

LEACHING OF DIELDRIN, PERMETHRIN, PHENYL UREA AND 4 - CL PHENYL UREA PESTICIDES THROUGH SOIL

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ABSTRACT

Leaching of four ^{14}C -labelled pesticides (Dieldrin, Permethrin, Phenyl Urea and 4 - CL Phenyl Urea) were investigated. It was found that Dieldrin and Permethrin were not leached through soil and adsorbed by the soil, Phenyl Urea and 4 - CL Phenyl Urea were leached to 7.5 cm. depth in soil.

ÖZET

Dört ^{14}C -etiketli pestisidin (Dieldrin, Permethrin, Fenil Üre ve 4 - CL Fenil Üre) toprak içinde ilerlemesi çalışmaları yapılmış, Dieldrin ve Permethrin'in toprak yüzeyinde tutulup, alt tabakalara ilerlemediği fakat Fenil Üre ve 4 - CL Fenil Üre'nin toprak içinde 7.5 cm derinliğine kadar ilerlediği tesbit edilmiştir.

INTRODUCTION

Organic chemicals have been used in agriculture on a large scale to increase production of crops, vegetables and fruits at the recent years. Some of them are persistent and toxic chemicals and they cause many environmental problems in the soil, air and water. One of these problems is that not all of the chemicals remain in the area of treatment and they move to other places in the environment by rain, wind and other effects.

Leaching of chemicals through soil is also an environmental concern because of the possibility that they will reach the water table and contaminate the ground water. However disappearance of the chemical from the soil is also important and whether a chemical will reach the ground water will not depend only upon its movement through the soil but also its disappearance from the soil. If the rate of degradation is bigger than the rate of leaching, the chemical will disappear before it can reach the ground water and there will be no environmental problem.

The determination of soil leaching rates is important because the rate of leaching of a chemical indicates how long a chemical is retained in the soil.

Soil adsorption also plays an important role in the leaching behaviour of chemicals. Strongly adsorbed chemicals do not leach through soil and are retained in the top soil. Mobile chemicals are leached to sufficient depth to enter the ground water and cause an environmental problem.

Experiments were carried out to compare the leaching of four ^{14}C -labelled chemicals at Woburn Experimental Station field of Rothamsted Experimental Station.

EXPERIMENT

Leaching tubes of 15 cm in length and 6 cm in diameter consisting of $6 \times 2,5$ cm rings were put into the soil at Woburn field $0,2 \mu\text{C}/\text{mMol}$ ^{14}C -Dieldrin and ^{14}C -permethrin, $0,3 \mu\text{C}/\text{mMol}$ ^{14}C -phenyl Urea and 4 - Cl Phenyl Urea were applied to the top of tubes. Weekly samples were taken for analysis in the laboratory. Each ring was cut from its joint, the soil in it put into a plastic bag and weighed. 10 g of soil from each bag, 20 ml of the extractant (1 : 1 Acetone/Hexane for Dieldrin and Permethrin, Hexane for Phenyl Ureas) were put into 100 ml conical flask and shaken for two hours at the orbitary shaker 5 ml of the supernatant was taken into the counting vial, evaporated to dryness, 10 ml. cocktail B' was added and counted at the Beckman LS 250 Liquid Scintillation Counter. ^{14}C -Permethrin and ^{14}C -Dieldrin were supplied from Amersham Radiochemical Center, Phenyl Ureas were synthesized by Dr. G. G. Briggs.

