

EGU21-14675

<https://doi.org/10.5194/egusphere-egu21-14675>

EGU General Assembly 2021

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Comparison of soil CO₂ emissions from three different tillage methods on chernozem soil

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Tillage practices influence soil CO₂ emissions, hence many research investigate the long-term effects of conservation and conventional tillage methods e.g. ploughing and no-tillage on soil greenhouse gas emission.

The experiment site is an 18-years-old long-term tillage trial established on chernozem soil. During 2020, we took weekly CO₂ emission measurements in the mouldboard ploughing (MP), no-tillage (NT), and shallow cultivation (SC) treatments Tillage depth was 26-30 cm, 12-16 cm and 0 cm in the cases of MP, SC and NT respectively. The experiment was under wither oat cultivation.

We investigated the similarity in the CO₂ emission trends of SC to MP or NT treatments. Besides CO₂ emission measurements, we also monitored environmental parameters such as soil temperature (Ts) and soil water content (SWC) in each treatment.

During the investigated year (2020 January - December) SC had higher annual mean CO₂ emission ($0.115 \pm 0.083 \text{ mg m}^{-2} \text{ s}^{-1}$) compared to MP ($0.099 \pm 0.089 \text{ mg m}^{-2} \text{ s}^{-1}$) and lower compared to NT ($0.119 \pm 0.100 \text{ mg m}^{-2} \text{ s}^{-1}$). The difference of the CO₂ emissions was significant between SC and MP ($p < 0.05$); however, it was not significant between SC and NT ($p > 0.05$) treatments. The Ts dependency of CO₂ emission was moderate in all treatments. CO₂ emissions were moderately depended on SWC in MP and SC, and there was no correlation between these parameters in NT.

The annual mean CO₂ emission of the SC treatment was more similar to the NT, than to the MP treatment.