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Using lysimeters to test the Penman Monteith actual evapotranspiration.

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Abstract : Differences in actual transpiration (ETa) of banana plants were quantified in a lysimeter experiment. ETA was computed using instantaneous data from two weighing lysimeters and compared to PM (Penman-Monteith) model for ETa. Two critical problems were faced in this test. A) Estimating canopy and aerodynamic resistances ("rc" and "ra" respectively) and B) converting the lysimeter changes in water volume (LYv cm3) to ETa length units (cm). The two unknowns " rc" and "ra" were obtained from continuous measurements of the differences between canopy and air temperature (Tc - Ta). This difference was established by means of the infrared thermometry which was followed by numerical and analytical calculation of ETa using the modification suggested by R. Jackson to the PM model. The conversion of lysimeter volumetric units (LYv) to ETa length units was derived from the slope of cumulative LYv/ETa. This relationship was significantly linear (r2=0.97and 0.98.). Its slope was interpreted as "evaporating leaf area" which accounted for 1.8E4 cm2 in lysimeter 1 and 2.3E4 cm2.in lysimeter 2 . The comparison between LYv and PM model was acceptable even under very low ETa. The average of two lysimeters was 1.1mm/day (1.4 mm/day , LYv 1 and 0.8 LYv 2) while ETa calculated on the basis of PM model was 1.2 mm/day. It was concluded that although lysimeters are most accurate systems to measure ETa one of its disadvantages (beside the high cost) is the volumetric output that in many cases should be supported by a one dimensional energy balance system. The PM model was found to be a reliable complementary tool to convert lysimeters volumetric output into conventional length units of ETa.