AERIAL SPRAYING

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To cover such a comprehensive subject on two pages is impossible so an endeavour will be made to discuss only a few of the more topical problems affecting the development of aerial spraying in Australia. The mechanics of spraying is a vast subject and must be omitted although a few references will be listed for those who are interested in obtaining more information on the subject.

The use of aircraft for agricultural purposes is not new and insecticidal dusts, baits, sprays and fertilisers have been applied since 1919; more recently, in Australia, the aerial top dressing of pastures has become established. The advent of hormone type weedicides and their subsequent development for the low-volume spraying of cereal crops and pastures enabled aerial spray contractors to spread their activities over a greater portion of the year thus off-setting overheads and the high initial capital investment necessary for operating aerial spray equipment. Even though some earlier companies were liquidated, due principally to the restricted nature of the work then available, most of the current contractors can maintain a full programme, for example -

January to March	-	top dressing and seeding.
February to June	-	control of pasture pests such as Red Legged Earth Mite and Lucerne Flea.
June to September	-	control of weeds in pastures and crops.
October to January	-	control of pests such as Climbing Cut Worms in oat, barley and linseed crops.

This programme has been and will be the most important factor in bringing the use of aerial spraying within the economic reach of farmers and graziers, and at the same time enable the spray contractors to assure their future and obtain better equipment.

Aircraft spraying is a useful means of treating large areas of weed infested crops and pastures within a short period with the highly effective and concentrated hormone type weedicides - regardless of soil conditions which may prevent the use of ground spray equipment. The early application of weedicides from the air in Australia was rather variable, and its present success must be attributed largely to the ingenuity and daring of the pilots, and the effectiveness of the new weedicides. Aerial spraying has now reached a stage of consolidation, although many problems remain to be overcome.

SOME PROBLEMS ASSOCIATED WITH AERIAL SPRAYING

(a) Suitable Equipment. Firstly, suitable aircraft are difficult and costly to obtain. Tiger Moths, ex Wartime Disposal stocks, have been the main aircraft used to date and, although relatively cheap and manoeuvreable, their load is small, which results in relatively high operating costs due to the time taken in filling, landing and taking off. The front cockpit of the Tiger Moth is converted into a tank holding 30-36 gallons of prepared spray, which is forced by a power or propeller driven pump to a boom slung beneath the lower wings. The quantity of spray applied varies between 1-3 gallons of prepared spray per acre, and the plant flies at between 2-10 feet above the crop or pasture at approximately 70 m.p.h.

Recently, Wirraways have been modified for aerial spraying and these will treat approximately 100 acres per flight compared with 15 acres by the Tiger Moth when the application rate is two gallons of prepared spray per acre; obviously, the higher loading capacity is a definite advantage, but better landing and maintenance facilities are necessary for the Wirraways. Other aircraft such as Piper Cubs, Bristol Freighters and D.C.3's. have been adapted for aerial spraying. In America, special aircraft have been designed, and it is understood that some of these will soon be available in Australia.

(b) Suitable Formulations. Practically all the hormone type weedicides have been applied from the air, although the oil soluble esters are more reliable than the amine salts, which in turn are more reliable than the sodium salts; in regard to the latter, however, the sodium salt of MCP appears to be preferable to the sodium salt of 2,4-D in that it dries out at a slower rate and to a finer crystal size, which enhances absorption. Variable results have been given by both sodium and amine salts of 2,4-D, particularly under dry dusty conditions, which indicates that these water soluble chemicals are adversely affected by evaporation during spraying, and at the leaf surface. It is known that more effective absorption by the weeds is obtained where the active chemical remains in solution. The effect of dust might be to take up moisture and leave the chemical absorbed at the surface of the dust particles, thus preventing effective contact with the leaf surface. The oil soluble esters are less subject to evaporation even when formulated as the water miscible oils - there may be some evaporation of the water phase, but evaporation of the oil phase, containing the active chemical, would be far less rapid, and thus ensure a more active up-take by the weeds.

