



SOUTHERN

SEPTEMBER 2018

GRDC™ GROWNOTES™



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GRAINS RESEARCH
& DEVELOPMENT
CORPORATION

CANOLA

SECTION 12

HARVEST

WINDROWING | DIRECT HEADING | COMPARISON OF WINDROWING AND
DIRECT HEADING | WET HARVEST ISSUES AND MANAGEMENT | RECEIVAL
STANDARDS

SECTION 12

Harvest

Canola crops can be either windrowed (Figure 1) or direct-harvested. The method chosen depends on the availability and cost of contract windrowing, the type of harvesters available and the relative risk of adverse weather in a particular locality. Some of the advantages of windrowing are: uniform ripening, earlier harvesting (7–10 days), less exposure to spring storms and rain, reduced shattering losses during harvest, and less hail and wind loss. Harvesting can usually continue ‘around the clock’.¹ Some advantages of direct heading include cost, availability of headers on the farm, and a higher harvest index on low-yielding crops. There is also a problem with windrows in lower yielding crops being susceptible to being blown around by wind, causing extensive losses.



Figure 1: Windrowing prior to harvest is the more common practice. (Photo: Rebecca Jennings)

More information

[GRDC: Direct heading canola. Fact Sheet](#)

[AOF: Better canola. Module 7. Harvest management](#)

12.1 Windrowing

Key points:

- Physiological maturity occurs when the seed moisture content reaches 35–45%.
- Check the crop regularly from 14 days after the end of flowering (10% of plants with flowers).
- Look for colour change across the whole plant, particularly in crops with lower plant populations.
- Sample from representative areas of the paddock, and check all varieties for change in seed colour; it will vary within a district.

¹ L Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

- Book a contractor early in the season and contact again when the crop has reached the end of flowering.
- Optimal windrowing stage lasts for 4–6 days in most areas.
- When seed losses are obvious on the windrower, stop and consider direct harvesting. Planning is critical for a smooth harvest operation. Less experienced growers are advised to organise a contractor or an experienced neighbour to carry out the windrowing.



Figure 2: Windrowed canola near Binalong, NSW. (Photo: Gregory Heath)

Canola is an indeterminate plant, which means it flowers until limited by temperature, water stress or nutrient availability. As a result, pod development can last over 3–5 weeks, with lower pods maturing before higher ones. Consequently, canola is often windrowed to ensure that all pods are mature at harvest (Figure 2).

Older varieties of canola had a lengthy flowering period, but growers now have access to a greater range of varieties with differing maturities and more tolerance to pod-shattering.

Some early-maturing varieties have been developed with shorter flowering and pod maturity periods. Direct harvesting (instead of windrowing) is more of an option for these shorter statured and earlier maturing varieties in some regions.

Whether the crop is windrowed or direct-harvested will depend on the varieties grown, soil types, seasonal conditions, availability of windrowers, and the size and variability of the crop. Canola crops that are variable in their maturity or show significant differences in the maturity of the top and bottom pods ideally are windrowed to minimise shattering losses. The plant should be windrowed before the lower pods approach shattering stage.

Like hay cutting, windrowing of canola hastens the maturity of the crop, allowing the top pods to be harvested at the same time as the lower pods. By cutting the crop and placing it in a windrow on the stubble, the pods and seeds can dry faster than a standing crop (by as much as 8–10 days). Windrowed canola is less susceptible than a standing crop to wind, rain and hail damage, although agronomists query this effect in light crops. In the windrow, seeds will reach a uniform harvest moisture content of 8% within 6–10 days of being cut.



Several harvester-front options are available for canola. A belt front, for example, can be used to windrow or direct-head a crop, but with minor modifications, it can also be used to harvest a windrowed crop. Various pick-up attachments or crop lifters can be used on existing open-front headers to harvest canola windrows.

