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CONTROLLED TRAFFIC FARMING FACT SHEET

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NORTHERN, SOUTHERN AND WESTERN REGIONS

IMPLEMENTING A CONTROLLED TRAFFIC FARMING SYSTEM

Controlled traffic farming (CTF) is a farming system built on permanent wheel tracks where the crop zone and traffic lanes are permanently separated. It can improve profitability and sustainability, and adoption of CTF need not be a daunting proposition.

KEY POINTS

- Controlled traffic farming (CTF) systems alleviate soil compaction constraints. They can deliver unique operating efficiencies and agronomic opportunities.
- CTF crops are typically higher yielding, and are more resilient in very wet or very dry seasons than those with less controlled cropping traffic.
- In the absence of subsoil constraints, CTF can deliver better water use and fertiliser use efficiencies.
- Costs of conversion to CTF depend on how well your current machinery fits, the length of a transition plan and the capacity to use partial CTF to accommodate existing machinery configurations.
- CTF soils leach fewer nutrients into groundwater, have less water erosion, better infiltration, more controlled run-off and fewer greenhouse gas emissions.

PHOTO: GREG CONDON

A gradual low-cost approach to machinery changeover was taken in this 9-metre system at Wagga Wagga, NSW. A Horwood Bagshaw seeder width was matched to the existing header, then axles on boom and spreader converted to 3m in the farm workshop. JD front wheel assist tractor on 3m is used for all operations. A new disc seeder was purchased in 2013 to complement the no-till continuous cropping and stubble retention system.

Why CTF?

The experience of growers with controlled traffic farming (CTF) in Australia shows the system can often provide:

- more profit and less financial risk than uncontrolled traffic systems, especially in very wet or very dry seasons;
- healthy soils and less erodible landscapes;
- efficient and effective use of our natural resources and inputs such as fuel and fertiliser;
- effective solutions to current and future challenges (productivity and sustainability, adaptation to climate change, reduced greenhouse gas emissions); and
- opportunities for improved agronomic practices and systems across a range of soils, environments and climates.

Cost-benefits

Australian research over 20 years has shown CTF can improve grain quality and increase grain yields by two to 16 per cent (10 per cent is a common average after the year of establishment) if there are no other limiting subsoil constraints.

These benefits are attractive, but ultimately a new farming system has to produce more profit. A recent estimate of profit from large-scale dryland grain farms is

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shown in Figure 1 below for a modelled Western Australian farm. The average profit from cropped area greater than 1000 hectares is $47/ha. Roughly half the profit came from improved yield and the other half from improved grain quality; fuel saving is a minor component. A similar economic study found $87/ha improvement in profit from CTF farming on the Queensland Darling Downs.

The costs of conversion to CTF depend on how well the current machinery fits a CTF system, the length of a transition plan and the capacity to use partial CTF to overcome farm-specific barriers.

Some CTF growers in summer cropping areas are reporting doubled production from higher crop frequency and cereal/legume rotations, higher yield and water use efficiency with less fertiliser, increased soil nitrogen (N) and phosphorus (P) with less fertiliser.

The cost of a transition to CTF varies from farm to farm, depending on what equipment is already on hand.

Following is a guide to the cost of upgrading to a CTF system:

***Tractor**:*

Front-wheel axle – new cotton reels	*$3600*
Trailed sprayer axle conversion	*$3000*
Air cart axle conversion	*$0 – $3000*

***Harvester**:*

Auger extension	*$1600 – $2000*
Chaser bin extension	*$16,000*
Total base cost: $24,200 – $27,600	
***Option 1** – If GNSS 2cm RTK is required*	*+ $18,000*
Total cost: $42,200 – $45,600	
***Option 2** – If narrow tyres are needed in a double cropping environment*	*+ $7000 – $14,000*
Total cost: $31,200 – $41,600	
***Options 1 and 2** – With narrow tyres AND GNSS 2cm RTK*	
Total cost: $49,200 – $59,600	

Compaction

The heavy equipment used to deliver ever-greater efficiencies in Australian grain production has resulted in subsoil compaction in our cropping regions.

In these farming systems, the scale of operation needs to be very efficient to minimise overhead costs.

This efficiency is improved by using high-capacity equipment that sows, spreads or sprays inputs over as much area as possible in the available time, as well as removing the harvested grain as quickly as possible with high-capacity transport.

Such high-capacity equipment is heavy and wide:

- some of the most recent models of air carts are more than 70 tonnes loaded;
- some seeders are now wider than 18m; and
- some harvester fronts are now wider than 12m.

Despite the widespread adoption of autosteer to minimise overlap in cropping operations, surface and subsoil compaction is still a reality for many dryland and irrigated grain farms.

Research of repeated 'wheelings' has shown that in five passes, the first pass does 80 to 90 per cent of the damage.

The negative impacts of compaction on crop production have been the primary motivation for the development of CTF systems.

