Researchers conduct novel wheat microbiome analysis under four management strategies

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Different crop management strategies can produce various and noticeable effects on a crop and its yield. But what are the effects at the microbial level...not just in the roots but the entire plant?

Molecular biologists Kristi Gdanetz and Frances Trail of Michigan State University sought to answer that question, developing a descriptive analysis of the wheat microbiome under four common types of management strategies: conventional, no-till, organic, and reduced chemical inputs.

Their analysis and data, recently published in the fully open-access journal *Phytobiomes*, is freely available for academic and industry researchers studying plant microbiomes and their role in reducing disease or increasing crop yields.

Their study was conducted on a unique and ideal plot of land for researching the effects on microbes associated with wheat under all four management strategies. The 24 one-acre management plots are randomly scattered throughout a larger field and each plot has been managed in the same way as part of a wheat-corn-soybean crop rotation for more than 20 years at MSU Kellogg Biological Station, which is funded as part of the National Science Foundation Long Term Ecological Research Project.

At various stages during the growing season, Gdanetz and Trail collected more than 200 samples of leaves, stems, and roots from wheat growing

in each of the different management plots. The samples were then processed using high-throughput amplicon sequencing to identify microbial communities. Microbial culture collections were also developed from the samples, providing a valuable resource for isolating and growing specific microbial taxa.

Specific endophytes, or microscopic fungi living inside the plants, were then isolated from the samples and tested for biocontrol activity toward Fusarium graminearum, a pathogen known for causing fusarium head blight, an economically devastating wheat disease. This part of the work was funded by Michigan Wheat Program.

"Most studies focus only on the roots and rhizosphere microbes associated with plants," said Gdanetz. "But we are continually gaining evidence that the aboveground microbial communities have important roles in plant health."

The results suggest that microbial communities are strongly affected by the wheat plant's organ and age, and it may also be influenced by management strategy.

"Manipulating plant-associated microbes to reduce disease or improve crop yields requires a thorough understanding of interactions within the phytobiome," said Gdanetz. "We provided some foundational data for people to generate synthetic microbiomes to use in experimental manipulations."

"We would also like to see similar studies conducted across other field sites in the U.S. to determine if these patterns we observed will hold," Gdanetz said.

More information: Kristi Gdanetz et al, The Wheat Microbiome Under Four Management Strategies, and Potential for Endophytes in

Disease Protection, *Phytobiomes* (2017). DOI: 10.1094/PBIOMES-05-17-0023-R