

Improving the efficacy of clethodim herbicide against annual ryegrass

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Key findings

- Clethodim applied at 500ml/ha to ryegrass at the 2 to 3 leaf stage averaged 84% control
- Two early applications, ryegrass at 2 to 3 leaf and then again 3 weeks later, gave the best control of resultant ryegrass head numbers
- All combinations of clethodim and butoxydim applied after ryegrass reached the 2 to 3 leaf stage significantly reduced grain yield

Why do the trials?

Group A herbicides are very important for the selective control of grass weeds in both crops & pastures. However, annual ryegrass has shown widespread resistance to the Group A 'fop' herbicides (i.e. Hoegrass) for many years and dealing with is now part of managing modern cropping systems in southern Australia. One of the consequences of this has been the heightened reliance on the 'dim' chemistry of Group A herbicides (i.e. Select) for providing selective control in both pulse & oilseed crops. Dim herbicides until recent have been extremely effective against ryegrass; however there appears to be a growing number of populations showing resistance to this important group of herbicides (Boutsalis pers. comm.). As a consequence use rates of herbicides like clethodim have dramatically increased by more than 2-fold (i.e. 500ml/ha) the recommended label rate (250ml/ha).

Importantly where populations of ryegrass are still susceptible to 'dim' herbicides like clethodim it is critical to ensure that they are used under optimal conditions to maximise weed kill. Dim herbicides, like the fops, move very slowly within the plant & so need to be applied under favourable growing conditions to ensure maximum activity & weed control. Spraying after a frost or in overcast & cold conditions can adversely affect herbicide performance. Furthermore, it is critical to maximise spray coverage so as to ensure plants receive a lethal dose of herbicide. By optimising herbicide use there should be fewer survivors which will help reduce the potential for resistance development & prolong the effectiveness of this very important chemistry.

Given the increasing reliance & importance of 'dim' herbicides in the management of annual ryegrass a field trial was established at Hart to investigate the factors influencing (i.e. ryegrass size) performance of 'dim' herbicides Select (a.i. clethodim) & Factor (a.i. butoxydim) on Group A resistant ryegrass in canola.

How was it done?

Plot size	1.75m x 12m	Fertiliser	DAP Zn 2% @ 80kg/ha
Seeding date	31 st of May 2012	Variety	Clearfield canola

Trials were established in canola to evaluate a) the impact of herbicide timing & ryegrass size on performance of clethodim & its tank mixture with butoxydim & b) the efficacy of clethodim on annual ryegrass following a range of weather conditions.

The range of herbicide timings for application determined for the treatments are shown in Tables 1 & 2. As an additional treatment, UAN (Urea Ammonium Nitrate) was used as the carrier with water, rather than water alone & applied with herbicides clethodim & butroxydim when the ryegrass was initially at 2-3 leaf stage (20th July) & again at 4-leaf to early tillering stage (16th August). The timing for 6 weeks after the 2 to 3 leaf stage was the 6th September. UAN was used at 20L/ha (8kg N/ha) & made up to a 100L/ha spray volume with rainwater. All treatments were applied using a handheld boom fitted with nozzles delivering a medium droplet spectrum & a spray volume of 100L/ha.

To ensure even annual ryegrass (ARG) establishment across the trial site ARG seed was broadcast at 10kg/ha ahead of seeding & tickled in with a shallow pass with the seeder. The ryegrass population at the site was known to be resistant to Group A fop herbicides, and partially resistant to the dim herbicides. The trial design was a randomised complete block with three replicates.

Annual ryegrass head density was assessed on 31st October.

Table 1. Herbicide mixtures, rates & timings for ryegrass control in canola (Note 1 % Hasten plus 2% Liase was used in each treatment).

Treat	Herbicide	Rate/ha	Timing
1	clethodim	500ml	-
2	clethodim + butroxydim	500ml + 80g	-
3	clethodim	500ml	Ryegrass 2-3 leaf
4	clethodim + butroxydim	500ml + 80g	Ryegrass 2-3 leaf
5	clethodim	500ml	3 weeks after ryegrass 2-3 leaf
6	clethodim + butroxydim	500ml + 80g	3 weeks after ryegrass 2-3 leaf
7	clethodim	500ml	6 weeks after ryegrass 2-3 leaf
8	clethodim + butroxydim	500ml + 80g	6 weeks after ryegrass 2-3 leaf
9	clethodim	500ml	Ryegrass 2-3 leaf + 3 weeks after ryegrass 2-3 leaf
10	clethodim + butroxydim	500ml + 80g	Ryegrass 2-3 leaf + 3 weeks after ryegrass 2-3 leaf
11	clethodim	500ml	Ryegrass 2-3 leaf + 6 weeks after ryegrass 2-3 leaf
12	clethodim + butroxydim	500ml + 80g	Ryegrass 2-3 leaf + 6 weeks after ryegrass 2-3 leaf
13	clethodim + UAN	500ml + 20L	Ryegrass 2-3 leaf + 3 weeks after ryegrass 2-3 leaf
14	clethodim + butroxydim + UAN	500ml + 80g + 20L	Ryegrass 2-3 leaf + 3 weeks after ryegrass 2-3 leaf

* Application of clethodim at 500ml/ha is not a registered rate & was undertaken for experimental purposes. UAN is not registered as a carrier for clethodim or butroxydim.

Results

Ryegrass counts in August and September showed that clethodim applied at 500ml/ha to ryegrass at the 2 to 3 leaf stage averaged 84% control. The addition of butroxydim improved this control to 91% (Table 3). Applying the same herbicide treatments 3 weeks later only marginally reduced the ryegrass control.

