



Separating soil evaporation and crop transpiration to improve crop water use efficiency

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A network of a FAO/IAEA Coordinated Research Project (CRP) on “Managing Irrigation Water to Enhance Crop Productivity under Water-Limiting Conditions: A Role for Isotopic Techniques”, involving seven countries was implemented from 2007 to 2012, to identify approaches to improve crop water productivity (production per unit of water input) under water-limiting conditions using isotopic and related techniques. This paper presents findings from the two of the studied sites, one in China and another in Morocco, in using both isotopic and conventional techniques to separate soil evaporation (E) and crop transpiration (T) from total water losses in evapotranspiration (ET) for winter wheat grown under different climatic conditions and methods of irrigation management practices. In the North China Plain (NCP), the estimated E/ET of winter wheat by the isotopic method (Keeling plot using delta oxygen-18 ($\delta^{18}O$)) was in agreement with that obtained by conventional methods (eddy covariance and micro-lysimeter). The high correlation between these methods ($R^2=0.85$, $n=27$) showed that the E from wheat-growing field contributes an average of 30% of water losses for the whole growing season (Nov-June), with higher E percentage (68%) can be expected before elongation stage due to incomplete canopy cover. The results also showed that through deficit irrigation and improved irrigation scheduling, soil E losses could be reduced by 10–30% of the total water loss compared with full irrigation. In Morocco, field Keeling plot isotopic E and T separation study was carried out for two days in spring of 2012 at Sidi Rahal. The percentage contribution of T to total ET was approximately 73%. The experimental results obtained from both China and Moroccan sites were used to validate FAO’s AquaCrop model for E and T, and for improving irrigation scheduling and agronomic practices. Good correlation ($R^2=0.83$) was obtained between measured (isotopic) and AquaCrop simulated ET from NCP. The measured and simulated E and T results from Morocco also compared well; the difference in E between the two approaches was only 5-12% over the two-day study.