

Temporal Variation of Surface Runoff and Interrill Erosion in Different Soil Textures of a Semi-arid Region, Iran

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Abstract : Interrill erosion is the detachment and transfer of soil particles between the rills due to the impact of raindrops and the shear stress of shallow surface runoff. This erosion can be affected by some soil properties such as texture, amount of organic matter and stability of soil aggregates. Information on the temporal variation of interrill erosion during a rainfall event and the effect soil properties have on it can help in understanding the process of runoff production and soil loss between the rills in hillslopes. The importance of this study is especially grate in semi-arid regions, where the soil is weakly aggregated and vegetation cover is mostly poor. Therefore, this research was conducted to investigate the temporal variation of surface flow and interrill erosion and the effect of soil properties on it in some semi-arid soils. A field experiment was done in eight different soil textures under simulated rainfalls with uniform intensity. A total of twenty four plots were installed for eight study soils with three replicates in the form of a random complete block design along the land. The plots were 1.2 m (length) × 1 m (width) in dimensions which designed with a distance of 3 m from each other across the slope. Then, soil samples were purred into the plots. The plots were surrounded by a galvanized sheet, and runoff and soil erosion equipment were placed at their outlets. Rainfall simulation experiments were done using a designed portable simulator with an intensity of 60 mm per hour for 60 minutes. A plastic cover was used around the rainfall simulator frame to prevent the impact of the wind on the free fall of water drops. Runoff production and soil loss were measured during 1 hour time with 5-min intervals. In order to study soil properties, such as particle size distribution, aggregate stability, bulk density, ESP and Ks were determined in the laboratory. Correlation and regression analysis was done to determine the effect of soil properties on runoff and interrill erosion. Results indicated that the study soils have lower booth organic matter content and aggregate stability. The soils, except for coarse textured textures, are calcareous and with relatively higher exchangeable sodium percentages (ESP). Runoff production and soil loss didn't occur in sand, which was associated with higher infiltration and drainage rates. In other study soils, interrill erosion occurred simultaneously with the generation of runoff. A strong relationship was found between interrill erosion and surface runoff ($R^2 = 0.75$, $p < 0.01$). The correlation analysis showed that surface runoff was significantly affected by some soil properties consisting of sand, silt, clay, bulk density, gravel, hydraulic conductivity (Ks), lime (calcium carbonate), and ESP. The soils with lower Ks such as fine-textured soils, produced higher surface runoff and more interrill erosion. In the soils, Surface runoff production temporally increased during rainfall and finally reached a peak after about 25-35 min. Time to peak was very short (30 min) in fine-textured soils, especially clay, which was related to their lower infiltration rate.

Keywords : erosion plot, rainfall simulator, soil properties, surface flow

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