WEED CONTROL IN NEWLY PLANTED AUTUMN-CROPPING RASPBERRIES

T.K. JAMES, J. MORTIMER and A. RAHMAN

Ruakura Agricultural Centre, MAF, Private Bag, Hamilton

SUMMARY

Sixteen herbicides were tested over 4 years on two varieties of autumn-cropping raspberries *(Rubus idaeus)*. Seven trials were conducted on two soil types of volcanic origin. Terbacil gave the best weed control on both soil types, controlling a range of broadleaf and grass weeds. Simazine and terbuthylazine gave good control of most broadleaf weeds but did not adequately control grass weeds. Although causing slight initial damage to some raspberry plants the terbacil treatments outyielded all others. The two varieties showed different tolerances to the herbicides.

INTRODUCTION

The production of autumn-cropping raspberries became widespread in New Zealand during the early 1980's with large areas being planted in the Waikato and other regions. As with most young crops it is necessary to maintain a high level of weed control during establishment of the raspberry crop. Several workers (Lawson and Wiseman 1974, 1976; Sutherland and Stephens 1960; Wood *et al* 1960) have reported the adverse effects of weeds during the first year of the crop. Lawson and Wiseman (1976) in Scotland have shown that raspberries are most vulnerable when weeds are present during cane emergence and that weeds germinating from early summer onwards are less competitive.

Management of autumn-cropping raspberries differs from that of the traditional spring-cropping varieties in that the canes are completely removed during winter and the fruiting canes emerge during the spring. In spring-cropping raspberries the fruiting canes are left standing over winter. Some herbicides which can be safely used around the emerged canes of spring-raspberries cannot be used on beds of autumn-raspberries where the herbicide could damage the sensitive emerging canes. For instance although simazine has been widely used for weed control and has given good results, it has often damaged the raspberry plants.

With the above points in mind several trials were conducted between 1984 and 1988 on two soils of volcanic origin testing several herbicides, alone and in combination, for weed control and crop damage in this crop.

METHODS

Trials 1, 3, 5 and 7 were conducted on a Horotiu sandy loam soil with 9.1% organic C, 16% clay, 61% sand, a pH of 5.7 and a field capacity of 43%. Trials 2, 4 and 6 were conducted on a Hamilton clay loam soil with 3.1% organic C, 27% clay, 38% sand, a pH of 5.2 and a field capacity of 37%. The main weeds present on both trial sites were willow weed *(Polygonum persicaria),* redroot *(Amaranthus spp.)* smooth witchgrass *(Panicum dichotomiflorum),* summer grass *(Digitaria sanguinalis),* black nightshade *(Solanum nigrum),* fathen *(Chenopodium album)* and narrow-leaved plantain *(Plantago lanceolata).* Prostrate amaranth *(A. deflexus)* and barnyard grass *(Echinochloa crus-galli)* were also abundant on the Hamilton clay loam site while twincress *(Coronopus didymus)* and shepherds purse *(Capsella bursa-pastoris)* were common on the Horotiu sandy loam site. The relative abundance of these weeds was different from year to year as each trial was on a new site within the main trial areas. Treatment application dates and weekly rainfall for the first 4 weeks after treatment are given in Table 1.

Over the 4-year period of the study treatments were modified according to the

results in the previous season. All treatments except dichlobenil were applied with a CO_2 powered precision sprayer applying 300 litres/ha of water at 210 kPa. Dichlobenil was applied with a hand held granule applicator. Treatments were applied within a week after planting the raspberries.

The raspberries were planted as pruned primocanes (sucker plants) at 40 cm spacing with 10 plants per plot. All trials were of a randomised block design with a plot size of 2 × 5 m. Trials 3, 4, 5 and 7 had three replicates of two varieties, Heritage and Southland. Trials 1, 2 and 6 had three replicates of the Heritage variety only. Each trial had both weeded and unweeded controls.

Visual assessments of weed control were made at regular intervals and where possible samples were taken from two 0.1 m^2 quadrats per plot for weed dry matter determinations. The raspberry plants were also inspected regularly for signs of herbicide damage or stunted growth. Berry production from the Heritage variety, which fruits well in the first year, was measured on most trials. Second season yields of Heritage and Southland were measured on Trial 4 which was continued for another year by repeating the treatments. Unwanted sucker growth was controlled by inter-row mowing. In Trials 3 and 4, cane growth was measured by weighing the canes from each plot when they were removed in winter.

