Performance of canola under no-till full stubble retention (NTSR) using different drill openers and row spacings at Coreen

Location: Coreen, NSW

Growing season rainfall:
Annual: 331mm
GSR: 234mm (Apr–Oct)

Soil:
Type: Clay loam
pH (H_2O): 5.9
pH ($CaCl_2$): 4.9

Sowing information:
Sowing date: 1 June 2009
Sowing rate: 2.5kg/ha
Sowing fertiliser: Superfect @ 170kg/ha
Sowing equipment: Single disc opener, Janke tine and press wheel
Varieties: Hyola 50, canola

Row spacing: 22.5cm, 30cm and 37.5cm

Paddock history:
2008 — triticale
2007 — wheat

Plot size: 44 x 3m

Replicates: 4 disc and 8 tine

KEY POINTS

- **A 30cm row spacing for canola produced significantly higher yields than crops grown at 22.5cm and 37.5cm row spacings ($p<0.001$).**
- **In this first-year trial the disc opener produced significantly higher canola yields than the tine based opener ($p=0.05$).**
- **Yield results represented water use efficiencies (WUE) ranging from 6.4 kilograms per millimetre to 7.3kg/mm.**
- **Dry matter (DM) calculations revealed that a 30cm row spacing produced greater transpiration efficiency than a 22.5cm row spacing.**

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Overall goal

Improved water use efficiency (WUE) in no-till cropping and stubble retention systems in spatially and temporally variable conditions in the Riverine Plains.

Trial aim

The aim of this trial was to evaluate the performance of different drill openers at a range of row spacings in two no-till rotations.

Method

A replicated experiment was established to test the effect of a range of drill openers and row spacings in two no-till canola rotations.

Crop stubble from the previous commercial triticale crop was chopped and spread at right angles to the direction of plots.

Results

Crop establishment:

Establishment was significantly better with the disc opener than with the tine when assessed 18 and 38 days after sowing. There was no significant difference in establishment between 22.5 centimetre and 30cm rows. However, plant populations were lower where row spacing moved out to 37.5cm (see Table 1 and Figure 1).

As row width increased using the disc opener, the established plant populations declined (see Figure 2), indicating a significant linear relationship between the two. For reasons that are not clearly understood, the establishment with the tine opener was significantly better at the 30cm rather than the 22.5cm row spacing, which also had been the case with disc opener.

TABLE 1 Plant establishment at the cotyledon stage and the two-leaf fully-unfolded stage assessed 18 and 38 days after establishment

Row spacing (cm)	Drill opener[1]					
	Plant establishment (plants/m²)					
	19 June 2009			8 July 2009		
	Disc	Tine	Mean	Disc	Tine	Mean
22.5	73.5	43.7	**58.6**	68.6	47.0	**57.8**
30	61.7	54.6	**58.2**	55.8	56.7	**56.3**
37.5	53.2	39.6	**46.7**	48.3	42.4	**45.4**
Mean	**63**	**46**		**58**	**49**	
LSD (row spacing)	7.5			5.3		
LSD (drill opener)	6.5			4.6		
LSD (disc) (tine) LSD (disc vs tine)	12.9 11.2	9.12		9.3 8.0	6.54	
Interactions — drill opener x row spacing						
Linear	*			**		
Quadratic	ns			*		

[1] Tine treatments had eight replicates compared with four for the disc treatment
* Significant at p = 0.05
**Significant at p=0.005

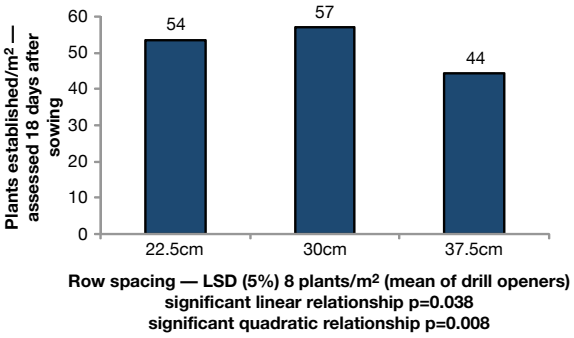

FIGURE 1 Influence of row spacing on plant establishment at the cotyledon stage (GS10) 18 days after sowing

