Canola growth and development – impact of ToS and seasonal conditions

Andrew Ware, SARDI, Pt Lincoln
Sarah Noack, Hart Field-Site Group
Stuart Sherriff, formerly of SARDI, Clare

Key findings

- Early sowing opportunities may provide a great opportunity to maximise canola yield, but selection of the correct variety is important.
- Understanding the drivers behind canola development will help to improve canola management and variety selection.
- Varietal maturity ratings don't always correlate with varietal phenology.

Why do the trial?

Despite the success of canola in Australian cropping systems, significant gaps remain in the underlying knowledge of canola physiology and agronomy. This situation was exacerbated by the release of new technologies including vigorous hybrid varieties with herbicide tolerance. Although growers recognise the high profit potential and the farming system benefits of canola, there remains a perceived risk of growing canola largely due to the high level of input required (eg. seed, nitrogen fertiliser, sulphur fertiliser, windrowing). There is a need to determine the level of investment appropriate for these inputs on a regional scale and the agronomic management practices (for example sowing date decisions) that reduce the overall risk and increase the profitability of canola.

This trial is part of a new five year GRDC project "Optimised canola profitability – understanding the relationship between physiology and tactical agronomy management". In year one the trial aimed to identify variety x sowing date combinations to achieve optimum flowering window.

How was it done?

Plot size	1.75 m x 10.0 m	**Fertiliser**	DAP (18:20) + 2% Zn @ 100 kg/ha @ seeding
Seeding date	ToS 1 – 14th April		UAN (42:0) @ 100 L/ha, 13th Jun
	ToS 2 – 1st May		UAN (42:0) @ 95 L/ha, 7th July
	ToS 3 – 16th May		ToS 1 and 2 only UAN (42:0) @ 70 L/ha, 15th August
	ToS 4 – 2nd June		

The trial was randomised complete block design consisting of four replicates, six varieties and (44Y88(CL), 45Y88(CL), Hyola575CL, Hyola559TT, ATR Gem and Hyola971CL) and two seeding rates (15 or 45 plants/m^2).

Canola establishment was assessed on all plots at the 2-4 leaf stage, by counting the number of plants along 3 X 1 m lengths of row sampled randomly from the central plot rows. Bud visible and flowering were assess 2-3 times weekly by identifying one random point in the center of each plot. From this point 10 plants were examined and the number of plants at bud visible or flowering were recorded until 50% of all 10 plants had reached the required growth stage. All plots were assessed for grain yield and oil content.

Results and discussion

Results of 50% flowering dates are presented in Table 1. They show that when planted early, Hyola 575CL reaches flowering up to two weeks before the other varieties trialled in 2014. Hyola 971CL, when planted in mid-April, failed to reach flowering at all sites prior to 1 October. The other varieties trialled generally flowered within a few days of each other, with any differences becoming smaller by the last time of sowing.

Table 1. 50% flowering dates recorded for each variety and each time of sowing at the Hart, 2014.

Variety	Time of sowing			
	14-Apr	1-May	16-May	2-Jun
Pioneer 44Y87CL	15-Jul	20-Aug	2-Sep	8-Sep
Pioneer 45Y88CL	16-Jul	17-Aug	4-Sep	9-Sep
ATR Gem	6-Jul	10-Aug	3-Sep	10-Sep
Hyola 559TT	6-Jul	8-Aug	1-Sep	8-Sep
Hyola 575CL	29-Jun	2-Aug	31-Aug	6-Sep
Hyola 971CL	2-Oct	1-Oct	4-Oct	7-Oct

Table 2 shows the different responses in grain yield to two different establishment rates (15 and 45 plants/m^2) recorded at Hart. Establishment rate only became significant at the third and fourth times of sowing (16th May and 2nd June), where having the higher seeding rate improved yields. This shows that while canola has the ability to compensate for poor establishment, in some situations having a poorly established crop will cost yield and needs to be factored into management.

Table 2. Grain yield of canola comparing two different establishment rates (15 and 45 plants/m^2) at Hart over four sowing dates in 2014.

