THE USE OF BROMOXYNIL/MCPA FOR WEED CONTROL IN CEREALS

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Summary

Eleven field trials carried out in the 1966-7 season have shown that a mixture of bromoxynil and MCPA esters at 4 + 4 oz and 5 + 5 oz a.i. per acre has given excellent control of most annual weeds occurring in cereals in New Zealand, especially wireweed (*Polygonum aviculare*), cornbind (*Polygonum convolvulus*), willow weed (*Polygonum persicaria*) and mayweeds (*Anthemis* sp. and *Matricaria* sp.). Results from two yield trials have shown that wheat and barley are very tolerant to this mixture, causing no significant reduction in yield compared with standard treatments, even when applied at 10 + 10 oz a.i. per acre. This confirms overseas results. Large-scale field assessments have confirmed the results obtained in the trials.

INTRODUCTION

TRIALS in New Zealand and Australia indicated that bromoxynil alone was effective against most weeds occurring in cereals including those not well controlled by 2,4-D and MCPA.

In Australia, the addition of MCPA ester to the octanoyl ester of bromoxynil widened the spectrum of weed control and appeared to increase the activity of bromoxynil (Isaacs and Miles, 1966). The success of the bromoxynil/MCPA esters mixture in Australia and Canada led to its being tested in New Zealand.

EXPERIMENTAL WORK

SCOPE OF PROGRAMME

Nine sites were selected to assess the degree of weed control obtainable. A further two sites were chosen where weeds were of minor importance and yields were measured.

PLOT SIZES

- (a) Weed control trials: 6 ft × 30 ft. Two replicates.
- (b) Crop tolerance trials: 6 ft × 198 ft. Four replicates.

FORMULATIONS USED

One experimental formulation was used — a mixture of 32 oz bromoxynil octanoate and 32 oz MCPA iso-octyl ester per gallon. (All rates in oz active ingredient per acre.) This was applied at 4 + 4 oz, 5 + 5 oz and 6 + 6 oz bromoxynil/MCPA at all weed control sites.

At the yield sites rates of 5 + 5 oz and 10 + 10 oz bromoxynil/MCPA were used. For the standard treatments commercial formulations of 2,4-D, MCPA and dicamba/MCPA were used.

In all cases the treatments were applied using a single wheel experimental sprayer, applying 17.5 gal/acre.

ASSESSMENTS

WEED CONTROL

At the time of spraying, weed counts were taken in 2 × ½ sq. yd fixed quadrats on each plot. The height and number of true leaves of

TABLE 1: PERCENTAGE REDUCTION OF WEED NUMBERS AND BULK
(Rates listed as oz a.i./acre)

Species	Site No.	Growth Stage at Spraying	Av. No./sq. yd at Spraying	Percentage Reduction									
				Sdl — seedling		YP — young plant		Bromoxynil/MCPA		Dicamba/ MCPA		2,4D Amine	
				No.	Bulk	No.	Bulk	No.	Bulk	No.	Bulk	No.	Bulk
Wireweed	401	YP 1½-2 in. Sdl 2-4 leaf	350	39	68	17	53	38	66	58	70	10	42
	403	Sdl 1 leaf	61	75	92	75	95	80	95	14	68	0	75
	404	YP 2-3 in. Sdl 2-4 leaf	440	35	58	57	64	61	73	28	32	24	23
	405	YP 2-3 in. Sdl 2-4 leaf	100	63	92	67	90	58	91	9	39	45	78
	406	Sdl 2-4 leaf	276	82	98	100	100	100	100	55	93	27	86
Willow weed	407	Sdl 1-3 leaf YP 3-4 in	477	89	97	92	98	95	98	89	96	19	77
	408	Sdl 2-4 leaf YP 2-3 in.	693	100	100	99	99	100	100	100	100	100	100
	410	Sdl 1-4 leaf YP 3-8 in.	533	51	34	59	67	65	69	67	75	36	26
Cornbind	402	1-2 leaf	6	—	—	96	80	—	—	58	0	—	—
	405	Sdl 1-3 leaf	11	90	97	100	100	100	100	100	100	None present	—
Mayweed	402	YP 2-3 in.	33	—	—	90	72	—	—	47	27	—	—
	405	YP 1-2 in.	7	60	95	67	91	38	82	0	32	25	41

each weed were recorded. Three to four weeks after spraying, counts were again taken of surviving weeds.

