KIWIFRUIT SEEDLING TOLERANCE TO SOIL APPLIED HERBICIDES

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SUMMARY

The tolerance of young kiwifruit (*Actinidia chinensis*) seedlings to soil applied herbicides was studied over two seasons. In two trials in 1981/82 13 promising residual herbicides were tested on dormant kiwifruit of three different ages up to 2 year old plants. Best crop tolerance was with napropamide, alachlor, proflam and diuron, but none of the herbicides affected the growth of 1 or 2 year old plants. Nursery seedlings transplanted from small pots were damaged by atrazine, oryzalin, and oxyfluorfen each at 2 kg/ha, oxadiazon at 3 kg/ha, and propazine, simazine and a terbutylazine/terbumeton mixture each at 4 kg/ha.

INTRODUCTION

Rapid expansion of kiwifruit plantings within New Zealand has increased the need for reliable information on herbicides which may safely be used on this crop. Official statistics (Anon. 1981) show that the area of planted vines increased from 1019 ha in 1975 to 5372 ha in 1980, with a projected total for 1985 of 8800 ha (Anon. 1980).

The greatest demand for weed control occurs during establishment when weeds are serious competitors for water and nutrients. Although contact herbicides such as diquat/paraquat and glyphosate are often used as directed sprays, most growers are unsure of the safety of residual herbicides.

The first New Zealand reports on herbicide screening for kiwifruit were from Levin (Cox 1980) using seedlings in a glasshouse and Pukekohe (Wilson 1980) on field planted seedlings. This paper reports follow-up field trials on nursery seedlings at Pukekohe over two seasons and studies on more advanced 1 and 2 year old plants.

METHOD

The same 13 herbicides as previously screened (Wilson 1980) were further evaluated at two or three rates (Table 1) over young dormant kiwifruit seedlings 10 - 20 cm tall (Trial 1). The herbicides were applied to weed free soil directly over the rows in a 50 cm wide band, on August 26 1980, the day after planting. In a supplementary trial on seedlings of the same age planted a month later, herbicides (Table 2) were applied on September 30 over plants at the advanced bud-swell stage.

In the last season (1981-82) the 11 most promising herbicides (Table 3) were tested over dormant kiwifruit seedlings of the following three ages:

- (a) ex 5 x 5 cm nursery pots.
- (b) One year old plants pruned as a single 15 cm rod.
- (c) Two year old plants pruned to two to three 20 cm rods.

The treatments were applied over the nursery and 1 year old seedlings on August 18 1981 (Trial 3) and over the 2 year seedlings on August 28 (Trial 4).

For all trials single row plots of 10 plants were randomised in four replicates. A modified Oxford Precision sprayer was used to apply 400 litres/ha at 200 kPa. Trial sites were all on Patumahoe clay loam with mean organic carbon levels of 3.1% for Trials 1, 2 and 3 and 3.9% in Trial 4.

For the 1980 trials (1 and 2) the plots remained undisturbed for 10 weeks after herbicide application and following a rating of percentage weed cover all weeds were removed by hand. The plots were then maintained in a clean condition to avoid

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subsequent weed competition. In the 1981 trials (3 and 4) all treatments including untreated controls were kept clean throughout by hand weeding. A separate trial site (without kiwifruit) was established to assess herbicide efficiency on weeds and the residual period of effectiveness.

In all trials the vines were supported by strings from overhead wires and shoot extension was the primary means of recording plant growth response.

RESULTS

Dichlobenil was extremely damaging in Trial 1, and killed 40% of the kiwifruit at 4 kg/ha and all plants at 8 kg/ha. Growth extension in the remaining treatments was similar but visual symptoms of early minor plant damage were recorded with the high rates of both oxyfluorfen (2 kg/ha) and oxadiazon (3 kg/ha). At the time of first height recording 21 weeks after treatment, on January 22, most herbicide treatments were better than the untreated control (Table 1). At the final height recording on February 23 when the mean values of herbicides were compared (2 or 3 rates combined), oryzalin (109 cm) was significantly lower than prodiamine (144 cm), propazine (142 cm) and oxadiazon (141 cm).

TABLE 1: Trial 1, herbicide screening on dormant kiwifruit seedling treated on 26 August 1980. Effects of weed cover and kiwifruit growth.

	Rate kg/ha	% Weed cover 10 weeks	Mean plant height (cm)	
			22 Jan	23 Feb
alachlor	2	68	65	138
alachlor	4	23	60	124
atrazine	1	1	72	130
atrazine	2	1	77	140
chloridazon/chlorbufam	4	53	74	145
chloridazon/chlorbufam	8	14	55	115
chlorthal-dimethyl	8	90	58	116
chlorthal-dimethyl	16	91	79	158
dichlobenil	4	0	33	69
dichlobenil	8	0	-	-
diuron	1	63	65	136
diuron	2	15	78	121
napropamide	2	15	67	138
napropamide	4	2	77	130
napropamide	8	1	69	111
oryzalin	2	0	72	111
oryzalin	4	0	64	106
oxyfluorfen	1	1	93	151
oxyfluorfen	2	0	81	125
oxadiazon	1.5	5	84	134
oxadiazon	3.0	1	90	147
prodiamine	4	1	96	145
prodiamine	8	0	89	143
propazine	1	0	83	156
propazine	2	0	76	133
propazine	4	0	78	138
simazine	0.5	90	73	128
simazine	1.0	8	80	143
untreated	-	100	57	131
CV %			18.3	16.6
LSD 5%			19.1	31.0

TABLE 2: Trial 2, effect of herbicides applied on Sept 30, 1980 at advanced bud-swell of young kiwifruit seedlings.

