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Effect of sewage amendment on the dissipation of terbuthylazine, metolachlor and their principal metabolites in a field study

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This study evaluates the effect of sewage amendment on the dissipation of terbuthylazine, metolachlor and their principal metabolites in the soil. The field trial was conducted at Padua University Experimental Farm, North-East Italy. The dissipation of these herbicides was evaluated in soils that had received different fertilization for three years: soil without amendment (fertilized with inorganic fertilizer), soil amended with sewage sludge, and soil amended with a combination of inorganic fertilizer and sewage sludge. Terbuthylazine and metolachlor were applied on sorghum as a formulated product (Primagram® Gold) at a dose of 300 L ha^{-1}. Their dissipation in the treated plots was followed for 2.5 months after application. The concentrations of herbicides and their principal metabolites in the soil were analyzed by liquid chromatography-mass spectrometry. The dissipation of terbuthylazine and metolachlor could be described by a pseudo first order kinetics. The DT50 of terbuthylazine in soil amended with inorganic fertilizer was lower than the DT50 in soil amended with inorganic fertilizer + sewage and with only sewage. Similarly, for metolachlor, the lowest DT50 was observed in soil amended with inorganic fertilizer but, unlike terbuthylazine, its degradation was faster in soil amended only with sewage than in soil amended with inorganic fertilizer + sewage. The observed reduction in mineralization of the herbicides after sewage addition can be attributed to the reduced herbicide availability to microorganisms, because of its sorption to the organic amendment. The degradation of terbuthylazine led to the formation of desethyl-terbuthylazine, which was the only metabolite detected for which it was possible to study the kinetics. The presence of sewage amendment had an impact on the formation and subsequent degradation of desethyl-terbuthylazine: the addition of sewage to the soil led to a slower formation of this metabolite and a higher amount measured at the end of the incubation in soil amended with sewage. These findings have practical implications for the assessment of the environmental fate of terbuthylazine and metolachlor in agricultural areas since these herbicides are frequently applied to soils receiving sewage amendment.