GOA Trial Site Report

The impact of rate and timing of clethodim herbicide applications on canola performance- Peak Hill 2013

Trial Code: GOCD00113-2

Season/year: Winter 2013

Trial Location: 'Old Wandellen' 31 km WNW of Peak Hill, NSW

Trial co-operator: Tim Bell and family

Keywords

Canola, clethodim, weeds, annual ryegrass, *Lolium rigidum*, pre-emergent, herbicides, Peak Hill, tank mixing, resistance, GOCD00113-2, GOA1311

Take home messages

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

There was also no statistically significant impact on yield or oil % from any clethodim rate, timing or tank mixtures tested in this trial.

This trial only included one variety of canola, 44Y84. Other verities 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 being 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.

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A trial in South Australia[1] 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

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

All plots were sown 100kg/ha of MAP (10% N, 21.9% P, 1.5% S and 1.6% Ca) drilled with the seed, 80kg/ha of Gran Am (20.2% N and 24% S) and 100kg/ha of granular urea (46% N)- both broadcast and incorporated by the sowing.

Plots were seeded with Clearfield - 44Y84 @ 3.5 kg/ha on the 20/5/2013.

The site was treated with trifluralin (IBS) ahead of sowing. Lontrel™ and Verdict™ was applied early post emergent 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 4-6 leaf stage, the late treatment was targeted to be applied when the crop was beyond bud initiation/visible stage approximately 8 leaf stage. The last (flexible) treatment was to be targeted at less than favourable growing conditions, ideally very frosty but in this trial, such a period was not identified. Instead two further treatments were added, (i) very late (plants are elongating but not yet flowering) and (ii) extremely late (at early flowering).

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

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) + Factor® (80 g/ha). All treatments were applied with Uptake™ Spraying oil at 0.5%.

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

Table 1: Treatment list

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

Table 2: Application data

Early (4-6 leaf)	**Date Applied**	12/07/2013	**Temp (°C)**	**Wind (km/hr)**	**Wind Dir.**	**Humidity (%)**
	Start time	1.30pm	17	Light	N	70
	Finish Time	2.00pm	**Δt**		**% Cloud**	100
	Water rate (L/ha)	100	**Nozzle**	AIXR015	**Pressure**	3 bar
	Equipment	Hand boom				
Late (8 leaf)	**Date Applied**	28/07/2013	**Temp (°C)**	**Wind (km/hr)**	**Wind Dir.**	**Humidity (%)**
	Start time	4.40pm	18	5		46
	Finish Time	5.30pm	**Δt**	6	**% Cloud**	10
	Water rate (L/ha)	100	**Nozzle**	AIXR015	**Pressure**	3 bar
	Equipment	Hand boom				
Very late (Elongating)	**Date Applied**	14/08/2013	**Temp (°C)**	**Wind (km/hr)**	**Wind Dir.**	**Humidity (%)**
	Start time	10.15am	18	4-10	NW	38
	Finish Time	10.45am	**Δt**	7.1	**% Cloud**	5
	Water rate (L/ha)	100	**Nozzle**	AIXR015	**Pressure**	3 bar
	Equipment	hand boom				
Extremely late (Early flowering)	**Date Applied**	22/08/2013	**Temp (°C)**	**Wind (km/hr)**	**Wind Dir.**	**Humidity (%)**
	Start time	11am	15	3-10	NW	44
	Finish Time	11.30am	**Δt**	6.3	**% Cloud**	90
	Water rate (L/ha)	100	**Nozzle**	AIXR015	**Pressure**	3bar
	Equipment	hand boom				

Results

Moderate levels (up to 33%) of damage was observed in response to some herbicide treatments as can be seen in **Table 2**. Similarly, there was observed damage to the podding in some treatments with some abnormality or abortion noted correlating well to the observed flower abnormality. Additionally there was also some effect on the crop biomass as measured by NDVI following treatments (not shown).

No treatments resulted in a yield significantly different to the UTC. A number of treatment did result in oil % different to the UTC as detailed in **Table 2**.

Table 2. Canola yield, oil, observed flower and pod damage in response to clethodim application timing, rate and tank mix partner, 72 days after first application (DAA1)

