Vegetable Crops

NEW HERBICIDES FOR CARROTS

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Summary

Weed control and crop tolerance trials in Levin and Ohakune districts suggest that alachlor may be used in carrots at 1 kg/ha with linuron at 0.5 kg/ha although in one instance this mixture reduced yield. Metribuzin 0.4 kg/ha was tolerated except in one trial applied pre-emergence. Carrots were tolerant to 1 or 2 kg/ha of asulam at the four true leaf stage. Metoxuron was safe but without any apparent advantage over existing herbicides.

INTRODUCTION

Commercial weed control in carrots has changed little in the past decade. A small number of well-known herbicides are accepted and regularly used by growers. As would be expected with an unchanging practice, weeds previously of moderate significance have now become important. The recent interest of some growers in specialised bed systems and small "finger carrot" production in high density sowings (Bussell 1973) has highlighted the problem of resistant weeds.

In the period 1973-75 eight trials were carried out at Levin and in the important Ohakune carrot growing area to examine the usefulness of newer herbicides, particularly alachlor and metribuzin, when applied before or after crop emergence. Crop tolerance to asulam was investigated as this herbicide, if safe enough, might be used against docks.

METHODS AND MATERIALS

Seedbeds were prepared and, generally, plots 6 m long and 1.5 m wide were drilled with four rows spaced 35 cm apart. In Ohakune a different practice was followed in one trial where the plots were drilled with two drill units 75 cm apart which spread the seed over a 2.5 cm wide band.

Details of the rates, times of application and mixtures of herbicides can be read with the weed information presented in Table 1 and crop yields in Tables 2 and 3. All herbicides were sprayed either after sowing or after crop emergence. No soil incorporated treatment comparisons were included in these trials.

Weeds were assessed by quadrat counts or visual scores made 20-30 days after treatment and as required thereafter. Information from individual trials has been consolidated and conclusions regarding weed susceptibility are drawn only when consistent data were obtained in two or more trials. The following species occurred:—

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Redroot	(<i>Amaranthus powellii</i>)
Shepherd's purse	(<i>Capsella bursa-pastoris</i>)
Fathen	(<i>Chenopodium album</i> agg)
Twin cress	(<i>Coronopus didymus</i>)
Scrambling Fumitory	(<i>Fumaria muralis</i>)
Poa annua	(<i>Poa annua</i>)
Willow weed	(<i>Polygonum persicaria</i>)
Wild portulaca	(<i>Portulaca oleracea</i>)
Black nightshade	(<i>Solanum nigrum</i> complex)
Spurrey	(<i>Spergula arvensis</i>)

Results are presented from three crop tolerance trials, that is, trials which were maintained as far as possible without weed growth affecting crop development. Plots were hoed as required and, in the case of the asulam tolerance investigation, overall applications were made of trifluralin 1.0 kg/ha pre-sowing, linuron 0.5 kg/ha pre-emergence and again post-emergence. The post-emergence application was timed to give a week's interval after the two true leaf stage and before the four true leaf stage asulam treatment.

Yields were taken from areas of the order of 4 m² per plot after discard strips had been removed. Trial 1 was sown in early November 1974 and harvested 98 days later. Trials 2 and 3 were sown in late February 1975, overwintered, and harvested after 193 days. The cultivar 'Manchester Table' was used for all three trials.

RESULTS

Weed Control (see Table 1)

Linuron, and a mixture of linuron with prometryn controlled most of the weeds recorded in the trials. No benefit could be detected by including prometryn although it was not possible to test the sensitivity of scrambling fumitory as this weed did not occur in the appropriate trials. More definite control of fathen, willow weed and black nightshade were obtained from applications made after, rather than before, emergence.

The advantage of alachlor was better control of poa annua. Several combinations of alachlor and linuron were tested. The inclusion of 0.5 kg/ha gave indefinite control of fathen and willow weed and there was no clear improvement with increase in rate of alachlor from 1.0 to 1.5 kg/ha. When linuron 1.0 kg/ha and alachlor 1.5 kg/ha were applied together, all species recorded were controlled. Metribuzin at 0.2 kg/ha gave good control of all weeds present except black nightshade.

Metoxuron 3.5 kg/ha, applied post-emergence, controlled fathen and black nightshade well but willow weed was resistant.

Crop Tolerance

In general, when compared with controls, treatments reduced yields more in trial 2, sown in February, than in trial 1 which was November sown.

