**Basic Information**

Project No. and Title: S1080: Improving Soybean Arthropod Pest Management in the U.S.

Period Covered: 10/01/2022 to 9/30/2023

Date of Report: 05/10/2024

Annual Meeting Dates: 03/17/2024

**Meeting Recording** Can Be Found: <https://drive.google.com/file/d/1LGaiEHskEbYLKcz9PgFIvqXiVjc7gfGy/view?usp=sharing>

**Participants**

David Owens (University of Delaware), Michael Crossley (University of Delaware), Emily Bick (University of Wisconsin), Jeff Davis (Louisiana State University AgCenter), Dominic Reisig (North Carolina State University), Don Cook (Mississippi State University), Fred Musser (Mississippi State University), Jeremy Greene (Clemson University), Justin McMechan (University of Nebraska-Lincoln), Louis Hesler (USDA-ARS), Raul Villanueva (University of Kentucky), Scott Graham (Auburn University), Sebe Brown (University of Tennessee), Silvana Paula-Moraes (University of Florida), Whitney Crow (Mississippi State University)

**Meeting Minutes**

*Membership Updates*

 Officer Selection: Incoming S1080 head: Scott Graham (Auburn).

 Whitney Crow (Mississippi State University) selected for 2025

*Selection of 2025 Meeting Location:* Baton Rouge, LA

*Soybean Pest Losses*

Dr. Fred Musser, Mississippi State

*State Reports*

Alabama (Scott Graham): AL is a low-input state, low soybean acreage. Pockets of red-banded stink bugs, garnering probably one spray. South AL experienced dry conditions that prevented many soybeans from flowering. Velvet bean caterpillars were a common defoliator.

Delaware (Michael Crossley): Few fields required replanting due to slugs. Seed corn maggot was not an issue. Stink bug and corn earworm activity were closer to normal than in 2022. Soybean aphids were higher than previous years. Slugs were collected from 9 sites in DE and parasitic nematodes were identified. Slug parasitism was very low. Slug populations did not appear to be influenced by cover crop choice in on farm trials. Liquid metaldehyde was not as effective as granular metaldehyde and iron phosphate. Prophylactic applications of insecticide and herbicide resulted in no return on investment.

Florida (Silvana Paula Moraes): Has observed a recent increase of soybean acreage in the state. Slugs are an issue, but growers are unwilling to use Deadline, and tillage has been recommended instead. An insecticide application was recommended for *Helicoverpa zea* in late July / August. *Helicoverpa armigera* was not detected during monitoring efforts. Plans to document insecticide (pyrethroids, diamides) susceptibility in *H. zea* in 2024. Documented *Spodoptera exigua* resistance to diamides in 2020, but was unable to collect populations in 2023 due to insecticide applications. Has been monitoring an invasive *Spodoptera* sp. for two years but has not detected it so far.

Kentucky (Raul Villanueva): There were very few insect issues. Stink bugs appeared very late in the year. Brown marmorated stink bug affected western KY in 2020, but in last two years they have decreased in importance. Three-cornered alfalfa hopper was an issue in fields that transitioned from pasture to soybean. Had a drought from mid-May to end of June, so slugs were not an issue. However, there was an outbreak of native snails (two species). These snails can impact later stage (e.g. V3) soybean plants than slugs.

Louisiana (Jeff Davis): Had worst drought on record, and lots of heat (many days > 100F), which affected stink bug numbers. Brown marmorated stink bug has been moving in, but has not expanded beyond one parish. Red-banded stink bugs are still the main problematic stink bug. Brown stink bugs (Euschistus servus) appears to be being replaced by Euschistus quadrator. Have been monitoring insecticide resistance in red-banded and noticed a 10-fold decrease in sensitivity to bifenthrin. Soybean looper, velvet bean caterpillar, and green clover worm have been a consistent problem.

Mississippi (Whitney Crow): Many soybean acres got planted earlier, which reduced pest pressures. Stink bugs continue to be #1 pest. Red-banded stink bug not particularly more common than other species. Some applications made for corn earworms. Did not see many soybean loopers compared to 2022, but is seeing changes in efficacy of intrepid (group 18) and diamides. Mild winter probably did not kill many stink bugs.

Nebraska (Justin McMechan): Soybean gall midge surveys continue (42 of 56 counties positive). Held first regional soybean gall midge field day (participants valued the impact of the event at $4 million). Soybean gall midge studies are ongoing.

