My client has purchased a disc seeder – what does this mean for my advice?

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Take Home Messages

- It is important to first identify what the grower aims to achieve by moving to a zero-till system with a disc seeder.
- With a wide range of configurations available, disc openers are not a direct substitute for tyne openers.
- When using a disc seeder, the furrow should be kept free of plant residue to achieve optimum seed to soil contact and uniform seed depth.
- Disc seeding requires different agronomic practices, particularly in relation to pre-emergent herbicide use and plant residue management.
- Disc systems also require a higher level of management in relation to crop rotation and grass weed control. Growers and their advisers need to understand the complexity involved to fully capture the benefits that are promoted.

Introduction

Many growers have now converted to no-till farming systems in both high and low rainfall production areas of Australia. Originally this meant a switch from seeders that achieved full seedbed disturbance to a system involving a knife point and press wheel with less soil disturbance. However growers are increasingly moving towards a zero-till system using a disc seeder, which is changing some aspects of the farming system and the recommendations advisers provide to their clients.

Zero-till systems impose far less soil disturbance than no-till systems with knife points, aiding moisture retention at sowing and throughout the growing season. Disc seeders also allow higher levels of stubble to be retained, particularly at narrow row spacings, which has been a key driver of their adoption. Disc seeders can also travel at higher sowing speeds than tyne openers and generally have lower draft requirements. Although improvements in soil structure and water holding capacity are proven outcomes of the zero-till system, these benefits take time and growers need to be aware of limitations during the transition stage.

Following are some of the practical experiences and key research outcomes to help advisers and growers get the most out of a disc seeder in a zero-till farming system.

1) The most important thing to do as an adviser is to understand the mechanics and engineering principles of the disc seeder being used.

Each disc seeder has gone through a rigorous engineering process in order to achieve what the manufacturer believes to be the best machine they can produce. EVERY DISC SEEDER IS DIFFERENT and knowledge of its strengths and weaknesses in various paddock scenarios is a must in order to give good agronomic advice. What one person

regards as an advantage, another may see as a disadvantage. Understanding this is the key to achieving good crops and robust farming systems.

Some things to look for and understand in each seeder include:

- level of soil disturbance
- evenness of soil disturbance and ability to keep the inter-row free of soil from neighbouring furrows
- ability to penetrate compacted soil, especially wheel tracks
- ability to penetrate through layers of stubble
- ability to get through wet, sticky clay soils and close the seed slot
- stubble clearance and mechanics that may affect poor residue flow under certain conditions
- shape of furrow achieved
- depth of furrow/maximum seeding depth
- seed placement in furrow, ie bottom or side
- press wheel shape and mechanics
- ideal sowing speed
- effect of depth gauge wheel on stubble during sowing

2) Management for disc seeders starts before harvest.

There are several aspects to consider during harvest in order to achieve good establishment at sowing:

- Minimise compaction from the header, chaser bins, seeder and boom spray. Disc openers are not as effective at penetrating compacted soils, with the lack of soil disturbance potentially limiting plant growth, uniformity and consequently yield. Disc seeders suit controlled traffic farming (CTF) systems, where wheel traffic is restricted to permanent, three metre traffic lanes. Consider removal of compacted layers with a tyne system or non-inversion tillage before moving to disc seeders and CTF.
- Spreading residue from the header becomes even more important with a disc seeder as stubble or residue lying on the ground causes hair-pinning with most types of disc seeders. Fitting appropriate spreaders or choppers, or even using stripper fronts, is very important to ensure that the ground surface is in a condition to allow a disc opener to roll over and penetrate. Consider the width of your comb front if wanting to sow into stubble using a disc – straw spreaders are currently only able to spread residue evenly in all conditions across the width of 9 or 10.5m (30-35ft) fronts. Residue is unable to be spread evenly across wider fronts such as 12 or 13.5m (40-45ft).
- Residue managers such as the Aricks wheel have proven effective at clearing stubble ahead of the disc unit and significantly improving stubble handling capacity and seed to soil contact. These units are essential for improving crop establishment in the presence of heavy stubble loads, especially for some single disc openers such as the John Deere or Excel machines. Aricks wheels have also been successfully added to large diameter discs such as the Daybreak.
- Residue management can be complemented in a zero-till system by using 2cm Real Time Kinetic (RTK) guidance, allowing repeatability across seasons or operations and the ability to inter-row sow between standing stubble.

