ESTABLISHMENT TECHNIQUES FOR DICHONDRA GROUND COVERS IN ORCHARDS

K.C. HARRINGTON, B.J. ANDERSON and E.A. CAMERON

*Institute of Natural Resources, Massey University, Private Bag 11-222,
Palmerston North*

Corresponding author: K.Harrington@massey.ac.nz

ABSTRACT

A field trial evaluated several different techniques for establishing strips of dichondra (*Dichondra micrantha*) under newly planted apple trees for weed control purposes. Each technique involved planting a line of dichondra either side of the tree row, with lateral spread of the plants eventually allowing the two strips of ground cover to merge. Plugs of dichondra allowed more rapid establishment than transplanted strips of material or sown seeds. However, all methods gave total ground cover after 12 months. In a separate pot trial, several herbicide treatments suitable for controlling weeds during this establishment phase were assessed for their effects on young dichondra. Herbicides that were tolerated by the dichondra included haloxyfop, clopyralid, tribenuron, metsulfuron, oxadiazon, oryzalin, glyphosate and propyzamide. Several application rates and mixtures of some herbicides were assessed. Plugs of dichondra tolerated more herbicides than young seedlings. The best strategies for establishing dichondra ground covers in orchards are discussed.

Keywords: *Dichondra micrantha*, ground covers, orchard weed control, tolerance to herbicides, orchard understorey.

INTRODUCTION

Over the past decade, a number of trials have investigated the feasibility of growing dichondra ground covers under orchard trees to replace the strip of herbicide-treated bare ground normally found (Harrington 1995; Harrington et al. 1999; Hartley et al. 2000). The objective of using dichondra is to prevent new weeds from establishing thereby avoiding the need to spray during the growing season. Covering the soil with a low-growing perennial species, such as dichondra, should reduce surface compaction of the soil, while keeping soil organic matter levels above those levels found in traditional bare soil regimes. It has been shown that dichondra will not reduce fruit yields when grown under established apple trees (Harrington et al. 1999).

Harrington et al. (1999) also found that establishment of dichondra ground covers using seeds is more successful than using stolon fragments. However, with seed costing \$70/kg, techniques are required to minimise establishment costs. Dichondra requires assistance from selective herbicides during initial establishment as well as during winter while trees are dormant to remove weeds that have invaded the sward. Some data is already available on which herbicides can be used safely in dichondra (Harrington & Zhang 1997; Harrington & Rahman 1998; Harrington et al. 2000), but further work is required.

This paper describes a trial in which a single row of dichondra plants was established either side of apple trees using seed, transplanted plugs or strips of dichondra. In addition, herbicide tolerance of dichondra is examined, particularly in relation to control strategies for establishing young seedlings.

MATERIALS AND METHODS

Trial 1

A newly planted block of apple trees (cv. Brookfield on semi-dwarfing MM106 rootstock) on Manawatu fine sandy loam at the Massey University Fruit Crops Unit was

New Zealand Plant Protection 55:202-206 (2002)

divided into 25 plots, each being 5 m long with trees down the middle of each plot. Dichondra was established into freshly cultivated soil in a single row 25 cm from the trees on either side of the tree row using five different techniques. For three of the establishment techniques, a single row of seeds was sown, either by drilling using a hand-pushed Stanhay precision belt-seeder at 120 seeds/m or 200 seeds/m, or hand-sown into a 7 mm deep furrow at 250 seed/m. The fourth technique used plugs of dichondra, 5 cm in diameter and 5 cm deep, planted 15 cm apart. These had been raised commercially in nursery cell trays. The final technique involved transplanting continuous strips of dichondra 5 cm wide and 6-8 cm deep, cut from an established sward of dichondra. Dichondra was established using each of these techniques on 20 November 1999, with each treatment replicated five times using a randomised block design.

Weeds which established in the plots were mowed monthly, and were also sprayed on 28 January 2000 with a mixture of 11 g/ha tribenuron (Granstar), 300 g/ha clopyralid (Versatill) and 250 g/ha haloxyfop (Gallant NF). Establishment of the dichondra was determined 2 and 6 months after planting by repeatedly placing a 20 cm x 50 cm quadrat randomly along the planted row and estimating the percentage cover of dichondra within the quadrat. This process was also repeated along the midline between the two rows of dichondra at 6 and 12 months after application.

