9th Australian Controlled Traffic Farming Conference
Mildura, Victoria, 26 – 28 August 2014

The Australian Controlled Traffic Farming Association (ACTFA) and the Victorian No-till Farmers Association (VNTFA) welcome you to the 9th Australian CTF conference. These conferences have been held in most Australian States since 1995 and have proved to be a valuable forum for farmers, advisors, industry and researchers to exchange ideas about the profound implications of controlled traffic in farm production systems. They have also been a powerful means of spreading the word about CTF practices and benefits in the grains, cotton, sugar, horticulture and forage industries and a source of significant cross-fertilisation across them. People involved in all of those industries have been stimulated to adapt and adopt systems, ideas, approaches and technology from other regions or industries.

We hope CTF14 will encourage a similar level of interaction between agricultural industry people across South-east Australia and give them a chance to discuss their farming systems and experiences. This has been a specific objective in designing the conference program. There are no parallel sessions or specialist groups, and the breaks and social activities are arranged to maximise delegates' opportunities for interaction.

Controlling field traffic in mechanised agriculture is not a new idea: the multiple advantages of improved field access, reduced energy use and improved soil conditions have been known for decades. What is relatively new (in the last 10 - 20 years) is its practical application on farm, an outcome assisted by the interaction and debate that has been a feature of CTF conferences which have all had programs that are focussed on farms and farming systems.

CTF farming systems are built on the basic concept of controlled traffic. This means that all the deleterious effects of weight-bearing machinery wheels are confined to permanent tracks covering no more that 15% of paddock area, leaving 85% of the paddock in optimum condition for plant growth. Research and farmer experience has found that controlled traffic also supports a wide range of other improved practices, innovative spatial information and technology applications that provide a platform for significant triple bottom line benefits. When CTF and these improved technologies are combined in a holistic system that recognises the interactions between farmers and their farms, soils, topography, crops, climate and equipment , the result is a more profitable, sustainable, environmentally and socially responsible farming business. Since 2006, CTF conferences have been organised by ACTFA and this is the first one in which VNTFA has been an active organising partner. The committee for this conference has consisted of Chris Bluett (ACTFA), Kerry Grigg (VNTFA) and Melissa Cann, Darryl Pearl, Jeff Tullberg, Don Yule, and John McPhee, with invaluable assistance from Sally Brown, Wendy Moline and Alex Milner-Smyth. The program covers important background information for CTF adoption including the effects of machinery compaction on soils and crops and discussions of cropping practices, technology and crop/equipment interactions, agronomic and cropping system opportunities and the economics of CTF.

There is also time scheduled for discussion of the future of ACTFA, so that it can continue to serve the needs of Australian agriculture and the development and promotion of CTF as a key enabling technology for long term improvement. Australian farmers can be proud that they are acknowledged across the agricultural world as the leaders in the development and adoption of CTF systems. But pride must not turn into complacency and ACTFA must continue to take a lead role in assisting farmers and policy makers across the four major plant production industries in Australia. What role should ACTFA, and similar organisations overseas, have in furthering the development and uptake of CTF? What strategic partnerships should ACTFA make? Who is ready to step up and play a role in that journey? Who will be the supporters?

We trust you will find value in the presentations and discussions and go home with re-invigorated enthusiasm to try something new, “do it, but do it right”. Remember, the principles of CTF are universal and applicable to any country and any plant production industry. How you apply those principles depends on what best suits you and your farm. Always start with a plan, seek good advice, and then “have a go”. We wish you a pleasant and productive visit to Mildura, and trust you find plenty of value over the course of the conference.

Biographies

Christian Bannan. B. Agriculture (Hons), Adv. Dip. Agriculture, ASSSI.
Company: South East Soil & Water. Position: Director, Soil Scientist.
Christian is a soil scientist located at Bendigo in central Victoria. Christian has over 7 years' experience with field consulting and reporting from environmental science, environmental engineering and agricultural science related projects. Christian has direct experience with soil and geotechnical investigation, soil forensic investigation, soil surveying and soil chemical test analysis, providing detailed and scientific recommendations for soil amelioration, management and production. Christian specialises in soils of the Murray Darling Basin, working regularly with soils throughout the Riverine Plains and Mallee regions of Victoria and south and western New South Wales. Christian has also undertaken work in southern Queensland, South Australia, Western Australia and more recently overseas in India.

Paul Blackwell, DAFWA
Paul works for the Department of Agriculture and Food in Western Australia (DAFWA) and helped research soil problems such as compaction, hard setting, non-wetting and their technical solutions, as well as helping investigate the effects of biochar on soil and crops. Controlled Traffic Farming development has been a specialisation of his in that State. He was heavily involved in the recently-finalised DAFF-funded project that promoted CTF in WA, and has a leadership role in the new five year GRDC project on CTF and soil compaction that has followed it.

Mark Branson (B.AppSc (Agric), 2005 Nuffield Scholar)
Owner manager of 'Branson Farms" a 1200ha mixed farm at Stockport, 80km North of Adelaide.

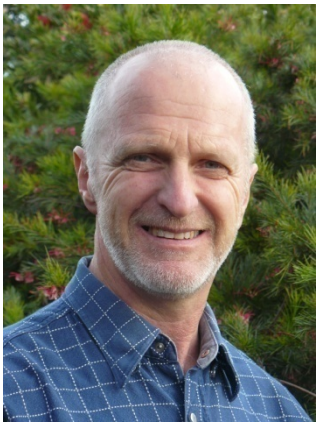
In 2002 he was a founding member of, and is an ex-president of SPAA - Precision Agriculture Australia. He is now on GRDC's High Rainfall Regional Cropping Solutions committee.

Mark is one of the leading farmers into the adoption of new cropping technologies in Australia and talks at many conferences on technology in annual rainfed cropping systems.

Grant Hausler, Manager, Geoscience Australia
Grant is responsible for coordinating planning and development of Geoscience Australia's National Positioning Infrastructure (NPI). Hailing from northern Victoria, Grant completed his PhD (Geomatic Engineering) at the University of Melbourne following experience as an engineering surveyor in Australia and London. Grant's time at Melbourne Business School assisted his research towards addressing economic, policy and technical criteria for developing Australia's NPI.

