HERBICIDE TOLERANCE OF YOUNG NASHI AND APPLES

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SUMMARY

The herbicide tolerance of young nashi (*Pyrus pyrifolia*) and apples (*Malus sylvestris*) was tested in trials in Hawkes Bay. Atrazine, diuron, linuron, methabenzthiazuron, metribuzin, oryzalin, oxadiazon, oxyfluorfen, simazine, terbuthylazine and terbumeton were sprayed directly over seedling nashi and dormant bud nashi and apples. Oxadiazon and oxyfluorfen reduced nashi seedling growth, but not survival. Nashi cultivars, Hosui, Kosui and Nijisseiki responded differently to different herbicides with Kosui and Nijisseiki being most sensitive. Apple cultivars, Braeburn, Royal Gala and Fuji were suppressed by weed competition but showed good herbicide tolerance.

INTRODUCTION

Nashi or Asian pears are a new crop in New Zealand with a potential export future. There appears to be no published information on their herbicide tolerance so weed control may present some problems during the development of new orchards.

Much work has been done on weed control in apples and they show good tolerance to several herbicides (Fryer and Makepeace 1978). Recent work showed terbuthylazine to be a very effective and economic herbicide for establishing peaches, nectarines and apricots (Hartley 1987).

This work reports on weed control in, and herbicide tolerance of, nashi rootstocks and dormant buds, and on some new treatments for dormant bud apples.

METHODS

Trials were conducted at Hawkes Bay Agricultural Research Centre on Mangateretere silt loam (pH 5.9; sand 26%; silt 42%; clay 32%; organic C 3.7%; CEC 21.4% me). All herbicides were applied in 200 litres/ha by hand-held precision boom sprayer at 230 kPa. Herbicides were applied to bare ground.

In a two-replicate screening trial in 1985/86 seedlings of *P. pyrifolia* were planted 20 cm apart in single plot rows in October. Seedlings were container-grown, about 20 cm tall and in-leaf at planting. Within each plot three seedlings were planted before herbicide application and three after application. Those planted before application were either covered or exposed during spraying. Herbicides tested were alachlor (Lasso), atrazine (Gesaprim), chlorthal-dimethyl (Dacthal), clopyralid (Versatill), diuron (Karmex), linuron (Linuron 50), methabenzthiazuron (Tribunil), napropamide (Devinol), nitrofen (Tok-E25), oryzalin (Surflan), oxadiazon (Foresite), oxyfluorfen (Goal), simazine (Gesatop), terbuthylazine (Gardoprim), terbutryn (Igran) and trifluralin (Treflan). Weeds were hand-hoed on all plots after assessment in November. None of the treatments killed any seedlings. There were no significant differences in tree growth between herbicide treatments (averaged over all application methods) or between application methods (averaged over all herbicides) although the genetic variability of *P. pyrifolia* seedlings reduced the sensitivity of this trial.

On the basis of these results, several of the more effective and cheaper herbicides were selected for further testing in 1986/87. These trials, on seedling rootstocks and dormant buds, were all of a split-plot randomised design with four replicates. Herbicides were applied to the main plots with application methods or different cultivars on sub-plots.

Herbicide effect was assessed by measuring tree height above graft union and trunk diameter 15 cm above graft or ground. Weeds were assessed visually as percent ground cover.

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Rootstock Trial

Container-grown, tissue-cultured nashi 'seedlings' from a single clone were planted 20 cm apart in single row plots in early August, six plants per plot. Herbicides (Table 1) were applied over the seedlings on 21-22.8.86, with three plants exposed and three covered during spraying. Plants were in early leaf. Rainfall was 36 mm in the first week and 96 mm in the first month after treatment. All plots were kept weed-free throughout the growing season. A visual assessment of leaf damage was made in September.

Dormant Bud Trials

Nashi dormant buds were planted in late July 1986, 50 cm apart in single plot rows. Each plot contained four cv Hosui, two cv Kosui and two cv Nijisseiki dormant buds on seedling *P. pyrifolia* rootstocks. The cultivars were planted in groups with group location randomised within plots. Rootstock height was measured as a possible co-variant for future scion growth.

Apple dormant buds were planted likewise with six trees per plot, two of each of the cultivars Braeburn, Royal Gala and Fuji.

Herbicides (Table 2 and 3) were applied on 5-6.8.86 directly over the dormant buds after the rootstocks were cut back. Rainfall was 35 mm in the first week and 79 mm in the first month after treatment. Some additional weed control was applied to weedy plots in late spring/summer. Weeds were controlled on untreated plots by hand-weeding every 1-2 months.

RESULTS

Rootstock Trial

As there was no significant difference between plants covered or exposed during spraying the mean results for tree growth are shown (Table 1). The genetically uniform clonal material showed good tolerance to most herbicides used but oxadiazon and oxyfluorfen reduced both height and stem diameter significantly. Two weeks after herbicide application leaf blackening was observed on all treatments, including the untreated, indicating that frost damage had occurred (Table 1). The damage score was similar for covered and exposed plants in most cases. Greatest damage was observed on oxadiazon and oxyfluorfen plots both covered and exposed.

TABLE 1: Effect of herbicide treatments on *Pyrus pyrifolia* clonal seedlings.

