

Project *brief*

Thünen Institute of Agricultural Technology

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Fractional deep tillage of arable soils to reduce harmful environmental and climate impacts in crop production

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- More carbon can be stored in arable soils through fractional deep tillage.
- Carbon-Sequestration in the soil is influenced by ongoing climate change.
- Farmers face complex challenges in incorporating arable soils into a carbon market.

Background and aims

Rapid technological progress and population growth over the last century have driven industrial agriculture, contributing to an increase in CO₂ emissions and a profound impact on soil organic carbon stocks (C_{org}) and thus climate change. However, through appropriate soiling, such as fractional deep tillage, it is possible to store more carbon in the soil without compromising the main objective of agriculture, which is to ensure a sustainable food supply.

Key questions

Can fractional deep tillage in combination with suitable fertilization strategies increase the carbon storage of arable soils? What are the effects of the expected climate change? What are the ecological and economic effects of fractional deep tillage for farmers?

Results

The Candy Carbon Balance (CCB) model shows that a C_{org} increase of up to 0.3 % is possible by 2050 through the use of fractional deep tillage (see figure). This takes into account future temperature increases of 0.5 - 1.5 °C, an increase in annual precipitation of 4 - 8 % and a change in yield of between -6 and +10 %. Both organic fertilization and the resulting increase in yield and the associated increase in crop residues have a positive effect on the C_{org} value in agricultural soils. However, at temperature increases above 1.5 °C, the carbon storage capacity in the soil under consideration decreases

noticeably. Despite the possibility of sequestering more carbon in the soil through fractional deep tillage, there are complex challenges for the inclusion of agricultural soils in a voluntary carbon market.

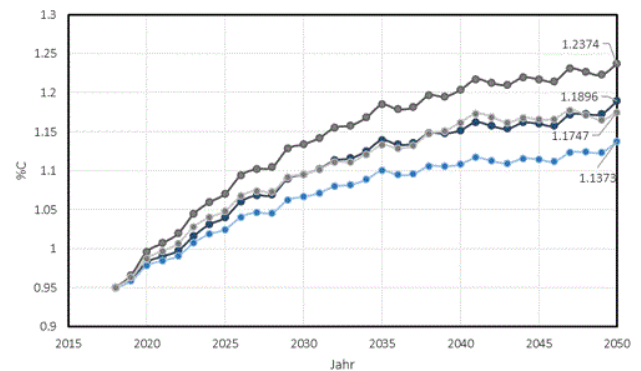


Figure: Increase in soil organic carbon content (C_{org}) after application of partial tillage by 2050. The curves show the range of carbon sequestration depending on the parameters described under "Results" (Source: Own illustration).

Conclusion

The voluntary carbon market is currently facing a significant downturn due to dwindling demand and regulatory gaps, meaning that this approach does not promise a sustainable solution for agriculture as things currently appear.

Further Information

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