NC1197 Meeting

June 28-29, 2017

Homewood Suites by Hilton, Fargo, ND

Chair: Haddish Melakeberhan

Secretary: Guiping Yan

Administrative advisor: Bill Ravlin

Attendees:

Senyu Chen – University of Minnesota

Jamal Faghihi – Purdue University

Haddish Melakeberhan – Michigan State University

Bill Ravlin - Michigan State University

Nathan Schroeder – University of Illinois Urbana-Champaign

Chris Taylor – Ohio State University

Tim Todd – Kansas State University

Tom Welacky – Agriculture & Agri-Food Canada

Ann MacGuidwin – University of Wisconsin-Madison

Guiping Yan – North Dakota State University

Emmanuel Byamukama - South Dakota State University (guest)

Pawan Basnet – South Dakota State University (guest)

Addison Plaisance - North Dakota State University (guest)

Krishna Acharya - North Dakota State University (guest)

Arjun Upadhaya - North Dakota State University (guest)

**June 28, 2017**

The meeting was brought to order at 8:45 a.m. followed by introductions, registration, announcements including lunch and dinner venues, and report presentation and discussion format. It was noted that Dr. Greg Tylka (IA) sent a report, but could not attend the meeting due to schedule conflict with the Iowa Soybean Association Board Meeting. Dr. Bill Ravlin of Michigan State University and the new administrative advisor to the project gave a brief background information of himself. An entomologist by training, Dr. Ravlin has broad professional and administrative experience at The Ohio State University and Virginia State University. He encouraged the group’s teamwork, information sharing, and set direction that lead to multi-state research proposals within the framework of the project. Due to conflict of timing, the welcome address by the NDSU Plant Pathology Department Head was postponed for the next day.

The group discussed the recruitment of Dr. Emmanuel Byamukama of South Dakota State University to be a member. It was noted that the necessary paper work was being processed in due course. In addition, the group discussed updates on soybean cysts nematode (SCN) coalition, SCN on dry bean, ineffectiveness of PI8878 resistance to SCN, limited varieties with Peking resistance and SCN and Sudden Death Syndrome in the region.

State reports begun at 9:30 a.m. in the following sequence:

**North Dakota:** Guiping Yan, PI, summarized her collaborative projects with Drs. Nelson (breeder) and Markell (Extension Plant Pathologist) of NDSU and the thrust of her own program on SCN and other plant-parasitic nematodes. These included screening soybeans for resistance to SCN and wheat cultivars for resistance to root-lesion nematode, SCN HG type characterization, chemical and biological controls for stubby root nematode on potato, development of three molecular assays for detecting and quantifying SCN, stubby root nematode and root lesion nematode, interaction of fungal pathogen (*Fusarium oxysporum*)and root-lesion nematode (*Pratylenchus penetrans*) for potato emergence disorder, and dissemination of the research findings to growers. She introduced her research team that included Addison Plaisance (lab manager) and graduate students Krishna Acharya and Arjun Upadhaya to present the following components of the research work.

Addison Plaisance described the significance of potato in ND and the need for chemical and biological agents for controlling stubby root nematode and potato corky ringspot disease. Their 2016 experiment consisting of different combinations of Velum Prime, Movento, and Vydate, biological agent Majestene on Yukon gold, disease rating, and disease severity rating were described. It was reported that Vydate3 (treatment 3) has the lowest disease incidence and severity. Noting the difficulty of working with stubby root nematode, an ectoparasite, this stimulated discussions on how build pure cultures of this nematode for more extensive work.

Krishna Acharya described his work on managing SCN and other nematodes using cover crops, including oilseed radish, Brassicas, and annual rye grass, in soybean production. Using greenhouse and micro plots, the objectives are to screen cover crops for host suitability and for nematode population reduction. Preliminary results indicate that annual ryegrass and radish are the best in reducing SCN population density. Discussions and questions included the potential for presence of *Cactodera* cyst eggs or other cysts were found in soil and effects of soil temperature and previous host on nematode population dynamics.

Arjun Upadhaya described his work on managing pin, root-lesion and other nematodes in field pea and their association with soil properties in field pea production counties of ND. He described his soil sampling method, nematode extraction, identification and quantification, molecular identification. He found eight genera of nematodes. About 90% of pin nematodes were without stylets. A pin nematode distribution map in ND pea fields was generated. Discussion included extracting nematodes out of plant debris and small pieces of dead roots in soil. The group adjourned for lunch at noon and resumed reports at 1:00 p.m.

