

Long term comparison of seeding systems

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Key findings

- Seeding systems did not affect wheat grain yield, averaging 5.3 t/ha.
- Good rainfall and cool temperatures during grain fill increased yield potential and the higher N rate resulted in a 1.2 t/ha yield advantage.
- Available soil N pre-seeding ranged from 80 – 190 kg N/ha with 75 kg N/ha more accumulated under the high N rate.

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	MAP (10:22) at seeding @ 70 kg/ha
Seeding date	24 th May 2016 (disc and no-till) 25 th May (strategic)	Medium nutrition High nutrition	UAN (42:0) @ 75 L/ha on 9 th Aug UAN (42:0) @ 75 L/ha on 9 th Aug and 75 L/ha on 29 th Aug Twin Zn (700 g/L Zn) @ 0.5 L/ha on 12 th Sept
Variety	Scepter wheat @ 107 kg/ha (Figure 1)		

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 2015 all disc treatments were harvested using a stripper front. Both the no-till and strategic stubble height were harvested at 15 cm. Snails were a significant issue in the 2015 canola phase and the trial was cabled and baited over Summer to provide control (Figure 2). Prior to this standing stubble load in the disc treatments was 1.2 t/ha and 0.6 t/ha for the no-till and strategic treatments.

The disc, strategic and no-till treatments were sown using local growers Tom Robinson, Michael Jaeschke and Matt Dare's seeding equipment, respectively.

2000	2001	2002	2003	2004	2005	2006	2007		
Sloop barley	ATR-Hyden canola TT	Janz wheat	Yitpi wheat	Sloop barley	Kaspa peas	Kalka durum	Janz wheat		
2008	2009	2010	2011	2012	2013	2014	2015	2016	
Janz wheat	Flagship barley	Clearfield canola	Correll wheat	Gunyah peas	Cobra wheat	Commander barley	44Y89 (CL) canola	Scepter wheat	

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

Seeding treatments:

- Disc – sown into standing stripper front stubble with 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 (district practice).
- High – starter fertiliser plus two in-season N applications and Zn.

All plots were assessed for soil available N (0-20, 20-40, 40-60 and 60-80 cm) on the 15th of April. 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 20th of June at GS13 (three leaf) and 29th July at GS30 (start stem elongation), respectively. Plots were scanned using a Greenseeker® to measure crop canopy greenness at GS31 (first node) on 12 of August. All plots were assessed for grain yield, protein, test weight and screenings at harvest (6th December).



Figure 2. (Left to right) Scepter wheat sown in the strategic, no-till and disc treatment on 20th June, 2016. Canola stubble was cabled for snail control during Summer.

Results and discussion

Soil available N was measured in Autumn and ranged between 80 kg N/ha (disc, medium) and 190 kg N/ha (strategic, high). The high nutrition treatment had accumulated 75 kg N/ha more compared to the medium treatment averaging 88 kg N/ha and 163 kg N/ha, respectively (Figure 3). This difference is a result of the additional N applied and the low yielding canola crop in 2015 which left residual fertiliser N in the system. Seeding system however, did not affect the amount of available soil N pre-seeding.

The potentially mineralisable N in-season followed a similar pattern with 10 kg N/ha more available in the high nutrition treatment. The trial average N mineralisation potential was 27 kg N/ha which may have been taken up by the crop or incorporated back into the soil microbial pool.

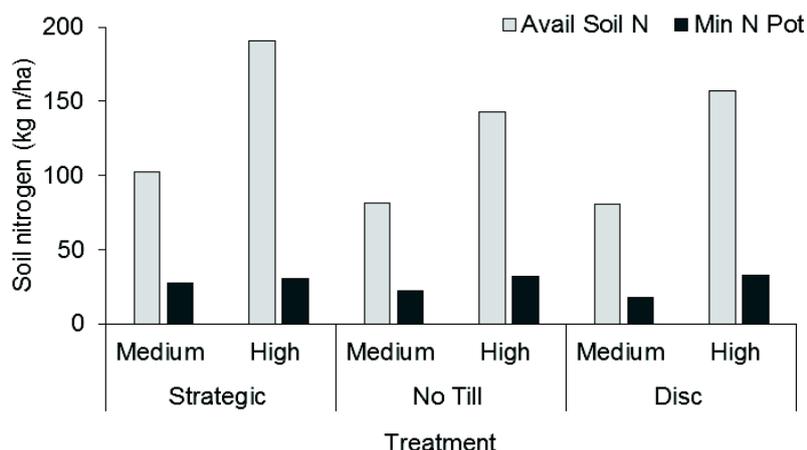


Figure 3. Soil available nitrogen pre-seeding (nutrition LSD = 27 at $P \leq 0.05$) and mineralisation N potential (nutrition LSD = 3.7 at $P \leq 0.05$).

Plant establishment and tiller number was highest for disc seeding systems 206 and 450 counts per square metre, respectively (Table 1). This high plant and tiller number also corresponded to a high NDVI value for 0.70. The remaining seeding systems did not differ in crop growth measures. This result is not consistent with previous years where more uniform establishment and tiller number has been observed across all three seeding systems.

Table 1. Plant establishment and tiller count (number/m²) and NDVI for seeding treatments in 2016.

Seeder	Plant count number/m ²	Tiller count number/m ²	NDVI
Strategic	134 ^b	263 ^b	0.58 ^b
No Till	141 ^b	301 ^b	0.60 ^b
Disc	206 ^a	450 ^a	0.70 ^a
LSD seeder ($P \leq 0.05$)	22	49	0.07

Seeding system had little effect on wheat grain yield, averaging 5.3 t/ha (Table 2). The cooler and wet finish to 2016 allowed good grain fill and as a result the high nutrition out yielded the medium across all seeding systems on average by 1.2 t/ha. Similarly the higher nutrition treatment had a higher protein content but, overall N was limiting and protein levels were low (Table 2). No differences were observed in test weight with all treatments higher than the required 76 kg/hL (minimum required for maximum grade). Screening level across the trial were low averaging, 1.2%.

Table 2. Grain yield (t/ha), protein (%), test weight (kg/hL) and screenings (%) for nutrition and seeding treatments in 2016.

		Grain yield	Protein	Test weight	Screenings
		t/ha	%	kg/hL	%
Strategic	Medium	4.8 ^b	8.3	81.4	1.1
	High	5.9 ^a	10.3	80.8	1.3
No Till	Medium	4.2 ^c	6.7	81.4	1.2
	High	5.8 ^a	9.8	79.6	1.6
Disc	Medium	5.0 ^b	7.4	81.4	1.2
	High	5.9 ^a	9.3	81.3	1.0
LSD nutrition (P≤0.05)			0.5	ns	
LSD seeder x nutrition (P≤0.05)		0.3	ns	ns	0.2

Read the full summary of 16 years of results at <http://www.hartfieldsite.org.au/pages/trials-results/hart-long-term-seeding-systems-trial.php>.

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Tom Robinson seeding the disc plots in the trial (above left), Matt Dare seeding the no-till treatments (above right), Hart 2016.



Third year UofA ag students taking plant sampling in the trial (above left), Greg Butler and James Barr talking to farmers about innovative seeding technology at the Hart Field Day 2016 (above right).