

Some domesticated plants ignore beneficial soil microbes

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While domestication of plants has yielded bigger crops, the process has often had a negative effect on plant microbiomes, making domesticated plants more dependent on fertilizer and other soil amendments than their wild relatives.

In an effort to make crops more productive and sustainable, researchers recommend reintroduction of genes from the wild relatives of commercial crops that restore domesticated [plants](#)' ability to interact with beneficial [soil microbes](#).

Thousands of years ago, people harvested small wild plants for food. Eventually, they selectively cultivated the largest ones until the plump cereals, legumes, and fruit we know today evolved. But through millennia of human tending, many cultivated plants lost some ability to interact with [soil](#) microbes that provide necessary nutrients. This has made some domesticated plants more dependent on fertilizer, one of the world's largest sources of nitrogen and phosphorous pollution and a product that consumes [fossil fuels](#) to produce.

"I was surprised how completely hidden these changes can be," said Joel Sachs, a professor of biology at UC Riverside and senior author of a paper published today in *Trends in Ecology and Evolution*. "We're so focused on above ground traits that we've been able to massively reshape plants while ignoring a suite of other characteristics and have inadvertently bred plants with degraded capacity to gain benefits from microbes."

Bacteria and fungi form intimate associations with plant roots that can dramatically improve [plant growth](#). These microbes help break down soil elements like phosphorous and nitrogen that the plants absorb through their roots. The microbes also get resources from the plants in a mutually beneficial, or symbiotic, relationship. When fertilizer or other soil amendments make nutrients freely available, plants have less need to interact with microbes.

Sachs and first author Stephanie Porter of Washington State University, Vancouver, reviewed 120 studies of microbial symbiosis in plants and concluded that many types of domesticated plants show a degraded

capacity to form symbiotic communities with soil microbes.

"The message of our paper is that domestication has hidden costs," Sachs said. "When plants are selected for a small handful of traits like making a bigger seed or faster growth, you can lose a lot of important traits relating to microbes along the way."

This evolutionary loss has turned into a loss for the environment as well.

Excess nitrogen and phosphorous from fertilizer can leach from fields into waterways, leading to algae overgrowth, low oxygen levels, and dead zones. Nitrogen oxide from [fertilizer](#) enters the atmosphere, contributing to air pollution. Fossil fuels are also consumed to manufacture fertilizers.

Some companies have begun selling [nitrogen-fixing bacteria](#) as soil amendments to make agriculture more sustainable, but Sachs said these amendments don't work well because some [domesticated plants](#) can no longer pick up those beneficial [microbes](#) from the soil.

"If we're going to fix these problems, we need to figure out which traits have been lost and which useful traits have been maintained in the wild relative," Sachs said. "Then breed the wild and domesticated together to recover those traits."

More information: Stephanie S. Porter et al, Agriculture and the Disruption of Plant–Microbial Symbiosis, *Trends in Ecology & Evolution* (2020). [DOI: 10.1016/j.tree.2020.01.006](https://doi.org/10.1016/j.tree.2020.01.006)

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