



Greenhouse gas emissions from reed canary grass cultivation in peatland rewetted to different levels of ground water table

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Rewetting of drained peatlands has been recommended to mitigate the greenhouse gas (GHG) emissions and to restore the carbon sink function of peatlands. Cultivation of bioenergy crops in rewetted peatland (paludiculture) is a new and emerging land use practice which can additionally reduce the CO₂ emissions by substituting fossil fuel. However, information on the overall greenhouse gas balance from paludiculture is lacking. The objective of this study is to investigate the greenhouse gas emissions from peatlands grown with reed canary grass (RCG) and rewetted to various extents (i.e. to different controlled water table levels). In May 2012, soil mesocosms (60 cm height and 30 cm in diameter) were collected from a drained fen peatland used for agricultural purposes (Nørreå river valley, Denmark). The mesocosms were sown with RCG and manipulated to water table levels of 0, 10, 20, 30 and 40 cm below the soil surface. Gas fluxes of CO₂, CH₄ and N₂O were measured at biweekly intervals with static chamber techniques from 10th July 2012 to 19th April 2013. GPP was estimated from the above ground biomass yield. The mean yield of dry biomass across all water table treatments was 6 t ha⁻¹ with no significant differences between the treatments. However, there was significant effect of water table on all three GHG emissions. Raising the water table to the surface decreased both the ecosystem respiration (ER) and N₂O emissions whereas CH₄ emissions increased. In terms of CO₂ equivalents the increase in CH₄ emissions was compensated by the decrease in ER. ER and N₂O emissions were highest when water table was at or below 20 cm in contrast to CH₄ which increased above 20 cm. Total cumulative GHG emissions (for 283 days) was 0.1, 0.2, 0.7, 0.8 and 1.0 kg CO₂ eq. m⁻² respectively from the treatments at 0, 10, 20, 30 and 40 cm below the soil surface. Our results showed that in order to get efficient mitigation in total GHG emission the water table should be maintained close to the surface.