A low-rate spike of Verdict 520 with Select Herbicide improves control of key grass weeds

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Summary One strategy grain growers in southern Australia have adopted as annual ryegrass (*Lolium rigidum* Gaudin) resistance to group A herbicides (ACCase inhibitors) has increased has been to replace a 'fop' (aryloxyphenoxy propionate) with a 'dim' (cyclohexanedione) for grass weed control in canola and pulse crops.

Select[A] Herbicide (active ingredient clethodim) has often been the 'dim' of choice and has provided annual ryegrass control, allowing time for farmers and researchers to develop systems that rely less on extremely effective, selective, herbicides for managing this adaptable and widespread weed.

However, whilst Select has given reliable annual ryegrass control, it has not always done the same on other grass weeds such as wild oats (*Avena fatua* L.), brome grass (e.g. *Bromus diandrus* Roth) or volunteer cereals (e.g. volunteer wheat, *Triticum aestivum* L. and barley, *Hordeum vulgare* L.).

The aim of this series of experiments was to determine whether tank-mixes would provide effective control of group A susceptible annual ryegrass in association with other grass weeds such as wild oats, brome grass and volunteer cereals in broadleaf crops.

Results from 10 experiments conducted across southern Australia during winter and spring 2001 show that the addition of Verdict 520* (haloxyfop-R) improved control of weeds other than annual ryegrass by Select. This new use has been cross-labelled and a registration is pending.

Keywords Haloxyfop-R, Verdict 520, clethodim, Select Herbicide, annual ryegrass, *Lolium rigidum*, wild oats, *Avena sativa*, great brome, *Bromus diandrus*, volunteer cereals.

INTRODUCTION

Annual ryegrass resistance to group A herbicides ('fops' and 'dims') has continued to increase in southern Australia and severely limits the herbicide options for weed management. While wild oat resistance to group A herbicides is also becoming an issue for broadacre agriculture in southern Australia, currently only four populations of barley grass (*Hordeum* spp.) and one of brome grass have been confirmed resistant to group A herbicides (Preston 2002).

Group A herbicides are still effective on volunteer cereals and most grass weeds other than annual ryegrass and are a useful component of grass weed management in the non-cereal phase of the rotation.

Verdict 520* has been widely used for selective grass control in canola and pulses in southern Australia. However, in recent years increasing resistance to group herbicides has reduced the effectiveness of Verdict 520 on annual ryegrass. Farmer experience and independent research has shown that Select may continue to work reliably where resistance to Verdict 520 (or other group A herbicides) has been confirmed (Roy and Jackson 1996).

Consequently Select[A] has been widely used and while it provides reliable control of annual ryegrass, it does not always do the same on wild oats, brome grass or volunteer cereals. Dow AgroSciences internal report DERBI GHF-P-2172 showed the potential of tank-mixes of low rates of Verdict 520 to improve the control of these weeds by Select. The aim of this series of experiments was to determine whether tank-mixes would provide effective control of group A susceptible annual ryegrass in association with other grass weeds such as wild oats brome grass and volunteer cereals.

MATERIALS AND METHODS

Ten experiments were conducted across southern Australia during winter and spring 2001. South Australian (SA) sites were at Ardrossan (annual ryegrass), Halbury (wild oats), Lochiel (great brome) and Lochiel (volunteer barley). In southern New South Wales (NSW) experiments were conducted at Ardlethan, Rannock and Ariah Park (all comprising wild oats and annual ryegrass). One experiment (annual ryegrass and volunteer wheat) was conducted at Bridgewater, in Victoria (Vic). Two experiments were conducted in Western Australia (WA), one at Meckering (annual ryegrass, volunteer wheat) and one at Williams (annual ryegrass).

Treatments consisted of 150, 200 and 250 mL ha^{-1} of Select (36, 48 and 60 g a.e. ha^{-1} of clethodim) alone and tankmixed with either 25 or 38 mL ha^{-1} of Verdict 520 (13 and 19.8 g a.e. ha^{-1} of haloxyfop-R). Fusion[B] (152 g kg^{-1} fluazifop + 72 g kg^{-1} butroxydim) at 280 g ha^{-1} was included as a standard and an unsprayed

untreated was also included. Select and Select+Verdict 520 treatments were applied with 0.5% v/v Uptake* Spraying oil (727 g L^{-1} Enepar 10A mineral oil) and Fusion was applied with 1% v/v Hasten[B] (904 g L^{-1} ethoxylated canola oil).

A randomised complete block trial design was used in all trials with four replications. Plot size was 3 × 10 metre or similar. Azo precision gas powered sprayers or similar were used to apply treatments via a 3 m handheld boom fitted with six flat fan nozzles (Teejet 110015 or Hardi 4110-10) spaced 50 cm apart. An operating pressure of 160–250 kPa was used to apply 100 L ha^{-1} total spray volume.

Assessment of crop selectivity was done at about 7 and 14 days after application (DAA). Assessment of weed control was done about 14, 28 and 56 DAA. Both assessments were done by subjective visual analysis of each plot and used a percentage scale where 100 = complete control or complete crop loss.

Individual trials were reported and analysed in PRM (Pesticide Research Manager) generally using LSD at P=0.05 as a means test. Across trials analysis was done in Minitab.

RESULTS

Across trials results are presented in Table 1.

