ABRASION OF DDT GRANULES BY TOPDRESSERS

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Summary

The degree and mode of abrasion of three DDT granule formulations, when distributed by four different topdressers, were determined. Results showed that one formulation only was unstable and readily abraded. With this formulation, abrasion was increased by the use of an agitator and was most severe in the two machines where the load rested directly on the spreading device. It was considered that at least 70% of this abraded material would be retained by treated pasture and could cause herbage DDT contamination of about 90 ppm.

INTRODUCTION

It has been established that the DDT retained by herbage during topdressing can lead to residues in the food products from animals grazed on treated pastures. Therefore, stock are not permitted to graze pasture until the concentration of DDT on the herbage has fallen to an acceptable level. The time required for this reduction to occur will depend on the amount of DDT retained by the herbage, the rate of removal by weathering, and the dilution by pasture growth. The rate of weathering and pasture growth will largely depend on local, climatic conditions which are difficult to control. Under any given weather conditions, a tolerable level of DDT will be reached most rapidly if only a small amount is retained by the herbage during topdressing.

The DDT retained on pasture has been greatly reduced by the use of DDT granules of a specified size range and their application under restricted pasture conditions. However, the advantages obtained from the use of granules can be reduced if topdressing machinery breaks the granules during application.

For this reason, the present investigation examines the amount of abrasion caused by some types of topdressing machinery.

EXPERIMENTAL

MACHINES AND MATERIALS

Four topdressers were tested in this trial.

1. *Vicon Vari-Spreader*: A general-purpose fertilizer distributor able to apply low rates of concentrated granular insecticides. Distribution is obtained with a reciprocating spout system.
2. *Vogal Spinner Topdresser*: A general-purpose machine using a spinning disc for distribution. It is not capable of low-rate application.
3. *Tartan Speed Spreader*: A special-purpose spinning disc distributor for the low-rate application of concentrated granular insecticides.
4. *International Harvester, Shuffle Plate, Box Topdresser*: A general-purpose, fixed width, fertilizer distributor not capable of low-rate application of concentrated granular insecticides.

Where an agitator was included in the feed tank of a topdresser the machine was tested with and without the agitator in place. When testing, machines were mounted in an enclosure lined with PVC-nylon to reduce impact abrasion of granules and driven by an electric motor at field operating speed.

Three formulations of granulated DDT were tested.

1. *Challenge*: 0.89% a.i. DDT-superphosphate granules. This is a homogeneous mix of DDT and superphosphate normally applied at 2 cwt/acre.
2. *East Coast*: Similar to Challenge but granulated by a different process.
3. *Mapua Prills*: A granule with an inert marble core coated with 40% a.i. DDT to give a final concentration of 20% a.i. DDT. Applied at 10 lb/acre.

Initially both types of DDT-superphosphate granule were tested but, since Challenge granules were more readily abraded, machines were compared using this type only.

MEASUREMENT OF ABRASION

The size of particles retained by pasture during topdressing was not known so all measurements of abrasion were based on the Agricultural Chemicals Board requirements that only 2% of a granule sample pass a 25 BS 410 mesh. Abrasion was defined therefore as: The percentage by weight, of material passing a 25 mesh, produced from a DDT granule sample during distribution.

It was not possible to make a direct measurement of the weight of abraded material produced by a topdresser and abrasion was measured indirectly by determining the loss in weight from a granule sample screened on a 25 mesh after distribution. This method required only that all material greater than 25 mesh be recovered after distribution.

For each topdresser and granule formulation tested, twenty samples, each weighing 20 lb, were drawn from a 4 cwt mix of bagged material. Ten of these samples were put individually through the topdresser and the weight of each distributed sample retained by a 25 mesh after sieving was recorded. The remaining ten samples were also sieved and the weight retained on a 25 mesh recorded. The difference between these weights was due to machine abrasion and was expressed as a percentage of the initial sample weight before screening.

