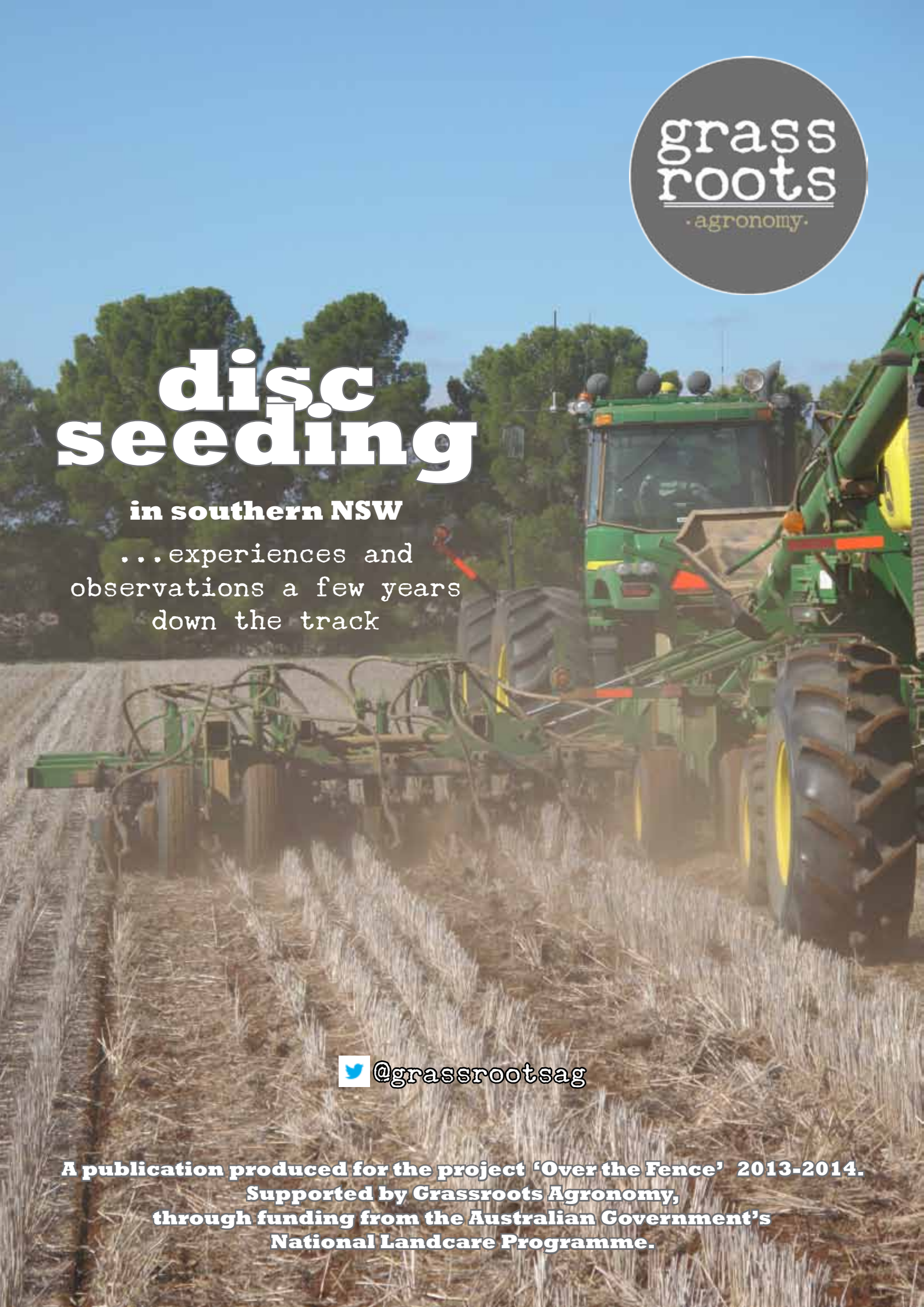

grass roots
·agronomy·

disc seeding

in southern NSW

...experiences and observations a few years down the track

@grassrootsag

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"Disc seeding has really improved the ability to sow through stubble in the medium rainfall zone, but it does require a change in management practices. A tyne system is generally more flexible, but usually requires stubble to be managed post harvest for best results."