Annual ryegrass (*L. rigidum*) control Select alone provided good annual ryegrass control, with 150 mL ha^{-1} (94.1% control), 200 mL ha^{-1} (98.0% control) and 200 mL ha^{-1} (98.0% control), all similar (P=0.05) to Fusion (96.9%).

Verdict 520 added nothing to annual ryegrass control at 200–250 mL ha^{-1} rate of Select, but improved (P=0.05) control at the lowest Select (150 mL ha^{-1}) rate.

Across studies boxplots and individual experiment data (not presented) show a moderate amount of across site/state variability. Despite overall high levels of control, some outliers were present. Select alone at 150 mL ha^{-1} provided 100% control in all southern NSW trials, but only 86% control in WA where overall control was the poorest. Annual ryegrass size at application was not the critical factor as weeds were smaller (2–5 leaf) at the WA site than in experiments in other states, where the growth stage was from 3–6 tillers.

Wild oat (*A. fatua*) control Select alone at 200–250 mL ha^{-1} (89.4–92.9% control) was about equal to Fusion (90.9% control), with 150 mL ha^{-1} Select inferior (P=0.05) at 83.1% control. The addition of either rate of Verdict 520 improved (P=0.05) control, with 38 mL ha^{-1} required to be added to 150 mL ha^{-1} of Select or

Table 1. Final % visual weed control (6–8 weeks after application), summary across experiments.

Weed		*L. rigidum*	*A. fatua*	*T. aestivum*	*H. vulgare*	*B. diandrus*
Size at application		Z 12-26	Z 15-26	Z 12-23	Z 14,21	Z 14,22
No of experiments		6	4	4	1	1
Treatment	Rate mL or g ha^{-1}					
1 Select*	150	94.1 b	90.8 d	52.8 d	5.0 c	27.5 d
2 Select* + 2 Verdict 520	150 25	96.8 a	99.7 a	91.6 a	100.0 a	94.5 ab
3 Select* + 3 Verdict 520	150 38	97.5 a	100.0 a	96.6 a	100.0 a	96.0 a
4 Select	200	98.0 a	94.2 cd	67.8 cd	47.5 b	33.8 d
5 Select* + 5 Verdict 520	200 25	98.6 a	100.0 a	94.3 a	100.0 a	95.8 ab
6 Select* + 6 Verdict 520	200 38	98.4 a	100.0 a	98.1 a	100.0 a	99.3 a
7 Select	250	99.3 a	96.1 bc	75.9 bc	50.0 b	53.8 c
8 Select* + 8 Verdict	250 25	98.8 a	100.0 a	96.3 a	100.0 a	97.8 ab
9 Select* + 9 Verdict	250 38	99.4 a	100.0 a	98.6 a	100.0 a	97.8 ab
10 Fusion^	280	96.8 a	96.4 abc	84.3 ab	98.8 a	88.5 b

* Uptake Spraying Oil added at 0.5% v/v, ^ Supercharge Oil added at 1% v/v.

Means followed by same letter do not significantly differ, P=0.05 LSD.

25 mL ha^{-1} to the higher rates of Select for excellent (97% +) control (cultivated oats, *A. sativa*, was the test weed in one experiment).

Volunteer wheat (*T. aestivum*) control Even the highest (250 mL ha^{-1}) rate of Select provided only 75.9% control, which was numerically inferior, but statistically (P=0.05) similar to Fusion. The addition of all rates of Verdict 520 improved (P=0.05) volunteer wheat control by Select.

Volunteer barley (*H. vulgare*) control 250 mL ha^{-1} of Select resulted in unacceptable (50%) control of volunteer barley. The addition of 25 mL ha^{-1} of Verdict 520 improved (P=0.05) control to 100%.

Great brome (*B. diandrus*) control 250 mL ha^{-1} of Select resulted in unacceptable (53.8%) control of great brome. The addition of 25 mL ha^{-1} of Verdict 520 improved (P=0.05) control to a level numerically superior, but statistically (P=0.05) similar to Fusion.

Selectivity Fusion caused slight, transitory leaf twisting to Rainbow canola (*Brassica napus* L. var. *napus*), but was selective to Mystic canola, field peas (*Pisum sativum*) and lupins (*Lupinus angustifolius* L). All other treatments were selective to canola, field peas and lupins.

DISCUSSION

The addition of 25 and 38 mL ha^{-1} of Verdict 520 to 150, 200 and 250 mL ha^{-1} of Select improved (P=0.05) control of wild oats, great brome, volunteer wheat and barley. Verdict 520 generally added more to control at the lower Select rates and on volunteer wheat and barley, where Select was relatively weaker. The following proposed cross label rates were validated on the weeds tested.

Fop/dim susceptible annual ryegrass plus volunteer wheat, volunteer barley, wild oats, brome grass (e.g. *Bromus diandrus*, barley grass (e.g. *Hordeum leporinum* Link), phalaris (e.g. *Phalaris paradoxa* L. and *P. minor* Retz.).

- 2–4 leaf: 25 mL ha^{-1} +150 mL ha^{-1} Select
- early tillering: 38 mL ha^{-1} +150 mL ha^{-1} Select

Fop/dim resistant annual ryegrass plus the above mentioned weeds:

- 2–4 leaf: 25 mL ha^{-1} +200 mL ha^{-1} Select
- early tillering: 25 mL ha^{-1} +250 mL ha^{-1} Select

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[A] Trademark of Sumitomo Aust. Ltd.
[B] Trademark of Crop Care Aust. Ltd.