RESIDUAL HERBICIDES FOR WEED CONTROL IN ESTABLISHED ASPARAGUS

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SUMMARY

Three field trials were conducted on a Horotiu sandy loam soil to test several herbicides for season-long weed control in established asparagus beds and to assess their crop tolerance. Terbacil, bromacil + diuron and atrazine + metolachlor provided the longest effective residual weed control. Hexazinone gave good control for 17-26 weeks. Metribuzin, methabenzthiazuron, simazine and diuron lacked the spectrum of weed control and/or the long residual activity, but most combinations with metribuzin provided effective long term weed control. Alachlor and trifluralin combinations with other chemicals lasted for 7-23 weeks. The short term results on crop tolerance showed no adverse effect of the herbicide treatments on crop yield or quality.

INTRODUCTION

Perennial crops such as asparagus readily harbour reserves of both annual and perennial weeds which act as a seed source and as a supply of regenerative vegetation as soon as cultivation occurs. It has been estimated that herbicides account for up to 20% of the cost of growing asparagus (MAF 1980). In a long term experiment, Walker and Brogdon (1972) found that weed competition during the cutting season seriously reduced asparagus yields; the reduction occurred gradually and continued until the experiment was terminated after 7 years.

Satisfactory season-long weed control is a major problem of asparagus crops, particularly in the mild, high rainfall climate of the Waikato and Bay of Plenty regions (Franklin 1980). Some preliminary work on weed problems of these regions and their control with herbicides in seedling and transplanted asparagus has been published recently (Rahman *et al* 1981 a, b). This paper reports on the further evaluation of herbicides in established asparagus crops.

MATERIALS AND METHODS

Three field trials were conducted near Hamilton over the 1981-82 and 1982-83 growing seasons. In each case the soil was a Horotiu sandy loam with an organic carbon content of 8.8% for Trials 1 and 2, and 9.1% for Trial 3. The pH levels varied between 5.4 and 5.7. The asparagus cultivars were Mary Washington 500W in the second and third season (since transplanting crowns) for Trials 1 and 2 respectively and UC72 in the second season for Trial 3. Trials were of a randomised block design with four replications with plot sizes varying between 5-10 m in length and 3-4.5 m in width. Between 18 and 28 mm of rainfall was recorded during the first 2 weeks after spraying.

Herbicide treatments were applied overall in 350 litres/ha at 210 kPa in late August/early September, just before the emergence of the first spears. The only exceptions were the post-emergence applications in Trial 3 which were sprayed between rows on 11.12.81 contacting only the lower parts of the plants. All treatments in Trial 1 also received 1.0 kg ai/ha of alloxym-sodium (Alloxol) plus 1.0% crop oil to control annual grasses on 14.1.82, 18 weeks after the initial treatment.

Regular weed control assessments were made by visual scoring on a 0-10 scale with 10 being complete weed control. In some cases, data on dry matter production of weeds were taken by harvesting duplicate 0.1 m² samples from each end of the plot. When

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plots became weedy, hand weeding and/or further herbicide treatments were applied to keep the crop relatively free of weeds. In Trials 2 and 3 asparagus spears were harvested nine times over a 4 week period from 24.9.82 to 22.10.82 according to commercial practice. Spears from one harvest were also graded to assess their quality.

RESULTS AND DISCUSSION

The main weeds present in these trials were redroot (*Amaranthus powellii*), black nightshade (*Solanum nigrum*), willow weed (*Polygonum persicaria*) and summer grass (*Digitaria sanguinalis*), with small numbers of prostrate amaranth (*Amaranthus deflexus*), narrow-leaved plantain (*Plantago lanceolata*) and broad-leaved dock (*Rumex obtusifolia*).

The weed control efficacy of the treatments was estimated by regular visual assessments and a treatment was deemed to have failed when the score was less than 8.0. Based on these data, the number of weeks of effective weed control from each treatment is presented in Tables 1 and 2.

Prometryn (Gesagard) gave acceptable weed control for only 4 weeks (Table 1) and was not included in subsequent trials. The combination of trifluralin (Treflan) and linuron (Linuron 50 WP) gave variable results and also suffers the disadvantage of being a split application. A mixture of alachlor (Lasso) with linuron provided only short to medium term weed control, 3-4 weeks less than the mixture of alachlor with metribuzin (Sencor) in both Trials 1 and 2 (Table 1). In Trial 3 (Table 2) metribuzin provided good results as a pre-emergence mixture with diuron (Karmex); and also as a post-emergence combination with simazine (Gesatop WP) causing only temporary scorching of the fern.

TABLE 1: Effects of herbicides on weeds and asparagus (Trials 1 and 2).

