**POLYGONUM PERSICARIA :
A TRIAZINE-RESISTANT BIOTYPE**

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In the past few years several field appearances of complete herbicide resistance have been reported, most of which have been due to *s*-triazine herbicides. Since the first report was published by Ryan (1970), incidences of triazine-resistant weeds have increased markedly. By 1983 at least 37 species of common weeds in 24 genera had been found to be resistant (Le Baron 1983) and the list is expanding every year.

Resistance to triazines has occurred mostly in areas where these herbicides have been used repeatedly for several years, and especially where little or no tillage has been used. The problem usually occurs over small areas. A summary of what is known about the problem, and what can be done to discover and prevent it, can be found in Le Baron and Gressel (1982).

The only case of true weed resistance to triazine herbicides reported in New Zealand, so far, has been that of fathen (*Chenopodium album*) in some maize fields of the Waikato where atrazine was applied for several years in succession (Rahman 1982, Rahman *et al* 1983).

This paper reports the discovery of a biotype of another weed species, willow weed (*Polygonum persicaria*), which is resistant to atrazine and many other triazine herbicides. This biotype was discovered at Te Kowhai, north of Hamilton, in a field which has been in successive maize crops since 1970. The herbicide programme followed over the years is listed below.

1970-75: alachlor + atrazine pre-emergence

1976-80: EPTC + R-25788 soil incorporated; atrazine post-emergence

1981-84: EPTC + R-25788 (+ extender) soil incorporated; atrazine post-emergence; dicamba post-emergence

1985-86: metolachlor + terbuthylazine pre-emergence; dicamba post-emergence

All herbicides were used at the highest label rates.

This suspected resistant biotype became evident following the 1980 post-emergence spraying of atrazine. Dicamba was then included in the spray programme, but the problem is still present. This confirms the conclusion of Le Baron (1983) that seeds from resistant plants which develop and infest an area cannot be easily eradicated, even though the plants can be controlled by other means.

Seeds from this biotype were collected in autumn 1985. Seeds were also gathered from a site never treated with atrazine ('control'), and from a maize field where atrazine had been applied annually for 7 years but in which no apparent resistance to atrazine was evident ('possible resistance'). These seeds were used for the two glasshouse experiments.

Experiment 1:

Seeds from the three sites were planted in 150 mm diameter plastic pots filled with a Horotiu sandy loam soil (9.6% organic C, 61% sand, 14% clay and a pH of 5.6). Fifteen seeds were planted in each pot and covered with 10 mm of soil. After 4 weeks, when most plants had three true leaves and were about 50 mm high, atrazine (Gesaprim WP) at 0, 2, 10 or 20 kg ai/ha was applied with a single nozzle glasshouse sprayer delivering 360 litres/ha. A wetting agent (Citowett) at 0.2% v/v was added to all treatments. Each treatment was replicated four times and pots were arranged in a randomised block design.

The final assessment 4 weeks after spraying showed that none of the treatments caused any damage or growth reduction of plants grown from the seeds of the atrazine-resistant biotype. All treated plants grown from the other two seed sources died.

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TABLE 1: Effect of soil applied triazine herbicides on different biotypes of willow weed.

Herbicide	Rate (kg ai/ha)	Total no. of surviving plants per treatment**		
		'Control'	'Possible resistance'	Resistant
atrazine	2	0	0	19
	4	0	0	18
simazine	2	0	0	18
	4	0	0	19
cyanazine	2	1*	1	19
	4	0	0	16
propazine	2	0	3*	18
	4	0	0	17
terbutylazine	2	1	0	22
	4	1	0	19
dimethametryn	1	3*	10*	20
	2	2*	5*	18
ametryn	1	0	3*	18
	2	0	0	16
aziprotryn	2	0	0	16
	4	0	0	21
desmetryn	1	0	0	17
	2	0	0	22
prometryn	1	2*	4*	23
	2	0	1*	17
terbutryn	1	3*	5*	21
	2	1*	1*	21
terbumeton	2	0	0	20
	4	0	0	21
Untreated	—	17	30	19

* Plants severely damaged

** Out of 45 seeds planted. The germination in most cases was below 50%.

Experiment 2:

Seeds from the three sites were planted in pots as for Experiment 1. Pre-emergence applications of 12 triazine herbicides (Table 1) were made to the soil surface through a glasshouse sprayer. Each treatment was replicated three times.

The number of plants surviving in each treatment 8 weeks after spraying showed that all plants of the atrazine-resistant biotype were completely resistant to the triazine herbicides tested (Table 1). By comparison most of the seedlings from the 'control' population failed to survive. The few that were still surviving were severely damaged and higher rates of these herbicides should kill the entire population. Similar results were achieved with the 'possible resistance' population, suggesting that this population, while possibly slightly more tolerant, was definitely not resistant to the triazine herbicides.

These results have confirmed that there is now at least one triazine-resistant biotype of willow weed in New Zealand. Therefore when failure of herbicides (particularly triazine herbicides) are reported, the inadequacy of the herbicide should not be the only factor considered by weed scientists, but they should also be very mindful of the possibility of herbicide-resistance. Several possible ways of delaying the appearance of herbicide-resistant weeds and their management have been described by Rahman (1982) and Le Baron and Gressel (1982).

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