14. *Brassica carinata,* a new crop for production of jet biofuel

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KEY MESSAGES

- *Brassica carinata* is a crop similar to canola that may be used to produce biojet fuel.
- Carinata is grown in Canada over summer but is very late flowering and taller when grown under our winter conditions.
- Earlier flowering carinata lines were selected in 2017 and tested in 20 yield trials in 2018.
- Several carinata lines have produced higher grain yields than canola at Bordertown.
- Future studies will develop an agronomic package to optimise carinata production.

Background

The aim of this project is to develop varieties of *Brassica carinata* that are more specifically adapted to Australian conditions to enable commercial quantities of biojet and biodiesel fuels to be produced. This project focuses on genetic selection, adoption and scale-up within Australia.

The current global jet fuel consumption is 300 billion litres annually and expected to grow to 500 billion litres annually by 2030. The aviation industry has committed to a carbon neutral future targeting a 50% reduction in CO2 by 2050. While biofuels are currently mandated in 62 countries around the world, and demand for renewable diesel and jet fuels is the most rapidly growing segment of the renewable fuels industry, the 'biojet' component has approximately 100 million litres of demand that is currently not being met.

Biojet fuels produced from carinata (*Brassica carinata*) oil have already been used successfully in both commercial and engineering flights, including the world's first 100% biojet fueled flight. Today many flights are powered by biojet fuels. With 40% erucic acid content, carinata offers manufacturers more efficient conversion into biojet fuel with reduced amounts of secondary products compared to other industrial oilseeds and bio-waste streams. Commercial carinata operations are established on three other continents and we are working with the Canadian company Agrisoma and Nuseed to develop Brassica carinata for Australia.

Activities

The trial was sown on 25 May 2018 near Bordertown and included 48 carinata lines which were compared to 8 canola (conventional, Clearfield and triazine tolerant types) checks. This was one of 20 trials conducted throughout Australia in 2018.

Carinata lines evaluated included selections made at Bordertown and Gatton (Qld) in 2017 where we selected for earliness to flower, height, lodging resistance and visual estimates of yield potential, as well as double haploids and hybrids developed in Canada and tested at other environments overseas.

Measurements included emergence, early vigour, date of flowering, plant height, lodging, shattering, grain yield.

Results & Discussion

Flowering dates ranged from late August until mid September for the canola varieties while the Australian carinata selections taken in 2017 flowered between 12 September and late September. Carinata double haploids and hybrids from Canada flowered from late September to 6 October. Therefore the canola varieties flowered over about 6 weeks but the Canadian carinata lines only flowered for 3 weeks.

Table 1: Range of grain yield (kg/ha) and height (cm) of canola varieties and carinata breeding lines tested at Bordertown in 2018.

Canola or carinata	Type	Lines Tested	Range of grain yield (kg/ha)	Mean height and range (cm)
Canola Varieties	Clearfield/conventional	3	1815 - 2201	140 (130-150)
	Triazine tolerant	5	1246 - 1536	119 (95-135)
Australian carinata	Selected in 2017	26	1110 - 2686	148 (135-170)
Canadian carinata	Double haploids	15	1595 - 2521	155 (135-180)
	Hybrids	7	2150 - 2562	170 (155-180)

While some of the carinata lines that had been selected in Australia in 2017 were similar in height to the Clearfield or conventional canola varieties, the Canadian double haploids and particularly the hybrids were much taller (Table 1). This could be expected to increase the difficulties of harvest even if the crop was being direct headed.

Grain yield of several of the carinata lines was higher than grain yield of the canola varieties that were used as checks (Table 1). This occurred even though many carinata lines flowered later than the canola varieties and flowered for a much shorter period of time.

Observations over a number of trials conducted throughout Australia in 2018 suggested that while carinata exhibited blackleg lesions these were much less than the canola varieties that were used as checks. Also, at York in WA, white leaf spot was extremely prevalent in canola but not in carinata. Disease incidence and severity will be further investigated in 2019.

In 2019 we intend to further evaluate possible carinata lines so we can commercially release one or more varieties as soon as possible. In addition we aim to evaluate a range of agronomic factors so we can further refine an agronomic package for carinata. These trials will include earlier sowing dates than we have been able to use so far (early April through to early May), harvest methodologies to determine if carinata can be successfully direct headed and the evaluation of potential herbicides to enable better control of broad leaf weeds in carinata as it currently needs to be treated like conventional canola.

Conclusions

Brassica carinata can be used to produce biodiesel and biojet fuel but we need to select lines better adapted for Australian conditions. This was the first year we have been able to evaluate *Brassica carinata* in yield trials after potentially better adapted lines were selected in 2017. At Bordertown the best carinata lines produced more grain than the 8 canola check varieties we used, even though many of the carinata lines were significantly later flowering than the canola. Future studies will aim to release one or more commercial carinata variety and we also aim to further develop an optimal agronomic package for carinata.

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