微孔管渗灌时土壤水分运动的有限元模拟及其应用

Finite Element Modeling of Soil Water Movement Under Subsurface Irrigation With Porous Pipe and Its Application

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中文摘要：

为了深入了解新型微孔渗灌管的灌水性能，提供推广应用渗灌的科学理论和技术依据，建立了含有第3类边界条件的二维微孔管渗灌土壤水分运动的数学模型，采用有限单元法进行了模拟。检验结果表明模型具有较高的精度。模型的仿真应用结果表明：供水水压力、土壤初始含水率、渗管的渗水速率等对渗灌效果都有明显影响。供水压力增大渗灌后土壤湿润范围内的平均含水率增大。初始含水率越高，湿润锋越不明显，总渗水量越小。随着渗管渗水速率的增大，渗管周围将出现饱和区，并存在渗水速率临界值，该值与土壤初始含水率有关。增加渗管的渗水速率可以提高渗灌的灌水效果。

英文摘要：

In order to acquire more scientific theories and technical basis of subsurface irrigation with porous pipes for wid espread use, it is very necessary to deeply study irrigation performance of the new kind of porous pipe. A two dimension soil-water movement model with boundary of the third type was built to simulate infiltration of subsurface irrigation. Fi nite element method (FEM) was used to solve this model. Results of tests show that precision of the model is high. Applic ation of the model indicates that effect of subsurface irrigation is influenced evidently by pressure of water supply, in itial soil-water content, penetration rate of porous pipe. With increase of water pressure, wetting range at the end of i rrigation will enlarge, and average water content within the range will become higher. The higher the initial soil water content, the more inconspicuous the wetting front, and the less the total amount of infiltration. If infiltration rate of porous pipe was larger than a threshold value, a saturated zone around porous pipe would form. The threshold value is rel ated to the initial soil water content. By increasing infiltration rate of porous pipe, effect of subsurface irrigation w ill be improved.

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