Richard MacEwan
Richard has been a soil scientist in the Victorian Department of Agriculture for many years. He has also taken leading roles in professional associations such as Soil Science Australia. Richard's long experience with soil and soil degradation and repair has led to his belief that "It (soil) is a silent servant that needs to be sustained so it can continue to provide the services necessary for agricultural productivity and environmental health – both of which are essential for our survival".

Marc Nulty – Mallee Farmer
4th Generation Mallee Farmer at Carwarp, Nowingi, 35km south of Mildura. Running a mixed farming enterprise of cropping and livestock, of which we are predominately cropping. Used to be a chartered accountant before returning to the family farm 12 years ago. Currently not implementing controlled traffic into our farming system.



John McPhee, Tasmanian Institute of Agriculture
John McPhee began CTF work in irrigated grain in Queensland in the late 1980's. After a long break, and now with the Tasmanian Institute of Agriculture, based in Burnie, CTF has been central to his research, development and extension work in the Tasmanian vegetable industry since 2006. He has a strong belief in the use of CTF as a means of looking after the soil resource and improving productivity, and despite the many challenges of implementation, works to promote the increased use of CTF in the vegetable industry. His presentation will cover some results and observations from his experience in the vegetable industry, and outline challenges and options for CTF in mixed farming situations.

Andrew Newall, Newag Consulting, Horsham, Victoria
Andrew Newall runs NEWag Consulting, based in Horsham in the heart of the Wimmera. He conducts a comprehensive trial program each year to keep clients up to date with the latest research and development. His aim is to ensure clients successfully adopt a profitable and sustainable crop production system that encompasses the No Till/Zero Till and Controlled Traffic principles to achieve desired results.

Annieka Paridaen, Southern Farming Systems
After graduating from University, Annieka joined the Victorian Department of Primary Industries' Graduate Recruit program. There are usually only around ten "Grad recruits" every year and they are picked from fields of several hundred applicants. Annieka now works as a Research Officer for Southern Farming Systems. She has recently attended the World Congress of Conservation Agriculture in Winnipeg, Canada, and studied CTF in Manitoba and the Dakotas.

Geoff Rethus, Farmer, Horsham, Vic
Geoff directs a 4000 hectare broadacre cropping enterprise in Victoria's Wimmera District that grows cereals, oilseeds, pulses and oaten hay. Geoff has been farming for over 40 years and has seen considerable change in the industry, particularly with technologies and farming practices. The enterprise has been applying a No-Till Farming (NTF) system for over 20 years and Controlled Traffic Farming (CTF) system for some seven years.
NTF and CTF have not been without their challenges, requiring new approaches to pest, weed and residue management compared to past conventional systems. With persistence, Geoff is seeing the results of reduced soil disturbance and compaction that NTF and CTF bring; soil structures are promoting water infiltration and soil organics are more active. This is leading to improvements in yields and quality through better plant access to moisture and nutrition elements.
Striving to "do more with less" is the basis for many business decisions that drive Geoff and his partners to continually develop, improve and look for new ways to operate that will ultimately deliver a more productive, efficient and lower risk enterprise.

Luke Young, Topcon

Growing up in Horsham Victoria surrounded by agriculture, I have always been interested in using technology to gain productivity. After completing a Certificate 111 in mechanical engineering, I went into Precision Agriculture support, sales and training with a local dealer. After 4 years an opportunity arose to become Regional Sales Manager for Topcon Precision Agriculture, Australia, looking after Victoria and Tasmania, and since starting I haven't looked back..

Australian Controlled Traffic Farming Conference, CTF14

26 – 28 August 2014

Quality Hotel Mildura Grand, Seventh Street, Mildura, Victoria
www.qualityhotelmilduragrand.com.au

"Concentratin' on Trackin' Right"

PROGRAM

Tuesday 26 August

Registration open from 14:00

Trade set up: Exhibitors can set up after 14:00

Welcome Reception and viewing trade displays: Grand Hotel, 17.30 to 19.00

Wednesday 27 August

Theme 1

CTF: Why would we?

Time	Topic or Title	Speakers
08:30 – 9.00	Registration	
09.00 – 09.15 15 mins	Welcome to CTF2014	**Chris Bluett (HRZ Consulting, Victoria)**
09:15 – 9.55 40 mins	What's it all about? The effects of machinery wheel compaction on soils and crop productivity in south-eastern Australia.	**Richard MacEwan (Senior Soil Scientist, DEPI, Victoria)**
09:55 – 10:30 35 mins	CTF delivers efficiency, effectiveness, opportunities and performance for the farmer and the farm – the journey so far and a look into the future	**Don Yule, CTF Solutions**
10:30 – 11:00 30 mins	***Morning Tea - Networking and viewing trade displays and posters***	
11:00 – 11:20 20 mins	Why go down the CTF Journey? A grain grower's perspective.	**Geoff Rethus, (Farmer, Horsham, Victoria)**
11:20 – 11:40 20 mins	CTF, a grains industry consultant's perspective. Why and how should consultants advise our clients about planning for and adopting CTF?	**Andrew Newall (NEWag Consulting, Horsham, Victoria)**
11:40 – 12:10 30 mins	CTF in WA - experience of researchers and grain growers in the lighter soils of the West.	**Paul Blackwell (Senior Research Officer, Dept of Agriculture and Food, WA)**

