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Extent and N_2O / N_2 ration of gaseous nitrogen losses from a soilless culture system (refereed)

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Abstract

During the cultivation of greenhouse crops in soilless closed-loop systems considerable amounts of nitrogen can be lost in gaseous form by the activity of denitrifying microorganisms in the root zone. In this study the influence of plant, nutrient solution and substrate parameters on both the intensity and the composition of N_2O+N_2 fluxes from a rockwool system planted with cucumbers was investigated. The denitrification activity was stimulated in regions of high root density by rhizodeposition of easily decomposable organic substances and oxygen consumption of roots. In a range between moderate sub- and supraoptimum nitrogen supply (80-160 mg N l⁻¹) the N_2O+N_2 emission rates were independent of the N concentration in the nutrient solution. However, the proportion of N_2O in denitrification was raised at high N concentration level. With increasing pH (pH 4-7) and temperature (16-30°C) of nutrient solution and substrate, respectively, the extent of the gaseous nitrogen losses rose nearly exponentially, whereas the N_2O / N_2 ratio declined inversely.