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

**Period Covered: 10/01/2019-1/25/2021**

**Date of This Report: 3/31/2021**

**Annual Meeting Dates: March 25, 2021 Virtual**

**Attendees at the 2021 meeting**

Chris DiFonzo, Michigan State University

Matt O’Neal, Iowa State University

Bryan Jensen, University of Wisconsin

Janet Knodel, North Dakota State University

Justin McMechan, University of Nebraska

Fred Musser, Mississippi State

Dave Owens, University of Delaware

Dominic Reisig, North Carolina State University

Nicholas Seiter, University of Illinois

Joe Spencer, University of Illinois

Sally Taylor, Virginia Tech

Raul Villanueva, University of Kentucky

Bob Wright, University of Nebraska

Scott Graham, Auburn

Ben Thrash, University of Arkansas

Silvana Paula-Moraes, University of Florida

Don Cook, Mississippi State

Thomas Hunt, University of Nebraska

Jeremy Greene, Clemson University

Louis Hesler, USDA ARS

**Non-attendees submitting a written report:**

Scott Stewart, University of Tennessee

**Brief summary of minutes of annual meeting**

Welcome and introduction of participants

Sally Taylor, Virginia Tech was Chair

Justin McMehan, University of Nebraska was Secretary

David Owens, University of Delaware was nominated for incoming Secretary

Administrative Update (Sally Taylor, Virginia Tech)

Thanked group for attending virtually. Meeting was set to resume in person in 2022 at the Southeastern Branch meeting of the Entomological Society of America.

State Reports. Reports on pest management developments and outputs were presented by state

Alabama – Scott Graham is replacing Barry, Ron, and Tim. Red banded stink bug work is ongoing, this is Scott’s first year

Delaware – Slug pests are number one, last year was particularly bad, many farmers spread bait, weather dependent (warm Feb/March, below average April and May), bait most effective when timed neared egg hatch – can we predict it? Marsh slugs are active all winter long, gray garden seem to arrive at once. Prophylactic insecticide treatments indicate that there is no value, in terms of yield, of tank mixing sprays, but there were so effects on pest numbers that indicated tank mix may control some insects

Florida – No big acreage of soybean, farmer planted 200 acres a couple years ago and she has some fields on station for her Lep work (host of important species, overlapping pests with peanut), trapping soybean looper also traps other species

Illinois – Nick: fairly quiet, typical year until the end of the year with bean leaf beetles and pod scarring time; defoliation levels are low (one field this year exceeded threshold from BLB and green cloverworm); spider mites early (too dry), other areas too wet. Joe: looking for gall midge and didn’t find any, one of their goals is to remain aware of this and to continue monitoring efforts; he looks for WCR beetles every year and populations are low, low concern from growers, 15 years ago people did not care as much about this population size and now they throw the kitchen sink by using pyramided corn

Michigan – affected by Covid and they did not go anywhere for several months, increase in aphids with hemp acreage; gall midge survey money was used to produce a gall midge identification card which she will print and mail out to states

Iowa – pandemic stopped some projects, otherwise fairly quiet year; drought was an issue; continue to survey for gall midge and trials were largely a bust from low pest numbers; soybean aphid resistant varieties were evaluated and Corteva varieties performed fine although numbers are low, the company will release these lines and they will include herbicide tolerant; some resistance screening using genetic markers for soybean aphid – two mechanisms possible that explain resistance (Dominic – is there selection pressure? Matt does not know for sure); adding prairie to cropland benefits fields in a number of ways including soil health and nutrient leaching (landowners can receive contracts for participation), beekeeping will be addressed in the afternoon session

Indiana – nothing to report.

