**Project/Activity Number:** NC1197

**Project/Activity Title:** Practical Management of Nematodes on Corn, Soybeans and Other Crops of Regional Importance

**Period Covered:** 08/03/2019-08/04/2020

**Annual Meeting Date:** 08/04/2020

**Participants:** Andrew Bent, Kaitlyn Bissonnette, Carl Bradley, Emmanuel Byamukama, Senyu Chen, Haddish Melakeberhan, Marisol Quintanilla, Chris Taylor, Tim Todd, Greg Tylka, Guiping Yan, Lei Zhang

**Brief summary of minutes of annual meeting:** Uploaded separately

**Accomplishments:** Plant-parasitic nematodes (PPNs) comprise a major constraint to crop production in the north-central region and beyond. The NC1197 multistate group is assessing strategies for the control of PPNs. Special attention is given to plant-parasitic nematodes of corn and soybean.

**Short-term outcomes:**

None at this time.

**Outputs:**

* Twenty-seven peer reviewed publications, nineteen Extension articles, and one book chapter published on the biology and management of PPNs.

**Activities:**

* Over 1,500 commercial and breeding soybean lines were tested for resistance to the soybean cyst nematode (SCN). SCN resistance was also determined in approximately 400 perennial *Glycine* spp. and common bean lines.
* Surveys of SCN field populations for virulence to sources of resistance were conducted.
* Long-term tillage and rotation experiments were conducted to determine the effect of agronomic practices on SCN and root-knot nematode populations.
* Nine different seed-treatments with putative protective effects against PPNs were evaluated in field, greenhouse, and microplot trials.
* Experiments evaluated cover crops for the control of and potential host status for PPNs.
* New molecular techniques leading to easier diagnosis of PPNs are being developed.

**Milestones:**

In year four of this five year project, we continue to communicate best practices for PPN control to stakeholders and maintain an active research program to evaluate new commercial products for efficacy.

**Impacts:** The NC1197 research team coordinates research strategies within the north-central region to develop strategies for the control of plant-parasitic nematodes. Information gleaned from research efforts allows growers to increase profitability. For example, characterization of soybean varieties for resistance against SCN allows growers to minimize potential losses to this devastating pathogen. Activities from the NC1197 have directly led to the formation of the SCN Coalition (<https://www.thescncoalition.com/>), a diverse group of University researchers, Extension specialist, and industry representatives that provide research-based information to growers on the management of SCN. The SCN Coalition includes 10 NC1197 members as PIs or Co-PIs and has been funded through support from industry, the North Central Soybean Research Program, and the United Soybean Board.

