

Relating N₂O emissions from energy crops to the avoided fossil fuel-derived CO₂ – a study on bioethanol and biogas produced from organically managed maize, rye, vetch and grass-clover

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One way of reducing the emissions of fossil fuel-derived CO₂ is to replace fossil fuels with biofuels. However, cultivation of soils results in emission of other greenhouse gasses, especially nitrous oxide (N₂O). In this study we relate measured field emissions of N₂O to the reduction in fossil fuel-derived CO₂, which is obtained when energy crops are used for biofuel production. The analysis includes five organically managed crops (*viz.* maize, rye, rye-vetch, vetch and grass-clover) and three scenarios for conversion of biomass to biofuel. The scenarios are 1) bioethanol production, 2) biogas production and 3) co-production of bioethanol and biogas, where the energy crops are first used for bioethanol fermentation and subsequently the residues from this process are utilized for biogas production. The net reduction in greenhouse gas emissions is calculated as the avoided fossil fuel-derived CO₂, where the N₂O emission has been subtracted. This value does not account for farm machinery CO₂ emissions and fuel consumption during biofuel production. We obtained the greatest net reduction in greenhouse gas emissions by co-production of bioethanol and biogas or by biogas alone produced from either fresh grass-clover or whole crop maize. Here the net reduction corresponded to about 8 tons CO₂ ha⁻¹ yr⁻¹.