



## **Submerged drains and sub-surface irrigation in Dutch drained peat soils: effects of drains on CO<sub>2</sub> emissions in wet and dry periods**

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Drained peatlands are responsible for 6% of the global anthropogenic greenhouse gas emissions. Thereby, peat oxidation causes soil subsidence, which gives damage to buildings and infrastructure, and could result in an increased frequency of flooding and crop failure.

In summer 2016 a large-scale pilot (5 farms, 11 pastures/meadows 3-4.5 ha each) was initiated to evaluate the effects of groundwater management with a dense network of submerged drainage tubes (1500-2000 m ha<sup>-1</sup>), compared to drainage management with ditches only. Drains were placed at 70 cm depth to accelerate drainage in wet periods (spring, autumn) and to irrigate subsoil (below 60 cm) in dry periods (summer). We tested how the change in groundwater levels during wet and dry periods affects CO<sub>2</sub> emissions, photosynthesis and yield.

In 2017 water levels dropped to about 100 cm below the surface during summer after a 2-months dry spell. Submerged drains increased water levels by 10-20 cm at most farms. Opposite to the expectations, submerged drains failed to reduce net CO<sub>2</sub> fluxes and ecosystem respiration remained high (Reco 126-144 t CO<sub>2</sub> ha<sup>-1</sup> a<sup>-1</sup>) unaffected by subsoil irrigation or site. Ditch drained sites revealed a trend to higher C-export from yields (18.6 t CO<sub>2</sub> ha<sup>-1</sup> a<sup>-1</sup>) than sites exposed to submerged drains (17.4 t CO<sub>2</sub> ha<sup>-1</sup> a<sup>-1</sup>).

In 2018 grass production was dominated by the prolonged drought affecting large parts of (Central) Europe. Water levels dropped to about 110 cm below the surface begin of august 2018. At the height of the drought submerged drains increased water levels by 20-30 cm. Sprinkler irrigation had a larger effect on water levels. CO<sub>2</sub> fluxes were lower in 2018 compared to 2017 probably due to the drought. Ecosystem respiration seemed largely unaffected by submerged drains and higher water levels during summer. The yield increase upon subsurface irrigation was small (0.54 t DW ha a<sup>-1</sup>).

In 2017 and 2018 sites with additional drainage tiles showed a rapid water level drawdown after rain. In the spring these sites were somewhat drier which allowed a higher intensity of fertilization using dairy cow manure.

First results show the effects of subsoil drains during and after a long drought period. Submerge drains can increase water levels by 20 cm (by 30 cm during extreme droughts). Yields increased only little upon higher (sub)soil moisture. A net CO<sub>2</sub>-reduction effect was absent even in a very dry summer.