Cropping systems

Funded by Caring for Our Country and conducted in collaboration with farmers Michael Jaeschke, Matt Dare and Jack Desbiolles from the University of South Australia.

Key findings

- There was no significant difference between sowing systems or level of nutrition on grain yield.
- Levels of brome grass were higher under the early sowing no-till plots and annual ryegrass was lower in the disc system.
- There is very little difference in long term gross margin between seeding system or level of nutrition.

Why do the trial?

To compare the performance of 3 seeding systems and 2 nutrition strategies. This is a rotation trial to assess the longer term effects of seeding systems and higher fertiliser input systems.

How was it done?

Plot size	35m x 13m		**Fertiliser**	DAP @ 50 kg/ha + 2% Zn
			High nutrition	Urea @ 60 kg/ha 10th August
Seeding date	Disc	27th May	**Medium nutrition**	Urea @ 120 kg/ha 10th August
	No-till	29th May		
	Strategic	29th May	**Variety**	Flagship barley @ 70 kg/ha

This trial is a randomised complete block design with 3 replicates, each containing 3 tillage treatments and 2 nutrition treatments. The strategic and no-till treatments were sown using local farmers seeding equipment, Michael Jaeschke and Matt Dare. The disc seeding treatments were sown by Jack Desbiolles from the University of South Australia.

Table 1: Previous crops in the long term cropping systems trial at Hart.

2000	2001	2002	2003	2004	2005	2006	2007	2008
Sloop Barley	Canola	Janz Wheat	Yitpi Wheat	SloopSA Barley	Kaspa Peas	Kalka Durum	JNZ Wheat	JNZ Wheat

Tillage treatments:

Disc – sown into standing stubble with a John Deere single opener disc seeder, 275mm (11”) row spacing.

Strategic – worked up pre-seeding, sown with 100mm (4”) wide points at 175mm (7”) row spacing with finger harrows.

No-till – sown into standing stubble in 1 pass with narrow points with 225mm (9”) row spacing and press wheels.

Nutrition treatments:

Medium – 60 kg/ha post emergent urea on 10th August
High – 120 kg/ha post emergent urea on 10th August

In the years 2007 and 2008 an early time of sowing treatment was introduced in the no-till treatment to demonstrate the benefits of dry sowing. In 2009 all no-till treatments were sown on the same day.

Soil nitrogen (0-60cm) was measured on 27th March in all plots.

Bromegrass, annual ryegrass and wildoat densities were counted using 3 counts with a 0.1 metre square quadrat in each plot.

Financial analysis:

A partial gross margin analysis of the trial results between 2000 and 2008 was conducted by Mike Krause of Applied Economic Solutions.

The analysis took into account differences in grain yields, fuel use, labour use and depreciation on the capital items for an area of 1500ha. Weed control, disease control and grain quality were considered the same between the treatments.

Results

The density of brome grass was significantly higher for the early sown no-till treatment (71 plants per square metre) compared to the other sowing systems, averaging 23 plants per square metre. This is due to dry sowing or sowing prior to weed emergence. The disc system had the lowest level of brome grass. However, this result is unexpected given that brome grass has been observed in the disc sowing treatments for many years. The disc also had a significantly lower level of annual ryegrass (19 plants per square metre) compared to the other sowing systems, averaging 103 plants per square metre. The average wild oat density in the cropping system trial was 13 plants per square metre, there was no significant difference between the sowing systems.

Table 2: Grass weed densities (plants per square metre) in the cropping systems trial at Hart in 2009 averaged across the nutrition treatments.

Sowing system	Bromegrass	Annual ryegrass	Wildoats
	Plants per metre square		
Disc	14	19	10
No-till	29	79	16
No-til early	71	92	28
Strategic	26	137	0
LSD (0.1)	33	84	ns

No treatment produced significant differences in grain yield between sowing system or level of nutrition (Table 3 & 4).

Table 3: Grain yield (t/ha), protein (%), retention (%), screenings (%), test weight (kg/hL) and soil N (kg N/ha 0-60cm) averaged across nutrition treatments for sowing system at Hart in 2009.

Sowing system	Grain yield (t/ha)	Protein (%)	Retention (%)	Screenings (%)	Tet weight (kg/hL)	Soil N (kg N/ha 0-60cm)
Disc	4.22	10.6	92.8	5.1	65.2	129
No-till	4.18	11.3	92.7	4.8	64.9	105
Strategic	4.32	11.5	91.7	5.4	64.5	181
LSD (0.05)	ns	0.5	ns	ns	ns	69

Table 4: Grain yield (t/ha), protein (%), retention (%), screenings (%), test weight (kg/hL) and soil N (kg N/ha 0-60cm) averaged across sowing system for nutrition treatments at Hart in 2009.

