Estimation of Consumptive-Use of Tomato Grown in Tropical Greenhouse Conditions using Evapotranspiration Models

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The crop water requirement during different growing periods may vary significantly depending on management practices and growth stages. Generally, evapotranspiration (ET) estimation is a reliable measure to maintain the water uptake and thus an efficient translocation of plant nutrients. However, direct measurements of the water requirement (consumptive-use; CU) is less accurate. Under this backdrop, an attempt was made to validate the available mathematical models for estimating ET of tomato with the aim of selecting the most appropriate estimation model/s for tropical greenhouse conditions. In literature, several mathematical models have been introduced for estimating ET, and compared with actual ET measurements, made using mass difference within a time gap. In this experiment, tomato plants were grown in coco-peat-bag culture under greenhouse conditions for making direct ET measurements and gathering climatological data and plant characteristics (i.e. leaf area) as parameter estimates of models. The latter were used to estimate ET using two simulation models, and also using the famous Penman-Monteith (PM) equation. The leaf area of tomato ranged from 0.00189 to 1.3665 m^2 $plant^{-1}$, while ET varied from 0.175926 to 1.5238 L m^{-2} day^{-1} during the two-month period. LAI varied from 0.0035 to 2.53 during the same period. Model validation resulted best values for R^2 (0.8692 and 0.8145), for RRMSE (5.9 and 15.98 %), and for ME (0.99 and 0.82) for the simplified model 1(SM1) and PM, respectively. The mean temperature, mean solar radiation and mean relative humidity prevailed during data collection were 24.5-29.5 ^{o} C, 5.03 -30.6 w m^{-2} and 66% - 88.1%, respectively. The results showed that the SM1 and PM model fitted well with the actual evapotranspiration values. However, based on the results of the model validation, SM1 could be selected better than PM model and the simplified model 2 for the test conditions with respect to crop and environment.

Keywords: Evapotranspiration, Leaf area, Relative humidity, Solar radiation, Temperature

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