Minutes of the NCERA – 137 Soybean Diseases Technical Committee Meeting
March 10-11, 2016 – Pensacola Beach, FL

Administrative Advisor: Dr. Steven Slack Director, OARDC 1680 Madison Ave. Wooster, OH 44691
Chair: Dr. Nathan Kleczewski, Department of Plant and Soil Sciences and Cooperative Extension, University of Delaware, Newark, DE 19716
Secretary: Dr. Damon Smith, Department of Plant Pathology, University of Wisconsin-Madison, Madison, WI 53706
Immediate Past Chair: Dr. Heather Young-Kelly, Department of Entomology and Plant Pathology Tennessee University Jackson, TN 38301

Members and guests in attendance:
Nathan Kleczewski (University of Delaware), Hillary Mehl (Virginia Tech), Ed Sikora (Auburn University), Tony Adesemoye (University of Nebraska), Scott Isard (Pennsylvania State University), Anne Dorrance (Ohio State University), Tom Welacky (OSACC), Tristan Mueller (Iowa Soybean Association), John Rupe (University of Arkansas), Alison Robertson (Iowa State University), Febina Mathew (South Dakota State University), Jing Zhou (University of Arkansas), Frank Zhao (University of Illinois), Laura Sweets (University of Missouri), Dean Malvick (University of Minnesota), Danise Beadle (Eurofins AgScience), Patricia Bollich (Louisiana State University Ag Center), Heather Kelly (University of Tennessee), Clayton Hollier (Louisiana State University Ag Center), Jim Kurle (University of Minnesota), Steven Slack (Ohio State University and NCERA 137 Administrative Advisor), Terry Niblack (Ohio State University), Travis Faske (University of Arkansas), Tom Allen (Mississippi State University), Sam Markell (North Dakota State University), Kiersten Wise (Purdue University), Carl Bradley (University of Kentucky), Daren Mueller (Iowa State University), Damon Smith (University of Wisconsin-Madison), Loren Giesler (University of Nebraska), James Haudenshield (USDA-ARS Urbana, IL), Yuba Kandel (Iowa State University), Ahmad Fakhoury (Southern Illinois University), Arjun Subedr (Southern Illinois University), Jason Bond (Southern Illinois University), Doug Jardin (Kansas State University), Kelly Whiting (United Soybean Board), Trey Price (Louisiana State University Ag Center)

The meeting of the NCERA 137 Soybean Diseases Committee was held in Pensacola Beach Florida at the Hilton hotel on March 10-11, 2016. Dr. Nathan Kleczewski welcomed attendees at 2:00pm on March 10. Group introductions followed the welcome. Brief oral reports on the status of the soybean crop and prevalent diseases were given for each state with a member present. Written reports were also provided and compiled with the final report.

The following presentations were given at the meeting:

- Kelly Whiting: USB Updates
    1. Compliments to the group for strong cooperation and working together to solve soybean disease problems.
    2. USB values the pathologists and all they do.

3. USB about to launch a new 5-year strategic plan – New focus areas and priorities will be identified as this is developed.
    - "Sustainability" will likely be a strong focus in the new plan
    - "Big data" will likely be another strong focus for the new plan
4. Another priority coming will be an increased focus on delivering the "message" to farmers after research is complete. Demonstrating a positive return on investment (ROI) for the research funded by the USB is gaining even more importance.
5. More disease monitoring and tracking can help deliver disease information to the farmer – predictive disease models might be a helpful priority area.

- Steve Slack- Remarks and introductions
    1. NCERA 137 does an excellent job of collaborating; one of the best NCERA groups as far as collaboration (ex. Soybean rust workers and warning system that was a spin-off group from NCERA 137).
    2. Also applauded the group for looking at priorities and combining the soybean virus, soybean rust, and soybean disease working group back to one group to be fresh and efficient.
    3. Need an annual report due 60 days after completion of meeting
    4. Need a termination report from the virus group and the soybean rust group. These reports are due at the end of September 2016.
    5. Terry Niblack (OSU) will be the new NCERA 137 administrative advisor after Steve Slack retires this fall
- Hillary Mehl: Development and Optimization of a Weather-Based Decision Aid for Soybean Foliar Fungicide Applications
    1. On-farm trials were used to adjust parameters for a new weather-based model to predict the need for fungicide application at the R3 soybean growth stage.
    2. Preliminary data show some success in predicting fungicide application, however, some refinement is needed
- Heather Young Kelly: The Story of Soybean Rust in the U.S.
    1. A synopsis of soybean rust research and management progress was provided
- Loren Giesler: Could the Movement to Conventional Herbicides Result in More Seedling Disease Problems?
    1. A conversation about the transition back to conventional herbicides and the possible interactions these products might have with disease and disease assessment in soybean.
- Jason Bond: Seedling Diseases of Soybean Regional Projects: Biology, Management and Education
    1. An update of funded research on soybean seedling diseases was provided to the full group.
- Tristan Mueller: On-Farm Evaluation of Fungicides on Soybeans and NCSRP Update
    1. Information about the mission of the On-Farm Network was provided
    2. Data from soybean fungicide on-farm trials from Iowa was presented
    3. Data from the on-farm strip trials is very similar to university small-plot trials

- Jing Zhou: Epidemiological attributes of *Soybean vein necrosis virus* -- An update from recent findings
    1. Background and introduction of SVNV was provided
    2. Soybean thrips is an efficient vector of SVNV
    3. Western flower thrips were shown not to be able to transmit SVNV in controlled experiments
    4. Ivy-leaf morning glory seems to be a good alternative host for both SVNV and soybean thrips
    5. Demonstrated 100% transmission efficiency of SVNV to kudzu using soybean thrips
    6. Showed that SVNV can be systemic in mixed virus infection with BPMV and SMV
- Carl Bradley-Fungicide management of frogeye leaf spot caused by QoI-resistant *Cercospora sojina*
    1. An update of USB funded frogeye leafspot and strobilurin resistance field research was presented
- Anne Dorrance: QTLs for Resistance to soil borne pathogens of soybean
    1. Large amount of variability in isolates of Phytophthora and Pythium in many north central and eastern states where isolates were collected
    2. Lots of genotypic variability in *Phytophthora sojae* isolates
    3. Need to continue breeding efforts for selecting and accurately characterizing oomycete resistance in soybean
- Alison Robertson: oomycete CAPS project update
    1. Diverse species of Pythium isolates identified in agronomic fields
    2. Diverse array of isolates also means that there are species that can infect soybeans across a wide range of soil temperatures
    3. Chilver's lab is also working on characterizing oomycete fungicide sensitivity to seed treatment fungicides
    4. Chilver's lab has also developed a series of molecular diagnostic techniques to identify species of *Phytophthora*
- Damon Smith: Stem diseases and project updates introduction
    1. Provided an introduction to new research in the North Central region sponsored by the USB and NCSRP
    2. Outlined projects underway to better understand the re-emergence of stem diseases of soybean in the North Central Region
- Febina Mathew: Soybean Stem Canker: Overview of Recent Research Developments
    1. Described new experiments to characterize the species profile of the *Diaporthe* complex in the North Central Region
    2. A discussion of the current names of species involved in the *Diaporthe* complex followed
- Dean Malvick: Macro and Micro Soybean Responses to the Stealth Disease Brown Stem Rot
    1. A presentation of recent research on brown stem rot in soybean and some management practice updates were provided.

- Tom Allen: Screening commercial soybean germplasm for resistance to southern stem canker
    1. Described the stem canker situation in the Mississippi Delta
    2. Provided a synopsis of research investigating resistance to stem canker in southern soybean cultivars
- Damon Smith, Martin Chilvers, and Mamadou Fall: Update on Sclerotinia Stem Rot Epidemiology and Forecasting Research
    1. Detailed information pertaining to fungicide evaluations for white mold control, and also apothecial mapping and prediction model development was presented to the group
    2. Improvements to the modeling efforts were discussed among the group
- Marty Draper-Updates from NIFA
    1. Provided a detailed update on upcoming NIFA funding opportunities
    2. Provided several suggestions on critical points desired by NIFA funding panels to improve the possibility of obtaining funding when submitting proposals – be sure to follow the specified guidelines

Business Meeting:

Motion to approve the minutes from 2015:

Dr. Doug Jardine moved to approve. Dr. Tony Adesemoye seconded. The motion passed with unanimous vote.

Secretary Nomination:

A nomination for secretary was submitted by Dr. Damon Smith. The nominee was Dr. Daren Mueller. Dr. Muller accepted the nomination. Other nominations were requested. With no other nominations, Dr. Tom Allen made the motion that Dr. Mueller should be the incoming secretary (2016) and future committee chair (2017). Dr. Doug Jardine seconded the motion. Dr. Mueller was elected unanimously by voice vote.

Meeting Location:

Dr. Damon Smith suggested that the 2017 NCERA 137 meeting might be held in conjunction with the World Soybean Congress in Savannah, GA. The World Soybean Congress is to be held on September 10-16, 2017. Given the dates of the World Soybean Congress, the group felt that this was not a good time of the year for the NCERA 137 to meet.

Dr. Tom Allen suggested that NCERA 137 might again meet in conjunction with the Southern Soybean Disease Workers meeting to be held on March 8-9, 2017 in Pensacola Beach Florida. Dr. Anne Dorrance made the motion that NCERA 137 meet starting in the afternoon on March 7, 2017 in Pensacola Beach with the meeting to proceed to the morning of March 8, 2017. The Southern Soybean Disease Workers meeting would commence on the afternoon of March 8, 2017. Dr. Travis Faske seconded the motion. The motion passed unanimously by voice vote. Dr. Smith will work with representatives of the Southern Soybean Disease Workers to plan the 2017 NCERA 137 meeting.

Other Announcements:
Dr. Anne Dorrance announced that the Soy 2016 meeting would be held in Columbus Ohio on August 7-10, 2016.

Recognition:
Dr. Steven Slack was recognized as the NCERA 137 Administrative Advisor. He was congratulated on his retirement with a gift of appreciation presented by Dr. Laura Sweets and Dr. Anne Dorrance and honored with a standing ovation for his years of excellent service to NCERA 137.

Adjournment:
A motion to adjourn the 2016 NCERA 137 was made by Dr. Tom Allen at 11:00am. The motion was seconded by Dr. Travis Faske.

State Reports, State-Based Impact Statements and Publications

Alabama

Edward Sikora, Extension Plant Pathologist, Auburn University

Auburn University personnel involved in soybean disease extension and research: Ed Sikora, Dennis Delaney, Kassie Conner, Alana Jacobson, Mary Delaney Johh Murphy, Joe Kemble

In Alabama a total of 500,000 acres of soybeans were planted in 2015 with 490,000 acres harvested. The statewide average yield was 41.0 bushels per acre.

The spring was very wet in Alabama forcing some very late plantings of soybean in the state. The weather turned hot and dry from late July through early October resulting in a variety of soybean diseases to develop during the season. Charcoal rot and stem canker were the most damaging disease noted during the season. A 90% yield loss was reported from a field in central Alabama most likely from charcoal rot. Stem canker was also a yield-reducer on susceptible varieties throughout much of central Alabama. Frogeye leaf spot was the most common foliar disease observed in 2015 and resulted in growers in central and North Alabama spraying for the pathogen. Soybean rust was observed late in the season but resulted in only minor yield losses in double-cropped soybeans in a few counties. Soybean Vein Necrosis Virus continued to be a concern in North Alabama where incidence of 80-100% was common in fields in North Alabama and the disease appeared to be increasing in was becoming more visible in central and southwest Alabama.

Impact Statements

1. Took part in a multi-state effort to determine the impact of soybean vein necrosis disease (SVND) on soybean yield and seed quality. SVND effects seed quality primarily by reducing seed oil content.
2. Conducted a meta-analysis study on yield and fungicides to determine the optimum timing of fungicide application for management of soybean rust and other foliar diseases of soybean in the southeast. In addition, top performing fungicide products were identified.

Refereed journal articles and books/book chapters.

