PROPARGYL - A POST-EMERGENT HERBICIDE FOR SELECTIVE CONTROL OF WILD OATS AND CANARY GRASSES IN WHEAT, TRITICALE AND DURUM

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SUMMARY

On wheat propargyl at 18 g/ha with 1.0 litre/ha of mineral oil applied between the two leaf and the first node stage of wild oats (*Avena fatua*) gave equivalent or better control than the standard L-flamprop isopropyl at 600-800 g/ha. Application from the two leaf up to second tiller stage gave excellent control of lesser canary grass (*Phalaris minor*), but diminished control of gnawed canary grass (*P. paradoxa*). No crop phytotoxicity or yield loss occurred on several cereal cultivars from propargyl at 48 g/ha alone or in mixture with emulsifiable mineral oils. The mixture of propargyl and mineral oil is compatible with many post-emergent herbicides used for broadleaf weed control.

Keywords: propargyl, wild oats, canary grasses, cereals

INTRODUCTION

Propargyl is a herbicide developed by Ciba-Geigy Limited, Basle, belonging to the group of pyridyloxy-phenoxy herbicides. It is applied post-emergent to crops for the control of annual grasses (Cornes *et al.* 1989). Applied alone, propargyl is not fully tolerated by small grain cereals and therefore requires a specific crop safening agent. For this purpose cloquintocet, a compound which has proved to be an effective safener, has been added to provide protection to all types of winter and spring wheats including durum, rye and triticale, but not barley or maize, without affecting the control of grass weeds (Kreuz *et al.* 1991). Propargyl is taken up by the leaves of grass weeds causing active growth of susceptible grasses to cease within 48 hours following application. It is quickly degraded in the soil and has little soil activity (Amrein *et al.* 1989). Symptoms are observed within 1 - 2 weeks depending on the environmental conditions and the grass species involved. Decay of nodes and growing points is visible with the young leaves showing chlorosis followed by necrosis, but older leaves may stay green and die later.

This paper summarises data from trials conducted in New Zealand during the 1988-93 growing seasons. The trials were designed to determine effective rates, primarily against wild oats and later against canary grasses in Canterbury wheat crops. Some of the trials also investigated the effect of emulsifiable mineral oils on the activity of propargyl, its compatibility with other post-emergence broadleaf herbicides, and tolerance of cereal cultivars.

METHODS

Eight trials were conducted on different sites in Canterbury, chosen because they had even distributions and populations of wild oats, canary grass and cereals. Trials A - G investigated the effect on wild oats and canary grass of propargyl (Topik) alone or in combination with mineral oil (Shellspray). Comparisons were also made with the standard L-flamprop isopropyl (Commando 200 EC). In Trial G applications were also made with broadleaf herbicides (Table 6) to investigate the compatibility of propargyl/ oil mixtures with other herbicides and their effect on wild oats. Wheat cultivars, application times, growth stage at application and assessment dates are given in Table 1.

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In Trial H the tolerance of various cereal cultivars (Table 2) to propargyl applied at 24 and 48 g/ha with 1 and 2 litres/ha of mineral oil (Shellspray) and at 24 g/ha with 1 litre/ha of the mineral oils Mobil Superior 663 and D-C-trate was investigated. The cereal plants on the whole plot were assessed for phytotoxicity on six occasions during the crop growing period between 27 November and 21 January 1993.

In Trial E a 100 g/litre formulation of propargyl was used. In all other trials a 240 g/litre emulsifiable concentrate was applied. In all trials, treatments were applied with a precision backpack sprayer and hand held boom fitted with either 80-02 or 110-02 fan nozzles operating at 300 kPa and delivering 200-300 litres of water /ha. Trials were of randomised complete block design with plots measuring 2 - 2.5 x 9 - 12 m and replicated 4 - 6 times with the exception of the cereal variety trial which had a sprayed plot size of 1.0 x 1.5 m and was unreplicated. The cereal variety tolerance trial (Table 4) was sown using a ten row cone seeder drilled in plots 10 m long.

