Upper North Farming Systems

Stubble Management Guidelines

Seeding into stubble retained systems

Key Facts

- Studies have found seeding into standing stubble can improve establishment compared to cultivation.
- To maximise the effectiveness of disc and tyne seeders growers should ensure even straw spread, and use inter-row sowing.
- To improve tyne residue handling growers can cut low at harvest, increase inter-tyne clearance through optimising tyne layout, attach trash guards, or use disc coulters.
- Uniform seed depth is critical particularly for canola.
- Seeding systems that increase the seedbed utilisation can result in improved canola yields by minimising fertiliser toxicity.

Retained stubble can create new challenges for seeding, particularly when stubble has been cut high to improve harvest efficiency and when high yields increase stubble density.

GRDC studies have found that in yields up to three tonnes per hectare there are no yield penalties from seeding into standing stubble, and a replicated trial at Hart in 2015 found no difference in cereal yield from tyne or disc seeders sowing into stubble, indicating that both tyne and disc seeders can successfully sow into stubble in Upper North conditions.

TYNE SEEDER SET UP FOR STUBBLE RETAINED SYSTEMS

Tyne seeders are popular in the Upper North due to lower costs and more robust results when used in a wider range of operating conditions.

Tyne seeders generally create higher soil disturbance than disc seeders, which limits their operating speed to around eight kilometres per hour.

However, their major limitation is the ability to seed into tall or heavy stubble.

Inability to handle residue results in clumping which can obstruct 15 to 20 per cent of the seed row area and reduce emergence, impacting on crop yield.

Project Information

This management guideline has been developed for the Upper North Farming Systems Group (UNFS) as part of the Maintaining Profitable Farming Systems with Retained Stubble Initiative, funded by the Grains Research and Development Corporation (GRDC).

The Stubble Initiative involves farming systems groups in Victoria, South Australia and southern and central New South Wales, collaborating with research organisations and agribusiness, to address challenges associated with stubble retention.

The GRDC, on behalf of growers and the Australian Government, is investing $17.5 million in the initiative that has been instigated by the GRDC Southern Regional Panel and the four Regional Cropping Solutions Networks that support the panel.

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

Seeding into Stubble

Research by the Agricultural Machinery Research and Development Centre (AMRDC) at the University of South Australia has developed indicative guidelines for maximising residue handling capacity:

Effective vertical tyne clearance

The most important factor in sowing into stubble for tynes is the effective vertical tyne clearance.

This is the distance from the ground surface to the first catch-point on the tyne shank or mounting head, and should be at least 1.5 times the stubble height.

Tyne profile

The tyne shank should be vertical or lean slightly backwards.

The optimum profile would be round and smooth to improve residue flow, minimise hair-pinning around the shank, and cover any brackets or bolts that may catch residue.

Growers can retrofit low-cost add-ons such as commercially available trash guards or polymer wrapping. See Desbiolles (2006) for more detail on these options.

Inter-tyne clearance

Inter-tyne clearance- the distance from the rear of one tyne to the front of the next- is important for minimising the risk of machine blockages.

The smallest inter-tyne spacing within a layout represents its bottleneck and should be about 1.5 times the residue height for up to 4.5t/ha wheat stubble.

Heavier stubble may require an inter-tyne clearance of up to double the residue height to be non-restrictive. The tyne layout should be spread over three to four ranks to maximise the inter-tyne spacing.

Precision seeders and stubble handling

Precision tyne seeder designs incorporate parallelogram linkages, gauge wheels, press wheels, and multiple tyne designs to improve contour following, seed placement and fertiliser separation.

However, growers should note that these design features often reduce the effective vertical tyne clearance and due to the longer opener assembly, the inter-tyne clearance is also reduced. These reduced tyne clearences compromise residue handling capacity.

While there are limited options to increase inter-tyne distance of current machines, one option is to adopt wider row spacing in conjunction with a paired row seeding boot. This increases inter-tyne clearance while maintaining a high seedbed utilisation (SBU) to maximise weed competition and yield potential.

Disc coulters

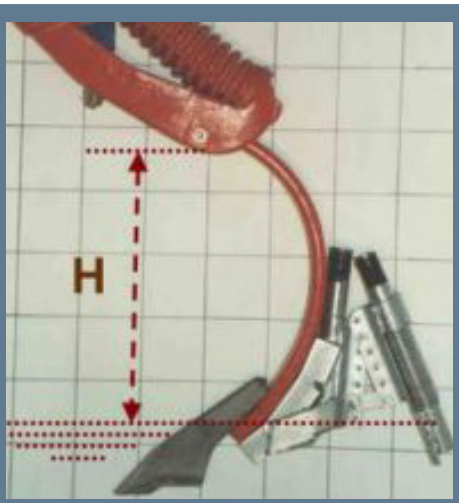
Residue cutting disc coulters preceding the tyne can improve residue flow provided they can successfully cut through residue.

