Application time of grass selective and non-selective herbicides for seed set control of Annual ryegrass (*Lolium rigidum* Gaud.).

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Summary
Two experiments assessing various herbicide treatments for seed set control of annual ryegrass (*Lolium rigidum* Gaud. LOLRI) were established in 1990. The results show that grass selectives may be used in place of the non-selectives currently used for seed set control. Synergism was exhibited between imazethapyr and glyphosate when applied together at anthesis. The most effective treatments were haloxyfop (104 gaiha-1) applied at booting and glyphosate plus sethoxydim (45 + 57 gaiha-1) at anthesis.

Introduction

While annual ryegrass (*Lolium rigidum* Gaud.) is valuable as a pasture plant in Australia, it also behaves competitively towards crops (6), provides disease carry over between crop phases (3) and is inherent in the Annual Ryegrass Toxicity (ARGT) complex in certain areas of southern Australia (1). Control of ryegrass during the pasture phase of crop rotations can reduce these effects.

Including grasses in pasture provides early winter feed and helps to maintain soil stability. Application of non-selective herbicides (glyphosate and paraquat) in spring to prevent seed set is common throughout the wheat/sheep zone of Australia. Preventing grass seed set with non-selectives has been shown to depress seed set in companion pasture legumes (2). The use of grass selective herbicides for seed set control has been found to overcome this depression (4).

The experiments presented here investigate (i) the possibilities for using grass selectives for grass seed set control and (ii) the time of application for most effect on seed set. Additionally in Experiment 2 it was intended that potential synergism between two selective (sethoxydim and imazethapyr) and one non-selective (glyphosate) herbicide be examined.

Materials and methods

Both Experiments were sited on a dark greyish-brown gravelly sandy-loam over yellowish brown medium clay at 30cm (Dy2.12) (5), on the Great Southern Agricultural Research Institute, Katanning W.A. The existing weed burden was removed by light scarification followed by a non-selective application (250 gaiha-1 diquat + 250 gaiha-1 paraquat). The site was seeded with 10 kgaiha-1 annual ryegrass (*Lolium rigidum* cv. Wimmera) on 21/5/90.

Herbicide treatments were applied with a 3m wide vehicle mounted spray-boom delivering 55L of water ha-1. Spray oil was added to sethoxydim and imazethapyr and wetting agent added to the remaining treatments.

Both experiments were randomised block designs and an analysis of variance was performed on the data.

<u>Experiment 1- Grass selectives for seed set control.</u>
Ryegrass seed yield was assessed from quadrat samples.

<u>Experiment 2- Time of application on seed set, potential synergism.</u>
Ryegrass seed yield assessed from seed head collection. Seed viability undertaken on 400 seed sub-samples, on filter paper at

20°C for three weeks.

Results

Experiment 1

All herbicide treatments significantly reduced ryegrass seed set (Table 1). The grass specific herbicides were equally or more effective at seed set control than the conventional glyphosate 162 gaiha-1), haloxyfop and quizalofop giving up to 95% reduction in seed set.

Table 1: Annual ryegrass seed set control with six herbicides.

Herbicide	Rate gaiha-1	Application Time Zadoks (7)	Seed Yield gm-2
Untreated	-	-	49
Sethoxydim	57	5 Leaf (Z15)	3
	95	Booting (Z45)	5
Diclofop-methyl	563	Booting (Z45)	4
Quizalofop	67	Booting (Z45)	2
Haloxyfop	104	Booting (Z45)	0.4
Paraquat	100	Booting (Z45)	10
Glyphosate	158	Booting (Z45)	16
LSD 5%			13

Application times; Z15 (3/7/90); Z45 (3/9/90). Approximately 90% of plants at this stage at time of application.

Experiment 2

All herbicides and herbicide mixtures reduced ryegrass seed set as time of spraying was delayed until anthesis (Table 2). Treatments containing sethoxydim were more effective in reducing seed yield than any other treatment when compared within each time of spraying.

Table 2: Annual ryegrass seed set control with applications of three herbicides alone and in mixtures applied at three growth stages.

Herbicide	Rate gaiha-1	Application Time: Booting (Z41-43) 4 Sept	Ear Emergence (Z52-53) 20 Sept	Anthesis (Z62-63) 11 Oct
		Seed Yield (gm-2)		
Untreated	-	117	-	-
Glyphosate	45	146	146	97
	162	41	29	9
Sethoxydim	57	30	3	14
Imazethapyr	50	135	102	73
Glyphosate + Sethoxydim	45+57	18	25	1
Glyphosate + Imazethapyr	45+50	122	91	17

Seed Yield LSD(5%) Time=12, Herbicide=17, HxT ns.

With the exception of glyphosate (162 gaiha-1) applied at anthesis which reduced seed viability to 59% ($P<0.05$) herbicide application did not influence seed viability (range of 74-91%).

There is no improvement in seed set control from using a mixture of sethoxydim + glyphosate compared to sethoxydim (57 gaiha-1) alone. The imazethapyr + glyphosate mixture was not different from either herbicide alone until anthesis. At anthesis the mixture achieved greater control than either of its components ($P<0.05$) which suggests that there may be some synergism occurring between these two chemicals at this time. Ryegrass appears more susceptible to the action of these chemicals in combination at anthesis.

Discussion

Seed set in companion pasture legumes was not measured in this study and it is not possible to say how the applied chemicals have influenced legume seed set. Grass selectives have the potential to control grass seed set while avoiding damage to other pasture species. Previous work by Blowes et. al. (1984) (2) has shown reductions of up to 45% in the number of subterranean clover (*Trifolium subterraneum*) plants the year following treatment with a non-selective (glyphosate). The timing of herbicide application is particularly important, should it coincide with the flowering of the legume it is more likely to reduce seed set than if sprays are applied before or after legume flowering. The influence of grass selective herbicides on the legume seed set is still being investigated.

Early application of herbicide (5-leaf or booting cf. anthesis) can lead to less grass seed set per area (Table 1). Controlling ryegrass early probably reduces the number of plants per area, not necessarily the number of seed set per plant or seed viability, as might a later application. Early season grass control has the disadvantage of reducing the amount of feed available for stock, particularly if there is a low percentage of legume in the pasture (6). The rate of grass selective required to kill plants increases with plant age, while reproductive control can be performed with sub-lethal rates.

Grass selective herbicides were able to control ryegrass seed set, in most cases to a level equal to glyphosate (162 gaiha-1), one of the standard non-selectives currently used. Apparent synergism was exhibited between glyphosate (45 gaiha-1) and imazethapyr (50 gaiha-1), however this is an uneconomical treatment (glyphosate + imazethapyr A$27/ha cf. glyphosate 162 gaiha-1 A$6/ha, approximately). Further investigation of non-selective and grass selective herbicide combinations is warranted. Discovery of a treatment which gives equal or greater seed set control for a similar or lower cost compared with chemicals currently used would be of value. Delaying application time until ryegrass is at anthesis increases the probability of successful control while minimising the rate of chemical and hence the cost.

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