

## HERBICIDE TOLERANCE OF GARDEN NASTURTIUM (*TROPAEOLUM MAJUS*)

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### SUMMARY

Garden nasturtium is a species which has a number of uses both in New Zealand and overseas. Several selective pre-emergence herbicides were applied to germinating seeds in two separate pot experiments, and chlorpropham and oryzalin showed the best crop tolerance. In another pot experiment which screened a range of post-emergence herbicides, haloxyfop, MCPB, asulam and methabenzthiazuron were the least damaging chemicals.

**Keywords:** garden nasturtium, *Tropaeolum majus*, herbicide tolerance, flower crops

### INTRODUCTION

Belonging to the Tropaeolaceae family and originating in Peru, garden nasturtium is an annual or short-lived perennial species often grown in New Zealand flower gardens but which has also escaped to cause weed problems in some waste places (Webb *et al.* 1988). Although normally grown for its attractive flowers, the leaves, flowers and seeds of this scrambling plant are all edible and can be used in salads (Heywood 1978). It also has herbal properties, and its trailing growth form makes it suitable for stabilizing steep banks and as a ground cover in orchards where it is claimed to smother weeds and repel certain insect species (Fakava 1992).

Despite the popularity of this species, there is little commercial production of its seed, so the price for seed is high (\$92/kg). Some growers are interested in cultivating garden nasturtium for seed, both for seed sales and to provide seed sprouts for the health food market. Some selective herbicides were screened for their suitability to control weeds in establishing garden nasturtium crops as part of a larger programme investigating the seed production of this species at the Seed Technology Centre, Massey University.

### MATERIALS AND METHODS

Three separate pot trials were conducted to assess tolerance to herbicides. In Trial 1, garden nasturtium seeds were sown 2.5 cm deep into 300 ml plastic pots containing Ohakea silt loam soil. Each pot had four seeds, and pots were immediately treated with a range of pre-emergence herbicides (Fig. 1) on 12 December 1991. The pots receiving trifluralin were sown after the herbicide was thoroughly mixed into the soil. Herbicides were applied in 215 litres/ha of water at 200 kPa using a pendulum laboratory sprayer similar to that described by Wiese (1977). Pots were then placed in a standing-out area and watered daily by hand. Each treatment was replicated six times using a completely randomised experimental design. Seedlings emerged 8 days after treatment, and were thinned to one per pot 5 days later. Plants were assessed for herbicide tolerance 4 weeks after emergence by scoring the severity of phytotoxicity. An analysis of variance was performed on the probit transformed scores, and means were separated using the Student-Newman-Keuls multiple range test.

Most treated and untreated plants in Trial 1 died for unknown reasons after the 4 week assessment. A second trial was then initiated in which the most promising herbicides (Table 1) were applied to pots of Ohakea silt loam soil with four seeds per

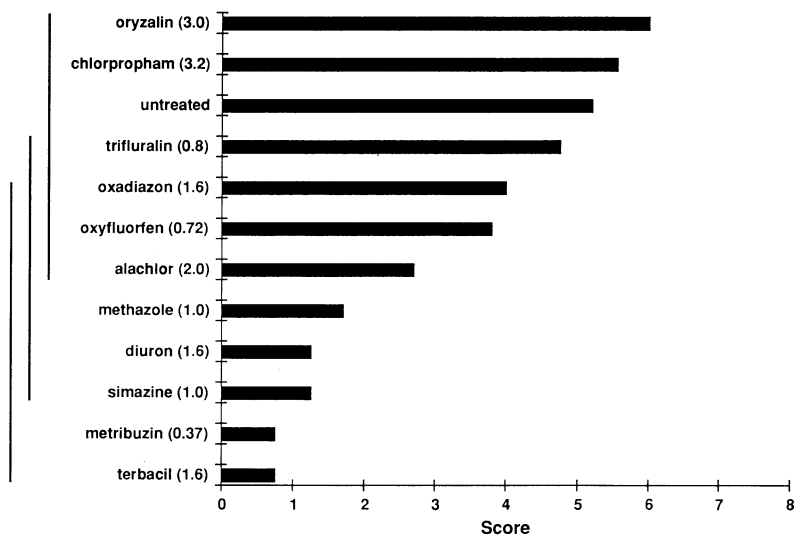
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pot and six replicates of each treatment. A further six replicates of each treatment were applied to pots containing a potting mixture with 73% sand, 20% peat, 7% pumice and slow-release fertiliser. Herbicides were applied as for Trial 1 on 10 February 1992 at 371 litres/ha. Pots were kept in a glasshouse between 15-25°C on automatically sub-irrigated felt mats, though they also received overhead hand-watering for several days after application to wash in the herbicides. Seedlings were thinned as in Trial 1, and assessed for herbicide tolerance by scoring at regular intervals.

A third trial involved application of several post-emergence herbicides (Table 2) to garden nasturtium seedlings at the 5-leaf stage (4 weeks old) growing singly in 300 ml pots of the potting mixture used in Trial 2. Treatments were replicated six times and applied in 479 litres/ha of water on 6 January 1992. Plants were placed in a glasshouse and visually assessed as for Trial 2. Individual plant dry weight and flower number were determined 16 weeks after treatment.

### RESULTS AND DISCUSSION

Results from the first trial suggested terbacil (Sinbar), metribuzin (Sencor DF), simazine (Gesatop 500 FW), diuron (Karmex) and methazole (Probe 75 WDG) were unlikely to be selective enough for use in establishing garden nasturtium crops at the application rates considered necessary to give useful levels of weed control (Fig. 1). However, oryzalin, trifluralin, chlorpropham, oxadiazon, oxyfluorfen and alachlor appeared worthy of further consideration.