DISC SEEDER CONFIGURATION

Disc seeders have a significant advantage when sowing into stubble retained systems.

They generally create less soil disturbance, resulting in higher residue cover after seeding, better moisture preservation, and enable higher seeding speeds.

However, their key advantage is the ability to handle high standing residue loads without clumping.



Left: The tyne vertical clearance, shown as 'H' is the distance from the ground to the first obstruction on the tyne shaft or mounting head. Photo: Jack Desbiolles

Right: Residue tubes can be added to existing tynes to improve the free flow of residue and increase the effective tyne vertical clearance. Photo: Jack Desbiolles

This in turn can enable the use of narrow row spacings, as low as 15 centimetres, to increase SBU, weed competition and yield potential.

Key disadvantages in Upper North conditions include the increased investment and maintenance costs, difficulty separating fertiliser from seed and increased risk of hair-pinning in wet conditions.

Hair-pinning can be minimised by cutting high at harvest and spreading straw and chaff uniformly, or adopting inter-row sowing.

There is also a different pre-emergent herbicide program required with discs that can be more expensive.

Pre-emergent safety generally increases with higher soil disturbance openers. This means a single disc seeder has a higher risk of crop damage compared with a higher disturbance triple disc or tyne seeder.

Crop damage from pre-emergent herbicides with low disturbance single disc seeders can be reduced by fitting residue managers in front of the single disc modules.

Putting it into practice - UNFS Seeder Demonstration

Upper North Farming Systems ran a seeder demonstration in 2013 at Booleroo. In the demonstration, 13 different seeders were tested including a range of discs and tynes, precision and conventional configurations.

The trial was sown to Hindmarsh Barley on 17 April into a dry profile. Growing season rainfall was 312mm with a wet June followed by a dry, sharp spring, and the plots were harvested 31 October.

Analysis was limited as the trial was not replicated, however it was found that plant establishment varied by 25 per cent between seeding systems.

In general, precision seeding systems had tighter and more precise seed placement range than the conventional and tyned seeding systems, and there was a good relationship between shallow and uniform seed placement and higher rates of plant establishment.

The trial found no yield penalty from seeding into standing stubble. Standing stubble improved establishment by five to 10 per cent compared to cultivation (Figure 1).

The average yield was 4.29 tonnes per hectare, varying between 3.95t/ha and 4.55t/ha. Because the trial was not replicated it is not possible to assess whether any differences were statistically significant.

