

Seeding uniformity and canola yield

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Key messages

- Canola yields were above 2.5t/ha from low plant density, 10p/m²
- Spacing plants more evenly did affect some aspects of plants growth
- There was a trend of more yield from evenly spaced plants compared to unevenly spaced plants but this was not statistically significant

Aim

To determine if spacing canola plants more uniformly within the row can improve yield in the WA Northern Region.

Background

Recent work in the Northern Agricultural Region has shown that canola can yield well from low plant densities of 5 to 10 plants/m² (Harries & Seymour 2015). Canadian researchers reported that at plant densities of around 20 plants/m² there was a significant improvement in yield when plants were spaced evenly apart rather than being spaced unevenly within the row (Yang et al 2014). Given the rapid adoption of hybrid canola technology in the Northern Region and the associated increase in seed costs, there is interest in precision placement of seed for two reasons (1) to reduce seed rates and therefore input costs and (2) to see if better placement can improve yield and yield stability.

This trial tested both aspects by using a range of plant densities with plants distributed either evenly or unevenly along the row.

Method

The trial was sown at Wongan Hills into a deep sandy soil (Orthic Tenosol) in mid-April. Plots were 20m long by 2.0m wide and were split in half; 10 metres of evenly spaced plants and 10 metres of unevenly spaced plants. Plots were sown at a high seed rate and soon after establishment seedlings were hand thinned to achieve the desired plant densities and geometry. Plant densities were 80, 40, 20 and 10 plants/m². Plant geometry was spaced unevenly and evenly such that all seedlings were in line with each other across the rows of the plot for the even treatments (Figure 3). Measurements included Normalised Difference Vegetation Index (NDVI) at regular intervals, grain yield components, grain yield and grain quality.

Additionally a survey of commercial paddocks was undertaken to assess whether the spatial pattern of un-evenness obtained in trial plots was similar to what occurred with commercial seeding operations. Forty two paddocks were surveyed in a transect from Geraldton to Merredin. Distance between plants in 6 metres of crop row was recorded.

Results

Seasonal conditions

Rainfall was above the site long term average of 388mm (Table 1). There was adequate moisture at sowing on April 20 to ensure good establishment and regular rain was received throughout the growing period.

Table 1. 2016 monthly rainfall (mm) from DAFWA Wongan Hills station.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year to date
Wongan Hills	66.2	0.0	149.2	77.6	46.0	57.0	80.8	68.2	34.8	17.2	-	-	597.0

Farmer establishment survey

There was a wide range of plant densities observed in commercial crops; a high of 63 plants/m², low of 9 plants/m² and average of 23 plants/m². The distance between plants was recorded in order to assess the variability in the distribution of the plants along the length of the rows. As expected when plant density declined the variability in distribution along the row increased (Figure 1a). The variability in distribution observed was similar to what was achieved with the hand thinning in the small plot 'uneven' treatments in our trials (Figure 1b). These graphs indicate that the lower the plant density of the paddock or trial plot the more un-uniform the distribution. For example at 20 plants/m² the deviation between plants in the row was approximately (+/-) 12cm while this reduced to (+/-) 5cm at 80 plants/m². Hence there is a greater degree of un-evenness in plant distribution at lower plant density and in theory if seed are placed more accurately at these low plant densities there may be a response in growth and yield from reduced intra-specific competition.

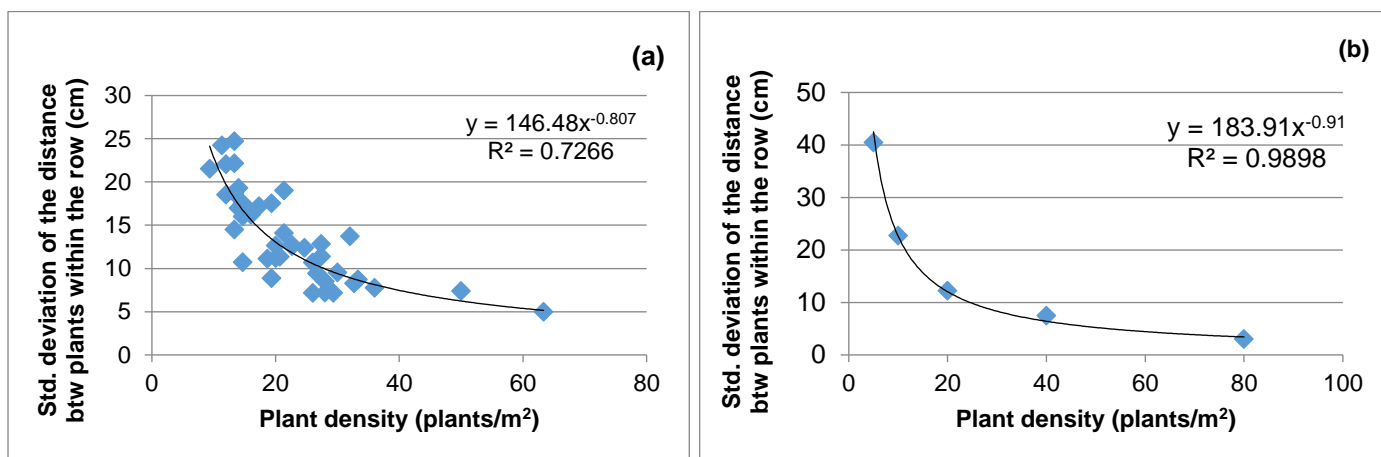


Figure 1. (a) Relationship of plant density to uniformity of plants within the row from commercial canola crops **(b)** Plant density and uniformity of plants within the row of small plots hand thinned to represent an uneven crop.