pros and cons of disc seeding...

pros

- allows sowing in marginal moisture, providing earlier sowing opportunities
- better moisture retention through the growing season
- minimal soil disturbance, less dust and clods, with improved soil structure
- penetrates heavier stubble loads without the need for mulching post harvest
- allows narrow row spacing in retained stubble for crop competition
- reduces disturbance of weed seeds
- faster sowing speeds
- generally lower draft requirements
- complements CTF (controlled traffic) systems

cons

- hair pinning, where straw is bent into the furrow instead of cut through by the discs, resulting in patchy establishment
- limited ability to penetrate compacted soils, eg. surface compaction from crop grazing in mixed farming systems; best suited to CTF systems
- reduced early vigour, although crops generally compensate through the season
- increased rhizoctonia in cereals, particularly following the change-over from a tyne seeder
- increased risk of fertiliser toxicity, fertiliser is concentrated in a more confined seed bed
- not suitable for lime incorporation
- increased risk of herbicide damage, with no pre-emergent herbicides currently registered for use with disc seeders

the nuts and bolts...

further reading:
'Disc seeding in zero-till farming systems'
M. Ashworth et al
WANTFA, 2010

some local trials...

disc v tyne

The disc vs tyne seeder demonstration trial has been running at 'Hillside', Illabo NSW since 2008. The trial was initiated by grower Tony Lehmann, who had then recently bought a disc seeder and wanted to compare it to a tyne system in a side-by-side, 16ha paddock scale trial.

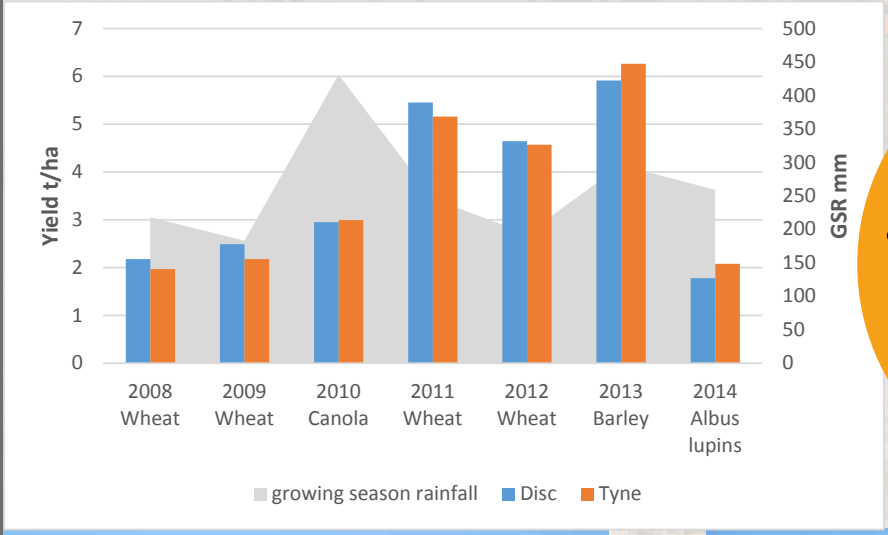
FarmLink Research and Grassroots Agronomy have helped co-ordinate the trial which has received much attention over the years, including a feature on ABC's Landline in 2014.

ABC Landline

Although yield results haven't favoured any particular system, a few observations have been made over time:

- the disc system seems to have performed better in drier seasons
- in the first few years, summer broadleaf weeds were more prevalent in the tyne area
- surface germinating winter grass weeds appeared to be more prevalent in the disc area

	Flexi-Coil tyne + press wheels	John Deere single disc
2008		
2010		



It's important to remember that a disc seeder is only one part of a zero till system. All the other components - including stubble retention, CTF, summer fallow management and early sowing - are critical to make the most of every drop of available rainfall.

stubble height

Cutting stubble high can be an advantage in disc systems to reduce the amount of straw left on the ground and therefore minimise hair-pinning at sowing. But what effect is the tall stubble having on canola performance?

