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## Could Ants Hold the Key to Sustainable Agriculture?

By Brandon Keim [✉](#) March 26, 2008 | 11:27:41 AM Categories: [Agriculture](#), [Animals](#), [Evolution](#)



Crop monocultures are bad. How, then, has the world's most successful herbivore thrived by exploiting a single cloned crop?

That conundrum is posed by the leafcutter ant, which harvests more greenery than any other South American animal and uses the vast plantfall to feed the fungi gardens on which they subsist.

But while other ant farmers plant a variety of fungus species, leafcutters sow just one, and they propagate it through cloning. That seems to contradict a tenet of sustainable farming: monocultures are bad, as their lack of genetic diversity leaves them vulnerable to disease and disruption.

How have leafcutters managed this trick? And could they teach us how to make our own agriculture sustainable?

At present, the land provides us with enough to eat -- but that might not last. Many agronomists say the clock is ticking on the bounties of the Green Revolution, which depended on fossil fuel-fueled pesticides and fertilizers, as well as soil-wearying techniques and the establishment of vast monocultures.

With the Earth's population booming and nearly every farm-friendly acre already exploited, keeping our farms running is a looming concern. And for inspiration, says Smithsonian Institution entomologist Ted Schultz, we might look to the leafcutter ant, which despite its reliance on a single crop represents the apex of ant agriculture.

I talked this morning with Schultz, who co-authored a recent *Proceedings of the National Academy of Sciences* paper on the evolutionary history of ant farming. Schultz described a complex evolutionary dance: the leafcutter fungi is constantly threatened by disease. At the same time, bacteria living on ant exoskeletons produces a disease-killing antibiotic. But somehow the system has stabilized, preventing pathogens from ever raging out of control.

The stability may come not only from the continuing evolution of disease-killing bacteria, but the ants' farming technique: they cultivate their fungal monocultures by constantly transplanting the best parts of their gardens. The health of these plots, said Schultz, "might be a product of microbial consortia -- lots of different microbes that form an ecosystem that is better in one part of the garden than another." By moving these "microbial consortia," the ants create an environment in which their otherwise-precious harvest can thrive.

"People are starting to think that in general there may be good proportions of certain soil microbes, and bad proportions of others," said Schultz. "It might make sense to culture the soil to optimize it for particular crops. What needs to happen is that people need to look at this in an evolutionary agriculture kind of way."

Evolutionary agriculture is a newly-emergent discipline that applies the lessons of evolutionary biology to agriculture through a long-term lens -- not just breeding a better crop or devising a one-time cure for disease, but setting the entire system on a healthily-evolving course.

Ants have farmed for million of years, said Schultz. "We've only been doing it for ten thousand. We're pretty rudimentary."

*Note: For more on evolutionary agriculture, check out "[Darwinian agriculture: When can humans find solutions beyond the reach of natural selection?](#)" [pdf]*

[Major evolutionary transitions in ant agriculture](#) [PNAS]

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