A Method Of Drift Free Spraying Of Water Weeds

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INTRODUCTION

The use of aircraft to spray herbicide onto weeds in waterways offers many advantages over other methods of delivery. Speed, accuracy, economy and better coverage are the benefits which can be expected when targets are complex, large and difficult of access by boat or from the ground; and when the pilot is efficient and interested in the work and the equipment is in good condition.

However, the risk of drift of herbicides onto susceptible crops has deterred many from using the air and has kept more laborious methods in use. Means of reducing drift have been studied by chemical firms and ingenious attempts to eliminate the fine drops, which are the dangerous components of the spray pattern, are being tested. All these methods seek, by adding suitable substances to the spray mixture, to produce droplets of a sufficiently large and relatively uniform, range of size and thus prevent drift.

The main disadvantage of these attempts is that an extra ingredient has to be added to the spray which inevitably increases both the cost and the logistic difficulties of the spraying operation.

At the Weed Research Organization (W.R.O.) we felt that there are still ways by which it should be possible to find a means of obtaining spray delivery free from a dangerous proportion of fine droplets but without using any additive.

Britain has its share of water weed problems. Many drainage channels and streams are choked with emergent weeds, like reeds and rushes, which necessitate laborious cutting or spraying from the land or by boat. Dalapon is effective against many of the most troublesome species and is approved in Britain for use in waterways.

When it was recognized that aerial spraying of these channels might be effective, it was clear that any successful methods might also be useful overseas. The Ministry of Overseas Development thus supported the project and the Tropical Pesticide Research Unit (T.P.R.U.) at Porton collaborated with W.R.O. in the trials.

METHODS

The first experiment was carried out in the summer of 1964 and preliminary results have been reported (1, 2, 3). Further trials are under way this, 1965 summer.

The principles under which the trials are being conducted are as follows:

(1) Aerial spraying is conventionally delivered through jets similar in type to those used by ground machines in that they deliver a wide angle fan usually containing a large proportion of fine droplets.

(2) Aerial spraying of water weeds differs from most agricultural spraying in that flying is usually hampered by trees, bushes, bridges and other obstacles.

(3) Thus for safety, a pilot spraying water weeds may need to fly fairly high above the target; and so providing good conditions for fine particles to drift.

(4) Emergent water weeds offer a large surface area of foliage (generally they are not a worthwhile target unless in this condition) and thus relatively large volumes of water are needed for adequate coverage of the spray.

(5) Drift free spraying from an altitude of several feet demands that the droplets used be large. Also if the fall of spray is to suffer minimum deflection from the target, the drops must travel at high velocity. Maximum velocity is obtained when the jet stream is channeled with the minimum of turbulence in a straight line path. Conventional agricultural jets do not have these charactristics so a search was made through catalogues of industrial jets. Jets designed to give the high impact needed for washing gravel or descaling steel appeared to have the desired characteristics of large drops, relative freedom from fine drops, and a straight path of liquid through the jet with only sufficient deflection needed to produce a small angle fan.

(6) Many water weed targets especially on irrigation or drainage channels are narrow. Thus one or two narrow angled jets would be all that were needed to cover the target provided they were of sufficient aperture to deliver the necessary volume of spray. This meant that the conventional aircraft boom could be dispersed with and, 1 - 2 jets fitted to convenient points beneath the aircraft fuselage would be all that was necessary. This configuration apart from saving weight, also tends to keep the spray out of the aircraft's vortex.

(7) For the type of waterways needing treatment in Britain, a slow flying aircraft was essential if the sharp turns often encountered were to be accurately negotiated. This required the use of a helicopter.

(8) If a helicopter is chosen at once the vital additional advantage of being able to land near the target is obtained. Water weeds by their nature are mostly found in flat country, in slow moving water, a situation which usually provides ample suitable landing places for helicopters. The trials are thus also testing practical ability of the helicopter pilot to self load his aircraft from the waterway itself; dumps of herbicide concentrate having been laid down at suitable sites in advance.

Equipment being tested in these trials include floating foot strainers to the filler pipe and portable auxiliary engined water pumps capable of being carried to each site as required by the helicopter.

(9) The types of spray jets tested in 1964 are found in Table 1. These jets were chosen after static tests at W.R.O. and T.P.R.U. and mobile ground tests at W.R.O. In order to simplify the task of the pilot, a uniform speed of 15 m.p.h. was chosen and a constant altitude of flight of 15 feet above the target. Where obstacles are generally higher than 15 feet, then a constant higher altitude would need to be flown using jets of an appropriately narrower spray angle. Even if obstacles are low, a spraying altitude of 15 feet is desirable as it gives the pilot a good angle of vision ahead so that he can anticipate the changes in situation inherent in water weed spraying.

Table 1. Characteristics of jets used in aerial spraying at 15 feet altitude and 15 m.p.h. at 40 lb./in^2.

Jet Type	Size	Maker	Spray Angle	Swath Width	Delivery Imp. Gals. per min.	Imp. Gals. per acre
"Flat"	35100	Spraying Systems Ltd.	35°	7 Ft.	8	33
"Flat"	1560	Spraying Systems Ltd.	15°	4.5 Ft.	5	36
"Strip"	SPJ4	H. T. Watson, Ltd.		8 Ft.	6	23

With these jets typical water channels were sprayed in replicated plots of 0.25 mile in length with width of weeds ranging from 9-15 ft. For the narrower channels, a pair of "Flat" jets 1560 were used. For the wider channels paired "Flat" 35100 and "Strip" SPJ 4 were tested. The aircraft used was a Brantly Helicopter B2. The jets were mounted at the forward end of each of the helicopter's skids by universal joints permitting adjustment of the attitude of each jet. In all the channels the 2 jets were adjusted so as to give a continuous swath of a width equal to twice that of a single jet.

On a wide expanse of weeds on a lake the jets were adjusted in attitude so as to give a gap of several feet between their swaths. This was to simulate a situation where weeds on the sides of a channel would require to be sprayed leaving the water between unsprayed.

RESULTS

The results observed a few weeks after treatment have been reported (1). The results indicated that the spray had been delivered with satisfactory accuracy to winding channels. A cross wind of about 1 m.p.h. was blowing during some of the plots. A fine mist of spray was observed drifting downwind but from previous ground tests in similar conditions this was known to present less than 1% of the total spray. This drift was insufficient to cause any signs of damage to the susceptible grasses growing on the side and downwind of the channels. Browning off of the susceptible weeds in the channel (*Phragmites, Juncus* and *Typha* spp) was complete. A recent report (4) has shown that regrowth of these species has been prevented so that the control of the weeds is satisfactory and spraying at 30 Imp. gallons per acre from the air has given as good results as ground spraying at the usual 100-150 Imp. gallons per acre.

CONCLUSION

Further trials are justified and these are at present underway using, in this instance, a Hiller 12E helicopter.

The trials are to be extended to the spraying of very narrow (3 ft.) farm ditches. This will necessitate the use of very narrow angle jets which have yet to be selected.

While the proportion of fine droplets produced by the industrial jets under test is low, it is felt that this proportion must be further reduced for use with spray such as 2-4-D in the vicinity of highly susceptible crops such as cotton. Research to improve the characteristics of these jets or the use of new designs is proposed. It is hoped to compare such results with the use of an invert emulsion type of spray.

Attempts are also to be made to set up a forward extended spray rig configuration on the helicopter which would enable the pilot directly to observe the fall of spray onto the target. Such a system would greatly assist the pilot in making applications to water weeds on narrow and sinuous channels.

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