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The impact of soil water repellency upon runoff and erosion.

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Soil water repellency (SWR) is a major limitation on water infiltration causing increased overland flow and erosion. SWR effecting agriculture has an even greater impact upon erosion as there is also decreased soil cover and less stabilising root systems. To understand the connection between SWR, slope, runoff and erosion, a laboratory experiment was conducted. This experiment used a very severely repellent, agricultural soil as well as a surfactant treatment at 3°, 6° and 9° slopes, in 60 cm × 60 cm × 10 cm catchments with irrigation at 60 mm hr-1 for 2 minutes, over five rainfall events. Runoff was monitored every second by collection in beakers on scales. Runoff was separated from erosion and both were analysed for macro-nutrient content and the eroded soil was analysed for particle size distribution. We found runoff coefficients were consistently high (0.5 – 0.8) for the water repellent soil and were significantly smaller for the wettable soil (<0.03). Erosion losses, however, decreased over the course of events. Nutrient amounts in the eroded soil also decreased, however, nutrient concentrations were consistent and were greater than that in the soil. Silt and clay were preferentially eroded (5.1% in the soil, 8.4% in eroded material). Consistently the 9° slope showed the highest losses and the 3° slope the lowest, however, the 9° slope was not significantly different to the 6° slope. Observations of the soil surface showed channels forming in the initial precipitation event. Subsequent events showed development of a surface water layer allowing water to flow across the surface without interaction with the soil. Slope and the number of events both showed significant impacts on erosion, however, the loss was not strongly related to the amount of runoff. This is likely due to the impact of the formation of a surface water layer protecting the dry soil underneath but also maintaining the high runoff. Due to the large amounts of loss, soils exhibiting SWR should consider management especially on slopes above 6°.