Long term comparison of seeding systems

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Key findings

- Seeding system had a significant effect on wheat grain yield with the disc treatment averaging 4.1 t/ha compared to the no-till and strategic systems which averaged 3.5 and 3.4 t/ha, respectively.
- The higher nitrogen treatments increased grain protein levels and screenings, while decreasing test weight across all seeding systems.

Why do the trial?

To compare the performance of three seeding systems and two nitrogen (N) strategies. This is a rotation trial (Figure 1) to assess the longer term effects of seeding systems and higher fertiliser input systems on soil fertility, crop growth, and grain yield and quality.

How was it done?

Plot size	35 m x 13 m	**Fertiliser**	DAP (18:20) @ 100 kg/ha
Seeding date	27th May 2017 (no-till and strategic), 1st of June 2017 (disc)	**Medium nutrition**	Urea (46:0) @ 75 kg/ha on 28th July
		High nutrition	Urea (46:0) @ 75 kg/ha on 28th July UAN (42:0) @ 70 L/ha on 12th Sept
Variety	Scepter wheat @ 100 kg/ha		

The trial was a randomised complete block design with three replicates, containing three tillage/seeding treatments and two N treatments. In addition to this in 2016 all disc treatments were harvested at 31 cm using a draper front (in place of a stripper front) due to lodging, while both the no-till and strategic treatments were harvested lower at 16 cm stubble height.

The disc, strategic and no-till treatments were sown using local growers Tom Robinson, Michael Jaeschke and Matt Dare'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	2008
Sloop Barley	ATR-Hyden Canola TT	Janz Wheat	Yitpi Wheat	Sloop Barley	Kaspa Peas	Kalka Durum	Janz Wheat	Janz Wheat

2009	2010	2011	2012	2013	2014	2015	2016	2017
Flagship Barley	Clearfield Canola	Correll Wheat	Gunyah Peas	Cobra Wheat	Commander Barley	44Y89 CL Canola	Scepter Wheat	Scepter Wheat

Seeding treatments:

- Disc – sown into standing stubble in one pass with a John Deere 1980 single disc 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 a Flexicoil 5000 drill, 16 mm knife points with 254 mm (9") row spacing and press wheels.

Nutrition Treatments:

- Medium – starter fertiliser plus one in-season N application.
- High – starter fertiliser plus two in-season N applications as Urea or UAN.

All plots were assessed for soil available N (0-20, 20-40, 40-60 and 60-80 cm depths) on the 10th of May. Nitrogen mineralisation potential was estimated using a 21-day laboratory incubation method (Gupta et al. 1994) where 75 g soil was wet up to 18% moisture and incubated at 25°C.

Plant establishment and tiller number was assessed by counting 4 x 1 m sections of row across each plot on the 22nd of June at GS13 (three leaf) and 28th of July at GS30 (start stem elongation), respectively. Plots were scanned using a Greenseeker® to measure crop canopy greenness at GS31 (first node) on 14th of August. All plots were assessed for grain yield, protein, test weight and screenings at harvest (6th December).

Results and discussion

Soil available N to a depth of 80 cm was measured in autumn and ranged between 64 kg N/ha (disc, medium) to 112 kg N/ha (strategic, high) (Figure 2). The high nutrition treatment had accumulated 70 kg N/ha more available N compared to the medium treatment with an average difference of 23 kg N/ha. Seeding system also had a significant effect on available N with the strategic system recording an average 23 kg N/ha more available N than the no-till and disc seeding treatments.

On average all treatments mineralised 19 kg N/ha in the lab incubation. There were no differences in soil mineralisable N among seeders and N rates. This is surprising, given the higher amount of N available in some treatments (Figure 2) to assist with stubble (carbon) decomposition. This outcome has been consistent across two seasons and indicates a value of 20 kg N/ha could be used to assist with N fertiliser calculations in-season at Hart.