Hartman, G. L., Rupe, J. C., Sikora, E. F., Domier, L. L., Davis, J. A., and Steffey, K. L. 2015. Compendium of Soybean Diseases and Pests. APS Press. American Phytopathological Society, St. Paul, Minnesota, U.S.A.

Hartman, G. L., E. J. Sikora and J. C. Rupe. 2015. Rust. In: Compendium of Soybean Diseases and Pests (5th Edition)

Symposia and conference publications.

Sikora, E. J., K. Conner and L. Zhang. 2015. Monitoring for Soybean Vein Necrosis Virus in Alabama (2014). Proceedings of the Southern Soybean Disease Workers 42nd Annual Meeting, Pensacola, FL.

Experiment Station publications

Sikora, E. J., M. A. Delaney and D. P. Delaney. 2015. Evaluation of foliar application of FORTRIX for control of soybean rust, 2013. Plant Disease Management Reports 9:STF.

Sikora, E. J., M. A. Delaney and D. P. Delaney. 2015. Evaluation of foliar applications of Topguard SC for control of soybean rust, 2013. Plant Disease Management Reports 9:STF.

Delaney D. P., E. J. Sikora and M. A. Delaney. 2015. Evaluation of foliar fungicides for control of soybean rust, 2013. Plant Disease Management Reports 9:STF.

Delaney D. P., E. J. Sikora and M. A. Delaney. 2015. Evaluation of foliar fungicides for control of soybean rust, 2013. Plant Disease Management Reports 9:STF.

Delaney D. P., E. J. Sikora and M. A. Delaney. 2015. Evaluation of fungicides for control of soybean rust, 2013. Plant Disease Management Reports 9:STF.

Extension publications, fact sheets and E-alerts

Sikora, E. J. Frogeye leaf spot Alert: Email Alert

Sikora, E. J. Management of frogeye leafspot in Alabama; Email Alert

Sikora, E. J. Stem canker of soybeans; Email Alert

Sikora, E. J. Charcoal rot and Sudden Death Syndrome on soybeans: Email Alert

Sikora, E. J. Soybean IPM recommendations for soybeans in Alabama, 2015 (revision)

Arkansas

Travis Faske, Extension Plant Pathologist, University of Arkansas Systems Division of Agriculture

University of Arkansas personnel involved with NCERA 137 objectives: Travis Faske and John Rupe

For the 2015 cropping season 3.2 million acres of soybean were planted with 3.17 million acres harvested. The average yield was 49 bu/A, which is one bushel lower than 2014. Three producers exceeded 100 bu/A yield contest again in 2015 with the highest average of 108 bu/A.

Environmental conditions were unseasonably cool for the start of the 2015 cropping season, which contributed to more seedling disease concerns than normal. Many of these issues were interaction with or solely caused by PPO herbicides. Stem canker were detected as individual scattered plants in a few fields, which is more than usual. The southern RKN is our most yield limiting issue and most important soybean nematode in Arkansas. Many cotton farmers opted to plant soybean, which contributed to a higher yield loss by RKN than in previous years. Other soilborne disease issues consisted of charcoal rot in the southern part of the state where near drought conditions persisted during mid-season. Frogeye leafs spot continues to be the most problematic foliar disease and QoI-resistant strains have now been detected in 27 counties, which plant over 90% of the Arkansas soybean crop. Soybean rust did return to the state in 2015 and was detected in 14 counties. As in previous year this disease arrived too late to affect the 2015 soybean crop. Of the foliar soybean disease, target spot and brown spot were more frequently detected in north central Arkansas.

Journal Articles

Abstracts:

Faske, T. R. 2015. Assessment of Several Commercially Available Triazole and Premix Fungicides for Management of Frogeye Leaf Spot in Arkansas. Proceedings of the Southern Soybean Disease Workers Annual Meeting; March 11-12; Pensacola, FL. Pp. 36

Jackson, C. S. and Faske, T. R. 2015. Assessment of fluopyram for management of *Meloidogyne incognita* on soybean. Phytopathology 105:S2.5.

Proceedings

Allen, T. W., Damicone, J. P., Dufault, N. S., Faske, T. R., Hershman, D. E., Hollier, C. A., Isakeit, T., Kemerait, R. C., Kleczewski, N. M., Koenning, S. R., Mehl, H. L., Mueller, J. D., Overstreet, C., Price, P. P., Sikora, E. J., and Young, H. 2015. Southern United States Soybean Disease Loss

Estimates for 2014. Proceedings of the Southern Soybean Disease Workers Annual Meeting; March 11-12; Pensacola, FL. Pp. 10-15.

Plant Disease Management Reports

Emerson, M., Faske, T. R., and Hurd, K. 2015. Evaluation of Affiance and Domark for control of frogeye leaf spot of soybean in Arkansas, 2014. PDMR 9: FC134.

Emerson, M., Faske, T. R., and Hurd, K. 2015. Evaluation of an experimental foliar fungicide for control of frogeye leaf spot of soybean in Arkansas, 2014. PDMR 9: FC133.

Emerson, M., Faske, T. R., and Hurd, K. 2015. Evaluation of Stratego YLD for management of frogeye leaf spot of soybean in Arkansas, 2014. PDMR 9: FC135.

Emerson, M., Faske, T. R., and Hurd, K. 2015. Evaluation of Cercobin and Topsin on soybeans for management of frogeye leaf spot in Arkansas, 2014. PDMR 9: FC132.

Extension Publications:

Faske, T. R. Soybean rust spreading in Arkansas, Univ. of Arkansas Row Crops Blog (9/21)

Faske, T. R. Soybean rust returns to Mid-South, but has yet to be detected in Arkansas, Univ. of Arkansas Row Crops Blog (9/8)

Faske, T. R. Key points to consider for frogeye leaf spot control, Univ. of Arkansas Row Crops Blog (8/21)

Faske, T. R. Triazole phytotoxicity vs. sudden death syndrome symptoms15 on soybean, Univ. of Arkansas Row Crops Blog (8/14)

Faske, T. R. Soybean seedling disease vs. herbicide injury, Univ. of Arkansas Row Crops Blog (5/19)

Delaware

Nathan Kleczewski, Extension Plant Pathologist, University of Delaware

University of Delaware personnel involved in soybean disease extension and research:
Nathan Kleczewski, Andy Kness, Christopher Ramage, Nathan Smith

In Delaware a total of 175,000 acres of soybeans were planted in 2015, down 10,000 acres from 2014. Statewide averages were 40 bu/A, down from 47.5 bu/A in 2014. Approximately 50,000 acres were irrigated, and yielded 48.5 bu/A vs 36.5 bu/A for dryland beans.

2015 was characterized by prolonged periods of dry, hot weather surrounded by brief patches of heavy rain. Consequently, growers with irrigation were able to compensate for the lack of water during crucial periods of plant growth, resulting in the roughly 12 bu/A increase in production when comparing irrigated to dryland beans. Septoria brown spot was observed in the lower canopies of some cultivars, but often was not at levels that would have caused a significant loss in yield. Downy mildew was present at low levels in some areas with poor airflow or irrigated areas, but quickly dissipated when temperatures increased. Frogeye leaf spot was present at very low levels in few fields, mostly those receiving supplemental irrigation. Charcoal rot was present in many dryland fields, and RKN caused significant damage in fields in Sussex and Dover counties. Soybean cyst nematode continues to be detected throughout the state, and few control options are available to growers due to lack of alternative resistance sources. Although there was some stem canker present, it was often not possible to determine its impact on yield as many fields were severely infested with Dectes stem borer late in the season. Greenstem was also prevalent throughout the state, but this was believed to be a result of environmental factors, not due to pest or pathogen issues. SVNV was detected in the majority of fields, with double crop beans being more severely impacted than full season beans. Other viruses were noted but not identified, but were likely SMV, tobacco ringspot, and or AMV. A unique, “Orange spot” symptom was again noted in some fields.

Impact Statements

1. Conducted a survey and small plot research on SVNV in Delaware and Maryland. Showed that double crop beans may be more severely affected by the virus, that varieties differ in symptom expression, and that symptoms, in terms of affected foliage in the upper 1/3 of the canopy, correlated negatively with yield in varieties tested. Sequential insecticide treatments in research plots reduced thrips but did not impact viral spread, indicating that if management is required, it likely will be related to planting date and variety selection.
2. Developed multiple soybean disease factsheets available for printing and viewing
3. Conducted soybean trials for white mold and brown spot. Data were used for training growers on appropriate timing and product selection for managing white mold. Data was also shared with other researchers as part of a large scale metaanalysis of fungicide timings in white mold management.

4. Isolated *Phytophthora capsici* from soybean stems. Although the organism does not appear to be pathogenic in soybeans, it is an issue in vegetable production. In the process of completing preliminary experiments to determine potential impact on *P. capsici* epidemiology.

Research Publications, Extension Articles, and Videos

Abstracts and Posters

1. N.M. Kleczewski, B. Cissel, and J. Whalen. Occurrence and Impact of Soybean Vein Necrosis Disease in Delaware Soybeans. NE Meeting of the American Phytopathological Society, Philadelphia, PA, 2015.

Extension/Outreach publications/blogs/web articles (*Total of 28*)

1. **Kleczewski, N.M.** and K. Everts**.** 2016. 2015 Applied Plant Pathology Research Book.
2. Kness, A., and **Kleczewski, N.M.** Charcoal rot in soybeans. University of Delaware Cooperative Extension Factsheet. Available at
3. Kness, A. and **Kleczewski, N.M**. 2015. Root Knot Nematode on Soybean. University of Delaware Cooperative Extension Factsheet. Available at: http://extension.udel.edu/factsheets/root-knot-nematode-in-soybeans/
4. **Kleczewski, N.M.**, Mehl, H. et al. 2015. Pest Management Guide: Field Crops. Virginia Tech Cooperative Extension (updated annually). (Available online at: http://pubs.ext.vt.edu/456/456-016/456-016.html)

   Field crops disease management blog – **10 articles** pertaining to soybean disease management located at: http://extension.udel.edu/fieldcropdisease/

   Weekly Crop Update- **14 articles** pertaining to soybean disease management. Online archives located at: http://extension.udel.edu/weeklycropupdate/

Indiana

Kiersten Wise, Extension Plant Pathologist, Purdue University

Purdue personnel involved with soybean disease activities: Kiersten Wise, Virginia Ferris, Jamal Faghihi, Gail Ruhl, and Tom Creswell

In 2015, approximately 5.5 million acres of Indiana cropland were in soybean production. The average yield was 50 bu/A, which was similar to 2013-2014 totals for production and yield.

The impact of soil-borne diseases of soybean was high in 2015. Excessive rainfall and cool, wet conditions in early spring resulted in seedling disease problems across most of the state. Foliar diseases such as brown spot, frogeye leaf spot, and downy mildew were present, but at low levels throughout the state. Sudden death syndrome (SDS) was patchy in areas, but was not as severe as 2014. Brown stem rot and stem canker were also present, and may have limited yield in some fields. Soybean vein necrosis virus (SVNV) was present, and was widespread across the state, but not severe. Personnel participated in monitoring for soybean diseases, including soybean rust, and distributed disease observations through the Purdue Pest and Crop Newsletter.

Impact Statement:

1. Led a multi-state effort to determine environmental and production factors that influence charcoal rot development in soybean.
2. Examined impact of production factors, such as planting date, fungicide seed treatment, irrigation, herbicide program, and variety selection on sudden death syndrome development in soybean.
3. Indiana participated in multi-state soybean seedling sampling projects to determine the prevalence and distribution of soil-borne fungi and fungal-like organisms associated with seedling blight.

Publications:

Dorrance, A.E., Kurle, J.*, Robertson, A.E., Bradley, C., Giesler, L., Wise, K. and Concibido, V.C. 2016. Pathotype diversity of *Phytophthora sojae* in ten states in the United States. Plant Disease. (In press).

