

Wind erosion as an environmental transport pathway of glyphosate and AMPA

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Glyphosate is the active ingredient of many commercial formulations of herbicides extensively used worldwide for weed control. Because glyphosate and its main metabolite aminomethylphosphonic acid (AMPA) are considered non-volatile, their loss to the atmosphere is considered negligible. Both compounds strongly adsorb to soil particles and wind-eroded sediment and dust are thus a possible environmental transport pathway. This can result in environmental and human exposure far beyond the agricultural areas where it has been applied. Therefore, special attention is required to the airborne transport of glyphosate and AMPA. In this study, we investigated the behavior of glyphosate and AMPA in wind-eroded sediment by measuring their content in different size fractions (median diameters between 715 and 8 μm) of a loess soil, during a period of 28 days after glyphosate application. Granulometrical extraction was done using a wind tunnel and a Soil Fine Particle Extractor. Extractions were conducted on days 0, 3, 7, 14, 21 and 28 after glyphosate application. Results indicated that glyphosate and AMPA contents were significantly higher in the finest particle fractions (median diameters between 8 and 18 μm), and lowered significantly with the increase in particle size. Glyphosate and AMPA contents correlated positively with clay, organic matter, and silt content. The dissipation of glyphosate over time was very low, which was associated to the low soil moisture content of the sediment. Consequently, the formation of AMPA was also very low. The low dissipation of glyphosate in our study indicates that the risk of glyphosate transport in dry sediment to off-target areas by wind can be very high. The highest glyphosate and AMPA contents were found in the smallest soil fractions (PM₁₀ and less), which are easily inhaled. This contributes to the risk of human and animal exposure and, therefore, more attention should be paid to this route of exposure in environmental and human health risk assessment studies. Moreover, glyphosate applications during dry periods in regions susceptible to wind erosion should be avoided.