WINDROW TIMING AND DIRECT HEADING IN CANOLA- EFFECTS ON YIELD AND OIL

Maurie Street, CEO Grain Orana Alliance

Key words

Canola, windrowing, canola windrow timing, canola direct head, desiccation, Pod Ceal™

GRDC code

GOA 00001

Take Home Message

- Windrowing timing can have a significant impact on yield and profitability of canola
- Yield increases up to 0.5t/ha have been seen over relatively short periods of only 8 days
- Windrowing timing has a limited effect on oil potential in canola
- Direct heading is a viable option to harvest canola and in many could maximise profitability.
- An economic benefit of over $200/Ha can be gained from choosing the best method and timing of canola harvesting

Background

Focus group meetings of winter 2009 highlighted an interest in validating existing understandings of ideal windrowing times in canola, in particular whether the old recommendations are still sound and applicable in the Central West of NSW. One common understanding of the impact of timing was simply that windrowing too early reduced oil contents and by windrowing later, yield may be lost through excessive shelling and shattering.

Over the past three seasons GOA has undertaken six trials to help examine the impact of windrowing timing on oil, yields and profitability. One of the first trials undertaken at Coonamble in 2009 demonstrated that direct heading of modern canola varieties was also a economically valid option equally matching the best performing option in the trial. In 2011 GOA undertook a further three trials investigating the relative performance of direct heading against windrowing. This trial also investigated the impact on yield and oil when direct headed using pre harvest treatments with Pod Ceal™ and desiccation with Reglone™.

Methods

All trial sites were large scale replicated trials applied to commercial, farmer sown paddocks of canola. Windrowing and harvest were carried out by commercial machines. The direct headed treatments were harvested at the same time as the windrowed crop. Yields were measured with mobile weigh bins with the exception of Nyngan which was weighed over a weighbridge.

Windrow timings are described as % colour change (CC) this refers to the percentage of seeds that had started to change colour in the middle third of the main stem of the canola plant. To determine this, 30 pods were sampled from the treatment areas, shelled out and visually assessed for colour change. This was completed three times for each plot.

<u>Coonamble 2009</u>

Treatments included windrowing at three timings: 10% CC, 50% and 70%, a Reglone™ (Reg) treatment at label recommendations (2.25L/ha) which was then direct headed, Pod Ceal™ (PC) at label recommendations (1L/ha) which was also direct headed and the final treatment which was direct headed with no other treatments. Sprayed treatments were applied by ground with no wheel tracks in the harvested areas.

Dubbo 2009
Three timings were applied in this trial 10%, 50% and 70% colour change.

Warren (Site 1) 2010
Four timings of windrowing were applied at this site, 5%, 40%, 70% and 95% colour change.

Nyngan 2010
Rain prevented the first timing of windrowing to be completed on time so only two timings went out in this site.

Warren (Site 2) 2010
Three timings were applied in this trial, 5%, 60% and 95%.

Nyngan 2011
Three timings were applied at 10%, 50% and 90%.

Warren 2011
This trial compared a single windrowing timing at 85% colour change to direct heading with a draper header front fitted with a finger reel and top auger.