For most canola-production areas, windrowing has several advantages:

- allowing earlier harvest (8–10 days) because seed matures more evenly
- hastening maturity (in higher rainfall areas)
- evening maturity where soil types are variable in individual paddocks
- reducing losses from hail and excessive winds (except in light crops)
- providing flexibility for the grower with large areas, because the timing of harvest is not as critical
- reducing shattering losses during harvest
- around-the-clock operation to cover large areas
- helping to control escaped or herbicide-resistant weeds in some cases ²

12.1.1 When to windrow

Windrowing should start when 50–70% of seeds have changed colour to red, brown or black (Figure 3). The crop is usually ready for windrowing 20–30 days after the end of flowering, and should be regularly checked for changes in seed colour. The end of flowering is considered to be when only ~10% of plants have any flowers left on them.

Windrowed crops should be ready to harvest 5–14 days after windrowing, depending on the weather. The moisture content of the grain should be $\leq 8\%$. ³

In warmer, drier areas, windrowing is better done when seed reaches 50–60% seed-colour change. Under higher temperatures, the windrowed plant dries too rapidly to allow seeds to mature fully in the pods and oil content can be lower.

² P Carmody (2009) Windrowing and harvesting. Ch. 14. In Canola best practice management guide for south-eastern Australia. (Eds D McCaffrey, T Potter, S Marcroft, F Pritchard) GRDC, http://www.grdc.com.au/uploads/documents/GRDC_Canola_Guide_All_1308091.pdf

³ L Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

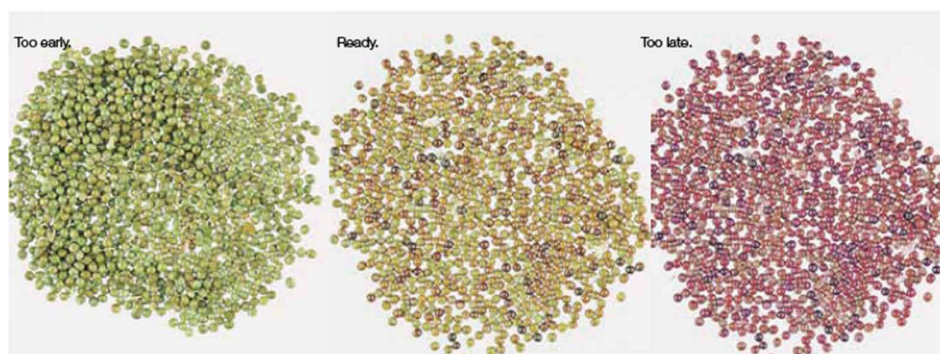


Figure 3: Changes in seed colour determine the optimum time for windrow timing. (Photo: DAFWA)

In summary, windrowing too early can result in lower yields and oil contents, and too late will lead to shattering losses.

The optimum time for windrowing is when the top third of the plant has mostly green seeds. These should be firm but pliable when rolled between the thumb and forefinger. The middle section of the plant will have 80% of seed green or green-red and be very firm but pliable; the other 20% may be red-brown to light brown. The bottom third of the plant will have dark brown to black seeds.

The time from the end of flowering to windrowing will vary with season, paddock and variety. Check each crop every year to determine the best windrowing time.

If using a contractor, ensure that they are booked well in advance. Noting the end of flowering will help the grower and the contractor to determine approximately when the crop will be ready to windrow. It is most important that a decision to windrow is made based on assessment in a representative area of the paddock.

The optimal windrowing stage for canola lasts ~4–6 days, depending on temperature and humidity. Each day that windrowing is delayed past the optimum time will make the crop more susceptible to shattering losses. These can be minimised by operating at night or when humidity is high after dew or rain. However, where shattering losses during windrowing are obvious, growers are advised to change strategy to direct harvesting or to desiccation followed by direct harvesting.

Windrowing too early, for example, by 4–5 days, can lead to yield losses of up to 10% and reduced oil content. A canola crop should never be windrowed before seed colour has changed, because it will result in significant yield loss. Rollers can be attached to the back of windrowers to help push the windrow down into the stubble and minimise wind damage. Note: withholding periods of pesticides relate to windrowing, not to harvest, if windrowing operations occur.⁴

12.2 Direct heading

Direct harvesting is cheaper than windrowing and can be done with an open front with an extended platform or with a belt-front attachment. Canola is ready to harvest when almost all pods are dry and rattle when shaken, pods are pale brown, and the seeds are dark brown to black and have <8% moisture content.⁵

Direct heading of canola can often be carried out sooner than generally accepted; although the crop stalks may still be green, crop delivery is based on grain moisture, not plant moisture.