Arkansas – Corn earworm number one insect although a mediocre year, corn planting dates extended and more late corn planted; brief flight of soybean loopers; expected red banded stink bug to show up based on early season weed surveys (found decent amount but crimson clover was hard to find), but they did not show up in any big numbers, very cold weather this winter should knock them back for the next couple of years

Kentucky – brown marmorated stink bugs were found across the state and are starting to be problematic; threecornered alfalfa hopper were numerous and widespread and some people sprayed but these sprays also targeted stink bugs; 30% max infestation rates of dectes when other years top 60% (Don: fipronil seed treatments work but will not be labeled)

Mississippi – Fred: pressure pretty typical; stink bugs number one pest which is normal, a few more red banded but not extremely high; loopers were typical, spotty, brief, sprayed a number of acres for them; sampling projects with a drone/sweep net, crashed a few times and have made some progress and the project is ongoing; resistance monitoring will be covered this afternoon, more participation is always good (Matt: reaching out to extension agronomists may help); working with the crop management network at Iowa state on losses. Don: red banded stink bugs thresholds are being refined, later growth stages susceptible, last year was strange because no high numbers of nymphs, lower populations may result from cold weather or may have insulated them; potential for large populations of loopers until cold weather crashes them; some parts of the state had high bollworm populations

Nebraska – Justin: cover crops had no measurable pressure regardless of timing of termination, data set indicates that rye cover is not much of an issue; slow growth as a result of replant; more neonics seed treatments were used; some defoliation issues with painted lady butterflies; soybean gall midge work continues and will be detailed in the afternoon session, some westward expansion found at low levels, some recently-identified areas had high pressure, adult emergence from pollinating corn, larval movement is likely around 10’from source plant, two new hosts were found (yellow and white sweet clover, alfalfa is a poor host in ditches and borders), efficacy studies indicated that foliars did not do well even with three applications (unlike 2019 with 6 bushel differences with one application) – perhaps due to emergence, seed treatments show some early season effect but no effect on final yield, thimet t-band showed promise but is unlikely to be used because of equipment not able to put out granular, late planting was heavily infested, auto phone call, text message and email alert system has over 380 participants and website soybeangallmidge.org was established to share information with clientele (Fred: should we add species to losses?; Justin: Not sure, it’s difficult to estimate it’s losses at a large scale. Nick: Where did this thing come from? Has it always been in Nebraska? Justin: We don’t know. Population genetics work is underway with Ana Velez at UNL. Not sure if that will answer the question but that along with host range work might help). Bob: PhD student documenting species distribution of stink bugs and parasitoids, we know a lot more than we did before, more diversity, other species than brown and green.

North Carolina – Losses have been useful to him for documentation for grants and for tracking over time; corn earworm was the number one pest; green cloverworm did cause defoliation thresholds in some fields; seed quality is a huge issue related to switch to indeterminate varieties and early planting dates, some fields have every seed rotted in the pod, stay green apparent in some fields, some are related to sprays and other are completely random, producers are blaming stink bugs and hurricanes, stink bugs have some role to play, southern green stink bugs populations are increasing, likely more issues will occur this year; in corn, green stink bugs are more present than in past years; new soybean agronomist is starting cover crop project and will help evaluate insect issues, she will also help with disease issues pending funding; project to determine where larvae are located on the plant, there is a big difference in cage studies and field studies (more on leaves in cages), does this change oviposition?, Ben and Gus are helping to determine thresholds for determinate vs. indeterminate, tend to yield the same within maturity group, there may be a small difference in compensation. Anders will give updates on his program this afternoon. (Ben: are yall using Heligen? Dominic: it makes sense for us to start using it with increasing prices and there will be some product this year; Silvana: Brazil thresholds did not change)

North Dakota – lots of scouting with their integrated crops survey, 6 scouts survey the state, ND is 9th in acreage in US and increasing, not many aphids for the past two years, most are concentrated around buckwheat in the red river valley although some are found in the central part of the state; increase in grasshoppers and good control was provided by insecticides even against adults, yield was benefited by sprays and sprays paid for themselves; surveys for gall midge were performed and none were found in over 600 fields, some other gall midges were found but they were not the same species; drought is expected in 2021; collected some soybean aphids for screening and they were susceptible; new midge in canola

