

## GROWTH RESPONSE OF STONEFRUIT TO TWICE YEARLY APPLICATIONS OF RESIDUAL HERBICIDES

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### SUMMARY

Residual herbicides applied twice yearly for weed control in stonefruit plantings did not inhibit tree growth. Applications were made in August/September and again in December for either 1 or 3 years. The additional December treatments extended the period of weed control into autumn but did not result in significantly increased tree growth. Continued weed competition had more effect on tree butt circumference than tree height in the first year.

### INTRODUCTION

The use of residual herbicides for weed control in dormant bud stonefruit has been reported by Hartley (1987, 1988) and Mitchell (1987, 1989). Both authors found that competition from weeds in the 4 to 5 months after planting suppressed tree development. They also reported that young trees tolerated a wide range of residual herbicides and that tree growth in herbicide treated areas was similar to that recorded in hand-weeded plots. However, the period of effective weed control using low rates of residual herbicides in dormant bud plantings is relatively short. Either hand weeding or spraying is generally necessary by December to control a fresh germination of weeds.

This paper reports the effects on tree growth and length of weed control of residual herbicides applied twice to stonefruit plantings during the growing season for either 1 or 3 years.

### MATERIALS AND METHODS

In 1985, six trials were established on dormant bud stonefruit plantings in Central Otago. Golden Queen rootstock was common to all trials. All sites were overhead irrigated. Trees were managed to standard orchard practice as regards fertiliser, fungicide treatments, pruning and fruit thinning.

**Series A.** This consisted of three trials, one at Bannockburn, (var. Flamecrest peaches) and two at Roxburgh East; one each at Awikiki (Fantasia nectarines) and Kerrimuir (Sundrop apricots). Soil types were a Molyneux stony sand at Bannockburn, Matakanui stony loam at Awikiki and a Pigburn fine sandy stony loam at Kerrimuir.

A total of 144 dormant buds were planted into ridged rows at each site in September 1985 and a combination of dichlobenil granules (Casoron 7.5G) and simazine (Shell simazine 50 SC) was applied to all rows as a 1.5 m band either side of the tree line within 3 weeks of planting. Dichlobenil was applied with a tractor mounted Vicon Vari Spreader at 4.8 kg/ha at Bannockburn, 5.1 and 6.5 kg/ha at Awikiki and 7.2 and 11.25 kg/ha at Kerrimuir. Simazine 0.75 kg/ha was applied with a Solo knapsack delivering 320 litres of water/ha.

In mid-December a four replicate trial using the treatments shown in Table 1 with each plot containing three trees was placed on the ridges previously treated with dichlobenil/simazine. Shoot growth was protected from spray contact by plastic sleeves. Weeds were removed from hand weeded plots in December, January and February. Weed control was visually assessed at various times with tree growth measurements taken in June 1986.

**Series B.** Three trials, one each at Cromwell (Fairlane nectarines), Earnsclough (Cal Red peaches) and Awikiki (Fantasia nectarines) evaluated the effects of residual herbicides applied twice a year over 3 years. Soil types were a Molyneux shallow loamy

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sand at Cromwell and Earnsclough and a Matakanui stony loam at Awikiki. Four combinations of dichlobenil/simazine and one of dichlobenil/terbacil (Sinbar) were applied to dormant buds after planting in August or September 1985 (Tables 2 and 3).

Hand weeded and unweeded treatments were included for comparison. Dichlobenil was spread by hand while simazine and terbacil were applied with an Oxford precision sprayer through 8002 fan nozzles. Each ridged plot contained six trees, and was replicated four times. In December 1985 these plots were halved and either simazine or terbacil applied to each sub-plot. The sub-plot treatments were repeated in September and December 1986 and again in the same months in 1987, except at Earnsclough where the December 1986 spraying was not applied. In September 1986, the unweeded treatment was split and treated with either glyphosate (Roundup) or dichlobenil. Dichlobenil was also applied to one half of the handweeded treatment. From this date, all sub-plots, except the handweeded sub-plot were maintained virtually weed free with spot sprayings of either glyphosate, glufosinate-ammonium (Buster) or paraquat/diquat (Preeglone) between the residual sprayings. The hand-weeded sub-plots were hoed monthly.

Percentage weed cover was visually estimated at various times. Tree growth was measured in June 1986, 1987 and 1988 at all sites except height was not recorded at Awikiki in 1988 as the main leaders had been cut back.

In March 1988 fruit was weighed and counted from the Cromwell trial.

## RESULTS

**Series A.** The basal September application of dichlobenil/simazine achieved excellent weed control and only traces of mallow (*Malva* spp.), yarrow (*Achillea millefolium*), dock (*Rumex obtusifolius*), sheep's sorrell (*R. acetosella*), Kentucky bluegrass (*Poa pratensis*) and downy brome (*Bromus tectorum*) were present when the small plot treatments were applied in mid-December 1985.

