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Determination of actual crop evapotranspiration (ETc) and dual crop coefficients (Kc) for cotton, wheat and maize in Fergana Valley: integration of the FAO-56 approach and BUDGET

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Determination of the actual crop evapotranspiration (ETc) during the growing period is important for accurate irrigation scheduling in arid and semi-arid regions. Development of a crop coefficient (Kc) can enhance ETc estimations in relation to specific crop phenological development. This research was conducted to determine daily and growth-stage-specific Kc and ETc values for cotton (Gossypium hirsutum L.), winter wheat (Triticum aestivum L.) and maize (Zea mays L.) for silage at fields in Fergana Valley (Uzbekistan). The soil water balance model - Budget with integration of the dual crop procedure of the FAO-56 was used to estimate the ETc and separate it into evaporation (Ec) and transpiration (Tc) components. An empirical equation was developed to determine the daily Kc values based on the estimated Ec and Tc. The ETc, Kc determination and comparison to existing FAO Kc values were performed based on 10, 5 and 6 study cases for cotton, wheat and maize, respectively. Mean seasonal amounts of crop water consumption in terms of ETc were 560±50, 509±27 and 243±39 mm for cotton, wheat and maize, respectively. The growth-stage-specific Kc for cotton, wheat and maize was 0.15, 0.27 and 0.11 at initial; 1.15, 1.03 and 0.56 at mid; and 0.45, 0.89 and 0.53 at late season stages. These values correspond to those reported by the FAO-56. Development of site specific Kc helps tremendously in irrigation management and furthermore provides precise water applications in the region. The developed simple approach to estimate daily Kc for the three main crops grown in the Fergana region was a first attempt to meet this issue.

Keywords: Actual crop evapotranspiration, evaporation and transpiration, crop coefficient, model BUDGET, Fergana Valley.