South Carolina – everything was around at some level except soybean aphid and gall midge; stink bugs are the largest pest and red banded are no present as well as BMSB, southern green, green, and brown; red banded were the most popular; 3CAH were present and lodging was associated with late burndown of weeds (Fred: seed treated soybean and 3CAH? Jeremy: we don’t really need STs although there has been a small yield bump in some tests. Dominic: don’t use an insecticidal treatment except in some cover crops; Matt: Seed treatments are gone by 40ish days in Midwestern studies)

USDA Louis – soybean aphid was not an issue, green cloverworm did cause some defoliation issues, no gall midge in his area

Wisconsin – some defoliation issues including armyworm and Japanese beetles but few sprays; some calls on soybean aphid early but calls were flat after that; no BMSB and no stink bug problems; survey for soybean gall midge was interrupted by Covid guidelines

 **Afternoon Research Meeting:**

1-120pm Isaac Esquival and pollinators in soybean: Diverse assemblage of bees in soybean including honey bees and native bees (e.g., Melissodes and Dialictus spp.), mainly ground nesters; soybeans serve as a resource; positive or neutral effects on yield in exclusion experiments

130-150pm Matt O’Neal pollinators in soybean: impacts on yield is still open area for research, prairie strips can improve health of bees and production of pollen, costs are relatively low given nutrient leaching reduction

150-205pm Sally Taylor pollinators in row crops: foraging is high in row crops during bloom, little pollen is collected from crop plants, but pesticide residues were numerous

205-230pm Anders Huseth using landscape scale methods to predict pest outbreaks, corn earworm are more numerous when there is more soybean in the environment, stink bugs benefit from wheat acreage

230-300pm Justin McMehan soybean gall midge: detected in Nebraska, Iowa, South Dakota, Minnesota and Missouri. In Nebraska, the intensity was greater in 2020. Multistate trapping network in 2020, significant plant death can occur, data from two years show that adults emerge from last year’s soybean fields in early to mid June, cracking (fissures) and depression of stem are symptoms. There is potential for adult midges to take advantage of injury on higher parts of the plant (i.e., hail injury), limited germplasm lines demonstrate resistance, seed treatments on late planted beans may reduce larvae counts, but yield was unaffected; frequency of infested plants decrease and yield increases with Thimet. Lots of preliminary work underway and 29 research objectives spanning the pests chemical, cultural, biological tactics as well as biology and ecology projects are underway.

300-320pm Silvana Paula-Moraes insecticide resistance in lepidopteran pests in the Florida panhandle and cross-attraction of sex pheromones: great diversity of caterpillars in her area, beet armyworm demonstrated resistance to diamides; Plusiinae cross-attracted to SBL sex pheromone – several variants of C. includens found. Many species look alike and need dissections to determine definitely

320-340pm Don Cook Bollworm in beans: collaborative effort of the mid-South; thresholds were established on old data and needed to be evaluated, loss of fruit caused more green stem when that loss occurs after R5; pyrethroids are not recommended but they work sometimes; heligen has been a good product as long as people understand how to use it (control of large worms is not practical, for example).

340-400 Fred Musser updated group on resistance monitoring efforts for both corn earworm and soybean looper. No resistance to chlorantraniliprole was detected although resistance ratios for soybean looper are starting to increase.

**Accomplishments:**

Individual state reports received from 16 states (Minnesota, Tennessee, North Carolina, Mississippi, North Dakota, Delaware, Louisiana, Iowa, Nebraska, Illinois, Wisconsin, Kentucky, Oklahoma, Arkansas, Virginia, and Michigan) were used to compile the list of accomplishments for the reporting period from October 1 2019 through January 2021. These accomplishments reflect work on a diverse array of arthropod management issues that are directly relevant to soybean growers, consultants, and other stakeholders in the soybean production enterprise and rural environments.

