KIWIFRUIT SEEDLING TOLERANCE TO HERBICIDES

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Summary

Crop tolerance to varying rates of 13 herbicides was tested on field planted kiwifruit seedlings (*Actinidia chinensis*). Alachlor at 2 and 4 kg/ha provided the most promising combination of crop safety and weed control. Napropamide 2, 4 and 8 kg/ha and oryzalin 2 kg/ha demonstrated adequate crop safety but were limited in the spectrum of weeds controlled. Low rates of simazine 0.5 kg/ha and propazine 1 or 2 kg/ha did not affect kiwifruit seedling growth but gave only limited weed control which was short lived.

INTRODUCTION

There is a notable absence of published research on herbicides for kiwifruit from anywhere in the world. Fischer and Browne (pers comm) summarised field trials during 1976-77 in California on seedling kiwifruit. They concluded that reasonable tolerance existed to post-planting surface applied napropamide, proflaminate, oryzalin, oxyfluorfen and oxadiazon. The first two were considered the safest while tolerance to simazine was narrow and they suggested it may not be safe to use even at 1.12 kg/ha on newly planted vines.

This paper reports two trials at Pukekohe on nursery seedlings as part of a series aimed at studying crop tolerance over a range of plant growth stages. Herbicide selection for the initial trials was based primarily upon identifying chemicals likely to provide adequate crop safety and a reasonable period of residual soil activity in a nursery situation.

METHOD

Varying rates of 13 herbicides (Trial 1) were applied to kiwifruit seedlings (from the cv 'Hayward') field planted at Pukekohe Horticultural Research Station on 28 November 1979 (Table 1). The seven most promising herbicides were further tested on a commercial nursery near Pukekohe (Trial 2, also on cv 'Hayward') planted on 8 December 1979. Both sites were Patamahoe clay loam of 3 to 4% organic carbon.

Treatments were applied to eight plants at 100 x 30 cm spacing (Trial 1), or over 32 plants spaced 40 x 30 cm as a double row in Trial 2. Three replications in randomised blocks were used in Trial 1 and four replications in Trial 2.

The herbicides were sprayed over actively growing seedlings 10-15 cm tall with 4-5 leaves 7 days after planting. Except for the granulated formulation of dichlobenil, herbicide application was with a modified Oxford Precision sprayer using 400 litres/ha at 200 kPa. The herbicides were washed off half the plants (Trial 1) or all plants (Trial 2) 15 minutes after the treatment application, using a watering can (at 9 litres/5m²).

Irrigation (18 mm) was applied 4-6 hours after treatment application in Trial 1 and heavy rain followed two days later. No irrigation was available for Trial 2 and while light rain (3.4 mm) fell one day after herbicide application adequate soil wetting did not occur until 7 days (16.9 mm) and 8 days (48.5 mm) later.

The young vines were trained up strings to overhead wires and pruned to a single leader. Plant heights were recorded at three intervals after planting in Trial 1 (57, 68 and 82 days) and at five intervals (48, 59, 73, 82 and 96 days) in Trial 2 as an index of crop growth rate. Height recordings were made from all 8 plants in Trial 1 and from 10 marked plants per plot in Trial 2.

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Due to some missing plants in Trial 1 the statistical analysis of plant height was stabilised by using median plant height per plot (Table 1).

RESULTS

Crop growth

Mean plant heights recorded 57 and 82 days after planting (Trial 1) and 48 and 82 days after planting (Trial 2) are shown in Tables 1 and 2. Promising treatments which showed reasonable crop safety were alachlor (2 and 4 kg/ha), napropamide (2,4 and 8 kg/ha), oryzalin (2 kg/ha), propazine (1 and 2 kg/ha) and simazine (0.5 kg/ha). All other treatments caused unacceptable check or damage to the crop.

TABLE 1: Kiwifruit seedling herbicides screening at Pukekohe HRS. Herbicide effect on weed cover and kiwifruit plant height at 57 and 82 days after planting.

Treatment	Rate kg/ha	Weed rating % cover* 45 days	Median plant height (cm)	
			57 days	82 days
alachlor	2	5	42	96
alachlor	4	0	49	104
atrazine	1	5	27	89
atrazine	2	10	SC	SC
chlordiazon/chlorbufam	4	20	SC	SC
chlordiazon/chlorbufam	8	5	K	K
chlorthal-dimethyl	8	30	35	118
chlorthal-dimethyl	16	5	22	93
dichlobenil	4	0	K	K
dichlobenil	8	0	K	K
diuron	1	5	SC	SC
diuron	2	5	SC	SC
napropamide	2	60	58	124
napropamide	4	50	50	114
napropamide	8	45	56	113
oryzalin	2	20	40	116
oryzalin	4	10	29	95
oxyfluorfen	1	0	K	K
oxyfluorfen	2	0	K	K
oxadiazon	1.5	0	K	K
oxadiazon	3.0	0	K	K
prodiamine	4	0	33	121
prodiamine	8	0	31	115
propazine	1	10	67	113
propazine	2	10	45	112
propazine	4	5	26	64
simazine	0.5	40	59	138
simazine	1.0	5	46	90
hand weeded control		100	59	121
SC	severely checked (not included in statistical analysis)	CV%	34	26
K	all plants killed (not included in statistical analysis)	F Test	**	**
*	hand weeded after weed assessment	LSD 5%	25	46

