An Exploratory Study on Optimal Sampling Time and Measurement Methods for Methane in Paddy Fields[1]

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Abstract

The closed chamber method is widely applied to quantify greenhouse gas emissions but is constrained by limited sampling frequency and the requirement for laboratory analyses. To improve temporal resolution, this study combined the closed chamber approach with a trace gas analyzer to continuously monitor methane emissions from paddy fields in Yilan and Hualien, Taiwan. Results demonstrated reliable CH_4 quantification and revealed distinct emission dynamics between field types. In rice-cultivated fields, CH_4 was mainly transported via plant aerenchyma, producing stable fluxes. Conversely, non-cultivated and fallow fields were dominated by irregular ebullition, with minor contributions from gas diffusion in fallows. Importantly, this study identified the period between 9:00 and 12:00 a.m. as the optimal sampling time for methane flux measurements in the Yilan and Hualien region. Methane fluxes measured during this period can be converted into daily average fluxes using a conversion equation ($R^2 = 0.982$), thereby improving the accuracy of carbon emission estimations.

Keywords: paddy, methane, ebullition, closed chamber method, greenhouse gas measurement

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