Wheeltracks and Widths

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ABSTRACT

Modular widths for all CTF machinery would minimise costs and maximise profits but is it practical? Expected outputs for a range of operating widths for seeding and harvest will be presented as well as some of the difficulties encountered when matching machinery. Issues arising from including the harvester in the CTF system are examined and possible solutions outlined.

INTRODUCTION

Machinery is the largest capital investment a farmer makes after land, yet many times this equipment is bought without due diligence. As with most capital purchases the service life exceeds the economic life of the investment and growers can become locked in to an inferior farming system for significant lengths of time by inappropriate equipment. Advice costs are much lower than the ongoing impact of a sub standard system.

Machinery issues often constrain farming system choices. The inability of many planting machines to handle significant levels of residue continues to hamper the adoption of full stubble retention in eastern states. The purchase of a larger tractor to get a tax deduction or better interest rate defies logic if it can only be used to do more of the same, faster.

Growers moving to Controlled Traffic Farming often stumble at the first hurdle of deciding what operating width and wheel track spacing they should use. This paper draws on the author's twelve years experience across Australia in assisting growers with these and other decisions.

In the past spacings and widths were *ad hoc* although Chapman (CTF 98) identified three common wheeltrack spacings, based on the spraying equipment used at the time of moving to controlled traffic.

- 1.5-1.8m - spraying with utility or tractor,
- 2m - tractor or truck and
- 3m with modified tractor or SP sprayer)

The narrower systems were unable to accommodate the grain harvesting operation, although some hay production systems were working successfully.

Sowing widths were not related to the width of other equipment and ranged from 6m to 32m; needless to say the grain harvester was seldom included. Spraying was carried out at 1:1, 2:1 or 3:1 ratios to planter width.

Since then, equipment has changed dramatically; in 1995 there was no CTF Ready equipment, now most companies offer something. The advent of 12m harvester fronts was the single biggest change, allowing larger acreages to move easily to fully matched systems.

SYSTEM REQUIREMENTS

By definition controlled traffic has ALL load bearing wheels operating on permanent tracks, because the goal is to minimise the area compacted. With random traffic and unmatched machinery regimes, compacted areas range from 80-100% for tillage based systems to 40-50% with zero till. Adopting

precision guidance (2cm) and matching operating widths reduces this dramatically. See Table 1 for more detail.

In the high rainfall zone some growers have developed dual 2m/4m raised bed systems, which involve 2m centres for the tractor and 4m centres for harvest and sometimes spraying. As can be seen from Table 1 these systems are at best a compromise, resulting in a larger proportion of crop suffering wheel induced compaction. Configuring raised beds to suit a 3m system would provide benefits in terms of limiting wheel traffic, reducing capital costs by alleviating the need for both bed and flat equipment and drainage capacity could be improved, if necessary, by installing minor furrows at 1.5m intervals in the wetter areas.

Table 1. Common systems - %wheeled

System	% wheeled
2m centres, single tyres, 15m planter, Auto steer, 30m sprayer, random harvest 11m	29%
2m centres 8m planter, Auto steer, 24m sprayer, 10m harvest 3m centres harvester on 800mm tyres	22%
As above but all 500mm tyres and harvester on 4m centres	16%
9m CTF	12%
12m CTF	11%
2m CTF cane 800mm twin rows	50%
3m CTF cane 1.5m rows	33%
Horticulture 2m CTF	25%

Only 3 m systems enable growers to progress and include all heavy wheels operating in their paddocks. All current model harvesters can be optioned to a 3m setting and narrower tyres of sufficient capacity are available.

Operating width

This is best described by the narrowest practical width operating in the system.
It should:

- match the width of the harvester fronts available
- be a multiple of the wheeltrack width
- suit the majority of situations across Australia
- be simple and concise.

This paper suggests that 9m and 12m fulfil all the above conditions. These systems offer the lowest % of wheeled soil, the widest range of planting and spraying capacity and the easiest harvesting solutions.

Choice of the best width for an individual's farming system should be based on a comprehensive review. CTF Solutions take clients through a process, which looks at, but is not limited to:

- Farm size
- Existing machinery
- Timeliness of all operations
- Labour
- Budget
- Goals

Operational capacity

Can two module widths satisfy the differing conditions, variation in climate and crops occurring across Australia? Successful farming systems based on these widths already exist in all states. Planter sizes from 9 to 24 metres are possible as multiples of either 9 or 12 metres. Sprayers up to 36 metres are in use. 12 metre fronts allow modern Class 7 and 8 harvesters to be operated efficiently in lower yielding crops.

Timeliness of operations is an integral part of the CTF system and growers should consider all facets of the system before deciding on operating width. Managing system change is not a new exercise for most growers, but many new issues need to be considered in the move to CTF.

Depending on speed, planters working at high field efficiency in controlled traffic systems are capable of sowing between 48 to 200 ha per 12 hour shift. (See Table 3) Spraying capacity is a function of the crop value, climate and the area to be covered, northern farms may be expected to have more spray capacity due to less favourable climatic conditions during the fallow period. Windows of operation are still a matter for judgment, but it is not unreasonable to assume that high value crops require more machine capacity than low value crops.

