# TOWARDS A STANDARD FOR CONTROLLED TRAFFIC MACHINERY

Peter Walsh, The Kondinin Group, Wagga Wagga
Troy Jensen, Farming System Institute, DPI, Toowoomba

## Introduction

There currently exists a unique opportunity to provide a major benefit to Australian farmers and our agricultural machinery industry. Farmers are rapidly adopting controlled traffic farming now. To do this they must modify existing equipment or specify custom built equipment. Australian manufacturers have limited research and development budgets. They are currently reluctant to invest in CTF machinery because the size of the market is unknown and customer requirements appear to vary widely. The international manufacturers have sufficient R&D budgets but Australia represents a small component of their market with little immediate influence on decisions.

The expertise exists in Australia to quickly develop uniquely Australian machinery for CTF and the potential exists to export it. The major constraint to this exercise is the lack of any standard for CTF machinery. Because of the lack of a standard, manufacturers are not confident to produce products for the market and farmers are unable to purchase items from different manufacturers with confidence. The alternative is to leave the development of CTF machinery to slowly evolve. This approach will greatly delay the adoption of CTF and require that Australian farmers continue to improvise until an international manufacturer eventually picks up the technology and exports it back to us.

The development of a standard for CTF machinery will improve the profitability and sustainability of broadscale farms nationally by ensuring the efficient supply of appropriate machinery for CTF. It will facilitate the ongoing success and continued expansion of Controlled Traffic Farming (CTF). It will necessarily involve farmers, researchers and the machinery industry. It will add value to current initiatives by GRDC and other agencies toward developing CTF nationally

This paper proposes a framework for the development of a standard for CTF machinery and explores the various approaches to standardisation, as well as listing a number of systems that are currently in use that may form the basis for the standard.

## Standards

### *Why Standardize*

The American Society of Agricultural Engineers (1983) explains that " *standards are normally generated for one of the following reasons:*

*1.1 To provide interchangeability between similarly functional products manufactured by two or more organisations, thus improving mechanical compatibility, safety and performance for users.*

*1.2 To reduce the variety of components required to serve an industry, thus improving availability and economy for manufacturer and user.*

*1.3 To improve the degree of personal safety during operation and application of products and materials.*

*1.4 To establish performance criteria for products, materials, or systems.*

*1.5 To provide a common basis for testing, describing, or informing regarding the performance and characteristics of products, methods, materials or systems.*

*1.6 To provide design data in readily available form.*

*1.7 To develop a sound basis for codes, education and legislation related to the agricultural industry; and promote uniformity of practice among states.*
*1.8 To provide a voice in international standardisation.*
*1.9 To increase efficiency of engineering effort."*

And additionally:
"2. *Standards are developed and adopted because of a need for action on a common problem. Their effectiveness is dependant on voluntary compliance with the standards adopted. It is, therefore, essential that affected groups be invited to participate in the development of and conformance with such standards."*

Sections 1.1 and 1.2 summarize the major benefit that adherence to a standard would provide for CTF machinery in Australia. That is the ability of manufacturers to confidently produce products for the market and the ability of farmers to purchase items from different manufacturers with confidence.

Similarly Section 2. summarizes the opportunity that currently exists within Australia, as well as emphasising that participation in the process of developing and implementing the standard should include all affected groups.

***Informal or formal Standard?***

Part of the process of developing a standard for controlled traffic machinery will be the necessity to decide whether the standard should be informal or formal. An informal standard is simply an agreement in principal to work toward some agreed principles. Alternatively it may be beneficial to involve a relevant organisation such as Standards Australia in the development and implementation of a formal standard. This would add cost and complexity to the process, but would greatly enhance Australia's ability to lead machinery developments for CTF.

***Standards Agencies and Relevant Standards***

The Standards Association of Australia, The American Society of Agricultural Engineers, The Society of Automotive Engineers, The Tyre and Rim Association of Australia and The International Standards Organisation are agencies that produce standards with relevance to Australian Agriculture. Although not immediately apparent to the end user, standards from one or more of the above organisations impact on m of the machinery currently in use on farm. For example, the ASAE standard ASAE S217.10 "Three-Point Free-Link Attachment for Hitching Implements to Agricultural Wheel Tractors" ensures that implement linkage masts are designed within tolerances that will allow ready attachment to all tractors comforming to the relevant linkage category.

