Long-term comparison of seeding systems

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Key findings

- Available soil nitrogen pre-seeding ranged from 41 to 115 kg N/ha. The high nutrition treatment had accumulated 44 kg N/ha more soil available nitrogen compared to the medium nutrition treatment.
- There was no effect of historic nitrogen application on grain yield. However grain protein was improved in the high compared to medium nutrition treatment (13.4% vs 11.7%).
- Wheat grain yields ranged from 2.3 to 3.0 t/ha. There were grain yield differences among seeder types this season with disc seeder > strategic > no-till.

Why do the trial?

The Hart cropping systems is unique, running since 2000, the trial provides SA grain growers with information on the long-term effects of cropping systems (a combination of seeders, tillage and stubble management) and nitrogen fertiliser regime. There continues to be industry interest in disc seeders due to their ability to retain heavy stubble, minimise soil disturbance, increased seeding speed and seed depth uniformity. To date the trial has shown no one seeding system or nutrition regime is consistently higher in grain yield, quality or gross margin.

The trial aims to compare the performance of three seeding systems and two nitrogen (N) strategies. This is a rotation trial (Figure 1) to assess the long-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	44 m x 13 m	**Fertiliser**	MAP (10:22) at seeding @ 50 kg/ha
Seeding date	May 27 - Disc May 29 - No-till and Strategic	**Medium nutrition**	Urea (46:0) @ 70 kg/ha on Aug 10
		High nutrition	Urea (46:0) @ 70 kg/ha on Aug 10 Easy N (42.5:0) @ 80 L/ha on Sept 11
Variety	Scepter Wheat @ 100 kg/ha		
Harvest date	December 9, 2020		
Location	Hart, SA		

The trial was a randomised complete block design with three replicates, containing three tillage/seeding treatments and two N treatments. Wheat stubble was uniformly managed across the trial area coming into 2020. The trial was managed with the application of pesticides to ensure a weed, insect and disease-free canopy.

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
Janz wheat	Flagship barley	Clearfield canola	Correll wheat	Gunyah peas	Cobra wheat	Commander barley	44Y89 (CL) canola

2016	2017	2018	2019	2020
Scepter wheat	Scepter wheat	Wharton field pea	Sheriff CL wheat	Scepter Wheat

Figure 1. Crop history of the long-term cropping systems trial at Hart 2000 – 2020.

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

Seeding treatments:

Disc – sown into standing stripper front stubble with John Deere 1890 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 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 (refer to previous page)

High – starter fertiliser plus two in-season N applications (refer to previous page)

All plots were assessed for soil available N (0-20, 20-40, 40-60 and 60-80 cm) at the start of May, 2020. Plant establishment was assessed by counting 4 x 1 m sections of row and NDVI in each plot on July 6 and August 22, 2020. All plots were assessed for grain yield at harvest. All data was analysed using ANOVA in Genstat.

Results and discussion

Soil available nitrogen

Soil available N was measured in autumn (following wheat in 2019) and ranged between 41 kg N/ha to 115 kg N/ha (Figure 2). The high nutrition treatment had accumulated 44 kg N/ha more, averaging 91 kg N/ha for the high and 47 kg N/ha for the medium treatment. This difference indicates there was higher amounts of N carried over from the high treatment compared to the medium under dry 2019 seasonal conditions.

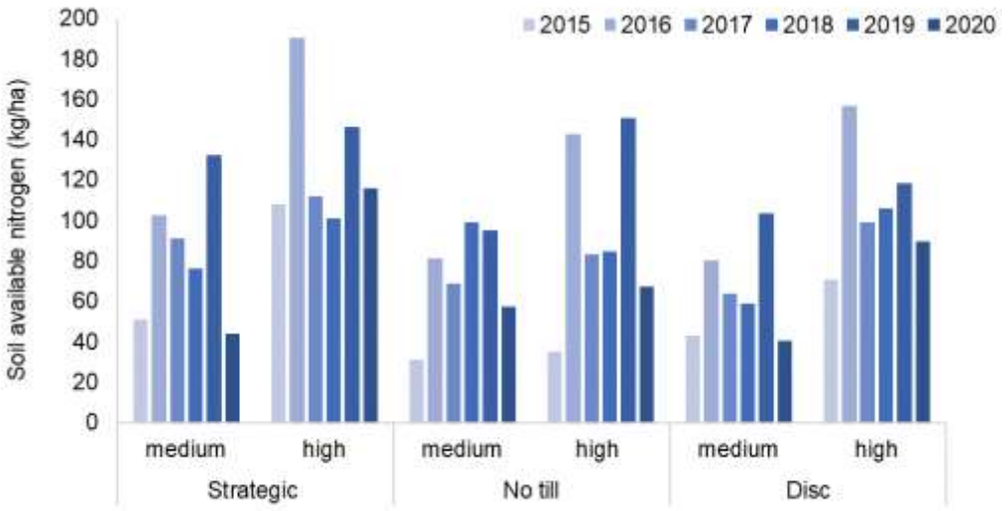

Figure 2. Soil available nitrogen (kg N/ha) pre-seeding for Hart long-term seeding systems trial from 2015 – 2020.