A demonstration trial was established at harvest 2013 in a Gregory wheat stubble near Cootamundra, NSW. Using a commercial header, 12m wide strips were harvested at 150mm, 260mm and 500mm stubble heights (see 'December 2013' photos below). Straw from the 150mm height was funnelled into a narrow windrow for burning (NWB), the 260mm height was harvested with straw spreaders both on and off, and the spreaders were on for the 500mm height.

The paddock was sown to Gem TT canola in April 2014 with a 12m Boss disc seeder (CTF system), inter-row sowing on 250mm row spacing. The effects of stubble height were monitored through the season, as follows:

- **Harvest efficiency (Dec 13)** was much greater when cutting high (500mm), using 6.2 L/ha fuel at 8.5 km/hr.
- Halving the cutting height to 260mm increased fuel use to 10.1 L/ha at 5 km/hr (spreaders had no impact).
- Harvesting low at 150mm used 10.8 L/ha at 5 km/hr.
- **Stubble biomass** at sowing (April) was more than three times greater in the tall straw compared to the short.
- **Canola emergence (May)** was relatively even across all stubble heights.

Harvesting high was faster and used less fuel.

	harvest height: 150 mm (NWB)	260 mm	500 mm
December 2013	 harvested at: 5 km/hr 10.8 L/ha	 harvested at: 5 km/hr 10.0 L/ha	 harvested at: 8.5 km/hr 6.2 L/ha
April 2014	 stubble biomass 1.1 t/ha	 stubble biomass 1.9 t/ha	 stubble biomass 3.5 t/ha
May 2014	 48 plants/m^2	 54 plants/m^2	 42 plants/m^2

Better harvest efficiency, more plant biomass and no yield penalty gave 'high harvest' the advantage.

- **Early canola biomass (June)** in the tall straw was less than half that of the short, most likely due to a shading effect from the stubble which limited access to sunlight. *(In the photo at right taken between the tall and short stubble in April, note the moisture line where the tall stubble has shaded the soil surface and prevented it from drying out.)*

- However as the season progressed, canola in the tall straw grew rapidly with better access to sunlight and potentially more soil moisture, producing taller plants with significantly more dry matter (shown at right and in 'August' photos below).

- Although canola biomass usually correlates well with yield, when the crop was harvested in November 2014 all stubble heights yielded the same at 2.8 t/ha.
- But.... less fuel and more speed at harvest, greater crop biomass (resulting in a light mulch layer of leaf matter after harvest - see November photos below) and no yield penalty gave 'high harvest' the advantage. Anecdotally, growers have also reported fewer grain losses when harvesting high, with the rotor having to process less straw.
- While these benefits apply to both disc and tyne systems, harvesting high has the added benefit of reduced hair-pinning with disc seeders. For tyne systems in the medium rainfall zone (wheat yields above approximately 3 t/ha), tall stubble still needs to be managed post-harvest, eg. mulched, to minimise blockages at sowing, resulting in a trade-off between cheaper harvest costs and extra mulching costs.

	harvest height:		
	150 mm (NWB)	**260 mm**	**500 mm**
June 2014	 canola biomass 2.1 t/ha	 canola biomass 0.84 t/ha	 canola biomass 0.78 t/ha
August 2014			
November 2014	 2.8 t/ha	 2.8 t/ha	 2.8 t/ha

disc seeding action plan...

Disc seeding has become popular in the medium rainfall zone for the ability to sow through retained stubble on marginal moisture. However the disc system is less flexible than a tyne and requires careful attention to detail to ensure it works effectively. The following plan suggests ways it can be successfully implemented.

harvest management

Hair pinning is the achilles heel of disc seeding, occurring when the disc bends the straw into the furrow rather than cutting through it. Canola establishment is particularly affected by hair pinning due to reduced seed/soil contact and uneven seeding depth.