- In higher rainfall areas or under irrigation, stubble height becomes critical. If conditions are likely to be wet at sowing, harvesting the stubble low allows some drying of soil from sunlight. This is particularly important on clay soils.

3) Understanding early crop vigour, disease and crop nutrition strategies.

Reduced early vigour is a common feature of the disc seeding system, with limited soil disturbance creating less mineralisation of nutrients in the immediate seed zone. This is usually not yield limiting as the plant tends to catch up quite quickly, particularly in lower yielding environments. However it does mean that sowing time becomes more critical, especially in medium to high rainfall areas where declining soil temperatures limit root development. Commercial experience suggests the sowing window can be pushed five to seven days earlier than recommended when using disc seeders. However this practice has not been verified in trials and is subject to managing frost risk with flowering, especially in cereals and pulses.

Rhizoctonia has been prevalent in cereals where disc seeders are used, particularly during the early years of transition from a tyne seeder. Tactics such as sowing early in the window using longer season varieties, avoiding root pruning herbicides (eg sulfonylureas), seed dressing with zinc and applying liquid nitrogen in the furrow at sowing help to improve early crop growth. Whilst the impact of rhizoctonia may be worse with a disc seeder, low disturbance tynes and fully conventional systems are still not immune to crop damage.

Fertiliser applied with the seed needs to be carefully managed in a disc system, with the concentration of fertiliser granules increasing in the confined seed bed. Seed bed utilisation (SBU) of common knife point and press wheel seeders is 10%, but this figure is commonly less than 5% with disc seeders. This is further compounded as row spacing is increased greater than 250mm. Crops sensitive to fertiliser toxicity such as lupins and canola should not have high levels of fertiliser with the seed. Most other crops will also show signs of toxicity, even at rates commonly used with tyne seeders. It is therefore important to plan your fertiliser strategy carefully, in many cases separating fertiliser from seed, or top dressing a portion of it in a separate operation.

Lime incorporation is not recommended with disc seeding units, particularly in medium and high rainfall areas where soil acidity is a major limitation to crop yields. Incorporation of lime using full disturbance tyne implements or offset discs is preferred, especially where soil pH_{Ca}, Aluminium % and cation exchange capacity (CEC) are required for sensitive crops. Where pH_{Ca} values are not critical and top-up lime applications are being applied, standard no-till tyne implements (knife points) are satisfactory, although it may take one to three years before the lime is fully effective.

4) Using pre-emergent herbicides in disc seeding systems.

This is an area which has attracted a lot of research in recent years. There are some key outcomes that need to be understood to be able to give good advice in this area. Importantly, discs are not supported by many herbicide labels at this point in time, so the decision to use a pre-emergent herbicide carries with it a certain level of risk.

a) <u>Every disc seeder is different!</u> This is so important - from trials in SW NSW we have found disc seeders that are nearly as safe as a well set up tyne machine, while

others have resulted in over 50% crop losses with some herbicides. Damage tends to be greater where the seed slot is not closed properly.

- In general you want to achieve:
  - a plant row free of herbicide
  - an inter-row with at least 2cm of fresh soil cover to limit herbicide washing back into the furrow
  - at least 2cm of herbicide free soil covering the seed in a fully closed furrow

b) Every herbicide is different! Understanding herbicide chemistry is equally as important as understanding the mechanics of your disc seeder. In particular:

- *Herbicide water solubility*, which impacts the way the herbicide may wash into (or out of) the seed furrow. This can also affect the way the herbicide may wash into the furrow even though it may be covered by soil on the inter-row.
- *Crop safety margins.* From the trials conducted, large differences in crop safety have been measured between herbicide products and rates of herbicides (refer point 'c' below). Understanding how a plant metabolises any herbicide that it comes in contact with is essential in selecting the most appropriate product and rate for the situation.

Table 1. Pre-emergent herbicide use with disc seeders – measurements and observations from trials across southern NSW over three years. *(Source: B. Haskins)*

Crop	Herbicide	Water solubility	Need for incorporation	Crop safety margin in adverse conditions
wheat, barley	Trifluralin	low	high	Very low. High rates worse.
wheat, barley	Stomp	low	med/high	Med. High rates worse.
wheat, barley	Boxer Gold	med	low/med*	Med. High rates worse.
wheat,	Sakura	med	low/med*	Med/High
wheat, barley	Avadex Xtra	low	med/high	Low. High rates worse.
wheat,	Logran B	high	low*	High. Little damage most trials.
wheat**, barley** chickpeas fieldpeas	Diuron	high	low*	High. Little damage most trials.
wheat**, barley** chickpeas fieldpeas	Metribuzin	high	low*	Low. High rates worse.
chickpeas	Simazine	high	low*	Med.
chickpeas fieldpeas	Terbyne	med	low*	Low/med.
chickpeas	Balance	high	low*	Low. High rates worse.
fieldpeas	Spinnaker	high	low*	Low. High rates worse.

