WEED CONTROL IN CEREALS

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Of all the crops the cereals are the most commonly sprayed with hormone weedkillers. Spraying of cereal crops has almost become standard practice, but with the introduction of new formulations and recent weed problems much work remains to be done. Weedkiller trials on wheat and oats have been carried out at Invermay Research Station over the last three seasons. The weed problem has become acute in some areas where the harder-to-kill weeds are replacing the more easily controlled weeds. At Invermay we always had our share of both types, but now the weeds in our cereal crops are predominantly those of the *Polygonaceae*, the worst being cornbind (*Polygonum convolvulus*), wireweed (*Polygonum aviculare*), redshank (*Polygonum persicaria*) and docks (*Rumex* spp.). The trials were designed to test the tolerance of wheat to these formulations and the control of weeds in the plots was closely observed.

WHEAT

All the trials were replicated plots with controls enabling an accurate assessment of yields. The variety of wheat was Cross 7 and it was always spring sown. The hormone weedkillers were applied at 1.0 and 2.0 lb. acid equivalent per acre, after tillering was complete, and in a later trial at the 4 to 5 leaf stage. The effects of the hormone weedkillers will be dealt with as follows:

(a) **MCP group:** The preparations used in the trials were the sodium salt, the amine salt, and the butyl ester of MCP. The MCP salts proved to be the most selective weedkillers used in the trials on wheat and oats. This result is in keeping with results obtained in other departmental trials. In two trials in two consecutive seasons the sodium salt of MCP at 1 lb. a.e. per acre gave yields of 2 to 6 bushels lower than the controls, whereas yield reductions from amine salts of 2,4-D applied at the same rate were in the vicinity of 4 to 10 bushels. At 2 lb. a.e./acre the yield decrease remained the same with the sodium salt of MCP, but was greater for the amine salt of 2,4-D, a 12 bushel decrease being recorded in one trial. The butyl ester of MCP was more severe in its action and gave slightly larger yield decreases than the sodium salt at 1 lb. a.e./acre. At 2 lb. a.e./acre its effect was much more severe, a 10 bushel yield decrease being recorded in one trial. The amine salt of MCP was similar in action to the sodium salt with similar yield decreases.

In many of these trials the yield differences from the untreated controls were not significant in the statistical analysis, but it must be pointed out that in 95 per cent. of the cases they are actual decreases in yield. In these trials the yields of the control plots were from 70 to 75 bushels. Weed control was adequate with the MCP group, but in the later trials it was noticed that weeds of the family *Polygonaceae* were not killed but checked and then grew again. However, the check was sufficient to enable harvesting without any difficulty.

(b) **2,4-D group:** The amine salt of 2,4-D proved to be the most selective of the 2,4-D group. The other forms applied were the ethyl ester, the triethylamine and dimethylamine salts and the polyethylene glycol ester of 2,4-D. The most severe form proved to be the oil-based ethyl ester which, however, is not generally recommended for crop spraying. Yield reductions of as much as 30 per cent. were recorded in one trial from the use of this compound at 2lb. a.e./acre. The triethylamine and dimethylamine salts of 2,4-D gave results similar to the amine salt with no outstanding differences. Weed control from the amine salts at 2lb. a.e./acre was good and slightly better than MCP preparations at that rate, especially with the family *Polygonaceae*. However, as mentioned before, the resultant yield decreases from the "weedy" control plots were rather large.

Spring sown wheat crops with their more rapid growth can be said to be more susceptible to damage by hormone weedkillers than are the autumn sown crops. For this reason, spring sown crops should be treated with salts of MCP, but the amine salt of 2,4-D is quite suitable on autumn sown crops.

The polyethylene glycol ester of 2,4-D was used in three trials. Yield reductions at 1lb. a.e./acre were 7, 5, and 14 bushels per acre. Weed control was good, but the wheat suffered a growth check which was most apparent in the 2lb./acre plots. In two trials head distortion occurred with shorter straw, but the yields were still of the order of 9 to 14 bushels less than the controls. Control of weeds of the family *Polygonaceae* was good. The application of the polyethylene glycol ester of 2,4-D at rates of 1lb. a.e./acre may be recommended where the crop is infested with weeds. However, up to 2lb. a.e./acre should be applied only where the weed growth is likely to reduce yields in any case. This preparation as well as the ethyl ester of 2,4-D had the effect in two trials of delaying head formation and ripening by as much as 7 to 8 days. It has been observed that all hormone weedkiller applications tend to delay ripening, the sodium salt of MCP usually by 3 to 4 days.

Time of application: Earlier trials had treatments applied only at after tillering. Last season's trial included applications at the 4 to 5 true leaf stage, that is, when the seedling plants were showing on the average 4 to 5 true leaves, as well as at after tillering. Interesting results were obtained from this trial. After spraying at the first stage slight leaf burn was observed with a definite growth check. This was severe in the 2.0lb. a.e./acre plots of the ethyl ester and polyethylene glycol ester of 2,4-D. This effect soon disappeared and at heading the only difference was that the controls were earlier. However, after heading the straw was shorter in most of the plots, as much as 4in. in the 2lb. a.e./acre of ethyl ester and polyethylene glycol ester plots, and some head distortion appeared, clubbed heads being the most common. The sodium salt of MCP plots were similar to the control as well as the 1lb. a.e./acre amine salt of 2,4-D plots. Yields appeared to be definitely depressed.