Treatment (kg ai/ha) applied 21.8.86	Leaf damage ¹ score 4.9.86		Tree growth (mm)		
	covered	exposed	height (Oct)	height (Feb)	diameter (Feb)
handweeded		1.7	459	1090	11.5
diuron 2 + methabenzthiazuron 3	4.3	2.0	425	1100	11.9
linuron 2	4.0	3.2	410	1020	11.2
oryzalin 4	3.7	4.0	409	1070	11.8
oxadiazon 2	6.7	8.7	263	860	9.5
oxyfluorfen 1	7.7	9.7	227	750	9.0
simazine 3	3.3	2.3	412	1090	11.5
terbuthylazine 4	2.8	6.1	425	1070	11.3
terbuthylazine 2 + terbumeton 2 ²	3.2	3.7	408	1050	11.8
trifluralin ³ 1 + simazine 3	2.5	3.6	445	1070	11.3
LSD 5%			81	134	1.0
LSD 1%			110	181	1.4

¹ degree of leaf blackening : visual score 0-10 (0 = unaffected, 10 = all black)

² Caragard

³ pre-plant soil-incorporated

Nashi dormant buds

Diuron + methabenzthiazuron resulted in the best height growth, significantly better than untreated/hand-weeded, when averaged over all cultivars. Linuron + metribuzin and oxyfluorfen gave significantly greater trunk diameters than atrazine and oxadiazon (Table 2).

TABLE 2: Response of dormant bud nashi to herbicides and weed competition.

Treatment (kg ai/ha) applied 5-6.8.86	% weed cover (October)	Tree size (February 1987)					
		Height (cm)			Trunk diameter (mm)		
		Hosui	Kosui	Nijisseiki	Hosui	Kosui	Nijisseiki
untreated/hand weeded	74	113	76–	116	10.4	11.1	9.3
atrazine 2	2	144	136+	115	9.7	8.9	9.1
diuron 2 + methabenzthiazuron 3	25	148	117	145 +	9.5	10.5	10.0
linuron 2 + metribuzin 0.5	4	132	109	103	11.1 +	11.8 +	9.6
oryzalin 4	28	115	93	100–	11.1 +	8.6–	11.3
oxadiazon 2	18	145	114	125	8.9–	8.5–	10.2
oxyfluorfen 1	9	130	99	84–	11.4 +	9.4	11.9 +
simazine 3	10	147	114	133	10.8	9.5	11.5
terbuthylazine 4	2	149	120 +	90–	9.9	11.6 +	8.8–
terbuthylazine 2 + terbumeton 2	4	127	101	128	10.6	10.3	11.5
LSD 5%		38	43	43	2.1	3.0	3.0
Range		36	60	61	2.5	3.3	3.1

+ Significantly larger ($P < 0.05$) than –

Comparisons within scion cultivars showed Hosui to be least responsive to herbicides and weed competition with no significant effect of treatments on height and only oxadiazon giving significantly reduced trunk diameter. The other two cultivars responded more but to different treatments. Terbuthylazine increased height and diameter in Kosui, but both these measurements were depressed by the same treatment on Nijisseiki.

Height and diameter responses were not well correlated. Oxyfluorfen on Nijisseiki gave the shortest trees with greatest trunk diameters. With Kosui, atrazine gave the best height growth but small trunk diameters while weed competition on 'untreated/hand weeded' reduced height but not trunk diameter. There was no correlation between rootstock size and scion growth.

Apple dormant buds

Good weed control was given by linuron + metribuzin, oxyfluorfen, terbuthylazine and terbuthylazine + terbumeton (Table 3). Diuron + methabenzthiazuron, oryzalin and oxadiazon gave poor weed control, which resulted in significantly reduced tree growth, both height and diameter. There were no significant differences between treatments with similar levels of weed control or between cultivars.

TABLE 3: Response of dormant bud apples to herbicides and weed competition.

Treatment (kg ai/ha) applied 5-6.8.86	% weed cover (October)	Tree size (February 1987)	
		ht(mm)	diameter(mm)
untreated/hand weeded	37	616–	7.7–
diuron 2 + methabenzthiazuron 3	36	715–	8.7–
linuron 2 + metribuzin 0.5	1	976 +	10.7 +
oryzalin 4	70	731–	8.1–
oxadiazon 2	47	661–	8.1–
oxyfluorfen 1	6	965 +	11.3 +
terbuthylazine 4	5	848	10.2
terbuthylazine 6	2	861	10.4
terbuthylazine 2 + terbumeton 2	4	907 +	10.6 +
LSD 5%		154	1.85

+ significantly larger ($P < 0.05$) than –

DISCUSSION

The availability of tissue cultured clonal plants of *P. pyrifolia* rootstock enabled reasonably accurate measurements to be made of herbicide tolerance. Better tolerance was shown to most herbicides than expected in view of the extreme sensitivity of *P. pyrifolia* to mechanical damage, insect attack and many emulsifiable concentrate insecticides (P.R. Pattullo, pers. com.).

Damage from over-spraying with oxadiazon and oxyflurofen during active growth was not unexpected as similar effects had been found in peach seedlings (Hartley and Loader 1985) but the equally severe damage to 'covered' plants was surprising. The plants ranged in height when planted from about 10-30 cm. They were blocked on size and the damage to 'covered' plants was greatest on the smaller plants. Damage could have occurred from vapour activity or direct splash of soil carrying the herbicides. It would appear that damage was aggravated by frost. In the screening trial these herbicides had no lasting effect and trees so treated were among the biggest.

There appeared to be a difference in sensitivity between nashi cultivars, both to weed competition and in herbicide tolerance. Unlike nectarines (Hartley 1987), effects on height and trunk diameters of nashi were not well correlated. Possibly treatments reducing height while increasing diameter should be favoured as excessive height is a problem with nashi. Although several treatments produced this response it was cultivar x herbicide related.

The absence of any detectable correlation between seedling rootstock size and scion growth was surprising. Variability in size of rootstock was very apparent throughout the first year and it was expected such variability in vigour would affect scion growth.

Dormant bud apples behaved very uniformly. All scions responded similarly to treatments and showed much stronger response to weed competition than herbicides susceptibility.

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