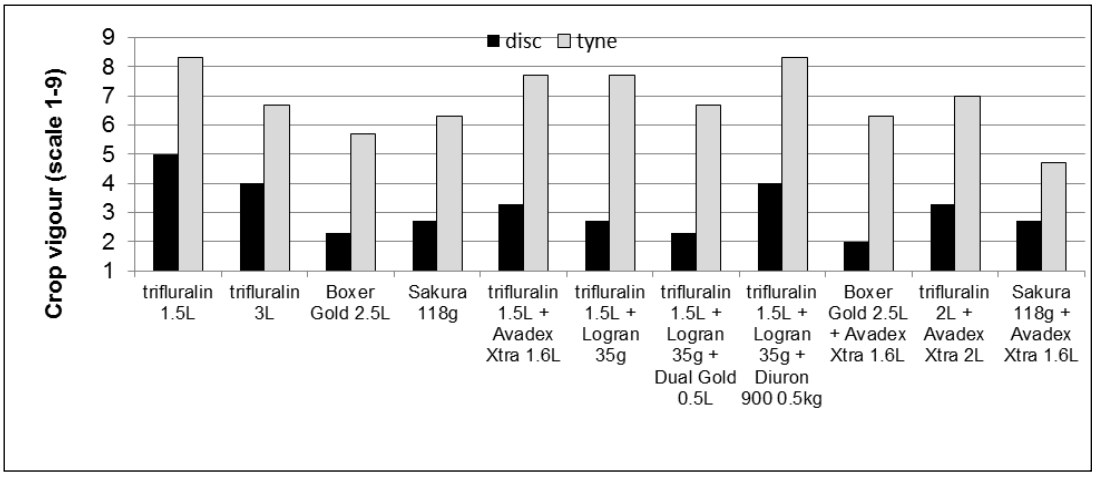
** Rainfall is required to activate and/or incorporate the herbicide. Labels may recommend physical incorporation.*

c) Be aware of crop safety.

- Many disc seeders (especially double discs) do not achieve any soil throw, so the choice of herbicides suitable for this type of seeder are limited to those that are non-volatile and will wash into the soil with moisture. Unfortunately in this scenario, the herbicide can run to the point of least resistance which is the plant row, where crop damage is likely.

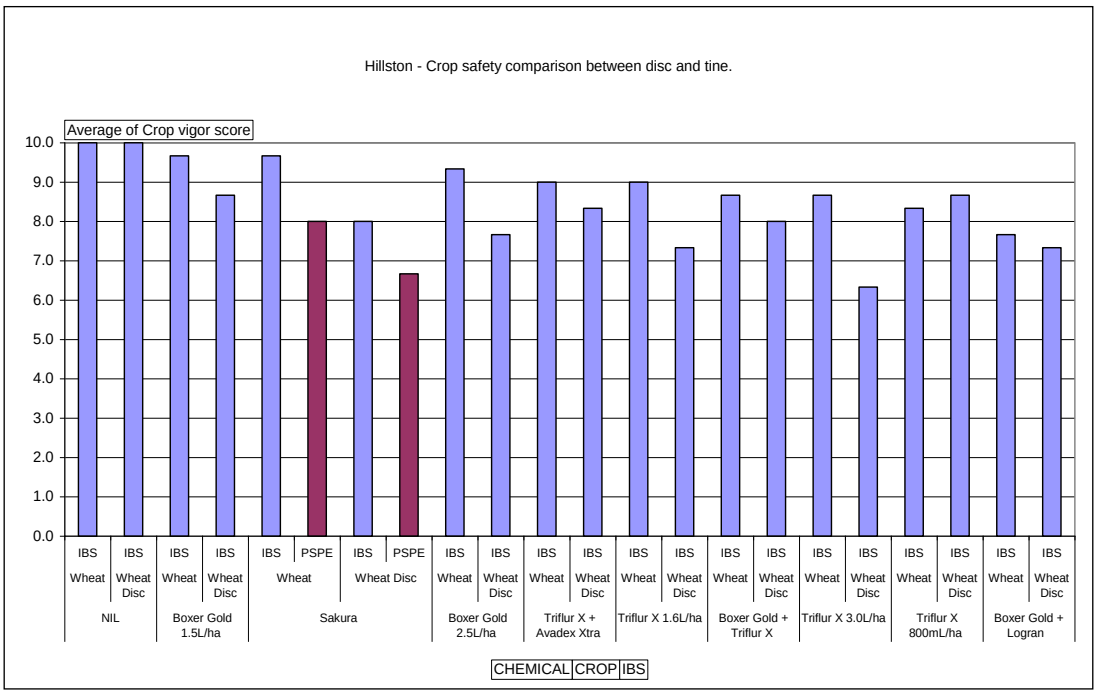
- Seeders that do achieve controlled soil throw (eg NDF Swing arm and Serafin Ultisow) allow much safer conditions when using pre-emergent herbicides, however the increased soil disturbance also encourages greater weed germination. Residue managers such as the Aricks wheel have improved crop safety with disc units where pre-emergent herbicides are used, but more research is needed.
- Wet soils can also pose a higher risk when using pre-emergent herbicides with disc seeders in cereals. A trial conducted at Grenfell in 2010 highlighted the extreme differences in crop safety that can occur between disc and tyne seeders when sowing into heavy stubbles and a wet soil profile (Figure 1). Slow emergence in the disc treatments was exacerbated by waterlogged conditions, which consequently placed the crop under greater pressure from pre-emergent herbicides compared with the tyne treatments. Prolonged wet conditions (1015mm rainfall was recorded for the year, 650mm of which fell between September and December) meant some disc treatments were unable to recover. Although the adverse conditions meant some damage was also evident in several of the tyne treatments, symptoms were only temporary.

