

NC1197: Practical management of Nematodes on Corn, Soybeans and Other Crops of Regional Importance.
Meeting Minutes
June 20-21, 2022, Lincoln, NE

The 2022 meeting was held in-person and in conjunction with the NCERA-137 Soybean Diseases Committee immediately prior to the North Central Division of the American Phytopathological Society's meeting in Lincoln, Nebraska hosted by the Department of Plant Pathology at the University of Nebraska-Lincoln.

JOINT SESSIONS between NCERA-137 and NC-1197

June 20, 2022:

- 1:00 - 1:30 - Introductions
- 1:30 - 1:45 - USB update (Jackie Weiss)
- 1:45 - 2:00 - Crop Protection Network update (Kiersten Wise)
- 2:00 - 2:15 - NCIPM Center update (Daren Mueller)
- 2:15 - 2:45 - SCN/SDS seed treatment summary (Kaitlyn Bissonnette)
- 2:45 - 3:00 - Break
- 3:00 - 3:45 - Pattern Ag update on PCR soil sampling (Danielle Watts)
- 3:45 - 4:00 - Discussion

June 21, 2022:

- 8:00 - 8:15 - Welcome
- 8:15 - 8:30 - SCN Coalition update (Sam Markell)
- 8:30 - 9:00 - Digital phenotyping and soybean breeding updates - Danny Singh
- 9:00 - 9:30 - Overview of machine learning applications in plant stress phenotyping - Arti Singh
- 9:30 - 9:45 - Break
- Separate committee meetings after break

NC-1197 MEETING JUNE 21, 2022

The meeting started at 10 am, with the host Tamra Jackson-Ziems welcoming everyone to Lincoln and thanking them for attending. Self-introductions followed:

Attendance:

Kaitlyn Bissonnette - Cotton Incorporated
Jefferson Barizon - University of Missouri
Monica Pennewitt - Iowa State University
EB Wlezien - Iowa State University
Greg Tylka - Iowa State University
Haddish Melakeberhan - Michigan State University

Guiping Yan - North Dakota State University
Tim Todd - Kansas State University
Carl Bradley - University of Kentucky
Tamra Jackson-Ziems - University of Nebraska

Marty Draper, Project Administrative Advisor addressed attendees. He thanked the committee for choosing to conduct an in-person meeting that helps to address past criticisms on evaluations for hosting online meetings only. The Appropriations cycle is frozen with the split in Congress, but he feels optimistic for future AFRI appropriations.

STATE REPORTS: Presentations and slide sets were shared from attendees and other committee members summarizing their work:

- Iowa State University's Greg Tylka described the evaluations his team conducted of soybean varieties resistant to SCN in Iowa at 9 locations. The full report of those results can be viewed at www.isuscntrials.info. He also shared yield results from 2014-2021 SCN x seed treatment field experiments. Assuming costs were \$8-\$25/acre and price of soybeans \$9-\$17/bushel, the break even yield increase was 1-3 bushels/acre. They also conducted microplot experiments with combinations of SCN resistance gene stacks in continuous planting and rotations to assess population densities and virulence. The number of SCN resistance lines have increased dramatically to >800 from 1991 to 2021 and can be viewed at store.extension.iastate.edu
- Tim Todd of Kansas State University described an alfalfa cyst nematode (CAN – *Heterodera medicaginis*) survey he led across Kansas. In that survey they also estimated population densities of root-lesion nematode in 57% of alfalfa samples (vs 95% in corn and 77% in wheat, historically). He also described a recent JON paper published describing new species *Pratylenchus smoliki* in the Great Plains region and its characteristics relative to other *Pratylenchus* spp. Tim Todd shared data on female indices of *H. medicaginis* and *H. glycines* on alfalfa, hairy vetch, pea, soybean, and vetch.
- Carl Bradley shared the report from his work and that of colleague Kiersten Wise at the University of Kentucky. He reported that SCN was confirmed in 84% of the approx. 300 samples from Kentucky fields between 2018-2021. He also reported on the devastation of their farm and lab facilities that have negatively impacted their research capacities and plans to rebuild.
- Haddish Melakeberhan reported on his lab team's work from Michigan State University. He reported on PhD student, Isaac Lartey's thesis work on northern RKN distribution and soil health conditions and microbiome conditions. He also described the effects crop production practices on nematodes, nutrient cycling, and soil health. Finally, he described their lab's development and dissemination of research-based information on soil health management, including biological, physiochemical, nutritional, structural and water holding integrity and the challenges of the work. He stated that currently, it is "information rich, but (with) limited integrated practical knowledge." He described 6 physical indicators of soil health, including microbial community diversity, including nematode indices. He indicated that nematode community analysis-based models can be integration platforms. He described how the models use the

changes in nematode population dynamics, including the Soil Food Web (SFW), Fertilizer Use Efficiency (FUE), The Integrated Productivity Efficiency (IPE). These models are decision-making tools and foundations toward step-by-step integration and alignment of different ecosystem services and soil health indicators.