Although there are some existing formal standards with relevance to CTF, there are currently no standards that relate directly to CTF. For example the ASAE (1983) Standard S343.1 "Terminology for combines and grain harvesting" indicates how to measure the discharge height of the unloader (auger) as well as the reach of the unloader.It does not specify standard dimensions for these despite the value that such standarisation would provide for designers of CTF systems. Similarly the Tyre and Rim Association of Australia (1993) produces standards to ensure that implement tyres are matched to appropriate rim sizes, but no standards currently exist to propose appropriate placement of implement tyres within the implement for CTF.

**The Need for A Standard**

Australia leads the world in the on-farm adoption of CTF. Hence we are in a unique position to set standards for CTF. If we do not take the opportunity to do this at this time, we risk similar problems to those that have occurred with imported machinery in the past. Imported machinery conforms to standards and voluntary codes in its country of origin, but in many cases these are incompatible. An example is break-away couplings for remote hydraulics. Due to differing standards across and even within manufacturing countries, farmers often must have multiple sets of couplings to allow an implement to be used on different tractors.

If standards for CTF are developed in other countries, such as the USA, it is highly likely that resulting machinery will be at best a compromise for Australian conditions and at worst, no better than the existing situation where tractor track width is invariably incompatible with the grain harvester.

There has been some research done to estimate the potential benefit of moving to CTF. The estimates range from an increase of $140 /ha. in whole farm net margin (Mason et al,1995) to a reduction of $19/ha for machinery costs alone (Robotham and Walsh, 1995). Such economic benefits, and the availability of "off the shelf" standardised machinery for CTF could readily increase the adoption of CTF by 1% above the current adoption rate. The benefits of this increased adoption would be applicable to our cereal production area of around 20M Ha. Hence the value of adopting such a standard could range from around $19M per year to $140M per year, Australia wide.

**Developing a Standard**

Some of the methodology that would be required to develop a standard for CTF is listed hereafter. A more detailed plan should be developed as part of the process.

Development of a standard will only succeed if farmers are convinced of the benefits, and are involved in the process. To assist the process, organisations such as The Kondinin Group, with it's farmer surveying expertise and the Tractor and Machinery Association's (TMA) with it's data on available machinery combinations should be involved. Hence it would be possible to quantify existing on-farm configurations and compatible machinery currently available. A publication and database could be produced and distributed.

Using this information as background, a national working group to consist of farmers and representatives from TMA, Kondinin Group, the NCEA and government agencies should be convened. Financial assistance from GRDC and other Research and Development organisations should be sought.

The working group should consider the best options for the rapid production of machinery for CTF. These might include:

- "best bet" wheel track configurations for the various farming systems;
- possible standardisation including a voluntary Australian Standard for wheel configurations and tracking ability;
- mechanisms to influence International manufacturers (eg harvesters);
- mechanisms to facilitate local innovation and machinery production (eg innovative companies such as A.E. Bishop, wide harvester fronts);
- regional issues and GRDC and other funder involvement.

- production of a national controlled traffic machinery information package explaining the proposed standard
- production of regional and farming systems additions to the package,
- Coordination with other initiatives on CTF.

**Likelihood of Success of this standard**

Is it still possible for Australia to set the direction for world machinery development, as we have done in the past? There are a number of indicators that the answer to this question should be a qualified yes:

1. The major overseas tractor manufacturers, at the request of Australian farmers and dealers, have taken major steps to ensure that tractors are available with factory warranty for use on 3m track width.
2. The major overseas tractor and machinery manufacturers are acutely aware of the Australian lead in CTF and are actively and overtly monitoring developments in Australia.
3. Australian manufacturers such as Janke Brothers and Australian Farm Machinery have manufactured prototype and "made to order" CTF machines. Other manufacturers are developing equipment, or have expressed interest in developing equipment.
4. Because a ready market exists and is expanding within Australia, our manufacturers have an opportunity to have developed and tested technology well in advance of overseas equipment manufacturers.
5. If such an installed base of equipment is in operation in Australia, and it has been shown to be successful under an Australian developed Standard, there will be pressure on international manufacturers to adopt, or at least conform to, the standard