Two applications of clethodim and butroxydim alone or in combination increased ryegrass control by 5%, at both application timings. The addition of 20L/ha of UAN increased control by another 2 to 5%, averaging 96% control.

Two early applications, ryegrass at 2 to 3 leaf and then again 3 weeks later, gave the best control of resultant ryegrass head numbers. As herbicide applications were delayed for longer, the number of heads formed increased i.e control was less.

The best herbicide treatments reduced ryegrass head numbers to below 5 heads per square metre, however, the average number of heads set were 17 heads per square metre. This still represents a significant quantity of ryegrass seed (potentially resistant) and so further harvest seed set control and other integrated weed management strategies would certainly be required.

All combinations of clethodim and butroxydim applied after ryegrass reached the 2 to 3 leaf stage significantly reduced grain yield (Figure 1). The stress induced by both the herbicides is well known, and the damage is understood to increase with later applications, closer to green bud development.

Table 3. Effect of herbicide clethodim & its tank mixture with butroxydim, applied at various timings to control annual ryegrass in canola at Hart, 2012. Values in brackets are % control relative to unsprayed treatments (T1 & T2 = Aug, 49 ARG plants per square metre; Sep, 53 ARG plants per square metre).

Herbicide treatments	Annual ryegrass					- heads/m ² -
	July	August		September	October	
	plants/m ² (% control)					
1	53	50	-	57	-	91
2	45	47	-	49	-	118
3	32	6	(88)	11	(79)	14
4	35	4	(92)	5	(91)	4
5	43	28		12	(77)	33
6	50	37		6	(89)	8
7	47	39		56		66
8	52	51		49		36
9	36	10	(80)	6	(89)	5
10	48	4	(92)	2	(96)	0
11	35	46		10	(81)	25
12	41	51		8	(85)	5
13	46	5	(90)	3	(94)	10
14	44	3	(94)	1	(98)	1
LSD (0.05)	NS	15		13		23

Refer to Table 1 for herbicide rates & timings.

Where values are not given in parenthesis (% control), herbicide applied within a week of assessment.

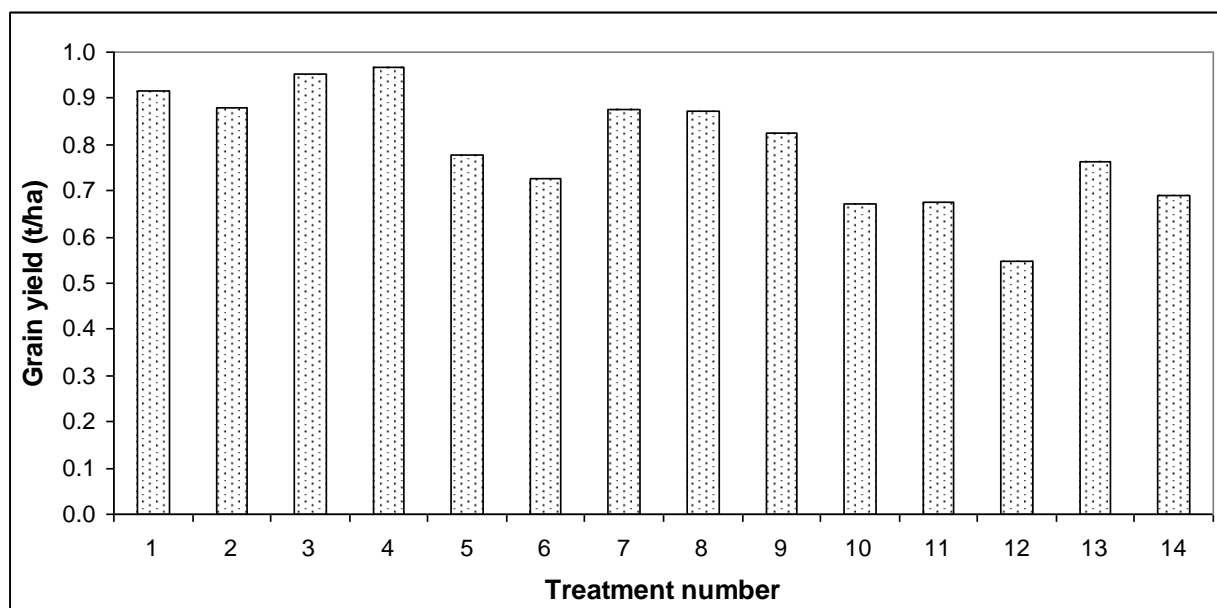


Figure 1: Effect of herbicide clethodim & its tank mixture with butroxydim, applied at various timings on grain yield response of canola at Hart, 2012. Refer to Table 1 for information on herbicide treatments (1-14). Bar represents LSD (0.05) = 132.

Some of the herbicide treatments contain unregistered pesticides, application rates and timings. The results within this document do not constitute a recommendation for that particular use by the author or author's organisations.

Suggestions for optimising control

- Always apply at correct herbicide rates & with appropriate adjuvants (see label recommendations).
- Efficacy is improved when applying to ryegrass around the 4-leaf to early tillering development stage. This will help ensure adequate spray coverage & herbicide uptake.
- Dim herbicides perform better in mild to warm conditions when the crop & weeds are actively growing, avoid using when conditions are cold & overcast or very dry.
- Avoid spraying for 2 to 3 days before a frost.
- There is some evidence that water quality can reduce herbicide efficacy, addition of ammonium sulphate can be beneficial when using hard water (i.e. high in bicarbonates).
- Ensure good spray coverage by using water rates of 80 to 100L/ha.

Acknowledgements

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