EVALUATION OF HERBICIDES IN ESTABLISHING STONEFRUIT

R.B. MITCHELL

Invermay Agricultural Centre, Private Bag, Mosgiel

SUMMARY

In a series of trials conducted in 1984/85 on the light schist-derived soils of Central Otago, low rates of residual herbicides applied to newly planted stone-fruit in September gave excellent weed control until mid to late December. Dormant bud varieties of nectarines and peaches grafted to Golden Queen rootstock, and also Golden Queen seedlings tolerated a range of residual herbicides. Significant growth increases were recorded from dormant buds or seedlings growing in soil treated with terbacil, diuron, linuron, oryzalin, pendimethalin, dichlobenil/simazine and hand weeded control plots when compared with untreated control.

INTRODUCTION

Throughout New Zealand there is increased interest in stone-fruit as an export crop. New techniques use intensively planted stock to give a cash return in the third year after planting, an economic return within 5 years, with possible replacement in 10 years if improved cultivars are available. This system can only be successful in the absence of moisture stress, nutritional stress, and weed competition. Gaynor *et al* (1982) reported that the removal of weeds from nursery trees and newly planted orchards increased tree growth in the first year and this effect was maintained for the duration of a 6 year investigation. Rupp and Anderson (1985) found that cherry trees in herbicide treated plots came into production 1 year earlier than trees in un-weeded plots. Worldwide, there is a lack of information on herbicide tolerance in establishing stone-fruit due to the surface rooting tendencies of the stock used and the light (coarse-textured) soils on which they are grown. The dangers of root uptake of herbicide residues in the light, porous, schist-derived loamy sand soils imposed severe restrictions on the rates and types of herbicides used in the trial work reported here.

Trials were established to: (1) evaluate residual herbicides for weed control; (2) establish herbicide tolerance levels for recently planted dormant bud and seedling stone-fruit.

MATERIALS AND METHODS

Five trials were laid down on different properties in Central Otago in spring 1984; four on dormant bud plantings and one on seedlings grown from stones. All four dormant bud trial sites had been cultivated out of permanent pasture while the seedling trial was in a nursery area. Soil type for Trials A, C and D was a Molyneux shallow loamy sand, for Trial B a Pigburn shallow sandy loam and for Trial E a Molyneux stony sand.

Spray treatments for all trials were applied with a modified Oxford precision sprayer in 320 litres/ha using 8002 nozzles at 185 kPa. Dichlobenil granules were applied by hand. Hand-weeded plots were hoed at intervals about 1 month apart. All experiments were overhead sprinkler irrigated within 48 h of spraying. Adequate irrigation and other management inputs were carried out as normal by orchard staff during the growing season.

Dormant Bud Plantings: Trials A, B, C, D

Golden Queen rootstock was used, with a budded variety of nectarine or peach as shown in Tables 1-4. Grafted buds were not protected during herbicide application.

Trial A was planted on the flat and Trials B, C and D planted on machine formed ridges. Each plot contained three trees, with treatments randomised within tree rows

Proc. 40th N.Z. Weed and Pest Control Conf.

and replicated three times in Trial A and four times in Trials B, C and D. Plot length varied from 5 to 6 m but plot width was a constant 1.5 m either side of the line of planting.

The treatments applied in each trial are given in Tables 1-4. In Trial B, simazine rates were increased to compensate for the heavier Pigburn soil type which contains more fine clay particles and therefore has more ability to adsorb herbicides. Herbicides were applied to bare ground after the disturbed soil had settled but within 3 weeks of planting. Application was made as a 1.5 m wide band either side of the tree line, directed at the base of the trees. At the time of spraying occasional annual weeds had germinated and traces of perennial weeds or grasses had emerged.

Percentage weed cover was visually assessed 80 days after treatment in Trials A and B and 100 days in trials C and D. All trial areas were then hand weeded for the remainder of the growing season except for the untreated plots where the weeds were topped at infrequent intervals. Patches of couch regrowth in Trial C were suppressed with a spot application of fluazifop-butyl. Tree growth response was measured at the end of the growing season (June 1985) by recording height, butt circumference 10 cm above the bud union, and the number of laterals for each successfully budded tree in each trial.

In the dormant bud trials up to 25% of trees could not be included in the final measurements as the grafted bud had failed to grow. This bud failure appeared to be random and there was no statistical evidence that herbicides had caused any bud deaths.

Seedling Trial E

Golden Queen peach stones were planted in early October and the herbicide treatments (Table 5) applied 1 week later, prior to weed and crop emergence. Plot size was 3.5 x 1.5 m with four replicates, and after crop emergence each plot contained an average of 35 seedlings planted in two rows 70 cm apart. Visual assessments of weed control were made in mid January 1985 and the number of seedlings, their height and the percentage budded were recorded in late March. Nectarine buds had been grafted to suitable seedlings in early March.

