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THE CONTROL OF WEEDS IN CEREALS

By G. A. PEARCE, M.Sc. (Agric.), Biological Services Division

PROBABLY the simplest way of obtaining an increase in crop yield is to control the weeds present. Nearly a million acres of cereal crops are sprayed by aircraft each year and when the area treated by ground units is added, something like 20 per cent of the total area sown is sprayed with herbicides.

Increases of 3 to 5 bushels an acre may be obtained when the weeds are killed with chemicals in the young seedling stage. This advantage is often lost if treatment is delayed until the later growth stages.

With the advent of several new herbicides practically all broad leaved weeds can be controlled, but this is not so with annual grasses, which are becoming a major problem.

Importance of cultivation

Cultural practices remain the most important method of controlling weeds and this means that every effort should be made to obtain a weed-free seed bed before planting. The use of herbicides should be regarded as supplementary to this initial preparation.

Over a period of some 30 years, trials undertaken on various research stations have shown that the earlier a crop is planted after the break of the season, the higher the yield is likely to be. However, because of the build-up of weeds over this same period, the emphasis has been placed on obtaining a weed-free seed bed rather than endeavouring to plant immediately after the opening rains. This has been
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necessary because, although planting early may increase yields by 2 to 4 bushels per acre, the presence of a heavy weed stand will reduce yields by more than this amount.

Although this article deals solely with the use of herbicides, it is assumed that cultural operations will be undertaken so that no weeds are present at the time of planting. Sometimes a chemical treatment is helpful in killing weeds just before planting but this is not a general situation.

**Chemical control**

Many of the weeds listed in Table 1 can be controlled by cultivation, and it is only in unusual seasons that they present a problem requiring a herbicide treatment. The more important weeds are those which are inclined to germinate after planting, and these are well known.

Like many other operations on the farm, the application of herbicides needs the proper equipment and care, and for this reason many farmers are satisfied to have their crops sprayed by specialists in this field.

**Time of application**

During the past 15 years the practice has been developed of treating cereal crops with herbicides only during the early tillering stage. With more herbicides available the time of application is now dependent on the type of chemical being applied.

It has been shown at a number of research stations that crop yields are increased more by killing weeds during the earlier growth stages than at the tillering stage. This is because the competition from weeds during the first six to eight weeks of the growing period has a far greater effect on crop yield than competition at later growth stages. For instance at Wongan Hills the yields of wheat in a crop heavily infested with doublegee were:

- Not sprayed .... .... 30.2 bushels
- Sprayed two-leaf stage 40.2 bushels
- Sprayed tillering stage 35.5 bushels

In another trial with a crop heavily infested with capeweed the yields obtained were:

- Not sprayed .... .... 7.6 bushels
- Sprayed two-leaf stage 16.3 bushels
- Sprayed tillering stage 14.7 bushels

Because of the advantage to be gained farmers should endeavour to control their weeds as early as possible during the growing season and so obtain a maximum yield increase.

Table 1 shows the weeds which can be safely treated at different growth stages of the crop and the appropriate treatment to be applied.

**Methods of application**

No matter which type of equipment is used, unless it is calibrated so that the correct quantity of herbicide is applied, results will be disappointing.

1. **Low volume boom spray**

   The first equipment used for crop spraying was a boom fitted with low-volume nozzles spaced at about 15-inch centres.
Four out of every five acres sprayed with herbicides are treated by aircraft. Note the even spray pattern obtained under ideal conditions.

Apart from nozzle refinements and improvement in the boom supports there has been little change in this type of equipment since it was first introduced. Although the boom spray unit probably gives the most uniform application it has certain disadvantages when compared with other methods of application. These include the need for large quantities of fresh water and its susceptibility to boggy conditions. The area treated in any day depends on the length of the boom, which does not often exceed 30 ft.

2. Single and multiple nozzle jets

With a view to reducing cost of construction and also to overcome the cumbersome nature of a long boom, various types of single and multiple nozzle jets have been designed. These are found to be quite satisfactory provided wind conditions are favourable for spraying, and close attention is given to pressure and prevention of blocking of the nozzle aperture.

3. Aerial application

The use of aircraft has the advantage of speed, the capacity to handle boggy conditions and freedom from the risk of mechanical damage to the crop.

Farmers’ acceptance of this method of application is shown by the rapid increase in the area treated over the years. In 1959, slightly more than 300,000 acres were sprayed by aircraft while in 1966 the figure was more than 900,000 acres.

