

No-till agriculture may not bring hoped-for boost in global crop yields, study finds

October 23 2014, by Pat Bailey



No-till farming, such as used in this Illinois soybean field, shows promise in dry regions but causes lower yields in cold, moist areas like Northern Europe, a new study finds. (Paige Buck/USDA NRCS Illinois photo)

No-till farming, a key conservation agriculture strategy that avoids conventional plowing and otherwise disturbing the soil, may not bring a hoped-for boost in crop yields in much of the world, according to an extensive new meta-analysis by an international team led by the

University of California, Davis.

As the core principle of [conservation agriculture](#), no-till has been promoted worldwide in an effort to sustainably meet global food demand. But after examining results from 610 peer-reviewed studies, the researchers found that no-till often leads to yield declines compared to [conventional tillage](#) systems. It still shows promise for yield gains in dryland areas, however.

The landmark findings from their review are published online Oct. 22 in the journal *Nature*.

"The big challenge for agriculture is that we need to further increase yields but greatly reduce our environmental impacts," said Cameron Pittelkow, who co-authored the study as a postdoctoral scholar at UC Davis and is now on the faculty of the University of Illinois. "The common assumption that no-till is going to play a large role in the sustainable intensification of agriculture doesn't necessarily hold true, according to our research findings."

About conservation agriculture

Conservation agriculture is currently practiced on 125 million hectares of land globally, an area nearly as big as the total U.S. cropland. Three key principles guide the concept: minimizing soil disturbance (also called no-till farming), protecting the soil with cover crops or leftover crop residue, and rotating the crops.

The goals of conservation agriculture are to improve long-term productivity, profits and food security, particularly under the threat of climate change. Because conservation agriculture avoids tillage, it is less time-consuming and can be more cost-effective than conventional farming methods.

In recent years, however, there has been some disagreement about the impact of no-till farming practices on yield.

New findings about yield

"This review was a tremendous undertaking and is probably the largest meta-analysis done in agriculture," said co-author Bruce Linquist, a Cooperative Extension specialist at UC Davis.

After assessing more than 5,000 side-by-side observations, the researchers concluded that on average no-till negatively impacts yields at the global scale, yet several opportunities exist for more closely matching or even exceeding conventional tillage yields.

For example, yield reductions were minimized when the principles of crop rotation and residue retention were also practiced, highlighting the importance of implementing all three conservation agriculture principles as part of an integrated management system rather than no-till alone.

Moreover, when adopted in dry climates in combination with the other two principles of conservation agriculture, no-till farming performed significantly better than conventional tillage, likely due to the higher retention of soil moisture.

Dryland ecosystems are home to 38 percent of the world's population, and millions of acres of land in arid regions of sub-Saharan Africa and South Asia have been identified as suitable for sustainable intensification. Yet, the authors also caution that practicing no-till in dryland areas without the implementation of the other two principles of conservation agriculture decreases yields.

In regions with moist climates and sufficient precipitation, no-till farming actually resulted in yields that were on average 6 to 9 percent

lower than with conventional tillage methods.

"No one has ever stated that there would be a significant decline like this," said Chris van Kessel, a professor of plant sciences at UC Davis and co-author of the study. "Our findings suggest that broad implementation of conservation agriculture may not be warranted in all areas, particularly where residue retention and crop rotation practices are hard to implement."

More information: "Productivity limits and potentials of the principles of conservation agriculture." *Nature* (2014) [DOI: 10.1038/nature13809](https://doi.org/10.1038/nature13809)

Provided by UC Davis

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