Nutrition	Grain yield (t/ha)	Protein (%)	Retention (%)	Screenings (%)	Tet weight (kg/hL)	Soil N (kg N/ha 0-60cm)
High	4.156	11.4	91.3	5.8	64.7	147
Med	4.322	10.8	93.5	4.4	65.0	130
LSD (0.05)	ns	0.4	1.9	ns	ns	ns

Higher protein was measured in the no-till and strategic treatments, compared to the disc in 2009. High nutrition also increased the protein to 11.4% compared to 10.8% in the medium treatment. In previous years tillage and nutrition have had little effect on protein (Tables 3 & 4).

Tillage and nutrition treatment did not have a significant impact on test weight and screenings in 2009. Test weights were all above 64kg/hL and screenings averaged 5.1% (Tables 3 & 4). High nutrition produced slightly lower retention (91.3%) compared with medium nutrition (93.5%) and was unaffected by sowing system.

Although soil nitrogen levels were not significantly different between the medium and high nutrition treatments, the high treatment has accumulated 17kg N/ha more than the medium treatment to a depth of 60cm. The strategic sowing system produced the highest soil nitrogen (181 kg N/ha 0-60cm) while the disc treatment is significantly lower (105 kg N/ha 0-60cm).

Financial analysis

The partial gross margin analysis of the results between 2000 and 2008 showed very little difference between the seeding systems or levels of nutrition (Figure 1).

The no-till tillage treatment at medium nutrition is $200/ha above the disc or strategic or $22/ha per year (Figure 1).

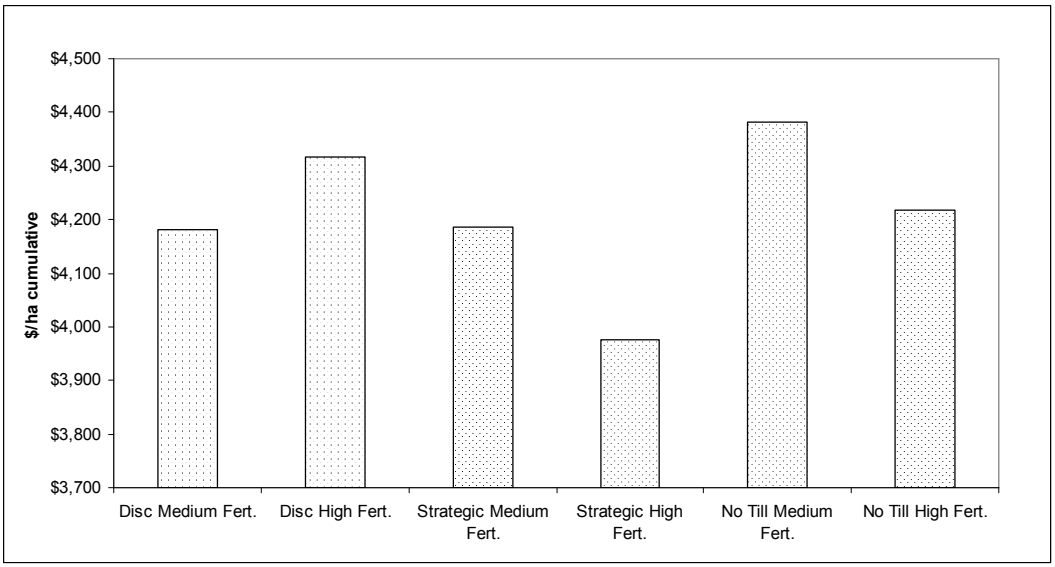

Figure 1: Cumulative partial gross margins for tillage and nutrition treatments at Hart between 2000 and 2008.

Although the cumulative gross margins between the treatments are similar there are differences which were unable to be measured.

- the no-till and disc seeding systems offer growers much greater labour efficiency compared to the strategic system. The gross margins do allow for labour, however, sourcing and maintaining it can be a difficult task.
- these systems also offer the potential for improved time of sowing, being able to sow into marginal soil moisture and using only one pass, in recent years this has proven to generate significant differences in grain yields.
- as farms continue to get bigger the ability to sow quicker becomes more important, and is where disc seeders might have a big advantage.
- strategic cultivation in the strategic treatment means that the reliance on herbicides for pre-sowing and summer weed control is much less. The herbicide costs for this treatment are lower and would help to account for the differences shown in Figure 1.