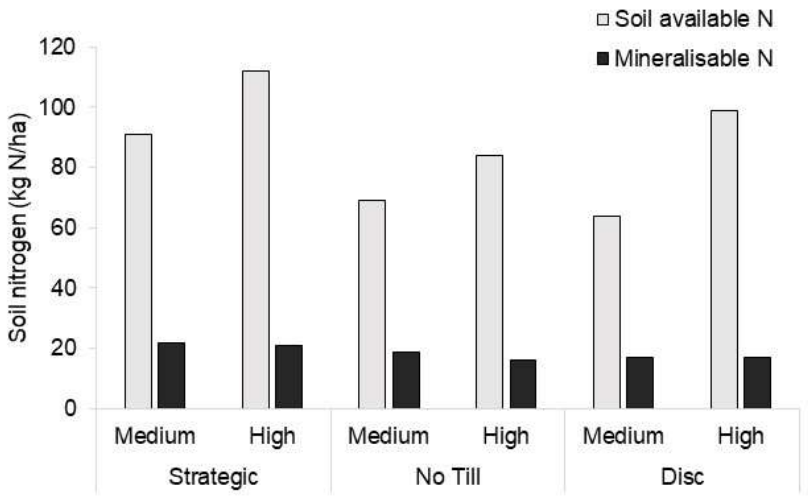

Figure 2. Soil available nitrogen pre-seeding (seeder LSD = 15 and nutrition LSD = 12 at P≤0.05) and mineralisable nitrogen potential (not sig).

Plant establishment and tiller counts indicate there was uniform plant establishment across the seeding systems (Table 2). The NDVI results also show there was little variation among the seeding systems and N rates.

Table 2. Plant establishment and tiller count (number/m²), and NDVI for seeding and nutrition treatments in 2017. There was no significant interaction between seeding system × nutrition treatment or either factor on their own.

Seeding System	Nutrition Treatment	Plant count	Tiller count	NDVI
		number/m²		
Strategic	Medium	148	392	0.47
	High	163	388	0.49
No Till	Medium	161	462	0.51
	High	143	337	0.47
Disc	Medium	148	398	0.56
	High	154	421	0.52

Seeding system had an effect on yield with the disc system averaging 4.1 t/ha, compared to the no-till and strategic systems which on average yielded 3.5 t/ha and 3.4 t/ha, respectively (Table 3). This could be linked to the disc treatments increased stubble load reducing the effects of evaporation throughout the growing season when rain events were limited.

The nutrition treatment effect on yield was not significant. This could be attributed to the lack of growing season rainfall for the crop to utilise the higher N application.

Grain protein was significantly higher for the high nutrition treatment. This is due to the additional N applied in season and the extra 70 kg N/ha of soil available N under this treatment pre-seeding. For the other quality parameters seeding system and nutrition treatments both had an effect. For grain test weight the no-till treatment averaged 75.6 kg/hL, compared to 74.6 kg/hL and 73.6 kg/hL for the strategic and disc treatments, respectively. The higher nutrition treatment also decreased the test weights in each seeding system, this is correlated to the increase in the percentage of screenings found in these treatments.

Table 3. Grain yield (t/ha), protein (%), test weight (kg/hL) and screenings (%) for nutrition and seeding treatments in 2017.

Seeding System	Nutrition Treatment	Yield t/ha	Protein %	Test Weight kg/hL	Screenings %
Strategic	Medium	3.54	7.0	75.4	1.9
	High	3.28	12.2	73.8	3.9
No Till	Medium	3.53	6.7	76.6	1.1
	High	3.47	10.6	74.6	3.3
Disc	Medium	4.07	6.4	74.6	1.3
	High	4.13	9.5	72.7	4.5
	LSD (P≤0.05)				
	Seeder	0.2	0.5	1.0	ns
	Nutrition	ns	0.4	0.8	0.8
	Seeder × Nutrition	ns	0.7	ns	ns

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Sowing the long term seeding systems trial in 2015