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TITLE: Two step procedure to model site specific herbicide soil persistence
ABSTRACT BODY:

Abstract Body: Soil persistence is the length of time an herbicide remains active in soil and it is crucial to describe risks of diffuse contamination due to the application of herbicides to soil. Persistence is described by the parameter half-life, which is the time it takes to reach half of the initial concentration supplied to the soil. Its quantification demands the construction of dissipation curves from periodic determinations of the analyte on the same soil. This type of data is costly to obtain and has been usually modeled assuming the existence of a single variance component and independence of the observations used to adjust the curve, which makes it difficult to interpret them in a comprehensive environmental context. The objective of this work was to design a statistical workflow to explain environmental behavior of persistence. A sample of soils over a wide region under study was selected using the cLHS sampling method. The soils were fortified with atrazine and incubated for 21 days by measuring herbicide concentrations at days 0,3,7,14 and 21 by liquid chromatography coupled to tandem mass spectrometry (LC-MS / MS) using QuEChERs. A two-step procedure was performed to explain site specific half-life: First, estimation of the decay of the herbicide along time with a mixed nonlinear model with random effect of soil associated to the decay rate to obtain half-life from the decay curve for each soil sampled; and second a statistical modeling of the half-life estimated at each site based on soil properties and management using Bayesian spatial regressions (R-INLA). The addition of a random effect on the decay rate produced a better fit and provided a tool to explore half-life variability of between soils in a region which was further modeled by a Bayesian spatial regression. Atrazine soil persistence variability was mainly explained by agricultural land uses, where sites with crops that often use atrazine had higher decay rates. From this method integration it was possible to enhance the environmental understanding of herbicides persistence process.

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