At the after tillering stage, some leaf burn was observed mainly in the 2lb. a.e./acre plots and straw length was 1 to 3in. shorter than controls. At this stage the 2lb./acre ethyl ester of 2,4-D plots showed a definite growth check; most of the heads were thin and not filled, but not clubbed as appeared in the earlier applications. Yields at this stage appeared to be better than the 4 to 5 leaf application, but this was not so in the plot yields. By far the largest yield reductions occurred in the application after tillering. The heads had apparently not filled, whereas the clubbed heads noted earlier were misshapen, but contained mature grain. Treatments showing significant decreases from

the control in the second application were: the butyl ester of MCP at 2lb. per acre, amine salt of 2,4-D at 2lb. per acre, ethyl ester of 2,4-D at 1 and 2lb. per acre, and the polyethylene glycol ester of 2,4-D at 1 and 2lb. per acre. At the 4 to 5 leaf stage none of the decreases was significant in the analysis. This, however, is the result of only one trial and it will have to be verified in further trials.

Rate effects: Over all the trials, the 2lb./acre treatments were rather severe, except with the sodium salt of MCP. More leaf burn was observed and straw length was shortened by as much as 4in. Maturity was delayed 4 to 5 days with the sodium salt of MCP and the amine salt of 2,4-D and by as much as 7 to 8 days with the ethyl ester and polyethylene glycol ester of 2,4-D. In two trials the mean yields showed a difference of 3 bushels in favour of the 1lb. a.e./acre application. In all trials the controls yielded the highest, with the 1lb. per acre applications showing a decrease from 2 to 6 bushels.

OATS

Trials on oats were laid down in 1951 and 1953. The latter trial incorporated new formulations of MCP. These were the diethanolamine salt of MCP, which contained the 2,4 isomer only, and the potassium salt of MCP. Recent overseas work has shown that only the 2,4 isomer has herbicidal properties and that other isomers such as the 2,6 have very little value as herbicides. The preparation used in this trial had an acid equivalent content of 3.3 of the 2,4 isomer. The potassium salt is more soluble than the sodium salt of MCP and presumably less likely to crystallise out of solution or on the foliage of plants. These were compared with the sodium salt of MCP, the butyl ester of MCP, the amine salt of 2,4-D, and the polyethylene glycol ester of 2,4-D. The variety was Abundance and the crop was spring sown. Spring sown oats are perhaps the most susceptible of all the cereals and they were chosen for this purpose. Applications were made at the 4 to 5 leaf stage and at after tillering, with only one rate of application 2.0lb. a.e./acre.

After the first application leaf burn was evident in the plots treated with the butyl ester of MCP and the polyethylene glycol ester of 2,4-D. At head formation, the sodium, amine, and potassium salts of MCP were similar to the control. The remaining treatments were shorter, later in development, and with leaf distortion, the leaves becoming rolled and spiked in appearance. The butyl ester of MCP was the least severe of these. With the after tillering application, the controls headed first and the remaining treatments were similar, with the MCP group nearest to the control in growth. At harvest the yield difference between the means of the two rates was 7 bushels in favour of the later application. However, the differences between the control and the salts of MCP were not significant, though yield decreases were recorded from 1½ to 5 bushels. The yield differences for the 2,4-D group were significant (1 per cent. level), the decreases ranging from 16 bushels for the amine salt of 2,4-D to 21 bushels for the butyl ester of MCP and the polyethylene glycol ester of 2,4-D. The control plots yield was 76 bushels per acre.

This trial shows the outstanding selectivity of the MCP salts over the 2,4-D compounds when applied to spring sown oats at 2lb. acid equivalent per acre. Weed control was good in all treatments. Earlier trials have shown this superiority of the salts of MCP over the salts of 2,4-D, the difference being more marked the younger the stage of

growth. In one trial there was a 9 bushel decrease between the sodium salt of MCP and the amine salt of 2,4-D, both applied at the 4 to 5 leaf stage of growth.

CONCLUSIONS

(1) MCP salts appear to be more selective than 2,4-D salts at equivalent rates and times of application.

(2) Application after tillering is the normal procedure, but applications at the 4 to 5 leaf stage are warranted, as weeds are least resistant as seedlings.

(3) In one trial on wheat, application at the 4 to 5 leaf stage gave better yield results than at the later stage, although head distortion was greater.

(4) In spring sown cereal crops the times for safe application may be short and only preparations giving the greatest selectivity should be employed.

(5) Rates of up to 2lb. acid equivalent per acre of salts of MCP can be applied to spring sown cereals and 1lb. a.e./acre should be the maximum applied of the amine salt of 2,4-D.

(6) The polyethylene glycol ester of 2,4-D was applied in three trials with satisfactory control of weeds belonging to the family *Polygonaceae*, but yield reductions were heavier than with other preparations of 2,4-D.

(7) In one trial on spring sown oats the sodium, potassium, and amine salts of MCP all gave similar results.

DISCUSSION

Q.—Is not the interval between tillering and the stage of ear emergence rather wide? If applications were made too late, would not this cause sterile heads and serious yield reduction?

A.—Yes, late applications would cause damage, and this may have been a factor in the trial mentioned. With spring sown cereals the time between tillering and ear emergence is much shorter than with autumn sown cereals.

Q.—What hormone weedkiller gave the best control of weeds of members of the *Polygonaceae*?

A.—PEG 2,4-D at 2lb. per acre gave the best control. One pound was slightly less effective, but both rates caused yield reduction in the crop.

Q.—If 2lb. of MCP gave less crop damage than 1lb. of PEG 2,4-D, would not this be the better treatment?

A.—Unfortunately MCP was not effective against the weeds present, which were mainly members of the *Polygonaceae*.