12:10 – 12:35 25mins	What can CTF offer the horticultural industries?	**John McPhee (Tasmanian Institute of Agriculture)**
12:35 –12:00 25min	CTF in drip irrigated tomatoes and pivot irrigated carrots - two very different soils, CTF an answer in both.	**Christian Bannan (Director, South East Soil & Water, Inglewood, Vic)**
12:00 – 13:00 60 mins	***Lunch - Networking and viewing trade displays and posters***	
	Theme 2 **CTF: How could we? And what are the challenges?**	
13.00 – 13.40 40 mins	CTF on LRZ grain farms.The Great Debate: "Why I did"; "Why I haven't"; "Why I might".	**Ross Watson, Mallee Farmer** **Alistair Murdoch, once an Agronomist, now a Farmer** **Mark Nulty, Mallee Farmer** **Matt Elliott, Consultant and Farmer** **Andrew Wylie, Wimmera/Mallee farmer**
13:40 – 14.30 50 mins	• The issue of scale: Making CTF work no matter what size. • Farmers answer your questions from their experience with CTF machinery: type, size, scale, possible pitfalls.	**Wayne Chapman, CTF Solutions and farmer, pluspanel of CTF farmers**
14.30 – 15.00 30 mins	The new GRDC Project, "Application of controlled traffic in the low rainfall zone". Overview and how to get involved as a farmer.	**Chris Bluett, HRZ Consulting** **Melissa Cann, DEPI, Swan Hill** **Peter Fisher, DEPI, Tatura** **Darryl Pearl, DEPI, Mildura**
15:00 – 15:30 30 mins	***Afternoon tea - Networking and viewing trade displays and posters*** **OR** **20 minute workshop on getting involved in the GRDC LRZ project**	Serafin MACHINERY

15:30 – 16:30 60 mins	"Bells, whistles and toys" - The vital technologies: GPS & RTK; sensors; software; integration, UAVs, imagery	**Luke Young (Topcon)** **Grant Hausler (Geosciences Australia)** **Ray Gillinder (HELImetrex)** **Hayden Asmussen (DEPI, GPSnet)** **Wayne Chapman (Manager, ACTFA UAV Project)** **plus panel members**
16.30 – 17.00 20 mins	Observations on farmer attitudes to CTF in Canada and North and South Dakota, as gleaned from the 6th World Congress on Conservation Agriculture and post-conference tour, June 2014	**Annieka Paridaen (Southern Farming Systems, Victoria)**
17:15 – 17:30 15 mins	Summary Day 1	
18:30 – 20:00	***Stefano's Brewery – Conference Dinner with Guest Speaker Stefano de Pieri***	TOPCON Precision Agriculture

Thursday 28 August		
08:30 – 09:00 30 mins	**Annual General Meeting: Australian Controlled Traffic Farming Association Incorporated**	**Kim Russell, ACTFA EO**
09:00 – 9:30 30 mins	Background and future opportunities for CTF RD&E in the LRZ	**Vic No-Till Farming Assoc ACTFA**
9:30 – 10:00 30 mins	CTF on Show including welcome from the Hon Peter Walsh, MLA - Victorian Minister for Agriculture and Food Security, and Minister for Water	**The Hon Peter Walsh, MLA**
10:00 – 10:30 30 mins	***Morning Tea - Networking and viewing trade displays and posters***	JOHN DEERE
10:30 – 11:30 60 mins	Economics & financial aspects of CTF adoption	**Mark Branson (Farmer, Stockport, SA) + panel of growers**
11:30 – 12:15 45 mins	Grains Research and Development Corporation Outlook	**GRDC speaker TBA**
12:15 – 12:40 25 mins	ACTFA, Where to from here?	**Kim Russell, ACTFA EO**
12:40 – 13:00 15 mins	What did we learn? Summary of CTF 2014.	
13:00 – 13.30	***Lunch*** ***Final opportunity for networking and viewing trade displays and posters.*** ***Delegates depart***	mallee catchment management authority
	Exhibitors dismantle displays	
13:30 – 17:00	Optional. Tour of a CTF Farm in the Mallee plus possible visit to a sub-soil manuring site	**People wishing to attend MUST indicate their intention when registering**
13:50 – whenever	Optional. ACTFA Strategic Planning Session	

Information Disclaimer: *The speakers, topics and times are correct at the time of publishing. In the event of unforeseen circumstances, the organisers reserve the right to alter or delete items from the Conference Program.*

TABLE OF CONTENTS

THEME 1: WHY WOULD WE?

THEME 2: CTF: HOW COULD WE? AND WHAT ARE THE CHALLENGES?

What's it all about? The effects of machinery wheel compaction on soils in South-Eastern Australia

Richard MacEwan

Agriculture Research and Development Division, Department of Environment and Primary Industries, Box 3100, Bendigo Delivery Centre, VIC 3554. Email: richard.macewan@depi.vic.gov.au

Soil compaction results in reduced porosity and increased soil strength. These two physical effects are anathema to healthy plant growth and consequently soil compaction reduces crop yield and farm profits. Besides the obvious physical effects of compaction there are also impacts on soil chemistry, soil biology and nutrient cycling. Land used for cropping in South-East Australia has a diverse range of soils from light sandy textures to heavy cracking clays and these occur across a rainfall gradient of 300-600+ mm mean annual precipitation. How does soil type affect the vulnerability of a soil to the compacting effects of farm traffic and how is climate involved? In this presentation, drawing from our knowledge of Australian soils, I will explore the interactions between traffic, compaction, climate and soil type and the importance of this knowledge in controlled traffic farming.

CTF delivers efficiency, effectiveness, opportunities and performance for the farmer and the farm – the journey so far and a look into the future

Don Yule

CTF Solutions. E-mail: don@ctfsolutions.com.au

CTF is a holistic farming systems approach to farm management, developed in the 1990's and has been continuously improved since then. The basic practices are - all machinery on permanent wheel tracks for machine efficiency and soil compaction; layouts to provide positive drainage to manage runoff, erosion and waterlogging; and zero till to increase infiltration and soil health, and reduce erosion. "Just do it, but do it right".

Tractor guidance with GPS was developed so growers could do CTF better, and this led to a spatial technology revolution – incredible equipment accuracy (no overlap, no misses), row and inter-row applications (effective operations, cost savings, residue management) and remote sensing (yield monitors and imagery), and could relate measurements to farmer actions (the spatial footprint). Two way communications were added – automation and also live feedback of operations (connection to the internet and the farm computer).

Measure to manage became achievable – automated, accurate, digital, timely; availability of satellite, aerial and very high resolution (UAV)imagery; weed and N seekers.

