CLETHODIM — A POST EMERGENCE HERBICIDE FOR SELECTIVE ANNUAL AND PERENNIAL GRASS WEED CONTROL IN BROADLEAF CROPS

G.W. KERSE, D.L. BALLARD* and A.M. CLIFFE

Nufarm Ltd, P.O. Box 11148, Chrichurch
P.O. Box 3088, Richmond,
P.O. Box 22407, Otahuhu, Auckland.

SUMMARY

Clethodim gave selective control of annual and perennial grass weeds in a range of broadleaf crops in field trials conducted in New Zealand over three seasons (1986-88). Activity of clethodim was improved with the addition of 2 litres/ha emulsifiable crop oil. At 60-120 g/ha clethodim provided excellent control of annual and seedling perennial grasses. Good control of regrowth couch (*Elytrigia repens*) was obtained with 240-480 g/ha clethodim in annual crops, but undisturbed couch was only suppressed for approximately 2 months by rates of 480-720 g/ha.

INTRODUCTION

Clethodim, a very active post emergence grass herbicide from Chevron Chemical Company (California, USA) which is selective to broadleaf crops is being developed in New Zealand by Nufarm Ltd under the trade name Select (containing 240 g ai/litre). It has been reported overseas to have activity against a wide range of annual and perennial grass weeds in a variety of broadleaf crops (Anon 1986; Baldwin 1987; Kinkade *et al* 1987). Its activity in New Zealand against some annual and perennial grasses has been reported by Rahman *et al* (1988) who also reported its limited residual activity and movement in two soil types at rates of up to 960 g/ha.

This paper summarises data from trials conducted in New Zealand over the last three seasons. The trials were designed to evaluate control of annual and perennial grass weeds in various broadleaf crops or in the absence of a competitive crop. Some of the trials also investigated the effect of non-ionic wetting agent and emulsifiable crop spraying oil on the activity of clethodim.

METHODS

Treatments were applied, in all trials, with precision backpack sprayers and hand held booms fitted with 730-154, 80-02 or 110-02 nozzles, operating at 230-300 kPa and delivering 200-300 litres/ha. All trials were of a randomised complete block design with plots measuring 1-2 m x 5-10 m and replicated 2-4 times. Unless otherwise stated, clethodim was applied with 2.0 litres/ha emulsifiable crop oil (SunSpray or Volck Supreme), and other herbicides used were applied with surfactants as per label recommendations. Some details of the trials are listed in Table 1, and chemicals and rates at which they were applied are given in Tables 2-4.

RESULTS AND DISCUSSION

Wild oat control

Clethodim at 60-120 g/ha (Table 2) gave a high level of wild oat (*Avena fatua*) control with wild oat counts similar to those recorded for 250 g/ha fluazifop-butyl. In Trial B, the wild oat seed count suggests that up to 120 g/ha clethodim may be required for optimum wild oat control where populations are very high.

No damage to oilseed rape was observed from any treatment, and rape seed yield data confirm the selectivity of clethodim. A temporary effect on the colour and sheen of

*Present Address: River Terrace, R.D. 1, Brightwater, Nelson

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TABLE 1: Trial details.

Trial no.	Crop, & grass weed	Location	Treatment date	Weed growth stage	Assessment date
A	peas, wild oat	Canterbury	9.12.86	3-6 leaf	12.02.87
B	oilseed rape wild oat	Canterbury	28.10.86	4-5 leaf	28.01.87
C	white clover, ryegrass	Canterbury	28.10.86	vegetative	02.02.87
D	white clover ryegrass	Canterbury	31.10.87	vegetative	06.01.88
E	soft brome onions	Auckland	27.09.87	seedling	12.01.89
F	annual poa seedbox, (no crop)	Nelson	03.11.86 17.11.86	2-5 leaf 2-5 leaf	01.12.86 15.12.86
G	various field (no crop)	Nelson	03.11.86	2-5 leaf	17.11.86
H	various lentils	Canterbury	08.11.87	3-5 leaf	11.01.88
I	regrowth couch peas	Nelson	29.01.87	2-4 leaf	09.11.88
J	regrowth couch raspberries	Nelson	25.09.87	vegetative	13.11.87 & 18.12.87
K	undisturbed couch peas	Canterbury	16.11.88	3-4 leaf	04.01.89
L	regrowth couch peas wild oat	Canterbury	31.10.87	3-5 leaf	22.12.87

