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Root microbiome engineering improves plant growth

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Summary: Humans have been breeding crops until they're bigger and more nutritious since the early days of agriculture, but genetic manipulation isn't the only way to give plants a boost. Integrative biologists now present how it is possible to engineer the plant soil microbiome to improve plant growth. These artificially selected microbiomes, which can also be selected in animals, can then be passed on from parents to offspring.

FULL STORY

Arabidopsis. (stock image)

Credit: © Vasiliy Koval / Fotolia

Humans have been breeding crops until they're bigger and more nutritious since the early days of agriculture, but genetic manipulation isn't the only way to give plants a boost. In a review paper published on September 25 in *Trends in Microbiology*, two integrative biologists present how it is possible to engineer the plant soil microbiome to improve plant growth, even if the plants are genetically identical and cannot evolve. These artificially selected microbiomes, which can also be selected in animals, can then be passed on from parents to offspring.

Only a few published studies have looked at the effects of artificially selecting microbiomes. In their own labs, the authors--Ulrich Mueller of the University of Texas at Austin and Joel Sachs of the University of California, Riverside--have seen microbiome engineering to be successful with *Arabidopsis* (a close relative of cabbage and broccoli). In the *Arabidopsis* experiments, bacteria from the roots of the largest plants were harvested with a filter and given to other plants growing from seed. Over time, the plants, which were genetically identical and therefore could not evolve by themselves, grew better because of their evolved and improved microbiomes.

"My hope is that others will become interested in optimizing methods in other systems," says Mueller. "For agricultural applications, I would start with artificial selection of root microbiomes in a greenhouse environment, using cash crops such as lettuce, cucumber, or tomatoes, learn from these greenhouse experiments, then gauge whether any of these principles can be applied to outdoor agriculture and horticulture."

Microbiome experiments can be tricky and affect reproducibility because of the complexity of propagating entire microbial communities between plants or between animals. The reason grasses and honeybees are attractive pilot organisms is because their microbiomes can be manipulated to be heritable. By testing this in organisms with stable genetics, it is easier to see the effects of adding specific bacterial communities.

"Selecting artificial microbiomes may be a cheaper way to help curb plant and animal diseases rather than pesticides and antibiotics or creating genetically modified organisms," Mueller says. "The methods to generate host-mediated artificial selection on root microbiomes are super simple (all you need is a syringe and a filter), and any farmer in any location could potentially do this to engineer microbiomes that are specific to the problems of the specific location where the farmer attempts to grow food."

Story Source:

The above post is reprinted from materials provided by **Cell Press**. *Note: Materials may be edited for content and length.*

Journal Reference:

1. Mueller and Sachs. **Engineering Microbiomes to Improve Plant and Animal Health**. *Trends in Microbiology*, 2015 DOI: 10.1016/j.tim.2015.07.009

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