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HOE 23408 FOR CONTROL OF WILD OATS IN PEAS AND LINSEED

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Summary

A field trial evaluation of the herbicide Hoe 23408 in peas (*Pisum sativum*) and linseed (*Linum usitatissimum*) confirmed the optimum time of application is when wild oat (*Avena fatua*) is at the 2-4 leaf stage. Treatments also provided acceptable control of wild oats at the onset of tillering when conditions were favourable. A non-ionic surfactant in tank mix with Hoe 23408*, and in an experimental formulation (Hoe 23408 28 EC) compensated for a reduction of active ingredient applied while maintaining high levels of wild oat control and a wide crop safety margin.

INTRODUCTION

Wild Oats are a serious problem in some intensive cropping areas of New Zealand (Allen 1962;1972). This prolific annual weed, which exhibits highly competitive growth that starts about the onset of tillering (Gargouri and Seeley 1972), is of particular concern in peas and linseed (N.Z.F.F. Survey 1978). Spring cultivation at the time when germination of *Avena fatua* naturally occurs increases germination (Bibbey 1935; Mullverstedt 1963), which combined with the poor competitive ability of these crops at the critical stage of wild oat development results in large plants with considerable reproductive capacity. Although economic control is an important consideration, the prime objective for eradication as discussed by Elliot (1972) must be to deplete soil seed reserves by reducing return of seed to the soil.

The objective of a series of trials reported in this paper was to evaluate the herbicide Hoe 23408 alone and in combination with surfactant with a view to reducing the amount of active ingredient applied, incorporating a wider safety margin against unfavourable treatment conditions (i.e. stagnating growth and weed stage at extremes of the susceptible 1-5 leaf growth range) and measure suppression of wild oat seeding.

EXPERIMENTAL METHOD

Sites were chosen for an even distribution of wild oat and crop plant populations. All trials were a randomized block design replicated four times with plots, split into single and double treatment applications (the latter to determine crop tolerance), measuring 7 x 2 m and 3 x 2 m respectively. Treatments were applied with a precision knapsack sprayer and hand held boom using Teejet 730154 nozzles pointing forward at a 20° angle to ground. Water rate was 260-320 litres/ha. The pre-spray wild oat assessment which totalled an area of 1 m²/replicate was undertaken immediately before spraying primarily as an indicator to the stage of growth of the wild oats present. Tillered plants on trial A were tagged for observation. Pea stage ranged from 3 to 7 nodes and linseed 20 mm high at the time of spraying.

* Unless stated otherwise, the 36 EC formulation was used.

Proc. 32nd N.Z. Weed and Pest Control Conf.

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Table 1. Details of trial applications and pre-spray wild oat assessments (% st

	TRIAL A1 (peas)	TRIAL A2 (peas)	TRIAL B (peas)	TRIAL C (peas)	TRIAL D (peas)	TRIAL E (linseed)
Location	Barrhill	Barrhill	Highbank	Wheatstone	Willowby	Lismore
Soil type	Barrhill	Barrhill	Lyndhurst	Wakanui	Waterton	Lismore
Crop variety	Maple	Maple	Pamaro	S.S. Freez.	Marrowfat	Redwood
Date sprayed	18.9.78	9.10.78	4.10.78	9.11.78	28.11.78	20.10.78
Percent Wild Oat population at growth stages recorded						
1 leaf	60	-	1	5	-	-
2 leaf	14	3	25	7	3	14
3 leaf	24	49	74	24	23	50
4 leaf	2	15	-	21	12	-
3 leaf (onset of tillering)	-	-	-	-	-	16
4 leaf (onset of tillering)	-	8	-	34	39	20
5 leaf (early tillering)	-	25	-	9	23	-
	100%	100%	100%	100%	100%	100%
No. wild oats/m ²	134	146	228	241	29	86

Treatments compared various rates of Hoe 23408 with and without a non-ionic surfactant. This was achieved by using

- An EC formulation containing 375 g/litre Hoe 23408
- The formulation as above, with a non-ionic surfactant added to the spray tank
- An EC formulation containing 284 g/litre Hoe 23408 and a specific non-ionic surfactant.