TABLE 1: Treatment dates and rainfall for the trials.

Trial No	Treatment date	Rainfall (mm)*			
		Week 1	Week 2	Week 3	Week 4
1	5.10.84	11	6	15	23
2	5.10.84	11	6	15	23
3	5.8.85	13	16	17	12
4	5.8.85	13	16	17	12
5	31.7.86	19	40	34	12
6	18.8.86	46	2	0	17
7	11.8.87	0	6	17	31

* Rainfall for 1st, 2nd, 3rd and 4th weeks after treatment.

RESULTS AND DISCUSSION

Over the four years of this study 16 different herbicides were evaluated (Appendix). Those not specifically mentioned in the text or tables were discarded due to poor performance in at least two trials (one on each soil type) or serious damage to the raspberries (as was the case with oxyfluorfen).

Weed Control

The herbicides that gave the best and most reliable weed control are listed in Table 2. Of these, terbacil consistently gave the best weed control except in Trial 1 where redroot was not controlled. Simazine, terbuthylazine and oryzalin gave good control of the broadleaf weeds in the early trials but failed to adequately control grass weeds. These herbicides were used in combination with either alachlor or metolachlor in later trials. However, the combinations did not result in better weed control, probably because the residual activity of alachlor and metolachlor applied in winter was not sufficient to control weeds germinating in late spring and summer. Oryzalin and the low rates of simazine and terbuthylazine began to break down 1-2 months after treatment allowing a range of broadleaf weeds to appear on these plots. Dichlobenil and diuron also were not persistent enough to maintain a weed-free crop from winter to late summer, with some weeds emerging within a month of treatment.

Freeman (1986) and Hartley and Loader (1985), working on non-volcanic soils in Canada and Hawkes Bay respectively, also found that terbacil and simazine gave excellent weed control. This suggests that these two herbicides are effective for controlling weeds in raspberries over a range of soil types.

Crop Tolerance

The herbicides which offered the best weed control (Table 2) also caused damage to

the growing raspberry canes on several occasions (Table 3). The Southland variety was more susceptible to herbicide damage than Heritage but there appeared to be no difference in susceptibility due to soil type.

The most serious damage occurred in Trials 1 and 2 which were planted in early spring (Table 1) with most herbicides causing some damage. In subsequent trials, planted in winter, damage was considerably less. Of the herbicides listed in the tables terbacil was the most damaging. However, the damage was confined to one or two plants per plot and consisted of discolouration of new leaves and an initial slowing of growth. Most affected plants recovered within 2 months of treatment. Berry yields were not affected, with the terbacil treatments consistently outyielding other treatments (Table 4). Cane yield of the Southland variety, measured on Trials 3 and 4, showed that terbacil did not affect the production of canes in the first year.

Most of the other herbicides tested also caused some damage but it was usually confined to one or two plants out of 30 and the damage (discolouration) disappeared within a short time. No long term effects of the herbicides were found. Where berry production was significantly reduced (Table 4) it was due to weed competition, with production from the unweeded controls being particularly low.

TABLE 2: Effect of herbicide treatments on weeds in newly planted raspberries.

	Soil Type:	Horotiu sandy loam				Hamilton clay loam		
	Trial No:	1	3	5	7	2	4	6
	Assessment:	DM*	DM	Score**	Score	DM	DM	Score
Treatment	Rate (kg ai/ha)	54 DAT	116 DAT	107 DAT	133 DAT	60 DAT	116 DAT	107 DAT
terbacil	1.0	43	0	9.2	8.7	2	1	9.0
terbacil	1.6	-	0	10.0	9.1	-	0	10.0
simazine	2.0	69	21	-	-	70	18	-
simazine	3.0	-	5	6.7	6.1	-	18	6.7
terbuthylazine	2.0	64	35	-	-	91	29	-
terbuthylazine	3.0	-	32	-	-	-	28	-
metolachlor/ terbuthylazine	3.2/ 1.8	-	-	4.0	7.6	-	-	4.7
metalachlor/ terbuthylazine	4.8/ 2.7	-	-	6.2	8.1	-	-	7.7
dichlobenil	4.0	31	38	4.2	6.2	-	3	3.3
oryzalin	3.0	51	76	-	-	75	-	-
diuron	2.0	53	88	-	-	19	-	-
unweeded (kg/ha)	-	100 (3561)	100 (6438)	0	0	100 (1205)	100 (5378)	0
LSD (P = 0.05)		29.5	7.8			46.8	7.1	
CV%		30.2	20.4				80.6	28.0

* % of unweeded control.

