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Dissipation of nicosulfuron and oxasulfuron in soil under field condition

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Sulfonylureas represent a major advancement in global crop protection technology and they have revolutionized weed control by introducing a unique mode of action. These herbicides have low toxicity to mammals while they are highly toxic to plants. The fate of sulfonylurea herbicides is directly related to their chemical structure and mainly to the ionisation of the sulfonylurea bridge. The dissipation behavior of nicosulfuron and oxasulfuron in soil were investigated. Soil was cored on experimental site Rimski Šančevi in Serbia four times (0–30 days after the spray). The residue levels and dissipation rates of nicosulfuron and oxasulfuron in soil were determined by liquid chromatography with diode array detection. The pesticide formulations were applied in two different rates for nicosulfuron (50 g ai ha-1 and 100 g ai ha^{-1} Nicogan 40SC) and oxasulfuron (80 g ai ha^{-1} and 160 g ai ha^{-1} Dynox). The fortified recoveries were in the following range for nicosulfuron from 85.90% to 98.71% with relative standard deviations (RSDs) of 0.16–4.80% and for oxasulfuron from 88.09% to 99.01% with relative standard deviations (RSDs) of 1.6–5.66%. The limit of detections (LODs) for nicosulfuron and oxasulfuron in soil were 0.002 mg/kg and 0.003 mg/kg, respectively. The dissipation of nicosulfuron and oxasulfuron residues over the time in soil was described by the Mittag-Leffler function $a*E_{\alpha,\beta}(-bt)$. Coefficients a, b, α, β were obtained from the experimental data, by using fitting procedure. We got α=0.8, β=3.71, a=159.11, b=12.79 for nicosulfuron and α=0.8, β=4.11, a=82.53, b=7.0 for oxasulfuron. The field dissipation half-life time for nicosulfuron at the topsoil (0-30cm soil depth) was 5.2 days while for oxasulfuron was 9.67days after application. These results could be utilized for the environmental risks assessment and minimizing risk for contamination of natural water resources and damage to following crops.

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Keywords: Sulfonylurea, HPLC-DAD, Soil