Department of Agriculture and Food
GOVERNMENT OF WESTERN AUSTRALIA

GRDC Grains Research & Development Corporation

DAW00277
Tactical Break Crop Agronomy in Western Australia

13ED09 – Plant density in low rainfall canola

Authors	Mark Seymour
Location of trial	Tim Osborne's Salmon Gums

Summary (Key messages)

- Grain yields of most canola varieties at Salmon Gums started to plateau at ~ 20 plants/m²
- Taking into account the costs of increasing plant density we calculated the economic optimum for higher cost seed types such as RR and hybrid TT to be 25 plants/m² or less
- Hyola 404RR had the flattest response indicating its yields were less affected by lower plant densities.

Background

Canola is now being grown in low rainfall areas. Primarily farmers choose open pollinated 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 in order to get these potential yield benefits. Seed for hybrid canola is 25 times more expensive than the seed of open pollinated canola. Inevitably if farmers are forced into hybrids they will wish to minimise seed costs by sowing at low densities.

Aim

To investigate the plant density response to yield and oil content of TT and RR hybrid canola in comparison with open-pollinated canola

Trial Details

- Property: Tim, Dave and Fiona Osborne's, Eldred Road Salmon Gums
- Agzone 5, Growing Season rainfall (GSR) = 206 mm, GSR + stored water (estimate) = 277 mm
- Soil type: sandy loam (0.8% organic carbon)
- Paddock rotation Wheat 2012, Barley 2011, Canola t/ha 2010
- Sowing date April 17
- Fertiliser (kg/ha) 99 kg/ha of Allstar at seeding (13.1%N, 14.8%P, 15%S, 0.1% Cu, 0.2% Zn, 7ppm Mo, 0.02% Mn), 120 kg/ha of Muriate of Potash and 400 kg/ha of gypsum (17% Ca, 14% S) topdressed over whole site 4 weeks after seeding, 145 L/ha of UAN (32%N) June 3.

Treatment detail

- 36 treatments:
  - 2 HT - Herbicide tolerant canola (TT and RR)
  - 4 Cultivar
  - TT– OP = CB Telfer TT and Hybrid = Hyola 450TT
  - RR - OP = GT Viper, Hybrid = Hyola 404 RR
  - 8 densities of 5, 10, 15, 20, 30, 40, 60, or 80 plants/m^2
  - 3 replicates

Assumptions used in Gross Margins

Oil bonus +/- 1.5% per unit of oil (%) either side of 42%, with no oil ceiling.

Additional costs such as seeding, harvest, insecticides assumed to be $100/ha.

Nitrogen costs $1/kg, application costs $8/ha

RR costs – seed $31/kg, Herbicides $28/ha, Grain worth $482/t (CBH Pool Esperance 5/11/13).

TT costs – seed $2/kg, Herbicides $47/ha, Grain worth $502/t (CBH Pool Esperance 5/11/13).

