WEED CONTROL TRIALS IN LINSEED

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Summary

Mixtures of MCPA with atrazine, bromoxynil, dicamba and linuron are compared with MCPA and with untreated control. Rates of application giving acceptable control of MCPA-resistant weeds are close to the maximum if a crop tolerance factor of 2 is required. Bromoxynil plus MCPA is promising and warrants more detailed testing.

INTRODUCTION

FOLLOWING the work of Leonard (1965), control of the MCPA-tolerant weeds, cornbind (*Polygonum convolvulus*), willow weed (*P. persicaria*), wireweed (*P. aviculare*), spurrey (*Spergula arvensis*) and fumitory (*Fumaria* spp.) has been improved by the use of dicamba plus MCPA mixtures and to a lesser extent by the use of 2,4-DB in undersown crops.

However, as pointed out by Purdon (1966), doubts exist as to the tolerance of the crop and degree of weed control with these chemicals.

This paper describes trials to locate treatments giving wide-spectrum weed control with acceptable crop tolerance.

EXPERIMENTAL

All quantities are given in lb of active material per acre. Redwood, the principal variety grown in New Zealand, was used throughout the trials.

The trials were sprayed with a bicycle-wheel-mounted boom sprayer with 14 in. spaced, independently-fed nozzles operated by compressed air at 30 lb/sq. in. pressure and at a speed of travel timed to give 20 gal of spray mixture per acre. Treatments were replicated four times in a randomized block layout using plots 6 ft wide by 1.5 chains long. Yields were obtained by direct heading. Because of second growth in 1968 and uneven ripening at Willowby in 1969, these trials were desiccated with diquat prior to harvesting.

1966-7 TRIAL

This trial was laid down to compare the materials reported promising by Leonard and by Purdon. Atrazine was included because of a Geigy report (Anon, 1964) of satisfactory use in Argentina. The chemicals were applied at two times to examine the possible effect of stage of crop growth on damage from 2,4-DB and the MCPA plus dicamba mixture and of age of weeds on the efficiency of the triazines and linuron. Owing to rain, the second treatment was applied later than intended. Results are set out in Table 1.

TABLE 1: TRIAL 1 — COMPARISON OF CHEMICALS AT TWO GROWTH STAGES, LINCOLN, 1966-7

Treatment (lb)	Yield as % of Untreated	
	Treated Nov. 10	Treated Nov. 28
2,4-DB 1.5	120 cdAB	101 eC
MCPA 0.75	135 aA	132 abA
linuron 0.5	130 abcAB	119 cdAB
atrazine 0.75	127 abcdAB	122 bcdAB
G34698 1.25	115 dBC	119 cdAB
MCPA 0.57/ Dicamba 0.093	130 abcAB	126 abcdAB
Untreated	100 eC = 14.2 cwt/acre	
CV	6.3%	

Linseed 8-12 leaves, height up to 3 in. on 10/11/66; 55-60 leaves, height up to 13 in. on 28/11/66.

1967-68 TRIALS

The promising results with atrazine and linuron were followed up with a series of trials to determine suitable dosage rates and the tolerance of linseed to mixtures of atrazine, dicamba or linuron with MCPA. MCPA has been used throughout in mixtures at 0.5 lb as this is considered to be the minimum dosage to control Californian thistle (*Cirsium arvense*) for the full season. A proprietary bromoxynil plus MCPA mixture was compared with MCPA alone and also with the likely commercial proportions of the above mixtures. Because of second growth, reliable yields were obtained for only two of the trials, Tables 2 and 3.

TABLE 2: TRIAL 2 — COMPARISON AT TWO TIMES OF APPLICATION OF MIXTURES OF MCPA WITH ATRAZINE, DICAMBA AND LINURON, LINCOLN, 1967-8

Addi- tive*	Rate 1* (lb)	Yield as % of Untreated		Rate 2* (lb)	Treated	
		Nov. 2	Nov. 22		Nov. 2	Nov. 22
atrazine	0.5	120 abcAB	133 aA	0.75	124 abAB	118 abcAB
dicamba	0.093	108 bcAB	121 abAB	0.125	117 abcAB	117 abcAB
linuron	0.33	123 abAB	121 abAB	0.5	115 abcAB	132 aA
MCPA†	0.5	123 abAB	128 abA	1.0	117 abcAB	116 abcAB
Untreated		100 cB = 15.4 cwt/acre				
CV		10.1%				

*Chemical and quantity added to 0.5 lb MCPA.

†Rate in table = actual rate applied.

Linseed 6-8 leaves, height up to 2½ in. on 2/11/67; 20-24 leaves, height up to 5 in. on 22/11/67.