The triple bottom line value proposition:

- The efficiency and effectiveness of CTF led to large cost savings, e.g. growers report over 50% less fuel and chemical use. The opportunity is to use the improved soil quality and management of soil constraints to increase yields. The adoption of raised beds in SW Victoria has been very successful with widespread uptake. My research showed more than a doubling of production. Similar increases were found in Central Queensland, associated with double cropping based on the access and timeliness from CTF. We need new approaches to crop agronomy to achieve these benefits and this challenges the applicability of past R&D in conventional systems. Growers are now doing their own research, and CTF supports this.
- Environmental benefits are massive – erosion control, less pollution, healthy soils.
- And the social benefits of increased safety and "less time to farm" are significant.

The proof of the value proposition is that we know of only one grower who has "gone back" financial returns. A recent survey of grain farms in Eastern Australia found that only 13% used 3m CTF, 66% used none and 21% used 2m and 3m "CTF". Low adoption is a major issue and the barriers identified included poor understanding of CTF by growers and advisers; advisers generally have "core business" and little interest or skills in holistic systems; and lack of standards and compatibility across machinery, technology and software.

The future will be: a culture of cooperation among CTF growers from all industries to present a unified claim for major industry and government funding to address the knowledge and applications gaps; continuous improvement in annual productivity and sustainability at the farm scale with new practices, higher value crops, higher yields; on-going applications of new technologies; and training and education at all levels increasing the knowledge and capabilities of our communities to provide research activity, widespread adoption, and upgraded services delivery to achieve our potential.

Why go down the CTF journey? A grain grower's perspective

Geoff Rethus

Farmer, Horsham, Victoria. Email: geoff@wilnecote.com.au

With the introduction of autosteer on our boom spray in early 2000 and the seeder a little later we had unwittingly started down the path of controlled traffic farming. The 90ft boom spray was travelling on the same tracks and each year the 50ft airseeder was traversing its own set of tracks. The combine with 35ft front was traversing a different path again, and sometimes at a completely different angle to the other equipment.

About seven years ago we started to notice some serious problems in some of our paddocks, particularly from the airseeder setup as the wheel track width was close to four metres of the fifteen metre sowing width because of the placement of all the wheels in the setup. The area was approximately 27% of the seeded area. The combine track was 15% and the boomspray 3.4%. The total driven on area was 46% plus maybe a pass with the prickle chain of another 10%.

Because of the large losses in yield in some paddocks because of wheeltracks we decided to match up the track and width of our equipment. We settled on 120" wheel spacing, 40ft wide seeder on 15" row spacing, 40ft combine and 120" seeder. The result has been that the wheel track area has been reduced to less than 10%.
A number of benefits have occurred:

- Crop growth is even across the row width
- Much improved water infiltration
- Better root development
- The hard setting soils do not set hard anymore
- Allows for inter row seeding
- Reduced weed germination

This all looks fantastic but CTF does create its own challenges:

- Pest management has changed
- Because tramlines are more trafficable when conditions are wet it can be tempting to be doing field operations under conditions that will damage the tramline causing ruts and "pot holes". These can be difficult to renovate and remove. Consequently some tramlines have become quite rough which can limit ground speed.
- Renovating wheel tracks has its own challenges. It is best done in minimal trash conditions and definitely not long trash.

Some rules I have set myself to manage the tramlines:

- Don't damage or make them rough in the first place
- Keep off when wet if possible
- Travel at moderate speeds
- Tracks on equipment are best to minimise damage

CTF, a grains industry consultant's perspective. Why and how should consultants advise our clients about planning for and adopting CTF?

Andrew Newall

NEWag Consulting, Horsham, Victoria

Farming in Australia provides many challenges, it being one of the driest continents in the world. One of the common deficiencies we experience in grain production is plant available water (PAW). So why wouldn't you then look at techniques or ways to ensure that you can be as efficient as you can in turning mm of PAW into grain.

Yield is limited by so many variables during the season, it is not just a direct correlation with the amount of PAW, although it helps. Many variables are out of our control especially when it comes to mother nature but one variable we can have an influence on is PAW. Reduced moisture availability due to compaction is still underestimated, it has a big impact on yields on all soil types not just clays. Conservatively 30% yield gains have been seen in our region and a minimum of 10% in sandier soil types, by introducing CTF and reducing the amount of compaction in the soil and increasing the amount of PAW.

If there was a new wheat variety that offered at least 10% yield gains over any other variety then every advisor would be advising their clients to grow it. However CTF has shown yield gains of at least 10% and yet there still seems to be a reluctance to implement a CTF system.

One of the key reasons for this reluctance as an advisor is the concern of having to give advice on machinery when your core job is to give agronomic advice on crop protection. However as an advisor you should be advising your client on all aspects of crop production so you need to be able and willing to advise and discuss aspects of CTF with your client.
One of the keys to successfully implementing a CTF system is planning, setting out a timeline and discussing with your client on where they are going with their business. The farming landscape is changing in terms of size of operations, so you need to know this, because once you put CTF lines down you don't want to have to change them down the track. Trust me we have had to and its disappointing when you have to start again.
So some key questions I would ask as advisor if my client was thinking about CTF:

- Is the size of your current operation going to change?
- What's your 5-10 year plan?
- What type of seeder do you want to use now and into the future?
- Can you or are you able to manage residue?
- Can you or do you want to rely on contractors?
- How do you go with labour?

From here you can then start to plan out the most efficient CTF working width for your client. This is the important stage, it is easy to try and implement a CTF system with current machinery in mind, however keep in mind potential machinery purchases in the future.

Pathways to more grain farming profit by CTF in WA

P. Blackwell[1], J. Hagan[1], S. Davies[1], G. Riethmuller[1], D. Bakker[1], D. Hall[1], Q. Knight[2], J. Lemon[1], S. Yokwe[3] and B. Isbister[4]

[1]DAFWA, [2]Precision Agronomics Australia, [3]Northern Agricultural Catchment Council, [4] Nth Pallinup Resources Centre

Key Messages

1. Controlled Traffic Farming (CTF) improves the financial returns from investment in deep tillage.
2. CTF need not be compromised by increasing seeder width for improved seeding capacity.
3. Future risks of very deep compaction in sands from heavier axle loads can be reduced by CTF.

Background

CTF is a system of restricting soil compaction and crop damage to permanent tramlines or wheelways enabling improved crop yields and quality; commonly 10% more yield and less screenings in cereal and more oil in canola (Webb et al. 2004).