In Trial 2, kiwifruit plant heights were recorded at five intervals after planting to plot growth curves in Fig. 1. These depict the best growth with alachlor (2 kg/ha), the poorest with prodiamine (8 kg/ha) while hand weeded control was intermediate.

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Similar curves 5-23% taller than hand weeded control were propazine (1 kg/ha), napropamide (4 kg/ha), simazine (0.5 kg/ha), and oryzalin (2 kg/ha). The remaining treatments with plant heights 6-25% lower than the hand weeded control were, in descending order, napropamide (8 kg/ha), oryzalin (4 kg/ha), chlorthal-dimethyl, (8 and 12 kg/ha) and prodiamine (4 kg/ha) (Table 2).

TABLE 2: Commercial nursery site. Herbicide effect on weed cover and kiwifruit plant height at 48 and 82 days after planting.

Herbicide	rate kg/ha	Weed rating % cover 40 days	mean plant height (cm)	
			48 days	82 days
alachlor	2	64	30.8	145
chlorthal-dimethyl	8	40	15.0	82
chlorthal-dimethyl	12	23	14.7	80
napropamide	4	90	26.0	110
napropamide	8	75	17.5	94
oryzalin	2	44	26.8	123
oryzalin	4	24	18.7	87
prodiamine	4	11	10.9	75
prodiamine	8	5	9.1	65
propazine	1	48	22.5	105
simazine	0.5	65	27.1	116
hand weeded control		95	20.8	100
CV %			19.0	21
F test			4.7*	12.7*
LSD 5%			5.5	30

In Fig. 1 the treatment differences present at the first (48 day) measurement remained constant throughout the recordings (covariance F test 0.45). Kiwifruit plants in the best herbicide treatments were significantly taller than the hand weeded controls throughout and probably reflect early differences in weed competition since hard weeding was not done till 42 days after planting.

Fig. 1 Growth curves of plant height in Trial 2 at five intervals after planting.

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Weed control

In Trial 1 where irrigation then rain followed soon after treatment application most treatments provided excellent weed control (Table 1). The notable exceptions among promising herbicides were the failure of napropamide, and to a lesser extent, oryzalin (2 kg/ha) to control black nightshade (*Solanum nigrum*). Simazine at 0.5 kg/ha was marginal for control of redroot (*Amaranthus powellii*) as well as barnyard grass (*Echinochloa crus-galli*), smooth witchgrass (*Panicum dichotomiflorum*) and yellow bristle grass (*Setaria glauca*). The low rates of propazine (1 and 2 kg/ha) failed to provide adequate control of summer grass (*Digitaria sanguinalis*).

In Trial 2, weed control was poor in most treatments because of lack of irrigation and adequate rainfall (Table 2). In spite of this, good weed control was achieved with prodiamine (4 and 8 kg/ha) while that for oryzalin 4 kg/ha was considered adequate.

DISCUSSION

Of the herbicides which displayed reasonable crop safety the best overall weed control was achieved by alachlor provided adequate moisture followed treatment application. The soil residual life of alachlor is, however, limited to less than 2 months.

Results on the effect of washing the chemical off the plants 15 minutes after application were inconclusive. For most treatments, including oxyfluorfen and oxadiazon which had marked contact activity, there were no differences when compared with the unwashed plants. There was, however, an unexplained difference where the high rates of alachlor (4 kg/ha), propazine (4 kg/ha) and simazine (1 kg/ha) were all improved by the post treatment hand watering soon after application. The plots were too small for reliable comparisons and further work is needed on this point.

In Fig. 1, kiwifruit plants in the best treatment were 48% taller than the hand weeded controls at the initial 48 day recording. Weed competition differences were the likely cause of this result as weeds (notably black nightshade) were equal in height to the kiwifruit plants when all plots were cleaned up by hand 42 days after planting. The hand weeded controls remained checked by this early competition and the mean plant height of the alachlor plots was 35% taller at the final 96 day measurement (Fig. 1).

Although simazine and propazine appeared safe at low rates which were also marginal for weed control any attempt to increase the rate is likely to be damaging to kiwifruit seedlings.

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