Performance of wheat (after faba beans) under no-till full stubble retention (NTSR) using different drill openers and row spacings at Bungeet

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Key points

- With 537mm growing season rainfall (GSR) (April–mid-November) wheat yields following faba beans were 2.2t/ha higher than those experienced in 2009 (5.06t/ha vs 2.86t/ha).
- The yield reduction moving from a narrow row spacing (22.5cm) to wide (37.5cm) was 12% (0.64t/ha), compared with 16% (0.49t/ha) in 2009.
- Yields were significantly higher on the narrow row spacing compared with the 30cm and wide row spacings, between which there was no difference.
- This contrasted with 2009 results where there was no yield disadvantage at 30cm compared with 22.5cm at lower yields in wheat on wheat.
- Nitrogen (N) off-take in harvested grain was nearly 13% higher with the narrow row spacing compared with the widest row spacing, however further analysis is required to determine if the nitrogen off-take of the whole plant was different, or whether nitrogen was partitioned differently between straw and grain.
- There was no difference in yield between the tine and disc opener when the three row spacings were averaged.
- Evidence suggests that at a row spacing of 30cm, the disc was inferior to the tine — a result that correlates to earlier establishment scores.

Location: Bungeet, VIC

Rainfall:
Annual: 925mm
GSR: 537mm

Soil:
Type: Loam over clay, Wattville No. 205
pH (H_20): 6.74

Sowing information:
Variety: Livingston, wheat
Sowing date: 8 June 2010
Sowing rate: 85kg/ha
Fertiliser: MAP + Intake 85kg/ha
Seeding equipment: Janke tine with Janke press wheel. Single disc opener

Row spacing: 22.5cm, 30cm and 37.5cm

Paddock history:
2009 — faba beans
2008 — wheat

Plot size: 44m x 3m

Replicates: 4 (disc and tine)

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 a first wheat situation following a commercial crop of faba beans.

Method

A replicated experiment was established to test the effect of a range of drill openers and row spacings in two no-till wheat rotations. In this trial the crop was first wheat after faba beans.

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

Results

Crop establishment

The establishment of wheat sown at a 22.5cm row spacing was significantly (p = <0.001) better than crops sown at 30cm, which in turn was superior to a 37.5cm row spacing (see Table 1 and Figure 1). These results were identical to those observed in 2009.

At very early emergence (early first leaf), the disc opener produced significantly more plants/m^2 than the tine, however by the three-leaf stage (GS13) this difference was no longer apparent (see Figure 2). This indicates slightly faster emergence with the disc, which may have been related to sowing depth.

The influence of the drill opener was not the same across the different row spacings, with evidence that at the 30cm row spacing the tine opener was statistically superior to the disc, while at other row spacings there was no significant difference in establishment (see Figure 3).

Crop structure

Differences in plant establishment followed through to produce significant differences in both tiller numbers at early stem elongation (GS30) and final head numbers at maturity (see Figure 4).

With the wider row spacings there was noticeably little tiller death, since final head number and tiller numbers are very similar, though final head number was still greater with the narrower row spacing.

Yield (t/ha) and grain protein (%)

i) Yield

Row spacing produced significant differences in yield (p = 0.001). The 22.5cm row spacing was significantly higher yielding than the 30cm and 37.5cm row spacings, between which there was no yield difference.

The yield reduction that occurred when row width increased from 22.5cm to 30cm was 9% in this first wheat following faba beans rotation position.

TABLE 1 Plant establishment at coleoptile emerging to first-leaf-unfolded stage (GS10–11) and three-leaves-unfolded stage (GS13) assessed 16 and 37 days after sowing

Row spacing (cm)	Drill opener[1] Plant establishment (plants/m^2)					
	24 June 2010			15 July 2010		
	Disc	Tine	Mean	Disc	Tine	Mean
22.5cm	134	92	**113**	280	271	**276**
30.0cm	92	65	**79**	198	236	**217**
37.5cm	92	54	**73**	169	154	**162**
Mean	**106**	**70**		**216**	**220**	
LSD [row spacing]	37			19		
LSD [drill opener]	14			16		
LSD [row x opener]	25			27		

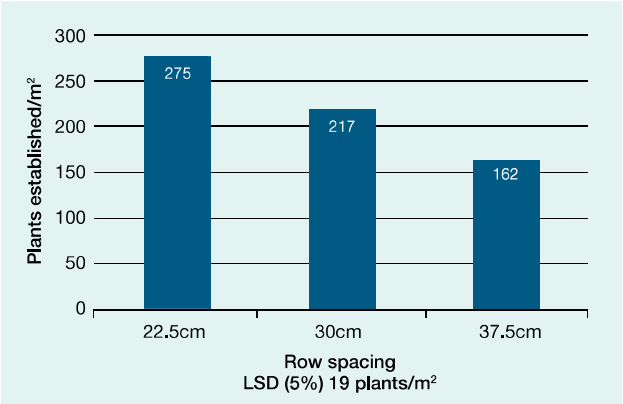

FIGURE 1 Influence of row spacing on plant establishment, at the three-leaves-unfolded stage (GS13), 37 days after sowing

