WEED CONTROL IMPROVES THE GROWTH AND YIELD OF YOUNG FRUIT TREES

M.J. HARTLEY

*MAFTech, Hawkes Bay Agricultural Research Centre,
P.O. Box 85, Hastings.*

SUMMARY

The effect of weed competition on first year growth of nectarines, apples and nashi was measured in trials conducted in Hawkes Bay. Weeds and white clover (*Trifolium repens*) reduced height and trunk diameter of young nectarine trees, especially if present in October and November. Weeds also reduced trunk diameter of young apple and nashi trees and affected branch structure of apples. There was a significant relationship between nectarine tree size at the end of their first season and fruit yield in their second season.

INTRODUCTION

Shribbs and Skroch (1986) showed most ground cover plants, including legumes, reduced young apple tree growth while Atkinson and Crisp (1983) showed the yield of both young and mature apple trees can be increased by good weed control.

First year growth of nectarine trees from dormant buds can be significantly increased by good weed control (Hartley 1987a; Mitchell 1987). The effect of this increased tree size has not been quantified in subsequent fruit yield. Any increase in early fruit production could be important to the economic viability of nectarine growing.

This paper reports the effect of good weed control and first year growth on subsequent fruiting of nectarines under Hawkes Bay conditions and also the effect of weed competition on the growth of young apples and nashi.

METHOD

Weed Competition Trials

Weed competition trials were conducted in 1986-87 on nectarines (cv Redgold on Golden Queen seedling rootstocks) and in 1987-88 on apples (cv Granny Smith on MM106, cv Braeburn on M793 and cv Fuji on M26) and on nashi (cv Hosui on *Pyrus pyrifolia*). Trees were planted out in July, as dormant buds, two or three of each cultivar per plot, 1 m apart with 2 m between plots. There were four replicates.

Weeds or clover were allowed to grow at different periods during spring and summer. In the nectarine trial, weed/clover populations were manipulated to be white clover dominant or 'other weeds' dominant (Table 1) by use of paraquat, MCPB and clopyralid. In the apple and nashi trials, weed competition periods (Table 2) were manipulated by paraquat spray or cultivation applied in October, November and December as required. Cultivation was done by hand driven rotary cultivator to within 15 cm of trees, along rows and between trees and remaining weeds were removed by hand.

Comparison was also made with five herbicide treatments on apples and one on nashi. Herbicides used were terbuthylazine (Gardoprim) 4 kg/ha, diuron (Karmex) 2 kg/ha plus methabenzthiazuron (Tribunil) 3 kg/ha, oxyfluorfen (Goal) 1 kg/ha, simazine (Gesatop) 4 kg/ha and terbacil (Sinbar) 1.5 kg/ha. Only terbuthylazine was used on nashi. All herbicides were applied by precision boom sprayer, in 200 litres/ha at 230 kPa, directly over the newly planted dormant buds on 4.8.87. Plots were kept weed free by spot treatment as necessary.

All trees were measured in April for height above graft and trunk diameter, 15 cm above graft. The apple trees were also scored 0-10 for development of branches. A tree

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with a score of 5 would have adequate branches for future structural development.

Fruit Yield Trials

Fruit yield of nectarines was measured on two randomised block trials. One block used cv Redgold from the weed competition trial and the other cv Fantasia from a 1986 herbicide trial (Hartley 1987a). In each block, five similar trees were selected from each of eight treatments (Tables 3 and 4) which gave a range of tree sizes.

The trees were transplanted in July 1987 in row 3 m apart with 2.5 m between trees. The trees were supplied with trickle irrigation and routine fungicide spray. All plots were treated with terbuthylazine 4 kg/ha and kept weed free.

The fruit was thinned in November and harvested in February 1988, with numbers and weight recorded.

RESULTS

Weed Competition

The effect of weed or clover competition on nectarines at different period, is shown in Table 1. If weeds or clover were controlled by late October the effect on tree growth was not serious but any further delay in control resulted in significant reduction in tree size. If weeds and clover were only controlled to early October little benefit was gained but control till mid November was beneficial. This result might have been different if higher rainfall had induced more weed growth. Rainfall was: November—25 mm, December—15 mm, January—14 mm and February—29 mm. The weeds were mainly black nightshade (*Solanum nigrum*), red root (*Amaranthus* sp) and prostrate amaranth (*A. deflexus*).

TABLE 1: Effect of weed and clover competition on growth of nectarines cv Redgold.

Period of Weed/Clover Competition								Tree Growth (mm) (March)			
								With Weeds		With Clover	
A	S	O	N	D	J	F	M	Height	Diameter	Height	Diameter
			No Weeds					1260	19	1210	19
			XXXXXXXXXXXXXXXXXXXX					830**	9**	960**	13
			XXXXXXXXXXXXXXXXXXXX					1190	16		
			XXXXXXXXXXXX					1110	18	1190	18
XXXXXXX								1080*	17	1060	14*
XXXXXXXXXXXX								880**	14*		
XXXXXXXXXXXXXXXXXXXX								700**	7**	840**	10**
XXXXXXXXXXXXXXXXXXXX								760**	7**	920**	11**
LSD	5%							180	4.0	180	4.2
	1%							240	5.5	250	5.8

*, ** significantly less than "no weeds" P=0.05, P=0.01

The effect of weed competition on apples and nashi in 1987-88 is shown in Table 2. There was no significant difference between paraquat and cultivation treatments or between residual herbicide treatments on apples so the appropriate data have been combined. There was also no significant interaction between treatment and cultivar of apples and so the cultivar data have also been combined. Weed competition had little effect on height growth but significantly reduced trunk diameter of apples and nashi and branching score of apples.

