# Improving harvest management decisions in canola – implications of seed colour change on windrow timing and yield- Tamworth 2017

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## Key findings

* It was observed, from the partitioning of seed from pods on the primary stem and branches that seed colour change (SCC) occurred later on the branches compared to stems
* Importantly, in the breakdown of yield components from the primary stem only contributed ~16% of total seed yield.
* Relying solely on the SCC of seed on the primary stem to determine windrow timing (WT) can underestimate overall seed development, negatively impacting seed size and ultimately yield potential.
* Windrowing at < 40% SCC on the primary stem was shown to reduce yield by up to 21%.
* Ideally SCC should be measured on a whole plant basis and not solely on the primary stem, as branches contribute a significant proportion of seed yield.
* Results from this study support the updated Australian Oilseeds Federation (AOF) recommendations that canola should ideally be windrowed when ‘40-60% of seeds collected from both the stem and branches’ have changed colour.
* There is also a need for a clear definition as to what constitutes actual SCC in order to develop robust industry guidelines around windrow timing.

## Introduction

Windrowing is a widely adopted harvest management practice of canola (Brassica napus L) in Australia, its timing has traditionally been based on seed colour change (SCC) of seeds taken from pods (siliques) in the middle third of the primary stem (primary racemes). Over the past decade however, with the introduction of hybrid varieties, improvements in canola germplasm and changes in farming practices, there has been increased discussion within the canola industry about how best to determine seed colour change (SCC) and hence windrow timing. Industry guidelines based on research conducted in the 1970’s and 1980’s recommend that canola (*Brassica napus* L.) is ready to windrow when 40–60% of seeds on the primary (main) stem change colour from green to red, brown or black. The main issue of concern, with this recommendation, centres on the proportion of yield contained on the branches versus the primary stems, and the effect of the differential rate of seed maturity on yield and seed quality parameters.

In 2015 research commenced as a component of the GRDC co-funded ‘Optimised Canola Profitability’ project (CSP00187), to examine the relationship between SCC, grain yield and quality parameters, with the aim of assisting growers to make more informed decisions on canola harvest management in the northern grains region (NGR) of NSW, and potentially across Australia. Preliminary results found that there were large effects of where on the plant (branch *vs.* primary stem) SCC was measured. It was subsequently observed from the partitioning of seed from pods, that the seed from branches were slower to mature than that of the primary stems and that there was potential for significant yield and grain quality reductions associated with windrow timing. In 2017, a series of experiments were conducted this time looking at both hybrid and open pollinated varieties, findings from an experiment conducted at Tamworth, is outlined in this reported. This change was made to see if there were any differences in yield components (Stem *vs* Branches), SCC and seed development, between a hybrid variety and an open pollinated variety.

## Site details

### Location

Tamworth Agricultural Institute

### Soil type

Grey/Brown vertosol

### Previous Crop

Barley

### Starting Water

160 mm PAW to 120 cm

### In-crop Rainfall

203 mm (May to October)

### Starting Nitrogen

Soil nitrate N was 51 kg N/ha (0-120 cm)

### Trial design

A replicated split plot design was used in each experiment, with windrow timing as the main plot and variety randomised within the treatment timing plots.

### Fertiliser

60 kg/ha Granulock Z extra treated with Intake® (500g/L Flutriafol @ 200ml/ha) and 220 kg/ha Urea (100 kg N/ha) side banded at planting

## Treatments

### Varieties (2)

Pioneer® 44Y89 (CL), ATR-BonitoA

### Sowing date (SD)

5 May

### Plant Populations (PP)

38 plants/m2

### Windrow timing

Windrow timings were conducted at 2 to 3 day intervals (i.e. Monday, Wednesday and Friday) from the commencement of SCC on the primary stem up until 100% SCC on branches. SCC was defined as when ‘a minimum of two-thirds of the surface area of an individual seed changed colour from green to brown, red or black’. Actual SCC was determined using a representative 200 seed sub-sample, taken from pods from the middle third of the primary stem and randomly from across the branches of individual plants.

## Results

The two varieties evaluated, had comparable 50% flowering dates (i.e. 50% plants with one flower open on the main stem), but differed in terms of maturity, with Pioneer® 44Y90 (CL) 4 days faster to the end of flowering (5% flowers remaining) compared to ATR-BonitoA. Windrow timing (WT) treatments commencing on the 18 October for both varieties but concluded on the 30 October and 6 November respectively for Pioneer® 44Y90 (CL) and ATR-BonitoA, reflecting differences in varietal maturity. Consequently, SCC was more advanced for Pioneer® 44Y90 (CL), compared to ATR-BonitoA at the commencement of the WT treatments. Pioneer® 44Y90 (CL) for example, was at 61% SCC primary stem, compared to 19% SCC for ATR-BonitoA at WT 1 (18 October). Due to the advanced stage of SCC for Pioneer® 44Y90 (CL) at the commencement of the WT treatments, results in this report, have focused on ATR- BonitoA. Importantly however, overall responses to delays in WT were comparable for both varieties, with the primary stems only contributing ~16% of seed yield.