CROP TOLERANCE

Observations were made at all sites of the effect of all treatments on the crop 5 to 10 days after treatment. At two sites the plots were harvested with a header harvester and yields weighed.

RESULTS

WEED CONTROL

Table 1 shows the percentage reduction of weed numbers and the percentage reduction of bulk, compared with control, of the main weeds encountered in the trials.

All rates of bromoxynil/MCPA gave excellent control of willow weed (*Polygonum persicaria*), cornbind (*P. convolvulus*) and wild turnip (*Brassica campestris*). Control of parsley piert (*Alchemilla arvensis*), shepherds purse (*Capsella bursa-pastoris*), redroot (*Amaranthus hybridus*) and Californian thistle (*Cirsium arvense*) was good, but in some cases these weeds were severely checked rather than completely killed.

Control of wireweed (*Polygonum aviculare*) was good and at all sites there appeared to be little difference in control between the different rates applied. Here again, any surviving plants were severely checked and had not branched as on the controls. Although the figures do not correspond closely, there is some indication that the proportion of the surviving wireweed plants were at a "young plant" stage at the time of spraying. Most of the smaller seedlings up to the 4-leaf stage were probably killed.

Control of mayweed (*Anthemis cotula*) was better with bromoxynil/MCPA than with other materials, although some variation occurred due to seasonal conditions. At site No. 402 there was considerable variation in weed size at the time of spraying.

Variable results were recorded with dicamba/MCPA and some of this variation could be attributable to the slower action of the mixture compared with the bromoxynil/MCPA.

CROP TOLERANCE

The results of yield measurements are given in Table 2.

At all sites, dicamba/MCPA caused the characteristic splaying of the crop. At two sites bromoxynil/MCPA at 6 + 6 oz caused very slight lightening in colour and very slight splaying. At the time of the 4-week assessment, these effects had disappeared and at harvest time no effect on the rate of maturity or damage to the ears was visible.

DISCUSSION

SOUTH ISLAND

In the South Island (Site Nos. 401-405) all trials were laid down in autumn- or winter-sown wheat. They were sprayed at the end of a long, dry period. Heavy rain fell within two days after spraying on sites 401, 402, 403, 404 and 8 hours after spraying on site 405. Thus the action of all treatments was initially inhibited by the abnormal, near drought conditions, and the heavy rain soon after spraying on site No. 405 could have been the reason for the poor performance of dicamba/MCPA. However, the performance of bromoxynil/MCPA at 5 + 5 oz and 6 + 6 oz was very satisfactory considering the physiological condition of the weeds at the time of spraying.

TABLE 2: YIELD DATA

<i>Treatment</i>	<i>Rate (oz a.i./ acre)</i>	<i>1966: Gamenya Wheat (lb/plot)</i>	<i>1967: Carlsberg Barley (lb/plot)</i>
bromoxynil/MCPA	5 + 5	61.02 ABC QR	76
bromoxynil/MCPA	10 + 10	56.06 C R	75.25
dicamba/MCPA	2 + 12	60.40 ABC QR	69.50
dicamba/MCPA	4 + 24	59.48 ABC QR	70.25
MCPA iso-octyl ester	5	61.22 ABC QR _s	75.50
MCPA iso-octyl ester	10	65.30 A P	71.75
MCPA sodium salt	24	64.00 AB QR	69.50
Control	—	57.96 BC QR	71.00
CV		7.2%	6.5%
			Treatment differences not significant

As a general rule, spraying should be carried out when the weeds are growing actively and are not suffering from water stress.

Overall, in the South Island under the conditions experienced for these trials excellent control of wireweed, cornbind and mayweed was obtained using all three rates of the bromoxynil/MCPA mixture. This control was obtained more quickly and, in general, it was more complete than the standard rate of dicamba/MCPA.

NORTH ISLAND

In the North Island (site Nos. 406–411) the conditions were wetter than normal and crop vigour was very good. Willow weed was the principal weed found in the trials in the North Island. Except at site No. 410, bromoxynil/MCPA at 5 + 5 oz gave over 90% control of numbers and bulk of willow weed. At the 4-week assessment, this was appreciably better than the dicamba/MCPA treatment, but at a later inspection control appeared similar, with both materials.