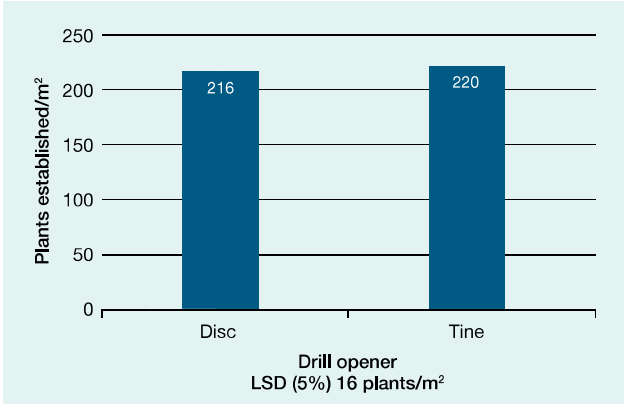

FIGURE 2 Influence of drill opener on crop establishment at the three-leaves-unfolded stage (GS13), 37 days after sowing

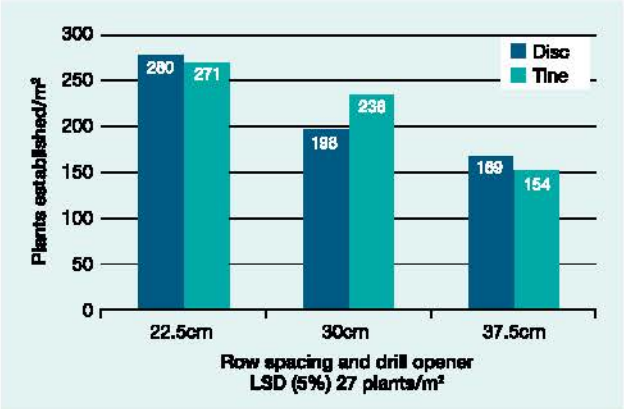

FIGURE 3 Influence of row spacing and opener method on plant establishment at the three-leaves-unfolded stage (GS13), 37 days after sowing

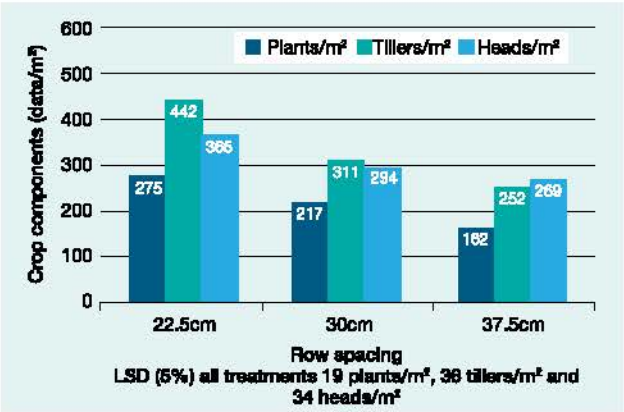

FIGURE 4 Influence of row spacing on crop structure*
*Mean of both openers

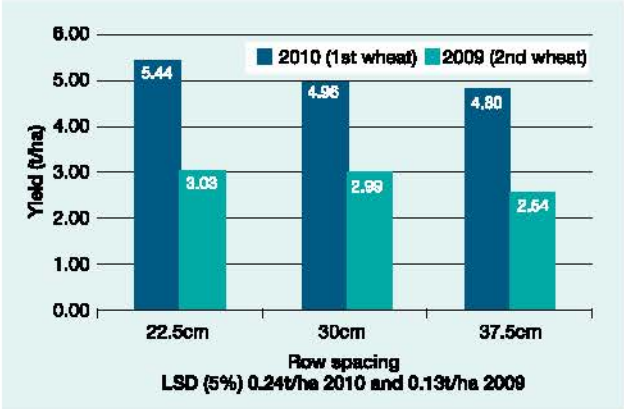

FIGURE 5 Influence of row spacing on yield *
*Mean of both drill openers. 2009 data is taken from wheat-on-wheat trial run in the same paddock but different rotation position

