AN EVALUATION OF DICLOFOP-METHYL PLUS SURFACTANTS FOR WILD OAT CONTROL IN WHEAT

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SUMMARY

Diclofop-methyl provided effective control of wild oats (*Avena* spp) at the 1 - 5 leaf stage in wheat (*Triticum* spp), when the weed was making slow growth under cool, moist climatic conditions. The addition of a non-ionic surfactant to the tank mix improved efficacy against 4 and 5 leaf tillered plants under optimum growth conditions, but was of no benefit when growth was stagnating under drought stress. Wild oat growth stage rate of diclofop-methyl and growth conditions had a greater influence on efficacy than the addition of surfactant.

INTRODUCTION

An EC formulation of diclofop-methyl containing 375 g/litre was granted a New Zealand field use registration in 1978 for the control of certain annual grass weeds in a number of agricultural and horticultural crops. The recommendation for control of wild oats in wheat at the 1 - 4 leaf weed stage coincided with the important period for weed removal, before it competes with the crop at about the 4½ leaf stage (Chancellor and Peters 1974). Where a staggered wild oat germination occurs in autumn sown wheat it can be desirable to control a minority of the population at the 5 leaf stage. McLaughlan (1979) working on peas and linseed concluded that a non-ionic surfactant added to diclofop-methyl 375EC and an experimental formulation containing 284 g/litre resulted in increased activity. Subsequent evaluation however, (McLaughlan unpublished) proved the 28EC formulation to be phytotoxic to commercial wheat cultivars. This paper reports on four trials conducted in wheat between 1979 and 1981, in which diclofop-methyl was evaluated with and without non-ionic surfactants. The objectives were to assess efficacy against wild oats ranging from 1 - 5 leaf growth stages and improve product performance under conditions of slow weed growth.

EXPERIMENTAL METHOD

Sites were chosen for an even distribution of wild oat and wheat plant populations. All trials were of randomized block design, replicated four times, with plots 8 x 2 m. Treatments were applied in 265-295 litres/ha using a precision sprayer and hand held boom with Teejet 730154 nozzles pointing down at an angle of 20° from vertical.

An assessment of wild oat plant numbers and growth stages (Table 1) was undertaken immediately prior to the applications. These assessments were made on three 0.1 m² quadrats per replicate. Wheat growth stages ranged from 3 leaf to fully tillered plants.

Treatments compared several rates of diclofop-methyl 375EC with and without the addition of two proprietary non-ionic surfactants concentrations shown in Table 2. Standard commercial treatments were also applied. Herbicides for broad-leaf weed control were applied 7 - 10 days after the wild oat treatments, with the exception of difenzoquat in trial B2 which was tank mixed with a compatible "triple mix" herbicide.

Regular visual assessments of wild oat control and crop vigour were recorded throughout the trials. Final quantitative assessment of wild oat control on treated plots was made on an area 8 x 1 m, while the assessment on untreated plots was reduced to three 0.33 m² quadrats per plot because of the high wild oat populations. Panicles and spikelets were counted on all wild oat plants pulled from the assessment area. Plots were

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headed with a "Poynter Stripper" and threshed on a stationary "Kurt Pelz". The area harvested measured 8 x 1.2 m/plot and all yield data was calculated at 14% grain moisture content. Statistical analysis was calculated using Duncan's new multiple range test with appropriate transformations where required.

TABLE 1: Trial details and pre-spray wild oat growth stages.

	Trial A1	Trial A2	Trial B1	Trial B2	Trial C	Trial D
Location:	Wigram		Lowcliffe		Willowby	Eiffleton
Crop variety:	Kopara		Karamu		Hilgendorf	Hilgendorf
Date sown:	20.6.79		11.10.79		10.9.80	30.5.81
Date sprayed:	12.9.79	23.9.79	2.11.79	14.11.79	24.10.80	1.9.81
No. wild oats/m ²	280	274	59	59	86	462
	% Wild oat population at growth stages recorded					
1 leaf	5	—	2	—	10	3
2 leaf	3	2	16	—	13	5
3 leaf	19	9	45	—	29	20
3 leaf (tillering)	—	—	19	—	10	—
4 leaf	36	24	—	20	10	37
4 leaf (tillering)	16	2	16	50	25	14
5 leaf (tillering)	21	35	2	30	3	20
6 leaf (tillering)	—	28	—	—	—	1

RESULTS AND DISCUSSION

Observations in the 2 - 3 week post spray period confirmed work reported by McLaughlan (1979) that the speed of wild oat "knock down" by diclofop-methyl was fastest on plants at the 1 - 4 leaf stage, while the growth of older plants stagnated for some time before death became apparent. The initial effect of diclofop-methyl on the crop and susceptibility of tillered wild oat plants was influenced to a large extent by the climatic conditions prevailing at the time of application. Diclofop-methyl provided very high levels of wild oat control on trials A and D, where a high proportion of plants at the 5 and 6 leaf stages (Table 1) were making slow growth under cold, wet conditions. In both these trials the low crop vigour provided little competitive control. In trial B wild oats were making rapid growth under optimum conditions at the two times of application, as indicated by the short interval between the spray dates (Table 1). In this trial the standard rate of diclofop-methyl 937 g/ha provided the highest levels of wild oat control on trial B1, where 98% of plants were at the 1 - 4 leaf stage and 2% at the 5 leaf stage. The addition of surfactant B however, significantly improved the efficacy of diclofop-methyl in trial B2 where 30% of wild oat plants had reached the 5 leaf stage at time of application.