Field trials

Higher plant density increased NDVI and produced a greater rate of ground cover (data not presented). Increasing plant density also resulted in thinner stems, reduced stem weight and reduced pods per plant (Figure 2a). Seed oil concentration was not affected by plant density or plant uniformity. Seed size was affected by plant density with a trend of increased seed size with increased plant density ($P < 0.05$), while there was no relationship between plant uniformity and seed size (data not presented).

With good rainfall and cool temperatures in spring canola yields were high, 3t/ha average. Even at the lowest density of 10 plants/m² yields were above 2.5t/ha (Figure 2b). However plant densities higher than 10 plants/m² increased yield ($P < 0.001$). Yield was not significantly altered by the uniformity of plant distribution however there was a consistent trend ($P < 0.1$) of increased yield at even plant distribution where the lowest three plant densities yielded approximately 5% more when spaced evenly.

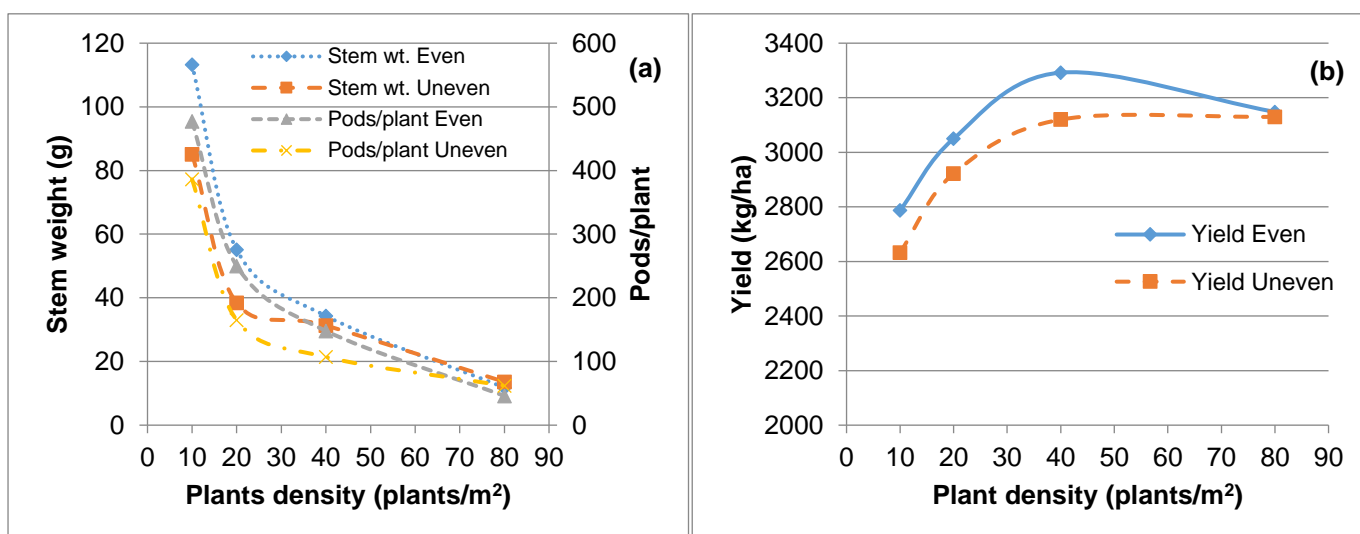


Figure 2. Effect of plant density and spacing on **(a)** individual plant stem weight (g), pods/plant and **(b)** yield (kg/ha)



Figure 3. 10 plants/m² handed thinned to even spacing (left) and uneven spacing (right) at Wongan Hills.

Conclusions

Yields were high even from very low plant density which indicates that it is worth pursuing low seeding rates with precision seeders to save on upfront seed costs. Whilst there were some differences in plant growth and yield observed between uniform and un-uniform plants even plant spacing did not translate to statistically significant increased yields. In Canadian trials yield improvements obtained from uniform spacing were greatest at lower yields of around 1 t/ha obtained from plant stands of 20 plants/m². Therefore it is apparent this work requires further testing in WA in a less favourable season with lower yield potential.

References

Harries M, Seymour M, (2015). Precision placement of canola seed, can we get the same or better yield from less seed? Western Australian crop update series. <https://www.agric.wa.gov.au/canola/canola-precision-placement-seed-northern-region-2015-15ge4142>

Yang C & Gan Y & Harker N.K & Kutcher R & Gulden R & Irvine B & May W.E (2014) Up to 32% yield increase with optimized spatial patterns of canola plant establishment in western Canada. *Agron. Sustain. Dev.* (2014) 34:793–801

Key words

Canola, density, precision sowing

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