2022 Abstract Award Winners

Ashley Jernigan

Title: Soil microarthropod effects on crop production under different cover cropping strategies

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Soil microarthropods, a group of fauna dominated by mites and collembolans, mediate multiple microbial-driven soil processes. The effects that soil microarthropods have on crop production are typically explored with a focus on one microbial driven process, such as nutrient cycling or plant pathogen disease incidence, though their behaviors influence these processes simultaneously. The primary objective of this research is to understand how the effects of microarthropods on these interconnected microbial processes impact crop production.
In 2019 and 2020 these relationships were investigated in both soybeans and dry beans under three different cover cropping treatments that directly alter the environmental conditions that affect microarthropod communities *[1) no cover crop with tillage (control treatment), 2) cereal rye with tillage, and 3) rolled cereal rye with no tillage]*. Early in the growing season the soybeans had greater microarthropod abundances than the dry beans, but by the harvest the dry beans had much greater microarthropod abundances compared to the soybeans. More tillage effects were observed in the microarthropod community early in the growing season. Interestingly, there were more mites in the no cover crop with tillage treatment which was primarily driven by Oribatida mite abundances. There were consistently more Collembola in the rolled cereal rye with no tillage treatment compared to the other treatments, and at the end of the growing season there were more Mesostigmata mites which prey on collembolans in this treatment as well. These shifts observed in the microarthropod communities highlight the importance of crop choice in cropping system and soil health management, in some cases even more so than cover cropping and tillage practices. The findings from this research can help inform sustainable crop management systems that rely on soil process to enhance crop production.

Supplementary Information:

Within this experiment we measured microarthropod communities, multiple microbial metrics (biomass, five enzymes, community DNA analysis), and soil characteristics that impact biological processes (soil carbon and nitrogen, aggregate stability, moisture). We also measured plant pathogen metrics (carpogenic germination of *Sclerotinia sclerotiorum*, *S. sclerotiorum* ascorporic inoculum density, white mold disease incidence, root rot [*Fusarium* spp.] disease incidence and severity) and crop production metrics (cereal rye biomass, soybean and dry bean establishment, weed suppression, and crop performance). This dataset will allow me to model microarthropod effects on bean production and investigate the role of nitrogen cycling, pathogen dynamics, and weed communities in the crop production outcomes.

I am currently working on analyzing this large dataset and plan to use structural equation modeling to more specifically identify how soil microarthropods are impacting crop production via these interconnected processes. I will use similar techniques to those I have used in the past (Jernigan et. al. 2020[1]), though this modeling will be even more expansive and will provide a clearer picture of the mechanisms driving the plant growth outcomes due to the specific metrics chosen for this experiment.

[1] **Jernigan, A.B., Wickings, K., Mohler, C.L., Caldwell, B.A., Pelzer, C.J., Wayman, S. & Ryan, M.R.** 2020. Legacy effects of contrasting organic grain cropping systems on soil health indicators, soil invertebrates, weeds, and crop yield. *Agricultural Systems*, 177. https://doi.org/10.1016/j.agsy.2019.102719