TABLE 1: Tree and weed response to simazine/dichlobenil mixtures in Trial A — Cromwell. Variety: Flavourtop Nectarines. Treatments applied 5.9.84.

simazine kg ai/ha	dichlobenil kg ai/ha	%Weed cover 80 DAT	Tree measurements 280 DAT**		
			Height (cm)	Butt circum. (cm)	No. of laterals
0.75	0	1.1	104	6.5	19
0.5	3	0.5	92*	6.0	18
0.75	3	0.2	99	6.6	22
1.0	3	0.6	105	6.9	22
0.5	6	0.1	101	6.7	20
0.75	6	0.2	104	7.4	23
1.0	6	0.2	99	7.3	18
0.5	9	0.2	100	6.9	22
0.75	9	0.1	98	6.4	21
1.0	9	0.2	89*	6.5	18
hand weeded		13	101	6.3	18
untreated control		48	74	3.8	12
LSD			19.9	1.27	5.8

* Not significantly different from untreated control ($P>0.05$)

** Days after treatment

RESULTS

Trial A: Excellent control of annual and perennial weeds was achieved by all simazine/dichlobenil combinations (Table 1). Annual weeds were mainly shepherd's purse (*Capsella bursa-pastoris*), fathen (*Chenopodium album*) and annual grass (*Bromus* sp) while perennials present were dominated by yarrow (*Achillea millefolium*), sheep's sorrel (*Rumex acetosella*) and dock (*Rumex obtusifolius* and *crispus*).

TABLE 2: Tree and weed response to simazine/dichlobenil mixtures in Trial B — Roxburgh East. Variety: Fantasia nectarines. Treatments applied 18.9.84.

simazine kg ai/ha	dichlobenil kg ai/ha	%Weed cover 80 DAT	Tree measurements 270 DAT		
			Height (cm)	Butt circum. (cm)	No. of laterals
0.75	0	29	77	4.2*	11
0.75	3	6	86*	4.5*	13
1.12	3	3	83	4.5*	12
1.5	3	2	80	4.4*	13
0.75	6	3	89*	4.7*	14
1.12	6	1.1	83	4.5*	12
1.5	6	0.2	81	4.6*	13
0.75	9	2.1	84	4.7*	11
1.12	9	2.1	90*	4.9*	16*
1.5	9	1.1	89*	5.2*	19*
hand weeded		24	87*	4.5*	12
untreated control		91	69	3.4	11
LSD			15.7	0.63	3.7

* Significantly different from untreated control ($P < 0.05$)

TABLE 3: Weed control and tree response to residual herbicides Trial C — Cromwell. Variety: Flamecrest Peaches. Treatments applied 12.9.84.

Treatment	Rate kg ai/ha	%Weed cover 100 DAT	Tree measurements 280 DAT		
			Height (cm)	Butt circum. (cm)	No. of laterals
simazine	1.0	1	70	4.7	12
	1.5	1	84	5.6*	14*
oryzalin	1.5	4	81	5.1	13
	3.0	1	89*	5.7*	14*
linuron	1.0	5	78	4.8	12
	1.5	3	81	5.1	12
terbuthylazine/ terbumeton	0.5	11	78	4.3	9
	1.0	4	71	4.4	12
diuron	1.0	3	80	5.2	13
	1.5	1	85	6.2*	15*
terbacil	1.0	1	83	5.7*	16*
	1.5	0.1	87*	5.8*	16*
untreated control		18	68	4.0	9
LSD			17.2	1.25	4.9

* Significantly different from untreated control ($P < 0.05$)

The effect of weed removal on tree measurements is shown in Table 1. Except for tree height in two treatments, all growth measurements in all treatments were significantly greater than that in the untreated control.

Trial B: The main weeds at this site, fathen, annual grasses, spurrey (*Spergula arvensis*), yarrow, dock and dandelion (*Taraxacum officinale*) were reduced to 6% cover or less by all dichlobenil/simazine combinations (Table 2). Weeds surviving in the simazine 0.75 kg ai/ha treatment comprised 24% perennials. At the assessment date, 5 weeks had elapsed since the previous weeding and there had been prolific weed growth in the hand weeded plots. All tree growth measurements were equal to, or better than untreated control.

Trial C: The low weed population included fathen, grasses, storksbill (*Erodium cicutarium*), mulleins (*Verbascum* spp), viper's bugloss (*Echium vulgare*), sheep's sorrell, with occasional patches of couch (*Elytrigia repens*).

Good weed control resulted from all treatments and tree growth was increased by all herbicides (Table 3). The higher rates used had no detrimental effect on tree growth

TABLE 4: Effect of simazine in mixture with other herbicides on percent weed cover and growth of trees. Trial D — Earnsclough. Variety: Fantasia nectarines. Treatments applied 17.9.84.

	Rate kg ai/ha	% Weed cover 100 DAT		Tree measurements 280 DAT					
		0.5	1.0	Height (cm)		Butt circum. (cm)		No. of laterals	
simazine				0.5	1.0	0.5	1.0	0.5	1.0
dichlobenil	3	0.1	0.1	88	80	6.7	6.1	28*	23
	6	0.1	0.1	95*	71	6.6	5.0	23	22
pendimethalin	1	0.1	0.1	78	92	5.5	6.5	22	28*
	1.5	0.1	0.1	90*	67	7.1*	4.8	23	19
oryzalin	3	0.1	3.5	62	83	4.5	6.1	12	24
	4.5	2	3	91*	81	7.2*	6.1	27	22
hand weeded			2		94*		6.2		28*
untreated			16		65		4.7		17
LSD					23.2		2.04		8.5

* Significantly different from untreated control ($P < 0.05$)

TABLE 5: Effect of herbicides on weed cover and growth of Golden Queen peach seedlings in Trial E. Treatments applied 8.10.84.

