

Behavior of Pesticide Residues in Agricultural Soil and Adjacent River Kuywa Sediment And Water Samples from Nzoia Sugarcane Belt In Kenya.(2012)

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Abstract

An inventory survey conducted to determine pesticide usage in a sub-catchment of the Nzoia sugarcane belt found a variety of pesticides used in the sub-catchment, which are reported in this paper. Analysis of soil samples from seven fallow experimental field plots left uncultivated for various periods from 3 to 96 months after cultivation with pesticide application indicated persistence of high concentrations of pesticide residues in the soil, with estimated soil half-lives (in years) ranging from 0.72 to 57.75 for organochlorines and from 1.13 to 8.25 for herbicides. The mean water concentrations (in $\mu\text{g/L}$) of the pesticide residues in River Kuywa, which flows through the Nzoia Nucleus Estate sugarcane farms, ranged from 0.12 (lindane) to 1.36 (p,p' - DDT) for organochlorines and from 0.14 (atrazine) to 1.75 (diuron) for herbicides during the heavy rains period in August 2008 while the mean sediment concentrations (in $\mu\text{g/g}$) ranged from 0.28 (lindane) to 1.87 (endrin) for organochlorines and 0.39 (hexazinone) to 4.61 (alachlor) for herbicides. The mean concentrations of residues in water during the light rain period in December 2008 ranged from 0.17 (p,p' -DDT) to 0.71 (aldrin) for organochlorines and 0.01 (atrazine) to 1.74 (alachlor) for herbicides while the sediment concentrations ranged from 0.38 (p,p' -DDT) to 1.145 (aldrin) for organochlorines and 0.74 (atrazine) to 1.98 (alachlor) for herbicides. Although DDT, aldrin, dieldrin, and endrin were not reported in the survey, their presence in the fallow experimental field plot soils and in River Kuywa water and sediment could indicate previous application, lack of recorded data or illegal usage since 1997 when they were banned. Notably, the concentrations of alachlor, diuron, cypermethrin, and hexazinone in the water column were substantial indicating their extensive usage and residual persistence in the sub-catchment, with subsequent wash-off and leaching into River Kuywa. The concentration levels of some of the individual pesticides exceeded the EU limit requirements for drinking water and indicated potential risk to humans and cattle if the water is used without treatment.

Keywords

Pesticide usage Residues Sugarcane farm Water River sediment Half-life Seasonal variation

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