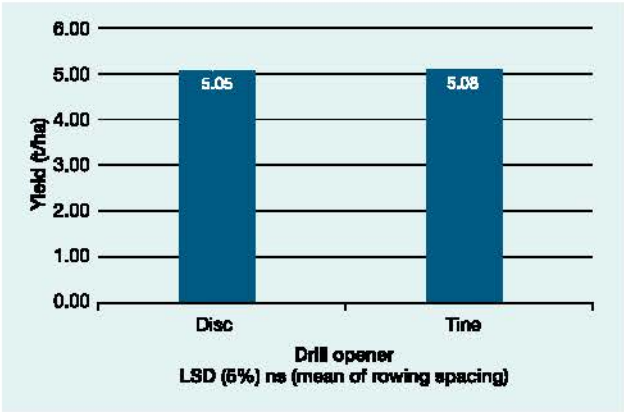

FIGURE 6 Influence of drill openers on yield*
*Mean of three row spacings

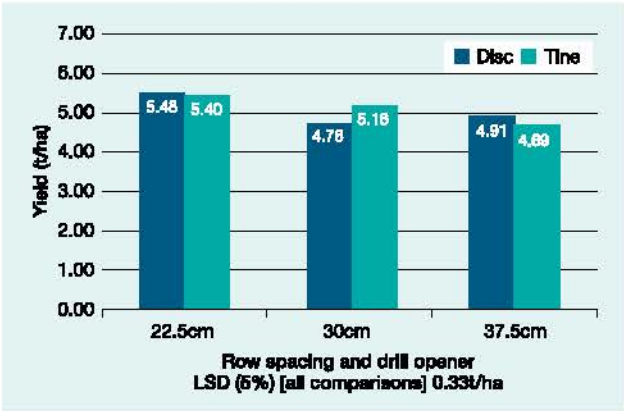

FIGURE 7 Influence of row spacing and drill opener on yield

In last year's trial the yield reduction as row spacing moved from 22.5cm to 37.5cm was 16% (0.49t/ha), this year the figure was 12% (0.64t/ha). The principal difference between the 2010 and 2009 results was that with the higher yields experienced during 2010, 30cm was significantly inferior to 22.5cm while during 2009 there was no significant disadvantage moving from 22.5cm to 30cm (see Figure 5).

Note: 2009 data was taken from a replicate trial at the same paddock location, but from a different rotation position (wheat on wheat).

There was no significant difference ($p = 0.72$) in the influence of drill opener in the trial, with the tine yielding 5.08t/ha and disc yielding 5.05t/ha when averaged across the three row spacings (see Figure 6).

However, there was a significant interaction between row spacing and drill opener ($p = 0.03$), with an indication of significantly better performance from the tine opener at the 30cm row spacing. This correlates to significantly better establishment at the start of the season (see Figure 7).

The combination producing the highest yield in the trial (5.48t/ha) was achieved with the narrow row spacing and disc, though this was only 0.08t/ha higher yielding than the tine equivalent.

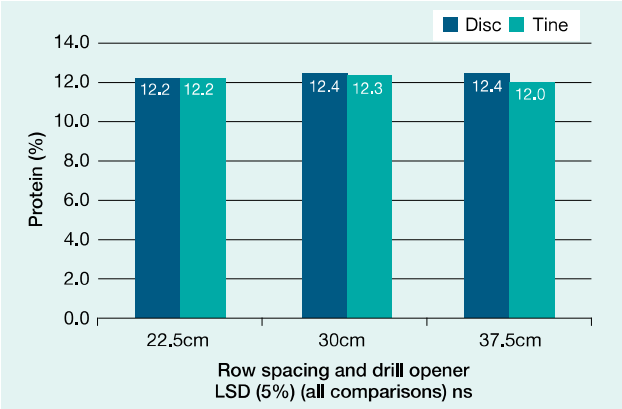

FIGURE 8 Influence of row spacing and drill opener on protein

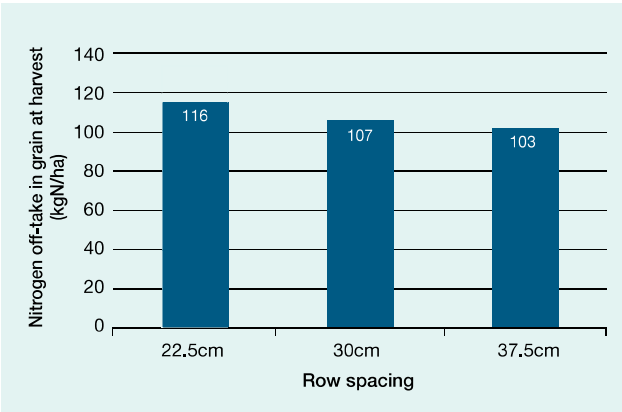

FIGURE 9 Influence of row spacing on nitrogen off-take

ii) Protein (%) and nitrogen off-take in the grain

There were no significant differences in protein associated with either row spacing or drill opener, despite significant differences in yield due to row spacing (see Figure 8).

As a consequence there was a greater nitrogen off-take in the grain at the narrower row spacing (116kg/ha of nitrogen at the narrow spacing and 103kg/ha at the wider spacing) (see Figure 9).

At present it is unclear whether this was the result of less nitrogen off-take overall with the wider row spacing or a different partitioning of nitrogen within the plant.

SPONSORS

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