RESPONSE OF POTATOES, ONIONS AND TOMATOES TO HERBICIDES USED FOR BRUSHWEED CONTROL

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SUMMARY

Three herbicides recommended for brushweed control, triclopyr, glyphosate and metsulfuron-methyl, were each applied to potatoes, onions and tomatoes. Triclopyr did not significantly reduce the yield of onions at 1000 g/ha, but reduced potato and tomato yields at 500 g/ha and 50 g/ha respectively. Glyphosate at 500 g/ha caused severe foliar damage and a significant yield reduction in all three crops. Metsulfuron-methyl severely damaged potatoes at 5 g/ha, onions at 1 g/ha and significantly decreased the yield of tomatoes at 0.1 g/ha.

INTRODUCTION

If proper precautions are not taken during spraying, the drift of herbicide spray may cause damage to sensitive crops growing in the vicinity. The extent of the damage depends on a number of factors such as the application method, rate, weather conditions prevailing at the time and the sensitivity of the crops to a specific herbicide. Previous work has shown that broadleaf crops do vary greatly in their sensitivity to a particular herbicide (Lobb and Woon 1983; Smith and Geronimo 1984; Lucas and Lobb 1987). From this information it is possible to choose a herbicide which is least likely to cause damage to a particular crop, if drift occurs.

These trials were carried out to measure the comparative damage caused by three herbicides recommended for brushweed control in New Zealand, viz. triclopyr, glyphosate, and metsulfuron-methyl. Trials were conducted on three commonly grown annual crops, potatoes, tomatoes and onions.

METHOD

Three trials were conducted, one each on potatoes, onions and tomatoes. Details of crops and the trials are given in Table 1.

The maximum rate chosen for each herbicide was derived from the lowest label rate commonly used for brushweed control using a handgun. For example the label rate for triclopyr is 120 g/100 litres. Assuming a total of 5000 litres of spray mix is applied per hectare, 15% of this, which is considered very significant off target drift, gives a concentration of 900 g/ha, which was rounded up for convenience to 1000 g/ha.

All three trials were replicated twice within a randomized block design. Application was made with a hand held precision sprayer fitted with a boom containing Teejet 730154 fan nozzles, delivering 200 litres/ha at 200 kPa.

TABLE 1: Summary of crop and trial details

Crop	Application date	Plot size	Planting date	Harvest date	Crop stage at application	Crop cultivar
potato	21.10.88	1 row x 9m	15.8.88	30.11.88	preflower 350 mm height	Ilam hardy
onion	20.12.88	4 rows x 8m	8.7.88	15.2.89	early bulbing	Pukekohe long keeper
tomato	29.12.88	1 row x 8m (15 plants)	25.11.88	8.2 to 14.4.89 10 x 1 wk	flowering	Scoresby dwarf

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Formulations used were triclopyr (Grazon, 60%, emulsifiable concentrate), metsulfuron-methyl (Escort, 60%, dispersible granule) and glyphosate (Roundup 36% aqueous concentrate).

A visual assessment of crop damage was made at approximately 1 week and 5 weeks after treatment using a 0-100 injury scale where 0 equated to no effect. Yields were taken for potatoes and onions at normal harvest time while the tomatoes were harvested weekly for 10 weeks from early February to mid April.

RESULTS AND DISCUSSION

The mean ratings of visual damage, expressed as percent injury, and crop yields (t/ha) are presented in Table 2.

Potatoes

Triclopyr had produced visible effects on foliage at rates down to 50 g/ha by 1 week post treatment which remained through until harvest. The two highest rates, 500 and 1000 g/ha, caused quite severe distortion of leaves and stems with the maximum damage symptoms appearing by 5 weeks. The 1000 and 500 g/ha rates of triclopyr significantly reduced the yield of edible tubers compared with the lower rates. Tubers regarded as inedible were covered in round scale-like blemishes. Rates of 100 g/ha and below did not produce skin blemishes.

Glyphosate had produced visible effects on foliage at rates down to 50 g/ha by 1 week post treatment. The higher rate caused leaf collapse while at the lower rates there was more of a general yellowing. By 5 weeks 1000 g/ha had caused total brownout and 500 g/ha had only a few green stems remaining. The 1000 and 500 g/ha rates of glyphosate significantly reduced the yield of edible tubers. The skin blemish from these rates was a crazed net-like pattern over one end of the tubers.