In America and Canada, the principal formulations used are straight solutions of esters of 2,4-D and 2,4,5-T in distillate or similar fuel oil, and to a lesser extent micronized 2,4-D or 2,4,5-T acids in oil. In Australia, the water miscible oils are favoured since fuel oils are more expensive, and water, although at times in short supply, is generally available at spraying time. There appears little to choose between the effectiveness of esters when applied as water miscible oils or oil solutions, although an exception may be in scrub control such as for Brigalow, where butyl ester 2,4,5-T is applied in distillate, and it is claimed that the distillate carrier assists the weedicide in penetrating the leaf surface of Brigalow.

There is little to choose between the different types of esters i.e., the cheaper ethyl or butyl esters or the more expensive low-volatile types for application by aircraft, since little volatilisation of actual esters occurs in the spray between the plane and weeds. It may be claimed that the low-volatile esters are safer to apply from the aspect of possible damage to susceptible crops growing in the vicinity of treated crops, but the more important factor is spray drift, which may extend over many miles, depending on the height at which the spraying takes place, and the prevailing winds. Restrictive regulations may have to be considered to protect the principal vine, orchard, cotton and vegetable growing areas in Australia, by declaring non-spray barriers around the susceptible areas.

(c) <u>Rates of Applications</u>. Where the ester forms of 2,4-D or 2,4,5-T are used, the rates of application of active ingredient per acre may be the same as those recommended for ground spray equipment; however, under dry conditions these rates for the sodium and amine salts are increased to counteract reduced effectiveness due to evaporation. The amine salts are less affected than the sodium salts since most amine formulations contain wetting agents which tend to reduce the evaporation rate.

For adequate spray coverage 2-3 gallons of prepared spray are applied per acre, and poor results have been obtained where only $1-1\frac{1}{2}$ gallons have been applied per acre under dry conditions. The concentrated nature of the spray may also lead to trouble in mixing if hard water is used; again the sodium salts of 2,4-D and MCP are more adversely affected than the amine formulations which generally contain sequestering agents, and, in addition, the triethanolamine itself has a sequestering effect. Good miscible oil formulations of ester 2,4-D and 2,4,5-T are affected least of all by hard water. The use of hard water for mixing the sodium and amine salts of 2,4-D and MCP might also be expected to increase the rate of crystallization at the leaf surface and reduce effective absorption. Where satisfactory water is unavailable as a carrier, than an oil can be considered as an alternative.

(d) Crop Damage. Aircraft cause no mechanical damage to crops, and so long as the hormone type weedicides are applied at the recommended rates, and at the correct stage of crop growth, there should be no adverse effect on crops. Some distortion of wheat-heads has occurred after aerial applications, which some attribute to the concentrated nature of the spray, but the real reason is probably due to incorrect time of application or faulty equipment.

(e) Inclement Weather. In overseas countries the trend has been for ground staff and pilots to live in self contained caravans. Supplies of mixed spray and fuel arrive in separate tankers, which are fitted with power pumps to save time in refilling and refuelling the aircraft between flights. Similar steps are being taken by Australian contractors, as the demand for aerial spraying increases, and another feature is that the pilots, by remaining on the job, are able to take advantage of good weather; the time for spraying crops and weeds is rather critical and every opportunity must be taken to treat as large an area as possible when good spraying conditions prevail.

The high cost of maintaining inoperative

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aircraft in the field due to bad weather has been one of the principal reasons for the relatively high cost of aerial spraying, but this can be overcome to some extent by good ground organisation.

CONCLUSION

Aerial spraying in Australia should continue to expand due to the nature of Australian agriculture. The limiting factor to date has been the relatively high costs of application when compared with ground spray equipment, but the difference will become less marked as aerial spray contractors are able to reduce their operating costs with more efficient equipment and ground organisation, and an increasing demand for their services.

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