Results

Using the MIDAS mode, a farm of greater than 2,000 ha moving to CTF in 2012 was estimated to benefit $36/ha if autosteer is already being used and $45/ha if autosteer has yet to be adopted; based on 5% grain yield increase from CTF. Analysis of seeding capacity and evidence of very deep compaction are shown in the paper.

Conclusions

1. CTF can increase return on investment into deep ripping, spading or inversion ploughing. A $200,000 cost of conversion may be paid off in at least 2 years if CTF provides yield increases of about 9%.
2. Improved seeding capacity is possible without compromising a CTF system. Seeding capacity of a 12m wide seeder can be increased to equivalent to an 18m seeder by increases in speed and air cart capacity.
3. Future risks of very deep compaction of sands can be minimised by conversion to CTF. Axle loads of about 15t on wet soil can induce root restricting cone resistance as deep as about 500mm. Such very deep compaction may be very expensive to rectify in deep sands which need easy crop root access to depth for conservation of their yield potential.

Controlled traffic for vegetable production

John McPhee

Tasmanian Institute of Agriculture
E-mail: John.mcphee@utas.edu.au

Mechanised vegetable production relies on intensive tillage, for two main reasons:

- Management of crop residue – there is a lack of zero-till seeders for many small seeded vegetable crops (e.g. carrot, onion, lettuce), and there is low tolerance of old crop residue in fresh harvested crops (e.g. beans, salad leaf etc.). Consequently, tillage is used to incorporate and manage crop residues to provide a seedbed with minimal surface residue.
- Remediation of harvest-induced soil compaction – this is particularly the case for crops that are mechanically harvested (e.g. most root crops, beans, peas etc.). Traffic compaction is difficult to avoid during vegetable harvest due to the lack of integration of track gauge and working width, both in individual machines, and between harvest technologies used for different crops. Further, as few vegetable crops are grown to dry maturity, and supply schedules are very demanding, harvest usually occurs when soil moisture conditions are ideal for compaction. An additional factor is the intensity of traffic during vegetable harvest, with 300 $t.km.ha^{-1}$ and wheel track coverage of 300 – 500 % being common for many root crop production cycles (compared to 20 – 30 $t.km.ha^{-1}$ and ~10% tracked area for CTF grain production). About half of the vegetable traffic load occurs during harvest.

Some sectors of the vegetable industry more easily lend themselves to the use of controlled traffic techniques. The production of hand-harvested crops (e.g. lettuce, melons etc.) is well suited to the use of permanent bed, controlled traffic production systems. In such circumstances, the main issues to address are the dimensional integration of machinery, which will already be in place in many bed production systems, the redesign of bed working and maintenance equipment to maintain the integrity of wheel tracks and beds, and farm layout to ensure adequate drainage and improve paddock access in wet conditions. Recent NZ experience indicates 40% greater production costs associated with random traffic in a bed production system.

Although vegetable and mixed farming enterprises may be mechanically complex, some benefits can be gained by transitioning to seasonal controlled traffic farming (SCTF). This requires that machinery used for tillage, seeding and crop management operations is matched for working width and track gauge, but the incompatibility of harvest equipment is accepted as being too difficult to overcome at this stage. The impacts of random traffic of harvest are "repaired" with post-harvest tillage, in much the same way as in a conventional production system. With the use of guidance and matched equipment, the production system can be reinstated on pre-existing traffic lanes for the next season. Research and commercial experience indicate improved soil conditions, reduced tillage requirements, lower fuel use and improved yield over time.

Machinery incompatibility is a barrier to CTF adoption in vegetables. Wide-span tractors (WS) offer a new mechanisation pathway for the vegetable industry, allowing many conventional implements to be mounted within the span. A prototype Danish WS tractor shows that mounting an onion harvester on a WS platform is no more complex than traditional tractor-driven or self-propelled harvest machines. Wide, non-trafficked crop beds would allow altered crop spatial arrangements, providing yield increases of up to 20% in some crops, purely by reducing the area required for wheel tracks.

Evaluation of controlled traffic farming operations for efficient soil management in row cropping operations using subsurface drip and centre pivot irrigation

Christian Bannan

Director, South East Soil & Water, Inglewood, Vic. Email: christian@sesw.com.au

Various types of irrigation systems are used to satisfy plant water requirements for row cropping in northern Victoria and the Riverina. For more precise water application subsurface drip and sprinkler application are favoured, whilst border check and furrow are used in more conventional sites. Guidance is achieved using Controlled Traffic Farming technology. This complements the irrigation system and guarantees precise placement of crop inputs whilst combining machinery mass to defined wheel tracks. CTF allows yield potential to be realised by making the most efficient use of space and water, providing accurate placement of inputs and machinery implements. Soil management operations which CTF allows precision placement of inputs and use of implements include:

- cultivation and discing, where traffic remains aligned on defined wheel tracks
- deep ripping soils around subsurface drip tape to shatter aggregates in massively structured and or compacted formations. These formations result from water logging which causes soil to slake and disperse with irrigation or rainfall
- ripping in the vicinity of the plant root zone to counter soil dispersion resulting from ingress of low electrolyte concentration rainfall
- shoulder busting, to alleviate compaction on the outside of raised beds
- exact placement of seed, fertilizer and pesticides
- "fluffing"(aeration) of soil in the planting line, rather than in the surrounding zone in order to disadvantage weeds
- employment of "Robocrop" technology, providing mechanical weed control.
- positioning of pipes, cables and conduits

Compaction of soils within CTF systems is restricted to the wheel tracks whilst soil modification of the cropping zone seeks to minimise blunt blade contact with the soil at times when compaction of the bed is enhanced. It is well understood that every soil has a compaction characteristic whereby the maximum dry density for a designated pressure is achieved at a specific moisture content called the Optimal Moisture Content (OMC). CTF practice relies on avoidance of implement contact to soil at or near the OMC. Ideally, contact of soils using implements at dry of OMC will facilitate the shattering of soil and the creation of aggregates. Compaction of the bed shoulder due to force applied to the side of the bed at or near the OMC by machinery wheels is a continuous problem requiring seasonal rectification. On the contrary, compaction of the wheel tracks is favoured for all weather management.

