

模拟降雨下初始含水量对砂黄土硝态氮迁移特征的影响

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Effect of initial soil moisture content on nitrate transportation in loessial soil under artificially simulated rainfall conditions

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摘要

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摘要 利用室内人工模拟降雨, 研究了不同初始含水量砂黄土在降雨条件下入渗-径流、土壤侵蚀, 以及 NO_3^- -N随径流流失和土壤深层淋溶特征。结果表明, 初始含水量对产流时刻影响在相对含水量为49.4%和76.9%之间存在一个转折点, 高初始含水量较低含水量产流提前大约15 min; 土壤侵蚀量随着土壤初始含水量的增加而增加, 相对含水量为97.1%时, 侵蚀泥沙量分别是相对含水量22.9%的2.8倍, 49.4%的2.3倍, 76.9%的1.5倍。初始含水量高的处理径流初始 NO_3^- -N浓度高, 随后各处理均衰减很快, 10 min左右 NO_3^- -N含量趋于雨水本底值; 土壤初始含水量越低, NO_3^- -N被淋洗的程度越严重, 土壤剖面中 NO_3^- -N的浓度峰越深。对于黄土高原坡地砂黄土 NO_3^- -N迁移特征来看, 按照 NO_3^- -N迁移数量, 随径流和泥沙流失量比向土壤深层迁移的数量小。说明在降雨条件下, NO_3^- -N主要通过土壤深层淋溶损失, 且土壤初始含水量越低其损失越严重。针对黄土高原降水量小, 分布集中的特点, 采取措施增加入渗, 蓄积水分, 在一定含水量下施肥, 以提高氮肥利用率, 降低 NO_3^- -N的淋溶。

关键词: 含水量 人工降雨 硝态氮 砂黄土 含水量 人工降雨 硝态氮 砂黄土

Abstract:

In this study, artificial laboratorial rainfall simulation was conducted under a range of initial soil moisture conditions in sandy loessial soils. The aim was to investigate the related processes such as infiltration-runoff, soil erosion, as well as nitrate loss by runoff and leaching. The results showed that there was a turning point between 49.4% and 76.9% of relative water content from the aspect of the effects of initial soil moisture on time to runoff. Commencement of runoff under higher soil water content condition was 15 minutes earlier than that under lower soil water content condition. The magnitude of soil erosion increased with soil water content, with the quantity of sediment under 97.1% of relative water content being 2.8, 2.3, and 1.5 times larger than that under 22.9%, 49.4% and 76.9% of relative water content, respectively. The higher nitrate concentration of initial runoff solution corresponded to the higher initial soil water content, and the nitrate concentration in runoff of the four treatments all dropped remarkably and about 10 minutes was close to the rainfall background nitrate concentration. When initial water content was lower, however, the extent of nitrate leaching was more serious, hence, nitrate migrated deeper in soil. From the experimental result we found that the nitrate loss from flow and sediment was less than that by deep migration. The results showed that nitrate was primarily lost through leaching under rainfall conditions, and the lower the initial soil water content, the more serious the nitrate losses. Precipitation characteristics of the Loess Plateau are low and concentrated, so adopting measures to increase infiltration, moisture accumulation, apply fertilizers under certain moisture content condition is of great significance for increasing nitrogen use efficiency, and decreasing nitrate leaching.

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