EFFECTS ON OTHER COMMON WEEDS

Of the weeds commonly found in cereals in New Zealand, fathen (*Chenopodium album*), cornbind, black nightshade (*Solanum nigrum*) and redroot would be controlled by bromoxynil/MCPA. At the one site where Californian thistle occurred, control was better than expected. This was probably due to the suitable size of the plants at the time of spraying.

Wheat and barley appear very tolerant to the bromoxynil/MCPA mixture at the rates used in the trials. Any slight effects of this mixture on the crop had disappeared 2 weeks after spraying. Results from the two yield trials reported showed that even at twice the normal rate this mixture did not cause any significant yield depression.

SUMMARY OF FIELD APPLICATIONS IN 1967-8

During the course of limited scale marketing in 1967-8, results were obtained from 57 sites, of which 28 were in winter cereals and 29 in spring.

Crops of wheat, barley and oats were included in the survey.

Paddocks were inspected 3 to 4 weeks after spraying and the degree of weed control assessed on a 0 to 4 scale (Table 3).

DISCUSSION

CROP TOLERANCE

Although the bromoxynil/MCPA mixture is safe to use at a 4-true-leaf stage, it was found that in the majority of cases application had been made some time after this stage, when 2 to 3 tillers had formed. Thus little, if any, damage of any kind was expected. There was only one mention of slight tip scorch after spraying, but this had disappeared by the time of inspection. There were two reports of application to crops under-sown with white clover and no damage was reported to the seedling clover. Thus, under the conditions experienced this season, the tolerance of wheat, barley and oats to bromoxynil/MCPA at 4 + 4 oz and 5 + 5 oz per acre can be classified as excellent.

WEED CONTROL

Twenty-two different weed species occurred at the 57 sites inspected and good confirmation of trial results was obtained.

Most cereal growers have been in the habit of spraying at a relatively late stage — *i.e.*, when the crop is tillering. Thus it was found that some farmers had sprayed rather too late for best results with bromoxynil/MCPA. This was the case in many of the winter cereals in the South Island, where mayweed was often the important weed. In the North Island, rain and wind can often prevent farmers from spraying their spring cereals at the optimum time.

Because bromoxynil/MCPA is so well tolerated, early spraying is satisfactory. The growth of the crop is not checked, it closes over quickly after spraying and prevents the establishment of late germinating weeds.

Bromoxynil/MCPA was applied at volumes between 11 and 30 gal/acre, the majority being within the range of 15 to 20. There did not appear to be much difference in results attributable to volume of application, and it is considered that 15 gal/acre should be the recommended minimum volume. This mixture was applied at the rate of 5 + 5 oz per acre to most autumn and winter sown cereals. In spring-sown cereals, especially barley, where growth conditions are favourable for both weeds and crops, 4 + 4 oz rate was usually applied.

The mixture was primarily introduced for "harder-to-kill" weeds such as the polygonums and mayweed. The polygonums were well controlled, especially willow weed. In the North Island, where all cereals are sown in the spring, willow weed is the main problem weed at present. Seedlings and young plants up to 8 leaves were well controlled with bromoxynil/MCPA. Provided there was good spray coverage, older plants were severely checked also. Wireweed was susceptible to bromoxynil/MCPA, especially in spring-sown crops, and in most cases good control was obtained in winter crops also. Some variable results could be attributed to drought conditions in one area prior to spraying, and to delayed applications in other places.

Varied results were obtained on mayweed (*Anthemis* and *Matricaria* spp.). In spring crops, good results were obtained because application

TABLE 3: WEED CONTROL WITH BROMOXYNIL/MCPA — FIELD ASSESSMENTS 1967

Ratings:

