WEED CONTROL IN ASPARAGUS IN OTAGO

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SUMMARY

A range of herbicides for general weed control in seedling and young asparagus (*Asparagus officinalis*), was tested on sandy silt loams mainly in Central Otago. The dosage required for acceptable weed control was similar to that reported for more traditional asparagus growing areas in the North Island. However for control of *Galium* and *Fumaria* species higher rates were indicated. Cultivation, pre-crop emergence, controlled both *Verbascum* spp. and volunteer asparagus better than did herbicides. Tolerance of seedling asparagus appeared satisfactory to linuron and diuron up to 2 kg ai/ha, but more objective data are required on bromacil and metribuzin, both of which may be useful on difficult-to-kill weeds.

INTRODUCTION

Because the export market prospects for asparagus (*Asparagus officinalis*) are promising, there has been a rapid increase in new plantings. Some of this increase has occurred in Central Otago, where the light free draining sandy loam silts and low water tables on the valley floors meet some of the major requirements of this crop. Modification of existing herbicide recommendations is most probably required for this area, because the weed community differs from elsewhere in New Zealand, and the soils are derived from mica schists which are believed to need lower quantities of root absorbed herbicides if phytotoxic effects on crops are to be avoided. This report summarises preliminary work from field trials studying herbicide effects in both seedling and young asparagus; that is, crops which were established but of barely adequate development for commercial harvesting. Field sites in both Central and coastal Otago were used.

MATERIALS AND METHOD

Details of herbicides, dosage and dates of application are shown in the appropriate tables. Hand weeded plots were hoed once or twice during the growing season, but because of re-establishment or fresh germination of weeds it was not possible to maintain constant weed-free conditions. Materials were applied in 220 litres/ha water at 200 kPa by a precision sprayer. Treatments were arranged and replicated in randomised blocks. Visual assessments of weed control and crop vigour reported are the means of three independent observers. A scale of 1 (= very poor) to 5 (= very good) vigour was used. Asparagus tolerance in trial C was assessed by measuring and counting the fern produced to give a mean total fern length per m².

The soil types for each experimental site were as follows:

A,B,C and E, Matakanui — very shallow sandy loam derived from schist alluvium.

D, Molyneux — stony sand derived from greywacke and schist alluvium.

F, Wingatui — silt loam derived from greywacke and schist alluvium.

RESULTS

Seedling asparagus

Trial A. Roxburgh. Etiolated three month old asparagus (cv. Lucullus) seedlings reared in a mist propagating unit and transplanted 8.12.80, were treated 1 week later with several herbicides. Fathen (*Chenopodium album*) and hawksbeard (*Crepis capillaris*) both in the cotyledon stage had recently emerged. Although no data are

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shown in this report, the most effective weed control was achieved with linuron/trietazine and linuron/monolinuron. The best asparagus vigour came from linuron and diuron but at 1 kg ai/ha neither of these gave adequate weed control. However this pilot trial indicated that linuron alone or in mixtures, and diuron, warranted further study in transplanted asparagus seedlings.

Trial B. Roxburgh. Asparagus seedlings reared in a similar manner to Trial A, and transplanted 31.11.82, were sprayed 1 week later, by which time cotyledon stage fathen, red dead nettle (*Lamium purpureum*), speedwell (*Veronica persica*), and gallant soldier (*Galinsoga parviflora*) had emerged. Linuron gave better control of weeds than diuron ($P < 0.05$) (Table 1) and the 2 kg ai/ha rate was optimum if adverse effect on crop vigour was to be avoided.

TABLE 1: Trial B. Roxburgh. Effect of herbicides on seedling asparagus and percent weed cover, 7 and 10 weeks after spraying.

Treatments (17.12.82)	Rate kg ai/ha	25.1.83		15.2.83
		Crop vigour ²	Weed cover % ¹	Weed Cover % ¹
linuron	1	4.4 a	6 b	37 abc
linuron	2	4.6 a	1 c	6 d
linuron	3	3.7 b	0.2 c	1 e
diuron	1	4.4 a	9 b	57 abc
diuron	2	4.6 a	3 b	17 cd
diuron	3	4.2 ab	7 b	31 bc
handweeded		4.5 a	35 a	75 ab
untreated		4.5 a	80 a	100 a

¹ Analysis on log transformed data, but means of untransformed data shown.

² Vigour assessed on the scale 1 = very poor, to 5 = very good vigour.

Trial C. Roxburgh. This trial was laid down on the Lucullus crop as used in Trial A, now one year older but still poorly developed and presumably sensitive to herbicides. Four weeks after spraying it appeared that adding other herbicides to linuron (1 kg ai/ha) made little difference to weed cover (Table 2), and linuron (2 kg ai/ha) or metribuzin (0.8 kg ai/ha) were necessary for maximum weed suppression. However a measurement of fern present at 2.12.81 indicated that linuron (2 kg ai/ha) might inhibit maximum growth, while only 1 kg ai/ha and metribuzin (0.8 kg ai/ha) resulted in growth significantly better than untreated.

