THE BROADCASTING OF GRANULAR INSECTICIDES

R. L. TAYLOR

Farm Chemicals Company, Mapua, Nelson

Summary

This paper discusses briefly the broadcasting, as uniformly as possible, of granular insecticides of size 16 mesh/in. approximately, from ground-based machines and from aeroplanes.

INTRODUCTION

GRANULAR INSECTICIDES are used in New Zealand mainly to protect pastures against soil insects. Dispersible granules which release powder in rain are used more than baits. Both kinds of granular insecticides need to be broadcast as evenly as possible over the surface of the ground with the lowest possible spreading cost. They should be deposited in a wide swath of uniform density over the central part but tapering off gradually at both edges so as to render lapping less critical.

There is little choice of size in the manufacture of granular insecticides. If the granules are too large there will be too few for adequate ground coverage. If they are too small they will be difficult to spread, will drift too much in wind and will be retained too much on pasture. In practice material is used of size roughly 16 mesh/in. giving 30 to 120 particles/sq.ft when broadcast at 5 to 20 lb/ac. Most of the particles have terminal falling speed between 20 and 30 ft/sec, which is rather less than the optimum for spreading. Spreading equipment which throws the granules must therefore be skilfully designed for sufficiently wide swaths.

MEASURING SPREAD PATTERNS

Granular materials are sometimes observed on tarmac, on oiled paper or other impervious surfaces. Such observations on the pattern of spread are sometimes useful, but are less valuable than those where samples are collected and measured. Open tins, which must be large to reduce statistical errors, are placed at desired sampling points and the amount of material collected in each is measured. Owing to the variable size of granules it is much better to weigh the samples than to count the particles. It has been found that the bulk volume of each sample provides an estimate of its total weight and insectidal component sufficiently accurate for all studies of spreading. The bulk volume can be found much more quickly than the weight and allows many more observations to be made.

Two kinds of estimates have been made: (1) Sampling in lines across the swath, to provide an estimate of swath pattern and width, and to check uniformity along the line of spread. (2) Sampling at random from many points in the treated area, to indicate errors from all causes including incorrect lapping.

BROADCASTING UNDILUTED GRANULAR INSECTICIDE FROM GROUND-BASED MACHINES

Very few of the various topdressing machines used to broadcast fertilizer are able to broadcast straight granular insecticide satisfactorily. Many machines cannot sow at a sufficiently low rate.

Fig. 1: A spinner spreader fitted beneath Piper 18 aeroplane, which allows lapping at 50 ft when sowing granular insecticide. The far side of the spinner is sheltered from slipstream.

Others break the granules up too much. It has been necessary therefore to develop special equipment for this purpose.

It has been found that granules can be spread more evenly from spinners than powders, and that under ideal conditions remarkably uniform spreading can be attained. In practice, however, spreading is less uniform than the ideal for several reasons, such as variations in forward speed or lapping width, or because the spinner throws more to one side. Nevertheless it is possible to broadcast granular insecticides on level ground so that no area receives less than 75% of the mean rate. On sloping ground the difficulties of even spreading are greater, and on ground sloping more than about 10° more even spreading can be done by aeroplanes.

BROADCASTING UNDILUTED GRANULAR INSECTICIDE FROM AEROPLANES

Granules are invariably spread from superphosphate hoppers and often the same doors are used to meter the flow in which case the opening gap—only about $\frac{1}{8}$ in.—is critical. Unless the door opening controls can be freed of backlash it is desirable to block off some of the width of the doors to render the opening wider and therefore less critical. With good equipment the flow out of the hopper is very constant and the rate sown per acre can be accurately judged.

After leaving the hopper doors the granules fall in a fairly narrow track, and lapping must be done as closely as 20 ft for good coverage. It is desirable to direct a proportion of the granules laterally after leaving the doors. This is commonly done by passing the granules and some of the slipstream through a spreader located just aft of the doors.

The most effective of these devices used in New Zealand is the "Swathmaster" which gives good spreading at lap distances of

Fig. 2: A small spreader fitted to Cessna 180 aeroplane. Spreaders of this kind are often used when sowing insecticidal dusts and granules, or grass and clover seed.

50 to 60 ft. The Swathmaster has large air drag, cannot be fitted quickly and is costly.

Many aerial operators use small spreaders which are easily attached and transported and which are very cheaply made. Those studied have been found to widen the swath usefully but only to the extent of allowing lapping at about 30 ft for good spreading. Their swath pattern is peaked at the centre. It is clear that the outer passages of such spreaders should be made to carry a greater share of the flow of granules, and to discharge in a more lateral direction.

An interesting development is the adaption of spinner spreaders to aeroplanes. These spreaders are inherently free from peaking at the centre of the swath and can achieve wide swaths. In one type a spinner is rim driven by slipstream, it has very low drag.

With all types of spreaders the swath does not widen with increasing height above 50 ft which is therefore the best height to fly on easy country. Flying up to 200 ft is normally satisfactory provided errors of lapping are not excessive. Few pilots however appear to be able to fly above 100 ft without some increase in lapping errors.

Granular insecticides can be spread from suitably equipped aeroplanes rather more evenly than spray, and much more evenly than dust or superphosphate. With good spreading equipment and skilful flying it is often necessary to collect samples in order to find fault with the spread pattern.

The uniformity of spread begins to deteriorate with 7 to 10 knots of wind but is usually satisfactory up to rather higher wind speeds.

SOWING GRANULAR INSECTICIDES MIXED WITH SUPERPHOSPHATE

Granular insecticides are sometimes mixed with superphosphate and spread from equipment used for spreading fertilizer. Observations on coloured granules have revealed surprisingly little disinte-

gration of well formed granular material mixed with superphosphate in passing through various topdressers.

Machines with spinners designed and operated for spreading fertilizer or lime are unlikely to throw granular material equally to right or left. It has been observed that the pattern of spread of the granules depends on the properties of both the granules and the fertilizer.

There are obvious economies in spreading fertilizer and insecticide together. The saving is however often offset by mixing costs, back freights and loss of economy in handling bulk fertilizer. Spreading of superphosphate from aeroplanes must be done straight out of the hopper doors because spreaders so far devised are clogged by superphosphate. This necessitates closer lapping than is usually done with superphosphate. All these considerations make the fertilizer mixture with granular insecticides less attractive.