Soil and irrigation factors contributing to consolidation within row cropping systems using CTF include slaking, dispersion and waterlogging. These factors can destabilise and destroy aggregates, consolidate soil and contribute to anisotropy. Non-uniform wetting of bypass flows result whilst root development is hindered by poor aeration and particle size which form barriers to root exploitation, limiting water and nutrient during peak irrigation. The need to maintain a wetted annulus around conduits and tapes can render subsurface drip more susceptible to this form of root zone instability than other types of irrigation systems. Surface crusting of susceptible soil under sprinkler irrigation and heavy rainfall can limit ingress of water to the rootzone. Well graded and even coarse textured soils are prone to damage and a

reduction in water holding capacity due to particle realignment and the clogging of voids. Impeded germination of direct seeded crops is a major threat. Knowledge of the susceptibility of a soil to crusting is vital and CTF can provide a measure of amelioration without exacerbating damage.

No irrigation system is without limitations and all can have a detrimental impact on soil which might be steady and insidious. Management of soil related problems out-of-season and within crops using fluid based ameliorants thorough irrigation systems or using CTF technology requires further research. Adequate levels of investigation and soil amelioration are vital for optimal soil condition prior to development to minimise overlap between soil types with significantly different physical and chemical characteristics.

CTF on LRZ grain farms. The Great Debate: 'Why I did'; 'Why I haven't'; 'Why I might'

Ross Watson[1], Alistair Murdoch[2], Mark Nulty[3], Matt Elliott[4] and Andrew Wylie[5]

[1]Mallee Farmer; [2]once an Agronomist, now a Farmer; [3]Mallee Farmer; [4]Consultant and Farmer; [5]Wimmera/Mallee Farmer

Notes:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

UAV's, RPA's, Drones or ROA's - Whatever they are called, do they work and what can they do? A report on ACTFA project - Eye in the Sky, coming to a field near you

Wayne Chapman

CTF Solutions, E-mail: wayne@ctfsolutions.com.au

This paper will look at the preliminary results from the project across horticulture, cereal grains and sugar, the regulatory framework and how that might change as well as a snapshot of the current offering of UAV's to suit the agricultural industry. Drones are always in the news for all the wrong reasons but that could change if farmers take up the technology demonstrated in this project.

Three sites have been flown over both grain and horticulture so far with more planned. Initial results are promising but there are issues. While the plane and control systems worked extremely well, the ability of the software to generate useful data was disappointing. Several updates and a complete reprocessing operation have finally delivered the expected product for one brand.

The quality and appropriateness of the shipped software to perform satisfactorily for agricultural data requirements appears to be as least as important as the hardware so far.

The current regulatory requirements are fluid with CASA proposing a rule variation based on weight. The outcome of this proposal may not be known for some time. Currently only flying for sport and recreation do not require CASA certification provided the following rules are followed.

Operate below 400ft , only in line of site, not within 5.5km from a airport and not over a populated area.

For commercial work requirements are as follows:
" To fly an RPA of any size *for commercial reward* you need an unmanned aerial vehicle (UAV) controller's certificate and an unmanned operator's certificate (UOC) for your business.
Additional ratings include a flight radio operator's licence, and experience on the type of UAV operated. "

The costs of obtaining these certificates varies but could be between $18-25,000 for a consultant.

While most farm drones around the world are taking the legwork out of monitoring crops, that is by no means their only role. Below are 10 ways I think a ROA could bring value to your farm.

1. Analyse Trials
2. Spray Escapes monitoring
3. Identify pest and disease outbreaks
4. Crop scouting
5. Identify water logging
6. Provide high resolution topographic data
7. Gives the ability to treat broad acre fields on an individual plant basis.
8. Application and development of software will provide automated analysis of results
9. Quantify vertebrate pests/ straying livestock damage
10. Compliance for varietal licences, monitor resource company activities, etc.

The issue of scale: making CTF work no matter what size

Farmers answer your questions from their experience with CTF machinery: type, size, scale, possible pitfalls

Wayne Chapman, CTF Solutions and farmer, plus panel of CTF farmer

Notes:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The new GRDC project, 'Application of controlled traffic in the low rainfall zone'. Overview and how to get involved as a farmer

Chris Bluett[1], Melissa Cann[2], Peter Fisher[3] and Darryl Pearl[4]

[1]HRZ Consulting; [2]DEPI, Swann Hill,; [3]DEPI, Tatura; [4]DEPI, Mildura

Notes:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

‘Bells, whistles and toys’ – the vital technologies: GPS & RTK: sensors, software, integration, UAVs, imagery including research from Geoscience Australia

Luke Young[1], Grant Hausler[2], Wayne Chapman[3] plus panel members

[1]Topcon; [2]Geosciences Australia; [3]Manager, ACTFA UAV Project

Notes:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Developing Australia's National Positioning Infrastructure - what does this mean for CTF?

Grant Hausler

Coordinator , National Positioning Infrastructure, Geodesy and Seismic Monitoring Group, **Geoscience**
Email: grant.hausler@ga.gov.au

A new era of satellite-based positioning has arrived with the entry of multiple Global Navigation Satellite Systems (i.e. in addition to GPS) to support growing markets for accurate and timely location information. Recognising the social and economic value that Australia's positioning infrastructure generates across multiple sectors of the economy, Geoscience Australia's National Positioning Infrastructure (NPI) project offers a modern and pragmatic approach to coordinating access to existing and future PNT resources across the country. Preparing Australia's NPI to encourage market growth and further stimulate our competitive advantage in industries such as agriculture is in the national interest.

The agriculture sector is one of many diverse user groups of PNT technologies, but one of few early adopters with the community and scope to exercise long-term leadership to encourage planning, increased user uptake, commercial innovation, government and industry engagement, and increased confidence in modern positioning technologies. From the coordinate frameworks used to record position information, to the multitude of space-based and ground-based technologies that produce and deliver this information, the NPI will address technical, institutional and economic challenges for agreeing and delivering performance expectations. Recognising the importance of data availability, continuity and integrity, the NPI vision of ensuring access to accurate and reliable PNT information anytime and anywhere will further stimulate downstream commercial development of turn-key solutions for applications such as CTF.

