

ABSTRACT

Chlorsulfuron is a sulfonylurea herbicide used to control broadleaf and grass weeds in wheat farms within the Mara River Basin. It is assumed to be environmentally safe due to low application rates, relatively shorter half-life and low mammalian toxicity; however, it persists in soil and has been detected in ground and surface waters. It has a low pK_a in soil increasing the risk of its residues being carried into the subsoil and underground aquifers. Soil organic matter, clay content, pH, soil moisture, application rates and temperature affect the dissipation of chlorsulfuron in soil. Mara River Basin soils are copper deficient, so copper foliar fertilizers are normally applied. The fate of chlorsulfuron in the wheat growing soils within the Basin is unknown. This study was to investigate the adsorption-desorption, leaching, degradation patterns and field dissipation of chlorsulfuron in wheat growing soils within the Mara River Basin. Soil for laboratory studies were sampled from five wheat growing areas within the Basin and their physicochemical parameters established. Chlorsulfuron adsorption-desorption pattern was determined using batch equilibrium model and column leaching studies in a laboratory, solid phase extraction was done and herbicide and its metabolites quantified using HPLC-MS. Field dissipation studies were laid as completely randomized design on 4m x 4m plots and sampling done at intervals. The soil physicochemical parameters varied ($p \leq 0.05$) in all the five locations. The soils were mainly sandy loam and clay soils with pH below 6.0. Chlorsulfuron sorption onto the five soils showed low K_d values (0.59 – 2.52). Adsorption was positively correlated to soil organic matter and negatively correlated to the soil pH. Increasing Cu^{2+} concentration increased the sorption of chlorsulfuron in all the five soils. Chlorsulfuron leached to a depth of 30 cm in all the soil columns. The leaching pattern varied ($p \leq 0.05$) with location, depth of the soils and rate of application. More residues were found in Mau East B soils than other soils. Influence of biotic degradation was faster in all the soils than the sterile soils. Chlorsulfuron degradation was faster in soils with repeated application of chlorsulfuron than in single application. Field dissipation of chlorsulfuron was faster with half-lives of 13.5 and 13.6 days in Olokurto and Mau East regions. The low sorption and high mobility raises the leaching potential of chlorsulfuron. Coexistence of chlorsulfuron and copper ions reduced the chances of underground water contamination while reducing the bioavailability of the herbicide.