TABLE 3: TRIAL 3 — COMPARISON OF BROMOXYNIL + MCPA WITH MCPA

Treatment (lb)					Yield as % of
bromoxynil 0.25/MCPA 0.25	....	....	....	....	115 aA
bromoxynil 0.375/MCPA 0.375	....	....	....	....	119 aA
MCPA 1.0	....	....	....	....	116 aA
Untreated	....	....	....	....	100 bB = 17.1 cwt/acre
CV	....	....	....	....	6.0%

Treated 27/11/68 when 24-26 leaves, height up to 7 in.

1968-9 TRIALS

The crop tolerance trials were repeated, the Sefton trial (Tables 4 and 5) under favourable conditions in a weed-free crop, the Willowby Trial (Table 6) less satisfactorily owing to a light weed infestation and moderate lodging. Yields in both trials were corrected to 10% moisture.

EFFECT ON CROP PLANT

All treatments produced some visual effect on the crop, tending to reduce height and delay maturity compared with untreated to a degree depending on chemical, dosage rate and time of application. This is illustrated by the data in Table 4.

Atrazine and linuron produced chlorosis of leaf margins, absent or barely detectable at 0.375 lb but, at 0.75 lb plus 1.0 lb MCPA, leading to severe scorch or death of sprayed leaves and sometimes, in the case of the linuron mixture, to death of the primary stem (in 56% of plants at Sefton).

New foliage following treatment with dicamba tended to be paler green and narrower and borne at a wider angle to the stem than normal, forming, at high rates with MCPA, a characteristic rosette. In some cases, development of the primary stem was completely arrested and subsequent normal growth was from cotyledonary buds. At later stages of growth, dicamba plots could be identified by the presence of fasciated leaves and bolls and uneven growth habit.

TABLE 4: TRIAL 4 — LINSEED TOLERANCE TRIAL, FERNSIDE, 1968-9

(Yield comparison of single and double rate treatments)

Treatments		Yield as % of Untreated			
	<i>x</i>	<i>2x</i>	<i>x + x MCPA</i>	<i>2x + 2x MCPA</i>	
atrazine <i>x</i> = 0.375	96 abcd	91 bcd	92 abcd		91 bcd
dicamba <i>x</i> = 0.093	95 abcd	98 abc	94 abcd		91 bcd
linuron <i>x</i> = 0.375	89 cd	94 abcd	90 bcd		89 cd
MCPA <i>x</i> = 0.5	98 ab	94 abcd			
Untreated	100 a = 22.7 cwt/acre				
MCPA 1.5 (3 <i>x</i>)	89 cd				
CV	5.5%				

Treatment applied 28/11/68, linseed 25-27 leaves, height up to 5½ in.

TABLE 5: TRIAL 4 — LINSEED TOLERANCE TRIAL, FERNSIDE, 1968-9

(Delay to maturity relative to untreated)

Treatments		Estimated Delay in Days at 5/2/69			
		x	2x	x + x MCPA	2x + 2x MCPA
atrazine	x = 0.375	2.1 bB	8.1 fD	6.6 cC	10.12 ghEF
dicamba	x = 0.093	4.5 dB	7.5 efCD	6.6 cC	12.6 iG
linuron	x = 0.375	3.3 cB	7.2 efCD	7.2 efCD	14.1 jH
MCPA	x = 0.5	3.6 cdB	9.6 gE		
Untreated		0 aA			
MCPA 1.5 (3x)		11.1 hF			

TABLE 6: TRIAL 5 — COMPARISON AT TWO APPLICATION TIMES OF CANDIDATE TREATMENTS AT SINGLE AND DOUBLE RATES, WILLOWBY, 1968-9

Treatments		Dose rate: Applied:	Yield as % of Untreated			
			x Dec. 5	x Dec. 16	2x Dec. 5	2x Dec. 16
atrazine	x = 0.375 + MCPA	0.5	99 bc	96 bc	90 c	98 bc
dicamba	x = 0.093 + MCPA	0.5	94 bc	95 bc	93 bc	105 ab
linuron	x = 0.375 + MCPA	0.5	93 bc	103 abc	92 bc	114 a
MCPA	x = 0.5		98 bc	105 ab	98 bc	99 bc
Untreated			100 bc = 19.8 cwt/acre			
CV			8.4%			

Linseed 10-14 leaves, height up to 4½ in. on 5/12/68; 35-40 leaves, height up to 9½ in. on 16/12/68.

MCPA and 2,4-DB caused stem curvature in proportion to dose rate and age of crop at spraying.