Sexton, Z., Hughes, T.J., and Wise, K.A.* 2016. Analyzing isolate variability of *Macrophomina phaseolina* from a regional perspective. Crop Protection. (In press)

Olson, T.R., Gebreil, A., Micijevic, A., Bradley, C.A., Wise, K.A., Mueller, D.S., Chilvers, M.I., and Mathew, F.M.* 2015. Association of *Diaporthe longicolla* with black zone lines on mature soybean (*Glycine max* L.) plants. Plant Health Progress. doi:10.1094/PHP-RS-15-0020.

Kandel Y. R., Bradley, C. A., Wise, K. A., Chilvers, M. I., Tenuta, A. U., Davis, V. M., Esker, P. D., Smith D. L., Licht M. A. and Mueller, D. S. 2015. Effect of glyphosate application on sudden death syndrome of glyphosate-resistant soybean under different field conditions. Plant Dis. 99:347-354.

Extension Publications:

Tenuta, A., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller D., Sisson, A., Smith, D., Wise, K. 2015. Scouting for Common Soybean Diseases. CPN-1001.

Wise, K., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., Smith, D., Tenuta, A. 2015. Scouting for Soybean Stem Diseases. CPN-1002.

Bloomingdale, C., Bradley, C., Chilvers, M., Giesler, L., Groves, R., Mueller, D., Smith, D., Tenuta, A., Wise, K. 2013 (Revised 2015). Soybean Vein Necrosis Virus. CPN-1003.

Smith, D., Chilvers, M., Dorrance, A., Hughes, T., Mueller, D., Niblack, T., Wise, K. 2015. Charcoal Rot. CPN-1004.

Mueller, D., Bradley, C., Chilvers, M., Esker, P., Malvick, D., Peltier, A., Sisson, A., Wise, K. 2015. White Mold. CPN-1005.

Wise, K., Bradley, C.A., Chilvers, M., Giesler, L. Mathew, F., Mueller, D., Smith, D., Tenuta, A. 2015. Stem Canker. CPN-1006.

Mueller, D., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Smith, D., Tenuta, A., and Wise, K. 2015. Pod and stem blight and Phomopsis seed decay. CPN-1007.

Wise, K., Bradley, C., Giesler, L. Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A. Sisson, A., Tenuta, A., Young-Kelly, H. 2015. Soybean Seedling Diseases CPN-1008.

Wise, K., Bradley, C., Chilvers, M. Giesler, L. Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A. Sisson, A., Tenuta, A., Young-Kelly, H. 2015. Scouting for Soybean Seedling Diseases. CPN-1009.

Mueller, D., Chilvers, M., Giesler, L., Sisson, A., Tenuta, A., Wise, K. 2015. Scouting for White Mold in Soybean. CPN-1010.

Wise, K., and members of the NCERA-137 Soybean Disease Committee. 2014, revised 2015. Fungicide Efficacy for the Control of Soybean Seedling Diseases BP-163-W

Wise, K. and members of the NCERA-137 Soybean Disease Committee. 2013 2014, revised 2015. Fungicide Efficacy for Control of Foliar Soybean Diseases. BP-162-W

Iowa

Daren Mueller, Extension Plant Pathologist, Iowa State University

Iowa State University personnel involved with soybean disease activities: Leonor Leandro, Alison Robertson, Greg Tylka, X.B. Yang

The major soybean problems in 2015 were sudden death syndrome, white mold and soybean cyst nematode. Stem canker was also more prevalent than in typical years. Diseases that present but not as severe were Septoria brown spot, downy mildew, Phyllosticta leaf spot, and some viruses (tobacco streak, soybean vein necrosis and soybean dwarf).

Impact Statements

Iowa State has led a multi-state project focused on management of sudden death syndrome of soybean. The foundational management strategy for SDS is using resistant cultivars. However, in years such as 2010 and 2014, when environmental conditions are favorable for disease development, it is evident that resistance alone does not provide adequate control or reduce farmer risk sufficiently. Also, SDS continues to move into new areas. Thus, the main goal of this project is to investigate management options that will help ensure resistant cultivars will be as effective as possible thereby reducing risk as well as providing farmers with maximum economic return on their investment even in unusually conducive SDS conditions. Here some highlights from these studies.

1. Examined the effect of glyphosate on SDS. Study has been published in *Plant Disease*. Study of effect of interaction between herbicide and seed treatment on SDS is ongoing. We collected and analyzed the first year data.
2. Completed a multi-lab study evaluating performance of six qPCR assays developed for *F. virguliforme*. The manuscript was submitted for publication to *Phytopathology*. In this study, we compared the strengths and weakness of all six assays under different research facilities in terms of their specificity, sensitivity, and consistency and also identified an effective protocol for better diagnosis and quantify SDS pathogen. To summarize, assays differed in their performances and also the performance of the same assay varied among the laboratories. An assay developed in Chilvers lab showed the highest sensitivity and the second highest specificity, and thus is suggested as the most useful qPCR assay for *F. virguliforme*. This assay is currently being used for quantifying *F. virguliforme* population in root and soil in other objectives.
3. Identified seed treatments to reduce SDS foliar symptoms. We completed a study evaluating planting date and seed treatment effect on SDS development. Manuscripts are being written to peer-reviewed journals. To summarize, ILeVO seed treatment reduced disease severity and increased yield nearly in all plantings and cultivars, with a maximum yield response up to 21% (Roland Iowa). Effect of planting date on foliar SDS symptoms was inconclusive. Although Mid-June plantings did not have higher disease

than early plantings it yielded lower grain up to 19 bu/A compared to early May plantings.
4. Collected SCN, SDS and yield data from all participating states and data analysis is being done.
5. Tested the susceptibility of 16 cover crops species to infection by *F. virguliforme.* Found that legume species tend to be susceptible to infection, whereas grasses and brassicas are not.
6. Conducted studies to determine the role of ethylene on SDS. Found that application of the ethylene inducer ethephon to soybean reduces SDS severity, and that ethephon treatment results in overexpression of soybean defense related genes.
7. Presented our preliminary research at professional meetings, on Plant Management Network, gave national and international seminars, media interviews, talk in field days and conferences for farmers and also published in state newsletter articles, 20+ media releases etc. To communicate with researchers, we also published or are in the process of publishing in peer-reviewed journals. We also had several press releases, including some jointly with NCSRP, based on results from this project (e.g., glyphosate study, ILeVO study).

Iowa State also collaborates on multi-state projects regarding soybean seedling disease pathogens. As seed prices increase, farmers seed rates are decreasing. A decade ago, farmers were sowing >200,000 seed per acre; today they are sowing 140,000 to 160,000. Moreover, farmers are planting earlier, which means soils are often cooler and wetter. This increases the risk of seedling disease. Consequently seed treatment use is on the increase. The goal of these studies is to identify what species are seedling pathogens and to improve our knowledge of the effect of environment and management practices on seedling disease. ISU highlights from these studies include:

1. Temperature affects pathogenicity and fungicide sensitivity of four *Pythium* species recovered in Iowa. This study was published in Plant Disease. We have just finished screening representative isolates of these four species from the north central region and are summarizing data and preparing a manuscript.
2. Commercial seed treatments were evaluated at three locations in Iowa in 2014 and 2015. Despite planting early and prior to a week long precipitation event and soil temperatures dropping below 50 F, no effect of seed treatment on emergence and yield was detected. This trial is being repeated in 2017, with inoculated and non-inoculated plots. The 2015 data were published in the ICM Newsletter (www.extension.iastate.edu/CropNews) and 2015 data will be published in Spring 2016.
3. The NAM parents were screened for resistance to five species of *Pythium.* Resistance was detected in some parents. A manuscript has been prepared. We are currently screening the NAM RIL populations to identify QTL for resistance to *Pythium*.
4. Preliminary experiments suggest cold tolerance that occurs soon after planting increases the susceptibility of soybean to infection by *Pythium* species. Research is underway to examine timing and length of cold stress, effect of germination growth stage of soybean

and effect of seed treatments on susceptibility to *Pythium* infection.

5. Over 50 isolates of *P. sojae* were sequenced. We are currently assembling data and will compare diversity amongst *Avr* loci to improve our understanding of the evolution of this pathogen in the presence of resistance (*Rps* genes and partial resistance) in soybean.
6. Data from these research were shared in three online panel discussions, and at five field days/farmer meetings (~600 participants).
7. Characterized the phenotypic variation within *F. oxysporum* from soybean. Found that F. isolates vary in aggressiveness on soybean and that there is an isolate by soybean genotype interaction.
8. Identified soybean genotypes with different levels of resistance to *F. oxysporum*
9. Determined the effect of temperature and pH on aggressiveness of *F. oxysporum* isolates

PUBLICATIONS

Books and Refereed Publications

1. Zhang, J, Singh, Ar., Mueller, D. and Singh, As. 2015. Genome-wide association and epistasis studies unravel the genetic architecture of sudden death syndrome resistance in soybean. The Plant Journal. 84: 1124–1136. doi:10.1111/tpj.13069
2. Kandel Y.R., Haudenshield, J.S., Srour A.Y., Fakhoury, A.M., Chilvers M.I., Wang J., Santos, P., Hartman G.L., Malvick, D.K., Floyd, C.M., Mueller, D.S. and Leandro, L.F.S. 2015. Multi-lab comparison of six quantitative PCR assays for detection and quantification of *Fusarium virguliforme* from soybean roots and soil. Phytopathology. 105:1601-1611.
3. Olson, T. R., Gebreil, A., Micijevic, A., Bradley, C.A., Wise, K.A., Mueller, D.S., Chilvers, M.I., and Mathew, F.M. 2015. Association of *Diaporthe longicolla* with black zone lines on mature soybean plants. Plant Health Progress doi:10.1094/PHP-RS-15-0020
4. Kandel, Y., Bradley, C.A., Wise, K.A., Chilvers, M., Tenuta, A., Davis, V.M., Esker, P.E., Smith, D.L., Licht, M.A., and Mueller, D.S. 2015. Effect of glyphosate application on sudden death syndrome of soybean under different field conditions. Plant Disease. 99:347-354.
5. Kanobe, C., M.T. McCarville, M.E. O'Neal, G.L. Tylka, and G.C. MacIntosh. 2015. Soybean aphid infestation induces changes in fatty acid metabolism in soybean. PLoS ONE 10(12):e0145660. doi:10.1371/journal.pone.0145660.
6. Kurle, J., Dorrance, A.E., Robertson, A.E., Bradley, C., Giesler, L. and Wise, K. Pathotype diversity of *Phytophthora sojae* in ten states in the United States. Plant Disease (in press).
7. Matthiesen, R., Abeysekara, N., Maroof, S. and Robertson A.E. Combining isolates to screen for novel sources of resistance to *Phytophthora sojae* in soybean. Plant Dis. (in press)
8. Matthiesen, R., Ahmad, A. and Robertson, A.E. 2016. Temperature affects virulence and fungicide sensitivity of four species of *Pythium* on corn and soybean. Plant Dis. (in press) Available online as Plant Disease "First Look": http://dx.doi.org/10.1094/PDIS-04-15-0487-RE

9. Stewart, S., Robertson, A.E. Wickramasinghe, D, Michel, A. and Dorrance A.E. 2016. Population structure among and within Iowa, Missouri, Ohio and South Dakota populations of *Phytophthora sojae*. Plant Dis. 100: 367-379
10. Hartman, G. L., Leandro, L. F. S. and J. C. Rupe. 2015. Sudden Death Syndrome. Pages: in: Compendium of Soybean Diseases and Pests, Hartman et al. eds., 5th Ed. APS press, St. Paul, MN.
11. Hartman, G. L., Chang, H.-X., and L. F. S. Leandro. 2015. Research Advances and Management of Soybean Sudden Death Syndrome. Crop Protection 73:60-66