Controlled traffic limits the compacted area to less than 15 per cent, compared with more than 50 per cent from some uncontrolled traffic systems in just one season.

PHOTO: TIM NEALE

Axle extensions are one way to facilitate a move to CTF. The part pictured here was manufactured specifically for this tractor and while not as inexpensive as cotton reel spacings, it is a robust option that will not cause damage to the machine.

Severely compacted soils usually have large dense and angular clods with rectangular or flat plate-like shapes with distorted and flattened roots confined to the cracks in between. In sandy soils there may be no cracks, just a dense mass of soil with large distorted roots.

While compaction is worse in wet soils, heavy harvesters in a dry harvest will still cause compaction. The main effects, though, are from sowing, spraying and spreading operations.

Subsoil compaction (below a depth of about 10 centimetres) is dictated more by total axle load rather than surface pressure under a tyre or track.

Deep tillage is often the most cost-effective way to correct subsoil compaction.

The 'shrink and swell' action in wetting and drying conditions (especially in cracking clays), biological activity of roots, burrowing

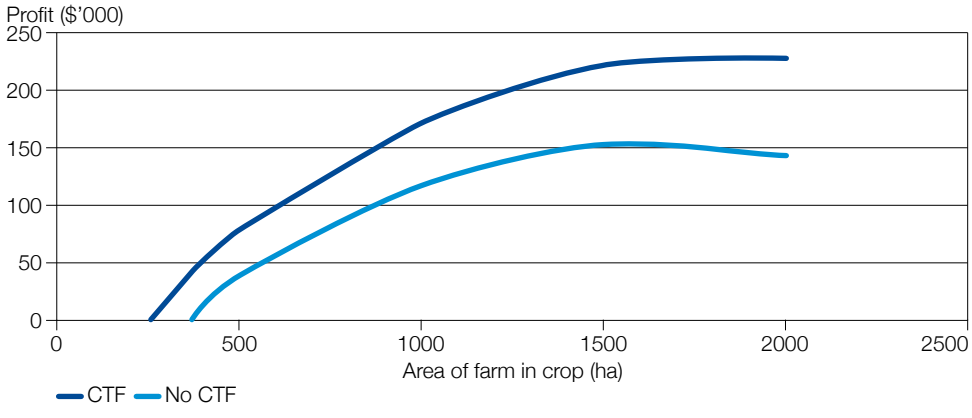

FIGURE 1 Estimated whole-farm profit from economic modelling of a dryland mixed farm in WA and the influence of crop area on profitability. The modelling is based on conservative costs and benefits ($45,000 costs, including autosteer, and average yield increase of seven per cent).

of soil fauna and chemical stabilisation of soil by organic matter can all help improve soil condition and alleviate compaction. Such responses are not as rapid as mechanical loosening, but may be cost-effective in the long term, especially on some clay soils. Studies have shown that severe compaction of a cracking black clay in Queensland by 10t axle loads can be ameliorated naturally in five years.

Moving to CTF

CTF is a crop production system in which the crop zone and the traffic zones are distinctly and permanently separated. All implements have matching width or multiples of it, and all wheels and tracks run in permanent traffic lanes.

CTF is built around five components.

1. Management zones

Controlled traffic means all machinery operates on a single set of wheel tracks for all load-bearing wheels on tractors, headers, sprayers and other equipment. Controlled traffic defines three management zones:

Wheel tracks

Wheel tracks should be hard and dry to give traction efficiency (to reduce fuel use) and access after rain to provide operational timeliness. They should be wide for safety and stability and tyres as narrow as possible to maximise the crop area.

Crop zone

The crop zone should be soft, uncompacted soil for plant establishment and root growth. Some rolling to firm very loose soil may be required after deep cultivation or after very long periods of CTF.

Inter-rows

The inter-row sowing of wider row crops (often summer crops) can be better managed for weeds with CTF, because controlled traffic does not interfere with the inter-row.

These zones are defined accurately (to a few centimetres) and can be easily used for inter-row sowing by using an offset hitch or minor adjustments to the guidance system.

2. Decide on operating width

Controlled traffic defines the wheel track and operating widths of all machinery on the farm. This is the first decision.

The harvester is the hardest machine to modify and sometimes the heaviest, so this is the best place to start.

Typically the grain harvester has a 3m wheel spacing. Modification to tractors, sprayers and other equipment to this track width have been developed and are widely available.

Following is a list of convenient harvester widths, along with the planter/seeder and sprayer widths to which they match. Odd matching ratios of sprayer to seeder (3:1) allow neater paddock edge matching. Even ratios (2:1) need overlap runs at the edge or an extra set of permanent wheel tracks in the wings of very wide seeders.

Harvester widths

9m 10.5m 12m 13.5m

Planter/seeder widths

9m 12m 18m 21m 24m

Sprayer widths

18m 21m 24m 27m 36m

However, machinery changes can be expensive, depending on what is already owned. A machinery plan outlining wheel track and implement width is needed.