Treatments	Yield t/ha	Oil	Estimated % flower damage	Estimated % pod damage
Untreated Control (UTC)	1.48 ns	44.43	1.3	0.0
Clethodim 250 (early)	1.38 ns	45.73 *	9.0	0.0
Clethodim 500 (early)	1.52 ns	44.97	2.3	0.0
Clethodim 1000 (early)	1.44 ns	45.27	13.0	3.0
Clethodim 250 (late)	1.43 ns	44.73	5.7	0.7
Clethodim 500 (late)	1.32 ns	46.23 *	5.7	10.7
Clethodim 1000 (late)	1.56 ns	44.43	33.3	33.3
Factor® (early)	1.30 ns	46.28 *	4.7	0.0
Factor® (late)	1.27 ns	46.33 *	2.0	0.7
Clethodim + Factor® 250 (early)	1.40 ns	46.37 *	2.3	0.0
Clethodim + Factor® 500 (early)	1.32 ns	45.50 *	2.7	0.7
Clethodim + Factor® 250 (late)	1.36 ns	46.03 *	3.0	1.3
Clethodim + Factor® 500 (late)	1.31 ns	45.30	16.7	7.7
Clethodim 500 (very late)	1.29 ns	45.83 *	30.0	20.0
Clethodim 500 (extremely late)	1.32 ns	45.73 *	7.3	1.7
L.S.D=	0.232	1.028		
p-value	0.3097	0.0021		

Ns indicates there is no significant difference, * indicates the result is significantly different to the UTC (P=.05, LSD)

Discussion

As detailed in the results above there was no statistically significant impact upon yield by either the rate or timing of the clethodim application. The use of Factor either alone or in combination with clethodim also did not result in any impact to yields. This is despite significant level of crop damage observed in the form of abnormal flowers as illustrated in **Figure 1** below and damaged pods. However as can be seen, the higher rates of flower damage are associated with higher clethodim rates and delayed application timings the relationship is not universal. It is also worth noting that despite the higher level of damage, yields of such treatments appear to have recovered well. This possibly indicates that the crop is able to compensate for the damage quite well.

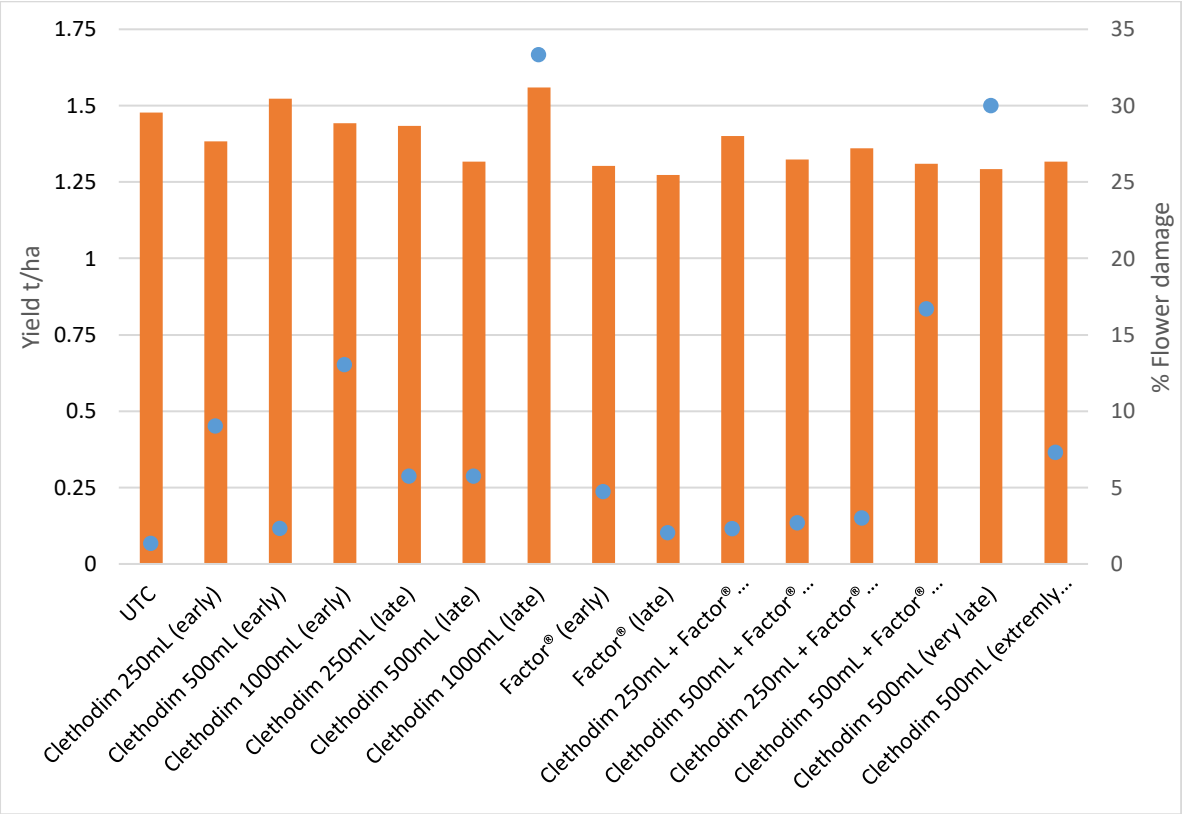

Figure 1: Canola yield in response to various clethodim rates, timings and tank mixes LSD=0.23

Although there was a statistically significant impact on oil%. The use of Factor either alone or in combination with clethodim commonly resulted in increased oil% but this outcome was not universal. The 500mL label rate of clethodim applied late, very late and extremely late all resulted in higher oil% as well. These results are illustrated in **Figure *2***. These outcomes were unexpected and at this time unexplainable and may deserve further investigation.