⁴ P Carmody (2009) Windrowing and harvesting. Ch. 14. In Canola best practice management guide for south-eastern Australia. (Eds D McCaffrey, T Potter, S Marcroft, F Pritchard) GRDC, http://www.grdc.com.au/uploads/documents/GRDC_Canola_Guide_All_1308091.pdf

⁵ L Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

More information

[GRDC Ground Cover: Revisiting canola management can lift returns](#)

i More information

[GRDC: Direct heading canola. Fact-Sheet](#)

[GRDC Media Centre: Direct heading canola delivers at Devenish](#)

[GRDC Update Papers: The benefits of disc seeders direct heading canola and on-farm storage](#)

[GRDC Update Papers: Harvest options for canola—windrowing timing, direct heading, desiccation with Reglone and treatment with Pod Ceal. Effects on yield and oil percentages](#)

[GRDC Update Papers: Harvesting canola in 2013—to windrow or direct head](#)

[GRDC Update Papers: Canola harvest: is direct heading a serious option](#)

[GRDC Ground Cover: Early planning the key to canola direct harvesting](#)

To download the Grain Orana Alliance 'Canola harvest loss calculator', visit: <http://www.grainorana.com.au/documents>.

Most headers are capable of direct heading of canola. Many machines are built for European agriculture, where direct heading of crops is regularly practiced.

It is essential to set up the header front correctly, according to the manufacturer's instructions.

Common draper fronts can be used to direct-harvest canola, but can be problematic when there is uneven flow of the crop into the machine. When canola is cut and fed onto the mat, it tends to bounce and fluff up and feed through in lumps. To counter this, a top-cross auger can be fitted to sit across the back of the header front above the belt. When the canola fluffs up, it hits the auger, which then flicks it towards the centre to even out the feed into the header.

Conventional, 'tin front' headers that have an auger at the bottom of the table are also capable of direct heading of canola.

The crop takes virtually no threshing to get the grain out of the pods, so machines can be set wide open to handle a significant amount of crop residue.

Incorrect setting up of the reel can cause significant losses in direct-headed canola. The reel on the header comes into play only when the crop is not feeding easily into the machine, so it should be set high, well forward and only slightly faster than the machine's ground speed. The reel is not for raking the crop into the header front, because this will create losses from seed shatter.

Harvesters should have sharp cutter bars so that they cut the crop cleanly rather than 'gnawing' it off.

in focus

FAQ

12.3 Comparison of windrowing and direct heading

GRDC Grower Solutions Group, the Grains Orana Alliance (GOA) examined the timing and adoption of pre-harvest practices in the Central West of New South Wales (Table 1). Research findings include the following:

- Yield loss due to shattering with later windrowing has proved not as severe as previously thought.
- Windrowing timing can have a significant positive effect on yield and profitability of canola.
- Relatively short delays in windrowing of only 8 days can lead to yield increases of up to 0.5 t/ha.
- Timing of windrowing has a limited effect on oil potential in canola.
- Direct heading is a viable option for harvesting canola and in many cases could maximise profitability.
- An economic benefit of >\$200/ha can be gained from choosing the best method and timing of canola harvesting.⁶

⁶ M Street (2013) Harvesting canola in 2013—to windrow or direct head. GRDC Update Papers, 22 August 2013, <http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/08/Harvesting-canola-in-2013-to-windrow-or-direct-head>

Table 1: Canola harvest treatments, windrow timing and crop maturity ⁷

Treatment	Windrowing timing	Assumptions of crop maturity	Proportion of crop physiologically mature	At risk of not reaching potential
Early windrow	10% seed-colour change in middle third of the main stem	Assume bottom third mature, plus 10% of middle third, nil top third	36% seed potentially already mature	64%
Ideal windrow	50% seed-colour change in middle third of main stem	Assume bottom third mature plus 50% of middle third and 10% of top third	53% seed potentially already mature	47%
Late windrow	70% seed-colour change in middle third of the main stem	Assume bottom third mature plus 70% of the middle main stem and 50% of top third	72% seed potentially already mature	28%
Reglone [®]	70% of all pods have changed colour	70%	70%	30%
Direct head	All seeds mature	100%	100%	0%