The volume of application has been reduced from two gallons per acre in the early years down to four pints per acre at the present time.

As more technical knowledge is required with the advent of new herbicides, farmers may well be advised to rely more on aerial operators who specialise in this work.

4. Misters

The misting machine uses a large blower to produce a strong blast of air into which is injected the spray solution. The mixture is broken into large and fine droplets and carried with the air stream over the crop. The larger droplets fall out of the stream close to the mister while the finer particles are carried further away.

The efficiency of misters is greatly dependent on the wind at the time of application and considerable skill is required by the operator to adjust the unit and direction of application with variations in the wind.

It is quite obvious that under still conditions, the spray solution will only be thrown as far as the air blast of the machine can carry it. With a wind of 5 to 10 knots blowing the coverage given by the mister will greatly exceed this distance.

Because of this variation it is desirable to maintain a spray swathe equal to half the distance the herbicide mist appears to travel. The constant overlap will even up
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the rate of application on that part of the swath furthest from the machine and where a smaller quantity of spray actually falls.

The alternative procedure is to alter the spray solution as the wind varies and change the spray swath accordingly. This would be far less convenient.

In an article such as this it is not desirable to give more detailed directions for the use of misters. However it must be pointed out that considerable experience is required to obtain a uniform kill without stripping when a mister is used.

HERBICIDES

The successful use of a chemical for weed control depends largely on an understanding of a herbicide’s characteristics. These include the range of susceptible and resistant weeds, the rate and time of application, and any other details required to ensure the success of the treatment.

1. Avadex BW:

This herbicide is used for the control of wild oats and wimmera ryegrass. Other annual grasses are not affected. It acts on the germinating seeds and does not control these two weeds even when they are only in the seedling stage. For this reason it is applied immediately before planting and the seeding operation is used to incorporate the herbicide into the upper layer of the soil. To obtain good results it is essential to have a clean seed bed with a good tilth.

These and other requirements for the success of an Avadex treatment are discussed in a separate article on wild oats and apply also to the control of wimmera ryegrass.

2. Carbyne:

Carbyne is used solely for the control of wild oats and is particularly useful where a farmer is not certain that a wild oat problem will exist in the crop. It should be applied when the wild oats are in the 1½-2½ leaf stage and this is approximately three weeks after seeding. Aerial as well as ground application can be used.

Further details are given in a separate article on wild oats.

3. Afalon and Linuron 50:

The active ingredient in these two proprietary lines, linuron, is a wettable powder, and for this reason it is necessary to keep the spray solution agitated. A normal bypass, as found on many spray units, is not sufficient. Where it is not convenient to fit a mechanical agitator special nozzles designed to agitate the spray solution can be fitted to the tank. It is necessary to ensure that the pump used has sufficient capacity to maintain the flow through the agitator nozzles as well as maintain the pressure in the spray boom.

Linuron is most effective against weeds in the seedling stage, and has little, if any,
TABLE 1
THE WEEDS WHICH CAN BE CONTROLLED BY VARIOUS HERBICIDES AT DIFFERENT GROWTH STAGES OF A CEREAL CROP