TABLE 2: Wild oat seed set/m², and pea and rape yield after application of clethodim, at various rates, and fluazifop-butyl

Trial no.		A		B	
Treatment	Rate (g ai/ha)	seed set/m ²	Yield T/ha	seed set/m ²	Yield T/ha
untreated		8726	1.65	13532	0.49
clethodim	30	161	2.12	2292	1.60
clethodim	60	0	2.01	120	1.69
clethodim	120	12	2.39	22	1.87
clethodim	240	11	2.58	6	2.06
fluazifop-butyl	250	8	2.39	12	1.74
cv%		152	19	#	14
LSD (P<0.05)		98	0.63	#	0.36

= no statistical analysis was done on wild oat seed counts in this trial.

the younger pea leaves was noted at rates of 60 g/ha clethodim and above, but pea yield was not affected by rates up to 240 g/ha.

Ryegrass and soft brome control

Data presented in Table 3 summarise results from two trials over two seasons evaluating clethodim for control of ryegrass (*Lolium multiflorum* and *L. multiflorum x perenne*) in white clover seed crops.

In Trial C, clethodim at 60 g/ha and above gave good ryegrass control and similar ryegrass herbage yields to 500 g/ha fluazifop-butyl. In Trial D all rates of clethodim

TABLE 3: Clover and grass herbage yields and white clover seed yields after application of clethodim and fluazifop-butyl.

Trial no.		C			D			
		D.M. yield		Seed yield (kg/ha)	Fresh weight ¹			Seed yield (kg/ha)
		(kg/ha)			(g/plot)			
Treatment	Rate (g ai/ha)	rye.	clover		rye.	brome	clover	
untreated		3319	1082	116	222	113	440	155
clethodim	30	1804	1754	242	—	—	—	—
clethodim	60	711	2006	286	0	82	842	321
clethodim	90	—	—	—	0	51	857	377
clethodim	120	80	1919	362	0	7	983	442
clethodim	240	10	2121	334	—	—	—	—
fluazifop-butyl	500	445	2325	314	2	2	991	404
cv%		143	25.2	14	167	70.2	12.9	14.3
LSD (P<0.05)		797	697	65	44	54	105	46

¹ from 5 x 0.1 m² quadrats/plot.

rye = ryegrass, (Trial C = cv Italian/Concord, Trial D = cv Ace)

brome = soft brome

used (60-120 g/ha) provided excellent ryegrass control, but 120 g/ha clethodim was required for effective control of soft brome (*Bromus hordaceus*).

There was a good response in clover herbage and seed yield to removal of grass competition in both trials. No visual damage was seen on the clover from any clethodim treatment and herbage yields confirm the selectivity of this herbicide to white clover.

Control of grass seedlings in onions, in seedboxes and in a field trial

In these trials, clethodim was used at rates of 30-240 g/ha and compared with 500 g/ha fluazifop-butyl. The only grass weed in Trial E was annual poa (*Poa annua*) which was treated at the seedling stage. Clethodim at 120-240 g/ha gave good control (85 and 96% respectively) of annual poa, while 60 and 90 g/ha gave 31 and 65% control respectively. Fluazifop-butyl had no apparent effect. There was no visible damage to onions from either herbicide, but no yield assessment was made.

In Trial F a variety of grass seedlings (2-4 leaf) were treated in seedboxes. By 4 weeks after treatment clethodim at 30 g/ha had killed annual poa, paspalum (*Paspalum dilatatum*) and floating sweetgrass (*Glyceria* spp), but 60 g/ha was required to kill soft brome, phalaris (*Phalaris tuberosa*), wild oat and prairie grass (*Bromus willdenowii*). Clethodim provided acceptable control of vulpia hairgrass at the highest rate used (120 g/ha) but not all the seedlings were killed. Fluazifop-butyl did not control paspalum, vulpia hairgrass and annual poa but gave excellent control of other grasses.

