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Microbes could be key for better yields, stronger plants

Contact(s): Mark Kuykendall

How can agriculture evolve to meet the demands of an increasing global population without compromising the integrity of the environment?

Microbes just might be the answer.

Michigan State University researcher James Kremer and his colleagues in the labs of University Distinguished Professors [Sheng Yang He](#) and [James Tiedje](#) are working to understand how plant microbes – the millions of microorganisms that reside in soil and plants just as they do in the human gut – could be the key to reliable, high-yielding agriculture.

“The goal of our research is to unravel the complexity of the plant microbiome to understand its functions and benefits to plant health. Intelligent tweaking of the plant microbiome could give rise to constellations of microbes that robustly increase yield and protect against disease,” said Kremer, who presented his findings at the 2015 General Meeting of the American Society for Microbiology.

The naturally occurring and complex community of plant-associated microbes – called the plant microbiome – elicits immune responses, actively sensing and responding to microbe-specific molecules. To investigate how the plant microbiome functions, Kremer and his team used microbe-free seeds, sterile growth vessels and bottom-irrigated pots (FlowPots), to raise completely microbe-free plants rooted in a sterile potting mix.

“We seeded FlowPots with diverse microbial communities from various soils across North America and found that much like the microbes in our gut, the plant microbiome boosts plants’ ability to fight diseases,” said Kremer, who invented the FlowPot system and is now working to patent it.

The researchers have found that when microbe-free plants are exposed to speck disease in tomatoes, the disease was significantly higher than in plants with a microbiome. Their findings have prompted many more questions to be explored in future research.

“A lot more remains to be explored: how do plants recruit particular microbes? Which microbes work together to help the plant? What characteristics does a microbe need to invade and persist in a microbiome?” Kremer said. “The untapped potential of plant microbiota foreshadows a bright and exciting future full of discoveries for microbiology, medicine and agriculture.”

The research is funded by the Howard Hughes Medical Institute, Gordon and Betty Moore Foundation and the U.S. Department of Energy.



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Michigan State University researcher James Kremer invented FlowPots, a bottom-irrigated pot design, in order to raise microbe-free plants for his research. Photo courtesy of James Kremer.

