Methanotrophic bacteria in the rhizosphere of rice microcosms and their effect on porewater methane concentration and methane emission

Gilbert B., Frenzel P.

in

Chataigner J. (ed.).
Perspectives agronomiques de la culture du riz en Méditerranée : réduire la consommation de l'eau et des engrais

Montpellier : CIHEAM
Cahiers Options Méditerranéennes; n. 15(1)

1996
pages 41

Methanotropic bacteria in the rhizosphere of rice microcosms

and their effect on porewater methane concentration and methane emission

B. Gilbert, P. Frenzel
Max-Planck-Institut für Lerrestrische Mikrobiologie, Marburg (Allemagne)

CH_4 emissions from irrigated rice fields are one of the major sources in the global budget of atmospheric CH_4 . Rates of CH_4 emissions depend on both CH_4 production in anoxic parts of the soil and on CH_4 oxidation at oxic-anoxic interfaces. In our study we used planted and unplanted rice microcosms and characterized them with regard to numbers of CH_4-oxidizing bacteria (MOB), porewater CH_4 and O_2 concentrations and CH_4 fluxes. Plant roots had a stimulating effect on both the number of total soil bacteria and CH_4 oxidizing bacteria as determined by FITC-fluorescent staining and the MPN technique, respectively. In the rhizosphere, and on the root surface MOB were enriched during the growth period of rice, while numbers of MOB remained constant in unplanted soils. In the presence of rice plants, the porewater CH_4 concentration was significantly lower, with 0.1–0.4 mM CH_4, than in unplanted microcosms, with 0.5–0.7 mM CH_4. O_2 could be detected at depths of up to 16 mm in planted microcosms, whereas it already disappeared at a depth of 2 mm in unplanted experiments. CH_4 oxidation was determined as the difference between the CH_4 emission rates under oxic (air) and anoxic (N_2) headspace, and by inhibition experiments with acetylene. Flux measurements showed varying oxic emission rates between 2.5 and 29.0 mmol CH_4.M^{2}.day^{1}. An average of 34% (up to 70%) of the anoxically emitted CH_4 was oxidized in the planted microcosms, which was surprisingly constant.

The rice rhizosphere appeared to be an important oxic-anoxic-interface, significantly reducing CH_4 emission.

Reference

• **Gilbert B., Frenzel P.** (in press). Methanotrophic bacteria in the rhizosphere of rice microcosms and their effect on porewater methane concentration and metane emission. Biology and fertility of soils.