HERBICIDES FOR CONTROL OF TWO BINDWEED SPECIES (*CALYSTEGIA SILVATICA* AND *CONVOLVULUS ARVENSIS*) IN ASPARAGUS

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SUMMARY

Several herbicides were evaluated for control of greater bindweed (*Calystegia silvatica*) and field bindweed (*Convolvulus arvensis*) in asparagus (*Asparagus officinalis*) during the harvest season. Most treatments provided good control of the sprayed top growth, but considerable emergence of new vines from the extensive root system continued. Imazapyr at rates of 0.5 to 1.0 kg/ha gave the best control of both species, with effects lasting through to the next growing season. Triclopyr, dicamba, glyphosate, chlorsulfuron and amitrole generally gave good knockdown of the weeds but regrowth soon occurred. Clopyralid, tested only on greater bindweed, did not provide effective control.

Keywords: asparagus, bindweed, *Calystegia silvatica*, *Convolvulus arvensis*, chemical control

INTRODUCTION

Control of the complete spectrum of weeds in asparagus crops for the duration of the season is difficult in the mild, high rainfall regions of the North Island. Soil applied herbicides with a long residual life are generally used to achieve this at present (Rahman 1986). The use of cultural measures for weed control is usually confined to the closeup stage (at the end of the harvest season) or to the winter season after the ferns have been cut down (Rahman and Sanders 1990). This reliance on chemical weed control can result in an increase of some perennial weeds that are tolerant to the herbicides and often have growth habits similar to those of asparagus.

Greater bindweed and field bindweed have become persistent problems in several asparagus crops, particularly in the Waikato and Hawkes Bay regions. Their deep rhizomatous root systems are capable of generating new plants from small fragments broken up by cultivation and in this way they are spread through the asparagus field. The sprawling climbing stems make harvesting of the asparagus spears very difficult as they cover the rows and entwine the growing spears. Recommendations for controlling the bindweeds have included spot applications of dicamba during the asparagus growing season, with risk of damage to the crop (Rahman and Sanders 1990).

The aim of this study was to evaluate several herbicides with potential to control the bindweeds and to observe their effects on the asparagus crop.

MATERIALS AND METHODS

This study included three field trials conducted over two growing seasons in asparagus crops in the Waikato. One site at Horotiu (Trials 1 and 2) had a severe infestation of greater bindweed, thought to have come as a contaminant when the crowns were planted, while the other site at Horahora (Trial 3) had a moderate infestation of field bindweed spreading in from the headlands. Both sites had well established (about 10 years old) crops of asparagus, cv. New Zealand Beacon and cv. Mary Washington respectively. Winter cultivation was used on both properties to incorporate the fern trash after mulching in early winter, for weed control and mounding up the rows for the next season. General weed control in Trial 1 at the begining of the season in September 1989 was with terbuthylazine (2.5 kg/ha) plus terbumeton (2.5 kg/ha) and in Trials 2 and 3 in 1990 with diuron (2.5 kg/ha) plus bromacil (2.5 kg/ha).

Trial 1 at Horotiu, was on greater bindweed with stems up to 40 cm long showing

some discolouration from the soil residual herbicide previously used. Treatments listed in Table 1 were applied in 200 litres/ha water at 180 kPa on 11.10.89. Citowett at 0.025% was added to the chlorsulfuron and amitrole treatments. Plots were 7 m x 2 m (1 row), arranged in a randomised block design with five replications. Trial 2, on the same property a year later, with stems up to 50 cm long, was sprayed with treatments listed in Table 2 in 250 litres/ha on 1.11.90. The plot size was 8 m x 4 m (two rows), with four replicates. Trial 3, at Horahora, on field bindweed with stems up to 30 cm long was sprayed in 300 litres/ha on 2.11.90 with the same treatments as Trial 2. Plot size was 8 m x 3 m (two rows), with four replicates.

Visual assessments of damage to the bindweed were made at regular intervals after application of the treatments. Regrowths were also counted four times in Trials 2 and 3, including a count at 12 months after treatment. Asparagus spear counts were made on several visits during the remainder of the season to assess damage to the asparagus plants.

RESULTS AND DISCUSSION

Trial 1 (Greater bindweed)

Visual damage asssessed at 3 weeks after treatment (WAT) showed imazapyr was the fastest acting and most effective herbicide, followed by dicamba and chlorsulfuron (Table 1). Glyphosate and amitrole were intermediate, while clopyralid was the least effective. Observations at 6 and 9 WAT showed that the effectiveness of herbicides still followed the same pattern, but new shoots and regrowth of bindweed were appearing in all plots except those treated with imazapyr.

TABLE 1: Visual assessment of percent control of greater bindweed in Trial 1 after application of herbicide treatments on 11.10.89.

Treatment	Rate (kg ai/ha)	Greater bindweed control (%)		
		3WAT*	6WAT	9WAT
clopyralid (Versatill)	0.3	40	31	28
amitrole (Weedazol)	4.0	63	47	54
glyphosate (Roundup)	2.16	64	58	48
chlorsulfuron (Glean)	0.015	82	67	57
dicamba (Banvel)	0.4	82	70	62
imazapyr (Arsenal)	1.0	92	100**	100**
SED (0.05)		7.9	13.1	11.2

* WAT - weeks after treatment.
** Not included in analyses.