In four of the five trials reported, difenzoquat was included as a standard treatment.

Other herbicides for control of broadleaf weeds, were applied no sooner than 10 days after the trial plots were sprayed. Trial C treated pre-plant with trifluralin did not need spraying for broadleaved weeds. Major emphasis was placed on visual assessments up to 28 days post spraying and quantitative harvest assessments, though regular visual control and crop vigour assessments were recorded throughout the interim period. On Trial A, final wild oat counts were made on three 0.333 m² quadrats plot. On the remaining trials untreated assessments were made on three 0.333 m² quadrats /plot but sprayed plots were assessed on 6 m² /plot in peas and 12 m² /plot in linseed. Spikelets and panicles were counted on all wild oats in the assessment areas. Pea crops were pulled by hand from an area of 4 m² /plot and threshed on a 'Kurt Pelz' stationery thresher with yield data adjusted to 14% moisture.

RESULTS AND DISCUSSION

The only Hoe 23408 treatments to record any crop effect were those containing extra surfactant on single applications of Trials A and B and double applications of Trials D and E. This effect of leaf tip burn disappeared within 10 days.

Difenzoquat plus non-ionic surfactant recorded a maximum visual rating at 7 days post-spray of 1.1 on three pea trials and 1.8 on linseed, all of which had developed into a noticeable growth check by 21 days post-spray, that was later reflected in reduced pea yields. Crop maturity was delayed by approximately 3 weeks on Trial C (pea crop).

The first symptoms of Hoe 23408 action on the wild oats appeared 5-10 days post spray after which growth stagnated rendering the plant non competitive. Plants in the 1-4 leaf stage before the onset of tillering were the most susceptible being controlled by lower rates of Hoe 23408 and died within 21 days, even under the poor growth conditions and low crop competition of trials A and B.

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

Trial	Treatments	Rate g/ha	Wild oat control			Yield as a % untreated
			Plants /m ²	Panicles /m ²	Seed set /m ²	
A1	untreated		123 a			
	Hoe 23408	1125	18 b			
	Hoe 23408†	852 + NISF	27 b			
	"	923 + NISF	16 b			
Assessed 7.11.78 at termination of trial						
A2	Hoe 23408	1125	6 c			
	Hoe 23408†	852 + NISF	7 c			
	"	994 + NISF	6 c			
	difenzoquat	1000 + SFB	19 b			
	CV%		21.1			
						(1.23 t/ha)
B	untreated		204.0 a	213.0	16123 a	100 d
	Hoe 23408	1031	4.7 c	5.6	117 c	281 a
	"	1125	3.1 d	3.0	65 de	246 ab
	Hoe 23408†	852 + NISF	4.9 c	5.0	96 cd	251 ab
	"	932 + NISF	2.9 cd	3.0	53 e	229 b
	difenzoquat	1000 + SFB	78.2 b	86.8	1743 b	141 c
	CV%		23.6	—	9.7	16.4
						(2.06 t/ha)
C	untreated	937	125.0 a	232.0	15750 a	100 e
	Hoe 23408	1125	10.1 b	19.3	161 b	195 bc
	"	562 + SFA	6.6 bcd	7.5	115 bcd	209 ab
	"	750 + SFA	9.1 bc	10.6	170 b	181 cd
	"	937 + SFA	6.1 bcde	7.2	116 bcd	207 abc
	Hoe 23408†	568 + NISF	3.6 f	4.2	76 de	203 bc
	"	710 + NISF	5.7 cdef	5.9	93 cd	205 bc
	"	852 + NISF	5.4 def	6.2	119 bc	201 bc
	Hoe 23408	1000 + SFB	4.0 ef	4.5	53 e	235 a
	difenzoquat		3.7 f	5.5	82 cd	166 d
	CV%		17.8	—	6.5	10.8
						(2.37 t/ha)
D	untreated		29.7 a	34.0	2008 a	100 c*
	Hoe 23408	1125	3.2 c	3.6	113 c	140 a
	"	750 + SFA	5.5 b	5.9	195 b	131 a
	"	937 + SFA	3.3 c	3.3	102 bc	146 a
	"	1125 + SFA	4.8 bc	5.1	163 bc	130 ab
	Hoe 23408†	710 + NISF	4.4 bc	4.6	170 bc	115 b
	"	852 + NISF	4.5 bc	5.0	157 bc	114 bc
	"	994 + NISF	5.7 b	6.1	193 b	113 bc
						10.9
E	untreated		58.1 a	147.0	11100 a	
	Hoe 23408	937	0.5 b	0.6	23 b	
	"	1125	0.8 b	0.8	39 b	
	"	937 + SFA	0.5 b	0.5	17 b	
	difenzoquat	1000 + SFB	1.3 b	2.0	137 b	
						33.1