**Kansas:** Tim Todd, PI, noted that root lesion nematode and SCN has been central to his research on plant-parasitic nematodes. His team used *Pratylenchus* COI tree to determine lineage of root-lesion nematode species: *P. neglectus*, *P. thornei*, *P. scribneri*, *P. alleni*/*coffeae*, and *Pratylenchus* sp. The host status of corn, sorghum, soybean, and wheat as main crops and alfalfa, soybeans, winter wheat, Rockford oats, and hairy vetch as cover crops) to root-lesion nematode populations from different regions were tested under greenhouse conditions. The reproduction of root-lesion nematodes are highly variable; *P. scribneri*, and *P. alleni* in corn and *P. neglectus* and *P. thornei* in wheat in particular. The group discussed the challenges associated with root-lesion nematode variable responses, molecular lineages, how to define species, and quantifying nematodes per unit of soil and plant tissue.

**Ohio:** Chris Tylor, PI, succinctly described his program on microbe-nematode-soil-plant research from the very basic to the field level of interactions. Brief description of projects include: Identification and propagation of 40 SCN populations to determine Hg type (most [95%] are Hg 2.5.7); Examination of the role of amino acids in root exudates in attracting nematodes (focus on amino acids, namely threonine); Transcriptomic analysis of adult female SCN grown on Hutcheson and PI 88788; And suppression of RNAi by nematode.  Some discussion was about whether nematodes that transmit viruses may be transmitting them to enhance the susceptibility of the host (better host through suppression of RNA interference pathways by viral-encoded viral suppressors). Most of the presentation focused on two projects: The role of maize in reducing SCN and the use of *Pseudomonas* for SCN control.  Analysis of different maize breeding lines revealed different effects on SCN eggs. Specific maize lines were found to reduce SCN infectivity of soybean when grown in rotation (corn-soybean).  Experiments were conducted in the greenhouse and replicated under microplot conditions.  It was found that SCN activity is located in the root-exudates.  A plan for future work related to identifying the maize factors that influence SCN activity was briefly presented.  The second major project focused on the identification nematode-antagonistic bacteria identified from a library of 12,000 bacterial isolates.  Research focused on the development of *Pseudomonas* that had antagonistic activity against nematodes.  Analysis of the genomes for50 of these nematode-active *Pseudomonas* produced a phylogenetic tree depicting the relationship of sequenced Pseudomonas spp. Interestingly, *Pseudomonas* that were active against SCN were clustered in two sub-groups of the family tree.  Data was presented on microplot studies for *Pseudomonas* control of SCN indicating that application of SCN-active *Pseudomonas* as a soil drench reduced nematode numbers by 30-40%.

**Indiana:** Jamal Faghihi, PI, described: i) the history of soil samples from corn and soybean fields from 1979 to 2017 and the associated nematodes where two new nematodes, *Vittatidera zeaphila* in corn and *Heterodera iri* in turf, and uncommon, *Meloidogyne hapla* in soybeans, *Longidorus sp*. in mint, *Trichodorus sp.* in corn and *Ditylenchus* spp. in alfalfa were found. ii) In greenhouse screening of cover crops including annual ryegrass, against HG type 2.5.7, most common in IN, found that none or very few cysts developed in these crops. iii) Seed treatments including ILevo for SCN management showed no consistent results.

**Michigan:** Haddish Melakeberhan, PI, briefly introduced his research on the effects of i) tillage-germplasm-corn-soybean rotation for SCN management, ii) tillage-corn-cover crop-soil amendment and soil health, and iii) cover crop-weeds-N management and soil health in vegetable under temperate systems cropping systems, and iv) soil amendments and soil health in potatoes, vegetables and fruits under tropical cropping systems. The bulk of his presentation focused on understanding the Ferris and colleagues soil food web (SFW) model for quantifying the effects of cropping systems on nematode community, the soil food web, and soil health, a cross-cutting priority for many commodities. The SFW model categorizes outcomes from worst-to-best scenarios for nutrient cycling, soil health and overall agroecosystem suitability. Analyses of data from vegetable and field cropping systems show that i) soil type is a major driver of variable responses, ii) major gaps between the cropping system-based expectation for meeting health goals and existing field conditions; and iii) the SFW model is an excellent tool for navigating the outcomes towards the best case scenario. The group had a lively discussion, including how to integrate other biological data into the SFW in the future.

