

## A SURVEY OF WEED CONTROL PRACTICES IN NEW ZEALAND PIPFRUIT ORCHARDS

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### SUMMARY

Weed control practices in 77 randomly selected pipfruit orchards were surveyed in 1989/90. Most growers had herbicide strips 2-3 m wide under tree rows with mowed grass-dominant strips of vegetation between rows. Two used mulches and none cultivated, but 47% used grazing animals in autumn. Herbicide programmes varied widely. Knockdown herbicides were applied from one to five times, and residual herbicides from none to three times, per year. Glyphosate and amitrole were the most commonly used knockdown herbicides, while triazines (particularly simazine and terbuthylazine/terbumeton) were the most popular residual herbicides. The 12 most troublesome weeds are listed.

**Keywords:** orchard crops, apple, pear, nashi, timing of applications

### INTRODUCTION

A review of weed control practices in New Zealand orchards in 1968 showed that most orchards had mown permanent grass swards and that the use of amitrole, paraquat and simazine was becoming an accepted technique for minimizing grass growth near the base of trees (Slade 1968). A similar review in 1979 noted that a number of weed problems had built up in orchards following repeated use of these herbicides (Taylor 1979). Many of these weeds were being treated with hormone herbicides and the release of glyphosate in New Zealand was predicted to be useful in overcoming some of these problems. Since then, a number of new herbicides, in addition to glyphosate, have been released which can be used safely in orchards (Hartley 1984; Hartley 1987). Research has also shown that yields in orchards can be improved significantly by replacing the mown grass alley-ways with bare ground (White and Atkinson 1984). This paper presents the results of a survey of weed control practices in New Zealand pipfruit orchards conducted in the 1989-90 season which assesses whether new herbicides and weed control techniques have been adopted by growers and the effects of control strategies on weed problems.

### METHODS

During the 1989-90 growing season, 77 pipfruit growers were visited and interviewed about their weed control techniques for that season. Details of the survey questions are listed elsewhere (Berry 1992). There were 40 growers from Hawkes Bay, 34 from Nelson and three from Manawatu, all randomly selected from suppliers to the NZ Apple and Pear Marketing Board. Apples were grown by 97% of the surveyed growers, European pears by 44% and nashi by 8% of growers.

### RESULTS AND DISCUSSION

Despite evidence that removal of all vegetation from orchard floors can improve fruit yields, none of the orchardists surveyed had adopted this practice. All orchards had mown permanent grass alley-ways. Only one orchardist grew grass within tree rows and cross-mowed throughout his property, though even this grower used herbicides to keep weeds clear from the base of each tree. All other orchards used herbicides to create strips of bare ground within each tree row, though small areas of five orchards

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still had cross-mowing in old blocks.

There was no cultivation of soil around established trees. Only two growers made use of mulches for control of weeds near the base of trees anywhere on their properties, and these growers used straw or mower clippings rather than black plastic. Weeds were controlled by livestock grazing during autumn on 47% of the properties. Slade (1968) stated that this practice was stopped in the 1960s when DDT was used in orchards, but the use nowadays of less persistent insecticides has led to its revival by many growers.

The average width of herbicide strips was 2.4 m, with 3% of orchards having strips exceeding 3.0 m and 10% with strips narrower than 2.0 m. By comparing the intended width of the herbicide strip for each grower with the distance between their tree rows, the average grower was aiming at keeping 45% of the orchard floor bare and 55% as mown grass alleys. Only 7% of growers intended to have herbicide strips occupying less than one third of the orchard floor. Thus although many growers object to having totally bare ground in their orchards because of damage to soil structure, erosion problems, sunburn of fruit or for aesthetic reasons, much of their soil is already bare. Weeds present within the mown strips readily invade adjacent bare ground by seed production or vegetative spread.

Since its introduction to New Zealand in the 1970s, glyphosate has become the most widely used herbicide in pipfruit orchards, being used on 95% of all surveyed properties (Table 1). The three main herbicides used in orchards during the 1960s, namely amitrole, paraquat and simazine (Slade 1968), are still widely used today, though not as extensively as glyphosate. Apart from glyphosate, few of the newer herbicides have been widely adopted by growers. The terbuthylazine/terbumeton mixture was the only residual herbicide apart from simazine to be used by many growers in the 1989-90 season.

**TABLE 1: The types of herbicides used by 77 surveyed pipfruit growers, and the percentage of growers who used each herbicide, in the 1989-90 season.**

Common name	Main trade name	% growers
Knock-down herbicides:		
glyphosate	Roundup	94.8
amitrole	various	51.9
paraquat ± diquat	Preeglone	31.2
asulam	Asulox	13.0
dicamba ± 2,4-D	Banvine	9.1
clopyralid	Versatill	7.8
glufosinate-ammonium	Buster	5.2
fluazifop	Fusilade	3.9
haloxyfop	Gallant	2.6
picloram/2,4-D	Tordon 50-D	1.3
2,4-D	various	1.3
Residual herbicides:		
simazine	various	54.5
terbuthylazine/terbumeton	Caragard 500 FW	32.5
diuron/linuron	Cohort	13.0
terbacil	Sinbar	13.0
terbuthylazine	Gardoprim 500 FW	5.2
diuron	Karmex	2.6
norflurazon	Solicam	2.6
oryzalin	Surflan Flo	2.6
methabenzthiazuron/diuron	Amatin	1.3
oxadiazon	Foresite	1.3
pendimethalin	Stomp 330E	1.3
terbuthylazine/metolachlor	Primextra II 500 FW	1.3

