

No-Till on Stony Soils

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Key messages:

- Wheat established by no-till yielded at least as well as full cut sowing on stony soils in 2009.
- Seed scattered on soil surface germinated at Lock in 2009!
- Hydraulic tines, K-Hart discs and Canadian design points are excellent options for no-till on stony soils.

Aims:

- To find no-till systems which establish successful crops on stony and deeper soil types.

Background:

No-till crop establishment in stony soil can be a challenge, particularly when using knife point systems with spring tines. Maintaining seed placement, whilst minimising damage to machinery over stony reefs is a tricky balance to achieve. This is the third in a series of trials investigating options for no-till sowing in stony soils.

About the trial:

The trial was sown at Lock (central Eyre Peninsula) using a 6 row plot seeder set on 254 mm row spacing. Wyalkatchem wheat was sown at 60 kg/ha with 60 kg/ha of DAP banded with the seed.

The trial was sown into excellent moisture conditions on 27-28 May over a limestone ridge and a calcareous clay loam, so a comparison of seeding systems could be made over both soil types.

Treatments used included the K-Hart disc, Rock Hopper, Agpoint, Agmaster, 250 mm Sweeps, Conservapak and DBS systems. Three front delivery points were also tested: the standard Atom-Jet; Atom-Jet Mallee point; and, the Bourgault front delivery point.

The basic Atom-Jet point is designed to deliver seed through the front of the point, to the bottom of the working depth. The Bourgault point used in the trial is a variation of the Atom-Jet design, but incorporates an interchangeable cast point, rather than a hardened steel and tungsten point like the Atom-Jet. The third variation of this design is manufactured by Atom-Jet for the Australian market as the "Mallee Point" which is intended to provide some tillage under the seed.

The Rock hopper point is a unique design with a backward rake angle which pushes rocks into the soil like a disc does, rather than pull them out.

The sowing system of Agmaster points and Agmor Boots was used as a standard control, with which several sowing variations were trialled: working shallow, working deep, using snake chains, using Agmaster wing points and sowing at 10 km/h.

All treatments were sown at 6 km/h however two contrasts were made with the disc and knife point system to see if sowing at 10 km/h would have any adverse effects on seed placement.

All treatments except the DBS, Conservapak and K-Hart disc systems were sown using Flexi-Coil 350 lb trip tines.

Assessments:

The collection of data at the trial site included:

- Emergence (21 days after seeding)
- Plot yield
- Grain quality

Results:

The crop established well with excellent moisture at sowing. The conditions were moist enough after sowing that seed which was scattered on the surface when the tines were breaking out was able to germinate, establish a root system and a viable plant.

Most sowing systems maintained sowing depth greater than 20 mm in the stony soil. The Agpoint + Agmor system was shallower due to incorrect setup of the Agmor boot, which was rectified in the subsequent treatments. The Agmaster wing point + Agmor boot, Agmaster point + Agmor boot, Agmaster point + Agmaster Flexi-boot, Atom-Jet Mallee point all had a significantly shallower seed placement in the stony soil. All other systems were able to maintain similar seed placement in both soil types.

There were no differences in crop emergence measured on the deeper soil. On the stony soil however, there were some differences observed. The Agpoint + Agmor boot system was one of the poorer emerging treatments, most likely due to shallow seed placement from incorrect boot setup. K-Hart discs at 10 km/h, Agmaster points + Agmor boots at 10 km/h, Rock Hopper + Agmor boots, Agmaster points + Agmor boots, Agmaster wing points + Agmor boots, Agmaster points + Agmor Boots + snake chains, Agmaster points + Agmor boots working shallow, sweeps + harrows, Atom-Jet and DBS had higher levels of crop emergence on the stony soil than the remaining treatments (Table1).

Increasing sowing speed from 6 to 10 km/h with the K-Hart disc and Agmaster and Agmor systems did not have any impact on seed placement or crop emergence. The faster sowing speed resulted in a much more violent breaking out of tines over stone. This would have a significant impact on machinery maintenance. The disc system yielded the same with both sowing speeds, however the Agmaster + Agmor system suffered a yield penalty for faster sowing speed on the deep soil, but not on the stony soil.

In terms of grain yield achieved on the stony soil, the DBS system performed better than the Conservapak, Agmaster points + Agmor boots, Agmaster points + Agmor boots @ 10 km/h, Agmaster points + Agmaster Flexi Boot, Atom-Jet Mallee point and sweeps + harrows treatments (table 1)

The DBS system and Agmaster point + Agmor boot working deep treatments yielded more than the Atom-Jet Mallee point system and the sweeps + Agmor boot systems.