With the exception of pendimethalin (Stomp 330E), all herbicides applied in December 1985 maintained adequate weed control until April 1986, with terbacil the most effective (Table 1). Downy brome was the dominant weed at this date.

In four instances at Bannockburn, tree growth was significantly reduced ( $P < 0.05$ ) by the December herbicide application. However, this did not occur at the other sites

**TABLE 1: Weed cover (17-4-86), tree height and butt circumference (June 1986) in Series A trials.**

Treatments applied Dec 1985	Rate kg/ha	Bannockburn			Kerrimuir			Awikiki		
		Weeds %	Hgt cm	Butt cm	Weeds %	Hgt cm	Butt cm	Weeds %	Hgt cm	Butt cm
terbacil	1.0	1	85	5.6	3	170	6.3	1	70	4.1
	1.5	1	90	5.8	6	192	6.4	1	64	3.8
simazine	1.0	14	88	5.1	17	186	6.4	16	71	4.1
	1.5	5	73	3.7	8	206	6.9	10	74	4.2
diuron (Karmex)	1.0	7	68	3.4	9	174	6.3	20	73	4.4
	1.5	2	85	5.0	9	154	5.2	11	56	3.5
terbacil/ pendimethalin	1.0 1.5	2	73	4.4	4	170	6.4	2	59	3.8
simazine/ pendimethalin	1.0 1.5	9	79	4.5	16	149	5.9	8	57	3.9
diuron/ pendimethalin	1.0 1.5	7	86	5.8	15	200	7.3	18	68	3.7
pendimethalin	1.5	22	76	4.0	43	204	6.8	32	74	4.3
handweeded control*	50	83	4.8	6	176	5.8	13	90	4.7	
basal only**	27	90	5.4	38	194	6.6	26	84	4.8	
LSD 5%			12	1.4		48	1.6		28	1.7

\* weed growth since mid-February

\*\* dichlobenil/simazine applied as a basal treatment in September 1985

**TABLE 2: Tree height (cms) in June of each year in Series B trials.**

Treatment (kg ai/ha)				Cromwell			Earnsclough			Awiki	
(1)		(2)		1986	1987	1988	1986	1987	1988	1986	1987
dichlobenil	3/	simazine	0.75	92	193	287	97	182	273	103	188
simazine	0.5	terbacil	0.75	103	199	291	78	161	238	96	183
dichlobenil	3/	simazine	0.75	101	214	298	81	161	253	85	172
simazine	1.0	terbacil	0.75	95	198	287	85	168	242	86	176
dichlobenil	6/	simazine	0.75	95	200	288	81	163	258	83	192
simazine	0.5	terbacil	0.75	86	204	280	83	158	229	99	187
dichlobenil	6/	simazine	0.75	89	201	292	83	171	248	89	173
simazine	1.0	terbacil	0.75	92	196	277	87	169	238	84	168
dichlobenil	3/	simazine	0.75	101	197	267	85	159	244	84	173
terbacil	0.75	terbacil	0.75	89	183	274	88	175	254	83	167
handweeded	—			97	199	287	86	185	271	90	181
	*dichlobenil 3				218	301		162	241		185
unweeded	*dichlobenil 6			73	176	265	66	131	212	83	166
	*glyphosate 2.1				191	284		122	201		172
LSD 5%	sub-plot comparisons			17	17	19	9	17	21	12	16
	other comparisons			20	25	26	11	27	34	18	25

(1) Applied August or September 1985

(2) Applied December 1985, September &amp; December 1986, September &amp; December 1987

\*From September 1986

**TABLE 3: Butt circumference (10 cms above bud union) in June of each year in Series B trials.**

Treatment (kg ai/ha)				Cromwell			Earnsclough			Awiki		
(1)		(2)		1986	1987	1988	1986	1987	1988	1986	1987	1988
dichlobenil	3/	simazine	0.75	6.5	12.9	20.1	6.4	11.8	17.0	5.8	10.5	15.7
simazine	0.5	terbacil	0.75	7.4	14.2	21.6	5.0	10.1	14.2	5.8	11.5	15.3
dichlobenil	3/	simazine	0.75	6.9	14.6	20.9	5.1	10.5	14.4	5.2	9.3	13.3
simazine	1.0	terbacil	0.75	6.7	12.7	20.4	4.8	10.7	15.1	5.3	10.0	14.0
dichlobenil	6/	simazine	0.75	6.3	13.2	21.2	4.7	10.2	14.8	5.0	11.1	14.9
simazine	0.5	terbacil	0.75	6.0	13.7	21.0	5.1	10.7	15.1	6.1	11.3	15.3
dichlobenil	6/	simazine	0.75	6.1	14.3	21.2	5.0	11.0	15.3	5.2	10.4	15.1
simazine	1.0	terbacil	0.75	6.5	13.0	20.6	5.2	10.8	14.9	5.0	10.2	14.8
dichlobenil	3/	simazine	0.75	6.8	14.1	21.0	5.3	10.4	14.8	5.2	10.0	14.8
terbacil	0.75	terbacil	0.75	6.6	12.7	20.5	5.6	11.4	16.4	5.0	9.8	14.0
handweeded	—			6.7	14.0	21.1	5.1	10.6	15.2	5.6	10.6	15.5
	*dichlobenil 3				14.8	21.8		9.7	14.0		10.3	14.3
unweeded	*dichlobenil 6			4.5	11.2	19.5	3.1	8.4	12.8	4.4	9.7	13.5
	*glyphosate 2.1				13.1	20.6		7.0	11.3		9.3	14.3
LSD 5%	sub-plot comparisons			1.2	1.3	1.4	0.7	1.5	1.6	0.8	1.2	1.3
	other comparisons			1.4	1.9	2.1	1.1	2.1	2.6	1.0	1.6	1.8

