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Tactical Break Crop Agronomy in Western Australia

Can agronomy overcome yield penalty of retained (F2) hybrid TT canola in the low rainfall zone? Grass Patch, 2015 (15ES19)

Authors

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Location of trial

Sanderson family farm, Grass Patch

Summary (Key messages)

- Across the trial series at Grass Patch, Ballidu, Merredin and Holt Rock the highest grain yields, oil and gross margins were from the open pollinated variety, so growers should continue to use open pollinated TT varieties in the low rainfall regions, rather than hybrid varieties.
- In the hybrid treatments, there were generally increased yields and oil from the purchased (F1) seed, compared with the retained (F2) seed. The gross margin was only significantly better at the Grass Patch site, for the 2014 F1 compared with the retained seed. Grading to increase seed size and sowing at a target density of 40 plants/m² improved the yield and gross margins of F2 retained hybrid seed, but at Grass Patch in 2015 using F1 hybrid seed or OP seed provided better results..

Background

Nearly 80% of area sown to canola in WA is still open pollinated (OP) triazine tolerant (TT) varieties. However, breeding companies are favouring the development of hybrids in order to pay for breeding services. Hybrids provide growers with more vigorous seedlings, comparatively better plant establishment and generally higher yields. However, growers have to purchase new seed of hybrid varieties every year, which is 25 times more expensive than the seed of open pollinated canola.

This trial is investigating if farmers in the low rainfall region are better off using purchased (F1) or retained (F2) TT hybrid canola seed.

This trial is part of a series, where the same trial is repeated at Ballidu, Merredin and Holt Rock.

Aim

To investigate whether agronomy can overcome the yield penalty of retained (F2) TT hybrid canola compared with purchased (F1) hybrid seed by using;

- seed mixes
- increased density or
- grading to increase seed size

Trial Details

- Sanderson family farm, Grass Patch
- Agzone 5, Growing Season rainfall (GSR) = 215 mm
- Sowing date April 24
- Fertiliser (kg/ha) 100 kg/ha of Agras No 1 at seeding, 117 kg/ha of Muriate of Potash) topdressed over whole site 4 weeks after seeding, 33 L/ha of UAN (32%N) June 10.

Treatment detail

9 treatments:

- Purchased (F1) and retained (F2) Hyola 450 TT, OP comparison, ATR Bonito

Agronomy treatments;

- Seed size; retained seed (F2) graded over and below 1.8 mm sieve
- Mixes; 25, 50 and 75% purchased (F1), with remainder being retained (F2) seed
- Density-2 densities of 20 or 40 plants/m²

Two different commercial seed lots of Hyola 450 TT F1 seed were used, one purchased in 2014 and one purchased in 2015. Retained Hyola 450 TT seed (F2) was also graded with seed kept above (Large Hyola 450TT F2) and below (Small Hyola 450TT) 1.8mm screen. Additional treatments included different F1:F2 seed mixes were prepared, using the 2015 F1 seed and ungraded F2 Hyola 450TT seed. 2015 seed of ATR Bonito was used as an open-pollinated control. All seed treatments were sown at two target densities of 20 and 40 plants/m². Seeding rates were calculated according to the target density, expected field establishment, seed size and germination per cent (Table 1). Plots were sown using DAFWA cone seeder at a depth of 2 cm, followed by press wheels. Trial plots were 20 m x 1.54 m. A randomised complete block design with three replicates was used. Establishment counts were taken 4-6 weeks after sowing by counting 10m of plants, over 5 locations within each plot. Plots were machine harvested and oil and protein measured on samples from each plot.

Table 1a. Treatments and seed information

Treatment	Seed size (mg)	Seeds/kg	Germination (%)	Expected field establishment
Hyola 450 TT F1 2014	5.53	180,766	88	85
Hyola 450 TT F1 2015	4.26	235,000	97	85
Hyola 450 TT F2	3.30	302,755	99	85
Large Hyola 450 TT F2	3.91	255,754	100	85
Small Hyola 450 TT F2	3.12	320,513	100	85
Mix 25% F1 [#] : 75% F2	mix	mix	mix	85
Mix 50% F1 [#] : 50% F2	mix	mix	mix	85
Mix 75% F1 [#] : 25% F2	mix	mix	mix	85
ATR Bonito (OP)	4.35	230,000	98	75