Assessments for wild oat and canary grass control were taken at the panicle growth stage by plant counts on a 1 m wide strip through the centre and for the length of each plot, or where counts were obviously high, 2 or 3 x 0.25 - 0.5 m^2 quadrats/plot. Harvesting was either by clipping quadrats of 2 or 3 x 0.25 m^2 per plot or by a mechanised mini plot harvester along a single strip 0.75 m wide through the centre and for the length of each plot. Quadrat samples were threshed and all grain was screened with a minimum mesh of 2 mm. Thousand grain weights were taken from screened seed. All grain yield data are expressed at 14% moisture content. The data were subjected to ANOVA.

TABLE 1: Details of Trials A-G.

Trial no.	Treatment date	Wheat cultivar	crop	Growth stage wild oats	*Phalaris* spp	Assessment date
A	6.10.92	Sapphire	2nd tiller	1-2 tillers		12.1.93
B	25.10.92	Domino	2nd node	1st node		11.1.93
C	25.10.92	Sapphire	2nd node		2 tillers	12.1.93
D	22.10.93	Sapphire	4th tiller		3-5 tillers	17.1.94
E	17.9.91	Batten	tillering			12.1.92
F	20.10.92	Amethyst	tillering			8.2.93
G	27.10.93	Monad	4th tiller	4 leaf		10.1.94

TABLE 2: Details of Trial H sown on 9 September 1992 and treated with different rates of propargyl and mineral oil on 23 November 1992.

Crop	Growth stage	Cultivars
wheat	tillering	Bounty, Brock
	1-2 node	Amethyst, Domino, Kokako, Monad, Norseman, Rongotea, Sapphire, Millbrook, 693.01
	boot	Karamu, Otane
	early flag	Briscard
durum	1-2 node	Waitohi
triticale	tillering	Pablo
	boot	Aranui
	early flag	18 ITSN 119

RESULTS AND DISCUSSION

Wild oat control

Observations in the 2-6 week period following propargyl application confirmed work reported by Amrein *et al.* (1989), that the youngest leaves die first while the older leaves stay green and die later without any visual signs of phytotoxicity to the wheat crop.

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The amount of propargyl required to control wild oats in winter wheat was less when applied at the 1 - 2 tiller stage in Trial A than at the 1st node growth stage in Trial B (Table 3). In Trial A, propargyl applied at 24 g/ha gave complete control whereas in Trial B the same rate gave incomplete control. Applied at 18 g/ha, propargyl did not fully control wild oats at either growth stage. However, the addition of emulsifiable mineral oil greatly improved the activity of propargyl at 18 g/ha, to give control of wild oats similar to that recorded for the 800 g/ha flamprop isopropyl treatments. There are sufficient data from these trials to show that a reduced herbicide rate is possible through the addition of an emulsifiable mineral oil. Other trials have given similar results (Kerse *et al.* 1989).

TABLE 3: The effect of propargyl with and without mineral oil on the number of wild oat panicles/m² in Trials A and B.

Treatment	Rate (g ai/ha)	Wild oats	
		Trial A	Trial B
propargyl	18	1.63	6.25
propargyl	24	0.0	2.4
propargyl + oil	18 + 1 litre	0.0	0.45
propargyl + oil	24 + 1 litre	0.0	0.0
flamprop isopropyl	800	0.02	0.48
untreated	-	145.0	24.93
LSD (P< 0.05)		10.64	8.51

Canary grass control

The annual grasses, lesser and gnawed canary grass, showed high susceptibility to propargyl applied post-emergence to winter wheat crops in Canterbury (Table 4). Observations during the 3 - 4 week period following application indicated similar herbicide activity to that on wild oat plants with the younger leaves dying first while the older leaves stayed green and died later. With gnawed canary grass, uncontrolled plants were initially suppressed then 4 -6 weeks later, a much weakened stem elongation occurred with the panicles often below the crop canopy.