Results

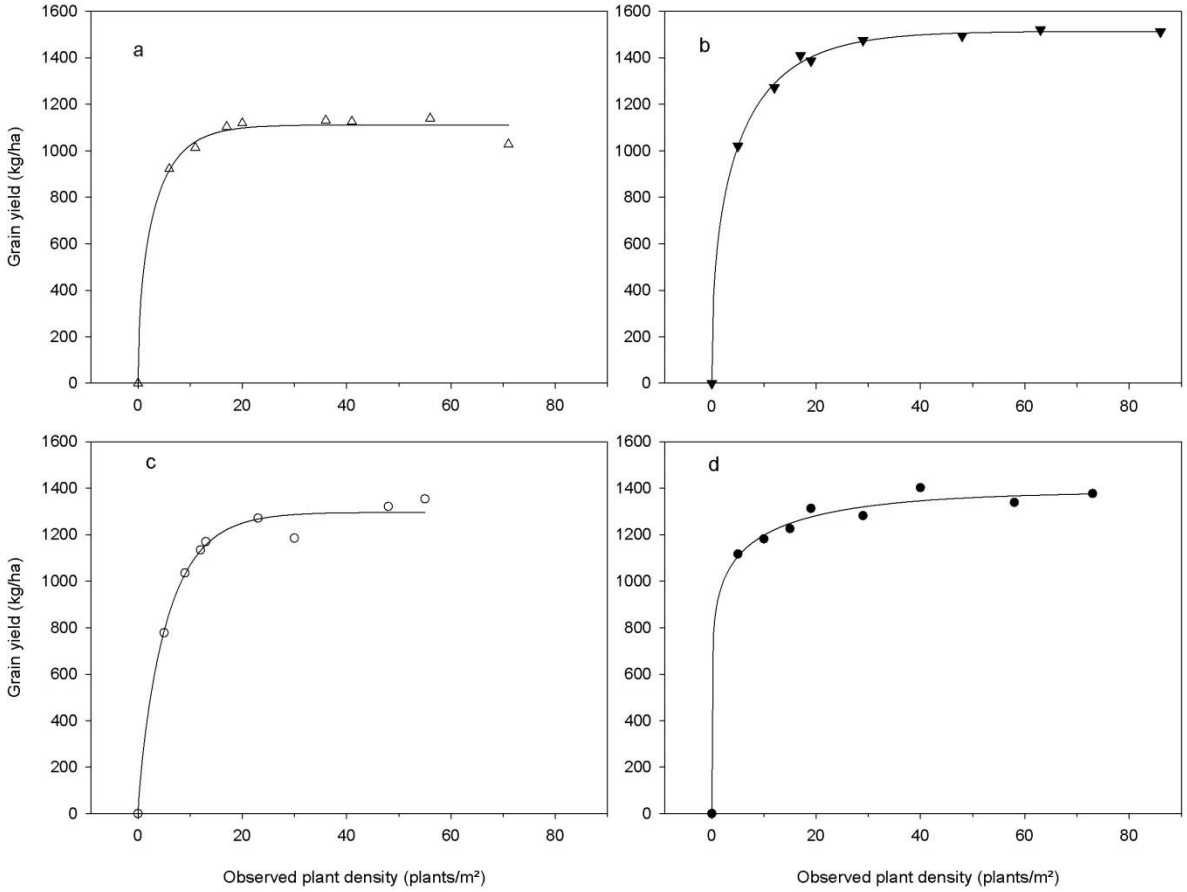

Figure 1 Relationship between plant density (observed, plants/m²) and the grain yield of (a) CB Telfer, (b) Hyola 450TT, (c) GT Viper and (d) Hyola 404RR at Osborne's, Salmon Gums in 2013 (13ED09)