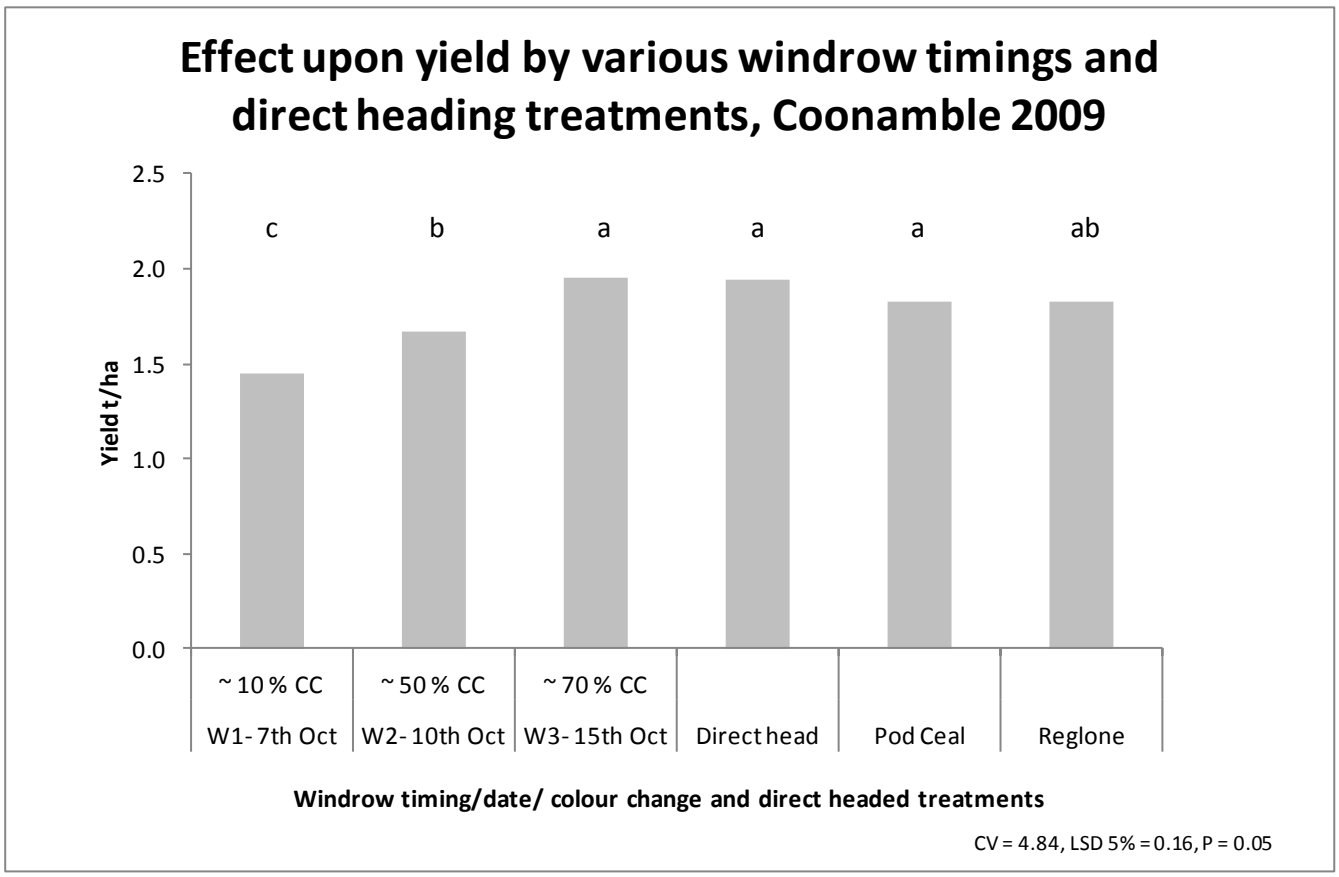
Wongarbon 2011
This trial compared one windrowing timing at 95% colour change and direct heading with a conventional "tin front" and a draper front with a finger reel. A different header was used for the harvesting with a draper front than was used for the other two treatments. The header used for the windrow and conventional treatments maintained the same separator settings for both.

Wellington 2011
This trial compared two windrow timings of 90% and 100% colour change and direct heading with a draper front fitted with a finger reel. The same header was used for both harvesting treatments with the same separator settings.

Results

Coonamble

- W1 was the lowest yielding treatment of the three timings.
- Each of the three windrow timings are significantly different and increased as windrowing was delayed.
- The yields between direct headed (no other treatment), Pod Ceal™, desiccation with Reglone™ and W3 were not significantly different and were the highest yielding treatments.
- Desiccation with Reglone™ and W2 were not significantly different.
- There was no significant impact upon oil% for any windrow timing or direct heading treatment.

