

## Solving the herbicide-disc equation

GRAEME JENNINGS

Disc depth and the amount of chemical in the crop row are emerging as key issues in a trial designed to work out how to get the best from soil-activated herbicides with disc seeders.

The trial, at Roseworthy, is exploring the factors impacting on crop safety and in-row weed control and how to manage those factors to achieve an acceptable compromise between crop safety and weed control. It is being conducted by a team comprising University of Adelaide scientists Chris Preston, Gurjeet Gill and Sam Kleemann and University of SA tillage specialist Jack Desbiolles.

“Our research is designed to help us understand why crop damage occurs with soil-activated herbicides when seeding with discs and identify whether or not there is a simple way of avoiding or minimising that,” said Dr Preston.

“Disc seeders are becoming increasingly common in SA paddocks but there is little advice on the labels of pre-emergence herbicides about how to get the best from them when using a disc seeder or how to minimise the risks that can occur.

“The labels of some IBS herbicides seem to preclude the use of those products with a disc seeder.”

The researchers are comparing the effects of different disc setups with the aim of identifying common factors that can be used as ‘rules of thumb’ by farmers wanting to use soil-applied pre-emergent herbicides and a disc seeder.

Based on visual observation and emergence data from the first season of the scheduled three-year project, those ‘rules of thumb’ seem likely to involve disc operating depth and soil disturbance ahead of the seeding unit, said Sam Kleemann.

“There is certainly no doubt that machinery set up influences crop safety and herbicide performance,” he said.

“Some treatments have resulted in almost total crop failure while others have resulted in good crops and good weed control.

“While it is still very early to make projections, the keys seem to be disc operating depth and the amount of chemical in the crop row.



AN NDF SEEDING MODULE WITH RESIDUE MANAGER FITTED.

### The characteristics of the seeding slot and how it is closed are also significant.

“Increasing the operating depth of the disc opener is possibly removing more herbicide-treated soil from the furrow slot and providing greater crop safety.

“Equipment set up and working speed can both affect seed placement, which is also important with shallow sowing increasing the risk of crop damage because the seed is more exposed to the chemical.”

The emergence and early crop performance in treatments where the set up included a stubble manager to clear surface residue from in front of the disc seeding unit suggest this may be one method of reducing the risk of crop damage when using a pre-emergence herbicide with a disc seeder.

“This season’s results appear to show that clearing surface residue from ahead of the seeding disc causes enough disturbance to reduce the risk to the crop by shifting some of the chemical out of the crop row, although this effect might vary with the

type of stubble manager and paddock terrain.

“The key is to reduce the amount of chemical enough to improve crop safety without reducing weed control to unacceptable levels.

“The early indications from this season’s treatments and some exploratory work we did last year are that the risk of crop damage from soil-applied pre-emergence herbicides can be reduced, though not totally eliminated, by operating the disc opener deeper and creating a low level of disturbance ahead of the coulter to move a little soil, and the herbicide on it, out of the line of the crop row.”

The characteristics of the seeding slot and how it is closed are also significant, Mr Kleemann said.

“If the slot is left open the herbicide is more easily washed into the slot from the surface.

“Closing the slot by scraping soil from the surface also concentrates the herbicide in the slot around and above the seed because the soil used to fill it is coated with chemical.”

The researchers hope, by the end of the



There is no doubt machine type and set-up influence the results achieved with soil-applied herbicides. The plots pictured all received the same chemical at the same rate, but were sown with different machinery configurations. The one on the **left** was sown with the NDF machine fitted with residue managers; the plot **second from left** was sown with the same machine but without the residue managers. The image **second from right** is of a plot seeded with the John Deere machine fitted with the managers; the one on the **right** is of a plot sown with the same machine but without residue managers.

project, to be able to produce guidelines on how to achieve particular weed control and crop safety outcomes when using pre-emergence IBS herbicides with disc seeders.

Depending on the strength of the data there may also be potential to talk to chemical manufacturers about the possibility of including that sort of infor-

mation on their labels, Dr Preston said.

“We are looking for general principles for crop safety when using IBS herbicides with discs. We know this varies with the chemical and the crop – wheat and barley react very differently to Boxer Gold, for example – as well as soil type and moisture levels, so we will need to have something that says ‘this is OK with this product and

this crop in these conditions’.

“Achieving this will require a very good understanding of all the factors and how they interact with each product.”

The researchers’ ideal outcome from the project would be to identify a simple, practical, universal set-up solution for discs that would enable herbicides designed to be incorporated by sowing

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(IBS) to be used effectively and safely with disc seeders.

However, given the variation in disc seeder characteristics, the complexities of the interactions of discs with the soil and between soil and crop types and the different chemicals, that seems unlikely to be achievable in the short-term so they are also looking for a way to rank disc seeders for herbicide efficacy and crop safety.

“Our initial aim is to identify a particular feature or effect that will enable us to rate machine types or settings,” Dr Preston said.

“If we can achieve that we may be able to link the rating to a risk profile, possibly for each chemical for each crop, given that some crops are more sensitive to some chemicals than others.

“We would like to be able to produce a farmer-friendly fact sheet that clearly sets out the factors that increase or reduce risk of crop damage from IBS herbicides when using disc seeders; along the lines of ‘doing this will increase risk but improve weed control. Doing that will reduce the risk but also lower the potential to control weeds in the crop row’.

“Crop safety and weed control are almost mutually exclusive. Good weed control requires the full rate of chemical, which maximises the risk of herbicide damage to the crop. Reducing the rate can reduce crop risk but also reduces weed control.