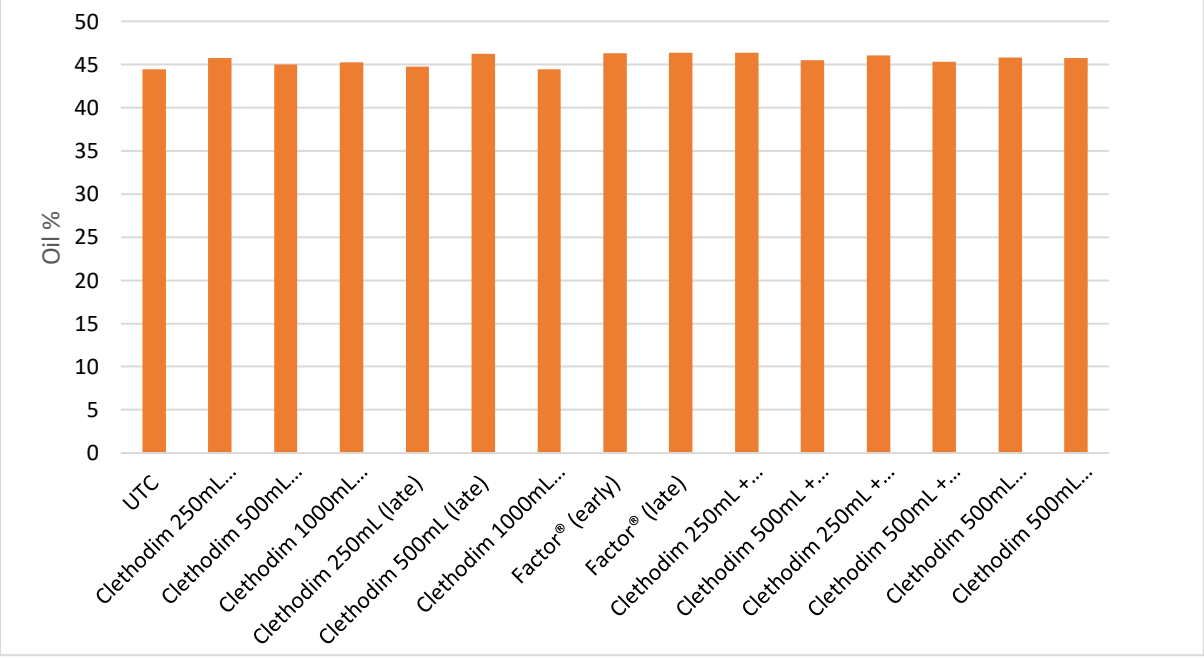

Figure 2 Canola oil% in response to various clethodim rates, timings and tank mixes LSD=1.028

This overall lack of responsiveness in crop yield could lend support to an argument that clethodim damage is not simply a function of the use of high herbicide rates and/or late crop stage at the time of application but something else such as adverse weather in particular heavy periods of frosting.

The weather conditions experienced during this trial were quite mild. BOM data from Peak Hill (31km ESE) did not record any frostings during the treatment periods. This may have limited a potentially higher expression of damage but also facilitated a better ability of the crop to recover from any adverse effects of the herbicide applications. It also however limited the testing the theory that frosty conditions may trigger damage by this trial.

Conclusion

The results from this one trial demonstrated that the use of clethodim within the stipulated label conditions (and under relatively favourable weather conditions) is unlikely to cause significant yield reductions with this hybrid variety (Clearfield - 44Y84).

The results from this trial demonstrated that crop damage and subsequent yield loss from clethodim damage is not a simple result of excessive rate or late timing. Crop damage was certainly observable with the higher rates and/or applications at later crop stages but this did not translate to any yield impacts.

It suggests that in some circumstances crops can tolerate quite high rates and delayed timing. Even in circumstances where crop damage, flowering and podding damage, does occur it may not necessarily translate into yield penalties as the crop may be able to compensate as was the case in this trial. It is perceivable that in some circumstances the crop may not be able to compensate as easily due to moisture, temperature or nutritional constraints and thus penalties may occur.

Interestingly this crop demonstrated crop damage in what would be described as very mild seasonal conditions suggesting that cold, frosty or otherwise poor growing conditions is not necessarily the environmental trigger needed to express damage. Further investigations are needed to help better understand what these triggers may be.

There was an impact on percentage of oil in some treatments which is unexplained and unexpected and this may deserve further investigations.

There does remain questions over varietal sensitivities to clethodim and the one variety tested in this trial is also 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 Tim Bell and his family for hosting this trial on his property. And a final thanks to Pioneer Hybrid for supply seed for these trials.