	Rate kg ai/ha	% Weed cover yarrow	cover couch	100 DAT annuals	Tree development 160 DAT	
					Height (cm)	%budded
pendimethalin	1	0.1	6	6	66	84
	2	0.1	44	3	60	71
napropamide	3	8	0.5	46	58	64
	6	1	0	68	65	67
dichlobenil	2	1	5	8	70*	83*
	4	0.1	5	4	69	77*
oryzalin	3	3	20	11	76*	79*
	6	4	15	1	74*	75*
norflurazon	1.5	2	5	78	52	60
	3	5	15	35	63	64
linuron	1	0.1	7	3	74*	90*
	2	1	19	0.1	75*	89*
untreated control		1	1	90	55	48
LSD					14.1	23.6

* Significantly different from untreated control ($P < 0.05$)

indicating good tolerance to the chemicals used.

Trial D: Weeds were easily controlled on the very coarse textured light soil at this site, and only traces of weeds, mainly downy brome (*Bromus tectorum*), remained 100 days after treatment. The dangers of using herbicides on irrigated light loamy sand soils are shown in Table 4 where the 1.0 kg ai/ha rate of simazine caused growth suppressions when combined with the high rate of each of the other herbicides.

Trial E: Black nightshade (*Solanum nigrum*) and fathen were the dominant weeds at this site with lesser amounts of willow weed (*Polygonum persicaria*), brome grass and yarrow. Pendimethalin, dichlobenil, linuron and oryzalin gave good weed control (Table 5). Napropamide failed to control black nightshade while norflurazon left varying amounts of annual weeds.

Couch occurred in small irregular patches of varying density over the trial area. Percentage couch cover does not, therefore, necessarily indicate the degree of control normally expected from a particular herbicide. Where 50% or more cover of couch occurred in a plot, peach seedling growth was reduced.

Some seedlings in the 3 kg ai/ha norflurazon treatment exhibited short-lived symptoms of leaf yellowing 7 weeks after spraying but no phytotoxic effects were noticed in any other treatment.

Because new bud varieties are only grafted on seedlings which meet a sufficient standard of size and vigour, the percentage budded (Table 5) reflects the strength of seedling growth for each treatment.

DISCUSSION

Excellent weed control was achieved with most materials used. The combination of dichlobenil/simazine, and terbacil alone gave best control where both annual and perennial weeds were present. The efficiency of dichlobenil alone was not tested, but recent results in established blackcurrant plantations indicated that maximum weed control was only achieved if simazine was added (Meeklah and Mitchell 1982). Weed control at the rates used in this series of trials persisted only until mid to late December, with the exception of terbacil where weed cover remained low for up to 5 months after application. The overhead watering which maintained moist growing conditions, combined with the coarse textured soil types, limited the length of weed control gained from light rates of residual herbicides.

Grafted buds and the Golden Queen peach stock, as well as Golden Queen seedlings tolerated low rates of the residual herbicides applied soon after planting. Tree growth data indicated that the removal of weeds resulted in taller, stronger trees in the year following planting.

Future work will be aimed at weed control for the entire growing season. This will necessitate a mid season application, the timing of which will be dictated by the success of the materials applied at planting. In addition, the danger of excessive herbicide residue accumulation will need to be considered.

ACKNOWLEDGEMENTS

Thanks to Allan Meeklah for his help with the text, Ron Abernethy, Tad Jacyna and Sue Trappitt for technical assistance. Also Noel Paulin, Jeremy Elvidge, Peter Taylor, Ray Goodall and John McLaren for allowing us to experiment on their new plantings.

REFERENCES

- Gaynor, J.D., Marriage, P.B., Layne, R.E., Hamill, A.S., 1982. Weed management systems and herbicide residues in nursery trees and newly planted peach orchards. *Proc. 1982 British Crop Protection Conference — Weeds*: 255-261.
- Meeklah, F.A. and Mitchell, R.B., 1982. Weed control in blackcurrants. *Proc. 35th N.Z. Weed and Pest Control Conf.*: 62-66.
- Rupp, L.A. and Anderson, J.L., 1985. Growth and fruiting responses of young apple and tart cherry trees to weed control. *Hort. Sci.* 20(4): 727-729.

Chemical Appendix:

Herbicides evaluated were dichlobenil (Casoron 7.5G), simazine (Shell Simazine 50sc), terbacil (Sinbar), diuron (Karmex), linuron (BASF Linuron), oryzalin (Surflan), pendimethalin (Stomp 330 E), terbuthylazine/turbumeton (Caragard 500 FW), napropamide (Devrinol 50), norflurazon (Solicam), fluzafop-butyl (Fusilade).