SFA and SFB proprietary non-ionic surfactants added at 0.3% a.i. v/v tank mix or 2% product v/v tank mix respectively.

NISF - Non-ionic surfactant in formulation.

* Trial D mean of 3 replication.

† 28 EC used

The results suggest that the excellent control of wild oats sprayed at the 2-4 leaf stage, using 1125 g/ha Hoe 23408 is equalled by adding a non-ionic surfactant to the spray tank and reducing active ingredient by

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a range of 17-24%. These treatments reduced seed set/m² to a level below the pre-spray counts of wild oat seedlings/m², thus achieving the first step towards depletion of soil seed reserves. The achievement of seed reductions of the order obtained in these trials, when combined with cultural practices should enable growers to make progress toward eradication of wild oats as a problem weed.

Treatments containing surfactant applied at optimum time compensated for a reduction of Hoe 23408 but did not significantly improve efficacy against plants at advanced growth stages. Plants with four leaves at on set of tillering and a proportion of five leaf plants were susceptible to higher rates of Hoe 23408 particularly when conditions of application were favourable (i.e., good growth and small droplet size) as on trials C and E. While it took up to 28 days before tillered plants could be confirmed dead, regrowth when it occurred from five leaf plants usually appeared within 14 - 21 days post spraying. Application when a large portion of the wild oat plants were at the five leaf stage, trials A2 and D, initially reduced competition from these plants but ultimately provided a less acceptable result. Although regrowth plants from all rates displayed the typical Hoe 23408 symptoms of slow recovery, undeveloped root systems, single tillers and heavy seed reductions, such late applications in dicotyledon crops should only be considered as a 'salvage measure' where strong wild oat competition necessitate crop release.

Conversely the low level of control from the first application, trial A1, resulted from lower susceptibility of emerging one leaf plants due to minimal leaf area for herbicide contact and a germination post spray as a result of applying too early.

Surviving wild oats on trials B and E were entirely the result of a late germination emerging from 21 days post-spray onwards, while on the other trials a late germination contributed to only a minority of wild oats present at harvest. There was little evidence of residual herbicidal activity at rates of Hoe 23408 used, thus confirming that the chemical acts primarily through the foliage. Assessments on double treatment applications revealed excellent crop selectivity by Hoe 23408 but not by difenzoquat.

Visual assessments of wild oat control proved to be not as reliable a measure of herbicide effect as detailed counts of wild oat plants, panicles and spikelets. The statistical analyses of results (Table 2) reveal significant improvement in seed set reduction by Hoe 23408 that would not have been recorded in any "visual acceptability rating".

CONCLUSION

The results of the five trials reported in this paper show that Hoe 23408 at 1125 g/ha applied when the majority of wild oats are at the 2-3 leaf stage will provide high levels of control in pea and linseed crops. The addition of a non-ionic surfactant as a tank mix or in an alternative formulation of Hoe 23408 can reduce the amount of herbicide required to control wild oats while maintaining crop safety.

ACKNOWLEDGEMENTS

The author wishes to thank the numerous people who contributed to this trial series, including the farmers who provided sites, company agents, contractors, MAF, Lincoln College staff and NZFF Co. Ltd staff.

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Hoe 23408 = methyl 2[4-(2,4-dichlorophenoxy) phenoxy] propionate