

The impact of the rate and timing of clethodim herbicide applications on canola performance- Wellington 2013

Trial Code:	GOCD00113-4
Season/year:	Winter, 2013
Trial Location:	“Spicers Run” 20 km NNE of Wellington, NSW
Trial Collaborators:	The Mason Family

Keywords

Canola, clethodim, Factor, weeds, annual ryegrass, *Lolium rigidum*, herbicides, crop damage, Wellington, GOA1312, GOCD00113-4, resistance

Take home messages

In this trial, there was very little visual clethodim damage found even with high rates of clethodim applied outside recommended timings.

Only one treatment tested in this trial, a tank mix of clethodim and Factor® applied outside label timings, resulted in a yield penalty of 180 kg/ha.

Even very high rates of clethodim, applied across a range of timings and even well beyond recommended label timings did not result in any yield penalties.

This trial only included one variety of canola, 44Y84. Other varieties may show different tolerance results.

Background:

Increasing levels of Group A ‘fop’ resistance and the reduction in pricing of clethodim herbicides has driven increases in both the frequency of use and the rates applied of these products in canola for the control of annual ryegrass. Coinciding with this there has been an increase in the observed level and occurrence of crop damage by that same herbicide. Damage by clethodim in canola has long been documented but the triggers that result in this expression are not very clear and neither are the possible impacts on yields.

Visual symptoms of crop damage have been rarely reported for the lower label rates of 250 mL/ha but are have been more commonly observed at higher rates of 500mL/ha, indicating that rates could be to blame, however, the use of the high rate does not universally result in crop damage. Suggested label timings of spraying before bud initiation may not always be achieved in reality, however, late applications have not consistently resulted in damage, thus suggesting that damage may be in response to a combination of rate and unfavourable conditions at application.

As mentioned above the true effect upon yield is unclear - some commentary suggests that the visual symptoms of flower distortion or abnormal or missing pods has little or no impact upon yield as the canola can compensate for the damage incurred. At the other end of the commentary is that the impacts on flowering and pod formation are terminally detrimental and the effects upon yield substantial.

A trial in South Australia¹ in 2013 suggests that grain yield losses from clethodim occur when using higher rates (1 L/ha) after the 8-leaf stage and resulted in up to 40% losses when applied at bud initiation. This work also indicated a possible variation in susceptibility between varieties.

Grain Orana Alliance have initiated a series of field trials to gain a better understanding of clethodim damage in canola, specifically investigating the impact that application rates and their timing may have on canola yields. These trials have also sought to investigate the potential for an alternate Group A, DIM herbicide, Factor[®] to cause damage in canola.

DISCLAIMER: Following is a report on a scientific experiment. It may contain some herbicide treatments that are not registered for the situation, manner or rate at which they are used in this trial. This document or anything else resulting from, construed or taken from this or by GOA or its representatives should not be taken as a suggestion, recommendation or endorsement of any unregistered herbicide uses.

Aim:

- Identify possible contributors to the expression of clethodim damage in canola, such as the critical rate, timing or other factors such as environmental conditions around application
- Quantify what is the level of yield and grain quality impact associated with the use of clethodim

Methodology:

Trial was a small plot, randomised complete block design with three replicates.

All plots were sown with 100 kg/ha of MAP (10% N, 21.9% P, 1.5% S) drilled with the seed and 80 kg/ha of granular sulfate of ammonia (20.2% N and 24% S) and 100kg/ha of granular urea (46% N), both broadcast and incorporated by sowing.

Plots were seeded with Clearfield - 44Y84 @ 3.5 kg/ha on the 29/5/2013.

Site was treated with trifluralin on 29/5/13 @ 2 L/ha ahead of sowing and with Intervix[®] @ 750 mL/ha on the 11/7/2013 at the 3-4 leaf crop stage to minimize any existing weed pressure. Any surviving plants were manually removed when found.