**Figure 1:** Effect of pre-emergence herbicides (application rates in kg/ha) on garden nasturtium in pots, 4 weeks after emergence (0 = dead, 10 = healthy). Treatments joined by vertical lines on the left are not significantly different ( $P = 0.05$ ).

The inclusion of the potting mixture in the second trial was an attempt to increase aeration and drainage in the pots. Garden nasturtium requires good soil drainage (Schutte 1959), so poor drainage from the potted silt loam soil used in the first trial may have caused the widespread plant mortality. However soil was still used in the second experiment as it was considered important to use a less artificial media to assess the effects of soil adsorption and microbial activity on herbicide activity.

Oryzalin and chlorpropham were the two least damaging herbicide treatments with both potting media in Trial 2 (Table 1). Alachlor and trifluralin both caused significant checks in the development of garden nasturtium plants, particularly in the potting mix, so caution would be necessary in using these herbicides.

**TABLE 1: Effect of pre-emergence herbicides on garden nasturtium in potting mixture or soil at 3 and 15 weeks after seedling emergence.**

Treatment	Rate (kg ai/ha)	Trade name	Score <sup>1</sup> at 3 weeks		Score at 15 weeks	
			Soil	Mix	Soil	Mix
trifluralin	0.8	Triflur 40	5.2 c <sup>2</sup>	3.7 b	7.7 a	7.3 b
oxadiazon	1.6	Foresite	0.3 d	3.8 b	0.7 b	7.2 b
oxyfluorfen	0.72	Goal	5.3 c	4.7 b	1.3 b	7.7 b
alachlor	2.0	Shell Alachlor	6.0 bc	5.0 b	8.3 a	7.3 b
chlorpropham	3.2	Chloro-IPC	6.7 abc	9.8 a	8.0 a	8.0 ab
oryzalin	3.0	Surflan	9.8 ab	10.0 a	8.3 a	9.0 ab
untreated	-	-	10.0 a	10.0 a	9.0 a	9.3 a

<sup>1</sup> Scores range from 0 = dead to 10 = healthy.

<sup>2</sup> Treatments sharing the same letter within a column were not significantly different (P = 0.05).

The two most damaging residual herbicides in Trial 2 were oxadiazon and oxyfluorfen. Phytotoxicity caused by them was more marked in plants growing in the soil than the potting mixture, and for oxadiazon was more marked for plants growing in soil in the second trial than in Trial 1. Both these herbicides are absorbed by the emerging shoot of plants from a moist film on the soil surface (O'Connor 1989). The variability in results may have been due to a drier surface layer during crop emergence in Trial 1, which had the occasional hand-watering, compared with the sub-irrigation of Trial 2. In addition, the more open structure of the potting mixture may not have drawn as much water to the surface of pots as the soil. Variability in results makes these herbicides unsuitable for selective use in garden nasturtium.

**TABLE 2: Effect of post-emergence herbicides on garden nasturtium plants treated at the 5-leaf stage, as assessed using a scoring technique (0 = dead, 10 = healthy) at 4 and 13 weeks after application, mean flower number per plant and mean plant dry weight at 16 weeks after application.**

Treatment	Rate (kg ai/ha)	Trade name	Score		Flower no.	Plant DW (g)
			4 week	13 week		
asulam	1.6	Asulox	6.8bc <sup>1</sup>	7.8 ab	2.0 ab	1.6 ab
bentazone	1.4	Basagran	4.7 e	3.2 c	0.7 ab	1.2 b
chloroxuron	4.0	Tenorán 50 WP	6.7 bcd	7.0 b	1.0 ab	1.3 b
clopyralid	0.3	Versatill	5.0 de	3.7 c	1.2 ab	1.7 ab
dalapon	5.1	Icapon	8.3 b	7.5 b	0.5 b	2.0 ab
haloxyfop	0.3	Gallant	6.7 bcd	7.5 b	2.0 ab	2.5 ab
ioxynil	0.67	Totril	2.2 f	1.0 d	0.0 c	0.0 c
MCPA	1.5	IWD MCPA	4.0 e	4.2 c	0.3 b	1.2 b
MCPB	1.6	IWD MCPB	5.3 cde	7.8 ab	1.2 ab	2.5 ab
methabenzthiazuron	1.4	Tribunil DF	7.0 bc	7.5 b	2.7 ab	2.1 ab
untreated	-	-	9.8 a	8.8 a	3.3 a	2.7 a

<sup>1</sup> Treatments sharing the same letter within a column were not significantly different (P = 0.05).

All post-emergence herbicides investigated in Trial 3 noticeably affected garden nasturtium seedlings initially (Table 2). However MCPB, asulam, haloxyfop and methabenzthiazuron all appeared to cause only minor checks in growth of the seedlings and, based on subsequent measurements, are probably safe to use. Chloroxuron may also be safe to use, though it did result in a significant reduction in plant dry weight, and is now no longer available in New Zealand anyway. The scores suggested that dalapon is safe to use, but it appeared to reduce the number of flowers formed. Ioxynil was the most damaging of the post-emergence herbicides, and bentazone was also too damaging to use selectively. The other two herbicides assessed, clopyralid and MCPA, could not be recommended either based on these results as crop tolerance was only fair.

Further work is required to check the crop tolerance of the most promising treatments in combination with each other and also under field conditions. However, if chlorpropham and oryzalin could be used pre-emergence either alone or in combination, most weed species should be prevented from establishing until the garden nasturtium crop had established a weed-smothering canopy. Any weed species not controlled by these two residual herbicides could probably be controlled by choosing the most appropriate compound from the list of MCPB, methabenzthiazuron, haloxyfop or asulam.

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