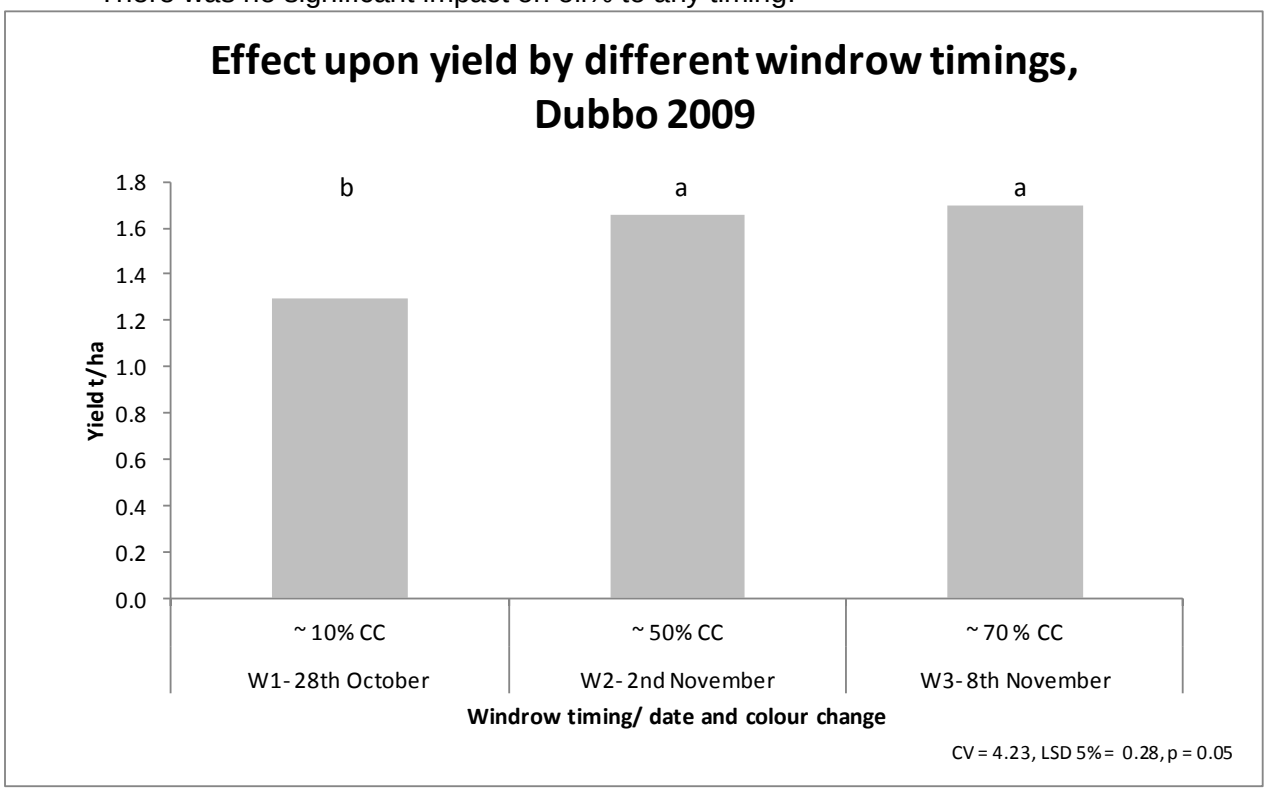


Treatments headed by the same letter denotes no significant difference

Figure 1 *Canola yield for direct harvest, PodCeal™, Reglone™ and windrow treatment timings at Coonamble*

Dubbo

- W1 was the lowest yielding treatment.
- W3 was the highest yield treatment but was not significantly different to W2.
- There was no significant impact on oil% to any timing.

