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Glyphosate distribution in loess soils as a result of dynamic sediment transport processes during a simulated rainstorm

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Glyphosate is one of the most widely used herbicides in the world. The wide and extensive use of glyphosate makes it important to be certain about the safety of glyphosate to off-target environments and organisms. This research aims to create more detailed insight into the distribution processes of glyphosate, and the effect that dynamic sediment transport processes have on this distribution, during water erosion in agricultural fields.
Glyphosate distribution characteristics are investigated for two different soil surfaces: a smooth surface, and a surface with seeding lines on the contour. The capacity to transport glyphosate for different sediment groups was investigated. These groups were water-eroded sediment and sedimentation areas found on the plot surface. The contribution of particle bonded and dissolved transport to total overland transportation of glyphosate was analysed with a mass balance study.
The experiment was conducted in the Wageningen UR rainfall simulator. Plots of 0.5m2 were used, with a 5% slope, and a total of six experimental simulations were done. A rainfall event with an intensity of 30mm/h was simulated, applied in four showers of 15 minutes each with 30 minutes pause in between. Glyphosate (16mg/kg) was applied on the top 20cm of each plot, and in the downstream part, soil samples were taken. Glyphosate analysis was done using HPLC-MS/MS (High Performance Liquid Chromatography tandem Mass Spectrometry). Besides that, photo analysis with eCognition was used to derive the soil surface per sediment group.
The results show that particle bonded transport of glyphosate contributes significantly (for at least 25%) to glyphosate transport during a rainstorm event. Particle size and organic matter have a large influence on the mobility of glyphosate and on the transported quantity to off-target areas. Moreover, seeding lines on the soil surface decreased total overland transport, both of sediment and glyphosate. Taking this into account, plots with a smooth surface, relative small particle sizes and high organic matter content have great risk to transport glyphosate to off-target areas, with consequences to aquatic systems and the environment.