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"Solidarity in a competing world — fair use of resources"

Research on Water-Saving System for Paddy Field in Thai Highland Communities

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Abstract

Rice cultivation in the Thai highlands is usually on terraced paddy fields that are rain-fed and often flooded, but flooding can cause water loss. Climate variability often results in insufficient rainfall at the beginning of rainy season, which can delay field preparation and transplanting. The objectives of this research were: (1) to investigate the volume of water usage on rice fields under the non-flooded and flooded soil condition; and (2) to monitor the emission of greenhouse gases on rice fields on non-flooded and flooded soil. The experiment was conducted in Chiang Mai province in 2014–2015. Two treatments were imposed: 1) flooded, which used irrigation water to maintain water depth from 3 to 10 cm; and 2) non-flooded, which used irrigation to maintain a water depth of 3 cm until 3 weeks after transplanting, followed by alternate drying and rewetting: when irrigation was applied water depth was up to 5 cm. Results showed that in 2014, local variety San-Pa-Tong1 yielded 3,925 kg ha^{-1} when grown under non-flooded conditions and 3,600 kg ha^{-1} under flooded conditions. The irrigated water volume of non-flooded was 4,504 m^3 ha^{-1} and 6,947 m^3 ha^{-1} under flooded soil condition, which is a 35 % water savings in the non-flooded treatment. In 2015, the non-flooded treatment 4,581 kg ha^{-1} and the flooded treatment yielded 4,147 kg ha^{-1}. The non-flooded treatment used 9,015 m^3 ha^{-1} of irrigation water, which was 56 % less water than the flooded treatment, which used 20,462 m^3 ha^{-1}. The cumulative methane emissions in the non-flooded treatment was 12.2 kg CH_4 ha^{-1}, which was 75 % less than the 50.4 kg CH_4 ha^{-1} emitted in the flooded treatment. Cumulative nitrous oxide emission was 2.69 kg N_2O ha^{-1} in the non-flooded treatment, which was 14 % less than the 3.13 kg N_2O ha^{-1} emitted in the flooded treatment. Combined, non-flooded produced 46 % less carbon equivalents than the flooded treatment. Thus, non-flooded conditions with alternate wetting and drying cycle increased crop yields and efficiency of water use while reducing greenhouse warming potential. If farmers adopt this water-saving system of non-flooded rice production in highland areas, they can conserve water for production of further crops.

Keywords: Greenhouse gases, rice, terraced paddy field, Thai highland, water-saving system

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