Abstract

This research aimed to monitor methane emission from paddy field and water usage during rice production on highland area. Two water management systems were compared, which were continuous flooding system using farmer's method and water-saving system with 2 cycles of alternate wetting and drying during tillering stage. The research was carried out during in-season planting of June-November 2015 at two field places including Pha Taak village, Pha Taak royal project extention area, Mae Rim district, Chiang Mai Province that grown Li Ka rice cultivar and Mae Sai Na Rao village, Long Kort royal project extention area, Phrao, Chiang Mai Province that grown San-pah-tawng 1 rice cultivar.

The results showed that highland paddy fields at Pha Taak village and Mae Sai Na Rao village which used water-saving and continuous flooding systems had cumulative methane emission at 473.12 and 12.20 kg CH_4/ha; and 515.13 and 50.41 kg CH_4/ha, respectively. Thus, the water-saving system effectively reduced methane emission by 8.16 and 75.80 % when compared with the continuous flooding systems.

For cumulative nitrous oxide emission, the amounts from water-saving and continuous flooding systems of Pha Taak paddy fields were 4.51 and 3.16 kg N_2O/ha, while from water-saving and continuous flooding systems of Mae Sai Na Rao paddy fields were 2.69 และ 3.13 kg N_2O/ha, respectively. Thus, the water-saving system effectively reduced nitrous oxide emission by 14.11 % when compared with the continuous flooding systems. In total, the water-saving system effectively reduced global warming potential by 4.05 and 46.32 % when compared with continuous flooding system for Pha Taak and Mae Sai Na Rao paddy fields, respectively.

The irrigated water volume throughout growing season of the water-saving system at Pha Taak paddy fields was lower than the continuous flooding system by 55.9 5 %. However, there were very high seepage rate at Pha Taak paddy fields thus the irrigated water volume of the water-saving system was higher than the continuous flooding system by 212.96 %. Rice yields from Pha Taak and Mae Sai Na Rao paddy fields showed that the water-saving system (924.45 and 737.93 kg/rai) had averaged higher yields than the continuous flooding system (849.18 and 663.49 kg/rai). Thus, the water-saving system gave higher yields than the continuous flooding system by 8.85 and 11.22 %, respectively. In addition, the influent of alternate wetting and drying cycle led to the increasing of net biomass assimilation rate, which the values from water-saving system (13.18 and 111.89 g/cm^2/day, respectively were higher than from continuous flooding system (10.32 and 8.32 g/cm^2/day, respectively).

The results indicated that the water-saving system and alternate wetting and drying cycle had co-benefit effects in reducing methane emission from rice terraces as well as increasing water usage efficiency and rice yields.