Trial 2 (Greater bindweed)

Triclopyr gave quicker initial control of the treated foliage, but by 5 WAT all treatments except glyphosate had resulted in a very high level of control (Table 2). Triclopyr was slightly more effective than dicamba. The number of bindweed plants continued to increase on all plots and by 11 WAT all treatments except imazapyr had a large weed population. Counts of stems in the plots 12 months after treatment (and after the winter cultivation which would have resulted in some movement of soil between plots) showed that large differences still existed between treatments, with the two high rates of imazapyr having the lowest numbers (Table 2), and with vines considerably shorter in length and growing very slowly.

TABLE 2: Effect of herbicide treatments on percent control and regrowth of greater bindweed and on the number of asparagus spears, in Trial 2, treated on 1.11.90.

Treatment	Rate (kg ai/ha)	Bindweed control (%)		Bindweed shoots/plot				spears/plot (no)*
		2WAT	5WAT	4WAT	5WAT	11WAT	50WAT	
glyphosate	2.16	70	86	95	142	many	1800	135
triclopyr	1.2	98	97	28	45	many	1700	168
dicamba	0.4	89	93	40	60	many	1070	184
imazapyr	0.25	58	96	17	21	19	1200	171
imazapyr	0.5	78	98	11	8	7	690	198
imazapyr	1.0	73	99	8	5	1	255	170
SED (0.05)		4.0	3.1**	5.4***	5.6***		371***	17.7

* Sum of four counts taken on 15.11.90, 27.11.90, 11.12.90 and 15.01.91.
** Approximate SED (reflects analysis of angular transformed data).
*** Approximate SED (for imazapyr treatments only).

Trial 3 (Field bindweed)

Results of assessments on the field bindweed were similar to those of the greater bindweed, with the exception that glyphosate also provided good control of the treated shoots (Table 3). Counts of the regrowths and new shoots showed triclopyr was more effective than glyphosate or dicamba, and by 10 WAT triclopyr and all rates of imazapyr were still providing excellent control. This difference between the treatments carried over into the next growing season, but by this stage the two high rates of imazapyr had significantly fewer shoots than all the other treatments (Table 3).

TABLE 3: Effect of herbicide treatments on percent control and regrowth of field bindweed, and on the number asparagus spears emerging in Trial 3, treated 2.11.90.

Treatment	Rate (kg ai/ha)	Bindweed control (%)		Bindweed shoots/plot*				spears/plot	
		2WAT	5WAT	5WAT	6WAT	10WAT	52WAT	1990**	31.10.91
glyphosate	2.16	38	95	11	13	14	58	394	47
triclopyr	1.2	75	98	5	7	5	46	394	41
dicamba	0.4	75	92	21	14	25	100	373	42
imazapyr	0.25	15	86	14	9	5	50	362	43
imazapyr	0.5	25	99	3	2	1	7	382	39
imazapyr	1.0	33	99	2	1	1	7	387	47
SED (0.05)		8.6	2.0***					28.6	4.7
MSR (0.05)†				2.2	2.03	2.07	2.9		

* Back transformed data of log (y + 1).
** Sum of five counts taken on 12.11.90, 4.12.90, 21.12.90 and 11.01.91.
***Approximate SED (reflects analysis of angular transformed data).
† Minimum significant ratio.

Crop tolerance

Asparagus spear counts made at various times (Tables 2 and 3) showed that there were no significant differences between treatments, except for lower numbers in the glyphosate treatment in Trial 2. This may have beeen due to greater competition and shading from the greater number and size of bindweed plants compared with other

treatments. In a separate small plot asparagus tolerance trial where imazapyr was applied to bare ground after a late closeup (4.1.90), and effects on crop growth were monitored for 18 months, 4 kg/ha imazapyr did not cause any long term damage to the asparagus crop (data not presented). However, observations have also shown that the herbicide caused extreme damage when applied to the young ferns after closeup.

In this study imazapyr at rates of 0.5 to 1.0 kg/ha gave long term reductions of the two bindweed species, which are a problem in asparagus crops. It was much more effective than the present recommendation of dicamba and also compared to the other herbicides tested. Unlike dicamba, only one application of imazapyr would be required during the growing season. It would probably be necessary to continue spraying for more than 1 year, although spot treatment could be adequate in subsequent years.

Short to medium term results show no noticeable adverse effects of imazapyr on the asparagus crop. However due to its long persistence and appreciable leaching in the soil recorded in our glasshouse studies (Rahman *et al* 1993), the crop tolerance aspect needs to be studied in different soil types and under different climatic conditions. If imazapyr is to be used during the harvest season (eg. after a hard cut) when bindweeds pose the biggest problem, information would also need to be collected on its residues in asparagus spears, as has been done for dicamba and glyphosate (Rahman *et al* 1992)

ACKNOWLEDGEMENTS

Thanks are due to G.N. Bradley (AFFCO Asparagus) and M.F. Van Camp for providing the trial sites and Dr J.E. Waller for the statistical analyses.

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