Trial 2

Dichondra was established in 600 ml planter bags containing Manawatu fine sandy loam soil by sowing seed either on 24 November 1999 or 24 December 1999, and also by transplanting plugs like those used in Trial 1 into pots on 24 November 1999. They were kept in an overhead-irrigated standing-out area at Massey University until 4 February 2000 when they received the herbicide treatments listed in Tables 2 and 3. Plants were scored for vigour prior to spraying, and were then allocated to treatments using a randomised block design. Four replicates contained younger seedlings, which were 5-weeks-old and at the 6-8 leaf-stage when sprayed. There were five replicates of transplanted plants and older seedlings, which were 10-weeks-old and had 15-30 leaves when sprayed. Treatments were applied using a precision laboratory track sprayer in which herbicide was delivered from a spray unit pulled by a motor at a constant speed along a track within a cabinet above the plants at a rate equivalent to 260 litres/ha.

Plants were assessed at regular intervals after treatment for damage using a scoring system (0 = very healthy, 10 = totally necrotic). Weeds that established from the soil were left uncontrolled until 9 weeks after treatment, when the species present were recorded and scored for overall mass (0 = none, 10 = maximum weed biomass present, equivalent to approximately 3.0 g fresh weight). Pots were then trimmed (equivalent to mowing) and given foliar fertiliser. An analysis of variance was performed on data from both trials.

RESULTS AND DISCUSSION

Trial 1

The area within 10 cm each side of the planting line filled most rapidly with dichondra from transplanted cells (Table 1). Although more dichondra plants were present at planting in the 5 cm-wide slices than the cells, it was more difficult to plant these flush with the soil surface, and they suffered from scalping when mown. As would be expected, plants established more slowly from seeds, and also at the lower sowing rates. This was accentuated by the low quality of the seed which, despite being recently purchased, gave only 30% field emergence. However, after 6 months, most techniques had resulted in over 95% cover of the ground along the planting line. The stoloniferous growth of the plants resulted in lateral spread under the trees so that the area between the two planted lines was filling with dichondra by 6 months after planting. The transplanted cells and drilled seeds (high rate) generally gave the best cover along the mid-line by May 2000, though results were quite variable due to competition from weeds. By 12 months after planting, there was almost 100% ground cover along the midline under the trees in all plots, regardless of planting method used.

TABLE 1: The establishment of dichondra under young apple trees within 20 cm x 50 cm quadrats located along planting lines or in the middle of tree rows between planting lines at 2 and 6 months after planting.

Planting technique	% cover in planted area		% cover mid-row
	after 2 months	after 6 months	after 6 months
transplanted cells	71.0	98.8	85.6
transplanted slices	37.7	97.6	37.1
drilled seeds (low)	7.4	83.6	57.1
drilled seeds (high)	20.4	96.9	82.7
hand-sown (high)	25.4	96.5	69.9
LSD (P<0.05)	20.1	12.2	23.9

Transplanting strips of dichondra would be the cheapest option for growers who already have dichondra. However, it was also the most awkward planting method and severely damaged the swards from which material was removed. Although trays of dichondra plugs are available from nurseries, a transplanter would probably be needed to plant large areas, and costs in 1999 were equivalent to \$1.40/m. Seed at the lower sowing rate (120 seeds/m) would cost \$0.11/m, and would give an equivalent ground coverage after 12 months provided early weed competition can be minimised with selective herbicides.

Trial 2

The mixture of tribenuron and clopyralid was not damaging to the young seedlings, even when haloxyfop was added to the mixture (Table 2). This mixture also gave the best weed control at the higher rate tested, as it removed both grasses and broad-leaved

TABLE 2: Scores of damage by herbicides at 3, 7 and 11 weeks after treatment to pots of dichondra seedlings sprayed while 5-weeks-old. Weed biomass was estimated 9 weeks after treatment.

Treatment	Rate (kg ai/ha)	Damage to dichondra ¹			Weeds ²
		3 WAT ³	7 WAT	11 WAT	9 WAT
flumetsulam	0.04	4.0	5.3	6.0	5.0
MCPB	1.15	5.5	6.8	8.8	7.0
metsulfuron	0.018	2.7	1.7	1.8	3.0
metsulfuron	0.036	2.5	2.3	1.5	4.2
oxadiazon + oryzalin	0.76 + 1.5	3.0	2.5	2.3	3.7
oxadiazon + oryzalin	1.5 + 3.0	3.5	2.3	2.5	2.0
tribenuron + clopyralid	0.022 + 0.45	2.5	2.3	2.8	4.5
tribenuron + clopyralid + haloxyfop	0.011 + 0.3 + 0.1	2.5	2.8	2.0	4.2
tribenuron + clopyralid + haloxyfop	0.022 + 0.45 + 0.2	2.0	1.8	0.8	1.0
untreated		2.5	2.0	2.3	5.2
LSD (P<0.05)		1.4	1.3	1.8	3.1

¹Scores of damage: 0 = healthy, 10 = dead.

²Weed biomass: 0 = none, 10 = most (3 g FW/pot).

