

暴雨条件下辽西不同水土保持措施的坡面产流产沙过程及 水保效益 *

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摘要: 【目的】辽西低山丘陵区是我国水土流失比较严重的地区之一, 很少有研究水土保持措施对暴雨条件下产流产沙过程的影响以及该条件下水土保持措施的减沙减流效益。通过探究暴雨条件下辽西低山丘陵区不同水土保持措施的坡面产流产沙过程及水保效益, 可以为辽西低山丘陵区坡面水土流失防治及坡耕地水土保持措施合理布设提供理论依据。【方法】试验基于辽西低山丘陵区二道岭小流域坡面径流观测场, 通过定位观测法, 研究暴雨条件下(7.28 暴雨)6 种不同水土保持措施的坡面产流产沙过程及水土保持效益。【结果】1) 暴雨过程中, 不同措施的初始产流时间整体表现为林草措施 > 工程措施 > 耕作措施。不同措施下的产流产沙过程与雨强的变化趋势相似, 雨强在 14min 达到峰值, 为 2mm/min, 裸地、顺垄耕作、水平梯田、柠条地埂植物带等小区也在 14min 达到产流和产沙峰值, 横垄耕作小区在 16min 达到产流峰值, 径流与含沙量与雨强存在延后现象。2) 在暴雨条件下, 以裸地作为对照, 横垄耕作、顺垄耕作、柠条地埂植物带、水平梯田、果树台田、林地的减流率分别为 33.71%、-38.51%、86.59%、86.38%、100%、100%; 相应各措施的减沙率分别为 67.52%、-44.82%、85.09%、80.40%、100%、100%。各水土保持措施的减流减沙效益均表现为耕作措施(横垄耕作、顺垄耕作) < 工程措施(地埂植物带与水平梯田) < 林草措施(林地与果树台田)。【结论】在暴雨条件下, 耕作措施中顺垄耕作缩短了初始产流时间, 而工程措施和林草措施延长了初始产流时间; 横垄耕作的径流与含沙量与雨强存在延后现象。林草措施具有良好的减流减沙效果, 而农业措施中的顺垄耕作则加大了产流产沙作用, 促进了水土流失。

关键词: 暴雨; 辽西低山丘陵区; 水土保持措施; 产流产沙过程; 水土保持效益;

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Runoff and sediment yield processes and soil and water conservation benefits of different soil and water conservation measures in western Liaoning under rainstorm conditions

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Abstract: **【objective】** The low mountain and hilly area in western Liaoning is one of the serious areas of soil and water loss in our country, little research has been done on the effect of soil and water conservation measures on runoff and sediment yield and sediment reduction under rainstorm conditions. Based on the study of runoff and sediment yield process and soil and water conservation benefits of different soil and water conservation measures in the hilly region of western Liaoning province under the condition of rainstorm, it can provide a theoretical basis for the prevention and control of soil and water loss on the slope and reasonable arrangement of soil and water conservation measures on the slope farmland. **【Methods】** [Methods] On the basis of the observation site of slope runoff in Erdaoling sub-watershed in the low mountainous and hilly area of western Liaoning, the experiment was carried out to study the processes of slope runoff and sand sediment yield and the benefits of soil and water conservation measures under rainstorm conditions (7.28 rainstorm) by using the locational observation method with six different soil and water conservation measures. **【Results】** 1) During rainstorm, the initial runoff-producing time of different measures as a whole was forest and grass measures > engineering measures > ploughing measures. The trend of runoff and sediment yield under different measures was similar to that of rainfall intensity, which peaked at 2 mm/min at 14 min, and the plots of bare land, smooth-row ploughing, horizontal terracing, and lemon ridge plant belt also reached the peak of flow and sand production at 14 min, while the plot of cross-row ploughing reached the peak of runoff yield at 16 min, and the phenomena of delayed phenomena existed in the runoff and sediment concentration and rainfall intensity. 2) Under rainstorm conditions, using bare land as a control, the flow reduction rates of cross-montane ploughing, smooth-montane ploughing, lemon ridge plant belt, horizontal terraces, fruit tree terrace, and forested land were 33.71%, -38.51%, 86.59%, 86.38%, 100%, and 100%, respectively; and the sediment reduction rates of corresponding measures were 67.52%, -44.82%, 85.09%, 85.09%, 80.40%, 100%. The effectiveness of the soil and water conservation measures in reducing runoff and sediment reduction was as follows: cultivation measures (cross-row cultivation and ridge cultivation) < engineering measures (ridge plantation and horizontal terraces) < forestry and grassland measures (woodland and fruit-tree terraces). **【conclusion】** under the condition of rainstorm, the initial runoff yield time was shortened by ridge tillage, but prolonged by engineering measures and forest and grass measures. The runoff, sediment content and rainfall intensity of ridge tillage were delayed. The forest and grass measures have a good effect on reducing sediment flow and sediment, while the bedding tillage in agricultural measures increases the effect of sediment production and erosion.

Keywords: rainstorm; low mountain and hilly area in western Liaoning; soil and water conservation measures; runoff and sediment yield process; soil and water conservation benefits;