

Predicting deep percolation with eddy covariance under mulch drip irrigation

Guanghui Ming (1), Fuqiang Tian (2), and Hongchang Hu ()

(1) State Key Laboratory of Hydroscience and Engineering, Department of Hydraulic Engineering, Tsinghua University, Beijing 100084, China [U+FF08] mgh14@mails.Tsinghua.edu.cn [U+FF09], (2) State Key Laboratory of Hydroscience and Engineering, Department of Hydraulic Engineering, Tsinghua University, Beijing 100084, China [U+FF08] tianfq@mail.tsinghua.edu.cn [U+FF09], (3) State Key Laboratory of Hydroscience and Engineering, Department of Hydraulic Engineering, Tsinghua University, Beijing 100084, China [U+FF08] huhongchang@tsinghua.edu.cn [U+FF09]

Water is essential for the agricultural development and ecological sustainability of the arid and semi-arid oasis with rare precipitation input and high evaporation demand. Deep percolation (DP) defined as excess irrigation water percolating below the plant root zone will reduce irrigation water use efficiency (WUE). But the DP was often ignored in mulch drip irrigation (MDI) which has reached the area of 1.6 million hectares in Xinjiang, the northwest of China. In this study DP experiments were conducted at an agricultural experiment station located within an irrigation district in the Tarim River Basin for four cotton growing periods. First it was detected the irrigation water infiltrated into the soil layers below 100cm and the groundwater level responded to the irrigation events well. Then DP below 100cm soil layers was calculated using the soil water balance method with the aid of eddy covariance (with the energy balance closure of 0.72). The negative DP (groundwater contribution to the crop-water use through capillary rising) at the seedling and harvesting stages can reach 77mm and has a good negative correlation with the groundwater level and positive correlation with potential evaporation. During the drip irrigation stage approximately 45% of the irrigation became DP and resulted in the low irrigation WUE of 0.6. The DP can be 164mm to 270mm per year which was positive linearly correlated to irrigation depth and negative linear correlated to irrigation interval. It is better to establish the irrigation schedule with small irrigation depth and given frequently to reduce deep percolation and meet crop needs.