Table 3. Planting capacity by width and speed at a field efficiency of 65%

	Field Efficency	65%			
Sowing		Area per	12	hr shift	
Width		7km/hr		11km/hr	
		ha	ac	ha	ac
9		49	121	77	191
12		66	162	103	254
18		98	243	154	381
24		131	324	206	509

Chaser bins, drying, windrowing or simply bringing additional harvesters in for the large crops, can all increase harvest capacity. Some clients have been able to reduce capital expenditure on harvesters. The choice of front size can impact harvester capacity particularly in light crops. (Table 4)

Table 4. Theoretical Harvester capacities based on 100% field efficiency

Width	t/hr [1]	t/hr [2]	t/hr [3]
9	37	27	15
12	50	36	20

[1] Wheat - 6t/ha and 7km/hr
[2] Wheat - 3t/ha and 10km/hr
[3] Wheat - 1.2t/ha and 14km/hr

Matching equipment

It should be noted that it is not harvesting per se which is difficult to achieve under a CTF system but rather the unloading of the harvester *on the go*, which requires the most effort. This requires the transfer of grain from the harvester bin to a chaser bin running on the adjacent set of wheeltracks.

Some machines, at either 9m or 12m, require modification to both unloading auger and chaser bin. Table 5 provides details of some models and the extent of modifications required.

Table 5. Harvesters, 3m compatibility, auger length and distance to adjacent track

Make	Model	Auger length Std. (m.)	Gap to 9m centre (m.)	Gap to 12m centre (m.)	3m centres
CaseIH	1688	5.28	2.64	5.7	Yes
	2188	5.28	2.8	5.86	Yes
John Deere	9610	6.1	1.8	4.86	No

Why?

In many situations the harvest is the heaviest operation in the paddock. Past experience with clients who matched operating widths but not harvester wheel tracks soon found the deleterious and expensive effects of harvest traffic on the following crops. You cannot make further enhancements to the farming system until these factors are right.

The charts below show individual row yields from a property before and after matching harvester traffic. You can clearly see the reduced variability in crop yield as a result.

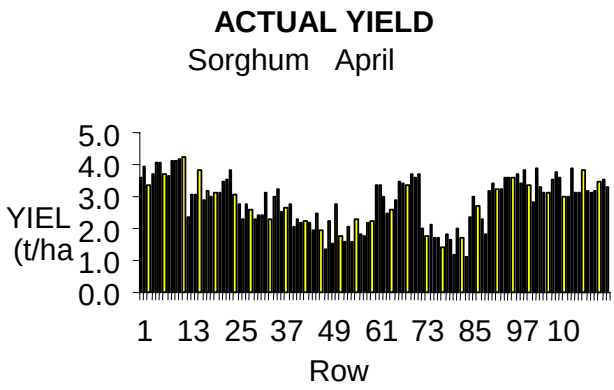

Figure 1. Individual Row Yields across paddock 1998

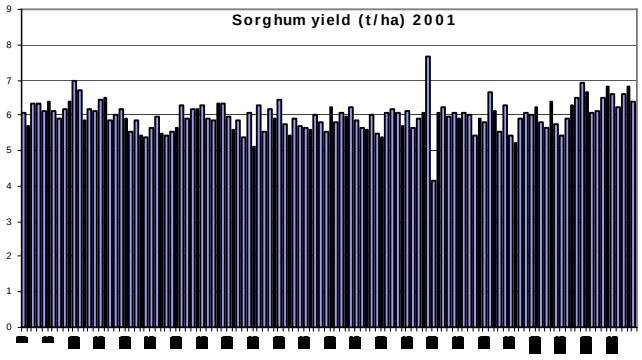

Figure 2. Individual Row Yields across paddock 2001

Another consideration is the soils ability to repair. Highly mobile vertisols repair very quickly, (1-3 years, although some data suggests it could take 2 – 7 years) while others may take much longer. Axle loading is the key determinant of compaction at depth and modern harvesters have very high axle loads. (12-23 ton on front axle) It stands to reason that the aftermath of one wet harvest is going to last a long time and would effect between 15-18 % of the paddock. In central Queensland one grower lost $70/ha as a result of harvester damage in the previous crop.

Another reason for matching the header to the system, is the affect harvest traffic can have on sowing the following crop. In some cases, growers have not been able to successfully plant where harvest traffic has formed deep wheel ruts and un-even seeding conditions. Matched CTF systems never miss these opportunites, and in fact, it is in these practical advantages of CTF where many of the gains are to be made. CTF farmers have control over their farming system.

Attitude or dollars and sense

There is ample evidence from worldwide research that compaction is bad for crop production. It makes no rational or economic sense to leave the heaviest machine in the paddock on random traffic, yet sadly this is the situation of many farmers who claim to be doing CTF. Rather than acknowledge wet harvests are a long-term feature of Australian grain growing, growers are in denial requesting more research into this area. While some prominent consultants can jump on the media bandwagon as grower champions by questioning the validity of a fully matched CTF systems, the reality is that the harvester should, and can be managed in a CTF system for a fraction of the cost of one missed planting opportunity.

CONCLUSION

In 1995 there was not the equipment available to encourage growers to adopt a fully matched CTF system. At CTF 07 we are able to say “Do it now, get some advice and do it properly”.