INTEGRATING THE CONCEPTS OF FERTILIZER USE EFFICIENCY (FUE) AND NEMATODE-BASED SOIL FOOD WEB MODELS FOR BROADER USE IN SOIL HEALTH MANAGEMENT. **Habteweld, Alemayehu W.[1, 2], D. Brainard[2], M. Ngouajio[5], S. Kravchenko[3], P.S. Grewal[4] and H. Melakeberhan[1, 2]**.[1]Agricultural Nematology Laboratory, [2]Department of Horticulture, Michigan State University, East Lansing, MI 48824, USA, [3]Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing, MI 48824, USA, [4]Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN 37996, USA, [5]Division of Plant Systems-Production, USDA-NIFA, Washington, DC 20024, USA.

The Fertilizer Use Efficiency (FUE) model separates the relationships among plant growth, herbivore nematode parasitism, nutrient deficiency and toxicity (Melakeberhan, 2006), and allows cross-disciplinary and integrated decision-making when amending soil. It calculates treatment outcome as a percent of control (untreated check) and graphically expresses data in four quadrants from best (A) to worst case (D) scenarios. The FUE model was modified to include assessment of beneficial nematodes and soil physicochemical properties in four quadrants (E, F-best case, G, worst case, and H, (Melakeberhan and Anvendaño, 2008). In order to fully assess soil health, the modification needs the power of integrating nematode functions. The objective of this study was to integrate weighted nematode guilds into the FUE model and test if the outcomes overlap with Quadrant F, which corresponds with Quadrant B of the Ferris *et al*. (2001) soil food web model. We tested the effects of plant and animal waste compost applied at 135, 203 and 270 kg N/ha to a processing carrot (*Daucus carota*) cv 'Cupar' field in 2012-2014. Urea and non-amended check were included as controls. Nematodes were extracted from soil samples collected at planting and harvest, enumerated and assigned to c-p 1 to c-p 5 groups. We adopted the Ferris *et al*. (2001) c-p value weighting for c-p 2 to c-p 5 nematodes and added weight for c-p 1 nematodes using the same formula, $0.8*(0.5*(n+1))^2$ where n is the c-p value and '0.5' is a fraction of increase in food web complexity with each increment in c-p class. This gives c-p value weighting of 0.2, 0.8, 1.8, 3.2 and 5 for c-p 1 to c-p 5, respectively. Weighted nematode guild abundance was calculated by multiplying the number of c-p group abundances with their respective c-p group weight and combined to form one value. The results were then fitted to the FUE model relative to soil organic matter (OM) and marketable carrot yield. Data points for OM and marketable carrot yield from animal and plant compost amendments appeared in quadrant F. This shows not only an improvement of the FUE model for soil health analysis, but integrates it with the soil food web model. The implications of this modification for much broader and cross-disciplinary analyses of soil conditions will be discussed.

EFFECTS OF ROTATION AND COVER CROPS ON NEMATODE COMMUNITIES AND SOIL HEALTH IN DIFFERENT SUGAR BEET PRODUCTION SOILS. **ZinThuZar Maung[1], S. Poindexter[2], G, Clark[3], J. Stewart[3], L. Hubbell[3], and H. Melakeberhan[1].** [1]Agricultural Nematology Laboratory, Department of Horticulture, Michigan State University (MSU), East Lansing, MI 48824, USA, [2]Extension Agriculture and Agribusiness, Michigan State University (MSUE), Saginaw, MI 48607, USA, [3]Michigan Sugar Company (MSC), Agricultural Research Center, Bay City, MI 48706, USA

Managing sugarbeet cyst nematode (SBCN, *Heterodera schatii*) and improving soil health (organic matter, biological, physiochemical, nutritional, and water holding priorities) are priorities for the Great Lakes Region sugarbeet industry. Crop rotation and use of cover and trap cropping systems are among the practices that potentially address both priorities. The pressing priorities and the practices that might lead to solutions, however, are further complicated by the diversity of sugarbeet production soils, cropping systems and varying infestations of SBCN. For example, it is unknown how any of cover, trap or rotation crops relate to the two industry priorities in different soils. The objective of this study was to compare how rotation (corn and soybean) and cover and trap (oil seed radish and mustard) crops affect soil health, nematode community and sugarbeet production in sandy clay loam and loam soils. A study was conducted in 2013 and 2014 using a randomized complete block (RCB) design of nine crops (oilseed radish: Defender and Tillage; mustard: Pacific Gold and Ida Gold; soybean: 92Y80 and 92M91; sugar beet: SBCN-tolerant, B-18RR4N and –susceptible, B-10RR34; and corn: P9910R) and six replicates. Nematode community composition, soil physiochemical properties, sugar beet yield (% of sugar, % of sugar purity, and recoverable white sugar per ton), and biomass of all crops were measured. Recoverable white sugar per ton and percentage of sugar from both sugar beet varieties on loam soil in 2013 were the lower than in 2014. Percentage of sugar purity of both varieties in 2014 on sandy clay loam soil was significantly lower than in the loam soil. Except for susceptible soybean on loam soil, populations of cyst nematode (*Heterodera* spp.) in the soil was less in 2014 than in 2013 for all crops on both soils. However, there was no significant difference among crops in the same growing season within the same soil. Based on the composition of nematode assemblages, soil food web indices: Enrichment (EI), Structure (SI), Basal (BI), and Channel (CI) indices, were calculated to infer soil food web condition. Fertility index varied among crops. While not statistically significant, percent composition of nematode trophic groups showed some variation across growing season and soil type. The soil food web analysis showed that both soil types do not have ideal conditions for agroecosystem suitability (few data points in Quadrant B). However, nematode communities in the sandy clay loam were more stressed than the loam soil and the stress varied by crop as well. Principal component analysis showed a distinct pattern of correlation between crops grown in different soil types with nematode community indices and soil physiochemical properties. The study suggests that more emphasis should be given to location-specific factors.

