

**Paul C. and Edna H. Warner Endowment Fund for Sustainable Agriculture Interdisciplinary
Grant Program for On-Farm Research**

Report Form

Project Title: Beneath the Surface: Investigating soil microbial communities and enzyme activities in a Canfield silt loam under various tillage and fertilizer management systems

Summary (Describe your project, its objectives and results in one or two sentences)

This was an additional research project attached to current on-farm research in Stark County called the Stark Sustainable Soil Initiative. The objectives of this project were to determine how farm management, particularly tillage and fertilizer, across 12 farms in Stark County impacted the soil microbial populations and the active soil carbon. The results demonstrate that soil microorganisms were not affected by inclusion of manure fertilizer, but soil microbes were more abundant and active in hay fields compared to cultivated fields. Analysis of active soil carbon is in progress with an estimated completion date of early 2022 (late January/early February).

What was done? (One paragraph describing the goals, experiments and how they were performed) The goal of this project was to determine if there was any particular farm management practice that increased or decreased soil microorganisms and their activity and to determine if there was an effect on active soil carbon which are quickly consumed by soil microbes. Soils were sampled at the 0-6" soil depth across 12 farms in Stark County OH in June/July 2021. All sampling locations were in Canfield silt loam soil. Fertilizer methods included 6 farms that use livestock manure and 6 farms that do not include manure. Tillage methods included 2 farms that have perennial orchardgrass/alfalfa hay production, 2 corn-soybean rotation farms use no-till, 4 corn or corn-soybean rotation farms that use moldboard plow, 4 corn-soybean rotation farms that use vertical tillage. Soils analyses included microbial abundance and structure using fatty acid methyl esters and microbial enzyme activities of 3 different enzymes which were glucosidase, N-acetyl- β -d-glucosaminidase, and acid phosphatase. All of these analyses were run at the OSU Soil Microbial Lab directed by Dr. Richard Dick. Analysis of soil respiration and permanganate oxidizable carbon are being run in the OARDC Soil Fertility Lab directed by Dr. Steve Culman.

What were the results? (One paragraph on the outcome of the experiments, what was learned from them)

The results demonstrated a distinct difference in soil microbial populations and microbial enzyme activity between hay fields and cultivated row crop fields. There were greater abundance and activity of soil microorganisms in the hay fields. When only row crop fields were considered, the one organic farm in the project had higher abundance and activity of soil microorganisms than all the other cultivated fields. Finally, when only conventionally cultivated fields were considered, it was found that most soil microbes preferred the reduced till fields as opposed to the no-till fields. These results were due to there being more soil organic matter in the hay fields. The lack of pesticide and synthetic fertilizer use in the organic farm may have resulted in more soil

microorganisms in that system. Lastly, the low population of soil microbes in the no-till fields may be due to high soil bulk density and low soil organic matter which might be improved with proper management of cover crops. Analysis of soil respiration and active carbon are being processed with results expected in late January/early February of 2022.

How have the results contributed or will they contribute to sustainable agriculture? (One paragraph on how will farmers use this research information and what difference will it make on their farm?)

Because soil microorganisms are responsible for making nutrients in the soil plant available, farmers can use this information to potentially reduce pesticide use or synthetic fertilizer inputs which could save money. Farmers could improve their soil biology by including perennial plants or hay fields in their crop rotation. While few farmers would convert to organic farming, they may be willing to include a perennial crop in their crop rotation, or at least, they would be aware of the impact that pesticides and synthetic fertilizers can have on the soil biology and make management decisions accordingly.

NOTE: Results from this project were submitted and will be published as part of the 2021 e-Fields on-farm research report. This report is widely distributed to producer, educator, research and sponsor/funder audiences within Ohio, the North Central region and across the United States.