FURTHER DATA ON PASTURE RESIDUES

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Summary

Much further residue data on chlorinated hydrocarbon insecticides needs to be obtained on a wide range of problems. Existing withholding periods may need reviewing on climatic $\times$ species concept when further data are available. Practices of using chlorinated hydrocarbon insecticides as seed protectants for field brassicas may need modifying if further trials support bulb and foliage uptake of chlorinated hydrocarbon insecticides.

INTRODUCTION

THE Agricultural Chemicals (Insecticides) Regulations 1964 attempt to minimize drift of chlorinated hydrocarbon insecticides by prohibiting the use of dusts, wettable powders and emulsions for pastures and field crop use. Pelleted DDT material of sufficient size not to cause drift and of sufficient hardness to withstand abrasion in handling and distribution have been the only materials approved by the Agricultural Chemicals Board for pasture and field crop use after June 30, 1964, without permit. Alternative materials, other than chlorinated hydrocarbon insecticides, have been recommended where formulations other than pelleted materials need to be employed.

For DDT pellets approved under the Agricultural Chemicals Act, no permit is required for use, but a 14-day withholding period is necessary for sheep and dry stock and 4 weeks for dairy cows in milk. These withholding periods are based on good perennial ryegrass (*Lolium perenne*)/white clover (*Trifolium repens*) swards growing under dairying conditions where dry matter production per acre is in the order of 12,000 to 14,000 lb. The results have been extrapolated to cover low fertility sheep pastures of 2,000 to 4,000 lb dry matter per acre, consisting largely of browntop (*Agrostis tenuis*), Chewings fescue (*Festuca rubra* var. *fallax*), and applications during periods of slower growth, namely, summer dry weather and winter cold periods. If elimination of residues is largely caused by pasture growth, then the factor of species $\times$ climatic conditions needs to be examined.

In a trial conducted at Winchmore Irrigation Research Station with dry-mix DDT superphosphate at 3 lb (all rates in lb active ingredient per acre) and reported by Leonard (1963), indications were that species may vary in their ability to remain contaminated for longer periods than other species when grown under the same conditions. Under the Winchmore conditions, samples of all species after 68 days contained residues above 3 ppm. After 98 days the residues stood at 4.2 ppm for Yorkshire fog (*Holcus lanatus*). In Harrison's (1962) work, after 42 days the residues on all species were below 3 ppm (a borderline safety level for dry stock).

A repeat of the trial at Winchmore Irrigation Research Station was conducted using wet-mix DDT at 2.28 lb on August 10, 1963. Forty days later the results were as follows:

Species	DDT ppm Undissected Dry Matter	DDT ppm Dissected* Dry Matter
Chewings fescue	8	—
Timothy (<i>Phleum pratense</i>)	7	6
Perennial ryegrass	7	—
Yorkshire fog	10	3
Cocksfoot (<i>Dactylis glomerata</i>)	12	4
Browntop	7	—
<i>Phalaris tuberosa</i>	6	4
White clover	—	3

* The main contaminant was browntop.

In all cases, dissected samples were lower in residues, suggesting browntop may remain contaminated for longer periods than other species.

In a replicated trial conducted at Ruakura Agricultural Research Centre by F. B. Thompson, using DDT wet-mix superphosphate at 2 lb, after 14 days the following results were available:

Species	DDT ppm Dry Matter
Cocksfoot	70
Cocksfoot + nitrogen	90
Ryegrass	16
Browntop	27
Browntop (Japanese DDT)*	31
Average Control	5

* A material from Nippon Soda Co., Japan, which possesses a waxy nature and is theoretically more easily washed from the foliage of plants.

In Harrison's trial, the contamination level in ppm dry matter for ryegrass-white clover sward was 31 ppm for 14 days.

Cocksfoot is the only one of the species tested showing a higher residue than normal.

FOLIAGE AND ROOT UPTAKE

In a further replicated trial at Winchmore Irrigation Research Station laid down on January 15, 1963, a range of treatments including DDT were disced into the soil prior to sowing a pasture. The rates of DDT employed were 2 and 5.6 lb per acre. Samples of foliage cut on August 19, 1963, gave the following average analysis:

	DDT ppm dry matter
High DDT (5.6 lb)	1.4
Low DDT (2 lb)	1.0
Control	0.7

Foliage in this trial showed a positive trend from no DDT to high DDT. A figure of 1 to 1.3 ppm dry matter on foliage is considered the appropriate safe level for grazing by dairy cows in milk.