Treatment	Rate kg/ha	Ratings at 10 weeks		Mean kiwifruit ht (cm)	
		crop vigour*	weed cover	23 Jan	23 Feb
simazine	0.5	9	80	94	150
simazine	1	7	18	95	153
simazine	1.5	6	10	97	161
simazine	2	5	8	80	144
simazine	4	3	0	20	77
pendimethalin	1	4	32	97	170
penidmethalin	2	4	2	87	141
cyanazine	0.8	6	70	51	118
cyanazine	1.6	4	41	60	112
untreated		9	100	85	144
CV %				29.4	22.5
LSD 5%				32.6	44.3

* 0-10 scale mean values, 10 = no growth reduction

In Trial 2 cyanazine, pendimethalin, and simazine (1.5 kg/ha and above), caused a visible check to kiwifruit vigour 10 weeks after treatment (Table 2). The first developed leaves were small, yellowed and sometimes necrotic while at the high simazine rate (4 kg/ha) 20% of the plants died. Cyanazine also killed 15% of the plants at 0.8 kg/ha and 20% at 1.6 kg/ha. Six weeks later when plant height recordings commenced on 23 January the pendimethalin treatments had recovered and were growing normally. The cyanazine treatments however remained checked, while growth from surviving plants treated with the high rate of simazine (4 kg/ha) was also poor.

In Trial 3 the high rates of atrazine, oryzalin, oxyfluorfen, oxadiazon, propazine (4 kg/ha), simazine (4 kg/ha), and terbuthylazine/terbumeton (4 and 6 kg/ha) all significantly suppressed growth of the nursery seedlings recorded 22 weeks after application (Table 3). Treatments applied to 1 year old seedlings had no effect on growth as measured after 10 weeks although initial shoot emergence was checked with the high rates of oxadiazon and oxyfluorfen. Only the higher rates were applied to the 2 year old seedlings and again oxadiazon and oxyfluorfen caused a check to early shoot emergence with pronounced reddening of the young leaves. Subsequent plant vigour was normal and a repeat application after 15 weeks on December 9, 1981 did not affect growth.

In the 1981 trials only three herbicides were sufficiently damaging to cause plant death of the nursery seedlings, namely oxyfluorfen 2 kg/ha (38% kill) oxadiazon 3 kg/ha (45%) and terbuthylazine/terbumeton 4 and 6 kg/ha (28% and 55% kill respectively).

DISCUSSION

Variable growth in Trials 1 and 2 was partly due to wind rub which caused death of some growing points. Growth was delayed for 2-3 weeks until a new growing point was established from an axillary bud. In 1980 growth was also influenced by weed competition during the first 10 weeks. Further variability resulted from root infection with *Sclerotium rolfsii* which caused 7% plant death throughout Trial 1 and 14% death in Trial 2.

Crop tolerance was more clearly demonstrated in Trial 3 where no weed competition occurred and care was taken to shake the potting mix free of the kiwifruit roots before planting. In Trials 1 and 2, the 1:1 peat and pumice nursery substrate remained intact at planting and was thought to provide a zone of herbicide protection for the roots after treatment. The larger root system of the 1 year old plants showed

good tolerance to all herbicides applied. The same situation was recorded for the even larger 2 year old plants in Trial 4 and only high rates of oxadiazon and oxyfluorfen caused a slight but temporary growth check.

Observations on all trials suggest that it is desirable to allow a minimum of 10 plants per plot and four replications although some reduction in number might be possible with careful size selection.

It should be emphasised that the present results refer only to the effects of herbicides on kiwifruit seedlings used as rootstocks. Preliminary observations on newly grafted plants suggest that the scion cultivar Hayward, may be more sensitive to herbicide injury. It is also important to obtain crop tolerance data on other soil types.

TABLE 3: Trials 3 and 4, effect of soil residual herbicide treatments on kiwifruit shoot growth of nursery seedlings, 1 year old and 2 year old seedling plants.

Treatment (applied 18.8.81)	Rate kg/ha	Mean growth extension (cm)		
		Nursery seedlings Jan 7	1 yr plants October 29	2 yr plants November 2
alachlor	2	81	97	-
alachlor	4	62	86	204
atrazine	1	99*	99	-
atrazine	2	66	90	273
diuron	1	73	83	-
diuron	2	69	100	216
napropamide	2	68	93	-
napropamide	4	66	71	214
napropamide	8	69	88	224
oryzalin	1	87*	92	-
oryzalin	2	55	89	238 ¹
oxyfluorfen	1	71**	96	-
oxyfluorfen	2	13	87	228
oxadiazon	1.5	68**	91	-
oxadiazon	3	17	79	177
prodiamine	4	61	81	-
prodiamine	8	50	94	203
propazine	1	97	88	-
propazine	2	69**	91	-
propazine	4	37	85	233
simazine	1	65	95	-
simazine	2	52**	87	255
simazine	4	17	79	266
terbuthylazine/	2	61	92	-
terbumeton	4	16**	110	247
	6	12	96	276
untreated	-	72	95	225
CV %		35.9	17.2	20.1
LSD 5%		30	22	67

¹ oryzalin incorrectly applied at 4 kg/ha.

* ** significant differences between herbicide rates at 5% and 1% respectively.

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