Abstracts

1. Phillips, X.A. and Mueller, D.S. 2015. Green stem disorder and the effect of fungicide application and stress. North Central American Phytopathological Society. Lansing, MI.
2. Silva, G.A., Leandro, L., Mueller, D. 2015. Root rot-like symptoms caused by grain-based inoculum substrates. American Phytopathological Society Annual Meeting, Pasedena, CA.
3. Kandel, Y.R., Wise, K.A., Bradley, C.A., Tenuta, A.U., Leandro, L.F.S., Mueller, D.S. 2015. Influence of planting date, seed treatment and cultivar on plant stand, sudden death syndrome, and yield of soybean. American Phytopathological Society Annual Meeting, Pasedena, CA.
4. Kobayashi Leonel, R., Leandro, L.F., and Mueller, D. 2015. Evaluation of cover crop susceptibility to Fusarium virguliforme, the causal agent of sudden death syndrome of soybean American Phytopathological Society Annual Meeting, Pasedena, CA.
5. Groves, C., German, T., Dasgupta, R. Mueller, D. and Smith D. 2015. Is soybean vein necrosis virus (SVNV) seed transmitted? Xth International Symposium on Thysanoptera and Tospoviruses. Pacific Grove, CA.
6. Acharya, K., E. Byamukama, and G. L. Tylka. 2015. Determining Heterodera glycines HG types to improve soybean cyst nematode management in South Dakota. Proceedings of the 2015 Annual Meeting of the American Phytopathological Society, August 1-6, 2015.
7. Beeman, A. and G. L. Tylka. 2015. Effects of ILeVO and VOTiVO seed treatments on hatching, motility and root penetration of the soybean cyst nematode. Proceedings of the 2015 Annual Meeting of the American Phytopathological Society, August 1-6, 2015.
8. Clifton, E. H., E. W. Hodgson, G. L. Tylka, and A. J. Gassmann. 2015. Proceedings of the 2015 North Central Branch Meeting of the Entomological Society of America.
9. Tylka, G., C. C. Marett, A. E. Robertson, M. Serrano, and T. A. Mueller. 2015. Effects of Clariva seed treatment on soybean cyst nematode (Heterodera glycines) population densities and soybean yields in Iowa in 2014. Proceedings of the 2015 Annual Meeting of the American Phytopathological Society, August 1-6, 2015.
10. Lerch, E. R., Dorrance, A.E. and Robertson, A.E. 2015. Screening the NAM parents for resistance to multiple *Pythium* species. Phytopathology 105 (Suppl.4) S4:81
11. Matthiesen, R., Morgan, M., Fakhoury, A. and Robertson, A.E. 2015. Antagonistic activity of potential biocontrol agents screened against *Pythium* spp. that cause seedling disease. Phytopathology 105 (Suppl.4) S4:90.

12. Matthiesen, R., Chilvers, M. and Robertson, A.E. 2015. Pathogenicity of *Pythium* species from the North central region on soybean and corn screened at two temperatures. Phytopathology 105 (Suppl. 4) S4:90
13. Rojas, A., Jacobs, J.L., Bradley, C.A., Malvick, D.M., Nelson, B. D., Robertson, A.E., Tenuta, A.U., Wise, K. A., Giesler, L., Jardine, D., Rupe, J. and Chilvers, M. 2015. Oomycete community diversity; The soybean root rot complex. Phytopathology 105 (Suppl. 4) S4:92
14. Serrano, M. and Robertson, A.E. 2015. Chiiling injury during imbibition of soybean seed increases incidence of damping-off caused by *P. torulosum*. Phytopathology 105 (Suppl.4) S4:125.
15. Abdelsamad, N., MacIntosh, G., and L. F. S. Leandro. 2015. Ethylene elicits soybean defense responses and reduces symptoms of sudden death syndrome. Phytopathology 105:S4.1.
16. Cruz, D. R., Leandro, L. F. S., and G. P. Munkvold. 2015. Effects of temperature and pH on Fusarium oxysporum and soybean seedling disease. Phytopathology 105:S4.31

Extension publications

1. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Smith, D., and Tenuta, A. 2015. Soybean Disease Management: Stem Canker. Crop Protection Network. CPN 1006
2. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A., Sisson, A., Smith, D., Tenuta, A., and Young-Kelly, H. 2015. Soybean Disease Management: Scouting for Soybean Seedling Diseases and Disorders. Crop Protection Network. CPN 1009.
3. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., Smith, D. and Tenuta, A. 2015. Soybean Disease Management: Scouting for Soybean Stem Diseases. Crop Protection Network. CPN 1002.
4. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A., Sisson, A., Smith, D., Tenuta, A., and Young-Kelley, H. 2015. Soybean Disease Management: Soybean Seedling Diseases. Crop Protection Network. CPN 1008
5. Tenuta, A., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., and Wise, K. 2015. Soybean Disease Management: Scouting for Common Soybean Seed Diseases. Crop Protection Network. CPN 1001.
6. Smith, D., Chilvers, M., Dorrance, A., Hughes, T., Mueller, D., Niblack, T., and Wise, K. 2015. Soybean Disease Management: Charcoal Rot. Crop Protection Network. CPN 1004
7. Tylka, G.L. and M. P. Mullaney. 2015. Soybean cyst nematode-resistant soybeans for Iowa. Iowa State University Extension Publication PM 1649, 28 pp.
8. Tylka, G.L., G.D. Gebhart, C.C. Marett, and M.P. Mullaney. 2015. Evaluation of soybean varieties resistant to soybean cyst nematode in Iowa – 2015. Iowa State University Extension, publication IPM 52, 32 pp.
9. Kandell, Y., Robertson, A., Zaworski, E., Chilvers, M., Dorrance, A.E and Bestor, N. 2015. Phytophthora Root Rot of Soybean. CPN 10-14. Iowa State University Extension and Outreach.

Kansas

Doug Jardine, Extension Plant Pathologist, Kansas State University

Kansas State University personnel involved with soybean disease activities: Chris Little (Soybean Pathology - Research), Tim Todd (Nematology), Harold Trick (Plant Biotechnology), Bill Schapaugh (Soybean Breeding)

Kansas soybean production for 2015 totaled 148.6 million bushels, up 4 percent from 2014. Yield, at 38.5 bushels per acre was up 2.5 bushels from a year earlier. Area for harvest, at 3.86 million acres, was down 3 percent from 2014. The reduction in planted acres was the result of consistent rains in May and June that caused some farmers to abandon planting intentions. Disease loss estimates for the state were 3.6 percent, which was the lowest since estimates were begun in 1995. Timely rains in August reduced charcoal rot to a negligible level of 0.1 percent, well below the annual average of 5.5 percent. Losses from seedling blight (2%) and SCN (1.0%) made up the bulk of the state's disease losses.

Impact Statements

1. "Metagenomics" and "metabarcoding" analysis of the soybean seed microbiome has revealed a more complete catalog of organisms in seed samples and specific seed tissues than the culture-based approaches of the past. Analysis of seed tissues (coat, cotyledons, embryo axis) showed that different species colonize these seed tissues at significantly different levels.

2. It has been discovered that *F. proliferatum* causes seedling disease under more acidic (pH 5.5) and warmer temperatures (30ºC) than the average for many other *Fusarium* spp. Also, increased soil phosphorus content, silty textures, and soybean rotations after sorghum tend to favor higher *F. proliferatum* populations. Many of the isolates of *F. proliferatum* tested have some degree of fludioxonil resistance also.

3. It has been demonstrated that early planting dates (e.g. 5 May to 19 May) results in the highest SDS severity, but the yield bump from earlier planting appears to mitigate disease impacts.

4. Using comparative genomics of *Macrophomina phaseolina* isolates from different host species (including soybean), it has been demonstrated that there are differences in unique proteins among isolates, genome size variability, and differential genome identities compared to the sequenced *M. phaseolina* reference genome.

Publications

1. Adee, E., Ruiz Diaz, D.A., and Little, C.R. 2016. Effect of soil test and phosphorus fertilization on soybean sudden death syndrome severity. Crop, Forage, & Turfgrass Management 2: *In press*.
2. Pedrozo, R., Fenoglio, J.J., and Little, C.R. 2015. First report of seedborne *Fusarium fujikuroi* causing seed rot and seedling blight on soybean (*Glycine max*) in the United States. Plant Disease 99: 1865.
3. Jardine, D.J., E. Adee, and G. Sassenrath. 2015. Effects of seed protection chemicals on stand and yield of soybeans in Kansas, 2014. Plant Dis. Mgmt. Reports. 9:ST001
4. Ciampitti, I., Ruiz Diaz, D., Jardine, D., Peterson, D., Whitworth, R.J., and D.H. Rogers. 2015. Kansas Soybean Management 2014. K-State Research and Extension Publication MF3154 (Revised) January 2015
5. Damon Smith; Adam Sisson, Albert Tenuta, Anne Dorrance, Carl Bradley, Daren Mueller, Dean Malvick, Doug Jardine, Emmanuel Byamukama, Kiersten Wise, Laura Sweets, Loren Giesler, Marty Chilvers, Sam Markell, Teresa Hughes, Terry Niblack. 2015. Soybean Disease Management: Charcoal Rot, Crop Protection Network 1004

Presentations and Abstracts

1. Radwan, O., Little, C.R, and Hartman, G. "Whole genome sequencing and comparative genomics of five isolates of *Macrophomina phaseolina* isolated from agronomic and prairie plant species." (Plant and Animal Genome XXIV, San Diego, California; January 9-13, 2016)

2. Little, C.R., Adee, E., and Presley, D. "Influences of planting date, ILeVO seed treatment, root structure, and soil compaction upon SDS in Kansas." (Kansas Soybean Commission, Topeka, Kansas; December 16, 2015)

3. Little, C.R. "*Fusarium* experiments in Kansas." (USB/NCSRP Soybean Seedling Diseases Meeting, St. Louis, MO; November 4, 2015)

4. Little, C.R. "Germplasm screening and seed treatment efficacy against *Fusarium proliferatum*." (USB/NCSRP Soybean Seedling Diseases Meeting, St. Louis, MO; November 4, 2015)

5. Pedrozo, R., and Little, C.R. 2015. The interesting case of soybean seedborne *Fusarium* spp.: from identity to pathogenicity. Phytopathology 105: S4.109.

6. Rojas, A., Jacobs, J.L., Bradley, C.A., Malvick, D.M., Nelson, B.D., Robertson, A., Tenuta, A.U., Wise, K.A., Giesler, L., Jardine, D., Rupe, J. and M. Chilvers. 2015. Oomycete

community diversity, The soybean root rot complex. APS Annual Meeting, Pasadena, CA, Abstract 42-S

Louisiana

Trey Price, Extension/Research Plant Pathologist/LSU AgCenter

LSU AgCenter personnel involved in soybean disease extension and research: Trey Price, Myra Purvis, Hunter Pruitt, Clayton Hollier, Patricia Bollich, Ray Schneider, Clark Robertson, Ronnie Levy, Blair Buckley, Charlie Overstreet

Frogeye leaf spot (FLS) was the most prevalent foliar disease in 2015 with Cercospora leaf blight (CLB) following close behind. We have fungicide resistance issues with both of these pathogen populations, which leaves us with limited management options, particularly for CLB. For this reason, soybean foliar disease management with fungicides should be approached reactively instead of proactively. Surprisingly, in 2015 a couple of fungicide treatments had significant efficacy on CLB. We will look closely at these compounds next year to confirm consistency. Fortunately, triazole fungicides remain effective on FLS, and there are resistant varieties available to manage this disease. We continued to search for varieties resistant to CLB, and were successful in identifying a handful that showed promise in 2015. Variety selection is the best way to proactively manage foliar diseases in soybean. Hopefully we will be able to test these varieties in more locations in cooperation with Dr. Blair Buckley and others throughout the mid-south to speed-up the breeding process.

Taproot decline (TRD) continued to be the predominant soilborne issue in Louisiana in 2015. Anecdotal information indicates reduced incidence and severity with rotation and/or tillage. Seed treatment efficacy for this disease is unknown. We will continue to work closely with producers to determine yield losses associated with TRD.

Other noteworthy issues in the state in 2015 included: aerial blight, anthracnose, brown spot, rootknot nematode, soybean rust, stem canker, sudden death syndrome, and target spot.

Throughout the 2015 growing season, we responded to approximately 300 phone calls and text messages, many of which resulted in field visits, laboratory diagnostics, or collaborative opportunities. We participated in 13 grower meetings and 9 field days throughout the year to extend results of our research efforts to stakeholders.

