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N_2O emission from organic barley cultivation as affected by green manure treatment

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Legumes are an important source of nitrogen in stockless organic cereal production. However, substantial amounts of N can be lost from legume-grass leys prior to or after incorporation as green manure (GM). Here we report N_2O emissions from a field experiment in SE Norway exploring different green manure management strategies: mulching versus removal of grass-clover herbage during a whole growing season and replacement as biogas residue to a subsequent barley crop. Grass-clover ley had significantly higher N_2O emissions as compared with a non fertilized cereal reference during the GM year (2009). Mulching of herbage induced significantly more N_2O emission (+ 0.37 kg N_2O-N ha^{-1}) throughout the growing season than removing herbage. In spring 2010, all plots were ploughed (with and without GM) resulting in generally higher N_2O emissions during barley production. Addition of biogas residue (80 kg N ha^{-1}) in 2010 to previously non mulched GM and unfertilized cereal plots (2009) had no significant effect on cumulative N_2O emissions relative to a treatment receiving the same amount of N in form of mulched aboveground GM. Ley management (mulching vs. removing biomass in 2009) had no effect on N_2O emissions during barley production in 2010. In general, organic amendments (previously mulched or harvested GM, biorest) increased N_2O emissions relative to a reference treatment with low mineral N fertilisation (80 kg N ha^{-1}). Organic cereal production emitted 95 g N_2O-N kg^{-1} N yield in barley grain, which was substantially higher than in the reference treatment with 80 kg mineral N fertilization in 2010 (47 g N_2O-N kg^{-1} N yield in barley grain).