Table 1b Seeding rates and seed costs

Seed	Seeding rate (kg/ha) @ 20 plants/m ²	Seeding rate (kg/ha) @ 40 plants/m ²	Seed cost (\$/ha) @ 20 plants/m ²	Seed cost (\$/ha) @ 40 plants/m ²
Hyola 450 TT F1 2014	1.5	3.0	35.50	71.00
Hyola 450 TT F1 2015	1.0	2.1	24.77	49.55
Hyola 450 TT F2	0.8	1.6	1.57	3.14
Large Hyola 450 TT F2	0.9	1.8	1.84	3.68
Small Hyola 450 TT F2	0.7	1.5	1.47	2.94
Mix 25% F1[#] : 75% F2	0.8	1.7	7.37	14.74
Mix 50% F1[#] : 50% F2	0.9	1.8	13.17	26.34
Mix 75% F1[#] : 25% F2	1.0	1.9	18.97	37.94
ATR Bonito (OP)	1.2	2.4	2.37	4.73

[#] 2015 F1 used in seed mixes.

Note that the difference in seeding rates between the two purchased seed treatments is due to differences in seed size and germination per cent.

Assumptions used in Gross Margins

- Oil bonus +/- 1.5% per unit of oil (%) either side of 42%, with no oil ceiling.
- Seed costs at \$2/kg for ATR Bonito and retained hybrid (F2) seed Hyola 450 TT, range \$1.50 to \$4.70. Seed costs at \$24/kg for purchased (F1) hybrid seed Hyola 450 TT, range \$24.77 to \$71.00 at high density).
- \$5 end point royalty for OP variety, ATR Bonito.
- \$260 used for other costs except seed, for both canola varieties. This included \$58 for herbicides, \$78 for fertiliser, also insecticides, fungicide, insurance, labour, repairs, depreciation, fuel and interest.
- Long term canola price used of \$555, which was \$513 at farm gate, after cartage and CBH costs.

Results

The average field establishment for the trial was 64% This was a high of 78% for the OP variety. For the hybrid Hyola 450 TT, the F1 treatments had the highest establishment at 63 and 64%, while the F2 was lower at 59%. Large F2 seed Grading increased field establishment to 64% whilst using small F2 seed reduced field establishment to 49%. There was no difference in field establishment between the target densities of 20 and 40 plants/m².

Early vigour was assessed by using GreenSeeker to measure the NDVI (Normalized Difference Vegetation Index) score. By July 7th (day 42), the NDVI of both F1 treatments was 20% higher than the retained seed (F2) treatment (Fig 1).

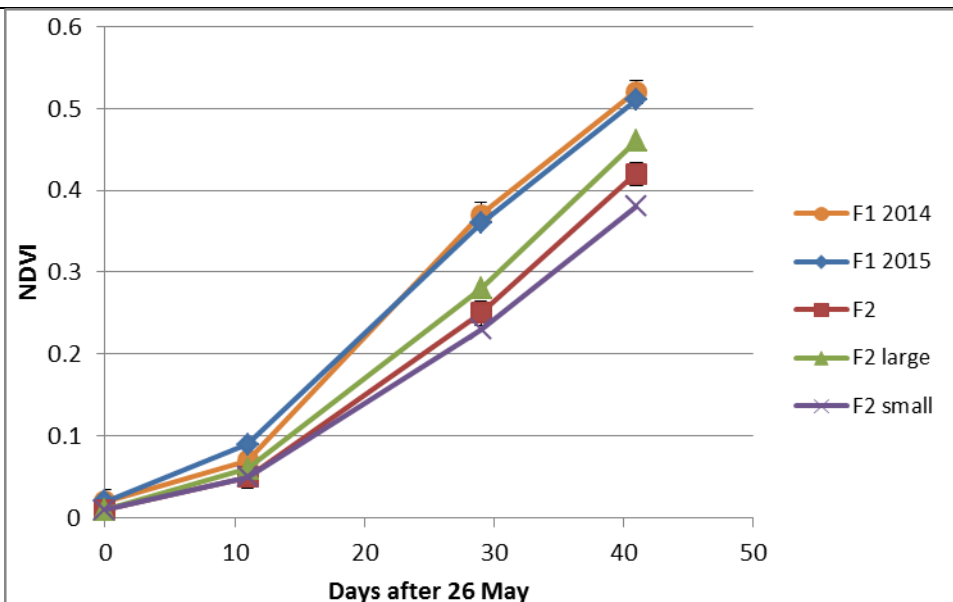


Fig 1 Early vigour, as measured by NDVI

(alt text; By July 7th (day 42), the NDVI of both F1 treatments was 20% higher than the retained seed (F2) treatment)