**Existing Systems as possible component of the Standard**

One feature of CTF that has the most need for standardisation is the wheel track width of tractors, harvesters implements. A number of farming systems with differing approaches to matching wheel-track widths have emerged. The more prominent are summarised below

*System 1*

| | |
|---|---|
| Location | Queensland, NSW, WA |
| Features | Forget the grain harvester |
| Tractor | Large 4WD usually on Singles or rubber track, track width varies |
| Implements | Remove tines behind Tractor tyres. 8-21m width. |
| Boomspray | Linkage or SP to match tractor tracks, width 1, 2 or 3 times implement width |
| Harvester | Random traffic, harvest is conventional |

*System 2*

| | |
|---|---|
| Location | Queensland, NSW |
| Features | Match the Grain harvester, 3m track-width |
| Tractor | Large FWA, 3m track width on singles. |
| Implements | Remove tines behind Tractor tyres 10-12m width. |
| Boomspray | Linkage or SP to match tractor tracks, width 1,2 or 3 times implement width |
| Harvester | Harvester front to match implement width |

*System 3*

| | |
|---|---|
| Location | Queensland |

| | |
|---|---|
| Features | Landcruiser or trailer based spraying |
| Tractor | Large FWA, 1.5m track width on singles. |
| Implements | Zero till. Lift assist wheels on parallelogram seeder. Width 10m |
| Boomspray | Landcruiser or trailer based spraying, width 2 times implement width |
| Harvester | Harvester front to match implement width. Harvester straddling tractor tracks. |
| Haul out: | Haul out bin running on adjacent harvester tracks. |

*System 4*

| | |
|---|---|
| Location | Queensland |
| Features | Smaller farms, eg Kingaroy area |
| Tractor | Small FWA or 2WD, 2m track width on singles. |
| Implements | Zero till. Lift assist wheels on seeder. Plant over contour banks. Width 5-8m |
| Boomspray | Linkage, width 2 or 3 times implement width |
| Harvester | Harvester front to match implement width. Harvester running on adjacent tractor tracks. For example, one farmer has a 5 m planter and 5 m harvester front, so his tractor is on a 2m wheel-track with the tracks 3m apart. The harvester on 3m wheel-track fits perfectly. |

Other systems to consider are permanent bed systems, mostly in use in irrigation or poorly draining soils. These include 2m permanent bed systems with the harvester track width increased to 4m, and 3m bed systems to match the grain harvester.

As well as standardisation of wheel track widths, there are other components of CTF systems that will benefit from efforts toward standardisation. The most important of these is tractor steering control systems. Standardisation in this area is important t
readily added to different tractor steering systems. Similarly, tracking systems to ensure that trailed implements accurately follow the tractor are under development and efforts in standarisation of the control interfaces will greatly assist matching of tractors to implements.

**Conclusion**

This paper has put forward a proposal for development of a standard for CTF machinery. The arguments supporting some standardisation are compelling. The success of standardisation will depend on the committed involvement of farmers and the machinery industry, as well as research and information organisations such as the Kondinin Group.

**References**

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## ADDENDA

The specifications of large front wheel assist tractors were reviewed to assess possible conformity to standardised track widths. The information is also important to emphasise the current diversity of track widths such that few machines conform to any proposed standard width above 2m. for tractors and below 3 m. for grain harvesters. The tabular information was assembled by Michael Warner. His input is gratefully acknowledged. The information is not intended to be exhaustive, but has been assembled to represent a cross section of the machinery likely to be employed for CTF. Neither the authors nor Michael Warner warrant the accuracy of the information. The spacings maybe subject to operating restrictions and approval by the manufacturers.