The trial treatments consisted of three planned timings of early, late and 'unfavourable conditions'. The early treatment was targeted within recommended timings of the 2-4 leaf stage, the late

¹http://www.hartfieldsite.org.au/media/2013%20TRIAL%20RESULTS/17_Clethodim_tolerance_in_canola_2013HartTrialResultsBook.pdf

treatment was targeted to be applied when the crop was beyond the label timing of bud initiation/visible stage. The last (flexible) treatment was to be targeted and applied 'unfavourable' or frosty growing conditions but in this trial, such a period was not identified. Instead two further treatments were added, (i) very late (crop bolting but not yet flowering) and (ii) extremely late (at early flowering).

At each of these timings a range of treatments were applied including three rates of clethodim (250, 500 and 1000 mL/ha) and a single rate of Factor (80 g/ha) as well as a tank-mix of clethodim (250 or 500mL/ha) and Factor @ 80 g/ha. A full list of treatments is listed in Table 1 below. All treatments were applied with Uptake™ oil at 0.5%.

All these treatments were applied by hand boom applying 100 L/ha of rain water through AIXR015 nozzles at 3 bar. The details are listed in Table 2 below.

Table 1: Herbicide treatments and rates applied

Treatment	Rate (mL or g/ha)
Untreated Control (UTC)	Nil
Clethodim (early)	250
Clethodim (early)	500
Clethodim (early)	1000
Clethodim (late)	250
Clethodim (late)	500
Clethodim (late)	1000
Factor® (early)	80
Factor® (late)	80
Clethodim + Factor® (early)	250 + 80
Clethodim + Factor® (early)	500 + 80
Clethodim + Factor® (late)	250 + 80
Clethodim + Factor® (late)	500 + 80
Clethodim (applied very late)	500
Clethodim (applied extremely late)	500

Table 2 Herbicide application dates and crop stage

Timing	Date	Crop Stage
Early	16/07/2013	4-5 leaf stage
Late	30/07/2013	8 leaf stage
Very Early Bud	12/8/2013	Bolting, buds visible but not yet flowering
Very Late	26/08/2013	20% flowering

Early (4 leaf)	Date Applied	16/07/2013	Temp	Wind vel.	Wind Dir.	Humidity
	Start time	10.3	16.8	5-10km	N	75%
	Finish Time	11	Δt	3	% Cloud	100%
	Water rate	100 L/ha	Nozzle	AIXR015	Pressure	3
	Equipment	Hand	Speed			
Frosty (5-7 leaf)	Date Applied	30/07/2013	Temp	Wind vel.	Wind Dir.	Humidity
	Start time	12pm	18	2-7k	sw	60%
	Finish Time	12.30pm	Δt	5.1	% Cloud	75%
	Water rate	100	Nozzle	aixr015	Pressure	3bar
	Equipment	Hand	Speed			
Bud visible	Date Applied	12/08/2013	Temp	Wind vel.	Wind Dir.	Humidity
	Start time	10am	15	1-5k	sw	64%
	Finish Time	12am	Δt	4.1	% Cloud	100
	Water rate	100	Nozzle	aixr015	Pressure	3
	Equipment	hand boom	Speed			
Very Late (20% flower)	Date Applied	26/08/2013	Temp	Wind vel.	Wind Dir.	Humidity
	Start time	9	22	0-4	N	51%
	Finish Time	9.3	Δt	6.6	% Cloud	20%
	Water rate	100	Nozzle	aixr015	Pressure	3bar
	Equipment	Hand	Speed	7		

Results

There was no observable crop damage evidence by a reduction in crop biomass (measured by NDVI) of by flower or pod damage. There was a small level of flower damage (1-3%) but the flower damage was not consistent or statistically different between treatments.

Five treatment were significantly different to the UTC as can be seen in **Table 3**, with an average yield reduction of 114 kg/ha.

Only one of these five treatments was applied within label timings and rates- Clethodim @ 250 mL/ha and Factor @ 80g/ha, the remaining treatments were all applied outside label recommendations.

Only one of the four other treatments was beyond label recommended rates but all were beyond label recommended timings.

