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覆膜开孔土壤蒸发的水盐分布特征及运移规律研究

李毅1;3;王全九3;4;王文焰4;邵明安2;3

1.青海师范大学地理系 西宁810008;2.中国科学院地理科学与资源研究所，北京 100101;3.中国科学院水利部水土保持研究所黄土高原土壤侵蚀与旱地农业国家重点实验室 陕西杨凌 712100;4.西安理工大学水资源研究所 陕西西安710048

Distribution and movement characteristics of soil water and soil salt during evaporation from perforated plastic mulch

LI Yi1;3;WANG Quan-jiu3;4;WANG Wen-yan4;SHAO Ming-an2;3*

1 Dept. of Geog. Qinghai Normal Univ.;Xining;Qinghai 810008;China; 2 Ins. of Geog. Sci. and Natural Resour. Res.;on the Loess Plateau;Inst. of Soil and Water Conser.;CAS;Yangling;Shanxi 712100;China;4 Inst. of Water Resour. Res.;Xian Univ. of Tech.;Xian;S

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摘要 在干旱半干旱的新疆地区,覆膜灌溉面积在逐年增加。但由于田间地膜覆盖率无法达到100%,同时出苗孔和灌水孔的存在使得研究覆膜灌后地表覆膜开孔率不同时蒸发的水盐运动很有必要。为获得覆膜开孔蒸发的土壤水盐分布特征,采用垂直一维入渗—蒸发双层有机玻璃土柱实验系统进行蒸发试验。以概化的覆膜开孔率为上边界条件,针对初始水盐均匀和入渗结束后的蒸发两种处理,研究了覆膜开孔率影响下,蒸发土壤含盐量剖面和盐分浓度剖面的分布特征。结果表明,对"水盐均匀"处理,剖面盐分浓度可采用含水率及开孔率的函数关系表达;而对"入渗—蒸发"处理,剖面盐分浓度随覆膜开孔率的范围不同可采用不同的指数形式表达。表土10cm返盐量随覆膜开孔率的增大而逐渐增加。单位膜孔面积的返盐量随覆膜开孔率的增加而减小,呈幂函数关系。此外,相同开孔率条件下,单位膜孔面积上蒸发量(E_R)与土表10cm返盐量($W_{sm,10}$)之间呈良好的线性关系。

关键词： 覆膜开孔率 蒸发 含盐量 盐分浓度 水盐运移 覆膜开孔率 蒸发 含盐量 盐分浓度 水盐运移

Abstract： In arid and semi-arid area of Xinjiang region, the plastic mulch irrigation area is increasing year by year. In fact, no entire mulch can be performed in the field, and planting film holes and irrigated film holes should be added in order that plant may merge and water can infiltrate into the soil. So it is necessary to study the characteristics of soil water and salt movement under plastic mulch during evaporation with different open hole ratios. In this paper, for the observation of soil water content and soil salt distributions during evaporation from perforated plastic mulch, experimental 1-dimension vertical infiltration-evaporation system was set up. In the experiment system, the soil columns were double-layer Plexiglas, soil water was observed dynamically using γ-ray attenuation method, and soil salt-conductor was used to measure soil salt content. Two treatments were adopted including "evaporation with initial uniform soil water content and soil salt content" and "evaporation after infiltration". Observations of soil salt content distribution and soil salt concentration (ratio of soil salt content to soil water content) distribution were analyzed for evaporation from perforated plastic mulch at different open hole ratios. In the treatment of "evaporation with initial uniform water and salt contents", a good relationship was found between soil salt concentration and soil water content at different open hole ratios, while in the treatment of "evaporation after infiltration", different functions were used to describe the relationship of soil salt concentration and depth at different open hole ratios. The increased salt content accumulated at 10cm top layer was increasing with the (increasing) of open hole ratios. And the increased salt content accumulated at 10cm top layer on unit film hole area was powerful function of open hole ratios, while at the same open hole ratio, the increased salt content accumulated at 10cm top layer in the treatment of "evaporation with initial uniform water and salt contents" was much higher than the treatment of "evaporation after infiltration", which indicated that the de-salt effect of infiltration not only played roles in the stage of infiltration, but also in the later evaporation stage. Moreover, there was fine linear relationship between the cumulative (evaporation) on unit film hole area(E_R) and the increased salt content accumulated at 10cm top layer on unit film hole area($W_{sm,10}$).

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