

Changes in the competition for water between poplar and cotton in a shelterbelt-farmland system caused by drip irrigation in oasis

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Abstract

Farmland shelterbelt plays a crucial role in protecting arable land but also exhibits high water consumption in arid areas. The coexistence of shelterbelt and farmlands always lead to the competition for water. However, the wide application of drip irrigation in recent years make shelterbelt difficult to get water, leading to a more complex relationships between shelterbelt and farmland in water use. Therefore, the evapotranspiration (ET) of poplar shelterbelt and cotton field under the drip irrigation were quantitatively analyzed, to explore the relationship between shelterbelt and cotton under drip irrigation in water use and determine the area and intensity of potential competition. The results showed that due to the larger planting area and higher density of cotton, the ET of cotton field was 56% - 66% higher than that of poplar shelterbelt, especially in the seedling stage and flowering and bolling stage. In the boll-opening stage of cotton, the ET of poplar shelterbelt exceeded that of cotton field by 24.15%, and the ET of cotton per unit area was significantly lower than that of poplar shelterbelt. Besides, in the area with a distance of 0.1 - 0.5 times tree height (H) from the shelterbelt (0.1H - 0.5H), shelterbelt had an obvious competitive advantage because the root length density and biomass were significantly higher than those of cotton in the 20-40 cm soil layer, and the competition for water between them was the most intense in this area. In >1H area, there was no poplar root and no competition. Therefore, the introduction of a poplar shelterbelt did not increase water consumption in the local area and aggravate the water shortage in oases. However, the amount of irrigation to cotton field close to the shelterbelt should be appropriately increased, to reduce the loss of water caused by the consumption of poplar trees.

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