TABLE 1: Summary of weed information gained from carrot trials in Levin and Ohakune, 1973-75

Application	pre	post	pre-emergence	Weed Species											
				redroot	shepherd's purse	fathen	twin cress	scrambling tumbleweed	Poa annua	willow weed	wild portulaca	black nightshade	spurrey		
Response:	S	I	R												
Herbicide and rate of application (kg/ha)															
linuron 1.0				S	-	I	S	R	I	R	S	I	I		
linuron 0.5 + prometryn 0.5				I	-	I	S	-	-	I	S	I	S		
alachlor 1.5				I	S	I	S	I	S	R	S	S	S		
linuron 0.5 + alachlor 1.0				-	-	S	-	I	S	I	-	S	-		
linuron 0.5 + alachlor 1.5				S	-	I	S	-	-	R	S	S	S		
linuron 1.0 + alachlor 1.5				-	-	S	-	S	S	S	-	S	-		
metribuzin 0.1				-	-	-	-	-	-	-	-	-	-		
metribuzin 0.2				S	S	S	S	S	S	S	I	R	R		
metoxuron 3.5				-	-	-	-	-	-	-	-	-	S		

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Two pre-emergence treatments caused damage in both trials (Table 2). Alachlor 1.5 kg/ha and linuron 1.0 plus alachlor 1.5 kg/ha reduced crop vigour and, at the 5% level of probability, significantly reduced yields. In addition, in trial 2, pre-emergence linuron and metribuzin treatment yields were low in comparison with the control.

TABLE 2: Effects of linuron, alachlor and metribuzin on yields of carrots (tonnes/ha)

Herbicide and rate of application (kg/ha)	Trial 1		Trial 2	
	Pre-em	Post-em	Pre-em	Post-em
linuron 1.0	49.6 abc	51.5 ab	48.5 bcd	50.5 bcd
alachlor 1.5	39.4 de	48.6 abc	50.3 bcd	
linuron 0.5 + alachlor 1.0	46.3 bc	48.7 abc	54.0 abc	48.9 bcd
linuron 1.0 + alachlor 1.5	38.7 e	49.6 abc	48.3 bcd	46.0 cd
metribuzin 0.2	47.9 bc	53.8 a	52.4 bcd	51.4 bcd
metribuzin 0.4	44.3 cd	46.8 bc	44.8 d	54.4 abc
control	49.7 abc		61.1 a	
CV %	9.2		14.8	

Post-emergence, in trial 1 all treatments gave yields equal to control but in trial 2 metribuzin 0.4 kg/ha was the only one which did not cause a statistical yield reduction.

Asulam applications at the carrot two true leaf stage resulted in yields lower than the untreated control as did the higher dose application at the eight true leaf stage (Table 3). The applications made at the four true leaf stage and the lower dose applied at the eight true leaf stage did not affect carrot yields.

TABLE 3: Effect of asulam applications on yields of carrots (Trial 3)

Stage of Growth	Rate (kg/ha)	Yield (tonnes/ha)
2 true leaves, 4-5 cm tall	1	40.5 d
	2	42.2 bcd
4 true leaves, 7-8 cm tall	1	47.8 a
	2	46.0 ab
8 true leaves, 13-14 cm tall	1	45.3 abc
	2	40.9 cd
untreated		48.9 a
CV %		8.1

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DISCUSSION

The experience gained in these trials has suggested several weed control treatments which may augment those already in use in carrots. Alachlor can complement linuron particularly where grass weeds are expected; also, it is known from other experience that the linuron-resistant *Veronica* and *Fumaria* spp are sensitive. Crop tolerance is rather delicate, however, and the use of alachlor should not be considered at more than 1 kg/ha. In mixtures it would be prudent to limit a linuron rate of 0.5 kg/ha pending further experience.

Metribuzin 0.4 kg/ha significantly reduced yields in one instance and there was a tendency for post-emergence applications to have less effect than those made before emergence. This herbicide already has a label recommendation in New Zealand for use in carrots but more experience under different conditions is needed. In the meantime the safest practice may be to apply a lower dose, say 0.3 kg/ha, at the two true leaf stage of the crop and repeat this if necessary a fortnight later.

Little evidence was produced by the trials to encourage the use of metoxuron in New Zealand (metoxuron is used in carrots in Europe particularly for control of mayweeds).

The differences of crop response in trials 1 and 2 to the same chemical treatments applied at different times of the year needs further investigation. Soil moisture was adequate in both seedbeds. Mean air temperatures were lower (15°C) at the start of trial 1 in November than when trial 2 commenced in February (19°C). It may be that under rapid growing conditions in summer the crop was more susceptible to herbicides.

Asulam at 1 or 2 kg/ha did not significantly affect carrot yields when applied at the four true leaf stage. At the eight true leaf stage the crop tolerated the lower rate. The dose range tested effectively controls docks (*Rumex* sp) and, as there should be no reason to spray a carrot crop overall, spot treatment should be a sound recommendation for dock control.

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REFERENCE

Bussell, W.T., 1973. Effects of plant density and time of harvest on yield of small finger carrots *N.Z.J. Exp. Agric.* 1 (1): 69-72.