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Spatial Variations among the Field Positions on Grain Yield and Environmental Impact of Paddy Rice Production in Southeast Asia

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Abstract

Understanding the spatial variations in grain yield and methane (CH_4) emission is essential for site specific management recommendation for grain yield and mitigating CH_4 emission from paddy rice in Southeast Asia. To access the spatial variation in crop yield and CH_4 emission, field experiments were conducted in Yen Chau district, Northwest Vietnam and Kanyutkwin district, Myanmar. In Vietnam, two rice cascades were divided into fertilised and unfertilised parts and all measurements were conducted at top, middle and bottom field during spring and summer season in year 2011. In Myanmar, two successive lowland rice fields were divided into fertilised and unfertilised and measurements were done at inlet, middle and outlet positions of both rice fields in year 2012. For the fertilised field, farmers practices were conducted using sulfate and ammonia based nitrogen fertiliser.

In Vietnam silt, clay, total nitrogen and carbon content was found to increase from the upper field to the down filed. Grain yields in the middle fields of both rice cascades were higher than other field positions in both fertilised and unfertilised fields. The highest cumulative CH_4 fluxes were observed in bottom fields of both cascades in both crop seasons. Fertilisation significantly lowered cumulative CH_4 flux in both cascades. Economic analysis showed that top and bottom fields need more management practice to increase yield and net income. In Myanmar, sand, total nitrogen and total carbon content decreased from top to bottom, while silt content increased. Grain yields were significantly higher in positions closer to the channel. The highest cumulative CH_4 fluxes were observed in 1^{st} outlet of 1^{st} field and 2nd inlet of 2nd field. Fertilisation reduced CH_4 emission but the degrees of reduction were spatially dependent. Economic analysis showed that fields near the channel, no or few fertilisers is required to increase net income. But more fertilisers were needed in fields far away from channel to increase yield as well as net income.

To increase grain yield and net income as well as to mitigate CH_4 emission, site specific management with the use of sulfate and ammonium based fertiliser should be practice in both study area.

Keywords: Ecobalance, grain yield, methane emission, paddy rice, spatial variation

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