From these trials, it could be concluded that timing of windrowing has limited effect on oil percentages in canola. Delaying windrowing or direct heading resulted in significant increases in yields of canola. These yield variations may be explained by the proportion of immature seed present at cutting and the risk that this seed will not fill its potential. For this seed to mature, it must draw on stored substrate, which may be influenced by cutting height, time of day, or even variability of the level of maturity within the crop. These aspects require further investigation.

The differences in yield, coupled with additional costs, contribute to significant increases in net returns for some treatments. Figure 4 depicts the relative benefits of the treatments, taking into account average yields, additional costs, and oil penalties or bonuses.

The limited nature of these trials does not allow a recommendation of ideal timing of windrowing. However, the trials do demonstrate the potential economic benefit of making the right decision. Paddocks, seasons and risk-averseness of growers will all differ. When formulating a time to windrow, remember that there are potential advantages to allowing immature seed in the paddock to mature before windrowing or desiccation. By ceasing the plant's growth during the filling of these seeds, yields could be reduced.

Therefore, a balance must be found between potential yield maximisation by delaying windrowing or desiccation, and potential increases in loss of yield through shattering. This should be considered in view of the grower's risk-averseness, or other advantages offered through windrowing. Potential risk in terms of pod shattering may be managed by use of products such as Pod Ceal[™].

Further investigations may be warranted into:

- time of day of windrowing and its effect on maturation of immature seed
- windrowing height—more stem may leave more substrate available to facilitate grainfill and hence reduce yield losses and variability

⁷ M Street (2010) Harvest options for canola—windrowing timing, direct heading, desiccation with Reglone[™] and treatment with Pod Ceal[™]. Effects on yield and oil percentages. GRDC Update Papers, 30 September 2010, <https://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2010/09/Harvest-options-for-canola-windrowing-timing-direct-heading-desiccation-with-RegloneTM-and-treatment-with-Pod-CealTM-effects-on-yield-and-oil-percentages>


More information

[GRDC Update Papers: Harvesting canola in 2013—to windrow or direct head](#)

[GRDC Update Papers: Harvest options for canola—windrowing timing, direct heading, desiccation with Reglone and treatment with Pod Ceal. Effects on yield and oil percentages](#)

- quantifying potential sources of losses—standing crop, windrowing losses, losses while in the windrow⁸

