PROSPECTS FOR CEREAL WEED CONTROL IN NEW ZEALAND

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Summary

Further field evaluations during 1965-6 have confirmed that no mixture of two herbicides adequately controls all problem weeds in New Zealand cereal crops. Present cultural practices favour the increase of hard-to-control weeds, and herbicides with improved activity over traditional compounds are required. The development of herbicides with greater crop selectivity offers promise of reduced crop damage. Mixtures containing 1½ to 2 oz dicamba and 9 to 12 oz MCPA per acre appear the most cost efficient in the short term but barley tolerance to these mixtures may be marginal. Mixtures of ioxynil or bromoxynil with MCPA and dicamba or picloram appear worthy of evaluation. Herbicides for wild oat control may be more widely used in the future.

INTRODUCTION

THE PECULIAR COMPLEXITY of weed populations in New Zealand cereal crops makes exacting demands upon herbicides (Foreman, 1965). Because of this, and because this usage has been commonplace for many years, techniques for the chemical control of weeds in cereals are probably more sophisticated than in most other branches of agriculture. Already, a variety of reasonably cost efficient herbicides are available to cater for a range of situations. It is unlikely, therefore, that dramatic changes will take place voluntarily either in materials or methods. Rather, an increasing density of weeds inadequately controlled by present herbicides will probably dictate the need for new compounds or mixtures of compounds.

The localization of cereal cropping, its probable intensification in those areas, together with the traditional use of narrow spectrum herbicides, predisposes an increasing population of hard-to-kill weeds. The introduction of dicamba/phenoxyacetic mixtures has to some extent alleviated the situation but weeds less well controlled by such mixtures, such as the mayweeds, *Anthemis cotula* and *Matricaria* spp., may well prove increasingly troublesome.

Grass weeds, other than wild oats (*Avena fatua*), are rarely a problem in New Zealand. However, there is some evidence that wild oats are becoming more prevalent and the use of specific herbicides for their control can be expected to increase.

In the past, it would appear that some herbicide damage to cereal crops has been acceptable to users, particularly if the weed problem was severe. This has probably been engendered by the deficiencies of available herbicides, coupled with the desire to obtain weed control right through to harvest. Timing of herbicide application has been governed more by the demands of the weeds than by the dictates of crop tolerance. At best, a sort of compromise has been struck between weed control and crop

safety. The development of chemicals which are more selective towards the crop will certainly encourage a new awareness of this crop damage factor and it is probably in this aspect that the most significant developments will occur in the immediate future.

EXPERIMENTAL

For reasons previously outlined (Foreman, 1965) mixtures of herbicides appear more likely to meet particular future requirements than do single compounds. Candidate mixtures were evaluated in replicated field trials in 1965-6 in the Wanganui area and in Canterbury. Octanoyl esters of ioxynil and bromoxynil were used because of their increased herbicidal activity compared with water-soluble salts. The butoxy ethanol ester of MCPA was used in admixture with ioxynil and bromoxynil and when MCPA was used alone. All other formulations used in the trials were water-soluble salts or amines.

Treatments were made with an Oxford Precision Sprayer applying 32 gal per acre, all dosages being expressed in oz active ingredient per acre.

Weed control ratings were made one month after treatment on a 0-10 visual scale (0 = no effect, 10 = maximum effect) and are the mean of two or more observers. Yields were obtained by a Poynter small plot harvester.

RESULTS AND DISCUSSION

WEED CONTROL

Mean weed control ratings for a number of hard-to-control weeds are shown in Table 1. No herbicide or mixture of herbicides gave satisfactory control of all weeds; dicamba/MCPA mixtures proved the most versatile but gave inadequate control of fumitory and only marginal control of chickweed and wireweed. The high rate of picloram/MCPA proved surprisingly ineffective against redshank and gave inadequate control of fumitory and chickweed. Wireweed control was marginal. Prometryne/MCPA was the most effective treatment against fumitory. Ioxynil and bromoxynil in mixture with MCPA performed similarly, except that bromoxynil/MCPA proved somewhat less effective on the legume tares. MCPA ester proved quite active against fumitory but in common with 2,4-D amine failed to give adequate control of other weeds with the sole exception of tares.

CROP TOLERANCE

Because of the presence of weeds at the time of treatment, the yield data presented in Tables 2 and 3 are not strict reflections of crop tolerance. However, published overseas data (Terry and Wilson, 1964) supported by observations in New Zealand indicate that, at the rates employed in these trials, ioxynil and bromoxynil are extremely selective towards all cereals. Previous indications of crop phytotoxicity from prometryne (Foreman, 1965) were not evident in the 1965-6 season and crop tolerance appeared satisfactory.

Although New Zealand evidence is not conclusive, picloram can probably be regarded as selective on oats and barley up to 1 oz but marginal on wheat above 0.8 oz.