Although only a fairly narrow range of herbicides was used by most of the orchardists, there was a wide variation between growers in the timing and combination of applications. Residual herbicides were not used by 13% of growers who relied on sequential applications of knockdown herbicides to keep the ground bare under trees. One residual herbicide for the season was applied by 56% of growers, while 30% applied two residual herbicides (either together or several months apart), and 1.3% applied three residual herbicides. The number of knockdown herbicides applied in the 1989-90 season varied from one for 6% of growers to five applied by one grower. Most applied either two (31% of growers) or three (40%) knockdown herbicides, with 11% applying four.

Although timing of applications varied, the majority of growers applied either glyphosate or amitrole in late winter (August to September) to clear the ground of weeds prior to the growing season (Table 2). A residual herbicide was also usually applied at this time to keep the soil weed-free during spring. The application of a residual herbicide was left until spring (October to November between flowering and fruit set) by 18% of growers to allow the effects of the herbicide to last further into the growing season. Knockdown herbicides were used by most growers in summer to remove weeds resistant to residual herbicides or weeds which appeared as the activity of these herbicides ran out. Although contact herbicides such as paraquat or glufosinate are safer in summer than translocated herbicides for trees in full leaf and with low branches weighed down by fruit, only 21% of growers used contact herbicides compared with 77% who used glyphosate, presumably because they consider it to be more effective.

**TABLE 2: The percentage of pipfruit growers surveyed who applied broad-spectrum translocated, contact and/or residual herbicides during late winter, spring, summer or autumn in 1989-90.**

Time of year	% of growers applying herbicide type		
	glyphosate or amitrole	paraquat or glufosinate-ammonium	residual herbicide
late winter	70.1	15.6	68.8
spring	28.6	6.5	18.2
summer	76.6	20.8	14.3
autumn	42.9	3.9	2.6

The use of a narrow range of herbicides by pipfruit growers has predictably led to some weed species building up in numbers, and the most troublesome of these are listed in Table 3. The main residual herbicides used by the pipfruit growers, namely simazine, terbutylazine and terbumeton, are all triazine herbicides, and all 12 of the weeds listed in Table 3 are either resistant or poorly controlled by triazine herbicides (Matthews 1975). Grass species such as paspalum, summer grass, barnyard grass and the bristle grasses can establish from seed in spring if only triazine herbicides are used. More use of residual herbicides such as terbacil, pendimethalin, oryzalin and norflurazon is needed to prevent these grasses from establishing successfully. Likewise, alternatives to the triazines such as the diuron/linuron mixture or terbacil should be used more often to prevent successful establishment of dicotyledonous weeds such as mallows, black nightshade and tall willow herb. Note, however, that 38% of growers used at least one residual herbicide that was not a triazine in the 1989-90 season, so sensible rotations or combinations of residual herbicides have already been adopted on some orchards.

**TABLE 3: The 12 worst weed problems of pipfruit orchards in the order of importance as ranked by surveyed growers.**

Ranking	Common name	Botanical name
1	paspalum	<i>Paspalum dilatatum</i>
2	mallows	<i>Modiola caroliniana, Malva</i> spp.
3	Indian doab	<i>Cynodon dactylon</i>
4	black nightshade	<i>Solanum nigrum</i>
5	summer grass	<i>Digitaria</i> spp.
6	tall willow herb	<i>Epilobium ciliatum</i>
7	Californian thistle	<i>Cirsium arvense</i>
8	dock	<i>Rumex</i> spp.
9	barnyard grass	<i>Echinochloa crus-galli</i>
10	greater bindweed	<i>Calystegia silvatica</i>
11	prostrate amaranth	<i>Amaranthus deflexus</i>
12	bristle grass	<i>Setaria</i> spp.

Once these weeds have established, many of them are reasonably tolerant of both amitrole and glyphosate, especially when used at the low rates applied by some growers, such as 0.7-1.1 kg ai/ha of glyphosate. However a number of growers were applying glyphosate at rates of 2.2-2.5 kg ai/ha to control weeds such as paspalum and Indian doab, and many were also adding extra surfactants to glyphosate. Such measures are necessary to control some of these species effectively. Some growers were resorting to spot-applications of hormone herbicides such as 2,4-D/dicamba or clopyralid to control some of the problem dicotyledonous species. Docks were mentioned by both Slade (1968) and Taylor (1979) as a problem in orchards, and their inclusion in Table 3 shows this is still the case. Asulam was applied in 13% of surveyed orchards for the control of docks.

Many orchardists appeared confused about the differences between herbicides and require firm recommendations for the effective control of weeds in their orchards, especially those listed in Table 3.

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