Spread of herbicide resistance through seed retail outlets

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Summary. Samples of annual ryegrass seed, collected from retail outlets in southern NSW and northeastern Victoria, were screened for resistance to herbicides used for its control. The outcome was that a high proportion (58%) showed resistance to at least one herbicide whilst 21% showed resistance to 4 or more chemicals. Concern is thus expressed that seed for sale provides a potential means of spread of herbicide resistance.

Introduction

The occurrence of herbicide resistance in annual ryegrass *Lolium rigidum,* throughout the cropping regions of southern Australia has been well documented (1) since the first confirmed case of resistance near Bordertown in South Australia in 1981 (2). Since this time, concern over the spread of resistant populations of annual ryegrass has increased with confirmed cases of resistance occurring throughout the cropping regions of Western Australia, South Australia, Victoria and New South Wales. It is expected that over 2000 farms across Australia have infestations of annual ryegrass resistant to one or more chemical groups (AVCA commissioned survey, unpublished).

Concern over the spread of herbicide resistance is well founded. In an attempt to minimise the problem, all avenues of its potential spread must be considered. This paper reports the finding of a survey which considers the hypothesis that sale of resistant ryegrass seed is one avenue of spread of the problem. Annual ryegrass can be easily collected through a seconds seed box of harvesting equipment as a by product of any grain harvest. It is suspected that such seed is making its way on to the commercial seed market in cropping regions, therefore increasing the rate of spread of resistance.

Methods

During 1991, retail seed outlets were approached to provide samples of annual ryegrass seed to undergo screening for herbicide resistance. A total of 24 samples of annual ryegrass was collected from seed merchants across central and southern NSW (Fig. 1). Collected samples were stored in a seed storage facility until required for testing. Samples were tested for resistance to a range of chemical groups based on modes of action, including both pre and post emergent herbicides (Table 1). All experiments were conducted under glasshouse conditions and were undertaken during the normal growing season of annual ryegrass.

Screening for resistance to pre-emergent herbicides was carried out in aluminium pots filled with a sandy loam soil. Herbicides were applied to the soil surface in a spray cabinet and were manually incorporated to a depth of 5 cm. Annual ryegrass seed was sown at the rate of 0.2 g per pot and pots were watered as required. Dry matter production was recorded after a minimum of four weeks.

Table I. Herbicides used to screen samples of annual ryegrass for resistance, grouped according to biochemical mode of action

Chemical group	Trade name	Chemical name
	Pre-emergent	
Dinitroanilines	Trifluralin(R)	Trifluralin
Triazine	Simazine(R)	Simazine
Sulfonylureas	Logran(R)	Triasulfuron
	Glean(R)	Chlorsulfuron
	Post-emergent	
Cyclohexanediones	Sertin(R)	Sethoxyodim
Aryloxphenoxypropionates	Verdict(R)	Haloxyfop
	Hoegrass(R)	Diclofop

Figure 1. Distribution of samples of annual ryegrass collected from retail outlets

Testing for resistance to post-emergent herbicides was carried out in aluminium pots filled with a sandy loam soil. Pots were sown with 0.2 g of annual grass seed. Once germinated, pots were thinned to twenty plants per pot and then sprayed between the 3 and 5 leaf stages in a spray cabinet. The effects of the herbicide were evaluated after a minimum of 28 days by recording the number of survivors.

Determination of resistance was carried out by comparing the effect of the herbicide on the sample. at the recommended field rate, with that of a known susceptible seed type. All experiments were conducted in randomised block design with four replications.

Results and discussion

Significant levels of resistance were recorded across all five herbicide groups at the recommended field rates (Table 2).

Table 2. Frequency of resistance in samples of annual ryegrass to major herbicide groups

Herbicide group	Number of samples exhibiting resistance
Dinitroanilines	6
Triazines	5
Sulfonylureas	10
Aryloxyphenoxypropionates	9
Cyclohexanediones	3

It should be noted that in addition to those samples which were significantly resistant at the recommended field rate, a number of other samples exhibited levels of tolerance to the herbicides although these were not statistically significant. A number of samples showed high levels of multiple resistance (Table 3).

Table 3. Frequency of multiple resistance of samples of annual ryegrass to major herbicide groups

Number of herbicide groups	Number of samples exhibiting resistance
5	2
4	3
3	0
2	3
1	6
0	10

These results indicate that a significant proportion of annual ryegrass seed being sold through seed outlets is resistant to a number of herbicide groups. With increasing interest in establishing annual ryegrass as part of the pasture phase of a ley farming system. the sowing of resistant seed has substantial implications for the cropping phase. It is thus important that seed outlets provide written certification that any annual ryegrass seed sold is not resistant at the point of sale. This would necessitate each seed lot for sale being screened for resistance to all herbicide groups. It is also important that any farmer purchasing annual ryegrass seed ensures that it is resistance free by demanding this type of certification or by having the sample tested through one of the testing agencies.

Where herbicide resistance is present on farms, it is important that resistant seed is collected and disposed of appropriately rather than made available for sale, in order to prevent the further spread of resistance.

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References

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