This presentation explores the opportunities and challenges of coordinating a standardised and seamless high precision positioning framework across Australia and its maritime jurisdictions, to investigate how the NPI will support key industries such as those engaged in CTF.

The issue of scale, making CTF work no matter what size

Wayne Chapman

CTF Solutions P/L; E-mail: wayne@ctfsolutions.com.au

Introduction

Achieving economies of scale are touted as prerequisites of a successful business. Grain farming is no exception. Everybody has heard the mantra, "Get big or get out" We all know people in the process of doing both. But what scale is right?

The reality is that there are peak profit nodes all the way along the scale spectrum. (Simon Fitsch, pers comm.) The challenge is to maintain the benefits of CTF during the transition from one node to the next.

This paper will review the attributes of a successful CTF system and the costs involved if that system is compromised. It will examine systems which can scale easily if the opportunity arises to increase land area. Other techniques to manage scale, beside capital expenditure, will be canvassed.

A successful CTF system

The basics are simple;

a designed farm layout incorporating drainage, access, optimal paddock usage and management.

a suite of machinery with matching widths and wheel spacings

RTK guidance

a comprehensive farm management philosophy incorporating timeliness, good nutrition, high crop frequency, ZT, grain drying, crop and herbicide rotations, a high number of planting windows and wide variety of crop types, (pulse, broadleaf, C_3 and C_4 grasses), record keeping and experimentation.

Compromised system

Mismatched wheels and widths cause losses through missed cropping opportunities, lower yields, less water infiltration, less efficient tractive performance, more soil loss through wind and water, more waterlogging, more costs.

Layout failures characterised by non-draining wheeltracks can also result in missed opportunities, increased costs and crop losses.

The Issue of Scale

The base width is set by the harvester. Currently 9, 12 or 15m predominantly. Operating width is set by the planting and spraying windows. Planter type, labour capacity, crop choice and area all interact to determine the size of the window. Operating widths can be any multiple of the harvester. i.e. 9m header, 18m seeder, 27m sprayer or 12m header, 24m seeder, 36m sprayer. Remember, regardless of the size of the seeder, wheeltracks are left for the harvester across the paddock and are used for spraying and spreading operations as well as harvest.

Opportunities

Additional area can be managed with capacity planning. Growers can increase capacity via efficiency gains, increased labour, contractors or use different crop choices to give a wider sowing window without large additional capital investment.

Observations on farmer attitudes to CTF in Canada and North and South Dakota, as gleaned from the 6th World Congress on Conservation Agriculture and post-conference tour, June 2014

Annieka Paridaen

Southern Farming Systems, 23 High St Inverleigh VIC 3321, aparidaen@sfs.org.au

After spending six weeks in the USA and Canada, I can attest that 'travel is the only thing you buy that makes you richer'. From an agricultural perspective, gaining an understanding of farming systems by meeting farmers and researchers on the other side of the world was an invaluable experience and has given me a lot to think about on my return. The focus of my trip was to gain insight into the role that no-till, rotations and livestock play in other farming systems, with a particular interest in the use of cover crops instead of fallow to build a resilient system. This interaction is recognised as Conservation Agriculture (CA), a brand that is worn by many with pride. The three key principles to abide by are 1) minimum mechanical soil disturbance, 2) protecting soil with cover and 3) diversity in the rotation (more than two crop types). An unofficial principle is the integration of livestock into a farming system and is deemed to be a very important element, which is definitely not the case in Australia.

The wide adoption of 'Conservation Agriculture' which is based on a no-till system had me thinking that controlled traffic and use of precision technology was a given, but it seems overseas they are not quite there, some even saying the controlled traffic phase has been and gone and won't work in their environment. A lot of progressive North American farmers look to Australia for updates on how we are using technology like guidance, yield monitor, NDVI and making system changes like controlled traffic on tramlines. Australian farmers are world leaders when it comes to innovation and application of technology on farm and we shouldn't forget that!

Farmer attitudes

Is it a lack of education or a lack of proof from their own backyard that has seen the 'denial' of controlled traffic in North America? Some of the attitudes that stood out to me are listed below and will be covered in more detail.

- Compaction is not a big concern due to freeze and thaw of soil across seasons
- Tramlines = erosion
- Drive across as much of the paddock as possible to reduce compaction
- Do the benefits outweigh the costs especially on my small farm?

Most farmers around the world have great respect for their soil. They understand that if it is treated right, it will repay the favour. Do soils in North America behave that differently to Australian soils or are we making excuses for our respective environments because we don't fully understand them? Perhaps we are baffled by the lack of uptake of CTF in North America, but who is to say that we aren't missing an obvious factor that others see as common sense? Learning from others, other parts of Australia to other parts of the world is how we progress. Have an open mind!

Background and future opportunities for CTF RD&E in the LRZ

Vic No-Till Farming Association, ACTFA

Notes:

The economics of controlled traffic and precision agriculture on Branson Farms

Mark Branson

Owner & manager - Branson Farms, Email: mark@bransonfarms.com.au

Branson Farm, a 1200-hectare parcel of land, is located between Stockport and Giles Corner in the Lower North of South Australia. Annual rainfall in 475mm, which predominantly falls in the winter months; growing season rainfall (GSR) is 350mm which falls from April to October. As such, the farm is in the high rainfall zone for cropping in South Australia.

The Bransons have been early adopters of new technology throughout the generations, including Mark the 5th generation farmer on this family property, and current manager. The inclusion of modern farming methods includes proactive moves to using superphosphate, the ley farming system, the use of grain legumes, nitrogen-based fertilisers, no-till, precision agriculture (PA) and controlled traffic farming (CTF).

The initial journey into PA started in 1997 with the purchase of a yield monitor, but PA was not widely adopted until 2006 after Mark completed a Nuffield Scholarship on precision agriculture technologies and conservation agriculture (CA). No-till was initially adopted on some crop types during the 1980s and increased to include the whole cropping program from 2002, after the purchase of a tyned seeder bar. With the purchase of an RTK autosteer system (to 2cm accuracy) in 2004, CTF was introduced, and mostly the same CT lines are used today. The PA on the Branson Farms now includes a full variable rate (VR) program for phosphorus and nitrogen fertilisers, seeding rates and some chemical applications.