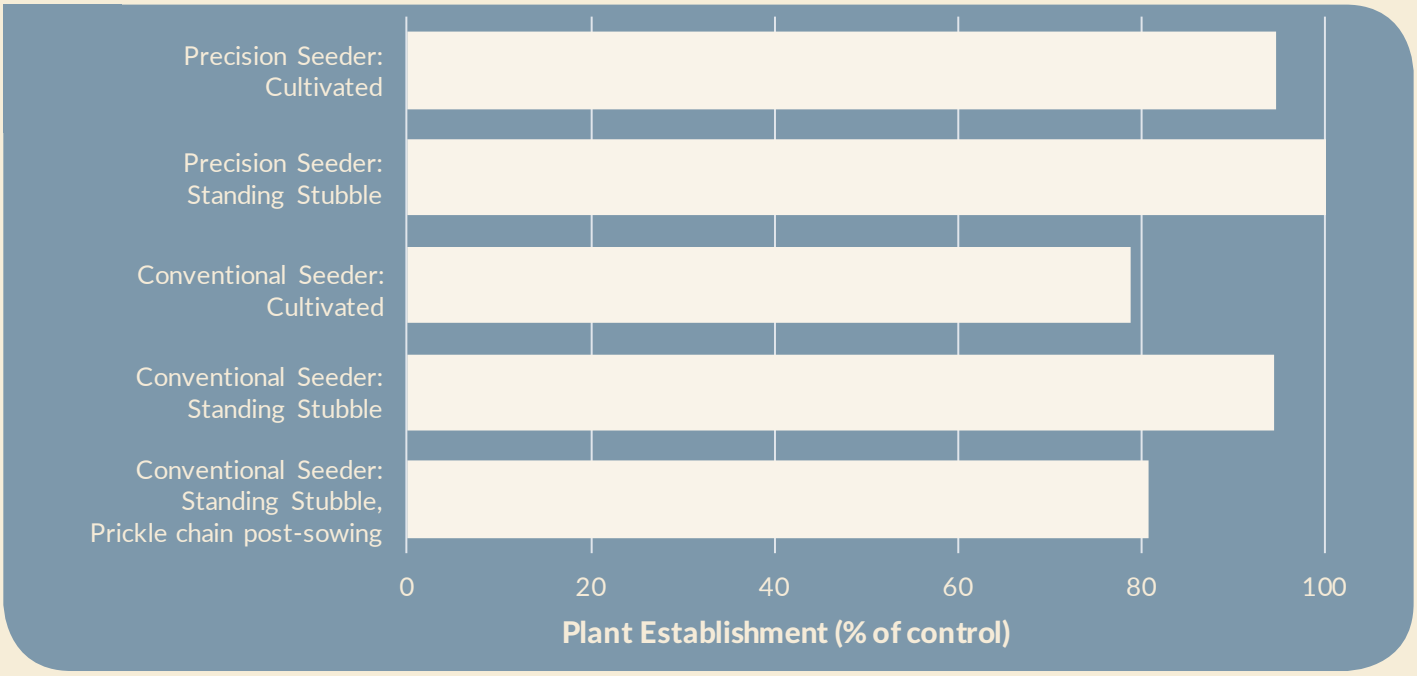


Figure 1: Plant establishment (% of control) from the UNFS seeder demonstration for three stubble management strategies using two seeders. The precision seeder was a Primary Sales Precision Seeder, 10' spacing, double-shoot and the conventional seeder was a Flexi coil 820 - 7.2' spacing, 7 inch shares, single shoot, K line Rolling Harrows

SEEDING SYSTEMS FOR CANOLA

Canola has proven to be a profitable break crop in recent years in the Upper North. Establishment is key for strong performance in canola, with establishment rates of 40 to 60 per cent compared to 80 per cent in cereals.

Heavy stubble (7-10t/ha) is known to reduce canola performance, however it is rare that these stubble loads will occur in the Upper North. A 2014 demonstration trial by Upper North Farming Systems found no difference in canola establishment between a 5t/ha retained barley stubble, burning or cultivation.

There are a range of methods growers can use to improve canola establishment, including reducing seeding depth, increased seedbed utilisation (SBU) and increasing seeding rate.

The small seed size of canola requires shallow seeding; research in the Mallee has shown that seeding deeper has a rapid negative effect on canola crop emergence, with 30 to 60 per cent reduction in seedling emergence at 5cm relative to 2.5cm depth.

However, a shallow depth can leave the seed vulnerable to drying out, pest damage, fertiliser toxicity or pre-emergent herbicide damage, therefore even seed depth is key to optimising emergence.

If retaining canola seed for planting it is essential to grade seed to greater than 2 mm to aid in seedling vigour while allowing deeper sowing if necessary.

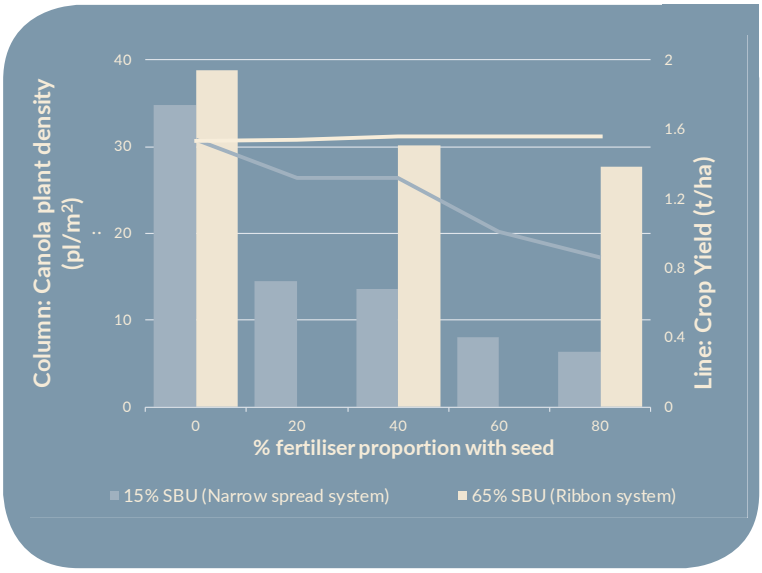


Figure 2: Canola establishment and yield for 65% and 15% SBU tyne seeding systems influenced by fertiliser quantity applied with seeds (the balance of fertiliser was deep banded 3-4 cm below the seeds). Source: Jack Desbiolles

Fertiliser toxicity can cause more losses in canola compared to cereals. Figure 2 demonstrates the effect of improving seedbed utilisation (SBU) on reducing damage caused by fertiliser toxicity. SBU can be increased with paired row, split-row, or spreader seeding boots.

In trials on the Eyre Peninsula, higher seeding rate increased yield by 10 per cent when the seeding rate increased from 1.5 kilograms per hectare (kg/ha) to 4.5kg/ha.

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