IMPACT OF COMPOST AMENDMENTS ON SOIL FOOD WEB, SOIL PHYSICOCHEMICAL PROPERTIES AND CARROT YIELD. **Habteweld, Alemayehu W.[1, 2], D. Brainard[2], M. Ngouajio[5], S. Kravchenko[3], P.S. Grewal[4] and H. Melakeberhan[1, 2]**. [1]Agricultural Nematology Laboratory, [2]Department of Horticulture, Michigan State University, East Lansing, MI 48824, USA,[3]Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing, MI 48824, USA,[4]Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN 37996, USA,[5]Division of Plant Systems-Production, USDA-NIFA, Washington, DC 20024, USA.

This study tested the hypotheses that compost amendment would enhance soil food web structure index (SI), improve soil biological and physicochemical properties, and increase carrot (*Daucus carota*) yield and quality, but these effects would differ by compost type and rate of application. Plant (PC) and animal waste (AC) compost was applied to supply 135, 203, and 270 kg N/ha for a processing carrot cv ‘Cupar’. Urea (UR) and non-amended check (CK) were included as controls. Nematode community was analyzed from soil samples collected at approximately 4- week intervals in 2012-2014 growing seasons. Soil respiration (SR) and physicochemical properties were determined from soils collected at planting and harvest. Compost amendments except AC at 203 kg N/ha significantly ($P \leq 0.05$) increased SI at 132 days after planting (DAP) in 2012 compared with the rest of 2012 sampling dates in Cupar, but this effect was not observed in UR and CK. At 133 DAP in 2013, all treatments significantly increased ($P \leq 0.05$) SI compared with the previous sampling dates in 2012 and 2013. Compost amendments significantly increased P and pH compared with UR while UR significantly increased NO_3-N compared with compost amendments at the end of 2013 growing season. There was no difference in total yield and carrot quality among treatments in Cupar. Multiple factor analysis (MFA) showed positive correlation between SI and calcium, magnesium, cation exchange capacity and soil pH while negative correlation was observed for total unmarketable carrot yield in which dimension 1(33.30 %) and dimension 2 (12.60 %) represent the first and second best summary of the variability of the information. Overall, results suggest that compost amendments improved SI compared with UR. Compost amendments also increase pH in average from 7.2 to 7.7 and phosphorus in average from 53 to 61 ppm after two years. MFA result supports the importance of SI as an indicator of soil health and carrot quality. Overall, results support the tested hypotheses and suggest that the compost-based improvements in soil food web structure may lead to increases in ecosystem services provided by the soil food web.

SOIL HEALTH DIFFERENCES IN THREE AFRICAN SOIL GROUPS REVEALED BY NEMATODE COMMUNITY ANALYSIS. **Zin Thu Zar Maung[1], S. Yildiz[1], W. Kimenju[2], C. Kwoseh[3], V. Saka[4]**, and **H. Melakeberhan[1].** [1]Agricultural Nematology Laboratory, Department of Horticulture, Michigan State University, East Lansing, MI 48824, USA, [2]University of Nairobi, P.O Box 30197, G.P.O, Nairobi, Kenya, [3]Kwame Nkrumah University of Science and Technology, PMB, UPO, Kumasi, Ghana, [4]Lilongwe University of Agriculture and Natural Resources, Lilongwe, P.O. Box 219, Malawi.

A soil group (order) based understanding of biological degradations could lead to developing scalable remedial and/or preventive soil health management strategies to deal with the vast degradations in sub-Saharan Africa (SSA). While the same soil groups may have overlapping textures (% sand, silt and clay), they have different horizons that correlate well with ecological zones. Using nematode and microbial communities as indicators of soil health, we analyzed soil samples from undisturbed (pristine forest or natural vegetation) and disturbed (agricultural or grazing) landscapes in Ferralsol, Lithosol and Nitosol soil groups in Ghana, Kenya and Malawi. A total of 74, 69, and 77 nematode genera were detected in Ghana, Kenya and Malawi, respectively. Only 12%, 20 – 25%, 25% and 56% of omnivore, fungivore, herbivore and bacteriovore trophic groups, respectively, were common to all three countries. The herbivores *Amplimerlinius*, *Heterodera* and *Trophurus* in Ghana, *Paratrophurus* in Kenya, and *Trichodorus* and *Longidorus* in all three countries were present in Ferralsols only. Total abundance across soil groups and countries ranged from 38 to 248 nematodes/100 cc of soil, with the most numbers observed in Nitosols. Generally, nematode diversity was higher in natural than in disturbed landscapes, suggesting impact of land use practices on biological diversity and degradations in the soil groups. Maturity indices indicated that the Malawi and Kenya soils were more disturbed than Ghana, and Ferralsols appeared to be more disturbed than Lithosols. The fertility index across soil groups in Ghana was closer to natural (0.9) than in Kenya and Malawi, which reflects the range of time that the soils have been in use. Soil food web structure showed similar level of depletions across landscapes, soil groups and countries, suggesting that these soil groups are naturally fragile to meet agroecosystem expectations. There were varying levels of two- and three-way interaction effects on the biological parameters, suggesting the conditions vary by landscapes, region and/or soil groups. Furthermore, multi-factor correlation analyses of nematode abundance and frequency, soil texture and physiochemical properties showed distinct separation of the soil groups and by country, and Ferralsols further from Lithosols and Nitosols. Although biologically degraded, the results indicate that these soil groups have different biological properties and may not respond the same way to a given treatment. The study for the first time establishes a biological basis for designing soil amendment strategies that could potentially lead to improving soil health conditions across soil groups and climatic zones.