Open pollinated canola still a better option than hybrid or retained hybrid seed in low rainfall areas.

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Key messages

- There was an overall yield loss of 19%, from using F2 retained hybrid TT seed, rather than F1 hybrid TT seed, and a reduction in oil content of up to 1.5 percentage units.
- At 2 out of 4 sites F2 seed at high density gave comparable gross margins to F1 seed at low density; at another 2 the F2 gross margins were substantially less.
- Agronomy did not overcome F2 yield losses: increasing F2 density alleviated, but did not overcome, seed yield loss. Grading gave a small benefit at some sites. Yield losses from seed mixes were directly proportional to the amount of F1 present.
- The best gross margin was from growing an open pollinated variety at 30-40 plants/m^2, rather than any hybrid treatment.

Aims

To determine how much yield and oil farmers would lose in low rainfall areas by retaining hybrid TT seed (F2) instead of buying fresh F1 hybrid seed.

To determine if the lower cost of farm retained seed would compensate for these losses.

To determine if adjusting seed rates, grading seed or using mixes of F1 and F2 seed would compensate for the yield loss of using F2 seed, in the low rainfall areas.

Method

We compared the growth, yield and oil yield of certified (F1) hybrid Hyola 450 TT with retained seed (F2). We also investigated the effect of increased density, grading the F2, F1/F2 seed mixes and an open pollinated TT comparison (ATR Bonito) in five field trials conducted in 2015; at Grass Patch, Ballidu, Merredin, Holt Rock and Cunderdin

Table 1. Treatments and seeding rate information

Seed	Seed size (mg)	Seeds/kg	Germination (%)	Expected field establish-ment	Seeding rate (kg/ha) @ 20 plants/m²	Seeding rate (kg/ha) @ 40 plants/m²
Hyola 450 TT F1 2014	5.53	180,766	88	85	1.5	3.0
Hyola 450 TT F1 2015	4.26	235,000	97	85	1.0	2.1
Hyola 450 TT F2	3.30	302,755	99	85	0.8	1.6
Graded Hyola 450 TT F2	3.91	255,754	100	85	0.9	1.8
Small Hyola 450 TT F2	3.12	320,513	100	85	0.7	1.5
Mix Hyola 450 TT 25% F1# : 75% F2	4.26/3.30		97/99	85	0.8	1.7
Mix Hyola 450 TT 50% F1# : 50% F2	4.26/3.30		97/99	85	0.9	1.8
Mix Hyola 450 TT 75% F1# : 25% F2	4.26/3.30		97/99	85	1.0	1.9
ATR Bonito (OP)	4.35	230,000	98	75	1.2	2.4

2015 F1 used in seed mixes.

Two different commercial seed lots of Hyola 450TT F1 seed were used, obtained in 2014 and 2015. 2015 seed of ATR Bonito was used as an open-pollinated control. All trials were sown using DAFWA cone seeders 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. All trials were sown at two target densities. The graded F2 seed was retained on a 1.8mm

screen, while the small seed passed through that screen. Different F1:F2 seed mixes were prepared, using the 2015 F1 seed. Seeding rates were calculated according to the target density, expected field establishment, seed size and germination per cent (Table 1). 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 2. Trial details

Trial	Sowing Date	Growing season rainfall (May-Oct)	Seeding conditions	Following rainfall
Grass Patch	24 April	215	Moist soil	May 18
Ballidu	28 April	245	Dry sown	mid May
Merredin	23 April	191	Dry sown (split germination)	mid May
Holt Rock	30 April	152	Dry sown	mid May
Cunderdin[#]	7 May	167	Dry sown	mid May

[#]Cunderdin site experienced herbicide damage after the post emergent grass selective spray so yield and oil data are not presented.

Results

We assumed field establishment appropriate for excellent conditions but this was only met at Cunderdin. At other sites establishment suffered due to marginal moisture during crop establishment, so generally plant densities were lower than the target (Table 3). Observed field establishment averaged 68% overall for Hyola 450 TT: 71% for F1 and 65% for F2; and for ATR Bonito was 71%. The observed density for the 40 plant/m² target was close to recommended optimum density for OP varieties at most sites (around 30 plants/m²).

Table 3 Observed plant densities (plants/m²) were below target at all sites except Cunderdin. Data averaged over seed treatments.

Trial	Target density 20	Target density 40
Grass Patch	17	36
Ballidu	15	31
Merredin	17	30
Holt Rock	14	28
Cunderdin	22	43

Yield and Oil

Retained F2 hybrid seed resulted in an overall average yield loss of 19% compared to fresh F1 hybrid seed (Figure 1). This figure was based on the mean of the 2014 and 2015 F1 seed. The yield loss at individual sites varied from 15% at Ballidu to 27% at Merredin. At the time of preparing this paper we only had oil data for Ballidu and Grass Patch which showed retained F2 hybrid seed produced 1 to 1.5 percentage units less oil than fresh F1 seed.