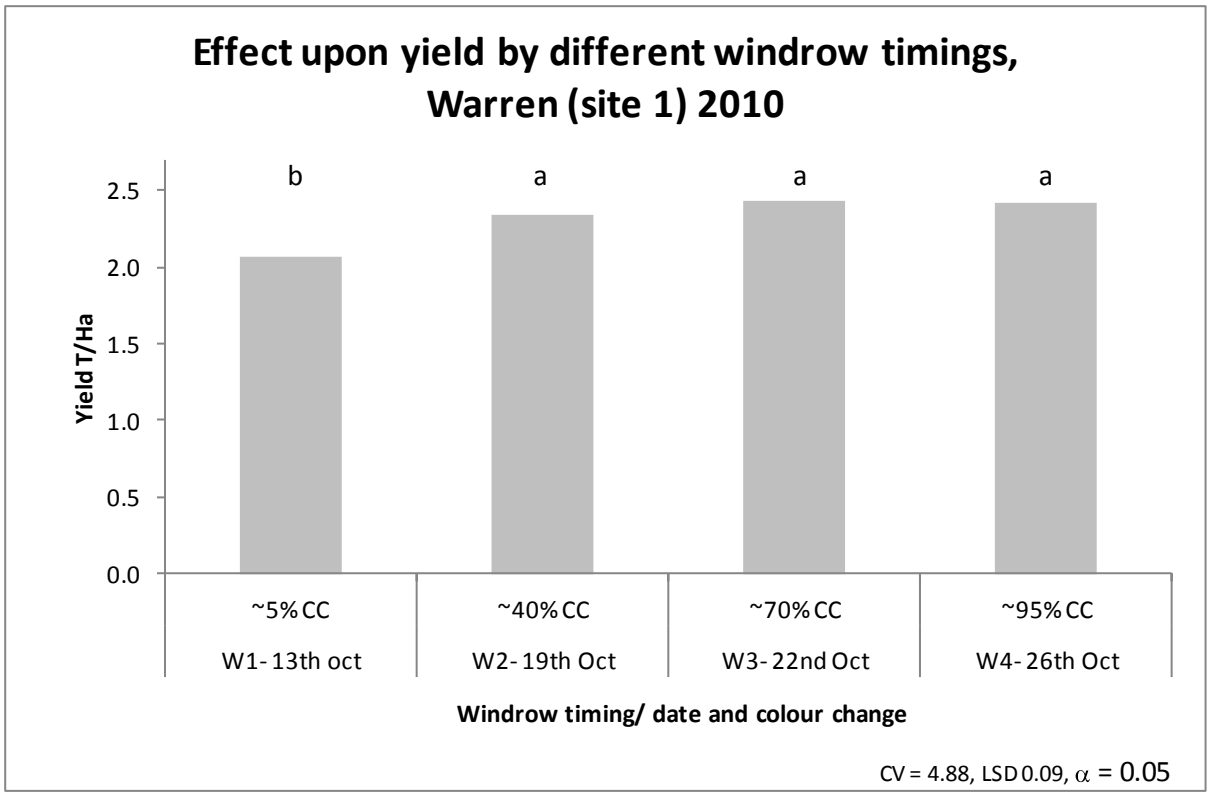


Treatments headed by the same letter denotes no significant difference

Figure 2 *Canola yield for the three windrow treatment timings at Dubbo*

Warren 2010 (Site 1)

- W1 timing was the lowest yielding treatment.
- The other three timing were not significantly different to each other but higher than windrow timing 1.
- As mean yields at each timing, windrowing at 70% was the highest yield.
- Windrowing later than 70% CC decreased yields but only slightly at 30kg/ha and not significant.
- There was no significant impact on oil% to any treatment.



Treatments headed by the same letter denotes no significant difference

Figure 3 *Canola yield for the four windrow treatment timings at Warren 2010*

Nyngan 2010

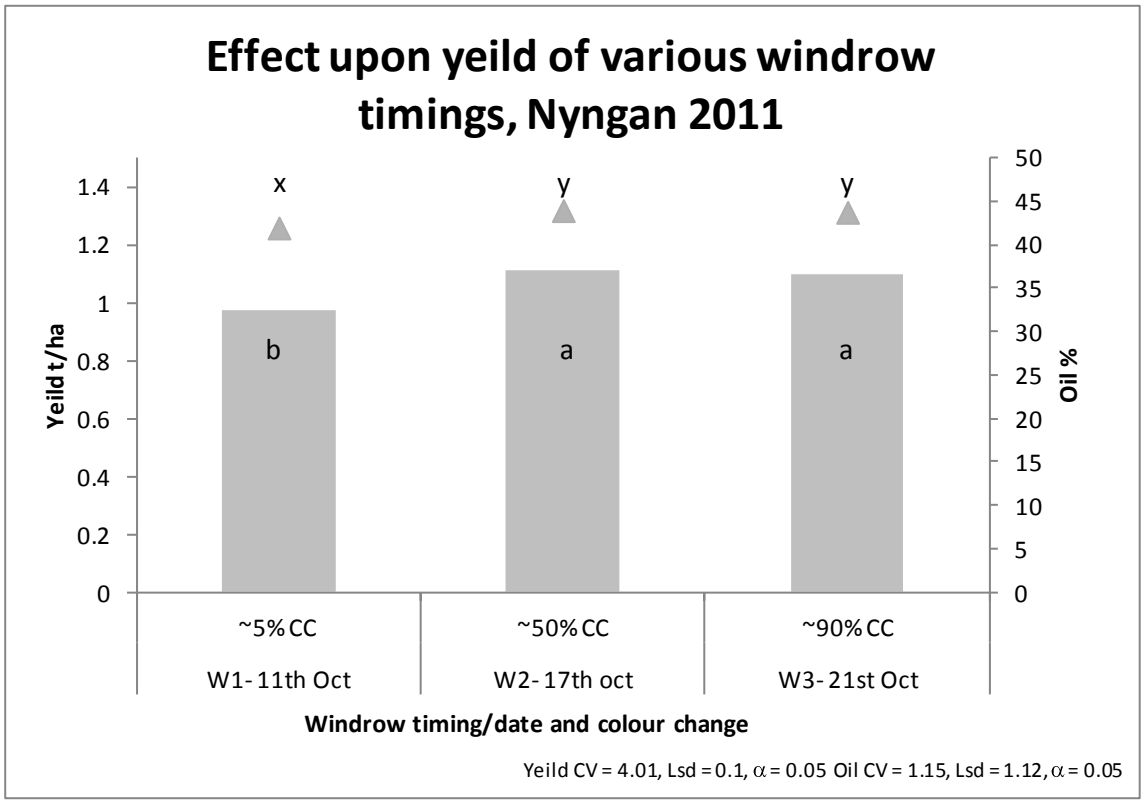
- From a delay in windrow timing from 60% to 90% there was no significant difference in yield or oil%.

Warren 2010 (Site 2)

- There was no significant impact on yield or oil at this site.

Nyngan 2011

- W1 was the lowest yielding treatment.
- W2 and W3 were not significantly different but yielded significantly more than W1.
- There was a significant response in oil% with W2 and W3 achieving higher oil than W1.