(1) Applied August or September 1985

(2) Applied December 1985, September &amp; December 1986, September &amp; December 1987

\*From September 1986

and was not consistent at Bannockburn. The extended period of weed control had no apparent beneficial effect on tree growth.

**Series B.** By early November 1985, weed cover in the unweeded treatment totalled 50% at Cromwell, 20% at Awikiki and 15% at Earnsclough and had increased to over 80% cover at all sites by February 1986. Fathen (*Chenopodium album*), shepherd's purse (*Capsella bursa pastoris*), downy brome, storksbill (*Erodium cicutarium*) and sheep's sorrel were common to all three trials. September treated plots contained less than 5% weed cover in mid-December 1985 when the sub-plot treatments were first applied. By February 1986 simazine sub-plots averaged 20% weed cover with 2% cover on the terbacil sub-plots.

The combination of residual herbicides plus spot sprayings of glyphosate, glufosinate-ammonium or paraquat/diquat to control seedlings, kept weed cover at a very low level over the next two seasons. Storksbill, haresfoot trefoil (*Trifolium arvense*), clover spp. and downy brome germinated throughout the duration of the trials. Fewer weeds germinated in terbacil sub-plots than in simazine sub-plots. Patches of couch (*Elytrigia repens*) at Awikiki were controlled by repeat spot applications of fluazifop-butyl (Fusilade).

Both tree height and butt circumference at Earnsclough and Cromwell were significantly lower ( $P < 0.05$ ) in the unweeded treatment in 1986 (Tables 2 and 3). There were few growth differences at Awikiki. In 1987 and 1988 significant growth differences were more evident in the previously unweeded sub-plots at Earnsclough than at either Cromwell or Awikiki where trees were growing under better conditions.

#### Fruit yield

The continued use of either simazine or terbacil over 3 years did not affect fruit numbers or tree yield (Table 4).

**TABLE 4: Yield of Fairlane Nectarines at Cromwell in March, 1988.**

	Treatment (kg ai/ha)		Weight kg/tree	Number of fruit per tree	
	(1)	(2)			
dichlobenil	3/	simazine	0.75	3.7	30
simazine	0.5	terbacil	0.75	4.4	34
dichlobenil	3/	simazine	0.75	7.8	64
simazine	1.0	terbacil	0.75	6.8	54
dichlobenil	6/	simazine	0.75	4.7	38
simazine	0.5	terbacil	0.75	5.6	43
dichlobenil	6/	simazine	0.75	7.0	53
simazine	1.0	terbacil	0.75	7.3	55
dichlobenil	3/	simazine	0.75	5.9	45
terbacil	0.75	terbacil	0.75	5.4	47
handweeded				7.0	55
		*dichlobenil 3		6.4	50
unweeded		*dichlobenil 6		4.4	35
		*glyphosate 2.1		4.5	39
LSD 5%		for sub-plot comparison		1.9	17
		columns		4.1	32

(1) Applied August 1985

(2) Applied December 1985, September & December 1986, September & December 1987

\*From September 1986

#### DISCUSSION

These trials confirm earlier trial work (Hartley 1988; Mitchell and Abernethy 1989) showing that the removal of weed competition from dormant bud stonefruit plantings soon after planting results in good tree growth. The advantages of establishing trees with good strong butt growth in the first year become apparent in later years when

pruning height and shape of a tree is largely determined by the strength of butt growth. Where weeds are not controlled some compensatory tree growth is possible in the second year on better soil types and under good growing conditions as shown at Cromwell.

The repeat herbicide application in December extended the period of weed control into autumn but this did not significantly increase tree growth. Even where simazine and terbacil were applied twice a season for three consecutive seasons, spot treatments were necessary to control resistant weeds, or weeds which had germinated between residual applications. As found in previous trials, no tree deaths could be attributed to herbicide up-take (Hartley 1987; Mitchell 1987). There was no evidence that continued twice yearly applications of either simazine or terbacil had any adverse effect on fruit production.

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