- Kaitlynn Bissonnette shared a summary of the multi-state SCN-SDS nematode protectant trials from her time at University of Missouri. There were a total of 51 site years in 13 states and 1 province across the 3 years. Seed were moderately susceptible to SDS and had PI 88788 SCN source of resistance from Maturity Groups 2-4. Treatments were nontreated seed, a base set of treatments, and others with Aveo, BioST, Clariva, ILeVO, Saltro, or Trunemco. Results are being summarized in a manuscript for publication. She also described a free SCN sample processing effort in Missouri in 2020 and 2021. There were 72 samples collected from 17 counties and 41 samples from 10 counties, respectively. Samples averaged 11,711 and 19,781 eggs per 250 cm³ respectively in the two years with the highest population densities of 90,500 and 110,250 eggs/250 cm³. In 2022, 76 more samples were collected in the spring from corn and soybean fields.
- Tamra Jackson-Ziems described some of the work being done in Nebraska. She received funding and more than 200 samples from Bayer Crop Science from 6 states to work on crown rot disease in corn. Objectives include investigation into the pathogen species collected from symptomatic corn plants. Testing includes comparison of plant parasitic nematodes from the soil from neighboring symptomatic vs. asymptomatic plants to test for potential interactions. In addition, her lab continues to test the efficacy of seed treatment nematicides on nematode population densities and yield. A new Extension Soybean Pathologist was hired in 2022, Dylan Mangel, and refills Loren Giesler's former position. Dylan has already begun some research on SCN in the state, as well as Extension programming and will contribute to the committee's objectives in the future. The UNL Plant & Pest Diagnostic Clinic, led by Kyle Broderick, continues to offer free sample processing for SCN for Nebraska samples with support from the Nebraska Soybean Board.
- Guiping Yan from North Dakota State University reported results from their SCN resistance evaluations (both soybean and dry bean) versus HG type 2.5.7. In addition, there appeared to be differences in performance of soybean varieties to *P. dakotaensis*. She also described use of new, early detection and temporal dynamics of *P. scribneri* in potato roots with QPCR and root staining. Guiping also described work they are conducting on SCN and *P. penetrans* versus cover crops in micropolots, including cover crops' impact on hatching and root penetration. Finally, she described genome and transcriptome studies on *Pratylenchus scribneri* associated with corn, where she's using it to compare responses of corn lines to *P. scribneri* and identifying parasitism genes.
- Emmanuel Byamukama and Febina Mathew's work in South Dakota was described, as well. They evaluated 7 seed treatment nematicides in 2021 on a susceptible soybean cultivar, but saw no significant differences in yield between treatments. In addition, they also initiated a study to investigate the potential interaction of SCN x *Phytophthora sojae*. Results suggested that the presence of SCN influenced lesion length in pathotype PS-15-TF3, but that SCN population was

reduced by complex and simple pathotypes. These results imply that using SCN and *P. sojae* resistant cultivars can manage the disease complex and reduce soybean yield loss. Finally, South Dakota State University is providing free SCN testing through state soybean check-off funding. Extension and outreach efforts have created awareness of SCN in SD Extension meetings to >700 attendees. They are also organizing summer field days to discuss SCN management strategies.

- An MacGuidwin, University of Wisconsin, shared results of studies global ordinal regression models used to predict 6 categories of *P. penetrans* within a field sampled in 60 locations. Models predicted *P. penetrans* relative population densities (L, M, H) based on % sand composition of soil, Zn, and Mg levels, especially for low and high levels. N, K, Mn, Ca, Fe, Mo, pH, and EC_a also had interactions with % sand x pH, Zn, K, Mo; N x Cu; and altitude x Fe. She also shared historic data of *Pratylenchus* species and *P. penetrans* from soybean fields in 9 regions of Wisconsin 2013-2016 and their impact on yield. Results from maximum likelihood estimates and confidence limits from general estimate equation models for relative yield loss and impacts on yield components showed impacts on number of pods per plant, seed number per plant, seed number per pod, seed mass, and total yield loss.
- Shahid Siddique provided results from pathogen effector work done at the University of California at Davis conducted by computation prediction based on N-terminal signal domain and the lack of transmembrane domain. Additional criteria identify effectors as RXLR motifs in Oomycetes. They used 99 putative secretory proteins possessing signal peptides, but lacking TM to identify effectors. Twenty-six effectors with unknown functions were identified, having no domain except signal peptide. They were conserved across all cyst nematode species but absent in all other nematodes. They're using functional genomic tools to understand gene and protein function, such as RNAi and CRISPR. Current challenges include the lack of effective tools for determining the function of genes and the gene products in plant parasitic nematodes.

Business meeting followed:

Request to add to the email list:

- Mandy Bish, University of Missouri, bishm@missouri.edu
- Jefferson Barizon, University of Missouri, ?
- Horacio Lopez-Nicora, The Ohio State University, lopez-nicora.1@osu.edu

Haddish Melakeberhan at Michigan State University agreed to host the 2023 meeting.

Quiping Yan was elected as 2023 Chair.

Carl Bradley was elected as 2023 Secretary and will be chair 2024.

Meeting closed at 12:05 pm, June 21, 2022.

NC-1197 NEMATODE WORKSHOP JUNE 21, 2022

The NC-1197 Nematode Workshop was hosted by Tom Powers and Peter Mullin on Tuesday afternoon June 21 at 1:30-5:00 pm at the University of Nebraska East Campus. The Workshop was offered to NC-1197 and NCERA-137 committee members and others attending the North Central Division APS attendees. The focus of the workshop was "Microscopic Adventures: A Hands-on Dive into the Nematode Species of the Corn/Soybean Soil Community to appeal to members of both committees and attendees at the NC-APS meeting. The 3-hour workshop provided an opportunity to explore the plant-parasitic nematodes and other commonly encountered trophic groups in the soils of the Great Plains. The workshop featured a field guide and poster to participants featuring images of enlarged common plant parasitic nematode genera to help sort through the murky depths of nematode diversity. Transportation was provided from The Graduate Hotel to UNL East Campus.

A second, earlier nematode identification workshop was planned for Monday morning for NC-1197 members. Due to low enrollment, the first workshop was cancelled and the two workshops were consolidated into a single workshop held Tuesday afternoon.