Publications

Albu, S., Price, P., Doyle, V., Schneider, R. W. 2015. Molecular characterization of the G143A mutation leading to QoI fungicide resistance among fungal pathogens causing Cercospora leaf blight and purple seed stain on soybean. Proc. Southern Soybean Disease Workers. 17.

Gauthier, N. A., Schneider, R. W., Chanda, A., Silva, E. C., Price, P., and Cai, G. Cercospora leaf blight and purple seed stain. In: Compendium of Soybean Diseases and Pests, Fifth Edition. APS Press, St. Paul, MN. 38-41.

Price, P. 2015. Frogeye leaf spot prevalent again in 2015. Louisiana Crops Newsletter. 5,7:1-5.

Price, P., Hollier, C., and Levy, R. 2015. 2015 Soybean re-cap and disease update. Louisiana Crops Newsletter. 5,9:5-8.

Price, P. 2015. Fungicide resistance in the Cercospora leaf blight and purple seed stain pathogen of soybean. Plant Management Network Webcast on the Soybean Fungicide Resistance Hub.

Price, P., Padgett, G. B., and M. A. Purvis. 2015. The effect of selected fungicides on frogeye leaf spot in Louisiana, 2014. Plant Dis. Manag. Rep. 9:FC037.

Price, P. 2015. Disease concerns in mid-south soybean production. Proc. National Conservation Systems Cotton & Rice Conference. 53-54.

Price, P., Purvis, M. A., Cai, G., Padgett, G. B., Robertson, C. L., Schneider, R. W., and Albu, S. 2015. Fungicide resistance in *Cercospora kikuchii*, a soybean pathogen. Plant Dis. 99:1596-1603.

Price, P., Purvis, M. A., Pruitt, H., Hollier, C., Schneider, R. W., Groth, D., and Padgett, G. B. 2015. Prevalence of fungicide resistance in Louisiana soybean and rice. Phytopathology Suppl. 2. 105:S2.9.

Singh, R., Price, P., Padgett, G. B., and Burks, T. 2015. First report of sudden death syndrome of soybean caused by Fusarium virguliforme in Louisiana. Plant Health Progress. doi:10.1094/PHP-BR-15-0031.

Minnesota

Dean Malvick, Extension Plant Pathologist, University of Minnesota

University of Minnesota personnel involved in soybean disease extension and research: Dr. Senyu Chen, Dr. James Kurle, and Dr. Dean Malvick. Dept. of Plant Pathology; and Dr. Aaron Lorenz Orf. Dept. of Agronomy and Plant Genetics (breeding)

In 2015, 7.6 million acres of soybean were harvested in Minnesota over the production area that extends from the Iowa to Manitoba borders. Average state yield was ~50 bu/ acre, which is about 8 bu/acre more than in 2014. Disease and crop challenges varied over this large area. In most areas it was a good year for soybean production with adequate rainfall, generally moderate to low temperatures, and minimal periods with environmental crop stress. White mold was the most widespread and talked-about soybean disease in MN this year. Wet weather during flowering periods in July along with relatively cool temperatures in many areas were favorable, especially in wet areas of southern MN vs. the drier areas in the northwest. Frequent rains in southern MN also favored sudden death syndrome (SDS, however, delayed development of the disease in August reduced its impact on yield loss in many areas. Weather conditions were also favorable for development of brown stem rot (BSR) in parts of MN. Other soybean diseases also occurred at notable levels in some fields, including pod and stem blight in western MN and downy mildew in Northwestern MN. One of the most common soybean diseases in the past two years in Minnesota was Rhizoctonia root rot, but this was a minor problem in 2015.

Impact Statements

1. The *Pythium* species that infect soybean roots in Minnesota soybean fields are very diverse. They can differentially decrease soybean and corn root growth over a range of cool and warm temperatures, and different fungicides are inconsistent in reducing their growth.
2. Our studies indicate that significant interactions can occur between several soilborne fungal pathogens of soybean, which may have strong implications for disease management and research on key diseases.
3. Association mapping and genomic prediction has identified novel loci for resistance to sudden death syndrome and was shown to be useful for improvement of genetic resistance to SDS in early maturing soybean germplasm.
4.

Publications

Peer-reviewed Research Articles

1. Kandel, Y., Haudenshield, J., Srour, A.Y., Islam, K.T., Fakhoury, A.M., Santos, P., Wang, J., Chilvers, M.I., Hartman, G., Malvick, D.K.,Floyd, C.M., Mueller. D., and Leandro. L.

2015. Multi-laboratory comparison of quantitative PCR assays for detection and quantification of *Fusarium virguliforme* from soybean roots and soil. Phytopathology, 105:1601-1611.

2. Bajaj, R., Hu, W., Huang, Y., Chen, S., Prasad, R., Varma, A., & Bushley, K. E. (2015). The beneficial root endophyte *Piriformospora indica* reduces egg density of the soybean cyst nematode. *Biological Control*, *90*, 193–199.
3. Bao, Y., Kurle, J. E., Anderson, G., & Young, N. D. (2015). Association mapping and genomic prediction for resistance to sudden death syndrome in early maturing soybean germplasm. *Molecular Breeding*, *35*(6), 1–14.

Abstracts and Posters

1. Srour, A.Y., Leonardo, L., Malvick, D., and Fakhoury, A. 2015. Unraveling the microbial profile of the rhizosphere of SDS-suppressive soils in soybean fields. Presented at the National Meeting of the American Phytopathological Society Meeting in Pasadena, CA.
2. Floyd, C. M. and Malvick, D.K. 2015. Interactions between *Fusarium virguliforme* and other common fungal pathogens in soybean root rot complexes. Presented at the National Meeting of the American Phytopathological Society Meeting in Pasadena, CA.
3. L. Radmer, G. Anderson, D. K. Malvick, and J. E. Kurle. 2015. *Pythium* species from Minnesota soybean fields, their relative pathogenicity to soybeans and corn, and their sensitivity to seed treatment fungicides. Presented at the National Meeting of the American Phytopathological Society Meeting in Pasadena, CA.
4. Floyd, C. M. and Malvick, D.K. 2015. Interactions between *Cadophora gregata* (brown stem rot) and *Fusarium* spp. in soybean plants. Presented at the North Central Division APS Meeting in Lansing, MI.
5. ROJAS, A., Jacobs, J. L., Bradley, C.A., Malvick, D. K., Nelson, B. D. Robertson, Tenuta, A. U., Wise, K. A., Giesler, L., Jardine, D., Rupe, J., and Chilvers, M. I. 2015. Oomycete community diversity: The soybean root rot complex. Presented at the National Meeting of the American Phytopathological Society Meeting in Pasadena, CA.

Book Chapter

1. D. K. Malvick, C. R. Grau, and L. E. Gray. 2015. Brown stem rot, pp. 64-67, In: Compendium of Soybean Diseases, 5th Edition. G. Hartman, J. Rupe, L. Domier, E. Sikora, K. Steffey, and J. Davis, eds. APS Press. St. Paul. 201 pp.

Missouri

Laura Sweets, Extension Plant Pathologist, University of Missouri

Area planted to soybean, at 4.55 million acres, was down 19 percent from 2014. The harvested area, at 4.48 million acres, was down 20 percent from last year. The soybean yield was estimated at 40.5 bushels per acre, down 6 bushels from 2014. Production is estimated at 181 million bushels, down 30 percent from the previous year.

The 2015 season was an extremely challenging one for soybean producers in Missouri. Although the year started out on the dry side that changed rapidly. By mid-April wet conditions had delayed corn planting by almost 50 percent of the five-year average. Soybean planting didn't really get underway until mid-May, slightly behind the five-year average. By June 1 soybean planting had progressed to 23 percent complete, compared to 74 percent for the previous year and 57 percent for the five-year average. This trend continued and by July 6 soybean planting had progressed to 73 percent complete, compared to 94 percent for the previous year and 97 percent for the five-year average. The primary reason for this major decrease in soybean acres was prevented planting due to extended cool, wet conditions. **Approximately 1.3 million acres intended for soybeans were not planted due to unfavorable environmental conditions.**

The 2015 season was an extremely challenging one for soybean producers in Missouri. The wet conditions led to poor stands with saturated soils, oxygen deprivation and Pythium diseases contributing to seed decay, damping-off and seedling mortality. Samples with Phytophthora, Fusarium and Rhizoctonia root rots were also received in the Plant Diagnostic Laboratory.

In spite of the wet conditions, foliage diseases were neither widespread nor severe. Septoria brown spot was unusually low in both incidence and severity. Frogeye leaf spot was also quite low in incidence and severity. Downy mildew came in quite late in the season but during September was very prevalent in the upper canopy of many fields. Soybean rust was not confirmed in Missouri during the 2015 season. Soybean vein necrosis virus was not found until late in the season and then in extremely low levels.

Sudden death syndrome had been a major issue throughout the state during the 2014 season. SDS did develop in 2015 but not nearly to the extent of the previous year. It came in late enough in the season the yield losses in most fields were low.

Soybean cyst nematode continues to be a major problem in soybean production throughout the state. Growers seem to believe that resistant varieties have controlled SCN. Although there have been documented cases particularly in the southwest region of the state of SCN populations achieving high reproduction rates on PI-88788 varieties.

Publications

Extension Manuals:

Bradley, Kevin, Laura E. Sweets, Wayne C. Bailey, and Moneen Jones and James W. Heiser. 2015. 2015 Missouri pest management guide: corn, grain sorghum, soybean, winter wheat, rice and cotton. University of Missouri Extension publication M171. 241 pp.

2015 Newsletter Articles: All articles published in the University of Missouri's Integrated Pest and Crop Management Newsletter, V. 25. Similar contributions made in previous years.

Sweets, L.E. Early season soybean diseases- May

Sweets, L.E. SDS and other late season soybean diseases- September

North Dakota

Sam Markell, Extension Plant Pathologist, North Dakota State University

The geographical expansion of soybean cyst nematode continues to occur in North Dakota. Egg level on first detection are commonly high (in excess of 10,000 eggs/100 cc). The majority of varieties available in maturity groups less than 0.6 are susceptible, placing growers in a precarious position if they are not managing SCN. Exacerbating the problem 0.75M to 1.0 M acres of dry edible beans are grown in the regions.

Roots rots remain a significant problem in the state. White mold was low in frequency and severity in 2015. Economic loss to foliar diseases is very rare in North Dakota. However, significant amounts (prevalence in fields and high severity in some fields) of downy mildew was observed in fields across the northern third of the state. It is unclear if yield loss due to disease pressure occurred, but, I estimate that at least 10,000 -20,000 acres were sprayed with fungicides in an effort to manage the disease. The primary chemical used was Aproach (DuPont).

Soybean production in North Dakota continues to increase in acreage and expand into new areas. In 2015, NASS ranked ND 4th in overall acreage with 5.4 M A, with an average yield of approximately 32 bu/A.

Research Publications:

Mathew, F., M., Castelbury, L., A., Jordahl, J. G., Taylor, C., A., Meyer, S., M., Lamppa, R. S., Pasche, J., A., and **Markell, S., G.** 2015. Identification of *Diaporthe longicolla* on dry edible peas, dry edible beans and soybeans in North Dakota. Plant Health Progress doi: 10.1094/PHP-RV-14-0045.

Abstracts/Proceedings:

Markell, S., Jordahl, J., Meyer, S., Glogoza, P. and Knudson, M. 2015. Increasing grower awareness and monitoring spread of *Heterodera glycines* in North Dakota, USA. XVIII International Plant Protection Congress. Berlin, Germany. August 24-27th, 2015 (Talk).

Yan, G. P., *Markell, S.,* Nelson, B. J., Helms, T.C., and Osorno, J. M. 2015. The status of soybean cyst nematode occurrence and management in North Dakota. Pages 126-127 in Abstracts of 54th Annual Meeting of the Society of Nematologists, East Lansing, MI, July 19-24. (Poster).

