

Effects of different drip irrigation patterns on water distribution in potted Yunnan red loam and yellow-sand soil and pepper growth

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ABSTRACT

It is important to study the law of water distribution in potted soil and the appropriate irrigation methods for improving the level of water-saving irrigation in greenhouse cultivation. In this study, pepper was taken as the experimental crop. Two kinds of drip irrigation models (root zone infiltrating irrigation and surface drip irrigation) and two kinds of irrigation emitter arrangements (a $3 \times 120^\circ$ distribution and a $2 \times 180^\circ$ distribution) were used to plot out the distribution pattern of soil water in a potted planting environment for two kinds of soils (Yunnan red loam and yellow-sand soil). Then, the growth indices of peppers were compared. The results showed that drip irrigation models and soil types had a significant interactive effect on soil water distribution ($P < 0.01$); in Yunnan red loam, the matric potential played a major role in the transport of irrigation water, while in yellow-sand soil, gravitational potential played a major role. Under root zone infiltrating irrigation, the high-water-content distribution area of the two types of soil is more continuous and balanced than that of surface drip irrigation, and the balance of water distribution of the yellow-sand soil is better than that of the red loam. In Yunnan red loam, the growth indices of peppers (plant height, stem diameter, fruit fresh weight, fruit dry weight, and similarly hereinafter) increased by 12.9%, 14.3%, 46.1%, and 36.8%, respectively; in yellow-sand soil, the growth indices under root zone infiltrating irrigation were 31.7%, 25.9%, 26.9%, and 35.3%, which were lower than those of surface drip irrigation. The experiment shows that in a greenhouse potting environment, Yunnan red loam with root zone infiltrating irrigation offers more water-saving potential. The results provide a theoretical basis and data support for the rational selection of drip irrigation models for facility agriculture in Yunnan.

Keywords: Irrigation methods; Root zone infiltration irrigation; Surface drip irrigation; Water distribution; Yunnan red loam; Yellow-sand soil

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