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Secondary salinization and evapotranspiration under mulched drip irrigation condition in Tarim River basin of northwestern China

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The secondary salinization induced by irrigation has been presented as a crucial threat to agriculture all over the world, especially in semi-arid and arid regions. Mulched drip irrigation (MDI), as a new micro-irrigation approach incorporating surface drip irrigation method and film mulching technique, has been widely applied in water scarce regions including Tarim River basin of northwestern China. However, salts are likely to build up in the surface soil due to the deficient leaching water in such an irrigation condition. To explore this new kind of secondary salinization issue, the oasis eco-hydrology experimental research station were established in 2008 in a cotton field of Xinjiang, northwestern China. More than 40,000 soil samples were collected to monitor soil moisture and salinity condition within the 1.5 meter depth. The patterns of soil salinity distribution under MDI along the horizontal direction as well as vertical direction have been explored. The results did show that secondary salinization tends to occur in the experimental field under mulched drip irrigation, and winter flush could leach most soil salt in the root zone into groundwater and keep salt balance to mitigate the soil salinization.
Meanwhile, soil salt always migrates with the soil water flux such as irrigation and groundwater recharge. Therefore the understanding of water balance is of great importance for estimating soil salinity accumulation, of which evapotranspiration (ET) is the key process, especially in the semi-arid and arid area. In our study, in order to quantify the relation between salinity balance and water balance, ET were derived from a range of measurement systems including eddy covariance, soil water budget (gravimetric methods, Hydra probe, TDT probe and groundwater table sensor, et al.), sap flow and portable photosynthetic system during cotton growing period. Our study is unique in its focus on ET scale issue ranging from leaf and plant scale to field. The up-scale methods of ET from point measurement to field average status are developed and verified. The characteristics of ET under mulched drip irrigation are analyzed over varied spatial scales.