Crop spraying with hormone-like weedkillers

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ALTHOUGH a considerable amount of investigational work on various weeds was carried out during last season it is intended to devote this article to experience gained from large scale undertakings as distinct from experiments. A very successful aerial spraying project was undertaken against water hyacinth (Eichornia crassipes) at Lake Monger and pasture weeds such as thistles and Cape tulip (Homeria spp.) were treated with hormone-like preparations in a number of districts, but by far the greatest activity with these chemicals was associated with the selective control of weeds such as wild turnip (Brassica Tournefortii), wild radish (Raphanus raphanistrum) and mustard (Sisymbrium spp.) in cereal crops.

Most of this work was carried out by the farmers, themselves, using low-volume spraying equipment. In many cases they worked in groups utilising one machine for several properties. A limited amount of contract spraying was done with low-volume units and, for the first time in this State, aircraft were used. At the beginning of the season it was considered likely that 500,000 acres of crop would be treated but later estimates indicated a somewhat lower figure mainly due to the unfavourable season in a number of districts where extensive sprayings would have been carried out. Approximately 30,000 acres of crop were treated from the air.

RATES AND TYPES OF CHEMICALS

Most of the spraying with boom units for wild radish, wild turnip and mustard was done with four ounces of acid equivalent per acre of the amine or sodium salt of 2, 4-D or the sodium salt of M.C.P.A. Some farmers used three ounces of acid equivalent when only wild turnip was involved while in other cases the rate was increased to six or eight ounces for wild radish. The volume of water used ranged from five to ten gallons per acre. The most popular length of boom is 30ft., although some 40ft. or more in length have been used.

With aircraft, the amine salt of 2, 4-D was used almost exclusively, in most cases the rate being six ounces of acid equivalent per acre. The amine is favoured as the sodium salt is regarded as being more likely to evaporate between aircraft and ground, especially if the effects of low humidity and a relatively high temperature are accentuated by a noticeable wind. Tiger Moth aircraft fitted with a 30ft. boom under the lower wing were used and the volume applied ranged from a little more than one gallon to two and one half gallons per acre. This volume is dependent upon the speed of the plane, the quantity of solution passing through the jets and the distance between each “run” of the plane.

RESULTS

With very few exceptions the treatment of wild turnip both with land units and aircraft has proved highly successful, and undoubtedly resulted in a considerable increase in yield on many thousands of acres, especially on light land. Spectacular results were obtained at Waddi Forest where 6,500 acres of turnip-infested crop under the control of the Land Settlement Board was sprayed from the air. A few weeks later a live plant of turnip was very difficult to find but the ground was covered with the dry remains of the infestation.

Fortunately, wild turnip is very susceptible to the hormone-like weedkillers and poor results are usually restricted to sections which have been missed during spraying operations. For demonstration purposes, bags were spread at intervals through a crop to be sprayed. These were removed immediately after the spraying.
Fig. 1.—A dense growth of wild radish on an unsprayed strip in a crop near Northam. Field peas can be seen among the crop in the right foreground.

was completed and several weeks later the area covered by each bag was a block of wild turnip in an otherwise clean crop.

Although most results with wild radish have been satisfactory some have been quite disappointing. Even though most of the wild radish plants showed the typical effects of 2, 4-D shortly after spraying, varying proportions survived the treatment and reached maturity. The reason for these unsatisfactory results may be found to be associated with one or more of the following factors:

Season.—Hormone-like weedkillers are most effective against weeds making active growth. During 1952 in many districts the growth of weeds was checked by dry soil conditions resulting from the low rainfall. It is reasonable to assume that under such conditions the weeds become somewhat more resistant to the chemicals.

Amount of Chemical Applied.—As a result of the initial investigations with wild radish carried out in 1950, under favourable conditions four ounces of acid equivalent was found to give a degree of control sufficient to prevent the weed from interfering unduly with the crop, but eight ounces per acre was required to give virtually complete control even when the various factors influencing the treatment were regarded as being satisfactory.

Growth Stage.—Some farmers have a strong conviction that application should be delayed until the weeds have reached the flowering or even the early seeding stage and a considerable amount of spraying undoubtedly has been carried out too late to be most effective. Treatment when the crop has commenced stooling and is 6-8 inches high is desirable for a number of reasons. The annual weeds are then small and most vulnerable to the chemical; they are destroyed before becoming an important competitor for the crop; at this stage of growth the cereal is least likely to protect the weeds from the chemical and later treatments, particularly when the cereal is commencing to run into ear, can cause a reduction in yield.

On occasions late spraying has been carried out with the view to causing large plants of radish and turnip approaching maturity to recede below the level of the crop and thus facilitate harvesting. This procedure does not take full advantage of the operation and can only be regarded as an emergency measure which may not always pay dividends.

Thoroughness of Application.—Results with hormone-like weedkillers have been so spectacular that there is a tendency to become careless with mixing and application and also to disregard rain as a factor. The small quantities used make accurate and thorough mixing imperative and although rain a few hours after treatment seldom affects results, some farmers have continued spraying until rain was falling. There is now no shortage of suitable spraying

equivalent per acre no doubt would give uniformly better control of wild radish.

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Recommendations have been made along these lines but the tendency has been to use the lower figure generally. Although, as already stated, this level has proved effective in the majority of cases some disappointing results have been experienced. Six ounces of acid
equipment but the most efficient machinery must be calibrated accurately in order to ensure the correct rate of application. The variables involved are the rate of output and the speed of movement of the boom along with the concentration of the solution.

