INSECTICIDE RESIDUES IN SOILS AND IN ROOT CROPS GROWN ON TREATED SOILS

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SUMMARY

Studies were conducted on the persistence of aldrin and BHC in two different types of soils *viz.* sandy (sandy loam) and clay (clay loam) and the extent of their residues in root crops grown in treated soils. The rate of loss of aldrin was between 30 – 50 percent in 113 days in both soil types whereas 74 – 87 percent BHC was lost during the same period in clay as well as sandy soil. Beetroot absorbed more aldrin when grown in sandy soils than in clay soils, but carrots absorbed aldrin more from clay than sandy soils. No aldrin was found in radish when grown in aldrin treated clay and sandy soils. BHC was accumulated more in carrots, beetroot and radish when these were grown in sandy than in clay soils. Although carrot absorbed more BHC than the other crops, the level, even in this was below the acceptable tolerance level of 8 ppm.

RESUME

Des études ont été menées sur la persistance de l'aldrin et du BHC avec deux types de sols différents, sablo limoneux et limono-agrileux et l'importance de leurs résidus dans les plantes à racine cultivées sur sols ayant subi de tratements. Le taux de parte de l'aldrin se situe entre 30-50 pour cent en 113 jours dans les deux types de sol, et entre 74-87 pour cent de BHC pendant la même période en sol aussi bien argileux que sablonneux. L'absorption d'aldrin est plus élevée chez la bettrave cultivée sur sols sablonneuz que sur sols argileux, mais l'absorption d'aldrin par la carotte est plus élevée en sols argileux qu'en sols bablonneux. Il n'y a pas de trace d'aldrin dans le radis cultivé en sols argileux et sablonneux traités a l'aldrin. La carotte, la betterave et le radis accumulent beaucoup plus de BHC en sols sablonneux qu'argileux. Bien que l'absorption du BHC par la carotte soit supérieure par rapport aux autres plantes, le niveau, méme dans le cas de la première, reste en dessous du niveau de tolérance acceptable de 8 ppm.

RESUMEN

Se condujeron estudios sobre la persistencia del aldrín y el BHC en dos diferentes tipos de suelos: uno arenoso (migajón arenoso) y otro arcilloso (migajón arcilloso) y también sobre el grado de residuos de los insecticidas encontrados en diferentes cultivos (para producción de raíces), desarrollados en esos suelos. La pérdida de aldrín a los 113 días fué de 30-50 porciento en ambos suelos, en tanto que BHC se perdió en un 74-87 porciento – durante el mismo período – en ambos suelos también. El betabel absorbió mas aldrín cuando se cultivó en un suelo arenoso que en uno arcilloso, en tanto que la zanahoria absorbió mas aldrín del suelo arcilloso que del arenoso. No se encontró aldrín en rábanos desarrollados en ninguno de los dos suelos. El BHC se acumuló mas en el betabel, las zanahorias y los rábanos, cuando se cultivaron en el suelo arenoso que cuando se desarrollaron en el suelo arcilloso. Si bien que las zanahorias absorbieron mas BHC que los otros cultivos, el nivel encontrado aún en éste caso estuvo por debajo de lo aceptable como límite de tolerancia, que es de 8 ppm.

INTRODUCTION

Insecticides are frequently applied to soil to control termites, white grubs and other soil insects. However, their applications into the soil is a cause of concern due to the potential accumulation of toxic residues either in the soil or in crops grown on treated soils.

There have been many studies on the persistence of insecticides in soils and their possible accumulation in the plant parts[2,4,6,9,10]. We have worked in two widely different soil and agro-climatic conditions, have soils and wet climate of Udaipur region and light soils and semi-arid climate of the Jaipur region of India.

