Unploughed fields take edge off heatwaves

No-till agriculture could cool Europe's hottest days by up to two degrees.

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23 June 2014

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Soybean plants emerge from the residue of the preceding year's wheat crop in this Arkansas field.

'No-till' farming — in which seeds are sown into fields without first ploughing them — could help to lower temperatures near croplands by up to 2 °C, researchers report in the *Proceedings of the National Academy of Sciences*[1].

The effect is driven by the increased fraction of sunlight that the soil reflects back into space, or albedo, in fields that have not been ploughed, which reduces the amount of heat the Earth's surface absorbs from the Sun. No-till plots are roughly 50% more reflective during summer months than tilled croplands, according to measurements made in the wheat fields of an experimental farm site in the Provence region of France.

And that can translate into a big effect on the climate at local scales, says Sonia Seneviratne, a climate scientist at the Swiss Federal Institute of Technology (ETH) in Zurich and an author of the study. "The effect on extremes is pretty strong — the cooling is twice as large for very hot temperatures than for the median temperature," she says.

Previous studies had concluded that the cooling effects of unploughed fields were small[2], but that research generally looked at temperatures averaged over longer periods and larger areas. Climate modeling by Seneviratne and colleagues also finds a small cooling effect — less than 1 °C — in no-till areas on days when conditions stay close to the seasonal median.

But on the hottest 1% of summer days — such as the heatwave that struck France in 2003 and killed more than 14,000 people — agricultural areas in northern Europe could see temperatures reduced by 1.6 °C, with a larger dip of 2 °C in southern Europe.

Sunny sensitivities

No-till agriculture is often promoted because it limits erosion, and leaving residues of the crops in fields means that the soil retains more moisture. That reduces evaporation, limiting its cooling effect. But the very hottest days tend to be very sunny and clear, Seneviratne says, so the cooling from increased reflectivity overwhelms any countereffect from reduced evaporation.

"It's quite surprising how big the effect they estimate is," says David Lobell, an agricultural ecologist at Stanford University in California.

During extreme heat, fluctuations of just a degree or two can be “the difference between annoying and harmful, or harmful and disastrous”, he says. “Every degree matters.”

Lobell notes however that in many places agriculture is concentrated well away from population centers. “The question is, how regional is this effect? If it's just local, how many people live in areas that are going to be affected?.”

The next step for Seneviratne and her colleagues is to determine what scale no-till farming would have to be done at to have an appreciable effect on climate. “You would need to have a fairly large area, because what we found in the simulation is that this is mostly a local effect,” she says.

Nature | doi:10.1038/nature.2014.15438

References

1. Davin, E. L., Seneviratne, S. I., Ciais, P., Olioso, A. & Wang, T. *Proc. Natl Acad. Sci. USA* http://dx.doi.org/10.1073/pnas.1317323111 (2014).
2. Lobell, D. B., Bala, G., & Duffy, P. B. *Geophys. Res. Lett*. **33**(6), L06708 (2006). http://dx.doi.org/10.1029/2005GL025492