Plants/m^2	Time of sowing			
	14-Apr	1-May	16-May	2-Jun
15	1.70	1.89	1.69	1.28
45	1.70	1.94	1.94	1.62
LSD(P=0.05)		0.17		

Pioneer 45Y88CL yielded the highest at Hart when planted in mid-April (Table 3). The early May time of sowing, showed yield of all varieties, with the exception of ATR Gem and Hyola 971CL, as being very similar. Results from the Hart trial didn't show any yield reduction when seeding was delayed to mid-May (third time of sowing) compared to early-May. The relative poor yield of Hyola 575CL in the mid-April sowing time is interesting. The early flowering of this variety was not advantageous in 2014, and may have led to increased damage from frost.

Table 3. Grain yield from canola sown at four sowing times at Hart site in 2014.

Variety	Time of sowing			
	14-Apr	1-May	16-May	2-Jun
Pioneer 44Y87CL	1.62	1.80	1.89	1.82
Pioneer 45Y88CL	1.98	1.96	1.89	1.42
ATR Gem	1.29	1.52	1.56	1.15
Hyola 559TT	1.76	1.84	1.74	1.32
Hyola 575CL	1.49	2.06	2.05	1.61
Hyola 971CL	0.37	0.40	0.49	0.25
LSD(P=0.05)		0.24		

Some of the differences in yields and plant development observed in the time of sowing trial can, in part, be explained by the drivers behind the development of each canola cultivar. There are three main controls of the development of canola; vernalisation response, photoperiod response and basic temperature response. Each of these will play a differing role in every variety.

Vernalisation affects canola from sowing to flowering. Varietal response to vernalisation will manifest as reduced time taken from sowing to flowering as well as a reduced number of leaves at flowering. It is expected that early sowing of canola into a relatively warm period (sowing in early April v mid May) will lead to a delay in the accumulation of vernalisation, which will exacerbate the differences in flowering dates of varieties with different vernalisation requirements.

Varietal response to photoperiod occurs between emergence and flowering. Canola is a long day plant, meaning that the duration from sowing to flowering is reduced in long day situations. In recent studies, varieties commonly responded to day length in the range of 11 to 16 hours. For canola plants emerging in mid-April after an early April sowing, there is potential that some of the photoperiod requirement could be met in autumn where day length is longer than mid-winter.

The basic temperature response is essentially the response of a variety to thermal time (degree-days) when both photoperiod and vernalisation requirements are met. Although there are differences in the basic temperature response amongst commercial varieties in terms of time taken to flowering, it is generally less important than the differences as a result of vernalisation or photoperiod response. The basic temperature response is however the main driver of development after flowering.

Using the data collected from South Australia and New South Wales in 2014 we can start to draw some conclusions about how some of the varieties trialled develop.

Hyola 971CL has a strong vernalisation requirement. When this variety was sown in mid-April in the low to medium rainfall area of South Australia flowering didn't commence until the first week in October. Dry conditions through spring at all locations led to this variety being the lowest yielding in all trials.

Hyola 575CL appears to have a relatively flat thermal time requirement, regardless of when it is sown. This resulted in Hyola 575CL being the first variety to commence flowering when sown early. Results from the first time of sowing in all trials show that the yield of Hyola 575CL was lower compared to Pioneer 45Y88CL, meaning that it was a disadvantage to plant this variety early in 2014. The variety description of Hyola 575CL indicated it should have a mid-season maturity, similar to 45Y88CL.

Pioneer 44Y87CL showed a reduction in thermal time requirement as sowing was delayed. Further research is needed to understand why this occurred but may have been due to a greater vernalisation requirement of 44Y87CL compared to Hyola 575CL, with early sowing taking longer to accumulate vernalisation than the later sowing dates. This may have helped 44Y87CL avoid some damage from early frost events.

Information generated by trials such as this into the future will add value to other trial results such as NVT and help explain difference in varietal adaptation, and performance as a starting point to growing more profitable canola.

Summary / implications

The way each canola variety develops can have a large influence the resulting yield, when planted at different times, and in different environments. The challenge for this project, going forward, is to be able to develop and deliver information on new varieties in a way that is timely and relevant to growers and advisors. Growers and advisors will be able to use this information to help select a suite of varieties that are suited to sowing opportunities that occur in their district and also to capitalise on early or delayed sowing opportunities as the seasons dictate.