Fruit Yield

The effect of first season growth on the following year's fruit production is shown in Tables 3 and 4. First years' growth had a significant effect on both numbers and weight of fruit in the second year. The relationship of yield (kg/tree) to first years' extension growth above the graft in m (ht) was:

Fantasia Yield = 1.32 ht—0.56 ($R^2=0.48^{**}$; $n=32$)
 Redgold Yield = 1.13 ht—0.37 ($R^2=0.36^{**}$; $n=40$)

Small trees showed some compensatory growth in the second year, especially for trunk diameter, but were still significantly smaller than better grown first year trees (Tables 3 and 4).

TABLE 2: Effect of weed competition on growth of apples and nashi.

Period of Weed Competition								Apple			Nashi	
A	S	O	N	D	J	F	M	Height	Diameter	Br. Score†	Height	Diameter
			No weeds					1670	17.5	5.5	1560	12.3
			XXXXXXXXXXXXXXXXXX					1540	11.7**	1.7	1300	9.5**
			XXXXXXXXXXXXXXXXXX					1600	13.7**	3.3	1200*	9.9*
								1580	18.7	5.8	1500	11.9
			XXXXXX					1520*	14.5*	1.9	1310	9.9*
			XXXXXXXXXX					1580	12.8**	2.0	1400	9.5**
			XXXXXXXXXXXXXXXXXXXXXX					1690	18.6	6.0	1560	12.0
			Herbicides									
LSD	5%							120	2.4		310	1.8
	1%								3.1			2.4

*, ** significantly less than "no weeds" $P=0.05$, $P=0.01$

† Branching score for Granny Smith and Braeburn only. Fuji had negligible branching in all treatments.

TABLE 3: Effect of herbicide treatment on first year tree growth (Hartley 1987a) and fruiting in the second year — Nectarine cv Fantasia.

First year treatment (kg ai/ha) applied 5-6.8.86	%Weed cover	Tree size (mm) (March 87)		No. Fruit and yield/tree (Feb 88)		
		Height*	Diameter*	Thinned	Harvest	kg
untreated	100	810 (1440)	7 (26)	0.5	1.5	0.21
oryzalin 4	54	990 (1740)	8 (27)	2.3	4.0	0.51
oryzalin 4 + metribuzin 0.5	36	1070 (1800)	9 (27)	2.5	7.8	0.86
terbacil 1	15	1150 (1910)	14 (33)	5.5	8.0	0.99
oxadiazon 2	16	1270 (1850)	15 (29)	12.3	11.3	1.11
oxyfluorfen 1	4	1340 (1900)	18 (28)	11.0	17.5	1.61
terbuthylazine 6	4	1380 (1970)	17 (29)	15.3	17.8	1.71
hand weeded	-	1400 (2120)	17 (35)	23.5	24.5	2.13
LSD 5%		130 (210)	2.2 (4.6)	10.7	8.2	0.79

* Figures for March 1988 in parenthesis.

DISCUSSION

The most critical time for weed competition to affect tree growth appears to be October-November, a period of rapid weed growth. With nectarines, weed competition affected both tree height and trunk diameter whereas with apples and nashi the main effect was on trunk diameter. A visual scoring of apple branching showed weed competition during October-November seriously depressed the development of a good branch structure. Late season weed competition, after November, had a greater effect on apples and nashi than it did on nectarines. This may have been a result of different summer rainfall and subsequent weed growth. Rainfall, November to January

inclusive, was 54 mm in 1986-87 and 127 mm in 1987-88. The growth of apples in all herbicide treatments was as good as in weed free controls, confirming previous work which showed that apples have good tolerance to a range of herbicides (Hartley 1987b).

Some growers believe clover to be a useful ground cover because of its nitrogen fixation properties. These results would negate this belief and support the work of Shribbs and Skroch (1986) who found legumes had a very depressing effect on growth of young apple trees.

The strong relationship between tree growth in the first year with fruit yield in the following year shows the value of good weed control and initial tree growth. Small, low fruiting trees, showed compensatory growth, especially for trunk diameter, in the second year but were still significantly depressed at the end of the second season. It could be anticipated, therefore, that yield would still be affected in the second fruiting season. A similar reduction in yield could also be expected in young apples especially where weed competition has affected branch structure development.

TABLE 4: Effect of weed/clover competition on first year tree growth and fruiting in the second year Nectarines cv Redgold.

Weed/Clover period*												
1986/1987												
Month												
								Tree size (mm)		No. Fruit and yield/tree		
								(March 87)		(Feb 88)		
A	S	O	N	D	J	F	M	Height**	Diameter**	Thinned	Harvested	kg
XXXXXXXXXXXXXXXXXXXX								720 (1610)	7 (27)	0.6	2.0	0.21
XXXXXXXXXXXXXXXXXXXX								880 (1850)	10 (32)	3.2	2.2	0.41
OOOOOOOOOOOOOOOOOO								890 (1900)	9 (32)	5.2	2.2	0.45
XXXXXXXXXXXX								990 (1670)	13 (29)	5.0	7.4	0.83
OOOOOOOOOOOOOOOO								1030 (1740)	12 (29)	5.2	9.2	0.91
XXXXXXX								1210 (2040)	19 (37)	8.2	10.4	1.01
XXXXXXXXXXXXXXXXXXXX								1250 (1910)	18 (33)	11.0	13.2	1.27
								1360 (2130)	21 (38)	10.8	18.8	1.75
LSD 5%								150 (330)	2.7 (7.6)	7.7	8.9	0.80