TABLE 2: Trial C. Roxburgh. Effect of herbicides on percent weed cover and asparagus growth (1-year-old seedling transplants). Seedlings planted 8.12.80.

Treatments 24.9.81	Rate kg (ai/ha)	% Weed cover	Mean length fern/m ² (cm)
		20.11.81	2.12.81
linuron	1	2.6	87 ab
linuron	2	1.6	73 abc
linuron + monolinuron	1 + 1	2.5	68 abc
linuron + trietazine	1 + 1	3.2	69 abc
linuron + trifluralin	1 + 2	5.3	61 bc
metribuzin	0.4	3.3	77 abc
metribuzin	0.8	1.8	97 a
untreated		22	57 c

TABLE 3: Trial D. Alexandra. Effect of pre-emergence herbicides on percent weed cover in 5-year-old asparagus.

Treatment	Date applied	27.8.80	15.9.81	16.9.82
	Date assessed	16.12.80 ³	19.11.81	17.12.82
	Rate kg (ai/ha)			
simazine	0.8	0.6 d	5 ab	3 bc
simazine	1.6	1.0 d	8 ab	3 bc
hexazinone	0.8	0.6 d		
hexazinone	1.6	0.1 d		
metribuzin	0.4 ¹	6.3 abc	2 b	1 c
metribuzin	0.8 ¹	5.0 abc	0.1 b	nil c
linuron	0.5 ²	5.8 abc	7 ab	1 c
linuron	1.0 ²	3.8 c	3 ab	0.1 c
diuron/bromacil	0.8	5.2 abc	5 ab	0.1 c
diuron/bromacil	1.6	6.7 abc	5 ab	0.1 c
handweeded		30.0 a	5 ab	17 b
control		27.0 ab	16 a	41 a

¹ Metribuzin was applied in error at 0.7 and 1.4 kg ai/ha in 1981² Linuron was increased to 1 and 2 kg ai/ha in 1981 and 1982³ Analysis on log transformed data, but means of untransformed data shown

Results from a two replicate pilot trial (data not reported) adjacent to the above suggested that there was no advantage in adding diuron 1.5 kg ai/ha to metribuzin if the rate of the latter was kept up to 0.8 kg ai/ha, while bromacil 1.6 kg ai/ha was required to give weed control equivalent to the best of the above treatments.

Trial D. Alexandra. Asparagus at this site, although 5 years old, was retarded in development through inadequate irrigation. A selection of residual herbicides were applied pre-crop emergence following a late winter cultivation in July. Table 3 shows those applied in 1980, the rates were then modified, hexazinone deleted, and the remaining herbicides applied to the same plots for two consecutive years.

Initially simazine and hexazinone appeared more efficient and had only very sparse weed infestations; subsequently other herbicides were as efficient.

Unusual weeds frequent on this site were the mulleins, moth (*Verbascum virgatum*) and woolly (*V. thapsus*), germinating each autumn. Cultivation pre-crop emergence was found to be the most efficient control, after a preliminary factorial trial indicated poor results from the contact herbicides, glyphosate, diquat + paraquat, and amitrole, when added to either simazine, linuron, or diuron/bromacil.

TABLE 4: Trial E. Roxburgh. Evaluation of herbicides for control of slender bedstraw. Applied 20.9.82, assessed 17.12.82 for percent cover.

Treatment	Rate kg ai/ha	Weed cover % ¹	Treatment	Rate kg ai/ha	Weed cover % ¹
diuron	2.0	3.5 cd	linuron	2.0	8.0 bc
diuron	3.0	4.5 cd	linuron	3.0	0.1 d
metribuzin	0.8	2.4 d	simazine	1.6	2.7 cd
metribuzin	1.2	0.1 d	propyzamide	1.0	21.0 ab
bromacil	1.6	4.9 bc	untreated		39.0 a
bromacil	2.4	0.1 d			

¹ Analysis on log transformed data, but untransformed data shown

No phytotoxic effect was noted on asparagus. One important weed at this site was volunteer asparagus, some probably 1 or 2 years old. None of the treatments gave any appreciable suppression, and although handweeding was infrequent and ineffective, the smallest quantities of volunteer asparagus were noted in both weeded and untreated controls.

Trial E. Roxburgh. In this crop, established for 5 years, a severe infestation of slender bedstraw (*Galium divaricatum*) had built up. Following a rough cultivation to kill some of the established bedstraw, herbicides were applied crop pre-emergence (Table 4). None of these had any effect on asparagus, but high rates of chemical were required to achieve maximum control of bedstraw. Metribuzin, bromacil and linuron at the high rate were the most efficient. Propyzamide, recommended by Fryer and Makepeace (1978) for control of *Galium aparine*, gave inadequate control.