Trade Magazine Articles:

Markell, S. 2015. SCN sampling program Q and A. North Dakota Soybean Grower Magazine. Vol. 4 (4): 29.

Nelson, B., Yan, G., Markell, S., and Pasche, J. 2015. Sample your soil for soybean cyst nematode! Northarvest bean grower magazine. Vol. 21 (3): 28-29.

Pasche, J., and Markell, S. 2015. Dry edible bean disease research. Northarvest bean grower magazine. Vol. 21 (2): 37-39.

Markell. S. 2015. Increasing awareness of soybean cyst nematode in North Dakota. North Dakota Soybean Council 2015 Research Update. P 28.

Podcast:

'Soybean cyst nematode' radio podcast. Recorded on August 17th, 2015 and distributed to the North Dakota Soybean Council listserve on August 18th, 2015.

Extension Presentations:

12/2/15	Broadleaf Crops Disease Control Update	Fargo, ND	NDSU/UM Commercial pesticide Applicator Training	250
12/2/15	Seed Treatment Update (with Andrew Friskop)	Fargo, ND	NDSU/UM Commercial pesticide Applicator Training	250
12/1/15	Soybean cyst nematode – A spreading problem	Fargo, ND	Northern Ag Expo	70
10/9/15	Plant pathology primer	Fargo, ND + video locations	Master Gardener course	105
9/11/15	Managing soybean cyst nematode with seed treatments	Hankinson, ND	Richland County soybean cyst nematode field day	25

9/11/15	The importance and biology of soybean cyst nematode	Hankinson, ND	Richland County soybean cyst nematode field day	25
9/9/15	Managing soybean cyst nematode with seed treatments	Galesburg, ND	Traill County soybean cyst nematode field day	20
9/9/15	The importance and biology of soybean cyst nematode	Galesburg, ND	Traill County soybean cyst nematode field day	20
9/8/15	Soybean diseases	Lisbon, ND	Ransom County soybean variety plot tour	25
9/4/15	Managing soybean cyst nematode with seed treatments	Absaraka, ND	Cass County soybean cyst nematode field day	40
9/4/15	The importance and biology of soybean cyst nematode	Absaraka, ND	Cass County soybean cyst nematode field day	40
9/3/15	Soybean diseases: Trailer two	Carrington, ND	Carrington Research Extension Center annual row crop tour	20
9/3/15	Soybean diseases: Trailer one	Carrington, ND	Carrington Research Extension Center annual row crop tour	50

9/2/15	Soybean diseases	Mooreton, ND	Richland County Variety Plot Tour	35
7/17/15	Plant pathology in North Dakota – research and disease focus in SE ND.	Fargo, ND	North Dakota State College of Science Field Day	30
7/17/15	Plant pathology in North Dakota – Research and disease focus on central ND crops.	Fargo, ND	Bismarck State University Field Day	30
3/4/15	Hands on: Soybean diseases	Mandan, ND	Western Crop Scout School	125
2/25/15	Hands on: Soybean diseases	Fargo, ND	Eastern Crop Scout School	103
2/24/15	The importance of pest management	Fargo, ND	Eastern Crop Scout School	103
2/19/15	Understanding and managing root rots	Grand Forks, ND	International Crop Expo	75
2/5/15	SCN: where it is and how we manage it	Grand Forks, ND	Best of the Best	325
2/4/15	SCN: sources of resistance and nematicides	Moorhead, MN	Best of the Best	196
1/30/15	Disease management in soybeans	Portage la Prairie, MB	Getting it Right	200
1/15/15	Soybean diseases: emphasis new growers	Newburg, ND	Getting it Right	50
1/15/15	Soybean diseases: emphasis on NW crop rotation	Minot, ND	Getting it Right	80
1/14/15	Soybean disease: emphasis on dry bean rotations	Underwood, ND	Getting it Right	50

1/13/15	Soybean diseases: emphasis on SCN	Streeter, ND	Getting it Right	28
1/9/15	Broadleaf plant diseases	Fargo, ND	CCA Training Prep	25

Ohio

Anne E. Dorrance, Professor and Research-Extension Plant Pathologist, The Ohio State University

The Ohio State University personnel involved in soybean disease extension and research:

Dorrance Lab: Clifton Martin (Research Associate, now with OSUE Muskingham County), Damitha Wickramasinghe (Research Associate, now with Bayer Crop Sciences), Deloris Veney (Research Assistant), Linda Weber (Research Assistant), Jonell Winger (Research Assistant), Anna Stasko (Graduate Research Associate), Jaqueline Huzar Novakowski (Graduate Research Associate), Meredith Eyre (Graduate Research Associate), Cassidy Gedling (Graduate Research Associate), Kelsey Scott (Graduate Research Associate), Amilcar Loyo Vargas (Graduate Research Associate);

John Schoenhals, Elizabeth Roche, Brian Kleinke (Masters in Plant Health Management Program)

Dr. Feng Qu, Associate Professor

Dr. Chris Taylor, Associate Professor

Dr. Terry Niblack, Professor

Niblack lab: Horacio Nicora Lopez (Graduate Research Associate, co-advise Dorrance)

Major Diseases. Disease conditions during 2015: The field season was again a bit challenging, especially during planting. Heavy rains in the end of June (>18") in some fields provided perfect environmental conditions for soybean seedling blight. Cool weather and rains during flowering also appeared for white mold in soybean this year, however drought conditions during July drastically limited disease development except in a few fields. There were also reports and losses due to Phytophthora stem and root rot and frogeye leaf spot. Sudden death syndrome was at very low levels in fields with a long history of this disease.

There were 4,750,000 and 4,740,000 planted and harvested, respectively to soybean in Ohio during 2015, which is down from the previous year, but still among the highest. More importantly, a statewide yield average of 50 bu/A as of March 26, 2016 from the National Agricultural Statistics Service.

Impact Statements

1. From seedlings with symptoms of damping-off that were recovered from affected fields, recovered a number of Pythium spp. that were metalaxyl insensitive.
2. Scouted fields and made recommendations to spray fungicides to manage frogeye leaf spot and white mold on susceptible varieties in fields with a long history of both diseases.
3. Evaluated a large number of seed treatment compounds for efficacy towards *Phytophthora sojae* and *Pythium* spp. Continued to expand list of available products with good efficacy towards these pathogens.
4. Identified novel major QTL for *F. graminearum* in plant introductions along with markers to use in introgressing this trait into high yielding varieties.
5. Completed several collaborative studies which looked at the endosymbiont that resides in soybean aphid, root architecture in a population that is also segregating for resistance to *P. sojae* and high density molecular map in one of our soybean populations.
6. Identified, again, that fungicides only provide yield benefits when disease is present (Bluck study)

Publications

Cassone, B. J., Redinbaugh, M., Dorrance, A.E., and Michel, A. 2015. Shifts in *Buchnera aphidicola* density in soybean aphids (*Aphis glycines*) feeding on virus-infected soybean. Insect Molec Biol. 24: 422-431.

Bluck, G.M., Lindsey, L.E., Dorrance, A.E., Metzger, J.D. 2015. Soybean yield response to Rhizobia inoculant, gypsum, manganese fertilizer, insecticide, and fungicide. Agron. J. 107: 1757-1765.

Acharya, B., Lee, S., Rouf Mian, M.A., Jun, T., McHale, L.K., Michel, A.P., and Dorrance, A.E. 2015. Identification and mapping of quantitative trait loci (QTL) conferring resistance to *Fusarium graminearum* from soybean PI 567301B. Theor. Appl. Genet. 128:827-838.

Prince, S.J., Song, L., Qiu, D., Maldonado dos Santos, J.V., Chai, C., Joshi, T., Patil, G., Valliyodan, B., Vuong, T.D., Murphy, M., Krampis, K., Tucker, D.M., Biyashev, R., Dorrance, A.E., Saghai Maroof, M.A., Xu, D., Shannon, J.G., and Nguyen, H.T. 2015. Genetic variants in root architecture-related genes in a *Glycine soja* accession, a potential resource to improve cultivated soybean. BMC Genomics 16:132. doi:10.1186/s12864-015-1334-6

Lee S, Freewalt KR, McHale LK, Song Q, Jun T-H, Michel AP, Dorrance AE, Mian MAR. 2015. A high-resolution genetic linkage map of soybean based on 357 recombinant inbred lines genotyped with BARCSoySNP6K. Mol Breeding 35:58

South Dakota

Febina Mathew, Oilseed Plant Pathologist, South Dakota State University

South Dakota State University personnel involved in soybean disease extension and research: Febina Mathew, Emmanuel Byamukama, Connie Strunk, and Connie Tande.

In South Dakota total of 5.15 Million acres of soybean were planted in 2015 with 5.12 million acres harvested (USDA-NASS 2016). Soybean production reached an average yield of 46 bushels per harvested acre in 2015, compared to 45 bushels per harvested acre in 2014.

Most soybean acres were planted by mid-to-late May in South Dakota in 2015. However, most areas of the state received rainfalls in late May and early June, resulting in planting delays. Some strong storms earlier this summer brought wind and hail damage to soybean fields in northeastern South Dakota. Weather became hot and dry in July, then turned cool and wet in August and September. These weather conditions led to moderate levels of bacterial diseases and Septoria brown spot throughout the season. White mold, Sudden death syndrome, Brown stem rot, Phytophthora, and Stem canker was scattered across the state and impacted a small portion of the acreage in South Dakota. Soybean cyst nematode was confirmed in greater than 85% of the soybean production area (~ 29 counties) as of 2015.

Impact Statements

1. Soybean disease updates were provided to producers, crop consultants and other stakeholders throughout the 2015 soybean growing season.
2. Soybean cyst nematode management information was disseminated to producers and crop consultants. This has led to an increase in SCN test sample submission.
3. Fungicide efficacy trials both for seed and foliar treatments were conducted in 2015 and summaries from these trials have presented at grower meetings.
4.

Research Publications, Extension Articles, and Videos

Refereed Journals

1. Olson, T. R., Gebreil, A., Micijevic, A., Bradley, C. A., Wise, K. A., Mueller, D. S., Chilvers, M. I., and Mathew, F. M. 2015. Association of *Diaporthe longicolla* with black zone lines on mature soybean plants. Plant Health Progress doi: 10.1094/PHP-RS-15-0020.
2. Mathew, F. M., Tande, C., Gebreil, A., Byamukama, E., Osborne, L., and Draper, M. 2015. First report of Brown stem rot of soybean (*Glycine max* L.) caused by *Phialophora gregata* in South Dakota. Plant Disease 99: 8.

Abstracts

1. Okello, P., Gebreil, A., Olson, T., Kontz, B., Micijevic, A., and Mathew, F. 2015. Pathogenicity of *Diaporthe* species infecting soybeans (*Glycine max* L.) in South Dakota. Phytopathology 105:S4.103.

2. Posch, J., Varenhorst, A., and Mathew, F. 2015. Interaction between soybean cyst nematode and stem canker pathogens. 11th Annual Ag Outlook conference and tradeshow, South Dakota Soybean Association, Sioux Falls, SD. December 10, 2015 (Poster).
3. Okello, P., Singh, A., and Mathew, F. 2015. Evaluation of soybean germplasm for resistance to *Fusarium proliferatum*. 11th Annual Ag Outlook conference and tradeshow, South Dakota Soybean Association, Sioux Falls, SD. December 10, 2015 (Poster).
4. Chowdhury, R., Byamukama, E., and Mathew, F. 2015. *Phytophthora sojae* pathotypes occurring in South Dakota. 11th Annual Ag Outlook conference and tradeshow, South Dakota Soybean Association, Sioux Falls, SD. December 10, 2015 (Poster).
5. Hernandez-Perez, O., and Byamukama, E. 2015. Tillage effect on population densities of Heterodera glycines in the United States: A review. CSSA/SSA/ASA Annual Meeting, Minneapolis MN.
6. Acharya, K., Byamukama, E. and Tylka, G. Determination of Heterodera glycines types for improved soybean cyst nematode management in South Dakota. APS Meeting, Pasadena, CA.
7. Acharya K., Byamukama, E. and Tylka, G. 2015. Greenhouse assessment of commercial soybean cultivar for resistance against Popular H. glycines populations of South Dakota. Ag Outlook Conference, Sioux Falls, SD.