### WHEEL TRACK CONFIGURATIONS FOR SOME GRAIN HARVESTERS
(source Michael Warner)

| Brand | Model | Drive Centre to Centre Range | | Steering Centre to Centre Range | | Cutter bar available |
|---|---|---|---|---|---|---|
| Case | 2144 | 2,658 | 3,048 | 2,337 | 3,048 | 7,620 |
| | 2166 | 2,896 | 3,048 | 2,337 | 3,048 | 9,144 |
| | 2188 | 3,048 | 3,353 | 2,337 | 3,048 | 9,144 |
| John Deere | 9000 series | 2,959 | 4,064 | | | 9,144 |
| New Holland | TR 88, TR 98 | | 2,994 | | 2,895 | 9,144 |
| Agco | Gleaner R42 | 2,718 | 2,997 | 2,896 | 3,658 | 9,144 |
| | Gleaner R52 | 2,718 | 3,353 | 2,896 | 3,658 | 9,144 |
| | Gleaner R62 | 3,048 | 3,683 | 3,099 | 3,708 | 9,144 |
| | Gleaner R72 | 3,048 | 3,683 | 3,099 | 3,708 | 9,144 |

NB. These spacings maybe subject to operating restrictions and approval by the manufacturer

## Tractors over 100kW PTO

| Brand | Model | Front Centre to Centre Range | | Rear Centre to Centre Range | |
|---|---|---|---|---|---|
| Massey Ferguseon | 8130 | 1,520 | 2,300 | 1,620 | 2,374 |
| | 8160 | 1,560 | 2,300 | 1,738 | 2,229 |
| Fendt Favorit | 816 | 1,970 | 2,250 | 1,970 | 2,250 |
| | 818 | 1,970 | 2,250 | 1,970 | 2,250 |
| | 822 | 1,970 | 2,250 | 1,970 | 2,250 |
| | 824 | 1,970 | 2,250 | 1,970 | 2,250 |
| Allis | 9675 | 1,565 | 2,276 | 1,562 | 3,170 |
| | 9695 | 1,525 | 2,240 | 1,562 | 3,170 |
| | 9815 | 1,525 | 2,240 | 1,562 | 3,170 |
| White | 6175 | 1,565 | 2,276 | 1,562 | 3,170 |
| | 6195 | 1,525 | 2,240 | 1,562 | 3,170 |
| | 6215 | 1,565 | 2,276 | 1,562 | 3,170 |
| AgcoStar | 8360 | 2,100 | 2,100 | 2,100 | 2,100 |
| | 8425 | 2,100 | 2,100 | 2,100 | 2,100 |
| Fendt | Xylon 520 | 1,490 | 2,200 | 1,490 | 2,200 |
| | Xylon 522 | 1,510 | 2,200 | 1,500 | 2,200 |
| | Xylon 524 | 1,510 | 2,200 | 1,500 | 2,200 |
| | Favorit 926 | 1,970 | 1,970 | 1,970 | 1,970 |
| JCB Fastrac | 185 | 2,015 | 1,875 | 2,015 | 1,875 |
| Caterpillar | 35 | | | 1,524 | 3,048 |
| | 45 | | | 1,524 | 3,048 |
| | 55 | | | 1,524 | 3,048 |
| | 65D | | | 2,286 | 2,286 |
| | 75D | | | 2,286 | 2,286 |
| | 85D | | | 2,286 | 2,286 |
| New Holland | 8670 | 1,524 | 2,235 | 1,524 | 3,150 |
| | 8770 | 1,524 | 2,235 | 1,524 | 3,150 |
| | 8870 | 1,524 | 2,235 | 1,524 | 3,150 |
| | 8970 | 1,524 | 2,235 | 1,524 | 3,150 |
| | 9282 | 1,829 | 4,402 | 1,829 | 4,402 |
| | 9482 | 1,829 | 4,402 | 1,829 | 4,402 |
| | 9682 | 1,829 | 4,402 | 1,829 | 4,402 |
| | 9882 | 1,829 | 4,402 | 1,829 | 4,402 |
| Case | 8930 | | | 1,524 | 3,353 |
| | 8940 | | | 1,524 | 3,353 |
| | 8950 | | | 1,524 | 3,353 |
| | 9310 | | | 1,532 | 3,302 |
| | 9330 | | | 1,532 | 3,302 |
| | 9350 | | | 1,532 | 3,302 |
| | 9370 to 9390 Quadtrac | | | 2,286 | 2,286 |
| Deutz | Agrotron 6.45 | 2,000 | 2,000 | 2,000 | 2,000 |
| John Deere | 8000 series | 1,524 | 2,235 | 1,716 | 2,956 |
| | 9000 Series | | | | |
| Claas | Xerion | | | | |