North Carolina (Dominic Reisig): Had a relatively low insect year. Now 80% full season, 20% double crop (historically closer to 50%), is reducing later planted (double crop) insect issues. Intrepid issues cropping up in soybean loopers. Garden flea hopper seems to be an expanding issue. Sprayed some soybeans for soybean aphid (which is rare). Contributed to soybean pest losses reports, a study by a student at Virginia Tech, field days, county meetings, blogs, etc. Have a student working on stink bug traps in soybeans and defoliation thresholds. Anders Huseth has a student working on stink bug distributions in the state, and on monitoring insecticide resistance in E. servus (not detecting any issues so far).

South Carolina (Jeremy Greene): Had ~400,000 soybean acres in 2023. Pest pressure was down compared to 2022. #1 pest was the stink bug complex. Brown marmorated stink bugs observed reproducing in SC. #2 pest was soybean looper. Velvet bean caterpillar also an issue. Corn earworm was the #3 pest. Most corn is Bt, and all cotton is Bt, which seems to be suppressing corn earworm.

Tennessee (Sebe Brown): Last year had 1.8 billion soybean acres in 2023. Stink bug complex is main pest issue. Stink bugs were low in 2023. Cold winter temperatures might have reduced stink bugs for 2024. Has only ever seen one red-banded stink bug in TN. Brown marmorated stink bugs and green stink bugs are more consistently seen (BMSB found in corn, cotton, and soybean), but they are managed easily. Slug pressure was down due to dry spring. Green clover worm was an issue, but didn’t find velvet bean caterpillar (appear to not go past the river). Kudzu bugs are hit or miss.

*Special topics*

Silvana Paula-Moraes (University of Florida) presented an update on how the Endangered Species Act will influence EPA pesticide label approval in the future.

Rachel Vann (North Carolina State University) presented on the “Science for Success” collaborative efforts to leverage funding by United Soybean Board.

Taynara Possebom (Dominic Reisig’s lab) presented on “Economic thresholds and corn earworm ecology between soybean growth habits”

Jeff Davis (Louisiana State University) presented on developing a national soybean pest strategic plan.

Scott Lee (Jeff Davis’ lab) presented on soybean looper parasitoids.

Emily Bick presented on development of the “Insect Evesdropper” for monitoring insects feeding on soybean.

Covey Lockhart (Fred Musser’s lab) presented on sampling insects with drones

Raul Villenueva presented on predatory ground beetles of slugs and snails

Michael Crossley presented on the hunt for slug-parasitic nematodes in the Mid-Atlantic US

**Accomplishments and Impacts**

Numerous scouting efforts, research trials, and insecticide tests conducted by all members of the S1080 group to inform stakeholders, refine management decision aids and guidance, and provide knowledge base for advancing IPM practices. In addition, new species were noted from several states. Multiple pests monitored with pheromone traps (stink bug, corn earworm, soybean looper, *Helicoverpa armigera*). Soybean insect losses are compiled annually. The report covering 2023 includes data from 18 states representing 54% of U.S. soybean acreage. Over time, the changes in infestation and injury reported can provide an indication of the spread or contraction of insect populations with changes in weather and production practices.

Insecticide resistance monitoring continuing in multiple states targeting multiple pests, including Spodoptera exigua and corn earworm. New control technology was evaluated by members and demonstrated that nanoparticles have promise to deliver insecticides.

Webinars, videos, and blog posts are the primary means of educating stakeholders in-season along with county and state-level extension meetings. These efforts are partially responsible for saving significant amount of money by stakeholders. North Carolina estimates that a major Extension effort targeting stink bugs alone via the NCCE portal system, assuming 15% of NC soybean acres were treated according to extension recommendations, growers would have secured an estimated savings of over $2.4 million.

**Publications by Objective**

**(1) Document changing soybean pest and beneficial arthropod assemblages. Soybean is injured by a diverse guild of insect pests feeding on leaves, stems, roots, nodules, and pods. The major insect pests in these guilds have markedly changed in the last two decades due to the introduction and range expansion of invasive insects and the adaptation of native pests.**

Peer Reviewed

Musser, F. R., E. Bick, S. A. Brown, W. D. Crow, J. A. Davis, C. DiFonzo, S. H. Graham, J. K. Greene, D. C. Ludwick, S. Malone, D. Owens, D. D. Reisig, P. M. Roberts, T. A. Royer, N. J. Seiter, A. J. Sisson, B. C. Thrash, K. J. Tilmon, and R. T. Villanueva. 2023. 2022 Soybean insect losses in the United States. MidSouth Entomol. 16: 1 – 25.