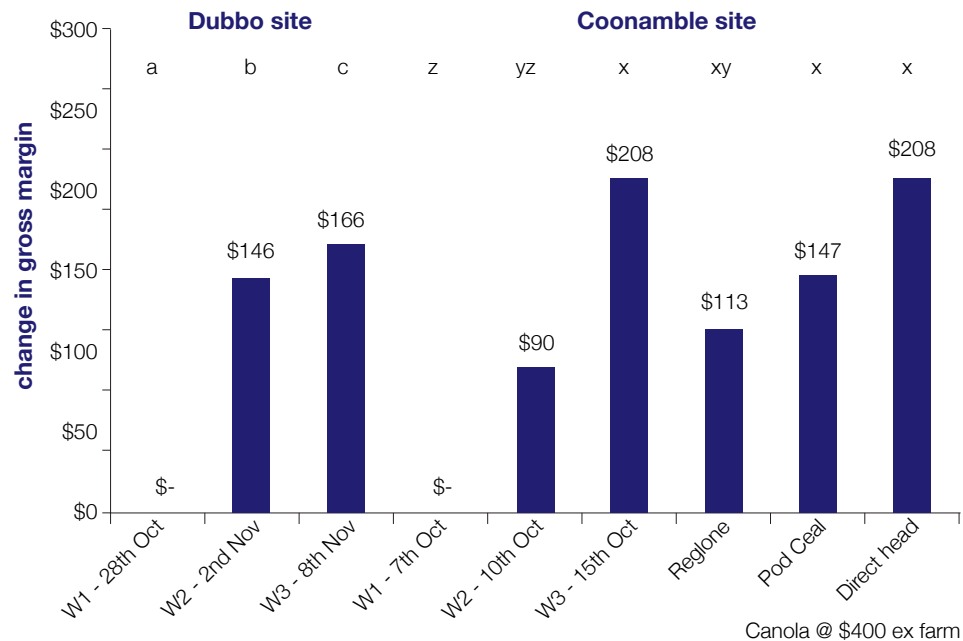


Figure 4: Relative cost–profit difference of various harvest options compared with windrow timing 1 (W1) at the Dubbo and Coonamble canola harvest trials. Treatment values headed by the same letter are not significantly different ($\alpha = 0.05$).⁹

12.3.1 Windrowing

This technique is likely to be the most widely used. The majority of canola is currently windrowed, however this is quickly changing. The objective in windrowing is to lay the cut material on top of the lower stem material to allow air movement under the windrow to assist in the drying process (Figure 5).

Advantages of cutting the crop and placing it in a windrow on the stubble:

- The pods and seeds will ripen faster than a standing crop (by as much as 8–10 days).
- Windrowed canola is much less susceptible to wind and hail damage than is a thin, standing crop, especially if it has been desiccated with diquat (Reglone®).
- Seeds will reach a uniform harvest moisture content of 8% earlier than with desiccation or direct heading.
- It can help in the management of uncontrolled or herbicide-resistant weeds.
- Even, well-made windrows will speed up the harvest operation

Disadvantages:

- There are additional costs.
- In very wet seasons, the crop can deteriorate in a windrow.
- The optimum timing only lasts 4–6 days depending on the temperature and humidity.

⁸ M Street (2010) Harvest options for canola—windrowing timing, direct heading, desiccation with Reglone™ and treatment with Pod Ceal™. Effects on yield and oil percentages. GRDC Update Papers, 30 September 2010, <https://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2010/09/Harvest-options-for-canola-windrowing-timing-direct-heading-desiccation-with-RegloneTM-and-treatment-with-Pod-CealTM-effects-on-yield-and-oil-percentages>

⁹ M Street (2012) Windrow timing and direct heading in canola—effects on yield and oil. GRDC Update Papers, 12 April 2012, <http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2012/04/Windrow-timing-and-direct-heading-in-canola-effects-on-yield-and-oil>

- The use of contractors may compromise timing.
- Timing of windrowing is determined by percentage change in seed colour, which is a compromise to allow for variability in the weather post-windrowing.
- Windrowing too early can lead to yield losses of up to 30% and reduced oil content, whereas too late makes the crop far more susceptible to shattering losses.
- Poorly made, uneven windrows resulting in 'lumps' or 'haystacks' will slow the harvesting process, and any blockages that occur can be time-consuming and costly to clear, especially where contractors charge on a machine-hour basis.
- If the cut plants are 'pushed' down onto the ground during the windrowing operation, the dry-down time may be increased, especially if moderate to heavy rain is received before harvesting starts. Lighter windrows are prone to movement in strong winds.



Figure 5: Windrowed crop prior to harvest. The cut material is laid on top of the lower stem material to allow air movement.

Timing

Collect pods from the main stem of a number of plants and from different positions in the canopy to determine the optimum timing for windrowing. The top third of the plant will have mostly green seeds that are firm but pliable; the middle third, ~80% of seeds green or green-red and very firm but pliable, and 20% red-brown to light brown; and the bottom third, dark brown to black seeds.¹⁰

Check withholding periods when using Reglone®. See: [Australian Pesticides and Veterinary Medicines Authority](#).

12.3.2 Direct heading

Recent research into direct cutting of canola has shown it to be a viable harvest alternative to windrowing in some circumstances. Favourable conditions for direct heading include having a crop canopy that is slightly lodged and knitted together, even maturity across the paddock, and few, green weeds (or when sprayed with a desiccant).

Advantages of direct heading:

- There are no windrowing or desiccation costs.

