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Emissions of greenhouse gasses from peat soils under different management and drainage

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In their pristine state, peat soils act as major sinks for CO₂ and as sources of methane. Drainage, fertilization, soil tillage and liming may increase the degradation of the peat turning it into a source of carbon dioxide. Organic soils used for agriculture in Denmark contributed to greenhouse gas emissions with 1.2 Mt CO₂ eq/year, meaning that the organic soils under agricultural management emit as much as the mineral soils even though the organic soil area only form a minor part of the total agricultural land. Management options for reducing the emissions, such as reduced drainage and fertilization, perennial crops or re-establishment of the natural ecosystem has been suggested. We established a field experiment in a fen peat with three different cropping systems (barley, fertilized grass and unfertilized grass) and five different degrees of drainage. We found that the unfertilized grass emitted more nitrous oxide compared to the fertilized grass. This contradicts the immediate expectations that fertilization would increase the emissions. A mixed model analysis revealed that the daily emission of nitrous oxide was mainly controlled by the nitrogen available in the soil and the occurrence of thaw. The daily emission of CO₂ (ecosystem respiration) was controlled by the water content of the soil. The daily (mainly negative) emission of methane was controlled by the soil temperature and the occurrence of thaw.