Plans to address the objectives of S1080 by group members for 2021 include:

* Continue to document trends in damaging insect occurrence and subsequent economic losses through the multi-state soybean insect losses survey
* Initiate new research on soybean insect management issues.
* Monitor for insect resistance to control technologies, and develop resistance management strategies for key soybean pests such as soybean aphid, soybean looper, and stink bugs.
* Translate research into practical recommendations for managing soybean arthropods, deliver these recommendations to soybean clientele through multiple outlets (e.g., Extension publications, formal presentations, workshops, websites, etc.), and collect feedback from these clientele to inform future research.

**S1080 Outputs for 2019 and 2020:**

Awards given to team members

Excellence in Extension Team Award 2019, Soybean Management Field Day (SMFD) Program, University of Nebraska Extension

Entomological Society of America Eastern Branch “Early career professional award: Excellence in early career award” Sally Taylor, Virginia Tech

“Outstanding Extension Leadership Early Career Award from Epsilon Sigma Phi, Alpha Upsilon Chapter of UNL”, “UNL Excellence in Extension Individual Award: Research and Discovery”, and “FMC New Investigator Award” Justin McMechan, University of Nebraska

Refereed publications (calendar year 2020)

Koch, R. L., B.D. Potter, J. Moisan-De Serres, J. Knodel, V. Calles-Torrez, J. Gavloski, T. Cira, M. Bartz, and R. Gagné. 2020. Karshomyia caulicola (Diptera: Cecidomyiidae) associated with Sclerotinia-infected soybean in the United State and Canada. The Great Lakes Entomologist 53(1): 59-63.

Musser, F. and A. Catchot, S. Conley, J. Davis, C. Difonzo, J. Greene, G. Lorenz, D. Owens, D. Reisig, P. Roberts, T. Royer, N. Seiter, R. Smith, S. Stewart, S. Taylor, K. Tilmon, R, Villanueva, M. Way. 2020. 2019 Soybean Insect Losses in the United States. Midsouth Entomologist. 13. 1-23

Tooker, J.F., C. Rodriguez, and M.E. O’Neal. 2020. Balancing disturbance and conservation in agroecosystems to improve biological control. Annual Review of Entomology. https://doi.org/10.1146/annurev-ento-011019-025143

Pozebon, H., Marques, R.P., Padilha, G., O'Neal, M., Valmorbida, I., Bevilaqua, J.G., Tay, W.T. and Arnemann, J.A. 2020. Arthropod invasions versus soybean production in Brazil: a review. *Journal of Economic Entomology*. <https://doi.org/10.1093/jee/toaa108>

Hodgson, E. W., A. N. Dean, and Z. Wang. 2020. Using an immediate feedback tool to improve learning and facilitate program evaluation. Journal of Extension. [v58-4rb4](https://joe.org/joe/2020august/rb4.php).

Hodgson, E. W., A. N. Dean, G. VanNostrand, and C. Ellers-Kirk. Developing a residual testing protocol for soybean aphid (Hemiptera: Aphididae). Journal of the Kansas Entomological Society, <https://doi.org/10.2317/0022-8567-93.1.24>*.*

Dean, A. N., J. B. Niemi, J. C. Tyndall, E. W. Hodgson, and M. E. O’Neal. Developing a decision-making framework for insect pest management: a case study using *Aphis glycines* (Hemiptera: Aphididae). Pest Management Science. DOI: 10.1002/ps.6093*.*

St. Clair, A.L., G. Zhang, A.G. Dolezal, M.E. O’Neal, A.L. Toth. 2020. Diversified Farming in a Monoculture Landscape: Effects on Honey Bee Health and Wild Bee Communities, *Environmental Entomology*, 49: 753–764,<https://doi.org/10.1093/ee/nvaa031>

Benjamin C Thrash, Angus L Catchot, Jr, Jeffrey Gore, Donald Cook, Fred R Musser, Trenton Irby, Jason Krutz, Gus M Lorenz, III, Effects of Soybean Planting Date on Yield Loss From Defoliation, *Journal of Economic Entomology*, 2021;, toaa280, <https://doi.org/10.1093/jee/toaa280>