Eventually there can be less machinery and possibly smaller tractors due to better traction and lower draft requirement.

Most of the machinery changes have been based on grower innovations or specialist consultant advice, and growers themselves continue to find improved approaches. If cost is the factor discouraging a move to controlled traffic, calculate future productivity and yield improvements and the likely increase in profits before rejecting the idea. Talk to someone who has done it and visit the farm.

3. Field layout

An efficient field layout is critical for CTF and seeking professional advice is recommended. Ideally the layout should be straight rows and up and back, following a fenceline and with consideration given to managing runoff, erosion, waterlogging and dry wheel tracks.

In high-rainfall areas, all wheel tracks should drain down to a safe disposal area. This way, water erosion is managed by preventing any flow concentration so wheel tracks do not erode. Waterlogging is also managed, as seen already with raised bed layouts in the high-rainfall zone.

In practice, there will be low areas in most fields and these require drainage.

4 .Tillage systems

Controlled traffic supports no-tillage and zero-tillage well because guidance makes spraying more straightforward and efficient. Reduced tillage is a valuable practice for water infiltration, ground cover, soil carbon and other soil health indicators.

The CTF management zones offer more effective spraying and residue management. The rows and inter-rows can be micromanaged. Any tillage system that conserves the permanent wheel tracks can be used in CTF; even full-tillage such as inversion ploughing can allow later restoration of permanent wheel tracks, which is essential if a large investment in deep tillage and soil amelioration is to provide long-term benefit.

PHOTO: TIM NEALE

Planning and layout are critically important when designing a CTF system. If the direction of the run is not right, water will not run off as it should and problems of waterlogging will result.

5. Guidance

CTF needs accurate and repeatable guidance to be able to return to the permanent wheel tracks every time.

Global Navigation Satelite System (GNSS) Real-Time Kinematic (RTK) 2cm guidance provides this and is the recommended option. It is likely that proprietary equipment (where one brand is not compatible with another brand) will decline and this will further benefit the industry. In addition, service from Continuous Operation Reference Stations (CORS) Networks and other networks are widely available and this reduces the capital investment.

High-quality guidance delivers autosteer, which provides accuracy and reduces driver fatigue.

Adoption barriers

Barriers to adoption include:

- poor understanding of CTF;
- urgent need for improved seeding and harvesting efficiencies with equipment wider than 12m;
- poor spreading of straw and lime beyond 9m;
- difficulty moving burned windrows;
- perceived high initial costs of conversion; and
- concerns about managing erosion and weeds in permanent wheel tracks.

These challenges can all be well managed in a good CTF system and with a sound financial transition plan.

A GRDC survey estimated that adoption of CTF related cropping increased nationally over three years, from 15 per cent in 2008 to 21 per cent in 2011. However in many large farming regions, change was slow or insignificant.

What is GNSS?

GNSS (Global Navigation Satellite Systems) are satellite-based positioning systems that includes satellites owned by the US, Russia, Europe and China.

GNSS is not restricted to GPS and in future, a proliferation of GNSS will become available. The technology is expected to revolutionise a range of industries – including farming – in much the same way mobile phone technology has done.

See Useful Resources for further information.

A recent survey by the CRC for Spatial Information (CRCSI) looked at the detail of controlled traffic adoption in eastern Australia and suggests that 86 per cent of growers do not understand the CTF system and 20 per cent think partial adoption is sufficient.

Ninety per cent of growers seek CTF advice from one-on-one contacts: agronomists and machinery dealers.

This adviser group was also surveyed and a large majority reported that they did not understand the CTF system. More effective education is needed.

Change is sometimes difficult, but the widespread move to zero-till is just one example of how growers embrace new knowledge and technology. Several successful Australian CTF growers regularly share their experience through field days, conferences and media. Improving the advisers' understanding of CTF will help to facilitate further adoption.

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USEFUL RESOURCES

Australian Controlled Traffic Farming Association
www.actfa.net
CRC Spatial Information
www.crcsi.com.au

GRDC
Search 'Controlled Traffic Farming'
www.grdc.com.au

Precision Agriculture
www.precisionagriculture.com.au

CTF Solutions
www.ctfsolutions.com.au

Department of Agriculture and Food Western Australia
Tramline Farming Systems:
Technical Manual (recently updated)
www.agric.wa.gov.au/objtwr/imported_assets/content/lwe/land/cult/bulletin4607_complete.pdf

Global Navigation Satellite Systems (GNSS) Research Centre
gnss.curtin.edu.au

Grassroots Agronomy
Controlled Traffic Farming:
A practical overview of CTF systems in southern NSW
www.grassrootsag.com.au/CTF%20brochure%20low%20res.pdf
Twitter: @grassrootsag #CTF

FURTHER INFORMATION

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