¹⁰ J Midwood (2013) Canola harvest: is direct heading a serious option? GRDC Update Papers, 6 February 2013, <http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/02/Canola-harvest-Is-direct-heading-a-serious-option>

- Crops dry out faster after wet weather than do windrowed crops.
- Crops are allowed to maximise yield potential and oil contents.
- It suits rocky areas, which can be a problem when windrowing, and reduces the risk of harvester blockage that can occur with windrows.

Disadvantage:

- In crops that are variable, the wait for ripening can expose the crop to wind damage, and thicker crops can take a considerable time to ripen evenly.

Timing

The general colour of the crop is a poor guide of when to harvest; use seed moisture content. The addition of pod sealants is a management aid when direct harvesting; it helps by reducing pod shattering and by allowing crops to achieve their full yield potential but is an added cost. When sprayed onto the crop pod sealant provides a unique, elastic, semi-permeable membrane over the filling pods. Timing is earlier than the optimum time for windrowing.¹¹

12.3.3 Desiccation followed by direct heading

The most common desiccant is diquat (Reglone®), which is registered for aerial and ground application such as using a self-propelled boom.

Advantages:

- The technique is useful on variable soil types because it allows more even crop ripening.
- It is ideal for weedy crops.
- Crops dry out faster after wet weather than a windrowed crop.

Disadvantages:

- There are shedding losses if a ground rig has to be used.
- Shattering losses can be very high in windy conditions.
- It is expensive, especially if the desiccant is applied by air.

Timing

The correct time for desiccation is when 70–80% of seeds have changed colour in the middle pods; this is when the crop has passed its optimal windrowing stage. The crop will be ready to harvest within 4–7 days after the desiccant is applied, depending on the size and density of the crop.

Other desiccants such as glyphosate are regularly used pre-harvest on canola in the southern grains region of Australia, Canada and Europe. This provides far slower senescence of the plants, considerably reducing pod shattering and providing superior end-of-season grass-weed control.¹² Weedmaster DST now registered for pre-harvest use on canola in Australia. Agronomists report it has much wider use than Reglone® due to lower cost and weed control benefits.

More information

[Options for crop-topping canola](#)

[Nufarm: Weedmaster now registered for use in canola](#)

¹¹ J Midwood (2013) Canola harvest: is direct heading a serious option. GRDC Update Papers, 6 February 2013, <http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/02/Canola-harvest-Is-direct-heading-a-serious-option>

¹² J Midwood (2013) Canola harvest: is direct heading a serious option. GRDC Update Papers, 6 February 2013, <http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/02/Canola-harvest-Is-direct-heading-a-serious-option>

12.4 Wet harvest issues and management

Canola generally withstands extended wet harvest periods better than other crops such as wheat. Severe windstorms can cause seed shatter more readily in canola; however, newer varieties have been selected to improve this characteristic.¹³

12.5 Receival standards

Canola receival standards as described in the Australian Oilseeds Federation standards manual are presented in Table 2.¹⁴

Table 2: Commodity standards—canola

Parameter	Specification
Oil (%)	42.0 base level; 1.5% premium or deduction for each 1% above or below 42
Free fatty acid (%)	1.0 base level; 2% deduction for each 1% over the base level, rejectable over 2.5
Moisture max. (%)	8.0; 2% deduction for each 1% over maximum
Test weight min. (kg/hL)	62.0; rejectable under this limit
Protein	Unlimited
Seed retention	Unlimited
Germination	Unlimited

More information

[AOF: Quality standards, technical information and typical analysis, 2014/15](#)

[GRDC: Integrated Weed Management Hub](#)

Links to GRDC Update papers and reports on weed management are available from the [Grain Orana Alliance](#).

¹³ L Serafin, J Holland, R Bambach, D McCaffery (2009) Canola: northern NSW planting guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf

¹⁴ AOF (2014) Quality standards, technical information and typical analysis. Section 1. In Standards manual 2014/15. Australian Oilseeds Federation, http://www.graintrade.org.au/sites/default/files/file/Commodity%20Standards/AOF_Standards_201415_Final.pdf