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Interactions of diuron with dissolved organic matter from organic amendments

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Addition of exogenous organic matter to the soil surface may decrease or increase pesticide transport. Water-soluble compounds from compost, frequently called "dissolved organic matter" (DOM), may influence the transport of pesticides, through the formation of DOM-pesticide complexes. Therefore, the objectives of our study were to evaluate such interactions in the case of diuron and subsequent diuron co-transport.

Elutions were performed using simplified laboratory experiments, i.e. glass bead columns. Four composted organic amendments (A, B, C and D) were chosen; C and D were sampled at fresh (F) and mature (M) stage. Columns were composed of 10 g of dried product (31 t ha^{-1}) placed above the beads. To compare these amended columns (C_{DOM}), others with DOM-free dried product (C_{FDOM}) were created in the same manner for each sample. DOM was extracted using an aqueous extraction method. Analyses by ^{1}H NMR and ^{13}C NMR were performed on each DOM leachate in order to determine its composition and provide hypotheses concerning diuron-DOM interaction mechanisms.

The cumulated amounts of diuron recovered varied from 45.6% to 72.6% of the herbicide applied. For all composts, average diuron recovery rates were not significantly different between C_{FDOM} (50.9%) and C_{DOM} (56.5%), whereas considerably more dissolved organic carbon (DOC) leached for C_{DOM} (25.7 g kg^{-1}) than C_{FDOM} (3.2 g kg^{-1}). An increase in diuron leaching was observed only for composts A and D_F (up to 16%), suggesting partial transport as diuron-DOM complexes. This increase in

diuron leaching was explained by the higher DOC content in composts A and D_F, and not by the nature of the DOM. This is confirmed by the affinity of diuron with DOM, evaluated by the diuron/DOC leached ratio, which is lower for composts A, D_F and D_M than for B, C_F and C_M. A principal component analysis performed on all proton and carbon NMR data and on the diuron/DOC ratio shows that this ratio seems mainly influenced by the contents of aromatic compounds and carboxyl and carbonyl functions of DOM. Thus, the low affinity of diuron for DOM from composts A and D_F could be explained by their lower aromatic compound and carboxylic function content, limiting the formation of bonds. The degree of maturity of the organic matter variously influences diuron leaching: no effect was observed in the case of compost C, yet some attenuation in diuron leaching was observed between D_F and D_M, probably due to an increase in aromatic compound content during humification. If these results are confirmed in soils, agricultural practices such as mulching and grass cover could, in some cases, facilitate pesticide leaching, and increase the risk of groundwater contamination.