

for relevant information in formats useful to informed decision-making. There is much to do in that regard. □

References

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Reply to 'No-till agriculture and climate change mitigation'

Powlson *et al.* reply — In our recent Perspective¹, we concluded that no-till agriculture offered only limited potential for mitigating climate change through soil carbon (C) sequestration, in contrast to the claims made in the agriculture chapter of the 2013 UNEP Emissions Gap Report². The authors of the UNEP report disagree with our conclusion and we are happy to respond to their comments³. They are correct that we concentrated totally on no-till rather than other agricultural practices as a means of mitigating climate change. This was deliberate because current uptake of no-till — and its probable rate of adoption in the medium term — is far greater than for the other practices mentioned, such as agroforestry and biochar applications to soil. And we have no disagreement with their comments on climate change mitigation through improved water and nutrient management and reduced use of fossil fuels — in fact, alterations to water and nutrient management are probably the most effective approaches in all agricultural systems, not only rice production.

We agree with Neufeldt *et al.*³ that estimating soil C accumulation following adoption of no-till using a 'bottom-up' approach is, in principle, preferable to the 'top-down' method we used. In their Correspondence, Neufeldt *et al.*³ accomplish bottom-up estimations of avoided emissions for specific countries by multiplying the area under no-till by a climate-relevant value for the annual rate of increase in soil organic C under the practice. They acknowledge the considerable uncertainty in rates of accumulation under no-till: for example, their estimate for Australia ranges from over 400 MtCO₂e saved from past no-till adoption to additional emissions of over 200 MtCO₂e compared with conventional cultivation³. In the face of such uncertainty the strong promotion of no-till as an effective means of climate change mitigation in the UNEP Emissions Gap Report² looks distinctly unjustified.

In our Perspective¹ we explained the numerous reasons why measurements of soil C change under no-till are almost always overestimates. These errors will have influenced the published values such as those of Smith *et al.*⁴ and used by Neufeldt *et al.*³, yet they continue to ignore them. They further ignore the findings from a large body of experimental data that we cited¹, showing either small rates of soil C accumulation under no-till or no effect in a substantial number of cases.

No-till agriculture can deliver significant benefits for farmers and sustainability in many situations: reduced GHG emissions are a small but important additional benefit

Neufeldt *et al.* arrive at their estimations of future avoided emissions by assuming that historic rates of adoption of no-till over the past 2–34 years will continue indefinitely³. This assumption is highly questionable because in countries covering large areas where no-till is already widely adopted (for example, Australia, USA, Canada, Brazil, Argentina) the change in tillage practice will already have occurred in the most suitable situations.

A recent theoretical study⁵ came to the conclusion that C sequestration in agricultural soils through changed management practices, including no-till, could provide “only a humble contribution to solving the climate problem of the coming decades”. Of course, even small contributions are welcome — put colloquially, every little helps. But it is important that scientists are realistic when making statements about the relative magnitudes of mitigation achievable through different options. This is essential for assisting policymakers

to arrive at evidence-based decisions on the prioritization of possible options. A recent meta-analysis⁶ drew attention to the risk of crop yield losses in many environments if no-till is not accompanied by crop residue retention and/or crop diversification — together with no-till these practices are elements of ‘conservation agriculture’ so, from the viewpoint of food security and farmer livelihoods, caution is needed in proposing no-till alone as done by Neufeldt and colleagues^{2,3}.

We see no reason to alter the conclusion from our original Perspective¹: “No-till agriculture can deliver significant benefits for farmers and sustainability in many (though not all) situations: reduced GHG emissions are a small but important additional benefit, not the key policy driver for its adoption.” □

References

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