When applied at 18 g/ha (Trial C) propargyl gave significant (P<0.05) but incomplete control of lesser canary grass, when compared with the untreated. Propargyl applied at 24 g/ha (Trial D) gave complete control of lesser canary grass and significantly reduced (P<0.05) the number of panicles/m² of gnawed canary grass. The addition of emulsifiable mineral oil improved the activity of propargyl at 18 g/ha giving complete control of lesser canary grass in Trials C and D and increased efficacy on gnawed canary grass to obtain 94% control, in Trial D (Table 4).

TABLE 4: The effect of propargyl with and without Shellspray mineral oil on the number of panicles of canary grass/m² in Trials C and D.

Treatment	Rate (g ai/ha)	No. panicles/m²		
		P. minor		*P. paradoxa*
		Trial C	Trial D	Trial D
propargyl	18	0.13		
propargyl	24	0.0	45.0	
propargyl	36	0.0		
propargyl + oil	18 + 1 litre	0.0	0.0	8.0
untreated	-	0.6	110.0	144.0
LSD (P<0.05)		0.21	14.8	58.7

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Crop tolerance and yield

There were no visible signs of crop damage on the wheat, triticale or durum cultivars in any of the treatments in the crop tolerance trial.

When applied to tillering wheat (Table 5) propargyl alone or in mixture with mineral oil did not affect yields in comparison with either flamprop isopropyl or the weed free untreated control.

TABLE 5: The effect on wheat yields of propargyl applied alone and in mixture with mineral oil in Trials E and F.

Trial No.	Treatment	Rate (g ai/ha)	Grain yield (t/ha)	1000 grain wt. (g)	% screenings
E	propargyl	25	7.1	44.6	3.1
	propargyl	50	7.2	44.5	3.6
	propargyl + oil	25 + 1 litre	7.3	44.5	3.5
	propargyl + oil	50 + 1 litre	6.9	44.3	3.6
	flamprop isopropyl	600	6.8	43.9	3.7
	LSD (P< 0.05)		0.95	0.9	0.7
F	propargyl + oil	24 + 1 litre	9.63	43.8	5.5
	propargyl + oil	48 + 1 litre	9.78	42.9	6.6
	untreated	-	10.07	43.7	5.6
	LSD (P< 0.05)		0.46	1.9	1.2

Compatibility

The mixture of propargyl and mineral oil, when tank mixed with the herbicides MCPB, clopyralid , bromoxynil/ioxynil, triasulfuron and chlorsulfuron, indicated no crop phytotoxicity and gave complete wild oat control. When mixed with dicamba or MCPA slightly less control (90-95%) was obtained, and there was no control of wild oats with mecoprop (Table 6). Temperature at the time of application was 18°C in the shade.

TABLE 6: The effect of a propargyl and mineral oil mixture alone and in tank mixtures with broadleaf herbicides in Trial G.

Treatment propargyl + oil	Rate (g ai/ha)	Wild oats control (% control)
mixture alone	18 + 1 litre	100
+ MCPA	+ 1125	95
+ MCPB	+ 1600	100
+ mecoprop (Duplosan KV)	+ 1560	0
+ dicamba (Banvel)	+ 140	90
+ clopyralid (Versatill)	+ 300	100
+ bromoxynil/ioxynil (Combine)	+ 600	100
+ triasulfuron (Logran)	+ 15	100
+ chlorsulfuron (Glean)	+ 15	100
untreated	-	(121/m^2)

CONCLUSIONS

Propargyl applied with a mineral oil gave very effective post emergent control of wild oats and canary grass species. The low use rates of 18-24 g/ha allow some flexibility in the timing of application prior to first node development. The inclusion of the safener cloquintocet allows safe applications of propargyl to wheat, triticale and durum with more than double the safety margin when applied between the three-leaf

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and the stem elongation stage of growth. The propargyl/mineral oil mixture can be tank mixed with MCPB, clopyralid, bromoxynil/ioxynil, triasulfuron and chlorsulfuron to control both wild oats and broadleaf weeds.

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