On the track of renovation

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Introducing controlled traffic to his Stockport farm has paid dividends for Mark Branson, and the use of a recently purchased track renovator has restored compacted tramlines to make travelling across paddocks a walk in the park.

The adoption of controlled traffic farming has been gradual and deliberate for Lower North grower Mark Branson, who sees an inextricable link between improving soil health and continued yield increases.

Mark cites former SANTFA Executive Officer Rohan Rainbow as the person who first planted the seed about controlled traffic. "At a SANTFA event I went to Rohan told me that if I was going to upgrade my air seeder I should start looking at matching up my wheel tracks."

In the late 1990s Mark matched up wheel tracks in paddocks where beans were grown, with the tractor and 28-metre spray both on a wheel base of 2.2 metres.

His next purchase was a Flexi-coil bar with a Horwood Bagshaw seed box and a 30-metre spray boom. That combination, which coincided with a move to GPS-based guidance, saw him change to a 10-metre working module and up-and-back working.

When he installed an RTK guidance system and auto-steer in 2004 he moved to 'true' controlled traffic, changes that significantly improved the accuracy of his cropping program.

The following year Mark undertook a Nuffield Scholarship investigating precision and conservation agriculture. The systems he observed during his scholarship confirmed his theories on the relationship between improving soil health and the increasing crop yields.

Based on the theory that 'if you do a Nuffield you have to buy something', Mark bought a 37-metre Hardi Alpha self-propelled boom spray when he returned home and extended the boom to 40 metres to fit his 10-metre module CTF system.

In 2012 Mark bought a Nitro self-propelled boom spray with a 2.8-metre wheel base, 600 mm wider than his existing permanent wheel tracks. He made the transition from the 2.2-metre to 2.8-metre wheel base by running the left-hand wheels of the new machine on the left-hand side existing wheel track and letting the right-hand wheels establish a new track 0.6 metres to the right of the existing right-hand track.

THE GRIZZLY RENOVATOR HANDLES DRY CLAY SOILS WITH RELATIVE EASE AND MARK BRANSON (INSET).

Mark's adoption of CTF, PA and inter-row sowing and the use of animal manures have led to the doubling of water use efficiency on his Stockport farm, from 80% in the period 2002 to '06 to 96% in 2008 to '12. Crop production has risen over the same period, with wheat yields increasing from 3.6 t/ha in 2002 to '06 to 4.7 t/ha in 2008 to '12. And visual assessment using soil pits shows improved soil structure.

However, confining machinery to tramlines invariably leads to the 'slumping' of wheel tracks, which was at a manageable level on Mark's property until the wet spring of 2010, when spraying weeds while the soil was wet caused rutting and other damage to the tracks. This made using the tracks difficult and driving utes and other vehicles across them almost impossible, which slowed harvest operations because chaser-bin drivers had to travel slowly across paddocks.

Mark tried ploughing the affected areas, but the soil was merely worked, not funnelled into the hollows and depressions in the tracks.

At a SPAA event in 2012 Mark met Dr Tim Neale, a precision agronomy consultant from Queensland who agreed to look take a look at the problem.

Dr Neale's first suggestion was to change the direction of some of the tramlines to run up and down slopes, so water could drain downhill along the wheel tracks rather than pooling on them. He also suggested using a renovator to repair compacted and sunken tramlines.

Mark could find no-one in SA with a track renovator so investigated buying his own.

He felt a renovator with discs would be the best option to penetrate dry clay soils during late summer and early autumn, before seeding started, and settled on a Victorian-manufactured Grizzly renovator. The purchase was made earlier this year through a local machinery dealer and the machine arrived set up at 2.8 metres wide to match his tramlines.

The Grizzly renovator is controlled by a three-point linkage system to ensure the unit tracks straight and stays in the correct position. Six angled discs on each side break down raised edges and funnel the loosened soil into the wheel tracks, filling the ruts and hollows and bringing the tracks back to the same level as the cropping soil between them. Rolling harrows press the soil into the tracks so loose soil is compacted. The machine is also fitted with finger tine harrows to level out soil and distribute stubble evenly, but 'might not be essential', according to Mark.

Working at 12 kph, Mark is able to renovate tracks at a rate of 30 ha/hr. This year he renovated the worst tracks on the property, on around 500 ha, in just under six days.