Hair pinning can be minimised by:

- **Cutting high at harvest** to reduce residue on the ground, followed by inter-row sowing. Stripper fronts have become popular in South Australia for this reason, cutting the straw just below head height. Cutting high also means greater harvest efficiency, with less residue to process, using less fuel and more speed.

- **Spreading straw evenly across the sowing width** at harvest. This is more difficult to achieve with fronts wider than 10.5m (35ft), although spreaders are improving on newer model headers. Several units, including the MAV™ Straw Chopper and PowerCast™ Tailboard, can be retro fitted. Several farmers have made their own spreader modifications and are now able to spread up to 13.5m (45ft), subject to wind.

  Although chopping and spreading can significantly reduce harvest efficiency (more fuel, less speed), the impact is offset when harvesting high.

- **Fitting residue managers, such as Aricks wheels,** which clear the stubble ahead of the disc unit. These are commonly used with single disc openers, including John Deere and Excel, but have also been successfully added to large diameter discs such as Daybreak.

crop rotation

After several years of zero till, the stubble mulch layer can become very dense, particularly in canola/wheat rotations. Canola struggles to emerge in these situations, so rotations should be planned to avoid sowing canola into cereal stubbles, particularly where there has been more than one cereal crop previously. Sowing canola into a legume stubble or brown manure fallow has the advantage of improving canola emergence and providing a double break crop for weed and disease management, although sclerotinia needs to be managed.

row spacing

Row spacing is one aspect where disc seeders have a distinct advantage over a tyne system. With the rapid adoption of stubble retention over the past decade, row spacings have become wider to accommodate stubble flow in the tyne/press wheel system. This has been at the expense of yield and crop competition, with research showing considerable yield and weed control responses from narrow row spacing.

However disc seeders don't face the same restrictions and are able to sow through stubble at narrow row spacings. Many disc operators are now returning to narrow rows for yield and weed management benefits.

Growers have successfully modified disc seeders using narrow gauge wheels to accommodate reduced row spacings. There are also a range of after-market products available, including firming wheels and crumbler wheels (eg. from Needham Ag), to improve crop establishment in narrow rows.

A review of 89 row spacing trials (Scott et al) conclusively showed higher crop yields from narrow row spacing, particularly those with higher yield potential.

sowing date

Reduced early vigour is a common feature of disc systems, with the lack of tilth creating a physical restriction to seedling growth, as well as reducing the mineralisation of nutrients in the seed zone. Although the plants tend to catch up quite quickly, early sowing is critical to avoid root development being limited by declining soil temperatures.

Early sowing can also help minimise rhizoctonia, which can be particularly prevalent during the early years of transition from a tyne to a disc seeder. Avoiding root pruning herbicides (eg. sulfonylureas) and using zinc seed or fertiliser dressing can also help manage the disease.

Fortunately, better moisture conservation through full stubble retention and minimal soil disturbance means sowing times in disc systems are generally not rainfall dependent and sowing can take place at the earliest optimal timing. Research is continually showing the benefits of early sowing within the recommended window.

ferti-liser

Fertiliser applied with the seed needs to be carefully managed in a disc system. The concentration of fertiliser increases in the confined seed bed, with a 'seed bed utilisation' (SBU) commonly less than 5%, compared with 10% for tyne seeders. The issue is further compounded with row spacings greater than 250mm - narrower row spacings are preferred with disc seeders to reduce feriliser toxicity.

Fertiliser should be separated from the seed, or a portion of it topdressed, particularly when sowing sensitive crops such as canola. Some disc seeders, eg. NDF, have a split boot delivery system which allows separation of the seed and fertiliser.

Long term trial data (Reithmuller, DAFWA) showed that decreasing row spacing from 360mm to 270mm reduced ryegrass seed set by 75%, and stopped seed set altogether at 180mm.

weed manage-ment

A high risk of crop damage means **there are limited options for pre-emergent herbicide use in disc systems**. Disc seeders generally produce very limited soil throw to incorporate the herbicide and remove treated soil from the furrow.