Treatment (Trial 1 10.9.81) (Trial 2 27.8.82)	Rate (kg ai/ha)	Weeks of effective weed control		Weeds g/m ²	Spear yield
		Trial 1**	Trial 2	Trial 1 20.4.82	Trial 2
terbacil	2.4	>32	>32	22	1.87
terbacil	1.6	-	22	-	1.62
terbacil	1.0	7	-	*	-
bromacil	1.6	-	18	-	1.37
atrazine + metolachlor	2.7 + 4.8	>32	19	73	1.43
atrazine + metolachlor	1.8 + 3.3	21	17	391	1.76
hexazinone	1.5	26	18	213	1.51
hexazinone	1.0	17	-	610	-
trifluralin + linuron	1.0 + 2.0	23	9	110	1.64
alachlor + metribuzin	3.0 + 0.7	10	15	574	1.90
alachlor + linuron	3.0 + 2.0	7	11	*	1.56
prometryn	1.0	4	-	*	-
SED†				115	NS

- Treatment not included

* Handweeded after failure of weed control

** Overall alloxym-sodium 1.0 kg/ha at 18 weeks

† Approximate SED as analyses were done using the square root transformation

Hexazinone (Velpar WSP) and the metolachlor/atrazine mixture (Primextra) provided season-long control of weeds other than grasses, for which an additional application of alloxym-sodium was required (Table 1). The bromacil (Hyvar X) treatment in Trial 2 (Table 1) lasted only 18 weeks, but in combination with diuron it persisted for a much longer period in Trial 3 (Table 2). A comparison of the diuron mixtures with bromacil or methabenzthiazuron (Table 2) shows that the long term

residual weed control is provided mainly by the bromacil component. Subsequent trial work has confirmed the long persistence of bromacil at the recommended rate of 1.6 kg/ha with or without the addition of diuron. Terbacil (Sinbar) at 1.6 kg ai/ha gave slightly longer weed control than bromacil in Trial 2 and kept the plots virtually clean for the whole growing season at the higher rate (Table 1).

Simazine on its own did not provide very long residual weed control at the recommended rate and the mixture of methabenzthiazuron (Tribunil) plus diuron also failed early in the season (Table 2). Five post-emergence treatments including linuron, metribuzin and its combinations with methabenzthiazuron or diuron were then applied as directed post-emergence treatments. 'Knockdown' and subsequent weed control for the remainder of the season was good for all five treatments, two of which, viz combinations of simazine with metribuzin or linuron, are shown in Table 2.

TABLE 2: Effects of herbicides on weeds and asparagus (Trial 3).

Treatment (8.9.81)	Rate (kg ai/ha)	Weeks of effective weed control	Weed	Asparagus		
			No./m ² (21.4.82)	stems/m ² (28.4.82)	fern kg/m ² (31.5.82)	spear yield t/ha
bromacil + diuron	1.3 + 1.3	>32	2.5 b	6.6	0.32	1.71
metribuzin + diuron	0.7 + 1.3	28	4.8 a	6.4	0.31	1.65
methabenzthiazuron 1.7						
+ diuron	1.3	8	-	6.8	0.34	1.42
simazine	2.4	10	-	5.8	0.28	1.61
simazine	2.4					
+ metribuzin*	0.7	>32	1.2	5.3	0.28	1.57
simazine + linuron*	2.4 + 1.0	28	3.8	6.3	0.31	1.45
				NS	NS	NS

* Herbicide applied post-emergence at 13 weeks; these treatments were not included in the analyses

- No weed data, plots re-treated for weed control

Trials 1 and 2 were on the same site but on different aged crops. The crop was harvested for 4 weeks in Trial 2. Although seasonal variations could account for some of the differences in the duration of weed control between Trials 1 and 2 (Table 1), general observations suggested that soil disturbances caused by harvesting operations, weathering and differences in crop cover had some effects on weed germination, establishment and competitive ability.

The weed dry matter figures for Trial 1 (Table 1) and the weed counts for Trial 3 (Table 2) also reflect the residual life of the treatments and support the weed control scores recorded throughout the growing season.

Spear yields (Table 1 and 2) varied between replicates, but overall results showed no significant differences between treatments in either trial. Grading at one harvest date in Trials 2 and 3 showed that spear quality was not affected by the treatments. Asparagus vigour was also not affected significantly by herbicides in either trial.

These results show that terbacil, bromacil + diuron and the atrazine + metolachlor are capable of giving more than 30 weeks weed control necessary for asparagus. At lower rates, these chemicals along with hexazinone, metribuzin, and possibly trifluralin + linuron could provide weed control for 20-30 weeks after harvest. Alone, metribuzin, methabenzthiazuron, simazine and diuron lacked wide spectrum weed control and/or long residual activity but some combinations of these herbicides were useful.

The short term results on crop tolerance show no adverse effects from the herbicide treatments on crop yield or quality. Further studies are underway on the long term tolerance of asparagus to the more residual chemicals such as bromacil and terbacil.

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REFERENCES

- Franklin, S.J., 1980. Weed control in asparagus. *Proc. seminar on asparagus, Hamilton*: 37-41, Advisory Services Division, MAF, Hamilton.
- MAF, 1980. *Proc. of Asparagus Seminar*, Flock House, M. Thomsen (ed.), 36 pp.
- Rahman, A., Sanders, P. and Thompson, A., 1981a. Weed control in asparagus seedlings. *Proc. 34th N.Z. Weed and Pest Control Conf.*: 59-62
- Rahman, A., Thompson, A. and Sanders, P., 1981b. Weed control in newly transplanted asparagus. *Proc. 34th N.Z. Weed and Pest Control Conf.*: 63-66
- Walker, W.V. and Brogdon, J.L., 1972. Effects of continued use of herbicides in asparagus plantings. *Weed Sci.* 20: 428-432