Treatments headed by the same letter denotes no significant difference

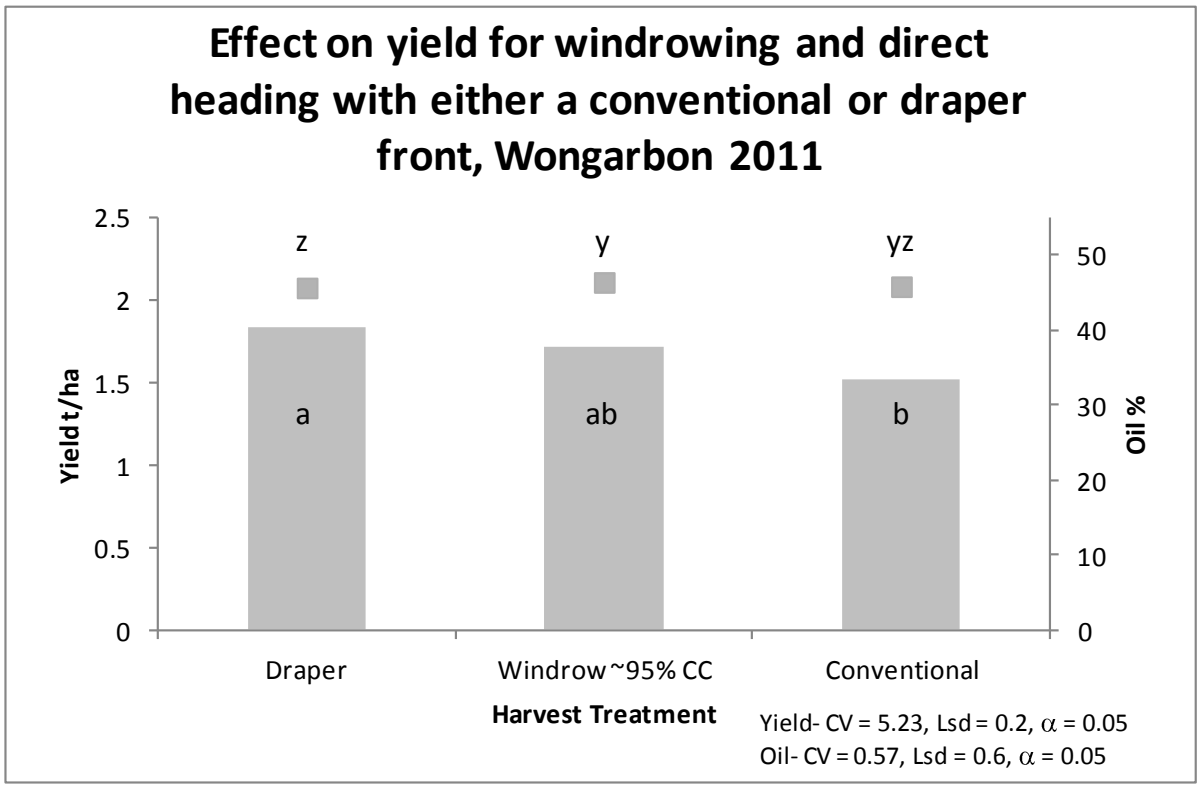
Figure 4 *Canola yield for the three windrow treatment timings at Nyngan 2011*

Warren 2011

- There was no significant difference in yield between windrowing at 85% colour change and direct heading at 95% confidence. Only at 90% confidence there was a difference with direct heading yielding only 45kg more than the windrowing treatments.
- There was no impact on oil%.

Wongarbon 2011

- It should be noted that the trial area experienced a heavy wind storm (>50km/hr) between windrowing and direct heading. This shattered an amount of the standing treatments. The windrows were relatively unaffected.
- Two separate headers were used for the two direct heading treatments and it could not be guaranteed their configurations were the same.
- Neither style of header front was significantly different to the windrow timing of 95% for yield.
- The conventional header performed worse than the draper front however it must be noted that there were issues with the reel of the conventional front going too fast for harvesting speed.

