Trial with Grumman Avenger, 1949

This was the first large-scale measurement trial conducted by the Department of Agriculture. During 1949, the RNZAF had made a Grumman Avenger available for widespread experimental topdressing of properties in the Wairarapa and a technique had been evolved. In all operations ground staff and radio were used to guide the pilot accurately on to his lines of flight, which were spaced evenly at 2 chain intervals. This practice was followed in the experiment, which was conducted on the Ohakea aerodrome.

The aim was to topdress an area 12 chains wide with six runs of the aircraft. Two hundred canvas catchers were spaced evenly over the target area. The length of each run during which the hopper was open was 40 chains. On one of the runways of the aerodrome which crossed the target area some more detailed measurements were obtained. The fertiliser dropped was double-screened hillside superphosphate with granules between $\frac{3}{8}$ and $\frac{1}{2}$ in. in diameter. The aircraft flew at 400 ft. and there was a light variable wind of about 7 m.p.h.

Measurements showed that the fertiliser was deposited in bands with density of up to 6 cwt. per acre at the centres. These bands were, however, by no means evenly spaced (see Fig. 1), despite precision flying. This could have been caused by a variable sideways displacement due to changes in wind speed or direction.

The shape of the distribution curve for a single run was estimated as far as possible from the runs which did not overlap. It was then calculated from the measurements taken on the cross runway that if the lines of flight were to be spaced at $1\frac{1}{2}$ chain intervals and the rate of discharge from the hopper correspondingly reduced, an even spread would be obtained with the density at all points being within the range of $2\frac{1}{2}$ to $4\frac{1}{2}$ cwt. per acre.

However, it was shown in this trial and confirmed in later ones that it is impossible to lay down the bands with their centres at regular intervals; no matter how good is the flying this ideal spread is never likely to be achieved.

Factors Affecting Efficiency in Aerial Topdressing

Though the series of trials reported in this article does not allow of precise evaluation of various factors governing the efficiency of aerial topdressing, the following conclusions can be fairly drawn:

1. Unless special precautions are taken, a single application of fertiliser applied from an aeroplane is likely to be very unevenly distributed. This applies whether or not the material is granulated; in fact, powdered materials, particularly where use can be made of crosswinds, are probably more evenly distributed than are coarsely granulated materials. The pilot's skill is probably the most important factor in securing evenness of spread. Where evenness of application is important several runs should be made over the area, a proportion of the total quantity to be applied being dropped on each run.

2. There is probably a serious loss of the "dust" fraction of materials dropped, especially with windy conditions and high flying. It is quite possible that much of this fine material is removed from the target area. Though the percentage lost in this manner is not known, there is sufficient evidence to show that it can be very substantial. With the larger types of aeroplane, or in any other circumstances where relatively high flying (by topdressing standards) is required, elimination of dusty material would seem to be essential.

3. Granular materials are probably dropped more precisely and must be used with applications from relatively high altitude. The most desirable type of granulation has not been established, but relatively fine granules appear to have certain advantages, particularly in securing more even application. Granular fertilisers which contain a high proportion of dust are, of course, just as likely to have this dust fraction blown from the dropping area as are powdered materials. A certain proportion of coarser granules may not be disadvantageous, especially with high flying and relatively fast aircraft. The narrowest width of spread will be achieved with coarse granules distributed from low-flying aircraft.

4. The data do not permit evaluation of the different makes of aircraft, types of hopper, etc., for efficiency of spread. Speed of flying may be an important factor that requires further investigation.

5. Wind speed and direction in relation to aircraft height and direction of flying appear to be of overriding importance in determining the type and efficiency of spread. Granulation must help to overcome the wind effect to some degree, but granular fertilisers are still markedly affected by wind drift. The skilled pilot can do much to take advantage of wind in assisting distribution, but in all operations it is a serious limiting factor. It is probable that wind conditions are rarely suitable for the application of dusty fertilisers.

▼ Fig. 1—Distribution from Grumman Avenger over whole field, showing lines of equal density.