Long-term cropping systems trial

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Key findings

- Barley grain yield was not affected by tillage treatment averaging 4.25 t/ha.
- The medium nitrogen level increased grain yield by 0.61 t/ha compared to the high nitrogen level.

Why do the trial

To compare the performance of three seeding systems and two nitrogen strategies. This is a rotation trial to assess the longer term effects of seeding systems and higher fertiliser input on soil fertility, crop growth and grain yield and quality.

How was it done?

Plot size	35 m x 13 m	**Fertiliser**	DAP/Urea (22:14:00:05) + 0.8% Zn
Seeding date	29th May 2014	**Medium nutrition**	No extra fertiliser applied
		High nutrition	UAN (42:0) @ 40 L/ha on 8th August
		Variety	Commander barley @ 70 kg/ha

The trial was a randomised complete block design with three replicates, containing three tillage/seeding treatments and two nitrogen treatments. In addition to this, in 2013 all disc treatments were harvested using a stripper front. Both the no-till and strategic stubble height were harvested at 15 cm. The disc, strategic and no-till treatments were sown using local growers Tom Robinson, Michael Jaeschke and Justin Wundke's seeding equipment, respectively.

Figure 1. Crop history of the long-term cropping systems trial at Hart.

2000	2001	2002	2003	2004	2005	2006	2007
Sloop barley	Canola	Janz wheat	Yitpi wheat	Sloop barley	Kaspa peas	Kalka durum	JNZ wheat

2008	2009	2010	2011	2012	2013	2014
JNZ wheat	Flagship barley	Clearfield canola	Correll wheat	Gunyah peas	Cobra wheat	Commander barley

Tillage treatments:

Disc – sown into standing stripper front stubble with John Deere 1980 single discs at 152 mm (6") row spacing, closer wheels and press wheels.

Strategic – worked up pre-seeding, sown with 100 mm (4") wide points at 200 mm (8") row spacing with finger harrows.

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

Nutrition treatments:

Medium – No extra fertiliser applied post seeding.
High – Extra nitrogen was applied as UAN (42:0) at 40 L/ha on the 8th of August

All plots were assessed for soil available nitrogen (0-30, 30-60 cm) on the 12th of April and soil carbon (loss on ignition method) on the 22nd of May. Plant establishment was assessed by counting 4 x 1 m sections of row across each plot. All plots were assessed for grain yield, protein, test weight, screenings with a 2.2 mm screen and retention with a 2.5 mm screen.

Results and discussion

Soil available nitrogen (N) to a depth of 60 cm was measured in autumn and ranged between 134 kg N/ha (disc, medium) to 160 kg N/ha (no-till, high). The high nutrition treatment had not accumulated more N compared to the medium treatment with an average difference of 8 kg N/ha.

Soil organic carbon levels ranged from 1.57% to 2.18% across all treatments in 2014. In comparison, the native vegetation area at the site contained 5.20% (data not shown) soil organic carbon.

Crop emergence was highest for the disc and no-till treatments with 149 and 144 plants per square metre, respectively. The strategic treatment had the lowest crop establishment with 118 plants per square metre.

Table 1. Available soil nitrogen (kg/ha) and plant emergence (plants/m^2) and soil organic carbon (%) for nutrition and tillage treatments in 2014.

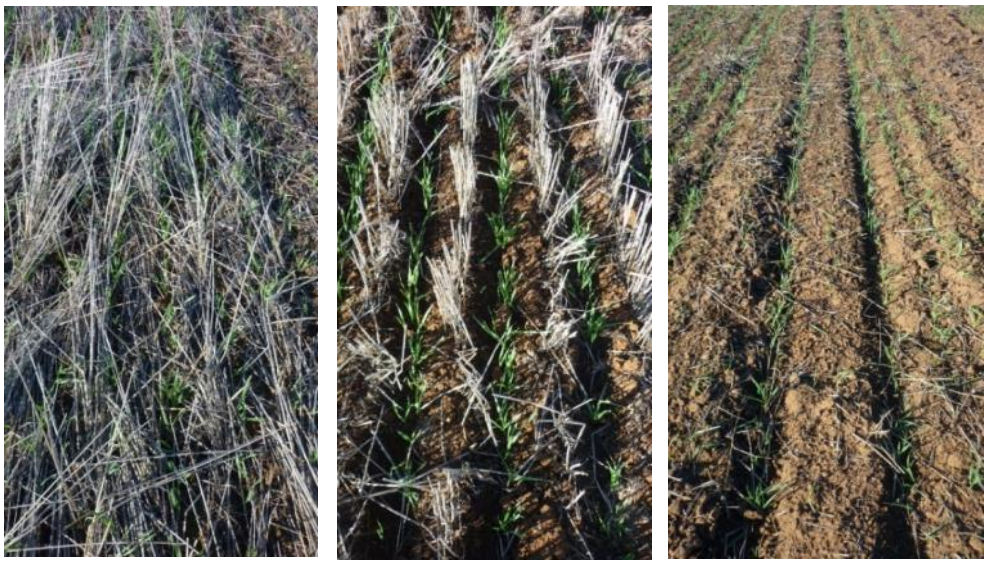
Tillage	Nutiriton	Available soil N kg N/ha	Emergence plants/m2	Soil organic carbon %
Strategic	Medium	140	122	1.98
	High	154	114	1.99
Disc	Medium	134	137	1.97
	High	140	160	2.18
No-till	Medium	155	147	1.57
	High	160	141	1.89
LSD (P≤0.05)				
Tillage		ns	25	ns
Nutrition		ns	ns	ns
Tillage × Nutrition		ns	ns	ns

Tillage treatment did not affect the grain yield of Commander barley in this trial with an average grain yield of 4.25 t/ha. Tillage treatment also had no effect on grain quality parameters test weight, screenings and retention. Grain protein was significantly higher for the strategic treatments however, this can be attributed to the poor crop emergence and growth in this treatment in 2013. These findings support the general conclusion from the previous 14 years of this trial, which is no one tillage/seeding system consistently yields higher than another.

Table 2. Grain yield (t/ha), protein (%), test weight (kg/hL), screenings (%) and retention (%) for nutrition and tillage treatments in 2014. There was no significant interaction between tillage × nutrition.

Tillage	Nutiriton	Yield t/ha	Protein %	Test weight kg/hL	Screenings %	Retention %
Strategic	Medium	4.44	12.9	67.9	11.1	53.5
	High	3.85	15.0	65.6	26.8	23.4
Disc	Medium	4.54	11.9	69.5	6.5	68.5
	High	3.96	13.9	65.8	24.1	31.8
No-till	Medium	4.69	11.1	70.1	5.9	71.8
	High	4.04	14.1	66.4	28.2	29.2
LSD (P≤0.05)						
Tillage		ns	1.0	ns	ns	ns
Nutrition		0.2	0.8	1.4	ns	12.6

Nutrition treatment affected grain yield and all quality parameters measured (Table 2). The medium nutrition treatment yielded 0.61 t/ha more compared to the high nutrition treatments. In general the medium treatment had better test weight, screening, retention and protein levels (within 9-12% for malt classification) compared to the high nutrition treatment. This can be attributed to the above average rainfall early in the season setting yield potentials high (see Yield Prophet® article on page 90) followed by below average rainfall from August onwards. This led to a situation of too much N in the high nutrition treatment for the yield potential, increasing protein levels and screenings at the same time.



Photos: (L-R) Commander barley sown with a disc seeder into stripper front stubble, no-till treatment and strategic tillage treatment taken on 18th June, 2014.

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