<table>
<thead>
<tr>
<th>Growth stage (crop)</th>
<th>Weeds controlled</th>
<th>Herbicide (Trade name)</th>
<th>Rate of Application per acre</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-sowing ....</td>
<td>Wild oats, Wimmera ryegrass ....</td>
<td>Avadex BW</td>
<td>1½ pints</td>
<td>Only effective under ideal conditions</td>
</tr>
<tr>
<td>1–2 leaf ....</td>
<td>Wild oats (1½–2½ leaves) ....</td>
<td>Carbyne</td>
<td>2 pints</td>
<td>Growth stage of wild oats critical</td>
</tr>
<tr>
<td>2 leaf ....</td>
<td>Capeweed, radish, turnip, mustard, doublegee, rapistrum, saffron, corn gromwell, wild pink, shepherds purse</td>
<td>Afalon or Linuron</td>
<td>8 oz. 50% material</td>
<td>Complete control only if weeds less than 2 in. diameter</td>
</tr>
<tr>
<td>2–6 leaf ....</td>
<td>Capeweed, radish, turnip, mustard, doublegee, rapistrum, saffron, corn gromwell, wild pink, shepherds purse, amsinkia, wireweed</td>
<td>Afalon or Linuron</td>
<td>12 oz. 50% material</td>
<td>Weeds usually 2–4 in. across</td>
</tr>
<tr>
<td>Early tillering</td>
<td>Capeweed, amsinkia, wireweed ....</td>
<td>Afalon or Linuron</td>
<td>12 oz. 50% material</td>
<td>Complete kill unlikely</td>
</tr>
<tr>
<td></td>
<td>Radish, mustard, turnip, rapistrum ....</td>
<td>2, 4-D amine or 2, 4-D ester</td>
<td>8 oz. 6 oz.</td>
<td>Active ingredient</td>
</tr>
<tr>
<td></td>
<td>Thistles, Paterson’s curse, stinking roger, stagger weed</td>
<td>2, 4-D ester or 2, 4-D amine</td>
<td>8 oz. 12 oz.</td>
<td>Active ingredient</td>
</tr>
<tr>
<td></td>
<td>Doublegee, dock, clovers ....</td>
<td>Banex</td>
<td>½ pt. 20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chickweed, sorrel ....</td>
<td>Banex</td>
<td>1 pt. 20%</td>
<td>Complete kill of sorrel unlikely</td>
</tr>
<tr>
<td></td>
<td>Radish, turnip, mustard, doublegee, dock, rapistrum, chickweed, clovers</td>
<td>Banair plus 2, 4-D ester</td>
<td>½ pint 20% plus 4 oz. active ingredient</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.—The herbicides mentioned in this article, with their trade names and distributors

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Trade Name</th>
<th>Distributors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barban</td>
<td>Carbyne</td>
<td>Lanes</td>
</tr>
<tr>
<td>Triallate</td>
<td>Avadex BW</td>
<td>Monsanto Barrow Linton</td>
</tr>
<tr>
<td>Dicamba</td>
<td>Banex (water soluble) / Banair (oil soluble)</td>
<td>Elders G.M. Westralian Farmers Dalgety’s Terra Trading</td>
</tr>
<tr>
<td>Linuron</td>
<td>Afalon / Luniron 50</td>
<td>Patersons Wesfarmers I.C.I. David Gray Lanes Shell Chemical</td>
</tr>
<tr>
<td>2, 4-D</td>
<td>Numerous</td>
<td>All Agricultural Chemical Firms</td>
</tr>
</tbody>
</table>
effect on weeds which germinate after spraying. For this reason it is necessary to time the application so that a full weed emergence has occurred but before the weeds are more than two inches across.

Cereals are not affected by the recommended rates of linuron at any growth stage up to flowering, and the two leaf stage is only used to indicate the likely time when full weed emergence has occurred and yet the weeds are still small.

If spraying is undertaken under these ideal conditions 8 oz. of the commercial product will give complete control of most broad leaved weed. If the weeds are larger than two inches across, but less than four inches, the rate used should be increased to 12 oz per acre. After this time the crop is usually approaching the tillering stage and little is gained by applying linuron if 2,4-D or Banex is effective against the weeds present.

Table I gives details of the rates and times of application for the various weeds listed.

4. Banex and Banair:

The active ingredient of both these herbicides is dicamba. With Banex the formulation dissolves in water while Banair forms an emulsion in water. The reason for this second formulation is so that 2,4-D ester can be added and the mixture applied by aircraft. The effectiveness of these two chemicals is restricted to double-gee, docks, clovers, chickweed and sorrel, but when 2,4-D is added the range of susceptible weeds is greatly increased.

The cereal is most tolerant to the treatment when in the early tillering stage.

5. 2,4-D:

Two formulations of 2,4-D are commonly used, the ester, which forms a white emulsion when added to water, and the amine derivative, which forms a clear solution when dissolved in water.

The ester form of 2,4-D is more active than the amine and this means that clovers and medics are slightly more susceptible to it. Low rates of application of 2,4-D ester can retard seed formation with legumes; however this is not regarded as serious—most cereal spraying is done with this formulation.

Cereals are most tolerant to 2,4-D when in the early tillering stage and the normal rate of application used for radish, turnip and mustard is 6 oz. active ingredient of 2,4-D ester or 8 oz. of 2,4-D amine per acre.

Where these weeds are under stress due to dry, or cold and wet growing conditions, the rate of application should be increased to 8 oz. of 2,4-D ester per acre.

Recommendations for the control of these and other weeds are shown in Table 1. Table 2 shows the distributors of the chemicals mentioned.
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