An assessment of the vertical movement of water in a flooded paddy rice field experiment using Hydrus-1D

ABSTRACT

A quantitative estimation of the major components of the field water balance provides management decisions on how the scheme ought to be operated to ensure better distribution of irrigation water and increased delivery performance. Therefore, in this study, the water balance component in transplanted and broadcasted rice fields with conventional irrigation (flooding irrigation) in the Tanjung Karang Rice Irrigation Scheme (TAKRIS), Sawah Sempadan were observed and then modeled using Hydrus-1D numerical model during two consecutive rice growing seasons. During the off-season, irrigation water accounted for 59.6% of the total water input (irrigation + rainfall), but about 76.2% of total water input during the main season. During the main season, rainfall water only contributed to 23.8% of total water input and 40.4% during the off-season. Drainage water accounted for 37.3% of the total water input during the off-season and 43.7% during the main season, respectively, which was the main path of water losses from conventional rice fields, which indicates that maintaining a high water level and huge rainfall events during both seasons increased drainage water. Simulated ET during the off-season and the main season accounted for 38.1% and 49.5% of the total water input, respectively. Observed and simulated water percolation revealed about 17.1% to 19.2% of total water input during both seasons, respectively. Additionally, the water productivities analyzed from total water input and irrigation water were 0.43 and 0.72 kg m−3 during the off-season and 0.60 and 0.78 kg m−3 during the main season, respectively. The water productivity index evaluated from observed and modeled evapotranspiration was 1.03 and 1.13 kg m−3 during the off-season and 0.98 and 0.94 kg m−3 during the main season, respectively. The overall results revealed that Hydrus-1D simulations were a reasonable and effective tool for simulating vertical water flow in both broadcasted and transplanted rice experimental fields.

Keyword: Water flow; Water losses; Water balance; Hydrus-1D; Water productivity