The Branson Farm is now one of the leading farms in Australia in the integration of new cropping technologies into a modern grain growing system. With 10 years experience with CTF and 8 years with PA technologies, adequate system data now exists to generate accurate economic patterns. This study includes an investigation into improvements in crop yields by assessing crop water use efficiency (WUE) performance, and crop inputs before and after 2004, when no-till, CTF and PA were introduced.

A summary of the economics:

Savings/Year	Yield Gains/Ha		$7.87/Ha	
	Input Overlap Savings		$7.24/Ha	
	PA Savings	Phosphorus	$16/Ha	
		Nitrogen	$33.78/Ha	
		Gypsum/Lime	$4.36/Ha	
			Total Savings	$69.45/Ha
Expenses/Year	Machinery Purchases		$11.11/Ha	
	RTK GPS Signal		$0.17/Ha	
	Data Management		$1/Ha	
			Total Expenses	$12.28/Ha
Estimated Annual Benefit from CT and PA				**$57.17/Ha**

GRDC speaker on negotiated topic

GRDC

Notes:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Background and future opportunities for CTF RD&E in the LRZ

Kim Russell

ACTFA Executive Officer

Notes:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Overview of CTF research activity in Central Europe and Australia

J. Galambošová [1], D. L. Antille [2,], M. Macák [1], V. Rataj [1], J. Eberhard [2], J. N. Tullberg [2,3]*

[1] Slovak University of Agriulture, Faculty of Engineering, Nitra, Slovakia. [2] University of Southern Queensland, National Centre for Engineering in Agriculture, Toowoomba, Australia. [3] Australian Controlled Traffic Farming Association Inc., Buninyong, Australia.

Background

Controlled traffic farming (CTF) has fundamental advantages in improving soil structure, which enhances crop and environmental performance with reduced inputs of energy and time compared with conventional field traffic systems. CTF is regarded as a practical and cost-effective technology to mitigate some of the unwanted effects of traffic-induced soil compaction. Intensification of agriculture and increased output will necessitate rapid adoption of sustainable technologies and their careful integration with those already in place. Therefore, increased adoption of CTF coupled with conservation tillage and with the aid of precision agriculture technology, can significantly increase both productivity and sustainability of arable farming. The increase in crop yield that is possible with CTF is due to a combination of overall improvement in soil conditions, and enhanced fertiliser use efficiency and nutrient uptake under those conditions. Greater nitrogen (N) uptake from applied fertiliser N reduces the risk of wastage through N_2O emission. Research conducted by the authors has shown N recoveries which are 10% to 15% higher where traffic compaction was absent. This is an important consideration since much of the effort on reducing greenhouse gas (GHG) emissions has been centred on reducing N application rates, which can compromise meeting future demand for food crops, restrict CO_2 capture by crops and affect regeneration and maintenance of soil organic matter.

Aim

The aim of this paper is to report on some of the research activities into controlled traffic farming being conducted in Central Europe and Australia. This work seeks to demonstrate that: (1) soil degradation processes can be reversed under a controlled traffic/zero tillage soil management system due to the synergistic effect between the two, and (2) significant gains in productivity with lower environmental impact can be achieved based on the integration of CTF and zero-tillage. It is envisaged that the outcomes of this research will encourage land managers to shift from a more common production-driven approach to farming to one that can deliver long-term economic and environmental benefits.

Ongoing research

Research projects in Central Europe are led by the Slovak University of Agriculture in Nitra and include: (1) Agronomic performance of strategic crops established in soils subjected to controlled and random traffic regimes, and (2) Soil conditions improvement through controlled traffic farming. In Australia, the projects are led by the National Centre for Engineering in Agriculture in partnership with the Australian Controlled Traffic Farming Association Inc., and include: (1) Greenhouse gas emissions reduction through CTF, and (2) Two PhD-based projects investigating timeliness, energy requirements and soil compaction in CTF and non-CTF systems, and improved fertiliser management in arable crops under CTF, respectively.

Acknowledgements

Research in Australia is conducted with funding from the Department of Agriculture, Fisheries and Food (DAFF, Australian Goverment) under the Action On The Ground Program (Project AOTG-0062). Research in Slovakia received funding from the European Community under the ITEPAg Project No.: 26220220014, and the Building Research Centre ‘AgroBioTech‘ Project No.: 26220220180.

GPSnet: A Continually Operating Reference Station (CORS) Network

Hayden Asmussen

Department of Environment and Primary Industries (DEPI),
hayden.asmussen@dse.vic.gov.au

Global Navigation Satellite System (GNSS) Continuously Operating Reference Stations (CORS) are now accepted as a part of the fundamental positioning infrastructure for the spatial sciences. The challenge is to ensure that high accuracy real time positioning based on CORS networks is accessible to new audiences and deliver quality services that ensure a sustainable future.

Vicmap Position – GPSnet managed by the Victorian State Governments Department of Environment and Primary Industries (DEPI) provides high accuracy positioning services state wide with availability and reliability that meets demanding use such as 24/7 operations for precision farming applications. To capture a broader selection of users such as asset managers of critical infrastructure and machine control applications, Vicmap Position has a robust design and efficient delivery model. This presentation will review high accuracy positioning infrastructure in Victoria and discusses technical aspects as well as economic and environmental benefits to agriculture, mining and construction industries using Controlled Traffic Farming as a case example.

Australia's resource-based economy requires continual productivity improvements to remain competitive in the international market place. Studies have shown that recent developments in machine automation demonstrate increased operational efficiencies, reduced costs and have improved safety systems. GNSS is a primary component used for autonomous machine control applications in the agriculture, construction and mining industries, where accuracy, reliability and integrity are critical 24 hours per day all year long.

The Asia Pacific region is well placed to benefit from new GNSS developed by Japan and China. To provide high-accuracy positioning across a vast continent with sparse infrastructure and a small but concentrated population like Australia, poses many challenges. To understand these challenges, a case example is provided from the state of Victoria in Australia, where a co-operative approach between industry, research and government proposes to leverage a CORS network for testing and validation of new multi-GNSS algorithms, methodology and delivery systems.