Wild oat susceptibility to diclofop-methyl, particularly that of the 4 and 5 leaf tillered plants, was lowest in trial C under 'hardened' growth conditions and drought stress. The visual assessments of wild oat control in Table 2 shows improved efficacy with the increased rates of diclofop-methyl and addition of surfactant, but the number of wild oat seeds returned to the soil were considerably higher than the pre-spray plant numbers. This result was in contrast to the performance of diclofop-methyl on trials A, B and D where the number of seeds set/m² were lower than the pre-spray plant numbers and were a step towards the depletion of soil seed reserves. The poor control achieved on trial C by comparison with the standard difenzoquat treatment was attributed to the low level of soil moisture (Dortenzio and Norris 1980). There was insufficient data from the trial series to substantiate a reduction in rate through addition of surfactant as reported in wheat (O'Sullivan *et al* 1977) and peas (McLaughlan 1979). The results of these trials indicate an interaction between weed growth stage, rate of diclofop-methyl and growth conditions that had a greater influence on efficacy than the addition of

TABLE 2: Chemical treatments, final wild oat control and crop yields.

Trial	Treatment	Rate g/ha	Visual % Control	Wild oat control Plants /m ²	Seed set /m ²	Yield as a % of untreated
A1	untreated	—	0	157	15790	
	diclofop-methyl 937		99	1	1	Not
	diclofop-methyl 562 + SA 0.3%		100	0	0	harvested
	diclofop-methyl 937 + SA 0.3%		99	0	3	
A2	diclofop-methyl 937		100	0	0	Not
	diclofop-methyl 750 + SA 0.3%		100	0	0	harvested
	diclofop-methyl 937 + SA 0.3%		100	0	0	
	flamprop-methyl 735		93	1.7	164	
B1	untreated	—	0	69.5 a	2982 a	100 b
	diclofop-methyl 937		97	0.3 cd	13.2 c	130 a
B2	diclofop-methyl 937		77	4.3 b	90 b	118 ab
	diclofop-methyl 937 + SB 0.5%		92	0.9 c	21 c	112 ab
	difenzoquat 1000 + SC 0.5%		100	0 d	0 d	127 a
	CV%			12.9	30.2	8.2
C	untreated	—	0	70 a	3808 a	100 b
	diclofop-methyl 562		55	24.7 b	1380 ab	123 a
	diclofop-methyl 750		78	18.5 b	914 bc	120 a
	diclofop-methyl 937		80	18.7 b	854 bc	124 a
	diclofop-methyl 562 + SB 0.3%		70	24.4 b	1170 bc	116 a
	diclofop-methyl 750 + SB 0.3%		82	18.4 b	932 bc	119 a
	diclofop-methyl 937 + SB 0.3%		85	14.0 bc	566 c	119 a
	difenzoquat 1000 + SC 0.5%		95	5.1 c	42 d	125 a
	CV%			13.9	83.0	8.5
D	untreated	—	0	352 a	8586 a	100 c
	diclofop-methyl 562		95	6.3 c	145 c	146 ab
	diclofop-methyl 750		98	1.7 d	34 d	155 a
	diclofop-methyl 937		98	1.5 d	40 d	144 ab
	diclofop-methyl 562 + SB 0.3%		98	2.3 d	49 d	146 ab
	diclofop-methyl 750 + SB 0.3%		99	0.9 d	22 d	155 a
	diclofop-methyl 937 + SB 0.3%		98	1.4 d	28 d	141 ab
	difenzoquat 1000 + SC 0.5%		94	58.7 b	1310 b	130 b
	CV%			12.4	43.6	7.2

SA = Hoe S2705 experimental surfactant

SB = octyl phenoxy polyethoxy ethanol (Triton X 114)

SC = nonylphenyl ethoxylate (Agral LN)

surfactant, thus confirming the conclusions of Schreiber *et al* (1979). Taubel *et al* (1977) demonstrated the value of surfactant in tank mix with diclofop-methyl as a means of improving spray coverage and retention on the target weed where nozzles with a large V.M.D were used.

The addition of surfactant A in trial A caused a prolonged check to crop vigour that did not justify further evaluation. Diclofop-methyl alone in trial A and in all treatments in trial D caused a trace of chlorotic spotting and tip burn on the crop which reached a maximum 14 days after spraying. This effect was contact only and appeared to be related to the cool climatic conditions as it was not recorded on trials B and C. All herbicide treatments harvested provided large yield increases over untreated, while trial B1 showed a trend towards a higher yield response from the earlier application of diclofop-methyl.

CONCLUSION

The results reported show that diclofop-methyl applied at 937 g/ha will provide effective control of wild oats ranging from the 1 - 5 leaf stage where there is adequate soil moisture for plant growth. Optimum results should be achieved when the majority of plants are at the 2 - 4 leaf stage and the oldest plants have no more than 5 leaves. A non-ionic surfactant added to the spray tank was of no significant benefit under the conditions of these trials.

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