生态学报 2007 27 (2007-06): 2516～2522 ISSN: 1004-616x CN: 44-1063/R

研究论文

红壤表土团聚体粒径对坡面侵蚀过程的影响

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收稿日期 2006-12-5 修回日期 2007-3-16 网络版发布日期: 2007-6-25

摘要 以湖北省咸宁市的3种典型红壤为研究对象，利用试验土槽，采用室内人工模拟降雨方法，研究土壤团聚体粒经对坡面径流和侵蚀的影响以及泥沙特性。结果表明，在前期含水量、坡度一致的条件下，随着团聚体粒径的增大其稳定性减小，坡面初始产流时间缩短；侵蚀量也随着团聚体粒径的增大而减小，供试3种土壤中＜2mm团聚体侵蚀量最大，依次为3.40、2.55、3 33g m^{-2} min^{-1}。侵蚀泥沙平均重量直径随着坡面表土团聚体初始粒径的增大而减小。研究结果有助于深入了解坡面侵蚀机理，为泥沙输移模型开发提供必要的土壤参数。

关键词 红壤；团聚体粒径；坡面侵蚀；径流；人工模拟降雨

分类号 S154.1,S155,S157,S181

Effects of topsoil aggregate size on runoff and erosion at hillslope in red soils

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Abstract The red soil hilly region, located in the tropical and subtropical zones of Southeast China, consists of 9 provinces and 1 autonomous region. The area of region is about 1.13 million km^2, and hold 30% of the population. Because it has plentiful light, heat and water resources, the red soil hilly region has a high potential for agricultural and economic development. However, soil erosion and seasonal drought are major constraint for sustainable agriculture due to improper land use and uneven distribution of rainfall. Efficient rainfall use and erosion control, therefore, are very advantageous from eco-environmental and agricultural perspectives. Soil aggregate stability has substantial effects on soil porosity and, therefore, may influence infiltration rate and runoff processes under rainfall. The objects of this study were to investigate the relationship between aggregate size and soil aggregate stability and determine the effect of aggregate size on runoff and soil loss. In this study, three red soils derived from Quaternary clay were studied. Aggregate size ＜2, 2 to 3, 3 to 5mm of each soil were exposed to simulated rainfall with an intensity of 60mm h^{-1}. The Le Bissonnais' method was applied to simulate the breakdown mechanisms of slaking in fast wetting, and mechanical breakdown by wet stirring. The aggregate stability index, normalized mean weight diameter (NMWD), indicated that fast wetting caused the most severe disruption to aggregates. The NMWD in the fast wetting treatment ranked in the order of aggregate size ＜2mm, 2mm to 3mm, and 3mm to 5mm. There was a significant interaction between soil loss, runoff rate and aggregate size. The results showed that as clod size increased, the runoff rate decreased, ranging from 0.36 to 0.62mm min^{-1}. The small aggregate size is likely to form a seal, consequently, the soil loss increased with decreasing aggregate size. The largest MWD of sediment materials were found in aggregate size ＜2mm of each soil.

Key words reds soil _ aggregate size _ soil erosion _ runoff _ simulated rainfall

DOI

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