³Weeks after treatment.

species. Similar weed control results were obtained when these herbicides were used on older seedlings and transplanted dichondra (data not shown). The mixture of oxadiazon (Foresite) and oryzalin (Surflan Flo) is a combination of residual herbicides selective to fruit trees and older dichondra (Harrington & Zhang 1997), and this trial showed these chemicals also cause little damage to young seedlings, preventing new weeds establishing while a dense sward is forming. Past work (Harrington and Zhang 1997) has shown oryzalin and oxadiazon severely damage dichondra seedlings when applied as pre-emergence treatments. However, this trial showed the older seedlings and plugs received more of a check in growth (Table 3) than the younger seedlings.

Metsulfuron (Escort) also did not damage the young seedlings despite being very effective on many broad-leaved species. However, it should not be used under fruit trees as it could cause crop damage, and is only intended for use in dichondra lawns. The MCPB (IWD MCPB) and flumetsulam (Preside) were included to solve a problem with creeping yellow cress (*Rorippa sylvestris*) in the Massey University orchard, but were too damaging to dichondra seedlings to be worth using. Although the plugs did eventually recover from the flumetsulam, another trial (K.C. Harrington, unpubl. data) showed the creeping yellow cress also recovered.

TABLE 3: Scores of damage by herbicides at 3 and 7 weeks after treatment. Herbicide was applied to pots of dichondra seedlings sprayed while 10-weeks-old and dichondra established from transplanted plugs.

Treatment	Rate (kg ai/ha)	Scores of damage ¹			
		seedlings		transplanted plugs	
		3 WAT ²	7 WAT	3 WAT	7 WAT
dichlobenil	3.37	-	-	4.4	3.6
dichlobenil	6.75	4.2	4.6	6.2	4.6
fatty acids	7.0	3.0	3.8	3.2	2.0
flumetsulam	0.04	4.8	5.0	5.6	2.2
glufosinate	0.6	4.0	4.8	3.0	2.6
glyphosate	0.36	4.0	3.6	3.4	2.4
MCPB	1.15	6.8	8.8	4.0	3.8
metsulfuron	0.018	3.0	3.4	2.8	2.2
metsulfuron	0.036	3.4	2.8	2.8	1.4
oryzalin	3.0	4.4	3.8	2.4	2.4
oxadiazon + oryzalin	0.76 + 1.5	4.8	4.0	3.6	2.4
oxadiazon + oryzalin	1.5 + 3.0	5.4	5.0	5.2	3.2
propyzamide	1.0	4.8	4.2	4.4	2.6
tribenuron + clopyralid	0.022 + 0.45	3.2	4.0	2.4	1.6
tribenuron + clopyralid + haloxyfop	0.011 + 0.3 + 0.1	3.4	3.4	2.6	2.4
tribenuron + clopyralid + haloxyfop	0.022 + 0.45 + 0.2	3.4	3.0	2.8	2.0
untreated		3.4	4.4	3.0	1.6
LSD (P<0.05)		1.4	1.9	1.2	1.3

¹Scores of damage: 0 = healthy, 10 = dead.

²Weeks after treatment.

The herbicide treatments to older plants confirmed the selectivity to dichondra of low rates of glyphosate (Roundup GII), and also showed that propyzamide (Kerb Flo) and low rates of glufosinate (Buster) are tolerated. However, all three of these herbicides reduced dichondra growth for some time after application, so care is needed if rapid

lateral growth is required. The fatty acids (Greenscape) tested caused little damage to the dichondra, while dichobenil (Prefix D) may be useful at the lower rate tested for spot-applications.

REFERENCES

- Harrington, K.C. 1995: Establishment of several ground covers in an orchard. *Proc. 48th N.Z. Plant Prot. Conf.*: 68-71.
- Harrington, K.C.; Hood, M.Z.; McKinnon, K.C. 2000: Assessment of two herbicide wiping devices. *N.Z. Plant Prot. 53*: 273-276.
- Harrington, K.C.; Rahman, A. 1998: Herbicide tolerance of ground cover species for New Zealand. *Plant Prot. Quart. 13*: 111-116.
- Harrington, K.C.; Zhang, T. 1997: Herbicides for controlling weeds in Mercury Bay weed. *Proc. 50th N.Z. Plant Prot. Conf.*: 462-466.
- Harrington, K.; Zhang, T.; Osborne, M.; Rahman, M. 1999: Orchard weed control with *Dichondra micrantha* ground covers. *Proc. 12th Aust. Weeds Conf.*: 250-254.
- Hartley, M.J.; Rahman, A.; Harrington, K.C.; James, T.K. 2000: Assessing ground covers in a newly planted apple orchard. *N.Z. Plant Prot. 53*: 22-27.