This level of yield loss is comparable with past Canadian and Australian results where retained hybrid canola seed yielded up to 25% less than fresh hybrid seed in environments yielding 1500 kg/ha or more. It is also supported by associated DAFWA field trials in 2015 where F2 canola was sourced from six locations in 2014 and compared with F1 seed at Grass Patch and Merredin. At Merredin with a trial average yield of 802 kg/ha, F2 hybrid seed produced 14% less grain than F1 seed and 1.2 percentage units lower oil. At Grass Patch, with a trial average yield of 1289 kg/ha, F2 seed produced 19% less grain, and 1.4 percentage units less oil.

Effects of agronomic treatments

In these trials, F1 yielded better than graded F2, which was not significantly higher yielding than ungraded F2 at any site, although it was significantly higher yielding than small F2 at Grass Patch and Ballidu (Figure 1). Small F2 seemed to yield better than graded F2 at Merredin but this difference was not significant. Grading improved the oil content of crops grown from F2 hybrid seed at both Grass Patch and Ballidu by 0.3 to 0.6 percentage units but this was only significant at Grass Patch (Figure 2).

Yields and oil contents of mixtures of F1 and F2 seed were directly proportional to the amount of each type of seed in the mixture (Figures 1 and 2).

Yield responded significantly to density in all treatments at each site (Figure 3). Although at Ballidu F2 seed at high density yielded as well as F1 seed at low density it was lower yielding than F1 seed at high density. There was a small but significant increase in oil content at high density, of 0.3 to 0.5 percentage units, but this did not differ between seed lots.

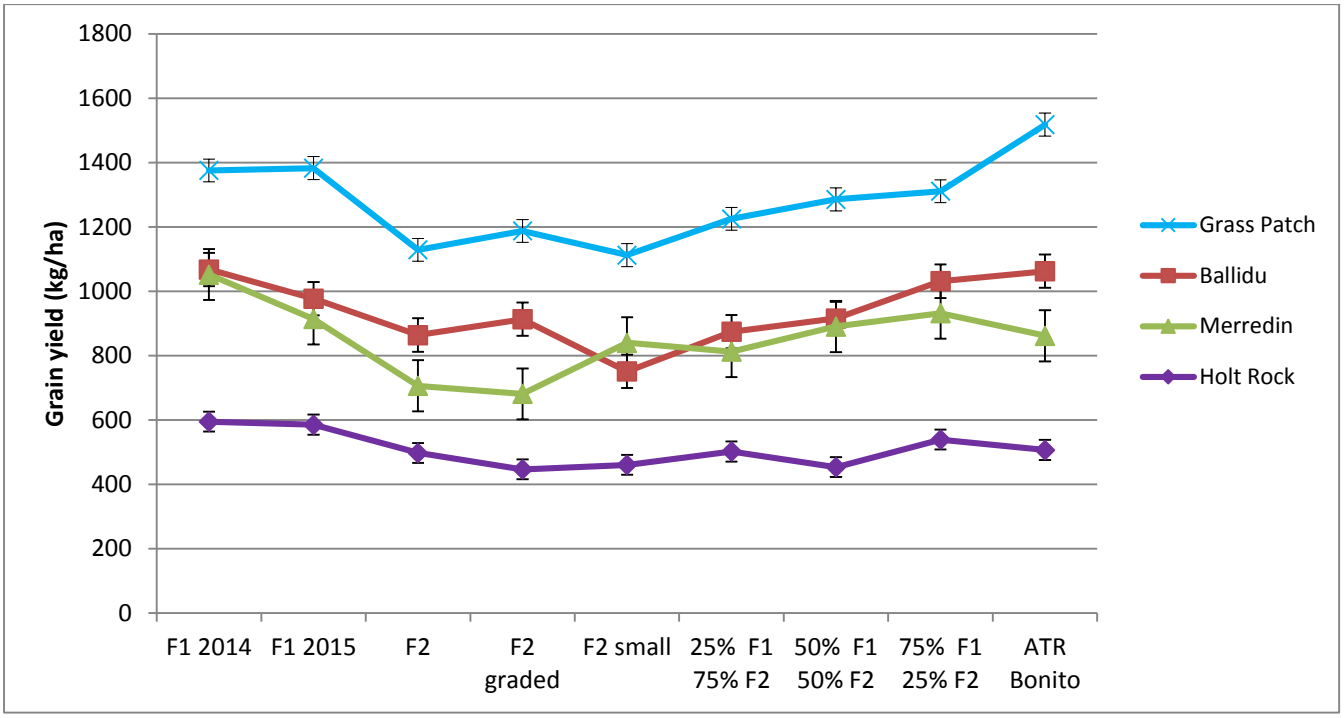

Figure 1. F1 Hyola 450 TT and ATR Bonito yielded more grain than F2 Hyola 450 TT (2015 F1 used in seed mixes). Vertical bars are ± sed.