Consistent with previous findings, SCC occurred earlier on the primary stem compared to the branches. In the case of ATR-BonitoA when the primary stems were at ~29% SCC, the branches were only at 7% SCC (WT 1) likewise, when the stems were at 90% SCC, the branches were only at 38% SCC (WT 3). Importantly, the results from 2017, reinforced how rapid SCC can occur, with SCC on the primary stem progressing from 28% to 90% SCC over a 5 day period (Figure 1). Interestly the plateauing in SCC developed around 23 October, reflected a drop in mean daily temperatures and coincided with a rainfall event (data not shown) again underlining the potential interaction of temperature on SCC.

Figure 1. Seed colour change (%) primary stem vs. branches over time as determined by windrow timing timings at Tamworth in 2017. [filename: GrahamR2 CanolaSeedColour Harvest TAI Figures.xlsx, sheet Figure1]

### Seed Size

Seed size expressed as thousand seed weight (TSW) is an indicator of both physiological maturity and yield potential. When looking at changes in TSW over time at Tamworth (Figure 2) as determined by windrow timing, it was observed that differences in TSW primary stems *vs*. branches were largest during the earlier windrow timings reflecting differences in SCC and maturity. This would be expected given that seeds mature progressively up the primary stem and from the lower branches to the upper branches, with changes in seed colour indicating declining metabolic activity and increasing seed maturity.

Figure 2. Changes in seed size (TSW) primary stem vs. branches over time as determined by windrow timing for Tamworth in 2017. l.s.d. (*P*=0.05) for primary stem = 0.15 g and l.s.d. (*P*=0.05) for branches = 0.09 g [filename: GrahamR2 CanolaSeedColour Harvest TAI Figures.xlsx, sheet Figure2]

### Grain Yield

Windrowing at the commencement of SCC at Tamworth (Timing 1-2) resulted in a 0.51 to 0.67t/ha decline in yield potential, compared to windrowing at ~46% to 67% SCC averaged across branches and primary stems (Timings 4-5), this equating to a yield loss of ~21% (Figure 3). When looking at the breakdown of yield components primary stems *vs.* branches, it was observed that stems only contributed 16% of total grain yield averaged across windrow timings (data not shown). As was noted with SCC, seed sampled from the branches was less advanced than the primary stem, taking longer to reach physiological maturity.

Figure 3. Effect of windrow timing/seed colour change on grain yield (t/ha) at Tamworth in 2017. l.s.d. (*P*=0.05) = 0.28 t/ha [filename: GrahamR2 CanolaSeedColour Harvest TAI Figures.xlsx, sheet Figure3]

## Conclusions

Results from this experiment, underline the importance of correct windrow timing and the need to accurately determine SCC. It was observed, from the partitioning of seed from pods on the primary stem and branches that SCC was slower to develop on branches compared to stems. Importantly, in the breakdown of yield components, it was found that seed from the primary stem only contributed ~16% of grain yield. If SCC on the primary stem is solely relied upon for windrowing decisions overall seed development can be underestimated. This will negatively impact on seed size and yield potential. Furthermore, windrowing earlier than 40% SCC on the primary stem was shown to significantly reduce yield by up to 21%.

Given the significance of the yield component contributed by the branches as opposed to stems, and with the increasing prevalence of hybrid varieties and/or improved germplasm, lower plant populations, and associated changes in plant architecture, there would appear to be a need to reconsider the method of how SCC is determined. This study demonstrates that SCC should ideally be measured on a whole plant basis and not solely on the primary stem, supporting current Australian Oilseeds Federation (AOF) recommendations that canola should ideally be windrowed when ‘40-60% of seeds collected from both the stem and branches have undergone SCC’ (Anon, 2017). There is also a further need for a clear definition as to what constitutes actual SCC in order to develop robust industry guidelines around windrow timing.

## References

Anon, (2017) [online] Available at: <http://www.australianoilseeds.com/about_aof/news/media_release_check_canola_pods_on_the_branches,_not_just_the_stem> [Accessed 28 September, 2018]

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