WEED CONTROL

The mixture of MCPA plus atrazine controlled spurrey, cornbind, willow weed, wireweed and fumitory in addition to the MCPA-susceptible weeds. Kill was complete at 0.75 lb MCPA + 0.75 lb atrazine.

At 0.375 lb MCPA + 0.375 lb atrazine, control was excellent, any recovery being attributable to the larger size of the weed (over 2-leaf) or to sheltering by the crop plant at the time of treatment. Wireweed control at this latter rate was superior to that obtained with either 1.0 lb MCPA or 1.0 lb atrazine used alone.

The MCPA plus linuron mixture was not effective against fumitory and less effective than MCPA plus atrazine against wireweed.

MCPA plus dicamba gave less positive control of weeds than other treatments and was less effective than the atrazine or linuron mixture against spurrey or the atrazine mixture against wireweed and fumitory.

MCPA plus bromoxynil was similar in efficiency of weed control to the dicamba mixture but more positive in action.

DISCUSSION

The trials indicate the value in terms of yield of controlling more than a certain (unspecified) quantity of weeds in the crop. In Trials 1 and 2 with moderate infestations of fathen (*Chenopodium album*), all treatments except one yielded significantly more than untreated. In Trial 2 with a light infestation of fathen, 7 out of 16 treatments outyielded control, while in Trial 5 at Willowby with a light infestation of cornbind and willow weed, only one treatment outyielded control. In Trial 4 which was weed-free, 8 of 15 treatments yielded significantly less than untreated.

There were no significant differences within trials between treatments containing atrazine, dicamba or linuron at equivalent rates or times of application except for the 2x rate of linuron plus MCPA applied at the 35- to 40-leaf stage in Trial 5. This equivalence of treatments is at variance with observed effects shortly after application and with height and maturity differences at harvest. Yields from the 2x mixture treatments in the weed-free trial (Table 4) were significantly less than untreated. This is also the case with the x rate of linuron, the 2x rate of linuron plus MCPA, and the 2x rate of atrazine. The inference is that the rates 0.375 lb atrazine plus 0.5 lb MCPA and 0.093 lb dicamba plus 0.5 lb MCPA are at or in excess of the maximum rate allowing a tolerance factor of 2 while the 0.375 lb linuron plus 0.5 lb MCPA is definitely in excess of this rate. The reduction in yield of the 3x rate of MCPA supports the recommendation not to use more than 0.75 lb of MCPA in linseed (Allen, 1949).

The performance of G34698 and of 2,4-DB was as expected from previous reports (Leonard, 1965; Purdon, 1966). G34698 gave unsatisfactory control of fathen while the last application of 2,4-DB twisted the linseed stems so severely that crop competition was reduced and storksbill (*Erodium cicutarium*), present in small numbers throughout the trial site, flourished.

In the time of treatment comparisons, the first application was the better in Trial 1, the second in Trial 5 and the difference not significant in Trial 2. This statistical evaluation, though plausible in view of the length of time between treatments in Trial 1 and the slightly inferior weed control of the first application in Trials 2 and 5, has been influenced by large differences between a few individual treatments. These differences can be ascribed to failure of weed control and to interactions between induced differences in crop development and the seasonal sequence of factors affecting plant growth. Comparison of the yields of the MCPA only treatments indicates that, within the developmental periods covered by the trials, herbicidal effectiveness was more important than time of application. The observed fall in effectiveness of atrazine and linuron treatments once the weeds are beyond the 2-leaf stage is relevant in this respect.

Despite known cases of yield reduction from field-scale use of MCPA plus dicamba, the herbicidally effective dose rate of 0.5 lb MCPA plus 0.093 lb dicamba has produced no adverse effect on yield in these trials. This appears to be due to the recuperative powers of the crop resulting from a large reserve of adventitious buds and propensity for indeterminate growth under favourable conditions. The linuron results support this contention.

CONCLUSIONS

Rates of application of the treatments tested which allow a tolerance factor of 2 appear to be:

- (a) 0.75 lb MCPA.
- (b) 0.375 lb atrazine plus 0.5 lb MCPA.
- (c) 0.093 lb dicamba plus 0.5 lb MCPA.

The 2x rate of linuron plus MCPA is less than the rates tested. The 0.25 lb bromoxynil plus 0.25 lb MCPA is most promising but crop tolerance figures were not obtained.

Where spurrey, cornbind or willow weed are the important weeds, the above rates of the mixtures of atrazine, dicamba or bromoxynil with MCPA will give adequate control.

If, in addition, wireweed or fumitory is an important element, then the atrazine mixture is to be preferred. Choice of treatment and rate will depend ultimately on cost efficiency considerations. It may be influenced by the marked response likely from the control of moderate weed infestations and by the ability of the crop to recuperate from growth checks.

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