FURTHER DATA ON RESIDUES

L. J. MATTHEWS

Research Division, Department of Agriculture, Hamilton

Summary

Data are presented for two trials involving (a) pelleted forms of DDT and (b) concentration of pellets by particle sizes. The evidence from the trials is not complete, but suggests that no matter what form, concentration or particle size range of DDT is employed, residue levels are higher than those desirable at the end of the present four-week holding period. Further support is given for recontamination of herbage after initial removal. It is not known how this recontamination occurs.

INTRODUCTION

PROPOSED REGULATIONS under the Agriculture Chemicals Act restrict concentrated pelleted formulations of DDT to 2% by weight passing the 25 mesh BSS (all sieve sizes referred to are British Standard Seives), and 0.5% DDT through 36 mesh. Less concentrated materials such as granulated DDT are still under review but in the interim the same tolerances apply. The initial intention was to limit the upper concentration of pellets to 20% but was relaxed to include a 30% admixture of superphosphate already on the market. These restrictions were aimed at giving minimal residues in primary produce with maximum biological efficiency.

When originally proposed, it was considered materials should fall between the 6 to 14 mesh (depending on concentration) and the 25 mesh with a modal distribution, although this was not written into the Regulations. With precise methods of manufacture and screening more concentrated pellets have been produced meeting the required tolerances. These materials have a skewed curve with the greatest percentage of material in the 22 to 24 mesh range. By reducing size of particles, more concentrated materials still give the required number of particles per square inch and are probably less costly to manufacture. Pellets in the 20 to 40 mesh range have also been produced.

Two trials were undertaken. One trial tested available proprietary materials and the other sought to reduce residues by determining the optimum size particle range and concentration. In both trials all materials were applied at the rate of 2 lb ppi DDT per acre and pastures cut within 1 in. of the ground level with electric shears. The areas were presampled for DDT content and materials were applied without abrasion.

TRIAL A: FORMS OF DDT

This trial compared the following materials:

Granulated DDT-superphosphate (Blunger & Pan process with 20% DDT per ton). Particle size range of 3/16 in. to 25 mesh with tolerance of 2% passing the 25 mesh.

Port Mapua prills* (20% material). Particle size range of 10 to 25 mesh with tolerance of 2% passing the 25 mesh.

Stauffer DDT-superphosphate (admixture of 30% pellets†, and superphosphate). Particle size range of 14 to 25 mesh with tolerance of 2% passing the 25 mesh.

The trial was sited on a dairy pasture at Ruakura Agricultural Research Centre which was pre-trimmed to 1 to 2 in. and allowed to recover to 2 to 3 in. The sward tended to be open which is typical of a high-producing ryegrass (*Lolium* species), white clover (*Trifolium repens*) pasture.

Results are given in Table 1.

RESULTS

No material reached a safe level of 1 ppm on the foliage at four weeks, and only marginally so for the nine-week cut. At four weeks, granulated superphosphate Pan process was significantly lower at the 5% level than for all other treatments but this trend was not consistent. At the six-week cut, if the mean of 8 replications is taken, the figure is considerably higher than the mean of 7 replications. This is true for the Port Mapua prills at the nine-week cut. This would indicate that pellets may lodge in the axils of plants and give rise to higher residues and sampling error. The regrowth from the two-week cut (6/2), cut four weeks later, contained residues higher than those considered safe for dairy stock. The two cuts may be added and if this is done residues are higher than for any cut including the one-week cut. Rainfall was adequate, but temperatures (average minimum 44.4°F, average maximum 62.6°F) may not have been high enough for optimum growth, although the materials were applied at a period suitable both for fertilizer application and grass-grub (*Costelytra zealandica*) control.

TRIAL A: CONCENTRATION BY PARTICLE SIZE RANGE

P. J. Gallaher, Fertiliser Manufacturers Research Association, Otara, indicated residues increased with particles smaller than 25 mesh (unpublished data). Although no direct comparisons have been made, increasing the concentration of Port Mapua prills from 12½ to 20% material has resulted in higher residues in trials. Residues in Trial A were higher than desirable. Trial B was laid down on a dairy pasture at Ruakura Agricultural Research Centre adjacent to Trial A but on a slightly higher quality sward (more ryegrass and less lower-producing grasses). Table 2 summarizes materials employed and results. Niagara pellets covering a 20 to 40 mesh were included and were a homogeneous mixture of carrier and DDT. The trial was replicated six times.

See Table 2.

RESULTS

At one and two weeks, there was no significant difference between residues with different size prills and concentrations of DDT, but there was some evidence (10% level) that Niagara 20 to

* An inert core with surface coating of DDT.

† Homogeneous mixture of carrier and DDT. Note: A sample of Stauffer pellets was employed that met specifications.