Trial F. Taieri. The weed community in this recently planted crop of 1-year-old crowns was dominated by fumitory (*Fumaria officinalis*); other weeds present were yarrow (*Achillea millefolium*) and lucerne (*Medicago sativa*) both growing vigorously from established rootstocks. Two selections of herbicides were tested (Table 5), one post emergence in early autumn on fumitory seedlings established after a recent hand weeding. Following a late winter cultivation in August, the other selection was applied pre-crop emergence, although some weeds had already emerged. In both cases bromacil gave best control of fumitory, while metribuzin was very efficient in autumn but not in spring. No phytotoxic effects were noted on the asparagus. Volunteer lucerne and yarrow were variable in occurrence. However bromacil 3 kg ai/ha tended to cause the greatest suppression of these, but this was not significant.

TABLE 5: Trial F. Taieri. Evaluation of herbicides for control of fumitory dominant weed community. Asparagus, 1-year-old crowns planted 30.9.81, handweeded 1.3.82.

Applied 15.3.82		Weed cover %		Applied 17.9.82		Weed cover %	
		(kg ai/ha) 21.5.82				(kg ai/ha) 26.1.83	
bromacil	1.5	1 d		bromacil	1.5	0.1 c	
bromacil	3.0	0.1 d		bromacil	3.0	0.1 c	
simazine	1.5	15 bc		simazine	3.0	5 bc	
simazine	3.0	15 bc		metribuzin	0.7	19 a	
diuron	1.5	48 a		metribuzin	1.0	19 a	
diuron	3.0	38 a		metribuzin	1.4	6 bc	
linuron	1.5	46 a		metribuzin + simazine	0.7 + 3	5 bc	
linuron	3.0	21 b		metribuzin + simazine	1.0 + 3	5 bc	
diuron/bromacil	1.6	6 cd		diuron	3.0	10 b	
diuron/bromacil	3.2	1 d		methabenzthiazuron	2.0	10 b	
metribuzin	0.8	3 cd		methabenzthiazuron	3.0	10 b	
metribuzin	1.6	1 d		methabenzthiazuron +	2.0		
				metribuzin	0.7	21 a	
control handweeded		6 cd		control handweeded		1 c	

DISCUSSION

One of the aims of evaluation of herbicides for use in Otago was to compare the rates required for effective weed control with those of more traditional asparagus production areas in Hawkes Bay. A review of the two most recent publications (Rahman *et al* 1981a, 1981b), in which a similar range of herbicides was evaluated, suggests that for 'good' weed control, metribuzin 0.8-1.0 kg ai/ha, diuron 1.5-3 kg ai/ha, linuron 1.25-2.0 kg ai/ha, or bromacil 0.75 kg ai/ha, would be required. The evaluations reported in this paper suggest about the same rates are required for effective control of most weeds in Central Otago.

However, for some weeds peculiar to Central Otago, such as slender bedstraw, a 50% increase in doseage is required even though the soils are light schist derived sandy loams with about 2.5% organic matter. For the mulleins, cultivation appeared a better option than herbicides.

On heavier silt loam in coastal Otago, with 10% organic matter, the approximate rates for effective weed control are bromacil 1.5 kg ai/ha, simazine 3.0 kg ai/ha, diuron 3.0 kg ai/ha or metribuzin 1.4 kg ai/ha. This indication was confounded in that the main weed was fumitory, which may need more herbicide than the 'average' weed community (Cox 1977). However the rates are approximately in line with current recommendations in the Waikato area (Rahman, pers comm).

Regarding crop tolerance, there are difficulties in objectively assessing herbicide effects on asparagus. In the early stages the amount of fern produced can be measured, but as the plant becomes better established, it is tedious and expensive attempting to cope with successive emergence of ferns, thus the simple alternative of visual assessment was used. In this investigation there was a remarkable lack of herbicide effect on colour, vigour, or size of asparagus older than 2 years. Linuron (up to 2 kg ai/ha) would be the preferred material on seedling asparagus in terms of effective weed suppression and crop tolerance. However where the crop is being established from 1-year-old crowns, more objective data are required on herbicides such as metribuzin and bromacil.

However the main weed may prove to be self sown asparagus, and at the Alexandra site where many small and shallow rooted crowns had established, excellent tolerance was subjectively demonstrated to all herbicides under test. Yet indications are that chemicals will be preferred for weed control, because the weed seed burden is so great and germination so facile on irrigated warm light soils, that mechanical control (hand hoeing in our case) is rendered ineffective or inadequate.

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APPENDIX

Product, name and presentation of the chemicals reported in this paper were:— amitrol (Weedazol T-L 20% AC), bromacil (Hyvar X-L, 22% AC), diquat/paraquat (Proeglon Extra 6%/12% AC), diuron (Karmex 80% WP), diuron/bromacil (Krovar I 40%/40% WP), glyphosate (Round-up 36% AC), hexazinone (Velpar 90% SP), linuron (Hoechst linuron 50WP), linuron/trietazine (Fisons Finox 25%/25% WP), linuron/trifluralin (Fisons Chandor 12%/24% AC), linuron/monolinuron (Fisons Afalon S 25%/25% WP), propyzamide (Kerb 50-W 50% WP), simazine (Simazol 4A 40% SN).