“This means we need to find a trade-off or compromise position that gives an acceptable level of risk for an acceptable level of weed control.

“The aim of the game is to put herbicide where the crop seed isn’t, without reducing weed control.”

The trial treatments have been designed using knowledge gained from previous research by Dr Desbiolles into what influences soil disturbance and soil throw by disc coulters and insights obtained from trials looking at how products like Boxer Gold, Sakura and trifluralin perform in different soil types, on different crops and in different moisture regimes.

The team is evaluating five different seeding systems in the field-scale trials.

The control is a high-disturbance disc seeder, represented in the trials by the K Hart triple-disc machine, which is known to minimise crop damage from pre-emergence herbicides.

The other machines are a Bertini triple-disc and NDF, John Deere and Daybreak low-disturbance single-disc

### Influence of residue managers on pre-emergent herbicide behaviour and wheat crop safety under NDF and JD90 single disc systems

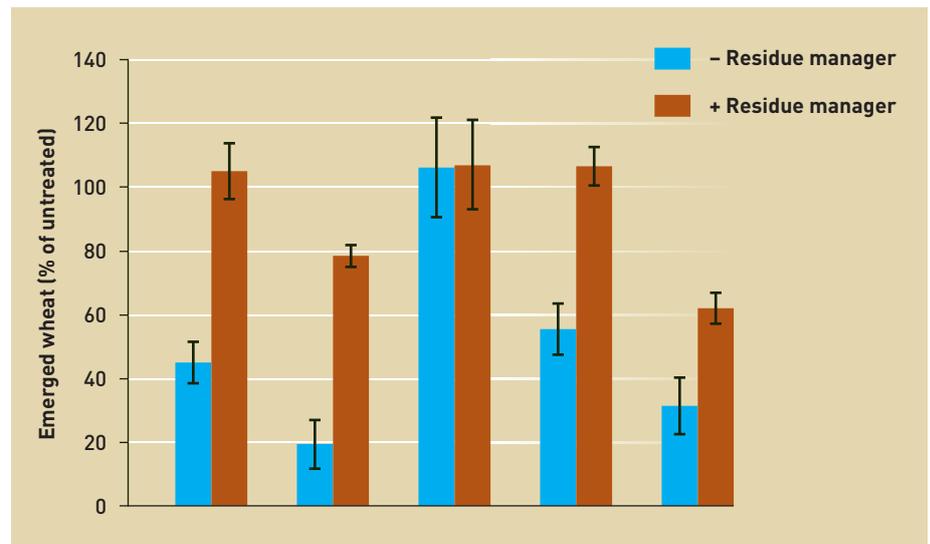


Figure 1. Effect of five pre-emergent herbicide mixtures on wheat emergence (% of untreated) under NDF single disc opener with and without residue managers. Untreated mean wheat density (162 plants m<sup>-2</sup>, + residue managers; 176 plants m<sup>-2</sup>, - residue managers). Bars represent SE of mean.

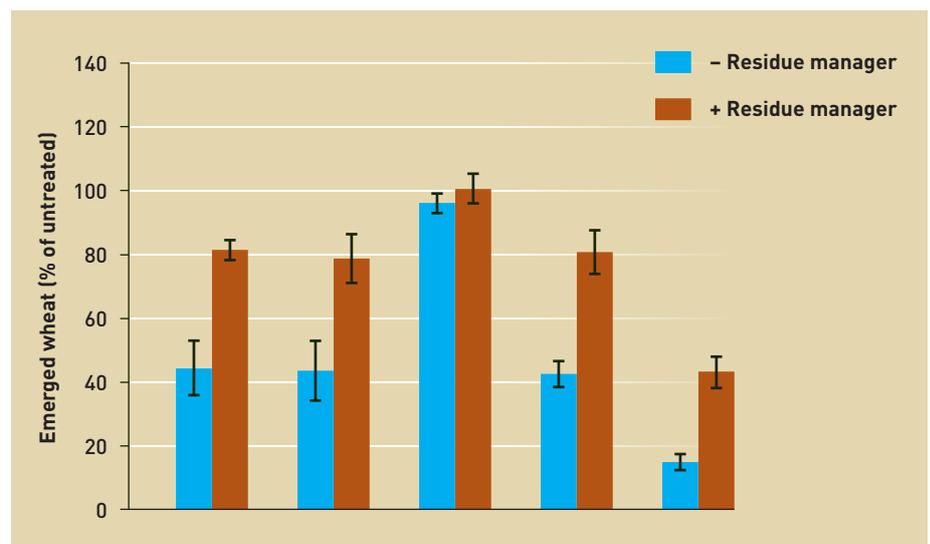


Figure 2. Effect of five pre-emergent herbicide mixtures on wheat emergence (% of untreated) under JD90 single disc opener with and without residue managers. Untreated mean wheat density (203 plants m<sup>-2</sup>, + residue managers; 211 plants m<sup>-2</sup>, - residue managers). Bars represent SE of mean.

machines. The Daybreak unit has been used with several different set ups to alter its characteristics so the researchers can assess the risks to crop safety of the different settings.

A ‘residue manager’ to clear surface residue from ahead of the seeding units is also included in some of the trial treatments.

“The aim is to find the ‘tipping point’, the level of soil disturbance or cleaning needed to ensure adequate efficacy of

chemical. So we are aiming to have treatments that provide low and high levels of crop damage so we can work out what the critical factors are,” Mr Kleemann said.

“The early results are in line with what we predicted when deciding on the different treatments, which is reassuring because it suggests we have a good understanding of the mechanics and how the chemicals behave in different circumstances.”