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Assessing the changes of groundwater recharge / irrigation water use between SRI and traditional irrigation schemes in Central Taiwan

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To respond to agricultural water shortage impacted by climate change without affecting rice yield in the future, the application of water-saving irrigation, such as SRI methodology, is considered to be adopted in rice-cultivation in Taiwan. However, the flooded paddy fields could be considered as an important source of groundwater recharge in Central Taiwan. The water-saving benefit of this new methodology and its impact on the reducing of groundwater recharge should be integrally assessed in this area. The objective of this study was to evaluate the changes of groundwater recharge/ irrigation water use between the SRI and traditional irrigation schemes (continuous irrigation, rotational irrigation). An experimental paddy field located in the proximal area of the Choushui River alluvial fan (the largest groundwater pumping region in Taiwan) was chosen as the study area. The 3-D finite element groundwater model (FEMWATER) with the variable boundary condition analog functions, was applied in simulating groundwater recharge process and amount under traditional irrigation schemes and SRI methodology. The use of effective rainfall was taken into account or not in different simulation scenarios for each irrigation scheme. The simulation results showed that there were no significant variations of infiltration rate in the use of effective rainfall or not, but the low soil moisture setting in deep soil layers resulted in higher infiltration rate. Taking the use of effective rainfall into account, the average infiltration rate for continuous irrigation, rotational irrigation, and SRI methodology in the first crop season of 2013 were 4.04 mm/day, 4.00 mm/day and 3.92 mm/day, respectively. The groundwater recharge amount of SRI methodology was slightly lower than those of traditional irrigation schemes, reducing 4% and 2% compared with continuous irrigation and rotational irrigation, respectively. The field irrigation requirement amount of SRI methodology was significantly lower than those of traditional irrigation schemes, saving 35% and 9% compared with continuous irrigation and rotational irrigation, respectively. The SRI methodology significantly improved water-saving benefit compared with the disadvantage of reducing groundwater recharge. The results could be used as a basis for the relevant government agency to formulate the integral water resource management strategies in this area.

Keywords: SRI, Paddy field, Infiltration, Groundwater recharge