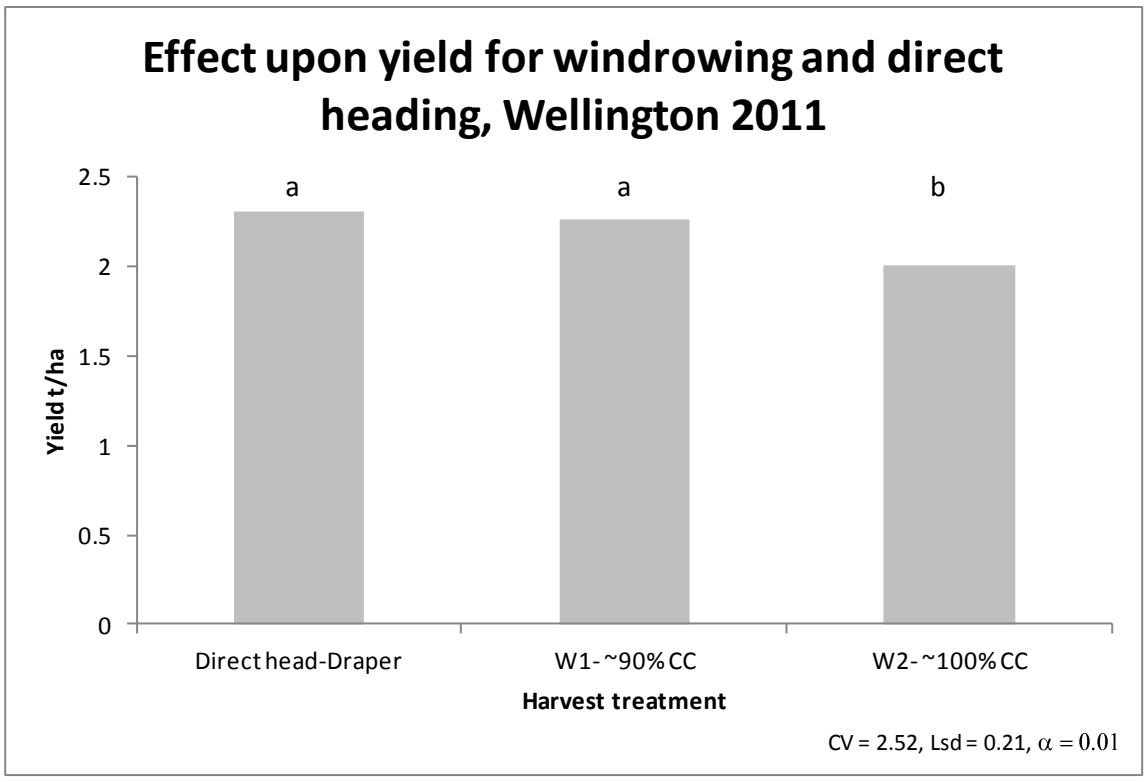


Treatments headed by the same letter denotes no significant difference

Figure 5 *Canola yield and oil% as a result of various harvest methods, Wongarbon 2011*

Wellington 2011

- Direct heading with a draper front was no different that windrowing at 90%.
- Windrowing at the later timing (100%) was significantly less than direct heading or the 90% windrowing.
- There was no impact on oil% by any treatment.



Discussion

Yield

Across the three seasons and a number of sites, windrow timing has shown to have a consistent and significant impact upon yields. Early windrowing around 5-10% colour change has consistently resulted in lower yields than later windrow timings. However windrowing past the 50-60% colour change has not always resulted in further significant yield increases. There often is a consistent trend to increase up to 90-95% colour change after which yields tend to trend downwards slightly. Increases in yield have been sometimes quite significant, at Coonamble a 0.5t/ha realised in only eight days delay in windrowing.

This is best explained by considering the process of windrowing whereby the plant's growth is ceased at time of cutting. This results in the key process within the plant also ceasing therefore directly affecting any further grain fill of seeds that have not yet reached maturity. Seed maturity is indicated by colour change in the seed. Desiccation with a product such as Reglone^{TM} that rapidly removes photosynthetic area could potentially have a similar effect. Therefore delaying any action that has the potential to cease plant growth whilst some seed is immature has the potential to have a positive impact on yields.

However this potential maximisation of yield must be weighed against the risks associated with delaying windrowing or indeed delaying to direct head. As the crop passes through the physiological mature stage and starts to dry down the brittleness of the crop and pods increase. This exposes pods to shatter and hence yield loss when the crop is either standing before or during windrowing. The ideal windrowing stage therefore should be a balance between maximising the grown yield and not losing this increase in yield through excessive pre windrowing or windrowing losses.

The question that should be asked is how much of an issue is pod shattering, and when does this start occurring?

- Warren in 2010 demonstrated a trend for yields to decrease by 25kg between the last two timings, from 70% CC to 95% CC but not significant.
- Nyngan in 2010 delays from 60% to 90% CC had yields decline by 70kg/ha but it was not significant.
- Warren (site 2) showed a decline in mean yield of 120Kg/ha from 60% to 95% but again this was not significant
- Wellington site were the due to bad weather the first windrow timing was already quite late, the second timing was very late and resulted in a decrease in yield of 0.25t/ha or 11% which was significant. It must be remembered that this second timing was potentially 7 days later than an already late timing so is an extreme example.