Benjamin C Thrash, Angus L Catchot, Jr, Jeffrey Gore, Donald Cook, Fred R Musser, Trenton Irby, Jason Krutz, Effects of Soybean Plant Population on Yield Loss From Defoliation, *Journal of Economic Entomology*, 2021;, toaa279, <https://doi.org/10.1093/jee/toaa279>

Selected presentations at professional conferences

Possebom, T., D. Goulard Montezano, J. Knodel, K. Anderson, M. Harris, V. Montenegro, T.E. Hunt and A. J. McMechan. 2020. Understanding the distribution of soybean gall midge (Resseliella maxima) silken cocoons in the soil. Virtual Entomological Society of America annual meeting. November 11-25, 2020.

Reisig, D. R., D. Cook, J. Greene, M. Caprio, J. Gore, F. Musser, and F. Reay-Jones. 2020. Vertical and temporal distribution of *Helicoverpa zea* (Lepidoptera: Noctuidae) larvae in determinate and indeterminate soybean. Bull. Entomol. Res. doi: 10.1017/S0007485320000619

 Reisig, D. R., D. Cook, J. Greene, M. Caprio, J. Gore, F. Musser, and F. Reay-Jones. 2020. Location of *Helicoverpa zea* (Lepidoptera: Noctuidae) larvae on different plant parts of determinate and indeterminate soybean. Bull. Entomol. Res. 110: 725-731. doi: 10.1017/S0007485320000280

Selected Extension Materials

YouTube videos:

- Stink bug management in soybeans. 2020. <https://www.youtube.com/watch?v=TKTxSfwiFIE&feature=emb_logo>

- Mid-season soybean insect scouting. 2020. <https://www.youtube.com/watch?v=5YvQEo1lWv8>

- Corn earworm in soybeans. 2020. <https://www.youtube.com/watch?v=1rVwz4z19qg&feature=youtu.be>

Knodel, J.J., P. Beauzay, M.A. Boetel, T.J. Prochaska and A. Chirumamilla. 2020. 2021 North Dakota Field Crop Insect Management Guide E1143 (revised). NDSU Ext., Fargo, ND.

Knodel, J.J. and V. Calles-Torrez. 2020. Common Arthropod Pests of Soybean E2005. NDSU Extension, Fargo, ND.

Calles-Torrez, V., P.B. Beauzay, A.H. Knudson and J.J. Knodel. 2020. Soybean Gall Midge and White-mold Gall Midge in Soybean E2006. NDSU Extension, Fargo, ND.

Knodel, J.J. 2020. Scout for soybean aphids. NDSU Extension Crop & Pest Report #9 (June 25, 2020).

Knodel, J.J. 2020. Soybean aphid low. NDSU Extension Crop and Pest Report #10 (July 2, 2020).

Knodel, J.J. 2020. No soybean aphids. NDSU Extension Crop and Pest Report #13 (July 23, 2020).

Knodel, J.J., and Calles-Torrez, V. 2020. Soybean gall midge. NDSU Extension Crop and Pest Report #14 (July 30, 2020).

Knodel, J.J. 2020. Gall midges in soybeans. NDSU Extension Crop and Pest Report #18 (September 10, 2020).

Knodel, J.J., Friskop, A., Beauzay, P.B., and Markell, S. 2020. 2020 soybean and sunflower IPM survey. NDSU Extension Crop and Pest Report #19 (September 24, 2020).

Hohenstein J. & O'Neal M. E. & Diers B. “Evaluation of Aphid-Resistant Soybean”, *Iowa State University Research and Demonstration Farms Progress Reports* 2019(1). https://www.iastatedigitalpress.com/farmreports/article/id/11362/

Hodgson, E. W., G. VanNostrand, A. Dean, and M. Helton. 2020. 2020 Yellow Book Report of insecticide evaluation for soybean pests, 34 pp. Department of Entomology, Iowa State University, Publication [CROP 3198](https://store.extension.iastate.edu/product/16055).

