

Selection of canola lines for low rainfall environments in south eastern Australia



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Take home messages

- **canolas and mustards performed well at sites with low growing season rainfall and high levels of stored water**
- **Roundup Ready lines show great promise over current commercial lines in better seasons**
- **results from the one site tested over the last three years under low rainfall conditions suggested that higher canola and mustard yields of acceptable quality are possible.**

Background

The development of a profitable break crop in a low rainfall cereal growing areas is essential for sustainable and profitable systems. Canola has many valuable characteristics as a break crop for cereals (eg non-host for nearly all cereal diseases, herbicide tolerance, high value grain and well-anchored stubble).

GRDC has supported a small program for early lines to be selected in the districts located around Minnipa (SA), Walpeup (Vic) and Condobolin (NSW). The third year of trials has now been completed.

In 2011, well over one hundred lines were trialled at each of the three locations. These included TT, IT, Roundup Ready (except in SA because of the GM Moratorium) and conventional lines, most of which were grown with their respective registered herbicides applied.

A summary of the last seasons of results appeared in the *BCG Season Research Results Summary Book* (2010 pg 84-85).

Aim

To identify early generation lines of canola and mustard which are well suited to low rainfall environments.

Method

Each trial tested up to fifty lines of early generation material from each of four companies (Nuseed, Pioneer, Pacific Seeds and Canola Breeders Western Australia Pty Ltd), giving a maximum of 200 lines in total to be tested each year. Several commercial varieties were included in each trial to evaluate performance of breeding lines against current commercial varieties and allow “calibration” with the NVT program. All experiments including GM material were conducted by practitioners trained in the Monsanto protocols for management of GM crops.

Site characterisation for each trial included soil fertility to depth, soil description, paddock history (including herbicide management) for previous five years, disease bioassay by RDTS, and meteorological data from a nearby station as well as pre seeding and post harvest soil moistures (except where rain fell between maturity and harvest).

Replicates were restricted to two because of limited seed supplies, but all plots were approximately 12 metres long by 6-8 rows wide. All experiments were seeded as soon as practical after 20 April each year, following the first suitable rain, at a seeding rate of 2.5kg/ha.

Lines were blocked according to their herbicide tolerance (e.g. TT, RR, conventional) and herbicides managed according to the protocol for that particular type (although in some locations, absence of weeds

meant these herbicides were not applied). Trials were managed according to best practice for each district and plots direct headed after desiccation if necessary.

The lines were observed for early vigour, height, standability, the actual days to 50% flowering (i.e. 50% of plants have at least one open flower), days to end of flowering and days to physiological maturity. Any other characteristics which may have been of commercial significance (e.g. sensitivity to herbicides) were also noted.

All grain was analysed by standard commercial NIR tests for oil content, protein and glucosinolates.

Results

Only grain yield data was available and fully analysed by the time of publication of this article.

Condobolin

Grain yield of Roundup Ready lines (RR) averaged 1.8 t/ha in a year with above average rainfall but only because of the wet summer preceding the growing season. They outperformed conventional (av of 1.7 t/ha) and triazine tolerant (TT) material (av of 1.6 t/ha). Some RR early generation lines substantially outperformed current commercial RR varieties (by up to 0.5 t/ha), giving yields of up to 2.4 t/ha.

The yields of all conventional lines were similar and around that average of 1.7 t/ha.

No early generation TT lines out-yielded current TT commercial varieties.

Walpeup

The mean yields of conventional, RR, TT and IT lines were respectively 1.55, 1.71, 1.38 and 1.35t/ha with the average of the RR material out-yielding the mean of the conventional and TT ($P < 0.05$). The average of the IT material was below that of the average of the conventional material. The season at Walpeup was similar in pattern to Condobolin in that the growing season was less than average but the annual total was higher due to substantial rains at the start of the year. However, Walpeup also had a wet finish to the season.

Grain yields of conventional lines varied from 2.21 t/ha to 1.28 t/ha, a higher degree of variation than found at Condobolin.

Some RR early generation lines substantially outperformed current commercial RR varieties (by up to 0.5 t/ha), giving yields of up to 2.1 t/ha.

As at Condobolin, no early generation TT lines out-yielded current TT commercial varieties.

Only five IT lines tested and there was little variation in grain yield between them.

Minnipa

The mean yields of conventional, TT and IT lines were similar at 1.72, 1.68 and 1.78 t/ha, respectively. The season at Minnipa was the third in a row with above average annual and growing season rainfall. Due to the GM moratorium in place in SA, RR material was not tested at this site.

Several conventional lines out-performed current commercial varieties (Tarcoola and Garnet), but most by less than 20%.

Similar to the other two sites, no early generation TT lines out-yielded current TT commercial varieties.

Seven IT lines were tested at this site, but only some out-yielded the control (Oasis CL, a mustard Clearfield variety).

Mustards struggled to match the yield performance of their canola cousins at all sites.

Grain quality analyses have yet to be received.

Interpretation

- the 2011 season provided yet again above average moisture supply at the three sites used in this project. This means that the early generation material was not tested under tough moisture conditions, which was the aim of this project. However, the results from the 2011 season show that there is much promise for the better years with improved RR lines in the system, that gains are still being made in conventional material, but that TT development is struggling at the moment
- some lines excelled under the tough conditions of one site in 2009 and also maintained their competitiveness in the better years
- canolas and mustards performed well at the two sites in 2011 which had low growing season rainfall but high levels of stored water at seeding. This suggests that these brassicas could efficiently extract stored soil water, an important quality to reduce their risk in low rainfall areas.
- while mustards do have some innate characteristics which make them more suited to low rainfall conditions than canola, some canola lines were competitive with mustard under tough conditions and most canola lines were superior under better conditions

Commercial Practice: what this means for the farmer

- the purpose of this project was to investigate whether early generation material existed with the current Brassica breeding companies which was better adapted to low rainfall environments than current commercial varieties. Based on one site in one year, this appears to be the case. This material does not seem to have the same advantage in the better seasons, but at least some lines do not lose against current commercial varieties and there seems to be a lot of substantially better material in the RR family across a range of production levels
- since the focus of this project was assessing early generation material, there will not be any immediate releases of new varieties as a direct result, but it has highlighted the potential to improve Brassica performance in low rainfall environments without losing potential in the better years
- the pattern of results from this project also suggests that while mustard has some inherent qualities which make it better suited to low rainfall environments than canola, it is struggling to keep ahead of the improvements being made in canola.

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