**Refereed Publications:**

1. Acharya, K., Yan, G. P**.**, and Berti, M. 2019. Can winter camelina, crambe, and brown mustard reduce soybean cyst nematode populations? Industrial Crops & Products 140: 1-6. https://doi.org/10.1016/j.indcrop.2019.111637.
2. Arora, D., Yan, G. P., and Baidoo, R. 2020. Developing a real-time PCR assay for direct detection and quantification of *Pratylenchus scribneri* in field soil. Nematology 22:733-744.
3. Basnet, P., Clay S. A., and Byamukama, E. 2019. Determination of weed hosts of soybean cyst nematode in South Dakota. Weed Tech. 34:377-382.
4. Bissonnette, K.M., C.C. Marett, M.P. Mullaney, G.D. Gebhart, P. Kyveryga, T. Mueller, and G.L. Tylka. 2020. Effects of Ilevo seed treatment on *Heterodera glycines* reproduction and soybean yield in small-plot and strip trial-experiments Iowa. Plant Disease <https://doi.org/10.1094/PDIS-06-19-1132-RE>
5. Chen, S. 2020. Dynamics of population density and virulence phenotype of the soybean cyst nematode as influenced by resistance source sequence and tillage. Plant Disease 104:2111-2122. https://doi.org/10.1094/PDIS-09-19-1916-RE.
6. Chowdhury, I. A. Yan, G. P. and Friskop, A. 2019. Occurrence of vermiform plant-parasitic nematodes in North Dakota corn fields and impact of environmental and soil factors. Canadian Journal of Plant Pathology, DOI: 10.1080/07060661.2019.1674384.
7. Haarith, D. Bushley, K.E., and Chen, S. 2020. Fungal communities associated with Heterodera glycines and their potential in biological control: A current update. Journal of Nematology 52: 10.21307/jofnem-2020-022.
8. Haarith D., Kim, D.G., Strom, N.B., Chen, S., and Bushley, K.E. 2020. In vitro screening of a culturable soybean cyst nematode cyst mycobiome for potential biological control agents and biopesticides. Phytopathology 110:1388-1397.
9. Haarith, D., Hu, W. M., Kim, D. G., Showalter, D. N., Chen, S. Y., and Bushley, K. E. 2019. Culturable mycobiome of soya bean cyst nematode (Heterodera glycines) cysts from a long-term soya bean-corn rotation system is dominated by Fusarium. Fungal Ecology 42: doi.org/10.1016/j.funeco.2019.08.001.
10. Harbach, C.J., E. Wlezien, and G.L. Tylka. A mechanistic approach to assessing the potential for cover crops to serve as trap crops for the soybean cyst nematode. Plant Disease https://doi.org/10.1094/PDIS-05-20-0964-RE
11. Hu, W. M., Strom, N., Haarith, D., Chen, S. Y., and Bushley, K. E. 2019. Seasonal variation and crop sequences shape the structure of bacterial communities in cysts of soybean cyst nematode. Frontiers in Microbiology 10:article 2671. doi.org/10.3389/fmicb.2019.02671
12. Hu, W., Kidane, E., Neher, D. A., and Chen, S. 2019. Field and greenhouse evaluations of soil suppressiveness to Heterodera glycines in the Midwest corn-soybean production systems. Journal of Nematology 51: DOI: 10.21307/jofnem-2019-032.
13. Huang, D., Yan, G. P**.**, Gudmestad, N., and Whitworth, J. 2019. Assessment of factors associated with molecular quantification of stubby root nematode *Paratrichodorus allius* from field soil DNA. Plant Disease 103:3265-3273.
14. Hung X.B., Hadi B.A.R., Oliva R., and N.E. Schroeder. 2020. Beneficial bacterial volatile compounds for the control of root-knot nematode and bacterial leaf blight on rice. Crop Protection. 135: 104792
15. Kawal, U., C. Legner, E. Wlezien, G. Tylka, and S. Pandey. 2019. New methods of cleaning debris and high-throughput counting of cyst nematode eggs extracted from field soil. PLoS ONE 14(10): e0223386. <https://doi.org/10.1371/journal.pone.0223386>
16. Ozbayrak, M., T. Todd, T. Harris, R. Higgins, K. Powers, P. Mullin1, L. Sutton and T. Powers. 2019. A CO1 DNA Barcoding Survey of *Pratylenchus* Species in the Great Plains Region of North America. Journal of Nematology e2019-81 | Vol. 51, DOI: 10.21307/jofnem-2019-081
17. Ravelombola, W. S., Qin, J., Shi, A., Nice, L., Bao, Y., Lorenz, A., Orf, J. H., Young, N. D., and Chen, S. Y. 2019. Genome-wide association study and genomic selection for soybean chlorophyll content associated with soybean cyst nematode tolerance. BMC Genomics 20:Article 94. DOI: 10.1186/s12864-019-6275-z.
18. Ravelombola, W. S., Qin, J., Shi, A., Nice, L., Bao, Y., Lorenz, A., Orf, J. H., Young, N. D., and Chen, S. Y. 2020. Genome-wide association study and genomic selection for tolerance of soybean biomass to soybean cyst nematode infestation. Plos One: doi.org/10.1371/journal.pone.0235089.
19. Ravelombola, W., Shi, A., Chen, S., Xiong, H., Yang, Y., Cui, Q., Olaoye, D., and Mou, B. 2020. Evaluation of cowpea for drought tolerance at seedling stage. Euphytica 216, 123. https://doi.org/10.1007/s10681-020-02660-4.
20. Sakai, K., Handoo, Z. A., and MacGuidwin, A. E. 2019. First report of the root-lesion nematode, *Pratylenchus fallax*, on soybean in Wisconsin, U.S.A. Plant Disease 103: 2141
21. Sakai, K., and MacGuidwin, A. E. 2019. First report of the root-lesion nematode, *Pratylenchus alleni*, on soybean in Wisconsin, U.S.A. Plant Disease 103:2141.
22. Saikai, K., and MacGuidwin, A. 2020. Difference in lesion formation by male and female *Pratylenchus penetrans*. Journal of Nematology (in press).
23. Strom, N., Hu, W. M., Harrith, D., Chen, S. Y., and Bushley, K. E. 2019. Continuous monoculture shapes root and rhizosphere fungal communities of corn and soybean in soybean cyst nematode-infested soil. Phytobiome Journal 3:300-314. doi.org/10.1094/PBIOMES-05-19-0024-R
24. Strom, N., Hu, W. M., Harrith, D., Chen, S. Y., and Bushley, K. E. 2020. Interactions between soil properties, fungal communities, the soybean cyst nematode, and crop yield under continuous corn and soybean monoculture. Applied Soil Ecology 147: doi.org/10.1016/j.apsoil.2019.103388.
25. Strom, N., Hu, W. M., Harrith, D., Chen, S. Y., and Bushley, K. E. 2020. Corn and soybean host root endophytic fungi with toxicity towards the soybean cyst nematode. Phytopathology: doi.org/10.1094/PHYTO-07-19-0243-R.
26. Upadhaya, A., Yan, G. P., and Pasche, J. 2019. Reproduction ability and growth effect of pin nematode, *Paratylenchus nanus*, with selected field pea cultivars. Plant Disease 103:2520-2526.
27. Vieira, P., Peetz, A., Mimee, B., Saikai, K., Mollov, D., MacGuidwin, A., Zasada, I., and Nemchinov, L. G. 2020. Prevalence of the root lesion nematode virus (RLNV1) in populations of *Pratylenchus penetrans* from North America. Journal of Nematology 52:1-10.