Metsulfuron-methyl had produced a general yellowing of foliage at rates down to 1 g/ha by 1 week post treatment. Five weeks after application 5 g/ha or higher rates

TABLE 2: Percent injury and yield of crops treated with triclopyr, glyphosate and metsulfuron-methyl

Treatment	Rate (g ai/ha)	Potato			Onion			Tomato		
		visual injury (%)		yield	visual injury (%)		yield	visual injury (%)		yield
		1wk	5wk	t/ha	1wk	5wk	t/ha	1wk	5wk	t/ha
triclopyr	1000	43	57	0 *	73	57	17.8	80	100	0 *
"	500	35	27	1.9*	65	50	18.6	73	99	0 *
"	100	10	5	9.8	10	5	33.2	42	50	15.3*
"	50	5	5	6.9	0	0	29.4	15	35	37.7*
"	10	0	0	13.0	0	0	41.6	0	0	45.7
"	1	0	0	11.0	0	0	28.6	0	0	60.9
glyphosate	1000	50	100	0.1*	20	65	4.2*	85	98	0.1*
"	500	43	90	0.6*	10	50	9.6*	58	90	0.3*
"	100	20	43	7.2	0	0	35.6	23	23	42.8
"	50	10	27	8.6	0	0	24.6	0	20	44.7
"	10	0	5	14.4	0	0	28.8	0	0	58.7
"	1	0	0	12.4	0	0	32.2	0	0	50.3
metsulfuron-methyl	100	35	94	0.2*	43	100	0 *	80	99	0 *
"	50	35	95	0.6*	50	100	0 *	73	94	0 *
"	10	27	90	0.9*	35	100	0 *	80	73	1.5*
"	5	35	90	0.6*	28	95	0 *	73	58	7.6*
"	1	15	10	3.8*	10	65	1.8*	50	23	30.7*
"	0.1	0	5	10.5	0	0	28.8	5	18	33.4*
untreated	—	0	0	11.9	0	0	31.4	0	0	64.0
	CV%	28	19	30	23	17	28	9	19	28

*Significantly different from untreated ($P < 0.05$).

had caused complete or near complete brownoff of all green tissue. Yields of edible tubers were significantly reduced from rates of 1 g/ha metsulfuron-methyl or higher. Tubers from these treatments also developed skin blemishes but these were dark sunken spots, round or figure eight in shape.

Onions

Triclopyr at 1000 and 500 g/ha had produced quite severe leaf distortion and chlorotic spots on onion plants after 1 week, which persisted to a lessening degree to 5 weeks post treatment. Visual symptoms were also observed at 100 g/ha and consisted of minor leaf spotting, but no symptoms were seen at rates below 100 g/ha. The yields for the 1000 and 500 g/ha rates were depressed, but not significantly.

Glyphosate caused very slight symptoms at 1 week and only from the 1000 and 500 g/ha rates. The symptoms were mainly a slight tip burn of foliage and by 5 weeks the burn had increased, but more noticeable was a stunting with a reduction in plant and bulb size. Both these rates resulted in significant yield reductions at harvest. Rates of 100 g/ha or lower caused no visual damage or yield reduction.

Metsulfuron-methyl down to 0.1 g/ha had produced visible effects on foliage by 1 week post treatment. Leaf necrosis gradually increased after 5 weeks with rates of 5 g/ha and above resulting in death of the plants. The 1 g/ha rate did not kill plants but at harvest the majority of bulbs were beginning to become soft and rotten. The lowest rate, 0.1 g/ha, caused no visual damage or yield depression.

Tomatoes

Triclopyr caused distortion of foliage and stems at rates down to 50 g/ha 1 week post treatment, with severe effects at the 1000 and 500 g/ha rates resulting in no fruit being formed. Triclopyr at 50 and 100 g/ha gave significant reductions in fruit yield, while 10 and 1 g/ha rates caused no visual symptoms or significant reduction in yields.

Glyphosate at 1000 and 500 g/ha initially caused chlorosis of foliage especially of the new apical growth, which resulted in some plants being killed. Those remaining were stunted and produced minimal fruit. Visible damage symptoms were observed from 100 and 50 g/ha while the 10 and 1 g/ha rates caused no visible symptoms. These treatments did not significantly reduce yield.

Metsulfuron-methyl caused auxin like symptoms 1 week after application on the tomatoes. At rates of 100 and 50 g/ha respectively, 100% and 50% of the plants were killed. The 10 g and 5 g/ha rates initially caused severe distortion and although plants largely recovered, fruit development and maturity was delayed so much that little fruit had been harvested by the end of the 10 week harvest period. Visible damage symptoms from 1.0 and 0.1 g/ha were slight but fruit yields were significantly reduced in both cases.

In these trials the crops were at an immature stage and growing very actively at the time of treatment, resulting in a rapid expression of damage symptoms. More mature crops growing under drier conditions may exhibit symptoms less readily, but the comparative effect of the herbicides should remain. The damage symptoms caused by each herbicide were quite distinctive. This was particularly true of damage apparent on potato tubers and may allow identification of the herbicide that has caused the damage.

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