Proceedings of Conferences

1. Mathew, F., Okello, P., Gebreil, A., and Deneke, D. 2015. Survey of fungal diseases in commercial soybean fields in South Dakota. Proceedings of the 8th International Integrated Pest Management Symposium. Salt Lake City, UT. March 23-26th, 2015 (Poster).
2. Gebreil, A., Micijevic, A., Weber, A., and Mathew, F. 2015. Characterization of *Diaporthe* species infecting soybeans (*Glycine max* L.) in South Dakota. Proceedings of the 100th Anniversary Meeting of South Dakota Academy of Science, Oacoma, SD (In press).

Extension/Outreach publications

1. Mathew, F. 2015. Sudden death syndrome appearing in South Dakota soybeans. The Soybean Leader Magazine. January/February 2015.
2. Tenuta, A., Bradley, C., Chilvers, M., Geisler, L., Mathew, F., Mueller, D., Smith, D., and Wise, K. 2015. Scouting for common soybean seed diseases. Crop Management Network CPN-1001.
3. Wise, K., Bradley, C., Chilvers, M., Geisler, L., Mathew, F., Mueller, D., Smith, D., and Tenuta, A. 2015. Scouting for soybean stem diseases. Crop Management Network CPN-1002.
4. Wise, K., Bradley, C., Chilvers, M., Geisler, L., Mathew, F., Mueller, D., Smith, D., and Tenuta, A. 2015. Stem canker. Crop Management Network CPN-1006.
5. Mueller, D., Bradley, C., Chilvers, M., Geisler, L., Mathew, F., Smith, D., Tenuta, A., and Wise, K. 2015. Pod and stem blight and Phomopsis seed decay. Crop Management Network CPN-1007.

6. Johnson O. P., Deneke, D. L., Rosenberg, M., Vos, D., Alms, J., Wrage, L. J., Szczepaniec, A., Bachman, Byamukama, E., and Ruden, K. 2015. 2015 South Dakota Pest Management Guide- Soybeans. SDSU Extension Service-iGrow. 83 p.
7. Strunk, C. and Byamukama, E. 2015. Be on the lookout for seedling diseases. Published 5/22/2015. http://igrow.org/agronomy/corn/be-on-the-lookout-for-seedling-diseases
8. Byamukama, E., Tande, C., Okello, P., and Mathew, F. 2015. Root rots developing in some corn fields. Published on 6/25/2015. Online http://igrow.org/agronomy/corn/root-rots-developing-in-some-corn-fields/
9. Strunk, C. and Byamukama, E. 2015. Differentiating between Phytophthora root rot and stem rot. Published 8/6/2015. Online http://igrow.org/agronomy/soybeans/differentiating-between-phytophthora-root-stem-rot-and-stem-canker/
10. Byamukama, E. and Strunk, C. 2015. Soybean diseases update. Published 7/23/2015. Online http://igrow.org/agronomy/soybeans/soybean-diseases-update/
11. Byamukama, E. and Acharya, K. 2015. Assess soybeans for the soybean cyst nematode. Published 7/23/2015. http://igrow.org/agronomy/corn/assess-soybeans-for-the-soybean-cyst-nematode/
12. Byamukama, E. 2015. Brown stem rot showing up in some soybean fields. Published 9/10/2015. http://igrow.org/agronomy/soybeans/brown-stem-rot-showing-up-in-some-soybean-fields/
13. Byamukama, E. and Strunk, C. 2015. Corn and soybean disease update: stem rots and Goss's wilt increasing. Published 9/3/2015. http://igrow.org/agronomy/soybeans/corn-soybean-disease-update-stem-rots-and-gosss-wilt-increasing/

Tennessee

Heather M. Kelly, Extension/Research Plant Pathologist, University of Tennessee

University of Tennessee personnel involved in soybean disease extension and research: Heather M. Kelly, Scott D. Stewart, Angela McClure, Jamie Jordan, Wesley Crowder, Ryan Blair, and over a dozen county agents

USDA-ARS personnel involved (collaborations): Prakash Arelli, Alemu Mengistu, Jason Deffenbaugh, Chris Street, and Barbara Michaud

In Tennessee a total of 1.75 million acres of soybeans were planted in 2015 with 1.72 million acres harvested. A total of 79.12 million bushels produced with an average of 46 bu/a. Harvested acreage and production was up 110,000 acres and 5.06 million bushels from 2014, respectively. Statewide average yield was the same in 2014.

Due to a wet spring some full season plantings were delayed or replanted in May and June, closer to the same planting time as soybean planted after wheat in the state. Some fields that did get planted on time had slightly reduced stands due to seedling diseases. In general, weather conditions throughout the season were conducive for good yields and foliar disease development in soybean. Dependent upon cultivar planted, there were low to severe levels of frogeye leaf spot and septoria brown spot throughout the season. Very little sudden death syndrome and southern stem canker was reported in the state. Soybean cyst nematode continued to be confirmed throughout the state through samples submitted. Late season diseases that had minimal impact on yield included anthracnose, cercospora leaf blight/purple seed stain, and diaporthe/phomopsis seed rot complex.

Impact Statements

1. Organized and evaluated soybean sentinel plots to monitor and test *Cercospora sojina* (frogeye leaf spot) disease and QoI fungicide resistant levels across the state
2. Evaluated over 70 commercial varieties in severe, moderate, and low disease pressure locations for foliar diseases and response to fungicide
3. Conducted fungicide efficacy trials on frogeye leaf spot used to update the soybean fungicide table curated by this group
4. Participated in multi-state trials on frogeye leaf spot and cercospora leaf blight evaluating fungicide products and application timings
5. Continued research trials investigating influence of different sources of inoculum and tillage on frogeye leaf spot development
6. Conducted greenhouse competition studies between QoI fungicide resistant and sensitive *Cercospora sojina* (frogeye leaf spot)

7. Held hands on training for disease identification and showcased fungicide efficacy trials at Soybean Disease Field day at the Research and Education Center in Milan

Research Publications, Extension Articles, and Videos

Refereed Journals

1. Kelly, H. M., Dufault, N.S., Walker, D. R., Isard, S. A., Schneider, R. W., Giesler, L. J., Wright, D. W., Marois, J. J., and Hartman, G. L. 2015. From select agent to an established pathogen: the response to *Phakopsora pachyrhizi* (Soybean Rust) in North America. Phytopathology 105:905-916. (invited article)
2. Mengistu, A., Kelly, H. M., Arelli, P. R., and Bellaloui, N. 2015. Effects of tillage, cultivar and fungicide on *Phomopsis longicolla* and *Cercospora kukuchii* in soybean. Crop Protection 72:175-181.
3. Kelly, H. M., Wright, D. L., Dufault, N. S., Marois, J. J. 2015. Decision models for fungicide applications for soybean rust. Plant Health Progress 16(2). 1 May 2015. doi:10.1094/PHP-RS-14-0050

Book Chapter

1. Young-Kelly, H. and Dufault, N.S. 2015. Soybean Diseases in North America Chapter In Doenças da Soja - Melhoramento Genético e Técnicas de Manejo (Diseases of Soybean - Genetic Improvement and Management Techniques). (eds E. Lemes, L. Castro, and R. Assis) ISBN - 978-85-7625-329-7

Plant Disease Management Reports

1. Jordan, W. J. and Kelly, H. M. 2015. Field evaluation of maturity group V soybean cultivars to frogeye leaf spot and fungicide in Tennessee, 2014. Plant Disease Management Report. Volume 9, Field Crops Section.
2. Jordan, W. J. and Kelly, H. M. 2015. Field evaluation of late maturity group IV soybean cultivars to frogeye leaf spot and fungicide in Tennessee, 2014. Plant Disease Management Report. Volume 9, Field Crops Section.
3. Jordan, W. J. and Kelly, H. M. 2015. Field evaluation of early maturity group IV soybean cultivars to frogeye leaf spot and fungicide in Tennessee, 2014. Plant Disease Management Report. Volume 9, Field Crops Section.
4. Cochran, A. M. and Kelly, H. M. 2015. Field evaluation of fungicide efficacy on frogeye leaf spot using single and combination FRAC code fungicides, 2014. Plant Disease Management Report. Volume 9, Field Crops Section.
5. Butler, S. A. and Kelly, H. M. 2015. Field evaluation of the influence of droplet size and spray angle on fungicide efficacy in soybean, 2014. Plant Disease Management Report.

Volume 9, Field Crops Section.

6. Butler, S. A. and Kelly, H. M. 2015. Field evaluation of the influence of spray volume and droplet size on fungicide efficacy in soybean, 2014. Plant Disease Management Report. Volume 9, Field Crops Section.

Proceedings at Conferences

1. Kelly, H.M. and Vega, B. 2015. Phenotypic and genotypic characterization of QoI fungicide resistant *Cercospora sojina*. Phytopathology (Nov. issue). Annual American Phytopathological Society Meeting, Pasadena, CA Aug. 2015.
2. Butler, S. A. Young-Kelly, H., and Kruger, G. 2015. Influence of application technology on foliar fungicide efficacy on *Cercospora sojina* infected soybean. Phytopathology (Nov. issue). Annual American Phytopathological Society Meeting, Pasadena, CA Aug. 2015.
3. Cochran, A.M., Jordan, J., Bradley, C.A., K. Lamour, and Kelly, H.M. 2015. Frogeye leaf spot response to solo and combination fungicides. Phytopathology (Nov. issue). Annual American Phytopathological Society Meeting, Pasadena, CA Aug. 2015.
4. Kelly, H.M. and Newman, M.N. 2015. Influence of cultivar, fungicide, and weather on frogeye leaf spot disease and yield in soybean. International Integrated Pest Management Symposium, Salt Lake City, UT March 2015.
5. Kelly, H. M. 2015. QoI Fungicide resistance *Cercospora sojina* update for Mid-South region. NCERA 200/208/137 Soybean Virus, Rust, and Diseases Joint Meeting, Washington, D.C. April 2015
6. Kelly, H. M. and Vega, B. 2015. Challenges and opportunities in the use of molecular tools to detect Strobilurin/QoI fungicide resistance: the case of frogeye leaf spot. Southern Soybean Disease Workers (SSDW) Meeting, Pensacola, FL March 2015
7. Butler, S. A. Young-Kelly, H., and Kruger, G. 2015. Influence of application technology on foliar fungicide efficacy in Cercospora sojina infected soybeans. Phytopathology 105(Suppl. 2):S2.2. Southern Division of American Phytopathological Society Meeting, Atlanta, GA Feb. 2015.
8. Cochran, A.M., Jordan, J., Bradley, C.A., K. Lamour, and Kelly, H.M. 2015. Frogeye leaf spot response to solo and combination fungicides. Phytopathology 105(Suppl. 2):S2.3. Southern Division of American Phytopathological Society Meeting, Atlanta, GA Feb. 2015.