A pot trial using perennial ryegrass was conducted at Ruakura Agricultural Research Centre on uptake of DDT (Thompson *et al.*, 1963). This gave no evidence of DDT uptake by the perennial ryegrass, even though the DDT was applied at 250 lb per acre and then the seed sown.

The 250 lb rate appeared to have no adverse effect on the perennial ryegrass growth, nor was there any evidence of DDT uptake.

ROOT AND FOLIAGE UPTAKE OF DIELDRIN

It became necessary to conduct a root and foliage uptake of dieldrin used for springtail (several species) trials in field brassicas when it became apparent that contaminated dairy produce was obtained when dairy stock grazed brassicas so treated.

POT TRIAL

In a replicated pot trial at Ruakura Agricultural Research Centre, soil was treated at 0.5 and 8 lb of dieldrin, and turnip seed sown. A post-emergent treatment of 0.5 lb was applied when the turnips were in the 2- to 3-leaf stage. Upper leaves only were used for analysis, and bulbs were scraped carefully to remove all soil, but care taken not to damage the skin.

Treatment	ppm dieldrin in Soft Turnips		
	Leaves	Bulbs	Soil
(lb)			
Control	Nil	Nil	0.2
	Nil	Nil	0.2
	Nil	Nil	0.2
0.5 pre-emergence	0.5	Trace	1.6
	0.5	Trace	1.2
	0.5	Trace	1.2
8 pre-emergence	1.0	0.6	11.2
	0.9	0.9	11.2
	0.6	0.6	8.0
0.5 post-emergence	0.4	Trace	0.8
	0.3	Trace	1.0
	0.4	Trace	1.0

"Trace" is less than 0.1 ppm

It is considered that dieldrin in the leaves and roots is due to uptake and not contamination.

FIELD TRIAL

In a further replicated trial at Ruakura Agricultural Research Centre, dieldrin was applied in water at the rates of 0.125, 0.25, 0.5 and 8 lb, after the seed was drilled in. Also dieldrin-coated seed at 100 g of dieldrin on 454 g of seed, 210 g dieldrin on 450 g of seed, and 210 g of dieldrin on 460 g of seed, were drilled in at the same time, giving a rate of 0.45 lb and 0.66 lb per acre of dieldrin, respectively. Results of analysis of leaves only are:

Dieldrin a.i./acre	Unwashed	Washed
0	0	0
0.125	0	0.1
0.25	0	0.25
0.5	*0.2 ?	Trace
8.0	1.1	0.9
Coated seed 100 g/per lb seed	1.0	0.2
Coated seed 210 g/per lb seed	2.0	0.5

* Only one replication contained dieldrin.

The trial suggests positive dieldrin uptake in the foliage has occurred.

DISCUSSION

The trials presented have not given consistent results. There is some suggestion that different pasture species may be more susceptible to contamination than other species, and cocksfoot and Yorkshire fog appear suspect. However, with the change from wet-mix and dry-mix DDT superphosphate to approved pellets, initial contamination is less (Harrison, 1961). With the initial level of contamination reduced, the present withholding periods may suffice. Nevertheless, it is worth continuing these studies. In the near future, it is proposed to use existing rate-of-growth trials scattered throughout New Zealand in areas characteristic of local conditions. By treating strips of these trials at fortnightly intervals, a knowledge should be gained of species by climatic effect. Further trials now being conducted should give information on other chlorinated hydrocarbon insecticides on grasses and clover.

The presence of dieldrin in the foliage of the pot and field trials conducted at Ruakura Agricultural Research Centre is disturbing. Harrison in unpublished work showed that soil adhering to turnips and seeds was sufficiently contaminated to cause residue in animal products. For this reason, the continued use of dieldrin as a seed dressing appears unwise for root crops. If further trials confirm foliage uptake, it may be necessary to restrict the use of dieldrin on brassica leaf crops.

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