There was no difference between any of the treatments and the UTC in oil%.

Table 3 Canola yield and oil% in response to clethodim application timing, rate and tank mix partners

Treatments	Yield t/ha	Oil %
Untreated control (UTC)	2.56	40.4 ns
Clethodim (early)250ml	2.57	40.2 ns
Clethodim (early)500ml	2.49	40.1 ns
Clethodim (early)1000ml	2.47	40.6 ns
Clethodim (Late)250ml	2.59	40.1 ns
Clethodim (Late)500ml	2.63	40.7 ns
Clethodim (Late)1000ml	2.45 *	40.2 ns
Factor (early)80ml	2.50	40.2 ns
Factor (late)80ml	2.51	40.0 ns
Clethodim + Factor (early)250ml + 80g	2.45 *	39.9 ns
Clethodim + Factor (early)500ml + 80g	2.54	40.1 ns
Clethodim + Factor (late)250ml + 80g	2.45 *	40.5 ns
Clethodim + Factor (late)500ml + 80g	2.42 *	40.2 ns
Clethodim (Frosty)500mL	2.59	40.7 ns
Clethodim (20% Flower) 500mL	2.46 *	39.8 ns
l.s.d	0.1	
p-value	0.01	0.828

Discussion

With the exception of clethodim 250 mL/ha + Factor® 80 g/ha all treatments when applied within label rates and label timings did not impact of the canola performance by way of crop yield or oil %. Only one treatment, a double label rate of clethodim when applied late resulted in any yield impact. Although the same rate, when applied in label timing was only just non-significant.

The use of factor alone regardless of timing did not impact on yield performance but when mixed with clethodim and applied outside label timings yield damage did occur. The same rates of clethodim applied alone at the same stages also did not damage yields suggesting that the resulting damage may be more likely when the combination of products is used and applied late.

Interestingly, there was no evidence of potential herbicide damage from the any of the herbicide treatments before harvest by way of flower or pod damage or crop biomass measured by NDVI, yet crop damage did occur. Although it is worth noting the degree of crop damage was only small at ~114 kg/ha or about 4.5%.

In terms of any environmental conditions exacerbating damage only one treatment was applied at a period predicted to be quite frosty and this did not result in any significant yield impacts. However the temperatures experienced at this trial site could be described as mild. BOM data from Wellington shows that the average monthly minimum temperature for application periods of July and August 2013 was 5° C, 2.7° C higher than long term means and very few frosting events occurred around any application timing. A single -3°C frost occurred the day after the very late timing and a

0°C occurred the day before the extremely late timing. Given this, the trial is inconclusive as to whether cold and frosty conditions increased any impact on crop performance.

Conclusion

The results from this trial demonstrated that the use of clethodim within the label guidelines for rates and crop stage did not lead to any crop damage or negative yield or oil % impacts.

However, this trial has demonstrated that clethodim and Factor herbicide when applied together, at high rates and later than recommended crop stages can have a negative impact on yield. The level of yield suppression although significant it was not catastrophic at ~4.5% yield reduction. Where yield penalties were incurred interestingly there were no pre-harvest symptoms of damage such as the typical flower damage or pod abortions.

Although little herbicide damage occurred in this trial it did only occur at higher rates and only when applied late. Growers should not be too complacent when it comes to application timing as often if spraying is left till later, rates tend to be higher. The combination of late timing and high rates will always carry more risk of damage although not demonstrated in this trial.

It should be noted that these trials only tested one variety and the relative sensitivity of the variety to clethodim damage is unknown and other more sensitive varieties may behave very differently.

The trial is one of a series of trials investigating clethodim damage and should not be considered in isolation nor any of the experimental timings or rates used in this trial as a suggestion, recommendation or otherwise to use such rates or timings.

Acknowledgements

GOA would like to thank GRDC support in running these trials which would not be possible without such funding. GOA would also like to thank the Mason Family for hosting this trial on their property. And a final thanks to Pioneer Hybrid for supply seed for these trials.