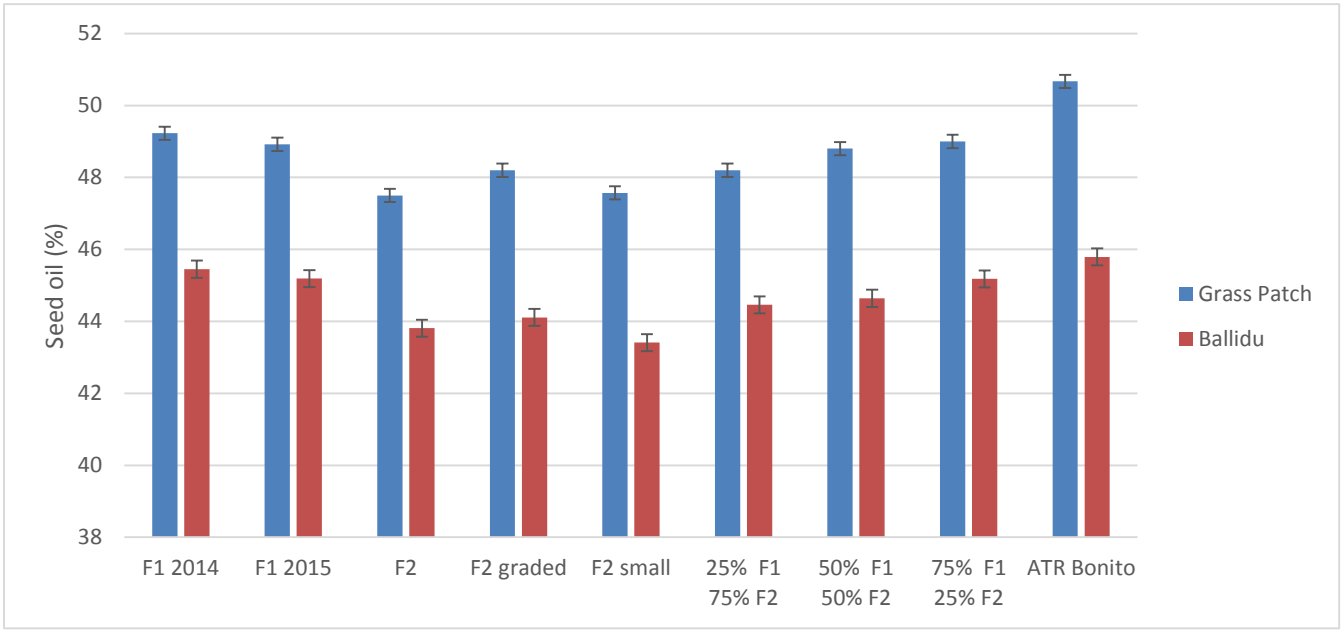

Figure 2. F1 Hyola 450 TT and ATR Bonito produces grain with higher oil percentage than F2 Hyola 450 TT. Vertical bars are ± sed.

Gross margins

Gross margins were calculated using typical practices of the eastern wheatbelt, with costs (not including seed) at $260/ha. We used costs of $24/kg for fresh F1 seed and $2/kg for other seed, assuming it was retained on-farm. The seed costs therefore ranged from $1.50/ha for small F2 seed at 20 plants/m² target to $71/ha for 2014 F1 seed at 40 plants/m² target. The farm gate price used was $513 (from FIS $555). A price premium of 1.5% for each percentage unit oil exceeding 42% was applied at Grass Patch and Ballidu, but not at Merredin or Holt Rock because oil data were not available.

The highest gross margin at each site was ATR Bonito at a target density of 40 (actual about 30) plants/m² (Table 4). F1 Hyola 450 TT had a comparable or higher gross margin than F2 at all sites. The best gross margins for F2 seed were for graded F2 seed with a target density of 40 plants/m². At Ballidu and Holt Rock this was better than 2015 F1 seed at 20 plants/m² but not significantly, and at neither of these sites did graded F2 seed at 40 plants/m² give a significantly higher gross margin than ungraded F2 at 40 plants/m². At Grass Patch and Merredin the gross margin of

graded F2 seed at 40 plants/m² was significantly less than F1 at 20 plants/m². This may be because F1 hybrids were able to express their superior yield potential in the good growing conditions at Grass Patch, and their better early vigour may have been an advantage under the marginal moisture conditions leading to staggered emergence at Merredin.