TABLE 1: FORMS OF DDT RESIDUE TRIAL
(Residues expressed as microgram DDT/sq. ft* based on dry matter production)

Means	Weeks after Application on Sep. 21, 1965					
	1	2	4	6	6/2†	9
Port Mapua	(13)‡	91 a (8)	91 b (5)	49 ab (2)	64 b (4)	68 a (39 a 1)
Pan	(6)	48 a (4)	24 a (1)	60 ab (2)	39 ab (3)	27 a (0.5)
Blunger	(15)	113 a (12)	81 b (4)	79 b (3)	65 b (5)	38 a (1)
Stauffer	(9)	57 a (7)	81 b (4)	27 a (1)	27 a (2)	42 a (1)
(Total)	11	(77) (8)	(69) (4)	(54) (2)	(48) (4)	(44) (1)
S.E. of treatment mean		21	15	13	10	17
Cumulative rainfall (in.)	0.69	2.05	4.05	4.05	7.6	
Height of sward (in.)	2-3	3-4	4-6	4-6	6-9	

* Mean of three 1 sq. ft samples.
† Cut at 2 weeks and exact area cut 4 weeks later — i.e., represents 4 weeks' regrowth after initial cut at 2 weeks.
‡ Figures in parentheses represent ppm on dry matter basis.

TABLE 2: CONCENTRATION BY PARTICLE SIZE — DDT RESIDUE TRIAL
(Residues expressed as microgram DDT/sq. ft* based on dry matter production)

Weeks after Applica- tion on Dec. 1, '65	BSS Mesh Size		Port Mapua Prills				Ave. DDT in Prills			Niagara 20-40 Pellets	Overall Ave.	S.D.	Significant Differ- ences
	16-22	22-25	25-30	30-36	5	10	20						
1		224 (14)†	262 (14)	226 (14)	187 (11)	234 (14)	245 (15)	191 (11)	225	135 (6)	218	111	Niagara 20-40 < Prills: <i>P</i> < 0.1
2		210 (10)	151 (7)	175 (8)	184 (7)	208 (9)	171 (8)	161 (7)	180	69 (3)	171	163	Niagara 20-40 < Prills: <i>P</i> < 0.1
4		81 (3)	32 (2)	102 (4)	56 (3)	48 (2)	80 (4)	76 (3)	68	84 3	69	63	Sizes diff.: <i>P</i> < 0.01
6		57 (1)	63 (1)	82 (2)	50 (1)	67 (1)	70 (2)	52 (1)	63	50 1	62	41	
Cumulative rainfall (in.)													
Height of sward (in.)													
					1 week	2 weeks	4 weeks	6 weeks					
					1.0	1.05	5.47	7.86					
					2-3	3-4	4-6	6-9					

* Mean of three 1 sq. ft samples.

† Figures in parentheses represent ppm on dry matter basis.

40 pellets were less than those for prills. At four weeks there was no significant differences between Niagara 20 to 40 pellets, and prills, or between the concentrations of DDT. There is evidence that prill size has a significant effect on residues, but there is no overall trend. None of the treatments reached a safe level of 1 ppm on the foliage at 4 weeks and marginally so at 6 weeks.

DISCUSSION

The results obtained in the forms of DDT trial would tend to support previous trials at Ruakura Agricultural Research Centre that a four-week withholding period for dairy stock is not adequate under all conditions, no matter what formulation of DDT is employed. The safe level has been taken as 1 ppm of DDT on a dry matter as being safe. This figure has been substantiated by recent trials (unpublished data). Analyses have demonstrated the possibility of picking up pellets within the leaf axils for two forms of DDT.

The materials were applied without abrasion, and the initial levels of DDT were low in comparison with those obtained by commercial applicators (unpublished data). This would indicate that, in practice, initial levels could well be much higher. It is not known how regrowth after cutting still contains an unsafe level of DDT. This could be due to one of several factors, systemic uptake, or the grass growing point being recontaminated by DDT, being slowly released from the pellets, or a combination of both. The results indicate that, if dairy stock were grazed at two weeks and again four weeks later, it may be possible for them to accumulate an additional dose of DDT, both doses being at an unsafe level. This is supported by previous mowing trials (Matthews, 1965).

The residues obtained from the Stauffer material were lower than normal as the sample employed met proposed regulations of 0.5% DDT passing the 36 mesh. From the evidence of one trial it is not possible to be certain that the Blunger process results in higher residues than the Pan process. It is known that under some undefined conditions Port Mapua prills are not safe after four weeks (D. L. Harrison, unpublished data).

The trial on concentration by particle size gave unexpected results and indicates formulation may be more important than particle size — *i.e.*, Port Mapua prills as a whole may be more prone to residues than Niagara 20 to 40 pellets. However, sampling error was so high that valid comparisons were not possible, and all materials were only marginally safe at six weeks. Rainfall and growing conditions were excellent. The relative biological efficiency of the various materials is not known adequately, and it may well be possible to formulate materials meeting residue requirements, but biologically inadequate.

ACKNOWLEDGEMENTS

My acknowledgements are due to W. M. Kain, for conduct of trials, to Dr E. Pawson for chemical analysis, and K. R. Drew for statistical analysis. My thanks are due to all other officers co-operating.

REFERENCE

Matthews, L. J., 1965: *Proc. 18th N.Z. Weed & Pest Control Conf.*: 159.