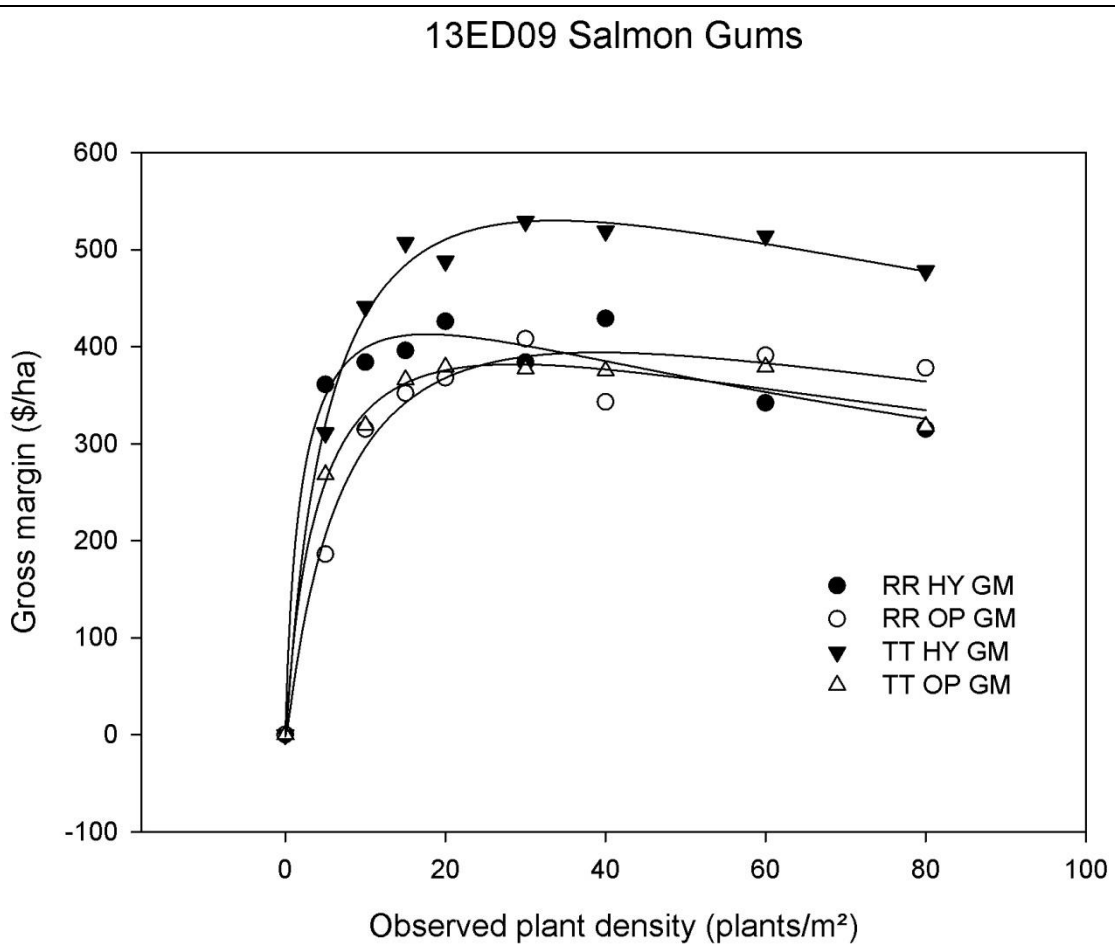

Figure 2 Relationship between plant density (observed, plants/m²) and the gross margin of TT OP (CB Telfer, TT hybrid (Hyola 450TT), RR OP (GT Viper) and RR hybrid (Hyola 404RR) at Osborne's, Salmon Gums in 2013 (13ED09)

Grain yields of most canola varieties at Salmon Gums started to plateau at ~ 20 plants/m² (Figure 1). Taking into account the costs of increasing plant density we calculated the economic optimum for higher cost seed types such as RR and hybrid TT to be 25 plants/m² or less. Hyola 404RR had the flattest response indicating its yields were less affected by lower plant densities.

CB Telfer was the lowest yielding variety at Salmon Gums in 2013, which may be attributed to its earlier maturity not making use of late spring rains to the same degree as other varieties. In spite of a long slow increase in yield with increasing plant density, the low cost of seed for CB Telfer ensured a slighter higher economic density of 31 plants/m².

Hyola 450TT was the highest yielding variety at Salmon Gums and produced the highest gross margins of $473/ha. Gross margins of all other varieties were in the range of $343 to $379/ha (averaged over densities)

Table 1: Summary of economic optimum density (plants/m²) of canola from 11 experiments conducted throughout WA in 2013.

Location	CB Telfer or ATR Stingray	Hyola 450TT	GT Viper	Hyola 404RR	Comments
Cunderdin	25	22	28	17	
Eradu	34	33	24	16	
Grass Patch[#]	53	71	53	41	Low density treatments targeted by birds
Holt Rock	39	20	30	38	
Katanning	39	24	39	21	TT blocks weedier – more ryegrass in low density
Merredin	22	20	17	18	TT blocks weedier, more ryegrass in low density
Miling	36	27	20	12	Low establishment, low density = more ryegrass
Mullewa	19	12	10	14	Extended dry period and aphids
Pingrup	29	23	19	18	
Salmon Gums	31	25	22	18	Late emerging barley grass understory in RR blocks
Wongan Hills	40	35	34	21	TT blocks weedier, more ryegrass in low density

Low density treatments at Grass Patch were preferentially attacked by birds; therefore this site was excluded from META analysis

Conclusion

The economic optimum plant density of canola appears to be different for each type of canola and in some instances may need to be altered for rainfall zones. Open pollinated TT canola which dominates the WA industry had higher optimum densities primarily because of the low cost of increasing density.

Optimum target densities and suggested seeding rates based on 2013 experiments are:

OP TT - 31 plants/m² which equates to a seeding rate of 2.1 kg/ha for ATR Stingray and 2.4 kg/ha for CB Telfer - but there is no economic reason not to go higher with farmer retained seed.

Hybrid TT - 23 plants/m² (seed rate of ~ 1.4 kg/ha). Using such a low seed rate may be risk so it may pay to increase seed rate if conditions are questionable or machine is not calibrated for low seeding rates

OP RR – 24 plants/m² (seed rate of 2.2 kg/ha)

Hybrid RR - 20 plants/m² equivalent to a seed rate of ~ 2.1 kg/ha. Adjust seed rate for variety/seed lot seed size differences

Note that all optimum densities calculated here assume a given field establishment of 50% for OP's and 65% for hybrids and 90% germination test. As observed field establishment rates can vary due to soil moisture, temperature and seeding errors. Similarly seed size may vary from those used in our trials. Farmer retained seed of TT OP's in dry areas is often smaller than purchased seed and it is our experience that hybrid seed size varies markedly from year to year. Therefore seed rates should be adjusted to suit individual circumstances. Variations in grain prices, seed size, germination and field establishment may also affect our optimum density calculations, particularly if the calculated optima are not on the plateau of the response curve. In most instances for OP TT's and RR hybrids the calculated optima are on the plateau of the response curve and variations in assumptions and changing crop density will affect gross margins slightly. However for TT hybrids and RR OP's the crop gross margins may be more sensitive to variations in density.

Acknowledgements

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Links

For other reports related to this trial see NVTplus

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