Extension/Outreach presentations

1. DuPont Crop Consultants meeting - Management of FLS in soybean 2/26/2015
2. Missouri Scout School – Plant pathology intro, disease management in wheat, corn, soybean, and cotton 2/10/2015
3. Obion Farm School – Soybean and wheat disease update 2/9/2015
4. West TN Grain Conference – Input values for soybean disease management 2/5/2015

5. East TN Grain Conference – soybean and wheat disease update 1/22/2015
6. KY/TN Grain Conference - Fungicide and Disease Update on Corn and Soybean 1/20/2015
7. Soybean Disease Management Update at 9 county production meetings

Extension/Outreach articles and other activities

1. News.UTcrops.com (newsletter/blog) - Soybean diseases and fungicide considerations 7/21/2015, and Soybean Disease Update 8/30/2015 (578 page views as of October 11, 2015)
2. Kelly, H. 2015. W 343 Soybean Fungicide Efficacy Table. UT Extension Soybean disease management information.
3. Allen, F. L., V. R. Sykes, R. Blair, M. A. McClure, H. M. Kelly. 2015. Soybean Variety Performance Tests in Tennessee, 2015. Contributed disease ratings section.
4. Contributed to article and video on '2015 weather not as favorable for SDS, but it's still around':http://deltafarmpress.com/soybeans/2015-weather-not-favorable-sds-it-s-still-around

Virginia

Hillary Mehl, Extension Plant Pathologist, Virginia Tech

Virginia Tech personnel involved in soybean disease extension and research: Hillary Mehl, Tian Zhou, David Holshouser, Linda-Byrd Masters, Steve Byrum, Ed Hobbs, Kelsey Vasser

Soybean was harvested on 620,000 acres and yields in Virginia averaged 34.5 bu/A, or 7.5 bu/A below the record high for soybean in 2012. Nematodes including soybean cyst, southern root-knot, sting, stubby root, and stunt nematodes contributed to yield loss. Frogeye leaf spot and Cercospora blight were the most prevalent foliar diseases and may have caused yield losses where outbreaks occurred during seed development and up to full pod (R6). However, overall levels of foliar disease in the Virginia soybean crop were low in 2015 due to dry conditions during July and August. However, seed rot and other seedborne diseases resulted in significant quality losses due to heavy rains following maturity of the soybean crop. Severe outbreaks of stem canker occurred in certain fields where susceptible varieties were planted. Charcoal rot was also confirmed throughout the state in fields where drought stress occurred.

Impact Statements

1. Conducted small plot research on foliar diseases and nematodes impacting soybean in Virginia.
2. Initiated a survey for QoI resistant *Cercospora sojina* in the mid-Atlantic region (NC/VA/DE).
3. Conducted on-farm trials to validate a weather-based decision aid for soybean foliar fungicide applications.
4. Disseminated soybean disease management data to growers through local meetings and through Extension publications and websites.

Research Publications, Extension Articles, and Videos

Abstracts

1. Mehl, H. L., Zhou, T. and Holshouser, D. 2015. Development and optimization of a weather-based decision aid for soybean foliar fungicide applications in Virginia. American Phytopathological Society Annual Meeting, Pasadena, CA.

2. Zhou, T., Holshouser, D., Phipps, P. M. and Mehl, H. L. 2015. Validation and optimization of a weather-based soybean foliar fungicide application advisory for soybean in Virginia. APS Potomac Division Meeting, Rehoboth Beach, DE.

Published Reports

1. Zhou, T., Byrd-Masters, L., and Mehl, H. L. 2016. Evaluation of foliar fungicide for control of common foliar diseases in soybean, 2015. Plant Disease Management Reports 10:FC136.
2. Zhou, T., Byrd-Masters, L., and Mehl, H. L. 2016. Evaluation of application timings of foliar fungicide for control of common fungal diseases in soybean, 2015. Plant Disease Management Reports 10:FC137.

Extension/Outreach publications/blogs/web articles

5. Mehl, H. L., Kleczewski, N. and Johnson, C. S. 2016. Disease and Nematode Management in Field Crops. In Pest Management Guide: Field Crops, 2016. D. A. Herbert, Coordinator. Virginia Tech and Virginia Cooperative Extension. Publication 456-016 (ENTO-70P).
6. Mehl, H. L. 2016. Applied Research on Field Crop Disease Control 2015. Virginia Tech and Virginia Cooperative Extension.
7. Mehl. H. L. 2015. Soybean disease updated – frogeye leaf spot. Virginia Ag Pest and Crop Advisory Blog (http://blogs.ext.vt.edu/ag-pest-advisory/) – August 21.
8. Mehl, H. L. 2015. Foliar fungicide applications in soybean. Virginia Ag Pest and Crop Advisory Blog (http://blogs.ext.vt.edu/ag-pest-advisory/) – August 20.

Wisconsin

Damon Smith, Extension Plant Pathologist, University of Wisconsin-Madison

University of Wisconsin-Madison personnel involved in soybean disease extension and research: Shawn Conley, Carol Groves, Scott Chapman, John Gaska, Brian Hudelson, Ann MacGuidwin, Quinn Watson, Chris Bloomingdale, Jaime Wilbur, Megan Mccaghey

Wisconsin Department of Agriculture, Trade and Consumer Protection personnel involved in soybean disease research: Anette Phibbs and Adrian Barta

Wisconsin saw 1.9 million acres of soybeans planted in 2015, which was an all-time record. However, the state is ranked #16 in the country for soybean production. The soybean crop was established on time and the season was very conducive for soybean growth and production. Record yields of 50 bu/a were 6 bu/a higher than 2014 and just shy of the all-time record of 50.5 bu/a.

Disease continue to be a significant yield-reducer in Wisconsin. Better than 92% of the acreage is infested with SCN. The state plant pathology lab will stop sampling for SCN as we move forward in 2016. In 2015, stem disease were of significant concern. White mold has continued to be the number 1 stem disease in the state and was found throughout much of the soybean production area. In addition to white mold, stem canker and pod and stem blight have increased. These diseases caused lots of confusion for growers because many fields suffered from these diseases and white mold. Other disease included brown stem rot and Phyllosticta leaf spot. Virus issues were fairly minimal, however, 12% of field sampled tested positive for *Aflalfa mosaic virus* and *Soybean dwarf virus,* While 6% tested positive for *Soybean vein necrosis virus.*

Impact Statements

1. Worked as a collaborator in the multistate group, Crop Protection Network, to generate a suite of soybean disease identification and management publications
2. Developed a pilot white mold fungicide decision tool based on a prediction model for apothecial development. This tool will be piloted in the field in 2016.
3. Soybean germplasm line with a high level of white mold resistance have been developed and field-tested. The lines are being used for further breeding of elite, commercial cultivars.

Research Publications, Extension Articles, and Videos

Refereed Journals

1. Piotrowski, J., Okada, H., Lu, F., Li, S., Ranjan, A., Smith, D., Higbee, A., Ulbrich, A. Coon, J., Deshpande, R., Bukhman, Y., McIIwain, S., Ong, I., Myers, C. Boone, C., Landick, R., Ralph, J., Kabbage, M., Ohaya, Y. 2015. The plant derived, antifungal agent poacic acid

targets β-1,3-glucan. PNAS www.pnas.org/cgi/doi/10.1073/pnas.1410400112.

2. Kandel Y. R., Bradley, C. A., Wise, K. A., Chilvers, M. I., Tenuta, A. U., Davis, V. M., Esker, P. D., Smith D. L., Licht M. A. and Mueller, D. S. 2015. Effect of glyphosate application on sudden death syndrome of glyphosate-resistant soybean under different field conditions. Plant Dis. 99:347-354.

Abstracts

1. Bloomingdale, C., Groves, R.L., and Smith, D.L. 2015. Seasonal occurrence of thrips species prevalent in soybean and the economic impact of *Soybean vein necrosis virus* in Wisconsin. Phytopathology 105:S4.16.
2. Ranjan, A., Smith, D.L., and Kabbage, M. 2015. Soybean respiratory burst oxidase homologs are required for white mold disease development. Phytopathology 105:S4.116.
3. Willbur, J.F., Lucas, H., Kabbage, M., and Smith, D.L. 2015. Development of a predictive model for *Sclerotinia sclerotiorum* apothecial development to control white mold in soybean fields. Phytopathology 105:S4.148.

Videos

1. *Soybean vein necrosis virus*. 2015. Invited webinar recording. Pest Management Network, Focus on Soybean series http://www.plantmanagementnetwork.org/edcenter/seminars/soybean/SoybeanVeinNecrosisVirus/.

Extension/Outreach publications

1. Watson, Q. and Smith, D.L. 2015. Fact Sheet: XGT1018 – Sclerotinia stem rot of soybean. UW Extension - Cooperative Extension Service. University of Wisconsin.
2. Davis, V., Jensen, B., Nice, G., Renz, M., and Smith, D.L. 2015. A3646 – Pest Management in Wisconsin Field Crops. UW Extension - Cooperative Extension Service. University of Wisconsin.
3. Tenuta, A., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., Smith, D.L., and Wise, K. 2015. Fact Sheet: CPN1001A – Scouting for common soybean seed diseases: Scouting card. Crop Protection Network.
4. Tenuta, A., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., Smith, D.L., and Wise, K. 2015. Fact Sheet: CPN1001B – Scouting for common soybean seed diseases: Full-length publication. Crop Protection Network.
5. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., Smith, D.L., and Tenuta, A. 2015. Fact Sheet: CPN1002A – Scouting for soybean stem diseases: Scouting card. Crop Protection Network.

6. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Sisson, A., Smith, D.L., and Tenuta, A. 2015. Fact Sheet: CPN1002B – Scouting for soybean stem diseases: Full-length publication. Crop Protection Network.
7. Bloomingdale, C., Bradley, C., Chilvers, M., Giesler, L., Groves, R., Mueller, D., Smith, D.L., Tenuta, A., and Wise, K. 2015. Fact Sheet: CPN1003 – Soybean vein necrosis virus. Crop Protection Network.
8. Smith, D.L., Chilvers, M., Dorrance, A., Hughes, T., Mueller, D., Niblack, T., and Wise, K. 2015. Fact Sheet: CPN1004 – Charcoal rot. Crop Protection Network.
9. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Mueller, D., Smith, D.L., and Tenuta, A. 2015. Fact Sheet: CPN1006 – Stem canker. Crop Protection Network.
10. Mueller, D., Bradley, C., Chilvers, M., Giesler, L., Mathew, F., Smith, D.L., Tenuta, A., and Wise, K. 2015. Fact Sheet: CPN1007 – Pod and stem blight and Phomopsis seed decay. Crop Protection Network.
11. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A., Sisson, A., Smith, D.L., Tenuta, A., and Young-Kelly, H. 2015. Fact Sheet: CPN1008 – Soybean seedling diseases. Crop Protection Network.
12. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A., Sisson, A., Smith, D.L., Tenuta, A., and Young-Kelly, H. 2015. Fact Sheet: CPN1009A – Scouting for soybean seedling diseases and disorders: Scouting card. Crop Protection Network.
13. Wise, K., Bradley, C., Chilvers, M., Giesler, L., Johnson, B., Legleiter, T., Licht, M., Mueller, D., Noveroske, A., Sisson, A., Smith, D.L., Tenuta, A., and Young-Kelly, H. 2015. Fact Sheet: CPN1009B – Scouting for soybean seedling diseases and disorders: Full-length publication. Crop Protection Network.
14. Mueller, D., Bradley, C., Chilvers, M., Giesler, L., Sisson, A., Smith, D.L., Tenuta, A., and Wise, K. 2015. CPN1010A – Scouting for white mold in soybean: Scouting card. Crop Protection Network.
15. Mueller, D., Bradley, C., Chilvers, M., Giesler, L., Sisson, A., Smith, D.L., Tenuta, A., and Wise, K. 2015. CPN1010B – Scouting for white mold in soybean: Full-length publication. Crop Protection Network.
16. Smith, D.L. 2015. Fungicide efficacy tables updated for 2015. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – April 15.
17. Smith, D.L. 2015. Time to consider your white mold in-season management plan. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – June 24.
18. Smith, D.L. 2015. Mid-season soybean issues in Wisconsin. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – July 29.
19. Smith, D.L. 2015. What should you know about corn and soybean diseases as you prepare for harvest? Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – September 16.
20. Smith, D.L. 2015. 2015 Wisconsin field crops pathology fungicide tests summary now available. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – December 15, http://fyi.uwex.edu/fieldcroppathology/files/2015/12/2015-Fungicide-Test-Summary.V2.pdf.

21. Wisconsin Best Management Practices Guide for Soybean. 2015. Edited by Conley, S.P., and Smith, D.L. Published by the United Soybean Board.
22. Marburger, D., Conley, S., Gaska, J., Gerber, L., MacGuidwin, A., and Smith, D.L. 2015. The Relationship between the Causal Agent of SDS and SCN in Wisconsin. Soy Sentinel. Vol. 12. No. 2.