Plant microbes have potential to unlock advances in agriculture, according to microbiologist

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Gwyn Beattie was part of a group of researchers organized by the American Academy of Microbiology to outline how smarter use of plant microbes can be used to improve agriculture. Credit: Robert Elbert.

Smarter use of the microbes that live in and around crops could pay huge dividends for farmers in the near future, according to an Iowa State University microbiologist.

Gwyn Beattie, a professor of plant pathology and the Robert Earle Buchanan Distinguished Professor of Bacteriology, said this week that a sharper focus on the billions of microscopic organisms that colonize plants and often share a symbiotic relationship with them could greatly improve yields and lessen the need for costly fertilizers and pesticides.

Beattie was part of a 21-member team organized by the American Academy of Microbiology to come up with a set of recommendations on how advances in microbiology can be harnessed to improve agriculture. The recommendations, published last week, set a goal of increasing yields by 20 percent over the next 20 years by enhancing the use of microbes while reducing the use of pesticides and fertilizers by 20 percent.

Reaching those goals would drastically cut input costs for farmers and produce a range of environmental benefits, Beattie said.

The sheer complexity involved in making sense of the virtually countless microbes that interact with crops made such an ambitious goal seem outlandish in the past, Beattie said. But new genetic sequencing technology means the benchmarks outlined in the report are realistic, she said.

"The sort of changes we're talking about have gotten lip service in the past, but because of the complexity involved, it often gets dismissed," Beattie said. "There are billions of different microbes and we didn't have the tools to tell one from another. Now we can profile them based on sequencing."

Most of the microbes in question are fungi, viruses or bacteria, she said. When crops are optimized with the right genetics and colonized by the right microbes, both organisms can flourish.

Mycorrhiza, for instance, is a fungus capable of forming an association with the vast majority of land plants. When that happens, that symbiotic relationship helps to expand uptake by the plant's root system by as much as 90 percent, helping the plant soak up water and nutrients from much deeper in the soil. The association also helps activate genes and physiological changes in the plant to help them survive drought conditions, Beattie said. Other microbes can boost a plant's resistance to pests.

"In the long run, we can make better use of our resources and protect the environment while enhancing yields," she said. "We're on our way there."

Provided by Iowa State University

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