Taillon, N., Lorenz, G. M., Thrash, B. C., Bateman, N. R., Plummer, A., McPherson, K., Felts, G., Floyd, C., Rice, C. (2020). Efficacy and residual control of selected insecticides for corn earworm, Helicoverpa zea, in soybean, glycine max. *Soybean Research Studies 2019*.<https://agcomm.uark.edu/agnews/publications/670_Arkansas_Soybean_Research_Studies_2019.pdf>

Bateman, N. R., Lorenz, G. M., Thrash, B. C., Taillon, N., Plummer, A., McPherson, K., Felts, G., Floyd, C., Rice, C. (2020). Cost of control for major insect pests in soybean in Arkansas, 2015-2019. *Soybean Research Studies 2019*.<https://agcomm.uark.edu/agnews/publications/670_Arkansas_Soybean_Research_Studies_2019.pdf>

Lorenz, G. M., Thrash, B. C., Bateman, N. R., Taillon, N., Plummer, A., McPherson, K., Felts, G., Floyd, C., Rice, C. (2020). Efficacy of selected insecticides for control of soybean looper, Chrysodeixis includens, in soybean. *Soybean Research Studies 2019*.<https://agcomm.uark.edu/agnews/publications/670_Arkansas_Soybean_Research_Studies_2019.pdf>

Thrash, B. C., Lorenz, G. M., Bateman, N. R., Taillon, N., Plummer, A., McPherson, K., Felts, G., Floyd, C., Rice, C. (2020). Insecticide seed treatment performance on soybean planted into cover crops. *Soybean Research Studies 2019*.<https://agcomm.uark.edu/agnews/publications/670_Arkansas_Soybean_Research_Studies_2019.pdf>

Selected Impacts

**Determine the mechanism for resistance to pyrethroids in the soybean aphid.**

**Research team:** Ivair Valmorbida (PhD student), Jessica Hohenstein (Post-doctoral Scientist), Erin Hodgson (Professor), Brad Coates (USDA scientist), Molly Ryan (Corteva) and Matthew O’Neal (Professor)

Soybean aphid, *Aphis glycines* (Hemiptera: Aphididae), can be effectively managed with inexpensive, foliar-applied pyrethroids. However, increased use of pyrethroids has selected a sub-population with resistance to this commonly used active ingredient (a.i.). These insecticide-resistant soybean aphids have been found in Iowa, Minnesota and North and South Dakota (Hanson et al. 2017, Menger et al. 2020), a region responsible for ~23.44 million acres of soybean in 2018 (USDA NASS 2018). The frequency and range of these resistant populations is highly variable. Switching to an alternative a.i. can increase the cost of soybean production at a time when profitability of the crop is challenging. We will build on recent discoveries describing the molecular and genetic basis of pyrethroid-resistance in aphids by using molecular tools that can identify these resistant individuals within sub-populations. We will integrate these resistance frequency data into economic models that account for the sporadic nature of this pest, helping farmers avoid a $67 per acre loss that can occur if an outbreak is treated with an ineffective insecticide. If only 10% of the acres in this region are at risk for damage by insecticide-resistant soybean aphids, there is the potential to lose $154,100,000 in revenue per year. Given the trends in insecticide use described below, this risk will increase if farmers are not better informed.

We have formed a team of scientists at ISU, USDA and the private sector (Corteva) to solve the problems associated with insecticide resistance for soybean aphid management. This team is using genomic resources, field trials and laboratory assays to determine if genetic markers can identify insecticide resistant aphids in the field. This work will be coupled with modelling to determine when the frequency of insecticide resistance is great enough to reduce revenue for soybean farmers.