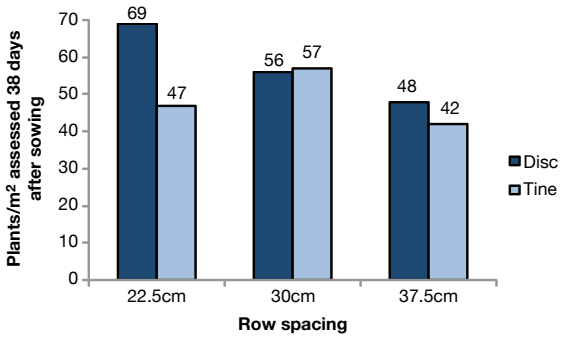

FIGURE 2 Influence of row spacing and opener method on plant establishment at the two-leaf stage (GS12), assessed 38 days after sowing

Dry matter production

i) Row spacing

Dry matter (DM) assessments of the treatments (three row spacings with discs and tines) were made at five assessment dates (green bud — 20 August 2009, early flower — 7 September 2009, mid flower — 21 September 2009, podding — 7 October 2009 and maturity — 11 December 2009).

At green bud there was a significant difference in DM production as a result of the row spacing (see Figure 3). Later assessments revealed no difference in DM production as a result of row spacing, but the trend was for a 22.5cm row spacing to produce more biomass than a 37.5cm spacing.

ii) Drill opener

There was a significant effect on DM production at green bud and crop maturity when the two openers were compared; however there was a trend for the disc to produce the higher DM across all assessments (see Figure 4).

Yield

Canola grown on 30cm rows was significantly higher yielding than that grown on 22.5cm or 37.5cm rows, between which there was no difference (see Figure 5). The results indicated that the relationship between row spacing and yield was not linear, with an indication that a 22.5cm spacing was too narrow and a 37.5cm spacing was too wide.

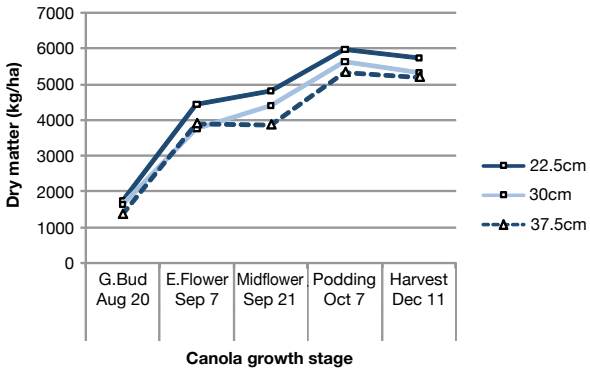

FIGURE 3 Influence of row spacing on dry matter production*

*Mean of both drill openers, assessed from green bud (20 August 2009) to maturity (11 December 2009)

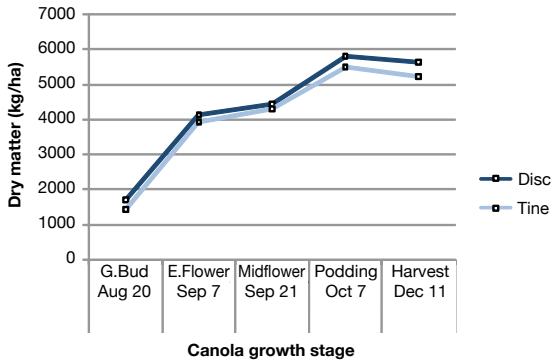

FIGURE 4 Influence of opener on dry matter production*

*Mean of three row spacings assessed from green bud (20 August 2009) to maturity (11 December 2009)