** 0-10 scale, 0 = no weed control.

TABLE 3: Effect of herbicides on raspberry plants (0-10 scale, 0 = no damage, 10 = plant dead).

	Soil Type:	Horotiu sandy loam					Hamilton clay loam		
	Trial No:	1	3		7		2	4	
	Variety:*	H	H	S	H	S	H	H	S
Treatment	Rate (kg ai/ha)	52 DAT	74 DAT	74 DAT	133 DAT	69 DAT	52 DAT	74 DAT	74 DAT
terbacil	1.0	3.50	0.02	0.43	0	2.00	5.50	0	0.05
terbacil	1.6	-	0.02	0.60	1.00	3.33	-	0.15	1.13
simazine	2.0	0.50	0	0.07	-	-	2.36	0	0.10
simazine	3.0	-	0.02	0.20	0	1.33	-	0	0.20
terbuthylazine	2.0	0.66	0	0.10	-	-	1.86	0	0
terbuthylazine	3.0	-	0.03	0.18	-	-	-	0	0.22
metolachlor/ terbuthylazine	3.2/ 1.8	-	-	-	0.33	0.67	-	-	-
metolachlor/ terbuthylazine	4.8/ 2.7	-	-	-	2.00	1.33	-	-	-
dichlobenil	4.0	0	0	0.03	0	0.33	-	0	0
oryzalin	3.0	1.16	0	0	-	-	4.80	0	0
diuron	2.0	0.50	0.07	0.32	-	-	2.90	0	0
unweeded	-	0	0	0	0	0	0	0	0

* H = Heritage, S = Southland.

TABLE 4: Effect of herbicides on raspberry production (% of weeded control).

	Soil Type:	Horotiu Sandy Loam		Hamilton Clay Loam			
	Trial No:	3	7	4			6
	Variety:*	H	H	H	H	S	H
Treatment	Rate (kg ai/ha)			1st year	2nd year	2nd year	
terbacil	1.0	115	182	126	140	100	111
terbacil	1.6	95	141	94	122	111	121
simazine	2.0	107	-	106	106	106	-
simazine	3.0	100	99	118	111	97	78
terbuthylazine	2.0	86	-	85	99	100	-
terbuthylazine	3.0	99	-	95	101	104	-
metolachlor/ terbuthylazine	3.2/ 1.8	-	96	-	-	-	24
metalochlor/ terbuthylazine	4.8/ 2.7	-	119	-	-	-	71
dichlobenil	4.0	101	82	85	95	81	55
oryzalin	3.0	91	-	60	125	119	-
diuron	2.0	85	-	27	108	106	-
untreated	-	27	22	27	55	99	10
hand weeded	-	100	100	100	100	100	100
(g/plot)		(7040)	(488)	(5238)	(5784)	(3494)	(2400)
LSD (P = 0.05)		34.1	77.1	14.7	27.2	30.4	39.0
CV%		19.3	38.3	10.1	13.3	14.6	28.6

* H = Heritage, S = Southland.

CONCLUSION

The detrimental effects of not controlling weeds in newly planted autumn-cropping raspberries has been clearly demonstrated. Several herbicides suitable for controlling weeds in this crop have been identified and their effects on the raspberries studied. Of these, terbacil was shown to be the best, with simazine and terbuthylazine also giving good results in most situations.

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APPENDIX

Herbicides evaluated were alachlor (Lasso), chlormethazole (Probe), chlorthal-dimethyl (Dacthal), dichlobenil (Casoron), diphenamid (Enide), diuron (Karmex), lenacil (Venzar), linuron (Linuron), methabenzthiazuron (Tribunil), metolachlor/terbuthylazine (Primextra II), napropamide (Devrinol), oryzalin (Surflan), oxyfluorfen (Goal), simazine (Simazol), terbacil (Sinbar) and terbuthylazine (Gardoprim).