Geophysical Research Abstracts
Vol. 21, EGU2019-19056, 2019
EGU General Assembly 2019

Zero-tillage could offer a long term strategy to mitigate climate change

Hannah Cooper, Sacha Mooney, Sofie Sjogersten, and Murray Lark
University of Nottingham, Nottingham, England

A change in the management of agricultural soils can affect their role as a source or sink in the global carbon cycle, and the size and composition of their greenhouse gas emissions. Conversion from conventional management by ploughing to zero-tillage can reduce soil erosion and increase biological activity, and is now practised on 7.9% of arable land globally (111 million ha). However, there is conflicting evidence on the effect of such a conversion on carbon storage and greenhouse gas emissions. Here we present a study to examine the effect of zero-tillage on both carbon storage and greenhouse gas release at a regional scale, in this case the East Midlands of England. We examined sites where zero-tillage had been implemented for different periods of time, and each zero-tilled site had an adjacent paired site under conventional management. We recorded a significantly higher net global warming potential under conventional tillage systems (30% larger than zero-tillage systems) due to the emission rates of different greenhouse gases, and provide evidence that the net global warming potential of zero-tillage systems decreases further over time (assessment was up to 15 years post conversion). When modelling regional estimates of global warming potential, conventionally tilled soils were more spatially uniform than zero-tilled soils (650-700 compared to 200-800 mg CO_2 eq. m-2 h-1 respectively) which were more spatially variable. Simultaneously, in zero-till systems, carbon stocks increased with time under management and a similar pattern emerged from the prediction of carbon stocks across the region with zero-tilled soils showing a larger variation in carbon stocks compared to conventionally tilled soils. In addition, changes in organic carbon chemistry indicated an increase in the proportion of sequestered recalcitrant carbon compared to conventionally tilled soils. Further research investigating the seasonal impact is imperative, but our work highlights the importance of the temporal effect of agricultural conversion and indicates that zero-tillage could play a significant role in reducing greenhouse gas emissions whilst increasing carbon stocks that may be enhanced over time.