Greenhouse Gas Mitigation in the Rice-Based Mekong Delta Agricultural System

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Climate change mitigation technologies in the agricultural sector are meaningless unless they are used by farmers. It is important that the mitigation potential of the technologies is high, but it alone is insufficient. A mechanism that encourages farmers to take the initiative in adopting the technologies for themselves is necessary. Also, the environment surrounding farmers varies from place to place. It is necessary to construct a sustainable agricultural system that is unique to and that makes good use of the local environment. Having set the Mekong Delta as the main target region, we are working to suggest a good example of the system.

Agricultural activities that we are mainly tackling are rice cropping, which is the major agricultural activity in the Mekong Delta, and cattle raising, which is expected to develop rapidly in the future. Rice cropping has an inseparable relationship with the Mekong Delta. In the delta region, which occupies 11% of the land in Vietnam, more than a half of rice produced in Vietnam, the fifth largest rice producing country since 1992 (FAOSTAT, 2017), is being produced (General Statistics Office, 2015), which amount corresponds to 2.3 times that produced throughout Japan (FAOSTAT, 2017). On the other hand, rapid development of livestock industry in the Mekong Delta region including cattle raising is expected (Thornton, 2010), although its scale is not yet large at this moment. The Mekong Delta region is assumed to be favorable in terms of self-sufficiency of feed for cattle raising, as a large amount of by-products such as rice straw and rice bran are produced but not very positively utilized in the region (Hong Van et al., 2014). If once they are used as major feed sources, it may raise the comparative advantage in cattle raising of the region. Turning our eyes to material outflow from cattle raising in the Mekong Delta, cattle urine looks merely utilized and simply discharged into the surrounding environment, such as water systems. With the rapid development of cattle raising in the future, it may become a potential source of environmental load in the region. In the Mekong Delta, by-products of rice production as feed for cattle raising and its excreta as fertilizer in rice cropping would be effectively utilized. In the current JIRCAS project, we are aiming at development of technologies for effective use of regional resources to establish a system, which realizes the benefits both to local environment and farmers and ultimately contributes to the mitigation of global warming through reduction of direct and indirect emissions of greenhouse gases.

From research activities on rice cropping, we achieved the following results. An intermittent irrigation technology called “alternate wetting and drying (AWD),” had been introduced for 5 years to a typical triple-rice-cropping farmer’s alluvial paddy in Can Tho City in a central area of the Mekong Delta. In the AWD practice, we irrigated up to 5 cm above the soil surface when the field water level dropped to 15 cm below the soil surface except for 14 days after sowing, for 10 days during the heading period, and just before fertilizer application, when the paddy soil was kept saturated or flooded, and except for 14 days before the expected harvest day, when standing water was drained. Irrigation water use was reduced by 1/3 in the 5-year experimental period. It is noted that the total of methane and nitrous oxide emissions (converted into their CO_2 equivalent amount) was reduced by 1/2, but also the grain yield was increased by 9%, compared with a conventional continuous flooding.

Currently we are implementing experiments to formulate concrete guidelines for the use of liquid waste discharged from domestic methane fermentation systems, where livestock excreta are the main source materials, as organic fertilizer for rice cropping. Because it is difficult for small scale farmers to know the plant nutrient contained in the organic fertilizer, we aim to use feedback information such as rice leaf color and plant height, which can be easily recognized by farmers, as indicators to adjust and decide the amount of the organic fertilizer application to achieve grain yields comparable to those of chemical fertilizers. Together with the use of the aforementioned water management technology, we strive to develop a technology that conserves the global and local environments and that realizes farmers' profits simultaneously in the Mekong Delta.

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