

Differences in soil microbial communities among management systems

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Rationale

- Organic agricultural systems often aim to boost soil microbial processes to increase the nutrients that these processes provide to plants.
- We know that organic practices such as cover cropping and compost addition can increase the abundance of soil microbes, but it is less clear whether these practices promote different *kinds* of microbes in organic soils.
- Because different kinds of microbes can differ in the rates and types of processes they carry out, understanding which kinds of microbes are promoted by particular management systems can help us link our management practices to their ultimate results, such as soil nutrient availability and crop yields.

Questions

- Do organic corn/tomato, conventional corn/tomato, and no input wheat/fallow systems differ in the composition of their soil microbial communities?
- If so, do these differences in composition suggest possible differences in the way that soil microbial communities might be functioning in these systems?

Methods

- We collected soil from three replicate plots of each system (organic corn/tomato, conventional corn/tomato, and no input wheat/fallow) in April 2010 and September 2010.
- We used DNA sequencing of a taxonomic marker gene to identify the range of microbes in these samples.
- Using these sequences, we identified the closest cultured and well-characterized relatives of each of our microbes..
- We used these relationships to estimate the values of an important microbial trait for each of our microbes, based on the known values of their close relatives. This trait – the number of ribosomal RNA gene copies within the microbe's genome – indicates a microbe's potential growth rate as well as how quickly it can rev up to take advantage of resource pulses.
- We averaged these estimates across all the microbes in each sample to get an overall estimate for the community.

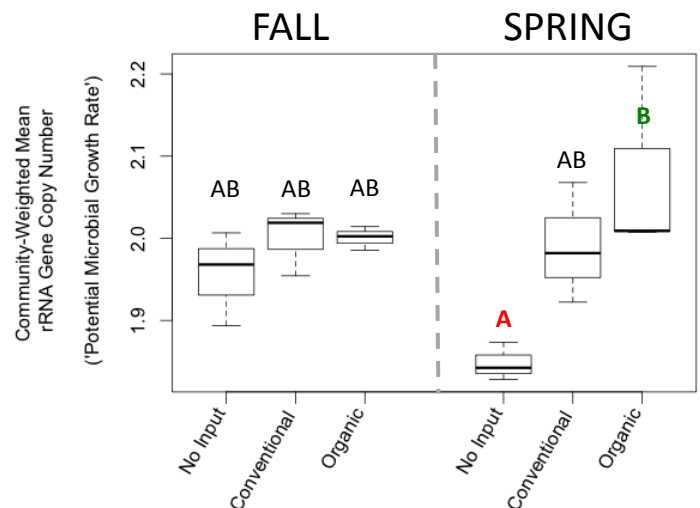


Figure 1. Estimated “potential growth rates” of microbial community in each system. Boxplots are based on values for three replicate plots.

Results

- In spring (soon after inputs were applied to organic and conventional), the organic system had the highest potential microbial growth rates, followed by the conventional system, and lastly the no input system.
- In the fall (after tomato harvest in organic and conventional and before wheat planting in no input), there was little difference between systems.

Implications

- Spring management appeared to stimulate the organic microbial community to potentially consume organic matter faster.
- No input system microbes had slowest potential growth in the spring.
- Recent management practices may drive functional composition of these microbial communities. Further exploration of these patterns may help us better synchronize nutrient availability with plant demand.