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Methane Emission from Rice Production as Affected by Rice Variety Selection

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Abstract

Rice production is a primary source of greenhouse gases (GHG) which is attributed to emission of methane generated in flooded soils. In order to meet the 1.5-/ 2-degree goal of the Paris Agreement, several studies have assessed the potential reduction of GHG emissions from rice production by changing farming practices namely water, nutrient and straw management. The impact of selecting different rice varieties, however, is still poorly understood. This study aims to quantify the mitigation potential of variety selection in combination with Alternate-Wetting-and-Drying, a water management proven to reduce GHG emissions. A field experiment has been conducted in the Mekong Delta, Vietnam in the early-year season of 2020 using the closed chamber method.

The emission potentials of different rice varieties have to be quantified in form of a Scaling Factor (SF) to be used in the IPCC Tier² guidelines for regional extrapolations. Conceptually, the SF quantifies a deviation from the baseline emissions whereas SF's <1 correspond to lower and >1 to higher emission rates. Strictly speaking, regional emission estimates should also be specified for one 'Baseline Variety' (BV), but this aspect has previously been taken into account. This lack of information can largely be attributed to the cumbersome field sampling for a high number of rice varieties, i.e. we had 120 plots (based on 20 varieties, 3 replicates and 2 water managements) requiring sampling in weekly intervals. Due to the pronounced changes in plant physiology under AWD, it can be assumed that the variety effects will change as a function of water management.

The available results confirm that the mean emission rates show large differences between two water management practices. Applying AWD reduced methane emission by more than 50% across all varieties tested whereas inter-varietal differences were lower. Thus, we can already conclude that water management determines of the magnitude of GHG emissions and that variety selection modulates these emissions within a smaller range. Nevertheless, it is fairly easy for farmers to change rice varieties – as compared to changes in water management – so that this approach should be considered in view of optimising mitigation impacts.

Keywords: Alternate-Wetting-and-Drying, IPCC Tier 2, methane

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