The ability to throw soil varies between disc seeders, but can be improved with the use of 'row cleaners' ahead of the disc. Disc size/shape/angle, closer plates and sowing speed all impact on soil throw and the amount of soil that falls back into the seeding furrow.

With pre-emergent herbicide limitations, growers implementing a disc system need to have a robust integrated weed management program - including a strict rotation with break crops or long fallow, option for cereal hay, narrow windrow burning and reduced row spacing for crop competition.

Herbicide Efficacy in No-Till Farming Systems

In 2010, Grassroots Agronomy co-ordinated replicated trials comparing pre-emergent herbicide efficacy between disc and tyne systems across three sites in southern NSW (click right for full project report). Key findings included:

- Significantly greater crop damage occurred in the disc system at two of the sites, where moist conditions after sowing increased herbicide mobility.
- Crop damage was particularly severe at the Grenfell site where waterlogged conditions made the less vigorous disc system more vulnerable at crop establishment. Damage was also evident in the tyne system, although symptoms were only temporary.
- The pre-emergent hebicide treatments provided similar levels of weed control between disc and tyne systems, even at the high pressure Wagga Wagga site.
- Wheat establishment at all sites was significantly higher in the tyne systems, with better early vigour.

local experiences...

Derek & Alexander Ingold, Dirnaseer

@deadlydisca @AlexanderIngold

YouTube: Ingold's farming system

- **Boss Engineering single disc opener**
- 12 m CTF
- 250 mm row spacing
- modified MAV™ Straw Chopper on Case 8120

The Ingolds purchased their Boss disc seeder in 2012. Up until then, their tyne/press wheel system on 305mm spacing had only allowed them to retain stubbles from lower yielding crops. Now they can retain all stubbles to improve soil structure and increase infiltration rates.

Having spoken to other people about potential problems with disc seeders, the Ingolds set about finding one that required less maintenance and minimised hair-pinning. In the end, the Boss disc was chosen for its greater disc angle, which means it can cut through the straw and into the soil without relying on downward pressure from a heavy bar. The lighter Boss frame would potentially also mean less wear and tear.

To further minimise hair-pinning, the Ingolds now cut their straw as high as possible. This not only reduces the amount of residue spread on the ground, but it also reduces fuel costs and increases harvest speed.

It is still critical for residue to be spread uniformly in this system, ensuring even crop establishment and reducing herbicide tie-up. The Ingolds are able to spread trash evenly across the width of their 12m front using a modified MAV™ Straw Chopper on a Case 8120 header.

In terms of agronomy, a full stubble retention system means the Ingolds have a strict broadleaf/cereal rotation to manage weeds and disease. With clean summer fallows and stubble cover, they are able to sow earlier to promote better root growth in warmer soil temperatures and maximise yield potential.

Sowing into stubble also means soil moisture is protected through the growing season. However they have found the stubble does shade the seedlings, reducing germination and early crop vigour. This is only temporary, with crops usually producing rapid growth by late winter.

local experiences...

Ben Beck, Downside

@AerodromeAg

- **Excel Stubble Warrior single disc opener**
- 9 m CTF
- 250 mm row spacing
- PowerCast™ Tailboard on John Deere 9770 STS

YouTube: Beck's farming system

Ben has been operating a stubble retention system since 2006, but moved to zero-till in 2011 to maintain more moisture at sowing and reduce weed seed disturbance. He originally purchased a Golden Valley 'single disc opener tyne conversion assembly', which was fitted to his existing 9m Horwood Bagshaw Scaribar. He felt this was a reasonable entry point into disc seeding and liked the option of still being able to use the knife points and press wheels if required. Initial crop germination problems were improved with the addition of Aricks wheels, press wheels, air diffusers and a mud scraper.

