

Preliminary Performance Evaluation of the Penman Monteith Evapotranspiration Equation in Southeastern Colorado

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Abstract. Accurate estimation of crop evapotranspiration (ET) is important to know how much water is required during the growing season, to improve crop water management, to conserve soil and water resources and for water rights purposes. Various forms of semi-empirical equations have been developed to estimate crop ET. The ASCE-EWRI Standardized Penman-Monteith (PM) equation and the full version of the Penman-Monteith equation have been used in this study to estimate alfalfa ET. The ASCE-EWRI Standardized PM equation along with crop coefficient (K_c) can be used to estimate actual crop ET. The full version of the PM equation can be applied to calculate actual ET directly for unstressed crop conditions by using the weather and crop variables. In this study, both PM ET methods were evaluated using a weighing lysimeter. A weighing lysimeter is one of the best methods available to accurately determine actual crop ET. Using the soil water balance, the ET from a crop grown in a lysimeter can be determined. The research was carried out at the Colorado State University- Arkansas Valley Research Center, Rocky Ford, Colorado. Data from 2009 and 2010 from a large precision monolithic weighing lysimeter were used. The performance evaluation of the PM equations was done for different atmospheric stability conditions. The statistical analysis included the mean absolute error, mean biased error, root mean squared error, linear regression slope-intercept (and goodness of fit), and the index of agreement. The evaluation was done using days where the alfalfa was at reference conditions. The results showed that both PM ET methods compared satisfactorily with the lysimeter ET values, however, both methods underestimated actual alfalfa ET. The ASCE-EWRI Standardized PM equation performed slightly better compared to the full version of the PM equation.