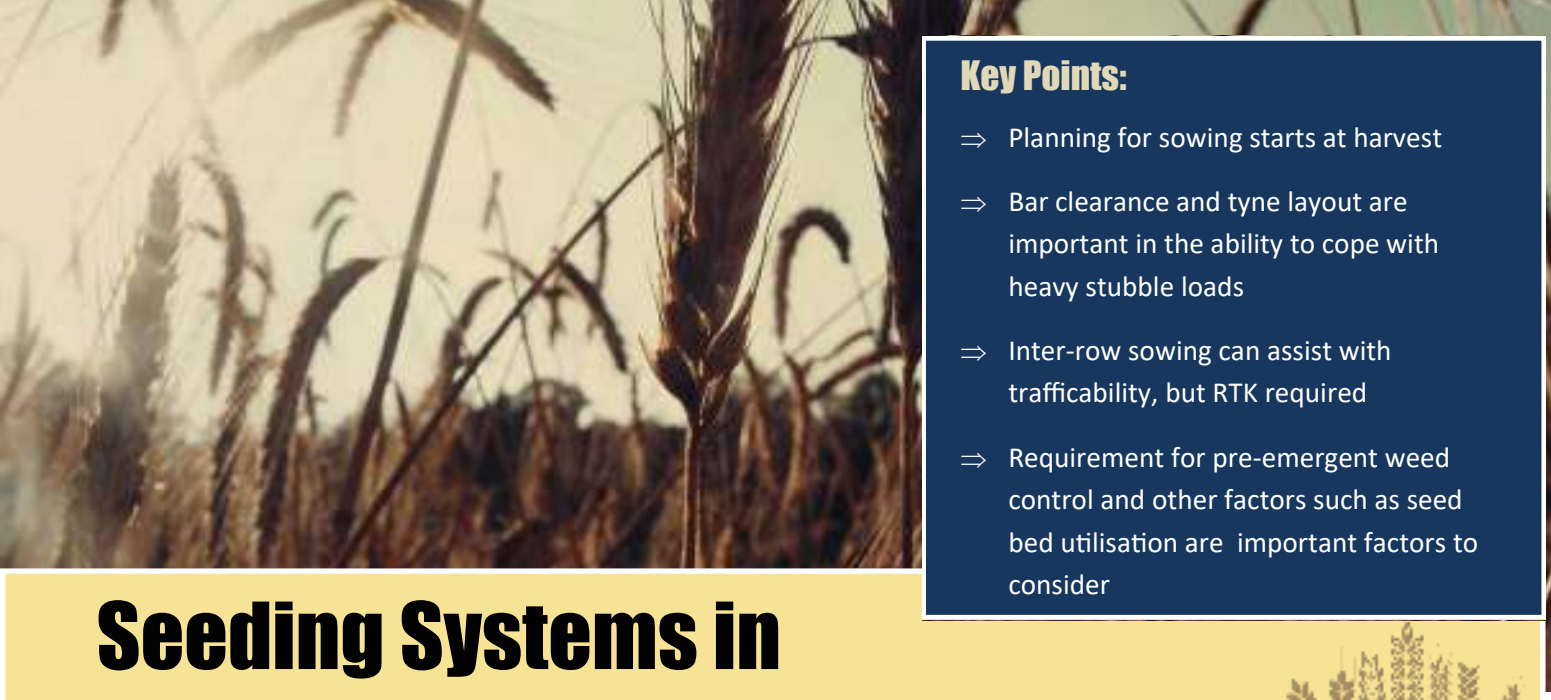

Key Points:

- ⇒ Planning for sowing starts at harvest
- ⇒ Bar clearance and tyne layout are important in the ability to cope with heavy stubble loads
- ⇒ Inter-row sowing can assist with trafficability, but RTK required
- ⇒ Requirement for pre-emergent weed control and other factors such as seed bed utilisation are important factors to consider

Seeding Systems in Retained Stubble Systems

Background

In retained stubble systems large stubble loads often cause issues for farmers at seeding. High residue loads and/or tough straw can result in seeder blockages, clumping and poor seed soil contact that have the potential to impact on seed germination.

Adequate preparation prior to seeding can assist in reducing these issues. This preparation starts at harvest with consideration of harvest height and management of the chaff or straw [1]. Management of stubble over the fallow period[2] is also important.

Reducing the stubble load to between 3-5 t/ha by the time of seeding will assist in minimising issues. Grazing is one tactic that can be imposed to manage stubble loads. However, issues such as stubble lodging affecting seeding operations especially if planning to seed with a disc seeder must be factored into the intensity of grazing.

The use of seeding equipment specifically designed for retained stubble systems will minimise challenges, but can require significant capital investment. The choice of equipment is highly dependent on the individual farming system. Some key considerations include;

- ⇒ History of the farming system
- ⇒ Presence / absence of livestock
- ⇒ Crops to be sown
- ⇒ Weed control
- ⇒ Pest management

Introduction

This guideline has been developed for the MacKillop Farm Management Group (MFMG) as part of the project "Maintaining Profitable Farming Systems with Retained Stubble in the South-East and KI regions", funded by the Grains Research and Development Corporation (GRDC) as part of the Stubble Initiative.