In 2013 Ben purchased an Excel Stubble Warrior single disc on 250mm row spacing. His system, which involves a combination of stubble retention, zero-till, CTF and a strict rotation including pulses, has resulted in highly active soil biota and rapid stubble breakdown, to the point that he no longer requires Aricks wheels to manage hair-pinning.

The rotation of pulse/canola/wheat/barley benefits each crop in the system. Canola establishment has improved by sowing into pulse stubble (instead of cereal), which also allows the crop to capture the benefits of nitrogen, residual water and a double break for grass weed control.

Cereal stubble is now cut as high as possible which benefits the following pulse crop, and reduces the amount of stubble spread on the ground. Ben has recently been investigating stripper fronts as the next step in his system, where the crop is cut at head height to manage hair-pinning and improve crop vigour.

YouTube: Shelbourne stripper front at Beck's

local experiences...

Tony Lehmann, Illabo

@awlhillside

CTF guide with Lehmann's case study

- **John Deere single disc opener**
- 10.6 m CTF
- 305 mm row spacing
- PowerCast™ Tailboard on John Deere S680

Tony was one of the earliest disc seeder converts in the district, purchasing a John Deere single disc opener in 2005. He had previously been using a Flexi-Coil tyne seeder, which he has kept for strategic tillage purposes to break up surface compaction in paddocks coming out of pasture, and may now also use for lime incorporation.

Tony has made several modifications to the disc seeder over time. Currently on 305 mm row spacing for inter-row sowing, Tony is now looking at reducing it to 150 mm for better crop competition.

Narrow gauge wheels were fitted to the seeder several years ago for more accurate ground following and to reduce stubble knockdown. Needham Ag modifications including narrow press (firming) wheels and crumbler (closing) wheels have been ordered for the 2015 season.

As stubble loads increased in the zero till system, hair pinning became a significant problem. Aricks wheels were fitted to clear stubble ahead of the disc opener. These were originally set at an angle of 23 degrees but were too aggressive, so a new set was fitted at 17 degrees with better results.

A change in rotation, avoiding two cereal crops in a row, has also reduced stubble loads and helped reduce hair pinning. Most significantly, the lower stubble mass has also improved canola germination and early vigour, a particular problem with open pollinated triazine tolerant varieties.

Stubble is cut as high as possible at harvest while still allowing enough straw to be spread for a thin mulch layer. The PowerCast™ Tailboard on the John Deere S680 header allows residue to be spread evenly across the full width of the 10.67m front.

Tony has made several agronomic changes to his system. He now sows earlier to take advantage of stored moisture and offset poor early vigour; more seed dressings are used to manage increasing insect numbers; weeds are carefully managed through crop rotation to overcome the lack of pre-emergent herbicides. He also cites no clods, no dust and no stress/time wasting with burning as significant advantages of the zero till system.

the South Australian experience...

In 2014 a group of 14 growers from southern NSW visited farms in the Mid-North of South Australia on a 'subble management fact-finding mission'. The trip provided much inspiration, particularly relating to the South Australian's use of crop rotation to manage stubble loads, as well as their focus on canopy management for crop competition.

Each of the SA growers emphasised the need to use a range of strategies to successfully farm in stubble retained systems. Despite challenges with increased insect pressure and resistant grass weeds, they were contiually adapting their systems to maintain productivity.

Following were the top 5 'highlights' contributing to the success of their stubble management systems.

1

1. Disc seeding (single discs) - commonly used in South Australia to allow sowing into heavy stubble loads.

2

2. Narrow row spacing - to maintain high yields and increase crop competition against weeds.

3. Pulses - particularly faba beans, are included in crop rotations to promote cereal stubble breakdown prior to canola. They also provide an opportunity to manage grass weeds using alternative chemical tactics.

4. Triple break rotation - to manage herbicide resistant weeds in stubble retained systems, eg. cereal hay / faba beans / canola sequence.

5. Stripper front - harvesting at head height to minimise chaff residues.

3

4

5

Many thanks to the South Australian growers who generously provided their time and knowledge, including:
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Written and compiled by Kirrily Condon,
Grassroots Agronomy

for the project

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