Table 4. Gross margins ($/ha) for ATR Bonito, F1 Hyola 450 TT and F2 Hyola 450 TT when sown to achieve targets of 20 and 40 plants/m².

Site	Ballidu*	Grass Patch*	Merredin#	Holt Rock#
ATR Bonito 20	238	566	111	-25
ATR Bonito 40	376	648	238	13
F1 2014 20	280	498	217	-9
F1 2014 40	234	422	224	-14
F1 2015 20	191	471	178	-15
F1 2015 40	255	489	156	15
F2 20	144	327	99	-27
F2 40	238	390	113	7
F2 graded 40	257	409	88	11
lsd (P=0.05)	80	57	109	45

*Oil included in gross margin calculations
#Oil not included in gross margin calculations

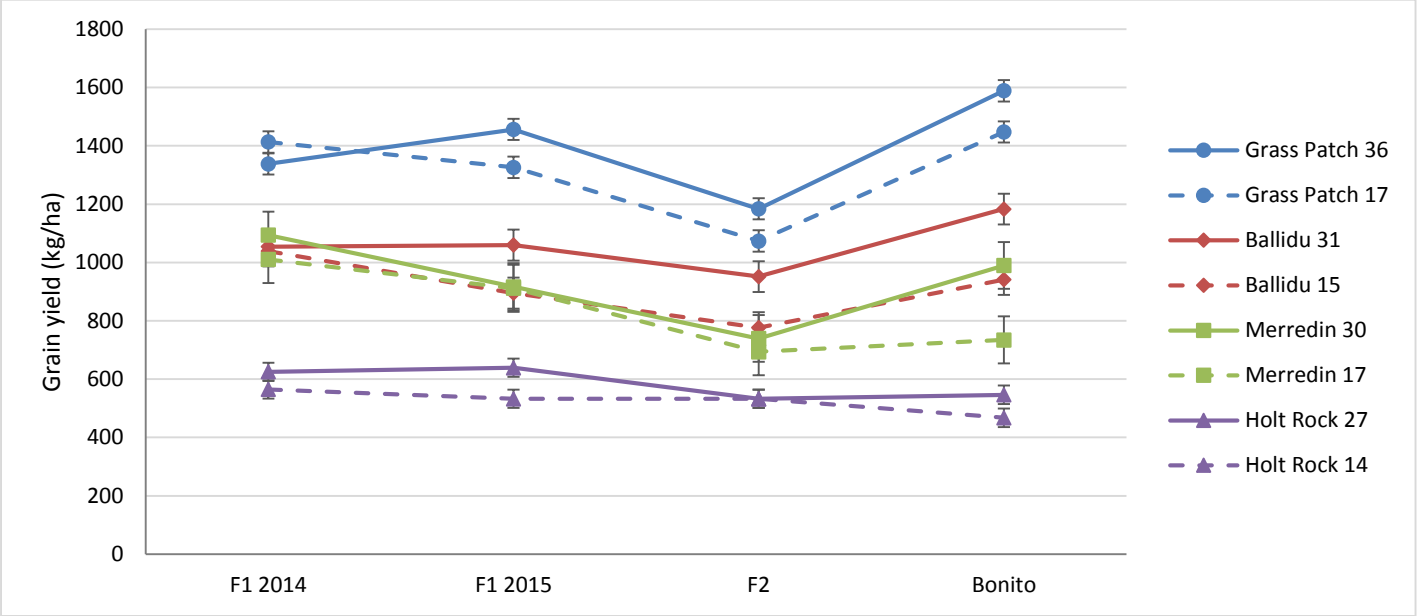

Figure 3. Increasing density does not compensate for lower yield potential of retained F2 hybrid canola seed. Numbers in legend are the observed rather than target densities. Vertical bars are ± sed.

Conclusion

Retaining hybrid canola in low rainfall environments to reduce seed costs may not improve profitability compared to using fresh hybrid seed of the same variety, due to the lower yield potential and oil content of F2 seed. However, as long as density is kept above 30 plants/m² in environments with yield potential of 1000 kg/ha or less F2 gross margins can be comparable to F1 gross margins, so retaining hybrid seed may be a way of mitigating risk associated with high seed costs in some environments. Grading seed only made only a small difference to yield and gross margin. Good open-pollinated TT varieties remain the most profitable option for the low rainfall regions.

Key words

Retained seed, triazine tolerant, TT, hybrid, F2,

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