4 — complete kill
 3 — good control
 2 — satisfactory control

1 — poor control
 0 — ineffective

Figures are the number of sites at which the stated response was obtained

Weed Species	Ranges of Growth Stages at Spraying	Total No. of Reports	Winter					Spring					Totals				
			4	3	2	1	0	4	3	2	1	0	4	3	2	1	0
Willow weed	1-6 in. 1-7 leaves	26	2	—	—	—	—	17	5	1	1	—	19	5	1	1	—
Mayweed	1-12 in.	20	—	6	5	5	—	3	1	—	—	—	3	7	5	—	—
Fathen	1/2-4 in. up to 6 leaves	17	2	1	—	—	—	13	1	—	—	—	15	2	—	—	—
Wireweed	1 1/2-2 in. 2-6 leaves	17	5	1	2	4	—	4	1	—	—	—	9	2	2	4	—
Californian thistle	1-8 in.	18	—	—	2	4	2	—	1	5	3	1	—	1	7	7	3
Wild turnip	1-15 in. up to flowering	12	5	1	—	1	—	4	—	—	1	—	9	1	—	2	—
Chickweed	2-10 in.	9	—	—	1	1	6	—	—	—	—	1	—	—	1	1	7
Spurrey	2-6 in. 4-8 leaves	11	—	—	1	1	—	—	2	1	6	—	—	2	2	7	—
Fumitory	1-6 in.	8	—	1	1	2	—	—	—	2	2	—	—	1	3	4	—
Shepherds purse	1-6 in. up to 8 leaves	6	—	1	2	1	2	—	—	—	—	—	—	1	2	1	2
Cornbind	2-4 in. 3-7 leaves	7	4	—	1	—	—	2	—	—	—	—	6	—	1	—	—
Nightshade	1-2 in. 2-6 leaves	6	—	—	—	—	—	6	—	—	—	—	6	—	—	—	—
Docks		7	—	—	—	1	1	1	—	1	1	2	1	—	1	2	3
Field pansy		5	—	—	—	2	1	—	—	—	—	2	—	—	—	2	3

was made when the weeds were small and susceptible. In many winter crops, however, control was not entirely satisfactory. The main cause proved to be late application—mayweed is much more susceptible to bromoxynil/MCPA in a seedling rosette stage under 3 in. in diameter. Older plants, some up to 8 in. high, suffered tip burn and a severe check which lasted through to harvest. In some other cases, however, they grew out of the check. Most farmers appreciated the fact that they had sprayed rather late, often when the crop was beginning to close in over the weeds and in winter cereals it appears that by this time weeds such as mayweed are past the susceptible stage. It is also difficult to achieve good spray coverage at this time.

In winter crops, Californian thistle was poorly controlled, mainly because of the large size at the time of spraying. In spring, however, a better result was obtained, the plants suffering a moderate check to the extent that they were no bother at harvest time.

Bromoxynil/MCPA gave some check to spurrey (*Spergula arvensis*), especially when sprayed at the first leaf whorl growth stage. Some tip burn occurred on older plants.

Fumitory (*Fumaria* spp.) was reported from 8 sites, and initially it appeared reasonably susceptible to the bromoxynil/MCPA mixture, but some time after spraying this weed grew out of the earlier twisting and continued growing up with the crop.

Cornbind up to 7 in. high was virtually completely controlled by the bromoxynil/MCPA mixture, in both autumn- and spring-sown crops.

Bromoxynil/MCPA was applied by air at four places in volumes of 8 to 10 gal/acre. Generally, the results were not as good as those obtained from ground applications, because the weeds were fairly advanced at the time of spraying.

CONCLUSIONS

- (1) From the results obtained in trials and during a limited marketing, wheat and barley appear extremely tolerant to bromoxynil/MCPA. No effects were observed on two crops of oats sprayed with this mixture.
- (2) The following weeds were found to be susceptible to bromoxynil/MCPA mixture: Mayweed, willow weed, fathen, wireweed, wild turnip, cornbind, black nightshade and redroot. Limited information indicates that shepherds purse and twincrest (*Coronopus didymus*) may also be susceptible.
- (3) The following weeds may be checked by bromoxynil/MCPA under favourable conditions: Californian thistle, spurrey, fumitory, docks (*Rumex* spp.).
- (4) The following weeds are resistant to bromoxynil/MCPA: Chickweed (*Stellaria media*), field pansy (*Viola arvensis*), sorrel (*Rumex acetosella*), cleavers (*Galina aparine*), yarrow (*Achillea millefolium*), tares (*Vicia* spp.) and speedwell (*Veronica* spp.).
- (5) Where mayweed is a problem in winter cereals early spraying is essential.

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REFERENCE

Isaacs, D. C.; Miles, K. B., 1966: *Proc. 19th N.Z. Weed & Pest Conf.*: 28.