2017, we performed field experiments in Iowa, Indiana, Michigan, South Dakota, Wisconsin and Ontario, Canada. We evaluated 9 treatments including fungicides and nematicides applied on seed and in-furrow on SDS susceptible and resistant cultivars at each location. We gathered data on plant population, root rot, root dry weight, foliar SDS incidence and severity, and yield using standard protocols from all locations and analyzed. In 2017, ILeVO and ILeVO with ethephone were found to be the most effective at reducing SDS when combined from all locations. We recently finished extracting and counting SCN population in spring (before planting) and fall (after harvest) to determine how SCN reproduction is affected by those treatments and data analysis is in progress.

- We compiled data from multiple locations evaluating ILeVO seed treatment for SDS management and yield response to the seed treatment using a meta-analysis approach. A manuscript has been published in Plant disease (in press). In summary, a 35% reduction in foliar disease and 4.4 bushels/acre (7.6%) increase in yield were estimated for fluopyram-amended seed treatment relative to commercial base seed treatments without fluopyram. A graduate student, Daniel Sjarpe, working on this project for his master's degree with Dr. Daren Mueller and Leonor Leandro at Iowa State University, recently graduated.
- We completed a study determining the interaction between the fluopyram seed treatment and pre-emergence herbicide in Iowa and Indiana. We published a manuscript in Crop Protection (Crop protection 106:103-109). In summary, seed treated with fluopyram resulted in higher phytotoxicity at VC-V1 than seed without fluopyram, regardless of preemergence herbicide treatment. The combination of preemergence herbicide and fluopyram did not increase the severity of soybean injury in any year or location compared to either applied alone. These results indicate that while injury can occur with both preemergence herbicides and fluopyram-treated seed, phytotoxicity is not more severe when both pesticides are used together, and yield is not reduced by their use.
- We completed field experiments on determining how increasing SCN resistance to SCN-resistant cultivars will affect SDS resistance performance. A manuscript has been published in Plant Disease (Plant Disease 101: 2137-2143). In summary, SCN resistance played a critical role on SDS development. Fall season SCN population density and SDS were positively correlated. We found PI88788 resistance source has been broken by nematode population in all tested sites except in Rodney, Ontario. Cultivars with no resistance to SCN had the highest disease and lowest yield. Even though, the PI 88788 type resistance was not holding up, any type of SCN resistance led to greater yields, lower SDS, and lower SCN reproduction than the cultivars with no resistance.
- In 2017, we continued field experiments in Iowa, Indiana, Michigan, Wisconsin and Ontario to investigate the effect of corn residue on SDS development. We compared two levels of residue removals and two tillage systems in corn and soybean rotation system. We gathered plant population, root rot, foliar SDS, and yield data and analyzed and a manuscript is being written. In brief, no difference was observed between the tillage system treatments, nor between the corn residue removal treatments. However, the disease level was minimal in 2017. The non-residue plots produced 7 bushels/a more yield than residue removed plots in Iowa
- We identified fields with long term fertility experiments in collaboration with Dr. Antonio Malarino, Professor Nutrient Management Research and Extension, ISU, in North east research farm, Nashua and South east research farm, Crawfordsville Iowa to determine how soil potassium levels affect SDS. We collected SDS and yield data and analyzed in 2017. In 2017, plots with no potassium had less disease than the potassium applied plots. We continue collecting data in 2018. We established a protocol for greenhouse studies using aeroponics chamber. We will conduct an experiment under controlled environment soon to

determine if susceptibility of soybean plants to *F. virguliforme* increases as the potassium and phosphorous are reduced.

- In 2017, we tagged plants with different visual ratings of SDS from low to high. Root samples were collected to quantify *F. virguliforme* in those roots. DNA extraction is completed from all of the plants roots collected. DNA samples are being processed for qPCR, which is next step to quantify the pathogen in root tissue and determine the correlation with visual ratings.
- To determine the soil sampling protocol for determining SDS pathogen level in soil, we identified fields with low and high risk of SDS based on previous years SDS severity and collected samples in different time and from different soil zones. DNA extraction has been completed and DNA samples are being processed for qPCR.
- We presented our research reports at professional meetings, on Plant Management Network, many state or province level talks, seminars, media interviews, talk in field days and conferences for farmers and also published in state newsletter articles, several media releases etc. To communicate with researchers, we published 3 manuscripts in peer-reviewed journals. We also had several press releases, including some jointly with NCSRP, based on results from this project. We developed two regional publications through the Crop Protection Network (Scouting for Sudden Death Syndrome on Soybean and Soybean Disease Management: Sudden Death Syndrome). These are linked to the SRII site. We also updated SRII with information from this proposal.
- The result from this study will have directly benefited soybean farmers in the North Central region and also establish foundation to address future research and management questions.