He found that some tracks were mounded after being renovated, but the traffic at seeding time levelled them out. After seeding this year Mark also noticed that the tracks that were slightly damp before being renovated looked better than those that were dry.

With a capital outlay of a little more than $20,000 and a week's work, Mark now has his permanent wheel tracks in good order, and is very happy with his investment. And come harvest time, so too will the chaser-bin driver.

SOIL PULLED ONTO THE WHEEL TRACKS BY THE RENOVATOR'S DISCS IS FIRMED BY ROLLING HARROWS AND LEVELLED BY BY TRAILING FINGER HARROWS.

Calculating potential yield and water use efficiency

Tracking water use efficiency (WUE) over time enables growers to see how effectively their system converts water into biomass.

Comparing WUE and yield data provides opportunities to identify potential opportunities to improve crop performance by, for example, adjusting time of sowing or the rate or timing of fertiliser applications. It can also enable growers to look back and see how and to what extent farming system changes have impacted on crop performance.

The French-Schulz model was developed in the mid 1980s by two South Australian researchers to predict potential yield based on water availability. The simple formula can be used to calculate the 'best yield' for wheat, barley and oilseeds based on the amount of growing season rainfall* (April to October), less evaporation. The resulting figure is the potential yield in kg/ha.

Calculating potential yield (kg/ha)

Wheat
(Growing season rainfall minus 110 mm) x 20

Barley
(Growing season rainfall minus 90 mm) x 20

Oilseeds
(Growing season rainfall – 110 mm) x 12

* More accurate figures can be calculated if available stored soil moisture is added to the growing season rainfall.

For example, for wheat where the available rainfall is 200 mm:

(200-110) x 20
= 90 x 20
= 1.8 t/ha

Comparing the actual and potential yield figures gives an indication of water use efficiency:

Calculating water use efficiency

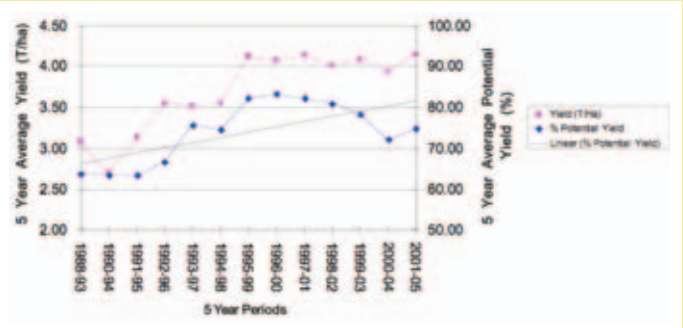
$$\text{WUE} = \frac{\text{Actual Yield}}{\text{Potential Yield}}$$

Therefore, if the yield potential was 1,800 kg/ha but only 1,600 kg/hectare was grown:

$$\text{WUE} = \frac{1600}{1800}$$

$$= 0.8888\ (88\%)$$

Mark Branson uses yield potential calculations and yield data to detect areas for improvement and to assess the effect of new crop varieties and farming methods.



Between 1998 and 2005 (above) he achieved a steady increase in water use efficiency of 1.1% a year. Towards the end of this period he introduced new crops such as legumes and oilseeds, changed wheat varieties and introduced nitrogen based fertilisers, stubble retention and no-till. He also increased the accuracy of his controlled traffic farming system.

These changes had a positive effect on his WUE, which jumped to 2% a year between 2002 and 2012 (above).

Mark believes that the amount of water being lost to evaporation is decreasing with the improvement of soil structure as a result of strategies such as no-till and retaining stubble. "Rather than subtracting 110 mm for wheat, it's probably more like 80 to 90 mm of water lost through evaporation". This is likely to be the reason Mark's actual yields are nearly always higher than the potential yield calculated using the French-Schulz model.

The French-Schulz model is far from perfect, if only because it makes no allowance for variations such as soil type, time of sowing or the amount of tillage. However it is simple to use, and doing the calculations annually and recording the results will provide data that can provide valuable insights, particularly when compared with actual yield and WUE information. It also offers growers a way to assess the impact of changes to farming systems such as stubble retention or reduced tillage.

More information on calculating water use efficiency can be found at: http://www.grdc.com.au/uploads/documents/GRDC_WUE_FS_SthWst_300909%20(2).pdf

You can find a video of Mark Branson's track renovator in action at: http://www.youtube.com/watch?v=tcKdnJLARLk&feature=youtu.be or by searching for SANTFA's youtube channel SANoTill.