So in summary of shattering decreasing yields due to late windrowing (>95% CC) these trials have shown that it was not significant except in one case with a very late timing. Trends do exist in the data but for the most part the amount lost is quite low. When considering the comparisons above also note that the shattering would have been most likely to occur at the late end of the range tested i.e. closer to 95% CC than 60% CC, and that yields may have actually increased from the 60% timing before declining.

Given that windrowing has the potential to reduce yields because by design it is done before all seed has matured does direct heading therefore has potential to capture higher yields? Four trials have shown that yields from direct headed situations have generally only matched the yields of a well timed windrowing (~70-80% CC). However if compared to currently recommended windrow timing of 40-60% as can be seen at Coonamble in 2009, direct heading has outperformed the windrowing.

In the case of two different styles of header fronts being tested (Wongarbon trial site), the results would be best treated as inconclusive. Problems with reel speed on the conventional

front and pod shatter due to weather in direct heading treatments pre harvest may have compromised the results. However neither direct head option outperformed the windrowing at 95% CC. Interestingly it was demonstrated at Wellington in 2011 that windrowing too late proved to have a greater penalty than that of direct heading.

There are a number of new products in the market place to manage potential shattering. If successful they could address one of the key concerns growers have with direct heading of canola. One such product is Pod Ceal which was trialled at the Coonamble site. Pod Ceal™ aims to minimise pod shatter through a coating applied over the pod. In this trial treatment with Pod Ceal™ was not statistically different to either direct headed after desiccation with Reglone or direct headed with no other treatment. However this site in all treatments had minimal shattering problems. If the site experienced greater shattering the advantages of such a product could well be justified. But again, how bigger issue is shattering?

Oil levels

The potential for harvest management of canola through such things as windrow timing or direct heading has shown to have a very limited impact oil%. Very few trials have shown any significant differences in oil % due to windrow timing or direct heading. Of the trial sites that have resulted in significant differences in oil the magnitude of such are small often less than 1%.

Conclusion

From these trials it could be concluded that windrowing timing has a limited affect on oil percentages in canola.

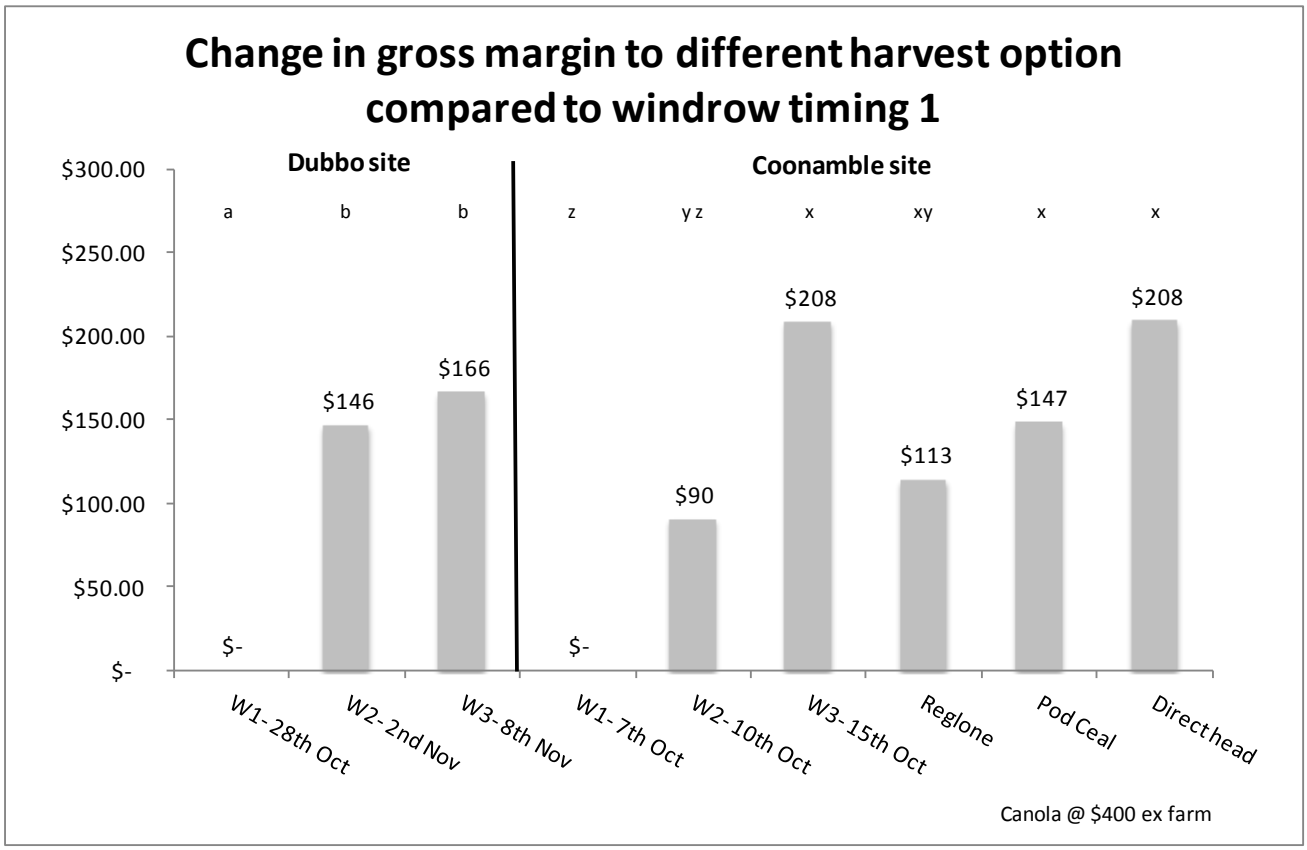
Delaying windrowing from early timings has resulted in significant increases in yields of canola in these trials. These yield variations may be explained by the proportion of immature seed present at cutting and the risk this seed experiences as to the ability to fill to its full potential. For this seed to mature it must draw on stored substrate and this may be influenced by cutting height, time of day or even the variability on the level of maturity within the crop. These aspects may require further investigations.

