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Changes in eroded material and runoff as affected by rain depth and aggregate slaking in three semi-arid region soils

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Seal formation, runoff and interrill soil erosion are controlled by, among other factors, soil texture, rain properties (kinetic energy and intensity), and aggregate slaking. Previous studies typically reported the total amounts of runoff and soil loss for an entire storm. We examined, at intervals of 6 mm of rain, using a laboratory rainfall simulator, seal formation, runoff and interrill erosion in three semi-arid region soils with different clay contents. Two levels of aggregate slaking were studied by wetting the soils at either a slow (2 mm h^{-1}) or a fast (64 mm h^{-1}) wetting rate prior to subjecting them to 60 mm of deionized rain. The infiltration rates, a measure of seal development, for the three soils subjected to minimal aggregate slaking (slow wetting), were higher throughout the storm than the respective rates of soils where severe aggregate slaking was imposed (fast wetting). This effect was greater in soils of higher clay content, possibly due to associated greater aggregate stability. Accordingly, runoff volume from all the soils that had been wetted at 2 mm h^{-1} generated less runoff than the same soils wetted at 64 mm h^{-1}. Sediment loads in the runoff water were smaller in the cases of limited aggregate slaking compared with those of severe slaking for all soils, even for comparable runoff volumes. The loam and sandy clay soils, subjected to severe aggregate slaking, yielded similar sediment loads which were significantly higher than that observed from the clay soil. For the limited aggregate slaking treatment, sediment load decreased significantly with the increase in clay content, being extremely low for the clay soil. In general, after about 5 mm of cumulative runoff, sediment concentration in the runoff water was fairly constant, suggesting that overland flow was responsible,

to a large extent, for the eroded sediments collected.