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Towards high throughput system in detecting GHG emissions in rice production: Assessment of measurement approaches

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Abstract

Since flooded rice fields are a major source of greenhouse gas (GHG) methane (CH_4) and to a lesser extent nitrous oxide (N_2O). Several Asian countries focus on rice production for mitigating GHG emissions in the agricultural sector. In turn, it is imperative to accurately quantify emissions of CH_4 and N_2O at field level as the basis for scaling up. Accessibility to appropriate field technologies becomes a prerequisite for reliable quantifications of (i) countries' commitments to international agreements like the UN Framework Convention on Climate Change as well as (ii) the emerging national and international carbon markets. The commonly applied method of closed chamber technique based on manual sampling entails significant restrictions in terms of observation sites and periods, particularly for regions lacking analytical lab facilities. At the other end of the technological scale, Eddy Covariance measurements facilitate accurate flux records, but require high investment costs and are unsuitable for comparative measurements of agronomic practices. In this study, we assess the pros and cons of a fast *in situ* measurement approach using the laser-based system trace gas analyzer with high accuracy and immediate detection of CH_4 and N_2O fluxes in the field. In combination with an automatically controlled system for sample transfer, this cutting-edge approach facilitates enhanced efficiency and mobility. The full potential of this technology, however, can only be tapped with advanced procedures for database management. Focusing on a case study in a research station at IRRI, our assessment highlights its potential for advancing understanding of main mechanisms of GHG emissions in rice systems with access to high resolution in space and in time of emissions data that were not possible before to inform mitigation strategies. We elaborate as well on the pivotal role of research in ensuring the exploitation of different technological progress for accessibility of on farm measurements.

Keywords: Advanced technology, field measurement, rice GHG

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