TABLE 1: PERCENTAGE ABRASION OF GRANULES IN MACHINES

<i>Topdresser</i>	<i>Granule</i>								
	<i>0.89% DDT-Superphosphate Challenge</i>			<i>East Coast</i>			<i>20% DDT Prills Mapua</i>		
	<i>Bef.</i>	<i>Aft.</i>	<i>Dif.</i>	<i>Bef.</i>	<i>Aft.</i>	<i>Dif.</i>	<i>Bef.</i>	<i>Aft.</i>	<i>Dif.</i>
Vicon + Agitator	2.3	5.7	3.4	0.3	1.3	1.0	0.3	0.8	0.5
Vicon — Agitator	0.8	2.6	1.8	0.4	1.4	1.0	0.1	0.9	0.8
Vogal + Agitator	1.4	8.7	7.3						
Vogal — Agitator	1.9	6.3	4.4						
Tartan Speed Spreader							0.2	1.3	1.1
International	2.0	8.9	6.9						

Bef. — Before. Aft. — After. Dif. — Difference.

RESULTS AND DISCUSSION

Table 1 compares the abrasion suffered by the different granules in each machine test.

GRANULES

Challenge granules were much less stable than either East Coast granules or Mapua prills. A good deal of abrasion occurred with Challenge granules, even before they passed through the topdresser and large variations were obtained in the amount of material passing a 25 mesh. The use of agitators in the topdressers aggravated the abrasion of these Challenge granules.

Mapua prills were not greatly abraded by either the Vicon or the Tartan Speed Spreader and East Coast granules were also resistant to abrasion. Neither type of granule was significantly affected by an agitator in the Vicon topdresser.

TOPDRESSERS

The Vicon caused least abrasion of all the topdressers tested. The Vogel and International machines caused twice the amount of abrasion found in the Vicon and this was probably due to the different methods of drawing off the distribute from the load. In the Vicon and Tartan machines, the load was held clear of the distribution mechanism and the distribute fell freely on to the spreading device. In the Vogel and International topdressers, the load rested directly on the distribution mechanism so that considerable grinding took place as the distribute was drawn off under pressure.

ABRASION AND HERBAGE DDT

From any test run, about 80% of the material passing 25 mesh was recovered. In order to obtain an indication of the level of pasture contamination likely to be produced by the abraded material, this fraction was regraded.

Fig. 1: Vogel—Challenge granules

Figure 1 shows that about 70% of the fine particles from the Vogel topdresser using Challenge granules passed a 52 mesh. Calculations based on the work of Harrison (1962) showed that, if all these particles adhered to the herbage, during the topdressing of an acre of 3 in. long pasture, the level of DDT contamination would be approximately 90 ppm on a herbage dry matter basis.

Comparison of regraded material from granulated DDT and prills, Fig 2, showed that abrasion produced a high proportion of very fine particles from either type of DDT superphosphate granule but a very low proportion from prills.

Fig. 2: Vicon with agitator

Analysis of the fractions for DDT, Table 2, showed all fractions from the DDT-superphosphate granules to be constant at 0.6%, but the prill fractions increased from 28% in 30 mesh to 36% in 52 mesh.

TABLE 2: PERCENTAGE DDT CONTENT OF REGRADED FRACTIONS

Material	BS 410 Mesh No.				
	30	36	44	52	<52
20% Prills	27.8	28.8	35.0	35.0	35.7
0.89% DDT-Superphosphate	0.63	0.63	0.56	0.58	0.58

These data confirmed an observation that prills tend to be chipped and superphosphate granules rubbed by topdresser action. From an equivalent DDT/acre dressing of these granules, the DDT-superphosphate abraded will contain more very fine material than the prills, but the prill material abraded will be of a greater DDT concentration.

CONCLUSION

Topdressers do cause abrasion of DDT granules but not always to the extent which would seriously increase the amount of DDT retained by

the herbage. The degree of abrasion produced depends both on the type of topdresser and granule formulation used. Topdressers in which the granules are drawn forcefully into the distribution mechanism seem more likely to cause severe abrasion than those in which the granules are fed by gravity. The use of an agitator can increase the degree of abrasion and its use is not required with these free-flowing granules.

The conclusions are limited by the variation that will occur both within topdressers of the same make and topdressers of the same basic design manufactured by different firms. However, the application of DDT granules to pasture, with the minimum of DDT contamination of the herbage, appears to require the use of granule formulations and applicators designed more specifically for this job.

REFERENCE

Harrison, D. L., 1962: *Proc. 15th N.Z. Weed Control Conf.*: 250.