The Stubble Initiative involves farming systems groups in South Australia, Victoria, southern and central New South Wales and Tasmania, collaborating with research organisations and agribusiness to address challenges associated with stubble retention, including weeds, pests, disease, nutrition and the physical aspects of managing stubble.

This guideline provides information around seeding systems assuming all other agronomic aspects of the farming system have been addressed.

Figure 1. DBS Seeder Sowing into Stubble

Seeding Systems

Disc and tynes are the two most common soil openers that people consider when looking at sowing into retained stubble. When using discs the main issue encountered is residue hair-pinning. This can be particularly challenging when seeding canola as the downward pressure on the machine isn't always sufficient to cut the stubble while maintaining a shallow sowing depth. If using tynes, residue clumping often poses the biggest challenge. Table 1 outlines tips for different seeding systems that will make sowing into stubble easier.

Table 1. Tips for different seeding systems.

Tyned Systems	Disc Systems
Short and uniformly spread dry residue	Uniformly spread residue at harvest
Use of inter-row sowing	Maximise the amount of standing residue
Ensure adequate bar clearance	Accurate inter-row sowing
Optimise tyne layout for trash flow	Use of residue managers

The type of soil opener will depend on each individual farming system. Soil type, farm history, the presence or absence of livestock, the need for pre-emergent weed control, and crop types being sown will all influence decisions around the seeding system used. Figures 2 (a-d) show the level of soil disturbance created by four different seeders on Kangaroo Island on a loamy soil.

Figure 2.
(a) John Deere single disc seeder (b) Baldan Disc seeder (c) Tobin Bullet disc seeder (d) DBS tyne seeder

Bar clearance and tyne layout

Research by the Agricultural Machinery Research and Design Centre (AMRDC) at the University of South Australia has developed indicative guidelines for maximising residue handling capacity[4]. They have shown the most important factor when sowing into stubble is the effective vertical tyne clearance (i.e. the distance from the ground to the first catch-point on the tyne shank or mounting head - shown as H in Fig 3). This should be 1.5 times the stubble height. The tyne shank should be vertical or lean slightly backward and ideally be smooth to minimise residue that may catch (trash guards can be added to assist in modification). Inter-tyne clearance is also important, with an inter-tyne clearance of 1.5-2 times the residue height required in heavy stubble loads. Inter-tyne clearance is the distance from the rear of one tyne to the front of the next. Tyne layout should be spread out over three to four ranks to maximise the inter-tyne spacing.

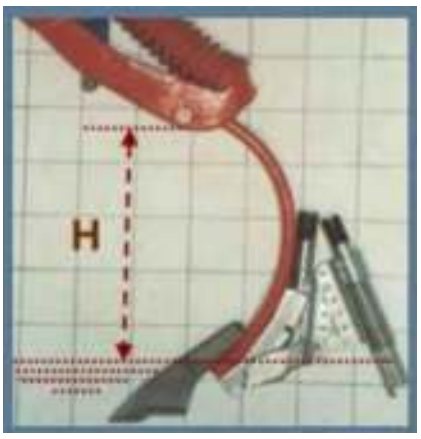

Figure 3. Vertical Tyne Clearance.
(Courtesy of J.Desboilles, University of SA)

Inter-row sowing

Inter-row sowing is a useful tool to improve germination – particularly when sowing canola at low seeding rates into stubbles to minimise potential challenges. To successfully inter-row sow, a real time kinematic (RTK) GPS signal is required.

Canola establishment in heavy stubbles

Work conducted in the South-East from 2014-18 showed that even though heavy stubble loads may reduce initial canola establishment when compared to bare or cultivated soils as shown at Frances in 2014 (Fig 4, 5(a-b)), canola has a great ability to compensate and no significant yield differences were observed (in the absence of pests).

Work conducted at Millicent, Bordertown and Hatherleigh (2015, 2017) showed no significant difference in canola establishment in systems where cereal stubble was retained and standing on the surface compared to stubble incorporated with a speedtiller or stubble at varying harvest heights.

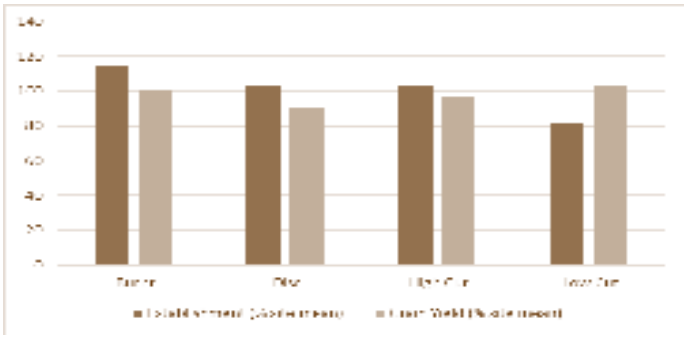

Figure 4. Canola establishment and subsequent grain yield when sown into varying stubble treatments, Frances 2014.