Nagoshi, R. N., J. A. Davis, R. L. Meagher, F. R. Musser, G. P. Head, H. Portillo, and H. Teran. 2023. Evidence for two soybean looper strains in the United States with limited capacity for cross-hybridization. Genes 14: 1509.

Nagoshi, R. N., J. A. Davis, R. L. Meagher, F. R. Musser, G. P. Head, H. Portillo, and H. Teran. 2023. Investigating the migratory behavior of soybean looper, a major pest of soybean, through comparisons with the corn pest fall armyworm using mitochondrial haplotypes and a sex-linked marker. Genes 14: 1495.

Non-Peer reviewed

 **(2) Characterize soybean insect biology and ecology The range expansion of invasive pests, coupled with the adaptation of native pests, necessitate further research into how insects cope with new selection pressures.**

Peer Reviewed

Lee, S., T., and J. A. Davis. 2023. The impact of thiamethoxam on the feeding and behavior of two soybean herbivore feeding guilds. J. Econ. Entomol. 116: 1621 – 1635.

Bonser, C. A. R., C. E. Astete, C. M. Sabliov, and J. A. Davis. 2023. Elucidating the insecticidal mechanisms of zein nanoparticles on *Anticarsia gemmatalis* (Lepidoptera: Erebidae). J. Econ. Entomol. 116: 1196 – 1204.

Bonser, C. A. R., J. Borgatta, J. C. White, C. E. Astete, C. M. Sabliov, and J. A. Davis. 2023. Impact of zein and lignin‐PLGA biopolymer nanoparticles used as pesticide nanocarriers on soybean growth and yield under field conditions. Agrosystems, Geosciences & Environment 6: e20350.

Bonser, C. A. R., C. Tamez, J. C. White, C. E. Astete, C. M. Sabliov, and J. A. Davis. 2023. Field applications of zein as a precise nanoscale delivery system for methoxyfenozide. J. Insect Sci. 23: 8, 1-9.

O’Hara, F. M., Z. Liu, J. A. Davis, and D. R. Swale. 2023. Catalyzing systemic movement of inward rectifier potassium channel inhibitors for antifeedant activity against the cotton aphid, *Aphis gossypii* (Glover). Pest Manag. Sci. 79: 194 – 205.

Mugala T., K. Brichler, B. Clark, G. S. Powell, S. Taylor, M. S. Crossley. 2023. Ground beetles suppress slugs in corn and soybean under conservation agriculture. Environmental Entomology 52: 574-582. <https://doi.org/10.1093/ee/nvad047>

Santos, A.A., Santos, I.B., Paula-Moraes, S.V. 2023. Flight phenology of *Elasmopalpus lignosellus* (Lepidoptera: Pyralidae) in the Northwest Florida Panhandle. *Insects*, 14:354. <https://doi.org/10.3390/insects14040354>

Non-Peer reviewed

Reisig, D., and E. Goldsworthy. 2023. Efficacy of selected insecticides on Lepidoptera pests in soybean, 2022. Arthropod Manag. Tests. doi: 10.1093/amt/tsad068

 **(3) Develop coordinated best management practices (BMPs). As soybean insect pest assemblages change, there is a need to update pest management strategies.**

Peer Reviewed

Sutton, K. L., T. P. Kuhar, S. L. Rideout, S. V. Taylor, M. S. Reiter, A. I. Del Pozo-Valdivia, D. D. Reisig, K. McIntyre. 2023. Simple insecticide bean-dip bioassay shows pyrethroid susceptibility of *Helicoverpa zea* (Lepidoptera: Noctuidae) populations in Virginia varies across locations and years. J. Entomol. Sci. doi: 10.18474/JES23-23

Non-Peer reviewed

**(4) Educate farmers, industry, colleagues, general public, and agricultural professionals using traditional tools and innovative methods. Our Working Group works extensively with stakeholders at all levels. For our clientele, we represent one of the only unbiased sources of information for decision-making of IPM strategies.**

Peer Reviewed

Non-Peer reviewed

DiFonzo, C., A. Pekarcik, K. Tilmon and A. Raudenbush. 2023.  Pocket field guide to Asiatic garden beetle with emphasis on Great Lakes field crops. 2000 printed & distributed at extension meetings. Also available free at <https://aginsects.osu.edu/news/new-agb-pocket-field-guide-available>

Reisig, D. D. and A. S. Huseth. 2023. Insect control in soybeans. 2023 North Carolina Agricultural Chemicals Manual. North Carolina Cooperative Extension Service, College of Agriculture and Life Sciences, N.C. State University, Raleigh, N.C. pp. 91-93.