pH of Woburn soil : 7

% organic matter content : 3.6

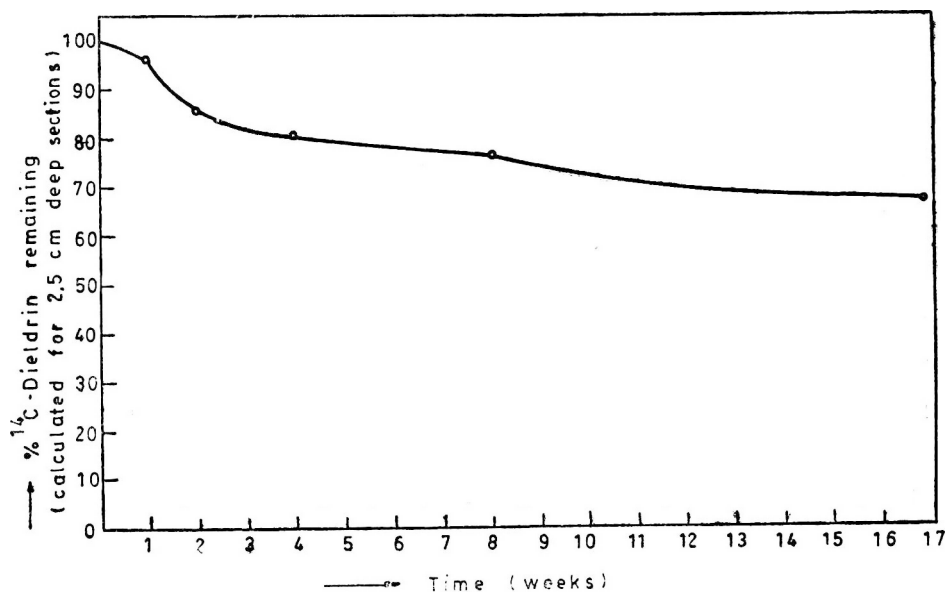


Fig. 1. Degradation of ^{14}C Dieldrin in Woburn soil

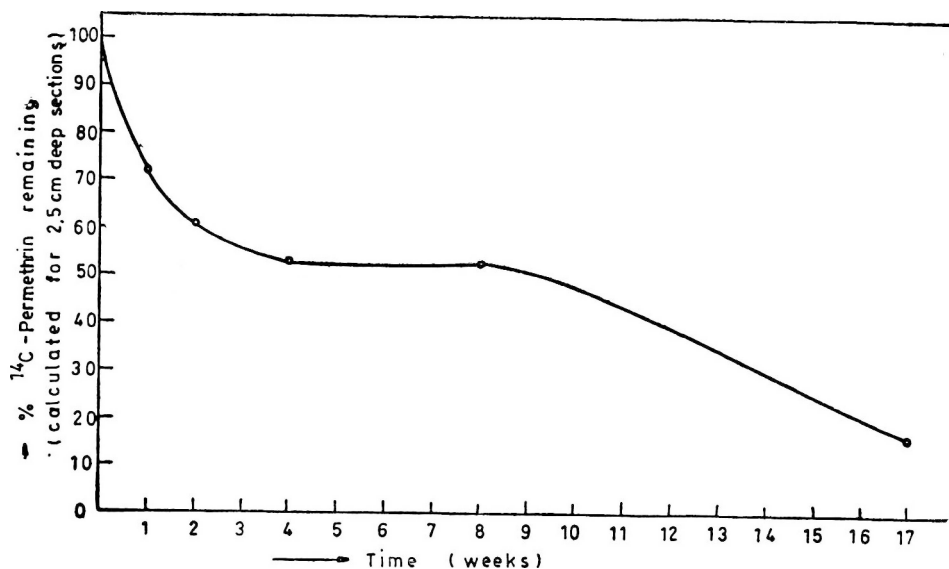


Fig. 2. Degradation of ^{14}C -Permethrin in Woburn soil

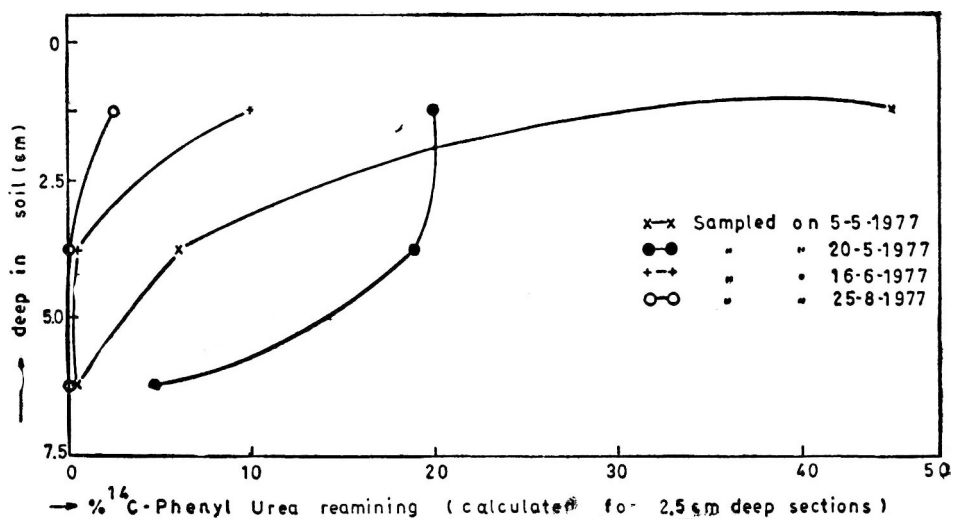


Fig. 3. Leaching of ^{14}C -Phenyl Urea in Woburn soil

RESULTS AND CONCLUSION

Total dpm in each 2.5 cm depth of soil was calculated. Results are given at Figs. 1 - 4.

Dieldrin and Permethrin are highly lipophilic chemicals and they are strongly adsorbed by the soil. % 99 of the radioactivity remained in the

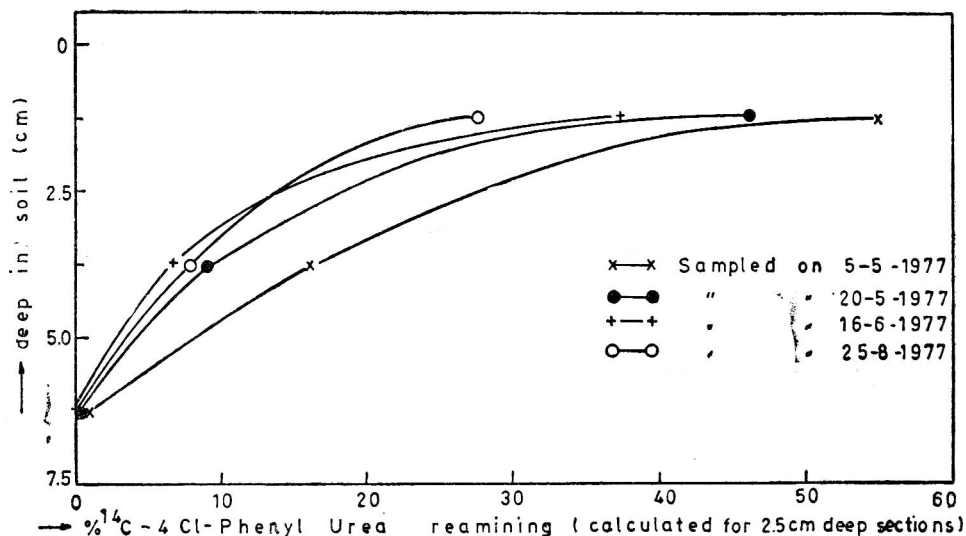


Fig. 4. Leaching of ^{14}C -4-Cl Phenyl Urea in Woburn soil.

top 2.5 cm. of the soil after 17 weeks of application and they are not leached through soil. Degradation of these chemicals are not high and they are persistent in the soil.

Phenyl Urea and 4-Cl Phenyl Urea are less lipophilic and only weakly adsorbed on soil and are leached to 7.5 cm. depth in soil after 17 weeks of application. Degradation of these chemicals are very high and most of the chemicals are degraded during 17 weeks.

Adsorption studies of these chemicals by soil were also done in the slurry systems at the laboratory. It was found that Dieldrin and Permethrin were strongly adsorbed by the soil, Phenyl Urea and 4-Cl Phenyl Urea were only weakly adsorbed by the soil.

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