Time of flowering was assessed at the Grass Patch trial. Both F1 treatments flowered at the same time, while the F2 treatments flowered on average 2.5 days later.

Table 2: Gross margin, grain yield and oil results.

	GM (\$/ha)		GY (kg/ha)		Oil (%)	
Target density (plants/m ²)	20	40	20	40	20	40
OP	566	647	1447	1589	50.5	50.8
F1 2014	498	423	1413	1338	49.1	49.3
F1 2015	456	507	1325	1458	48.7	49.0
F2 small	340	359	1096	1129	47.4	47.7
F2	327	390	1074	1184	47.3	47.7
F2 large	383	409	1164	1211	48.1	48.3
25% F1 [#]	391	428	1189	1262	48.1	48.5
50% F1	417	461	1237	1335	48.6	48.9
75% F1	449	443	1299	1323	48.9	48.9
LSD	58	58	102.7	102.7	0.5	0.5

[#] 2015 F1 used in seed mixes.

For simplicity in reporting, only the results of the 2015 purchased seed (F1) are discussed, not the 2014 F1.

Overall, there was a 19% (170 kg/ha) yield loss at Grass Patch, from using 2015 retained (F2) seed, rather than purchased (F1) hybrid TT canola, a drop in oil of 1.3% and \$122 (26%) drop in gross margin (average of 20 and 40 plants/m² treatments).

Mixes of seed produced a relatively linear response; the more purchased (F1) seed in the mix, the better was the yield, oil and gross margin.

Increasing the density of the retained (F2) seed increased the yield by more than 100 kg/ha and increased the gross margin, but did not match the purchased (F1) yield and gross margin.

Similarly, grading the F2 seed increased the yield, oil and gross margin but did not match the purchased (F1) canola result.

Growers generally use a higher plant density for any retained seed, compared with purchased seed. Using both the higher plant density and grading the retained (F2) seed, reduced the yield penalty to 114 kg/ha (10%), from the initial 260 kg/ha (19%).

The best yields, oil and gross margins from the trial were the open pollinated variety ATR Bonito, at

1.59t/ha yield, 50.8% oil and a gross margin of \$647/ha.