**Difficulties Peculiar to Aircraft Application.**—Some excellent results have been obtained by aerial application during the past season but this method is somewhat less precise than with land boom units and is associated with additional technical difficulties. On the other hand it has some marked advantages, including speed of application and the possibility of treating crops on land too boggy to carry equipment.

A slight lateral wind, if anything, is an advantage as it facilitates overlapping of strips but strong winds are most undesirable as they cause very uneven distribution. Such winds especially when associated with low humidity are also the cause of evaporation of the solution as it moves from the aircraft towards the ground. This evaporation can prove a very significant factor readily understandable when the very low volumes used are kept in mind.

All planes operating in Western Australia at the present time are Tiger Moths fitted with a 30ft boom. Spray is directed beyond each end of the boom by terminal jets, and planes are being operated by different firms at 30ft., 45ft. and 60ft. shifts. In order to obtain a complete and effective coverage, especially with wild radish, conditions must be ideal when a 60ft. spraying width is adopted and this width leaves no margin for the pilot to move off course. American experience indicates that the effective spraying width should not be considered greater than 15 feet more than the length of the boom.

The volume of solution applied per acre has ranged from slightly more than one gallon to two and one half gallons. The lower rate has proved satisfactory under favourable conditions but a minimum of two gallons per acre is considered desirable.

As already mentioned, with most of the aerial spraying, six ounces of acid equivalent of the amine was applied per acre. When treating wild radish, especially under conditions not highly favourable for weed control, it is advisable to increase this rate to eight ounces per acre.

When applying higher rates the increased possibility of crop injury must be kept in mind, especially when very low volumes are used. When the crop is at the “safe” stage and soil moisture conditions are satisfactory it is unlikely that eight ounces of acid equivalent of the amine per acre will cause appreciable, if any, injury to cereal crops.

**Fig. 2.—** Dispersal of droplets resulting from application by aircraft at the rate of 2 gallons per acre. The average number is 33 per square inch.

**Damage to Crops**

Cereal crops are known to be susceptible to 2, 4-D in the seedling stage. They gain considerable resistance by the time they have stooled and reached 6-8 inches in height although some oat varieties are known to remain susceptible longer. Risk of damage again occurs when the early “boot stage” is reached, that is when the head in enclosed in the sheath of the flag leaf, and continues during the period of pollination, the plants again becoming resistant during the late “milk” and “soft dough” stages.

During the 1952 season only a very few cases of damaged wheat heads attributed to 2, 4-D came to our notice. The main symptoms were elongation of the internodes giving the head an interrupted appearance, along with lack of development of some of the lower clusters. These few experiences can scarcely affect the usage of hormone-like weedkillers for crop spraying.

An important consideration is the reaction of clovers, particularly subterranean clover, growing along with the crop. Some farmers have reported adverse effects and cases of delayed flowering have been noted. Reduction of subsequent stands is most likely to occur when spraying is carried out in the season of sowing as contrasted with a crop grown on old clover land. Medics, including burr trefoil and barrel clover, are known to be more susceptible than
Fig. 3.—Typical effects of 2, 4-D are shown by the tomato leaf on the right.

Fig. 4.—A normal grape leaf (right) compared with leaves showing moderate and severe effects of 2, 4-D.
the true clovers. It is planned to investigate this aspect in some detail during the coming season.

Lupins are readily damaged by 2, 4-D even at low rates of application, and the spraying of peas cannot be undertaken with confidence. The sodium salt of M.C.P.A. is regarded as being the safest type to use, but even with this results cannot be predicted with certainty. Two crops of field peas in the Avon Valley at a comparable stage of growth and sprayed at the same time for control of wild radish reacted differently to four ounces of acid equivalent of M.C.P.A. per acre. In one case a high degree of radish control was obtained without visible damage to the peas while the growth of the peas in the other crop was obviously checked.

The possibility of damage to nearby crops must always be kept in mind especially with application from the air. Tomatoes and grape vines are particularly sensitive and several cases of damage to these plants were reported during last season.

CONCLUSIONS AND COMMENTS

In order to obtain maximum results from spraying operations, consideration must be given to the following aspects:

1. **Time of spraying** with reference to growth stage of both crop and weeds. Weeds are most susceptible when small and the "safe period" for the crop is between stooling at 6-8 inches in height and the "boot stage" already described.

2. **Conditions.**—Fine, warm weather without a strong wind is desirable. Rain a few hours after treatment is unlikely to be detrimental but spraying should not be carried out when rain is imminent.

3. **Rates of Application.**—Four ounces of acid equivalent is sufficient for wild turnip but will only give satisfactory results with wild radish under favourable conditions. Six ounces per acre would undoubtedly give uniformly better results. Eight gallons per acre is a convenient and satisfactory volume.

4. **Accuracy of Treatment.**—With small quantities of chemical and relatively low volumes being used it is essential to be accurate when preparing the solution and to ensure that the correct volume is being applied.

5. **Aerial Application.**—Best results have been obtained with 30ft. shifts applying at least two gallons of solution per acre and flying at a low level. With aerial application six ounces of acid equivalent per acre is regarded as being a minimum and for wild radish, under some circumstances higher rates, for example eight ounces, may be necessary.

6. **Investigations.**—Further work is planned for the coming season particularly with reference to the reaction of clovers in crops, and the possibility of other formulations of 2, 4-D such as the esters, including low volatility types, proving more effective against wild radish.

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