Figure 1. Crop safety in disc and tyne systems at Grenfell, August 2010 (Daybreak disc on 375mm and Horwood Bagshaw with press harrows on 350mm); *Adverse conditions for pre-emergent herbicides.* *(source: Grassroots Agronomy)* **LSD (0.05) = 2.2.**



- Observations across 15 trials over various seasons and soil types have shown that in most situations, crop safety is improved when a herbicide is applied and incorporated by sowing (IBS) rather than post sowing pre-emergent (PSPE), eg. Figure 2. While the improved safety margin is usually better than 10% with IBS, this figure can be as great as 50% with some water soluble herbicides. Weed control was usually similar between the two application methods.

Figure 2. Crop safety in disc and tyne systems at Hillston, 2010 (NDF Swingarm disc seeder on 330mm and Morris Contour drill tyne seeder on 250mm). *Conditions not adverse for pre-emergent herbicides.* *(source B. Haskins)*



5) Disc seeders in mixed farming systems.

Disc seeders are predominantly used by dedicated cropping operators. However in southern NSW, there are a number of growers who have successfully integrated disc seeding and stubble retention into a mixed farming system without negative impacts on crop yields. Access to a tyne seeder is still recommended for certain operations to ensure crop and pasture establishment is not compromised.

Grazing cereals can be established very efficiently with disc seeders in autumn on marginal moisture, allowing early growth for greater dry matter. Sowing the following crop, however, may be compromised by surface compaction from grazing. The lack of tilth with a disc opener can restrict establishment, particularly when sowing sensitive crops (eg. canola) into dry soils. Growers should consider using a tyne seeder after grazing crops to break up surface compaction and improve tilth for establishment. If grazing crops make up a large percentage of the rotation for a mixed farmer, it would be advisable to avoid a disc seeder altogether.

Disc seeders, however, have a key advantage over tyne seeders in their ability to sow through grazed stubbles, although the stubble still needs to be carefully managed. Limiting grazing pressure of heavy stubbles and the use of residue managers such as Aricks wheels will help avoid hairpinning and reduce residue within the furrow that restricts seed to soil contact required for optimum crop establishment.

Undersowing lucerne and clover with disc seeders has proven effective, but requires attention to detail to ensure small pasture seeds are sown in a residue free environment. The stubble should be grazed heavily or burnt to reduce establishment problems and lime incorporated with a tyne implement prior to sowing pH sensitive pastures such as lucerne.

A tyne seeder with knife points is preferred when returning to the crop phase after pasture to ensure the paddock is levelled at the start of the rotation and crops emerge

in loose soil. Disc seeders have proven ineffective at sowing crops into hard pasture paddocks, with limited root development and dry matter production ultimately restricting crop growth and yield.

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