Wheat shows fairly good tolerance to dicamba (Guenther *et al.*, 1965) when treated at the 4- to 5-leaf stage but stunting and pos-

TABLE 1: MEAN WEED CONTROL RATINGS (5 trials) AFTER 1 MONTH

Treatment (oz)	Redshank (Poly- gonum persicaria)	Corbind (P. convol- vulus)	Wireweed (P. avi- culare)	Fumitory (Fumaria spp.)	Matricaria (M. matra- caroides)	Chickweed (Stellaria media)	Tares (Vicia spp.)	Mean
2,4-D (amine) 16		6.8	2.8	0.6	3.0	1.1	8.8	3.9
MCPA (ester) 16		3.6	3.7	5.5	2.0	1.6	9.3	3.9
Dicamba 1.5/MCPA 9		7.0	5.1	0.6	6.7	3.7	9.8	5.8
Dicamba 2/MCPA 12		8.2	6.0	1.1	8.5	4.0	9.5	6.6
Ioxynil 4/MCPA 8		—	3.2	1.1	1.5	1.8	6.8	3.1
Ioxynil 6/MCPA 12		7.8	4.7	1.7	2.0	2.3	7.5	4.6
Bromoxynil 4/MCPA 8		—	3.9	1.2	1.5	0.8	3.5	2.4
Bromoxynil 6/MCPA 12		8.0	5.6	1.3	1.7	1.5	6.8	4.4
Picloram 0.6/MCPA 9		6.9	3.7	1.8	5.0	1.2	9.5	4.3
Picloram 0.8/MCPA 12		8.3	5.2	2.5	9.0	2.3	9.8	5.8
Prometryne 4/MCPA 8		7.9	1.8	5.6	0.7	4.0	9.3	4.7

TABLE 2: WEED CONTROL AND GRAIN YIELD IN WHEAT CROP

Wheat variety: Aotea

Sown: September 15, 1965

Treated: October 21, 1965

Stage of growth 4 to 5 leaf

Weeds: Fathen (*Chenopodium album*), chickweed, wireweed, nettle (*Urtica urens*), from ½ to 2 in. in height.

Treatment (oz)	Weed Control (after 4 weeks)	Yield (bu/acre)
Picloram 0.8/MCPA 12	7.0	84.2 a
2,4-D (amine) 16	3.5	83.2 a
Ioxynil 4/MCPA 8	4.6	80.2 a
Dicamba 2/MCPA 12	8.0	79.0 ab
Picloram 0.4/MCPA 6	4.1	73.8 abc
Prometryne 4/MCPA 8	5.2	72.6 abc
Dicamba 1.5/MCPA 9	7.1	71.7 abc
Ioxynil 6/MCPA 12	6.3	71.5 abc
Bromoxynil 4/MCPA 8	4.0	71.4 abc
Bromoxynil 6/MCPA 12	5.9	71.2 abc
Control	0	55.3 bc
MCPA (ester) 16	4.2	50.6 c
CV 19%		

TABLE 3: WEED CONTROL AND GRAIN YIELD IN BARLEY CROP

Barley variety: Carlsberg

Sown: October 7, 1965

Treated: November 23, 1965

Stage of growth: 3 to 5 leaf

Weeds: Cornbind, spurrey (*Spergula arvensis*), sorrel (*Rumex acetosella*), fathen, redshank, from ½ to 2 in. in height.

Treatment (oz)	Weed Control (after 4 weeks)	Yield (bu/acre)
Picloram 0.6/MCPA 9	6.9	34.9 a
Picloram 0.8/MCPA 12	8.5	28.3 ab
Dicamba 4/MCPA 24	9.6	25.7 bc
Dicamba 1.5/MCPA 9	7.2	25.0 bc
Bromoxynil 6/MCPA 12	8.1	24.6 bc
MCPA (ester) 16	3.8	23.4 bcd
2,4-D (amine) 16	7.0	22.9 bcd
Dicamba 2/MCPA 12	8.5	21.2 cd
Control	1.1	21.1 cd
Ioxynil 6/MCPA 12	7.9	18.7 cd
Prometryne 4/MCPA 8	8.0	16.4 d
CV 19.5%		

sible yield depression may result from treatment at the late fully tillered stage. Oats appear somewhat less tolerant than wheat (Regan and Ilnicki, 1966).

Evidence on barley tolerance is conflicting. Some indication of crop suppression immediately following treatment has been noted occasionally on actively growing barley in New Zealand but recovery has appeared to take place when good growing conditions obtain. Regan *et al.* (1966) found Wong barley to be tolerant. It is

probable that barley varieties vary in tolerance to dicamba and stage of growth may also influence susceptibility.

Although little difference in selectivity towards wheat appears to exist between MCPA and 2,4-D (Allen, 1952), oats and barley appear more susceptible to 2,4-D damage, especially from ester formulations. It would appear, therefore, that MCPA is more versatile as a selective companion compound in cereal herbicide mixtures in New Zealand despite its lesser herbicidal activity.

It is apparent that crop tolerance to certain new herbicides is greater at the 4- to 5-leaf stage than at the completion of tillering. Treatment at this stage is desirable to reduce weed competition as early as possible but is not always practical where perennial weeds such as Californian thistle (*Cirsium arvense*) emerge after the optimum treatment stage.

CONCLUSIONS

A further season's field evaluation has confirmed that no two-component mixture adequately controls all significant cereal weeds in New Zealand. Dicamba/MCPA mixtures have proved the most herbicidally active of those evaluated but crop safety is marginal under some conditions. Picloram/MCPA mixtures have given inadequate control of redshank and are marginally selective on wheat at herbicidal rates. Prometryne is the most active compound evaluated against fumitory. Ioxynil and bromoxynil are the most selective herbicides tested but are herbicidally weak against certain problem weeds, such as spurrey, even in admixture with MCPA ester.

From the evidence already available, it is clear that the dual targets of increased herbicidal activity and improved crop tolerance can be met in the near future only by greater sophistication in the mixtures employed. Obviously, the very selective compounds ioxynil and bromoxynil cannot be ignored, but their weed spectrum must be broadened if they are to be sufficiently versatile. The fortification of hydroxybenzoxitrile/MCPA mixtures with small amounts of herbicidally more active but marginally selective compounds such as dicamba and picloram appears well worthy of evaluation.

Dicamba/MCPA mixtures are clearly the most active and cost efficient cereal herbicides in the short term and represent a distinct advance over traditional compounds.

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