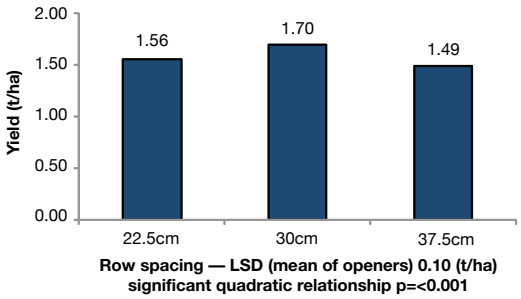

FIGURE 5 Influence of row spacing on seed yield*

*Mean of both drill openers

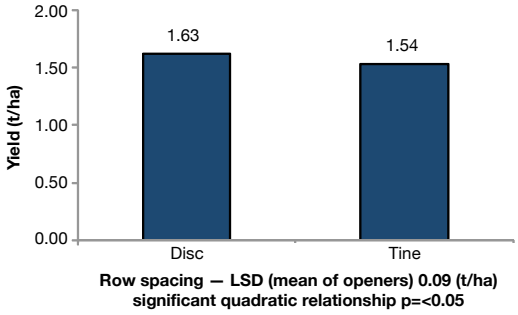

FIGURE 6 Influence of drill openers on seed yield*

*Mean of three row spacings

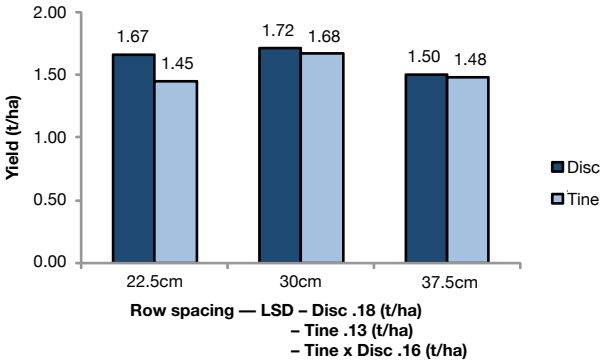

FIGURE 7 Influence of row spacing and drill opener on seed yield

TABLE 2 Maximum biomass at podding, seed yield, harvest index (HI), WUE, transpiration, estimated soil evaporation/other soil losses and transpiration efficiency (TE)

Row spacing (cm)	Biomass (kg/ha)	Yield (t/ha)	HI (%)	WUE[1] (kg/mm)	Transpiration[2] (mm)	Evaporation[3] (mm)	TE[4] (mm)
22.5	5987	1.56	**26**	6.7	120	**114**	**13.0**
30	5652	1.69	**30**	7.3	113	**121**	**15.0**
37.5	5347	1.49	**28**	6.4	107	**127**	**13.9**

[1] Based on 234mm of GSR (Apr–Oct) with no soil evaporation term included.
[2] Transpiration through the plant based on a maximum 50kg biomass/ha.mm transpired.
[3] Difference between transpiration through the plant and GSR (mm).
[4] Transpiration efficiency based on kg/ha grain produced/mm of water transpired through the plant.

The disc opener (when all row widths were considered) produced significantly higher crop yields than the tine (p=0.05) (see Figure 6), with the same trends in yield exhibited in terms of row spacing — 30cm being the highest yielding treatments (see Figure 4). However the disc opener showed no statistical difference in yield between the 22.5cm and 30cm row spacings, both being superior to the 37.5cm spacing.

Observations and comments

The results were very similar to those observed in the wheat trial (see pages 14–17), which was part of the same national WUE project. The drop in yield from exceeding a 30cm row spacing and moving to a 37.5cm spacing was just over 12 per cent — the same as that recorded in the wheat. However, in the wheat there was little difference in productivity between the 22.5cm and 30cm spacings, whereas in the canola there was a penalty at the narrower spacing.

In terms of overall WUE, a 30cm row spacing gave slightly better WUE than either 22.5cm or 37.5cm spacings (7.3 kilograms per millimetre vs 6.4–6.7kg/mm with no soil evaporation/run-off/drainage factor included) (see Table 2).

While a 22.5cm row spacing produced superior DM per unit area at podding (maximum DM recorded) and harvest compared with a 30cm spacing, less DM was turned into seed yield. As a consequence the 22.5cm spacing produced a lower harvest index than the 30cm row spacing (26% vs 30%). There was slightly greater water loss through soil surface evaporation with a wider row spacing, but this estimated loss was small compared with the benefit of a superior harvest index.

Sponsors

This trial is part of a nationwide project funded by the Grains Research and Development Corporation (GRDC) aimed at improving WUE in broadacre cropping systems.

Farmer co-operator: Hanrahan family, Coreen and Peracto Pty Ltd as trial manager.

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