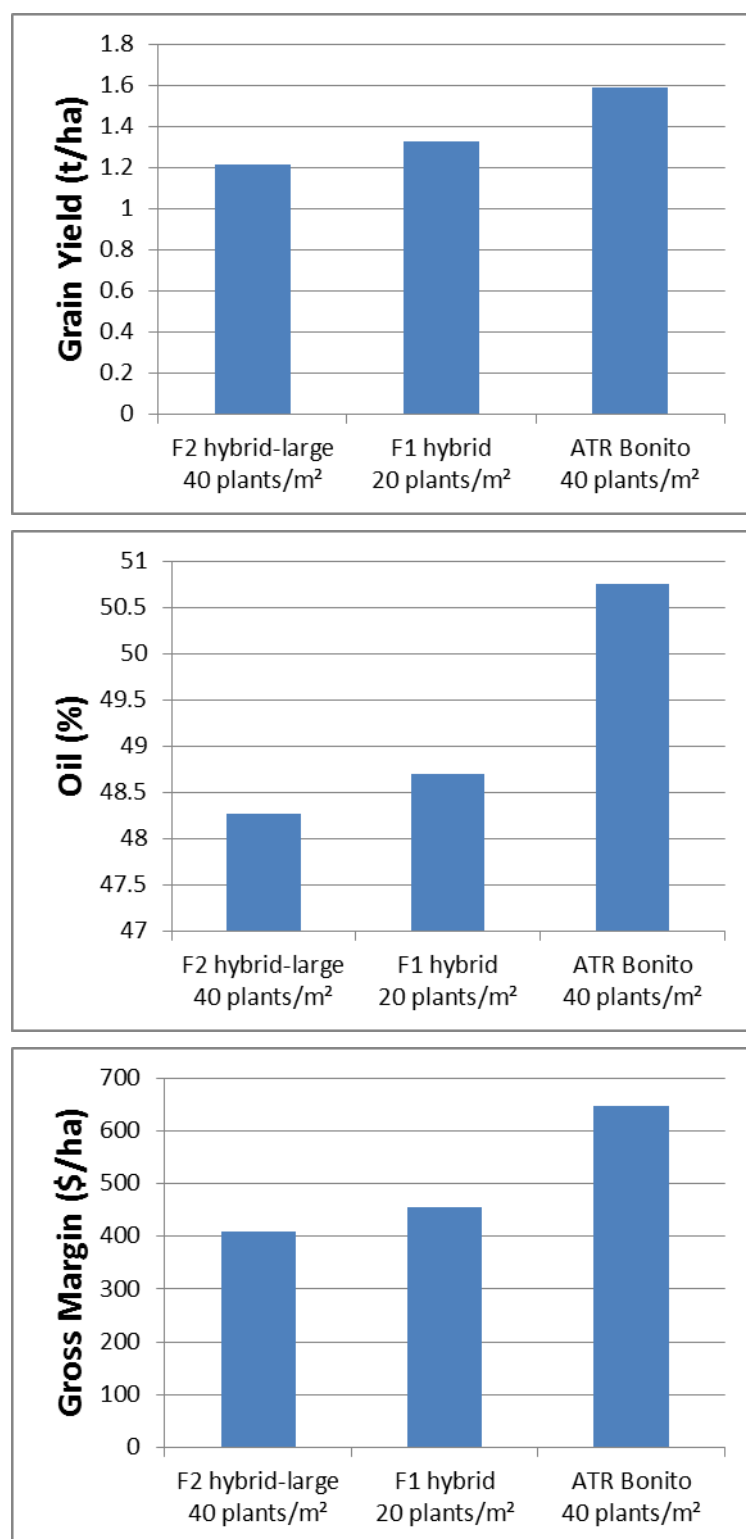


Figure 2 Grain yield, oil and gross margin comparison of retained (F2) hybrid graded and sown at high density, with 2015 purchased (F1) hybrid at lower density and open pollinated variety ATR Bonito.

Trial series results; Grass Patch, Holt Rock, Ballidu and Merredin

These results are similar to the other trials at Ballidu, and Merredin, where the OP variety gave the best yields, oil and gross margin. The trial at Grass Patch was the highest yielding of the series, at 1.6t/ha, and gave the best gross margins and the biggest advantage of OP over hybrid seed (F1 and F2). The same general pattern was repeated at Ballidu (1.2t/ha), Merredin (1.1t/ha) and Holt Rock (600kg/ha).

There was a trend (i.e. non significant) of higher yields and gross margin of purchased hybrid seed (F1) over retained seed (F2) at Grass Patch, Merredin and Holt Rock but not at Ballidu.

Table 3. Yield, oil and gross margin losses averaged over Grass Patch, Ballidu and Merredin trial sites in 2015.

	Purchased hybrid (F1) vs retained hybrid (F2)	OP vs purchased hybrid (F1)	OP vs retained hybrid (F2)
Grain yield (kg/ha)	80	215	300
Oil (%)	1%	1.5%	2.5%
Gross Margin (\$/ha)	\$17	\$150	\$167

Conclusion

The highest grain yield, oil and gross margins were produced by the open pollinated variety ATR Bonito at the higher target density (40 plants/m²). Growers should continue to use elite open pollinated TT varieties in the low rainfall regions, rather than hybrid varieties.

If growers choose hybrid varieties

Agronomy reduced the yield penalty from growing retained hybrid seed (F2), compared with purchased hybrid seed (F1). Where growers choose to retain hybrid varieties, grading to increase seed size and targeting a high plant density can improve yield and oil, but the size of the improvement is relatively small and apart from reducing upfront costs there appears to be little overall economic benefit compared to purchasing F1 seed each year.

Acknowledgements

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