The findings from these trials suggest that striving to meet current recommended windrow timings is important (40-60% CC). However it has been demonstrated that delaying past these times have shown to further improve yields in some locations/seasons. Trends in yields have continued to increase up to 90+% CC. One concern with such a practice is the risk of shattering before or during windrowing. It has been demonstrated that the magnitude of the shattering is small and statistically insignificant. The penalty of going too late is much smaller compared to yield penalties attached to going too early.

Selection of varieties with greater shattering tolerance through breeding programs and better machinery may mean that pod shatter may not the issue that it was when the original recommendations of timings were founded.

Direct heading has also shown to be a suitable management option for canola demonstrating that it often matches the performance of a well timed windrowing. However compared to early or currently recommended timings direct heading did perform better.

The differences in yield of the various treatments coupled with additional costs can all contribute to significant increases in net returns for the various treatments. The following graph depicts the benefits for the average of all the treatments, taking into account average yields, additional costs as well as oil penalties/bonuses from Dubbo and Coonamble in 2009.



Treatments headed by the same letter denotes no significant yield difference only ($\alpha = 0.05$)

Figure 5: Relative cost / profit difference of different harvest options to W1 at the Dubbo and Coonamble canola harvest trials

To compare windrowing timings it should be remembered that there is no changes in costs simply a delay in time. Hence any increase in yield is 100% profit. Comparing windrowing to direct heading may see changes in costs through the saving of windrowing costs but possibly increased costs as harvesting may be slower.

These trials do not allow an "ideal" timing of windrowing to be put forward. What they do hope to do is to demonstrate the potential economic benefit gained by getting it right. Each paddock will be different, seasons will be different and growers risk adversity will be different. When formulating a windrowing timing it is best to remember that whilst there is immature seed in the paddock there is potential upside to allowing this to mature before windrowing or desiccation. And by ceasing that plants growth during the filling of these seeds, yields could be reduced.

Therefore, a balance must be made between potential yield maximisation by delaying windrowing or desiccation, against the potential increases in yield loss through shattering. This should be weighed against the growers risk adversity or other advantages offered through windrowing. Advances in machinery may also help minimise the potential losses in direct heading situations. Modern headers with draper fronts or conventional fronts with extendable tables may also limit any potential losses.

Potential risk in terms of pod shattering may be managed by use of products such as Pod Ceal™.

Acknowledgements

Special thanks to:
Clyde Agriculture "Netherway" Coonamble,
Graeme Callaghan- Graeme Callaghan & associates, Dubbo

Garry Evans- “Larry’s Plains”, Dubbo
Lindsay Northcott, North-Hill harvesting, Young
Syngenta crop protection, Australia
Agspec, Australia (Pod Ceal™ Distributors)
John Delyall- Pioneer Hi Bred Australia
“Haddon Rig” Warren
A Walker-“Erlside” Warren
R Ledger “Erlside” Warren
The Waas family at Nyngan
ME- Wongarbon trial site
“Spicers Run” Wellington
Michael White and Co. Wellington
Julie Monroe- GOA
All windrowers, agronomists and growers that have helped out along the way.

Contact details

Maurie Street
Grain Orana Alliance
PO Box 2880
Dubbo NSW 2830
0400 066 201
maurie.street@grainorana.com.au