(a) Burnt stubble (b) Standing stubble (high)

Figure 5. Canola establishment at Frances, 2014.

Seed Bed Utlisation

Seed bed utilisation (SBU) is the volume of soil in which seed and fertiliser is mixed. It is a measure that is used primarily to quantify safe fertiliser rates.

SBU is an issue in retained stubble systems, as often the row spacing is increased to improve trash flow. This then results in a concentration of fertiliser in the seed row, increasing the potential for fertiliser toxicity on the germinating seed.

The soil openers used at seeding will impact on the SBU, with narrow points and disc openers having a small spread of fertiliser, whilst wider shears have a larger spread and a greater mixing of the soil diluting the fertiliser.

$$\text{SBU} = \frac{\text{Width of Seed row}}{\text{Row spacing}} * 100$$

SBU is important to consider when looking at seeding equipment. Canola seedlings are sensitive to damage due to the close proximity to fertiliser. Larger seeds have less damage potential. Any legumes that have been inoculated should be lime coated to protect rhizobia from damage if they are being sown with nitrogen that is likely to be in contact with the seed. Table 2 shows the SBU for cereals at various row spacings across various soil types for seeding fertilisers in cereals.

Table 2. Approximate safe rates of N as urea, mono-ammonium phosphate (MAP) or di-ammonium phosphate (DAP) with the seed of cereal grains if seedbed has good soil moisture (at or near field capacity). [4]

	25mm (1") seed spread			50mm (2") seed spread		
Soil Texture	Row spacing			Row spacing		
	180mm (7")	229mm (9")	305mm (12")	180mm (7")	229mm (9")	305mm (12")
	SBU			SBU		
	14%	11%	8%	29%	22%	17%
Light (sandy loam)	20	15	11	40	30	22
Medium-Heavy (loam to clay)	25	20	15	50	40	30

Source: GRDC Fertiliser Toxicity Fact Sheet

Paired row or splitter boots have the ability to improve SBU, however the use of large seeds (e.g. faba and broad beans) may affect the use of these technologies across the region as the smaller opener size may restrict seed flow of these large seeded crops.

Key factors to consider when deciding what seeding system to use:

⇒ Soil type
⇒ Is good pre-emergent weed control required (ensure machine is going to have adequate soil throw for incorporation
⇒ Do you have livestock in the system (tyne may be better at going through grazed stubbles)
⇒ What crops am I likely to be growing (make sure the machine is able to deal with larger seeds)
⇒ Select a rotation sequence that minimises challenges e.g. sowing canola into legume stubble

Case Study

Ben Pontifex with wife Sarah crops 4500 ha on Kangaroo Island across a range of soil types, cropping canola, wheat and broad beans.

For the past five seasons, he has used a Tobin Bullet Disc Seeder. He finds it works well across the majority of his soil types with the only issue being encountered on sticky wet clay. “These clays are only a small portion of the land cropped, and when they are too wet there is always something else to sow while they dry out a bit”.

Average working speed is 12 km/hr but this ranges from 10 km/hr to 14 km/hr depending on the smoothness of the paddock. Sometimes speed can be limited with broad beans due to the higher flow rate of seed required and the capacity of the piping and fan on the air cart.

“At these speeds, we get a good amount of soil throw for a disc machine so we can still use the pre-emergent herbicides that require incorporation and get good efficacy.”

Ben’s Tobin Bullet handles stubble when sowing wheat and beans but has some hair pinning issues when sowing canola into heavy stubble loads. “This is because the canola needs to be sown shallow and as a result there is less pressure from the discs to cut through the stubble than there is for the deeper sown wheat and broad beans.”

To overcome the issues sowing canola into heavy wheat stubbles, Ben has now set up his rotations so that canola is planted into bean stubble instead of wheat. “Bean stubble causes much less hair-pinning when sowing canola eliminating the need to broadcast canola or burn stubbles. I find I get a much better job that way”.

Figure 6. Ben Pontifex in front of his disc seeder

Acknowledgements

- Andrew Ware, Amanda Pearce, SARDI
- Jenny Stanton, Keith Bolto, AgKI
- SARDI New Variety Agronomy Team, Struan

References

[1]Harvest Management in Retained Stubble Systems, MFMG, 2018

[2]Fallow Management in Retained Stubble Systems, MFMG, 2018

[3]Agricultural Machinery Research and Design Centre (AMRDC), University of South Australia https://grdc.com.au/resources-and-publications/groundcover/ground-cover-supplements/ground-cover-issue-64-notill-supplement/stubble-still-a-challenge

[4]https://grdc.com.au/__data/assets/pdf_file/0019/203635/fertiliser-toxicity.pdf.pdf

Further Information

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