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Compaction of cultivated peat soils, how does it affect GHG emissions and yield?

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Objective: GHG emissions from cultivated peat soils can be substantial. Soil compaction by vehicular traffic alters aeration and water flow affecting gas flow and microbial activity. In tropical peatlands, compaction has sometimes been shown to reduce CO₂ emissions. This project investigated how GHG emissions from cultivated peat soils in Sweden are affected by compaction using field and laboratory experiments.

Methods: In a long-term field trial, GHG emission and yield from compacted and non-compacted plots growing timothy, reed canary grass, and tall fescue on peat soil have been measured. Compaction in the field has been done by using a tractor with a total weight of 9640 kg. Compact density, penetration resistance, GHG emissions and yield in the different treatments were compared. In the lab, peat soil in steel cylinders were compacted using a uniaxial compression machine with defined stresses of 100, 200 and 300 kPa. GHG emissions were measured before, during and after compression.

Key results: Compact density of the peat soil changed for all crops, but the effect was just present in timothy one year after the compaction. In the lab, N₂O emission increased with compaction, and CO₂ emission decreased.

Conclusions: Compaction can alter the pore size distribution in the soil affecting GHG emissions. In this project, we found lower CO₂ emissions from compacted peat but sometimes higher N₂O emissions. Plots with reed canary grass and tall fescue were less affected by compaction than timothy, which is the traditional crop grown in the area.