Plant establishment and NDVI

This season plant establishment was higher (271 plants/m^2) in the disc sown treatments compared to the no-till and strategic treatments (187 and 194 plant/m^2). The target plant density of the wheat seed source was 220 plants/m^2. This higher plant number translated to a higher NDVI (0.20 compared to 0.16) at the early July assessment. After six weeks this NDVI difference disappeared with all seeding systems averaging 0.41.

Historic and current nutrition regime had no effect on plant establishment or NDVI this season. At the July and August assessments soil moisture and rainfall at Hart had been low, resulting in similar N uptake in all treatments.

Grain yield and quality

Wheat grain yields across the trial ranged from 2.3 to 3.0 t/ha (Table 1). The dry winter combined with later seeding dates (late May - early June) reduced yield potential. The disc seeder provided the highest yields at 3.0 t/ha followed by the strategic and no-till seeders at 2.6 t/ha and 2.3 t/ha respectively. In the last five seasons (Table 1), all years have resulted in grain yield differences among the seeding systems. In seasons where yield differences were observed, generally the no-till and disc alone or together outperformed the strategic treatment. However, across the last 20 years of research one of the main outcomes from this trial has been a positive one for growers, in that there is no one seeding systems that gives consistently higher yields.

Grain quality values for screenings and test weight were not affected by seeding system or nutrition treatment (data not shown). The trial average screening level was less than 1.0% and test weights averaged 82 kg/hL. This lack of difference in grain quality among the seeder and nutrition treatments is consistent across the history of the trial.

Grain protein levels were high as a result of carry-over soil available N pre-seeding (Figure 2) and the accumulation of 44 kg N/ha more under the high nutrition treatment. It is not surprising that this translated to protein differences between the medium 11.7% (H2 classification) and high 13.4% (H1 classification) nutrition treatments.

Table 1. Grain yield (t/ha) for all seeder and nutrition treatments for the past five seasons.

Seeder type	Fertiliser strategy	2016 Wheat	2017 Wheat	2018 Field pea	2019 Wheat	2020 Wheat	
		Grain yield (t/ha)					Protein (%)
Strategic	Medium	4.8	4.8	0.8	1.3	2.6	11.7
	High	5.9	5.9	0.7	1.2	2.7	13.6
No Till	Medium	4.2	4.2	0.9	0.9	2.3	13.1
	High	5.8	5.8	1.0	1.1	2.4	13.9
Disc	Medium	5.0	5.0	0.7	1.3	3.0	10.3
	High	5.9	5.9	0.7	1.3	3.0	12.9
LSD nutrition (P≤0.05)				*NS*	*NS*	*NS*	
LSD seeder (P≤0.05)				*0.2*	*0.1*	*0.2*	
LSD seeder x nutrition (P≤0.05)		*0.3*	*0.3*	*NS*	*NS*	*NS*	*0.7*

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

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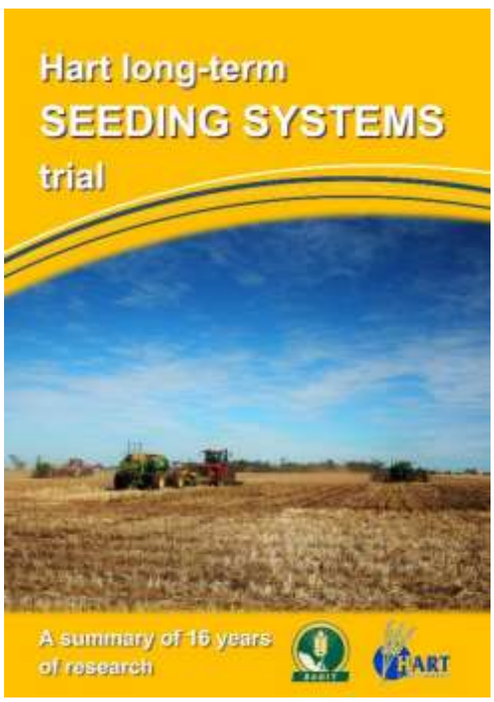

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- Ten tips for early sown wheat
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- Soil Organic Matters – can soil carbon be increased through stubble retention
- Nitrogen management in wheat – why are nitrous oxide emissions an issue

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