

Irrigation and crop water requirement estimation for oil palms using soil moisture balance model in Peninsular Malaysia

ABSTRACT

This study presents the irrigation and crop water estimation in a Malaysian oil palm plantation for effective irrigation water management during water years 2013 and 2014. The study area was divided into four plots: 2000, 2002, 2006 and 2010, indicating years of peat swamp forest conversion to oil palm plantation. Hydrologic Engineering Centre-Hydrologic Modeling System (HEC-HMS) and Soil moisture balance hydrologic models were used to model the rainfall-runoff in the basin. Statistical analysis using coefficient of determination (R^2) and Nash–Sutcliffe efficiency coefficient (NSE) were used to evaluate the performance and correlation of the two hydrologic models. The result showed that R^2 and NSE were 0.94 and 0.90 respectively for calibration and 0.92 and 0.54 respectively, for monthly validation. This showed that the models performed well for simulation of the peatland hydrology. With the modelling of rainfall-runoff satisfied, the irrigation demand of the study plots was determined using the same soil moisture balance model. The irrigation demand ranged from 0.893 to 1.6 million cubic meters (MCM) in 2010 and 2000 study plots respectively. Irrigation demand is observed to be site specific which depends on the soil moisture deficit, readily available water in the oil palm root zone and oil palm rooting depth. Estimation of a future oil palm water requirement using the soil moisture balance model would be recommended for further studies for use as an advisory manual for the oil palm managers to enhance adequate water resources planning for oil palm productivity.

Keyword: Runoff estimation; Oil palm plantation; Soil moisture balance; Hydrological models; Irrigation water demand