

ABSTRACT

The quantities of ethoprophos (EP) and endosulfan (ES) which leached with 1 L of water through soil columns of Valda Gravelly Sandy Loam (VGSL), Cuffy Gully Gravelly Sandy Loam (CGGSL) and Linstead Clay Loam (LCL) ranged between 67.0 and 81.5%, and 2.9 and 9.1 %, respectively; the orders of leaching of EP and ES in the three soils were VGSL > CGGSL > LCL and VGSL > LCL > CGGSL, respectively. Leaching was correlated with initial soil moisture level, the correlation coefficient for EP was 0.967 and for ES, 0.985.

The run-off of EP and ES (data in parentheses) with 5L water from trays with VGSL, LCL and CGGSL soils held at 5°, 15° and 25° slopes were 55, 57 and 61% (12, 15 and 25%) > 31, 35 and 36% (1.7, 2.0 and 2.1%) > 7, 9 and 32% (0.4, 0.4 and 2.4%), respectively.

Volatilisation in 12 hours from the soils at 0, 10 and 20% moisture levels of EP ranged between 1.4 and 3.6%, 2.3 and 4.5% and, 6.5 and 20.2%, respectively, and of ES, 4.8 and 15.1%, 8.9 and 20.3% and, 13.2 and 21.3%, respectively.

Degradation of EP and β -ES in normal soil was significantly greater ($P = 0.045$ and 0.025 , respectively) than in sterile soil; the half-lives of EP being 10.9 and 28.8 days and of ES, 24.5 and 33.0 days, respectively.

Half life values (days) for EP, α -ES and β -ES in soil were 4.7, 25.2 and 8.7, respectively, in sunlight and 12.3, 215.8 and 181.3, respectively, in the dark and in water, 14.4, 22.2 and 45.3, respectively in sunlight and 24.7, 35.1 and 50.4, respectively, in the dark.

Degradation rates ($t_{1/2}$ in days) in river, open sea and “closed sea” waters, of EP were 132.8, 81.2 and 64.9, respectively, and of α -ES 260.3, 303.2, 104.9, respectively, and of β -ES 547.5, 151.5 and 86.9, respectively.

In field studies, trenches at 25° slope with 30 and 60 cm grass bands reduced run-off of EP by 11 and 40%, respectively, and of ES, 78 and 81%, respectively. In Blue Mountain plantations, the loss of EP and ES (data in parenthesis) from treated weeded and unweeded slopes after 9 weeks and 27.5 mm of rainfall were, 93.6 and 89.5% (60.5 and 53.9%) at 23° and 92.4 and 91.2% (59.9 and 56.6%) at 38° slopes. Only 2 - 3% of EP and 1 - 3% of ES were leached to 10 - 15 cm depth.

The 1990-91 monthly survey revealed insecticide contamination of Swift and Spanish Rivers and their coastal waters. Residues of ES in water, sediment and fauna ranged from 0.42 - 7.12 $\mu\text{g/L}$, 8.64 - 28.1 ng/g and 28.1 - 141 ng/g, respectively. Dieldrin, DDE and arochlor were also detected but only occasionally. A one-time rapid sampling of 17 rivers, 7 natural springs and 13 well revealed residues of endosulfan in all but three rivers; α -ES in 15 samples of sediment (0.9 - 108.1,

mean = 28.93 ng/g) and 13 of water (0.01 - 0.35, mean = 0.11 $\mu\text{g/L}$), β -ES in 5 sediment (15.29 - 49.35, mean = 30.56 ng/g) and 12 water (0.05-0.31, mean = 0.14 $\mu\text{g/L}$) samples, and endosulfan sulphate in waters of three rivers (0.003 - 0.244 $\mu\text{g/L}$). Chlorpyrifos was present in 9 sediment (0.423 - 135.2, mean = 18.38 ng/g) and two water (0.001 - 0.002 $\mu\text{g/L}$) samples, diazinon in the sediment of two rivers and EP in sediment of only one river

The 24-h LC_{50} and LC_{95} values for EP for the red hybrid *Tilapia* (7 - 9 cm long) were 8.41 and 21.0 mg/L, respectively, and for ES 0.031 and 0.049 mg/L, respectively. Bioaccumulation after one hour of exposure to EP at 1 mg/L in the surrounding water was 2.6 $\mu\text{g/g}$ (74%), and that of ES at 0.0075 mg/L was 0.55 $\mu\text{g/g}$ (94%) of α -ES and 0.44 $\mu\text{g/g}$ (100%) of β -ES. ES lactone and ES sulphate appeared in the fish after 4 hr.

Elimination of EP by the EP-exposed fish which were transferred to clean water was 83% in 12 hr whereas only 26% of α -ES and 39% of β -ES were eliminated in 72 hr. Order of partitioning of the insecticides in the tissue of the fish were gonads > liver > gut > gills > SMB.

Applicability of the results in risk assessment of pesticide residues in tropical island ecosystems is discussed.