**June 29, 2017**

The meeting began at 8:35 a.m. with a welcome by Dr. Jack Rasmussen (NDSU, Plant Pathology Department Head). The group had interesting and informative exchange with Dr. Rasmussen relative to statewide research, funding priorities, and that Nematology is well appreciated and supported in ND. State reports resumed at 8:48 a.m.

**Illinois:** Nathan Schroeder, PI, described the research work on fundamental biology of SCNand *Caenorhabditis elegans*, bacterial feeder, based approach that his team is using to understand the biology of SCN. These include neurobiological responses of SCN when exposed to soybean root exudate hatching stimulants. Using ZnCl2 as hatching stimulant model, the team showed deleterious effects on SCN infection and subsequent reproduction. Discussions included the group’s appreciation for Schroeder’s approach to weaving the basic and applied sciences that will lead to practical solutions and help growers.

**Minnesota:** Senyu Chen, PI, described his research that applies to this project: i) HG typing, ii) cover crops as SCN hosts, and iii) seed treatment for managing SCN. He described replicated greenhouse screening work for resistance to HG type 1 and HG type 2 in 40 soybean varieties, where few of the soybean lines had resistance. The cover crop work included screening of 120 pennycress lines, where SCN reproduced less than it did on the standard susceptible soybean. The seed treatment evaluation was inconclusive. Chen also described analysis of his long-term project on microbial communities (major fungi and some nematodes) associated with SCN and crop rotation.

**Ontario, Canada:** Tom Welacky, PI, presented his collaborative and program thrust projects. These included i) multi-year screening for SCN resistance an identifying resistance sources; ii) survey work and SCN HG typing; iii) continuing to look at biological agents for management of SCN, with variable outcomes over time; iv) developing new sensor for detecting SCN for its management; v) investigating the relationship between SDS infestation and yield at farmer’s field with SCN; and vi) mapping SDS and SCN interaction in Ontario.

**Wisconsin:** Ann MacGuidwin, PI, presented her work on i) incidence of where root-lesion, spiral, dagger, lance, stunt, stubby root, ring, needle, root knot, and soybean cyst nematodes were found in soybean fields; ii) HG typing and evaluating SCN populations fitness of parasitism on soybean cultivars, iii) the relationships among sampling, nematodes, yield and soil physiochemical properties; and iii) evaluating interactions between *P. penetrans* and *Verticillium dahlia* in potato early dying disease complex.

**South Dakota:** Emmanuel Byamukama, PI, briefly described his research program as it relates to extension responsibilities, SCN and HG typing populations in SD, SCN management employing similar approaches to the regional team, SCN and weed management, SCN and fungal interactions, and chemical control as well as graduate student projects. Pawan Basnet, SDSU graduate student, presented his research on determining alternative weed hosts for SCN. Greenhouse studies included testing field pennycress, cocklebur, horseweed, and other 5 weed species, and *in-vitro* assay for nematicidal effects of plant extracts (Absinth wormwood) on eggs and juveniles of SCN. In addition, *in-vivo* assays were conducted over 24-96 hours.

**Business meeting:**

The business meeting was called to order at 10:40 a.m. to discuss next year’s meeting location, formalize publications and year of reporting, identify potential collaborative projects, and elect officers. By a vote of 7 yes, 1 no and 1 abstention (and 3 absent), the team voted to meet in New Mexico after the SON meeting is over. This will be a Thursday/Friday meeting time. Since students will give their presentations at the SON meeting, there is no need for them to have special time for presentations in the 2018 NC-1197 meeting. Where NC-1997 meeting does not follow the SON meeting, the team consensus was that students will present as block before the PIs do. The group emphasized workshops that can make use of the local expertise where meetings take place.

Since the NC-1197 meeting is held in the middle of the year, standardizing what publications go into the report was discussed. Bill Ravlin, Administrative Advisor, advised to restrict to the previous year’s publications, i.e., publications that came out in 2016 for 2017 report.

The group discussed potential ideas for grant proposal that will lead for work to be done regionally. Broadly discussed ideas included projects on plant-soil-nematode-microbiomes suitable for many federal funding agencies and that will lead to practical applications. The team is to do more one-on-one discussions with the expertise and follow up at a later date.

Greg Tylka (IA) will be the Chair, and Christopher Taylor (OH) was elected as Secretary by a unanimous vote. Since there are no members from New Mexico, organizing next year’s meeting will be the NC-1197 Chair’s responsibility.

The group thanked Guiping Yan for her generosity and hosting the meeting

The meeting was adjourned at 11:45 a.m.