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Methane and Nitrous Oxide Emission from the System of Rice Intensification (SRI) under Rainfed Lowland Ecosystem in Cambodia

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Abstract

The system of rice intensification (SRI) receives considerable attention for its potentials to increase rice productivity in marginalised rice-growing environment. SRI differs from conventional rice management by several parameters, including water management. The intermittent irrigation (as opposed to permanent flooding) under SRI was carried out in order to improve soil aeration, root activities, reduce ineffective tillers and remove toxic substances. This practice may significantly reduce methane (CH_4) emissions, a potent greenhouse gas. However, this benefit may be offset by increased nitrous oxide (N_2O) emissions, which has much higher radiation absorbing capacity. The present field study measured the fluxes of CH_4 and N_2O under SRI practices and compared the emission of greenhouse gases from SRI with a Conventional Management Practices (CMP) production system under which continuous flooding was applied. The effects of nutrient amendment (composted farmyard manure (FYM), mineral fertiliser (MF) and FYM+MF) were also investigated under each production system. The results indicated large seasonal variations of CH_4 patterns during the growing season with a peak emission of about 1300 mg CH_4 m^{-2} d^{-1} under both production systems two weeks after rice transplanting. N_2O emissions were not detected in any treatments, which indicates NO_3^- and available C were limiting in the field trial. Under each production system, the highest emission of CH_4 was under FYM+MF treatments (282 kg CH_4 emission ha^{-1} under CMP and 213 kg ha^{-1} CH_4 emission under SRI). Total CH_4 emission under SRI practices was reduced by 22 % in FYM treatment, 17 % in MF treatment and 24 % in FYM+MF treatment compared to CMP practices. There was no effect of water management on CH_4 emission in the non-fertilised control. Grain yields were not significantly affected by the production system. Thus the CO_2-equivalent emitted per kg grain produced is lower under SRI than CMP, namely 21 % in FYM+MF treatment, 8 % in MF treatment and 21 % in FYM treatment, respectively. The results therefore suggest a potential of SRI to mitigate the greenhouse gas emission from rice production without compromising rice yields.

Keywords: Cambodia, methane, nitrous oxide, nutrient, system of rice intensification, water management, rice

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