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蓄水坑灌单坑土壤氮素迁移转化的数值模拟

Numerical simulation of soil nitrogen transformation for water storage single pit irrigation

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中文关键词：氮素,土壤,模型,蓄水坑灌,有限体积法,数值模拟

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中文摘要:

为了提高蓄水坑灌条件下土壤氮素的利用率，建立了蓄水单坑土壤氮素迁移转化的数学模型，利用有限体积法进行了求解，并利用室内蓄水单坑灌施尿素条件下土壤水分和氮素运移转化实测数据进行了验证。结果表明，蓄水单坑灌施尿素1 700 mg/L条件下，土壤铵态氮主要分布在20～70 cm深度范围内，1～3 d内土壤铵态氮含量明显增大，7 d后开始减小；土壤硝态氮主要分布在湿润锋附近，1～7 d内硝化作用逐渐增强，20～70 cm范围内硝态氮浓度不断增大。土壤含水率、湿润锋、铵态氮、硝态氮含量计算值与实测值吻合较好，说明所建立的蓄水单坑土壤氮素迁移转化的数学模型是正确的，采用有限体积法求解是可行的。该模型可较好地模拟蓄水坑灌单坑土壤氮素迁移转化的动态变化。

英文摘要:

In order to improve nitrogen use efficiency under water storage pit irrigation condition, a mathematical model on soil nitrogen transformation was proposed with characteristics of single water storage pit and was solved by finite volume method, which was verified by the measured data of soil water content and nitrogen transport under indoor experiment conditions with urea fertigation. The results showed that for single water storage pit irrigating with urea application of 1700mg/L, soil ammonium nitrogen were mainly distributed within the range of 20-70 cm depth, the ammonium content increased gradually during 1-3days and decreased after the seventh day. The soil nitrate aggregated near the water front, the nitrification increased gradually during 1-7days after irrigating and the nitrate content increased gradually within 20-70 cm depth. The simulated results of soil water content, wetting front, ammonium and nitrate content are in proper accord with those corresponding measured data, which indicates that the soil nitrogen transformation model is accurate, and numerical solution with finite volume method is acceptable. The proposed model can be used to simulate the soil nitrogen transformation processes.

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