Early sowing of canola. Field trials and crop simulation

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Key messages

- It can be difficult to obtain reliable canola yields for very early sowings, due to bird damage and/or difficulty establishing canola in hot conditions
- APSIM-Canola model can satisfactorily simulate flowering dates across locations and sowing dates
- More field trials are needed to further calibrate and validate the APSIM-Canola model for WA conditions and for newer varieties in order to confidently simulate yields
- We do not have yet the answer to how early is too early but we will be working on that with more trials in 2019

Background

In the last decade there has been considerable interest in sowing canola early to maximise yield and minimise the risk of missing a sowing opportunity (Harries and Seymour 2016). Dry sowing canola in mid-April has become standard practice in the northern cropping regions and growers are even prepared to sow around the first week of April if there is rain at that time (Fletcher *et al* 2016). However, there is a lack of experimental data on very early sowings before mid-April. Harries and Seymour (2017) found significant yield increases when sowing mid-April compared to end-April in 2015 at Buntine and a small yield increase when sowing end-March compared to mid-April in 2016 at Wongan Hills. In 2018, time of sowing trials were conducted in 3 locations with sowing dates starting from mid-March to obtain better information on canola yields for very early sowings. Unfortunately, due to bird damage at Wongan Hills and Dale or difficulty in establishing a crop in very hot conditions at Mullewa, no reliable yield data was available from the early sowing times for the 2018 trials.

Despite these problems, the trials have been useful in tracking plant development and comparing this to the APSIM model. Past simulation studies have identified the optimal sowing window to maximise yield and minimise frost, heat and water stress for different locations in Western Australia (Farre *et al* 2018). While the APSIM-Canola model had been validated for WA for the traditional sowing window and for older varieties, further model validation is needed to extend the use of the model to very early sowings and to new varieties.

The use of modelling highlights the importance of accurately characterising the phenology of different canola cultivars. The cultivars currently used in Western Australia are the spring type cultivars, which display significant vernal response and a lesser photoperiod response (Wish *et al* 2018).

Aims

To obtain phenology and yield data of canola cultivars in three locations to 1) calibrate and validated the APSIM-Canola model for phenology and yield for very early sowings, and 2) to provide better advice to agronomists and growers about safe sowing windows and best varieties for different locations

Method

Trials

Three trials were conducted in 2018 with a range of sowing dates, including very early sowings (see Harries three papers in Research Updates 2019 for more details on the trials). Trials were conducted at Dale, Wongan Hills and Mullewa. Treatments included 11 varieties and four or five times of sowing (TOS) (15 March, 5 April, 26 April, 17 May and 20 June). The varieties were all Triazine Tolerant and included both open pollinated and hybrid plant types of a wide range of season lengths: CB Telfer (V.Early), ATR Stingray (Early), ATR Bonito (Early/Mid), ATR Wahoo (Late), Hyola 350TT (V.early), Bayer InVigor 4510 (Early), Pioneer 44TO2 (Early), Hyola 559TT (Mid), SF Ignite (Mid/late), DG 670TT (Late), Hyola 725RT (Late). Telfer and ATR varieties are open pollinated and the rest are hybrids. Irrigation was applied prior to sowing to assist crop establishment.

Simulations

The APSIM-canola model was run with 2018 climate data for the three locations in order to replicate the three time of sowing trials. Generic phenology parameters for early, mid and late maturity cultivars were used in the simulations, as the model does not have phenology parameters for



the wide range of current cultivars. Observed data were compared to simulations outputs.

Results

Phenology

APSIM-Canola model simulated the flowering dates for 3 generic cultivars (early, mid and late season length types), 4 or 5 times of sowing and 3 locations with a Root Mean Square Error (RMSE) of 6.5 days (Figure 1). The biggest discrepancies between observed and simulated flowering dates were for very early and very late sowings at Dale.

The generic early cultivar in APSIM had the best fit in flowering time to cultivar ATR Stingray in Dale and Mullewa and to CB Telfer in Wongan Hills. The mid maturity cultivar in APSIM had flowering dates that matched best Hyola 559TT, SF Ignite and ATR Bonito. The APSIM late maturity cultivar phenology had the best match with Hyola725RT.

In the coolest location (Dale), for the very early sowing (mid-March), observed flowering dates ranged between 59 and 109 days after sowing (DAS), while simulated flowering dates were between 71 and 107 DAS. For that very early sowing the biggest discrepancy between observed and simulations was for early cultivars, with trial cultivars flowering faster than the simulated early cultivars (59 DAS compared to 71 DAS).

In Dale, for late sowings (mid-May), it was observed that delaying sowing caused flowering dates of the varieties to converge more (observed range 84 to 96 DAS) than was simulated by APSIM (range 80 to 101 DAS). This discrepancy in flowering dates for later sowing dates may be in part due to the way that the model uses the daily average temperature to calculate vernalisation. Averaging smaller time steps would be more accurate as the crop would accumulate more vernal hours than using the daily average (Whish *et al* 2018). If a 3 hourly temperature was used to calculate vernal time in APSIM, there would be more vernal time accumulated in locations with warm days and cool mornings, and this may improve the simulation of flowering date.

At Dale, for the very early sowing, the varieties reached flowering faster than the model simulated (about 12 days). For the late sowings, all the cultivars flowered within 12 days, whereas the model simulated flowering of the 3 cultivars within 21 days. The simulated flowering dates converged less than the observed for the late sowing.

Flowering dates were satisfactorily simulated for the two April sowings in Dale and for all treatments in Wongan Hills and Mullewa (Figure 1).



Figure 1. Observed versus APSIM simulated flowering dates for 3 canola cultivars (Early, Mid and Late maturity type), 3 locations (Dale, Wongan Hills and Mullewa) and 4 or 5 sowing dates (15 March, 5 April, 26 April, 17 May and 20 June). Solid line is 1:1 line.

Crop establishment and yield

At Mullewa, despite irrigation applied, crop establishment was unsuccessful for the first three times of sowing due to very hot conditions. Only a May and a June sowing were established in this location. Difficulty establishing canola in hot conditions could limit how far the sowing window can be brought forward.

No reliable yield data was obtained from the 2018 field trials due to bird damage at Wongan Hills and Dale or difficulty in establishing the canola crop in very hot conditions at Mullewa.

In 2019, early sowings treatments will be covered with bird netting at all locations.

Conclusions

The difficulty establishing canola in hot conditions could limit how early the sowing window can be brought forward.

In general, APSIM-Canola can satisfactorily simulate flowering dates across locations and sowing dates. The best match between observed and simulated flowering dates occurs in locations with little or no vernalisation and for sowing dates that are not outside the common sowing windows.

More time of sowing trials are necessary to further calibrate and validate the APSIM-Canola model for WA conditions and for new newer varieties to confidently simulate yields.

We don't have yet the answer to how early is too early but we will be working on that with more trials in 2019

Key words

Canola, time of sowing, APSIM, crop modelling, phenology, yield

References

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