**Expansion of the Brown marmorated stink bug (BMSB) in KY**

The BMSB was first reported in 2010 in KY and since then, it has established population affecting vegetables or fruit in most central and eastern counties of the state. Although BMSB has been reported in many western counties (most likely hitchhikers). Overwintering BMSB populations and tallies in soybean fields resulted in nil counts in most western counties (west of Hardin Co.) since 2016 up until 2018 when a graduate student (Yaziri Gonzalez) found one specimen in a pheromone trap in the Research and Education Center (REC) at Princeton; and several specimens in McLean, Henderson and Daviess counties in 2019.

**Soybean Gall Midge Multi-State Research Team**

**Research team:** Justin McMechan (Assistant Professor, Nebraska, Project Lead), Thomas Hunt (Professor Nebraska), Robert Wright (Professor Nebraska), Erin Hodgson (Professor, Iowa), Bruce Potter (Specialists, Minnesota), Robert Koch (Professor, Minnesota), Adam Varenhorst (Assistant Professor, South Dakota), Janet Knodel (Professor, North Dakota), Brian McCornack (Kansas), Kevin Rice (Missouri), Nick Seiter, (Research Assistant Professor, Illinois), Joe Spencer (Professor, Illinois), Kelley Estes, (Survey Pest Coordinator, Illinois), Chris Difonzo (Professor, Michigan), Kelley Tilmon (Associate Professor, Ohio), Bryan Jensen (Specialist, Wisconsin)

Soybean gall midge (*Resseliella maxima* Gagne) is a newly identified species causing significant injury to soybean and it has been found in five midwestern states (NE, IA, SD, MN, and MO). In 2020, a 12 state survey led by PD McMechan through funding provided by the North Central Soybean Research Program to determine the distribution and plant injury of soybean gall midge. Field surveys were conducted in North Dakota, Minnesota, South Dakota, Iowa, Nebraska, Kansas, Missouri, Illinois, and Wisconsin. Covid-19 restricted surveys intended for Michigan, Ohio, and Indiana. Of 9 states surveyed a total 1,745 fields across 267 counties were checked for the presence of soybean gall midge. A total of 19 new counties were identified as infested in states where soybean gall midge presence was already confirmed. In Nebraska, a field survey with larval presence and injury found that several counties (Otoe, Cass, Sarpy, Saunders, Bulter, Stanton, and northern Lancaster) had a very high frequency of infestation. Survey results from 2020 showed a considerable increase in both frequency and injury of soybean gall midge compared to 2019.

A multi-state emergence network through NCSRP with PD McMechan for soybean gall midge adults was conducted across four states (NE, IA, SD, MN) in 2020 showed a significant increase in the duration of adult emergence from overwintering sites (last year’s soybean fields) at an average of 25 days. In addition, the total number of adults was 225% greater than collections that occurred during the 2019 season. In addition, a multi-state soybeangallmidge.org with over 2,200 unique visitors, 3,994 page views from 26 countries and 39 states within the USA since it became live in May of 2020. This website connects 380 registered users across 8 states with an automated phone call, text message and email on soybean gall midge emergence and management.

**Cover Crop and Arthropods in Soybean NCSRP Team**

**Research team:** Justin McMechan (Assistant Professor, Nebraska, Project Lead), Thomas Hunt (Professor Nebraska), Louis Hesler (USDA-ARS, South Dakota), Bruce Potter (Specialists, Minnesota), Robert Koch (Professor, Minnesota), Kevin Rice (Missouri), Kelley Tilmon (Associate Professor, Ohio), and Shawn Conley (Professor, Wisconsin)

A two-year multi-state cover crop and arthropod research project conducted with funding from the North Central Soybean Research Project has found no significant pest pressure with the use of rye cover crop to soybean transition system. Cover crop termination dates 14 days prior to, at-plant, and five days after planting soybean have shown no increased potential for pest presence through pitfall traps or injury through soybean defoliation. Pitfalls trap data from Nebraska, Wisconsin, Illinios, and Minnesota has varied considerably and few site-years have shown potential for increased beneficial arthropod activity that may be correlated with delayed terminations.