Shallower working of the Agmaster + Agmor system (ie lifting machine out over stony reefs) resulted in seed placement on the stony soil reducing from 30 mm to 17.8 mm. There were no differences in crop emergence for the shallower seed placement or final grain yield.

There were no benefits or penalties for working the points deeper in either soil type.

The addition of snake chains did not increase seed depth or contribute to any difference in crop emergence. Using snake chains, however did result in a yield reduction on the deep soil, however there were no differences on the stony soil.

The K-Hart discs performed as well as the tine treatments for crop establishment on both soil types. The slower sowing speed resulted in a lower grain yield than the best tine systems on the deep soil, but the discs performed as well as the best tine systems on the stony soil. At the faster (more typical) travel speed, the discs grew as much grain as the best tine systems on the deep soil type.



Table 1. Seeding system impact on wheat performance on stony and deep soil at Lock in 2009

Opener	Technology	Other sowing treatments	Emergence Depth (mm)		Emergence (Plants/m ²)		Grain Yield (t/ha)	
			Soil	Stone	Soil	Stone	Soil	Stone
K-Hart		6 km/h	30.6	28.3	155	122	1.85	1.12
K-Hart		10 km/h	26.3	30.6	172	1587.5	1.91	1.14
Rock Hopper	Agmor		19.7	23.6	143	148	1.89	1.13
Agpoint	Agmor		23.1	19.8	137	90.0	1.62	1.09
Agmaster	Agmor	Wing Point	44.4	29.4	150	142	1.96	1.11
Agmaster	Agmor		48.1	30.3	148	145	2.08	1.04
Agmaster	Agmor	10 km/h	41.9	34.5	157	150	1.52	1.01
Agmaster	Agmor	10 mm Snake Chains	43.1	39.5	169	142	1.79	1.19
Agmaster	Agmor	Work Deep	39.7	28.1	176	116	1.73	1.23
Sweeps	Agmor	Star Harrows	53.1	54.5	140	139	1.68	0.98
Agmaster	Agmaster Flexi-Boot		48.1	31.9	118	123	1.60	1.01
Agmaster	Agmor	Work Shallow	30.9	17.8	152	141	1.89	1.16
Atom-Jet	Front delivery boot		45.9	35.6	165	127	2.05	1.17
Atom-Jet Mallee	Front delivery boot		43.8	29.1	165	109	1.60	0.99
Bourgault	Front delivery boot		54.4	43.0	172	115	1.92	1.10
Conservapak			54.1	49.2	129	106	1.62	1.05
DBS			29.7	34.4	156	124	2.10	1.28
LSD P=0.05			13		NS	39	0.22	

All of the no-till treatments yielded at least as well as the full cut treatment, which by default guarantees some soil on the top of seed in stony soil which can be an advantage.

The Atom-Jet concept of a front delivery point system has the most merit on stony soils. The shallower working depth is ideally situated for sowing into stony soils as less steel is in the ground. The standard Atom-Jet point and the similar Bourgault design yielded similarly to the highest yielding treatments in the trial on stony soil.

The K-Hart disc performed well in 2009, which is a viable option for growers to reduce their downtime at seeding, increase their overall work rate with faster travel speed, as well as reduce the amount of stone brought to the surface by tines.

Hydraulic tines are an obvious choice for growers looking to optimise their seeding success in stony soils. The DBS system utilises hydraulic tines, which was one of the higher yielding treatments sown.

Growers have overcome serious delays at seeding time through downtime with the use of hydraulic tines. Whilst searching for a suitable site for the stony soils trials, the author saw some rocky country which is sown with knife points and hydraulic tines (with minimal breakdowns) which must have been a horrible nightmare with spring tines.

Breakout characteristics of tines can have a significant impact on how well they perform in stone. The tip of the knifepoint needs to be behind the pivot point of the tine. If this is not the case, when the point strikes an obstacle like a rock, it will dig deeper before it begins lifting out to jump over the barrier. This places greater force at the point of impact as well as a greater recoil speed upon re-entry. The breakout pressure works best if it increases to a maximum (to keep the tine in the ground while sowing), however reduces as the tine lifts out over an obstacle, such as a rock.

Regardless of seeding system chosen for stony soil, it is critical to optimise seed placement on deep soil as well as provide adequate backfill on shallow ground to maintain seed depth, resulting in an acceptable result on all soil types. The seeding system also needs to be robust enough to take the wear of sowing into stone. This can be a challenge and is where the advantage of a hydraulic tine or disc system is greatest.

Who's Involved:

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