In Trial G grass seedlings were grown in the field in the absence of any competing crop and treated at the 3-5 leaf stage. The knockdown scores recorded at 2 weeks after treatment showed that 30 g/ha clethodim killed perennial ryegrass and cocksfoot (*Dactylis glomerata*) but 60 g/ha clethodim was required to kill barnyard grass (*Echinochloa crus-galli*) and summer grass (*Digitaria sanguinalis*). Whereas these results were achieved against young seedlings (up to 5-leaf stage), Rahman *et al* (1988) found that a higher rate of 120 g/ha clethodim was required for control of tillered plants of barnyard grass, summer grass and smooth witchgrass (*Panicum dichotomiflorum*).

Control of couch

Table 4 summarises results from two trials evaluating control of regrowth couch in lentils and peas, and one trial evaluating clethodim on undisturbed couch in raspberries. In Trial H, 240-480 g/ha clethodim provided good control of regrowth couch. Increasing the rate to 720 g/ha did not improve the level of control. Both fluazifop-butyl and haloxyfop gave levels of control similar to clethodim. There was no visible damage seen to lentils from clethodim treatments and lentil yields confirm its selectivity.

TABLE 4: Tiller counts and percent ground cover of couch in lentils, peas and raspberries and lentil seed yield after application of clethodim, fluzifop-butyl (Trials H and I), sethoxydim (Trial J) and haloxyfop (Trial H).

Trial no.	Treatment	Rate (g ai/ha)	H		I		J	
			Tillers/m ²	Yield	% Ground cover	% Ground cover	% Ground cover	% Ground cover
			9 WAT	T/ha	7 WAT	7 WAT	12 WAT	12 WAT
	untreated		346	1.88	80	90	100	100
	clethodim	120	44	2.66	30	—	—	—
	clethodim	240	12	2.78	8	85	100	100
	clethodim	480	4	2.97	3	27	100	100
	clethodim	720	2	2.77	2	11	100	100
	fluzifop-butyl	750	5	2.92	2	—	—	—
	sethoxydim	1000	—	—	—	92	100	100
	haloxyfop	480	6	2.93	—	—	—	—
	cv%		25.12	8.56	—	—	—	—
	LSD (P<0.05)		13.7	0.95	—	—	—	—

WAT = weeks after treatment.

Similar results were recorded in Trial I. The ground cover scores indicate that 240-480 g/ha clethodim and 750 g/ha fluzifop-butyl provided good couch control for the duration of the crop. No damage was seen on the peas from clethodim treatments, but no yield assessment was made in this trial.

In Trial J, the ground cover scores suggest that undisturbed couch is not as susceptible to clethodim as regrowth couch is. Sethoxydim also gave poor control. The knockdown scores recorded at 7 weeks after treatment show that 480-720 g/ha clethodim had a good knockdown effect on undisturbed couch. Ground cover scores at 12 weeks after treatment indicate that couch had regrown from rhizomes in all plots. These results against undisturbed couch are consistent with those reported by Rahman *et al* (1988).

Effect of surfactants on activity of clethodim

In two trials (K & L), treatments were included to evaluate the effect of a non-ionic wetting agent (Activator 90, 850 g/litre alkyl polyoxyethylene ether & 50 g/litre isopropanol — Loveland Industries Ltd, USA) and an emulsifiable crop spraying oil (SunSpray or Volck Supreme) on the activity of clethodim. In Trial K, on regrowth couch in peas, clethodim plus wetting agent (240 g/ha + 0.125%) reduced the number of couch tillers by 69% compared with untreated (986 tillers/m²), while the same rate of clethodim with oil (2 litres/ha) reduced tiller numbers by 92%. In Trial L, on wild oats in peas, comparisons were made with clethodim used at 30 g/ha. The results were again highly significant with clethodim alone, clethodim plus wetting agent (0.125%), and clethodim plus oil (2 litres/ha) reducing wild oat seed count to 1855, 354 and 46 seeds/m² respectively compared with 6640 seeds/m² in untreated. Thus the addition of crop oil consistently improved the activity of clethodim relative to clethodim applied alone or with non-ionic wetting agent. This supports the overseas recommendation that clethodim should be applied with a crop spraying oil (Anon 1986; Baldwin 1987; Kinkade *et al* 1987).

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