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MATERIALS AND METHODS

Beetroot, radish and carrot were grown in our study. Four levels of aldrin, 0, 3, 6 and 12 kg a.i./ha, and of BHC 0, 5, 10 and 20 kg e.i./ha, were applied to soils with three replicates per treatment. Each plot was 2.1 x 2.1 m. Insecticidal dusts were thoroughly incorporated in the soil to a depth of 4 – 6 inches before sowing. Soil samples were drawn randomly with an auger from five different locations in each plot and were mixed and quartered before analysis. Plant samples (root only) were collected by uprooting the plants from the same five points. Roots were washed thoroughly under tap water to remove soil and were chopped, mixed and quartered before analysis.

Air dried soil samples were extracted in suitable solvents by tumbling over a motorized shaker for 30 minutes. The plant material was extracted by blending with a suitable solvent. Redistilled n-hexane and acetone (2 ml per g sample) were used as solvent for the extraction of samples containing aldrin and BHC respectively. Photometric methods were based on the phenyl azide reaction for aldrin[14] and we used a modified Schechter and Hornstein method[15] for analyses of BHC using standardized levels of direct contamination of plant materials by the chemicals. Recoveries of aldrin by photometric method were 88, 76, 87 and 69 percent for beetroot, carrot, radish and radish leaves, and that of BHC were 83, 90, 100 and 93 percent for beetroot, carrot, radish and radish leaves respectively.

RESULTS AND DISCUSSION

Aldrin residues

Results are presented in Table 1. The rate of decline of residues was greatest for a treatment level of 3 kg/ha applied to the clay soil, being about 50 percent loss in 113 days. The rate of loss of aldrin was much the same for all the three dosages when applied to sandy soils. Elgan[3] also found that aldrin (2 lb/acre) and telodrin (0.5 lb/acre) disappeared rapidly from soil immediately following application with levels dropping to about 15 percent of the initial values after a year. Lichtenstein *et al.*[7] also reported rapid disappearance of DDT, lindane and aldrin from experimental soils in Kansas.

Data collected showed that some aldrin was absorbed by beetroot grown in sandy soil than in clay soil. The quantity of aldrin found in beetroot after 101 days in sandy soil was more than 30 percent of the initial deposit as against 9 – 17 percent after 113 days in clay soil. For carrot, more of aldrin was absorbed when grown in clay soils (17 – 46 percent) after 113 days than when grown in sandy soil (8 – 33 percent after 101 days. Lichtenstein *et al.*[8] found that concentrations of insecticidal residues in carrots varied from 22 – 80 percent of the concentration in the soil. Lichtenstein and Schulz[11] and Harris and Saus[5] also reported that in loam soils carrots absorbed more aldrin residues than any other crop tested. No aldrin was detected in radish either from clay or sandy soils. This finding supports Muns *et al.*[13] who reported that radishes grown in soils treated with 4 pounds of aldrin per acre contained no aldrin but did however contain 0.24 ppm of dieldrin.

BHC residues

About 74 – 87 percent of BHC was lost in 104 – 112 days in both clay and sandy soils. Lichtenstein *et al.*[8] also reported that lindane was the least persistent insecticide among the three insecticides DDT, lindane and aldrin tested in Kansas soils. Allen *et al.*[1] found that four and a half years after a single application, 38 percent of DDT and 6 percent of BHC remained.

The amount of BHC accumulating in beetroot varied between 6 – 11 percent of the initial deposit in heavy soil in 112 days and 4 – 13 percent in sandy soil in 104 days. The absorption figures of BHC for carrots were 11 – 15 percent in clay soil and 12 – 18 percent in sandy soil of the concentration available in the soil. Macphee *et al.*[12] showed that 0.94 ppm of BHC was found in carrot grown in soil treated with BHC and the insecticide was distributed throughout the root. Only 1 – 5 percent BHC was found in radish after 73 days of application. There appeared to be more accumulation of BHC in all the three crops carrot, beetroot and radish when grown in treated sandy soils than in clay soils. Carrot seemed to absorb more BHC than the other two crops, but the amount of BHC absorbed never exceeded the tolerance levels of 8 ppm in any root crop.

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Editorial note: Tabulated data, which however provide no statistical analysis or other measure of precision, were provided, but the authors' summary as printed presents an adequate summary of the data.

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