The Economics of Controlled Traffic : South Burnett Case Study

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Introduction

The majority of crops grown in the Burnett are rain-grown. For these crops the major limiting factor is soil moisture. However, the viability of cropping in the Burnett is being questioned following a run of "dry" seasons. The problem of dry seasons has been compounded by the destruction in the soil physical properties which has reduced the soil's ability to take in water and store it so that it is available to the crops.

Research into the current cropping system suggests that it's not sustainable and changes are required if cropping is to continue. The option being considered here is controlled traffic. As most of the crops are grown as row crops they are, to a limited extent, in a controlled traffic system from the time they are planted through to harvest. The next step is to extend the controlled traffic from one crop to the following crop by maintaining permanent laneways.

For this technology to be adopted by landholders they must have the confidence that they will be no worse of in the short term but better off in the long-term..

This paper describes the results of an analysis on a property in the South Burnett. The objective was to determine whether or not controlled traffic and zero tillage would contribute to both short and long term profitability without jeopardising the ability to revert back to the current system if the changes do not work .

Description of the Case Study property - Current System (CS)

The property is located in the South Burnett. It is operated by the owner and one permanent farm hand and they plant between 500 and 600 ha of rain-grown crops per year. A typical crop rotation on this property would be, Soybeans; Wheat; Maize; Maize; Millet; Soybeans; Sorghum; Soybeans. Up to 40% of the crops are grown on a share-farming basis where 25% of the gross income of the crop is paid to the land owner. The crops grown over the past year were:

Maize	189ha	Millet	26ha
Soybeans	170ha	Wheat	100ha
Sorghum	63ha		

Four tractors (100, 90, 70, 45 kW PTO power) perform the tillage, planting and spraying operations. Summer grains and legumes are the dominant crops and winter cereals are planted as an opportunity crops. The landholder has a specialist summer crop planter and a tractor mounted air-seeder to apply fertiliser prior to planting and to plant winter cereal and narrow row soybean crops. Both planters can be used as zero tillage planters. A contractor is used to harvest all crops.

Up to half the crops in any one year are grown under zero tillage conditions. This is decided by seasonal and paddock condition at the time of planting. The choice of crop and tillage system are chosen to maximise profits, while minimising the soil erosion potential. Where possible a winter cereal crop is planted after a summer legume to provide erosion protection for the following summer crops.

Options considered and assumptions

PADCOST (an Excel spreadsheet) was used to analyse the current cropping system on the property. This was compared with three alternative systems and the impact on labour requirements, costs and profitability was measured and compared. The options considered were.

1. controlled traffic without changing the current cropping system.
2. changing completely to zero tillage.
3. changing to a combined system of complete zero tillage and controlled traffic.

To incorporate seasonal variations in yields and prices a beta distribution was used to estimate expected yields and prices. The beta distribution uses the landholders estimate of the best, worst and most likely yield and price for each crop. The mean yield and price used in the calculations were calculated using the following equation.

$$Mean;Yield\,/\,\Pr ice = \left(\frac{best + (4 \times most\_likely) + worst}{6}\right)$$

1. Current system + Controlled traffic (CT)

In this analysis it was assumed that controlled traffic would be introduced with minimal changes to the current system. The largest tractor (100kW PTO) would be replaced with a 70kW PTO tractor and there would be no chisel plough or offset disk operations. As the tractors would be driving on permanent wheel tracks it is assumed that their overall fuel consumption would be reduced by 30% (Tullberg, 1994). No tractors or implements would be sold and their costs would be included in the overall costs of production.

It was assumed that in the worst seasons yields would improve by 40%, the most likely change would be an increase of 10% and in the best seasons there would be no change in yield. Fertiliser rates were increased to take account of the higher nutrient removal.

2. Zero tillage (ZT)

It would be possible to grow every crop currently produced on this property Under a zero tillage system. In a zero tillage system we have assumed that only planting, slashing and boom-spray operations would be retained. No machinery would be sold and more fallow and in-crop herbicides would be included to control weeds. The area of winter crop would be increased to match the soybean area.

In most seasons there would be no change in yield. However, in the worst seasons it was assumed that yield would increase by 10% and in the best seasons yields may decline by 10%.

3. Controlled traffic + Zero tillage (CT & ZT)

This combines the previous two options. The assumptions are:

- replace 100kW tractor with 70kW tractor (PTO)
- retain only planting, slashing and boom-spray operations
- replace mechanical weed control with chemical weed control
- reduce all tractors fuel consumption by 30%
- increase winter crop area from 100ha to 150ha
- Yields

Yields	in the worst seasons	+40%
	most likely season	+10%
	in the best season	no change

- increase fertiliser rates to take account of increased nutrient removal
- no machinery would be sold and the cost of all machinery would be included in total production costs.

Changes in Labour requirements

PADCOST calculates the labour inputs based on the number of operations in a paddock and the expected work rate for each operation. The labour input is calculated on a paddock basis and these are added together to give a total labour requirement for current system and the alternatives considered (Figure 1). By implementing controlled traffic with the current system the labour requirement decreased by 28%. However, by changing to complete zero tillage the labour requirement for this property was almost halved.

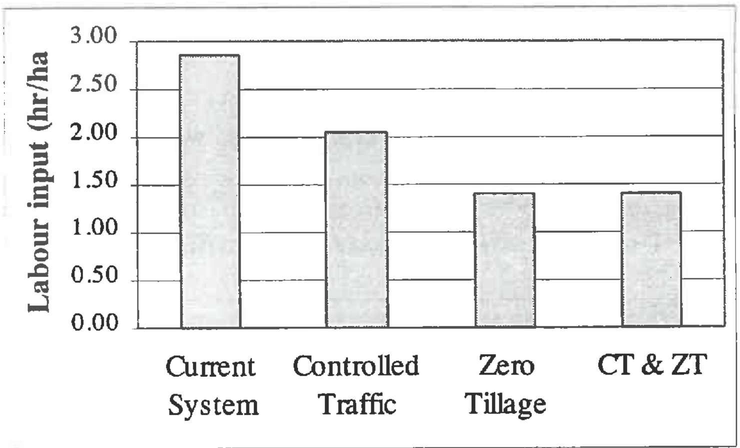

Figure 1 Labour inputs under four tillage systems.

Changes in Costs

Costs have been calculated on a paddock basis, then summed for the whole property and divided by the cropping area (figure 2). Variable costs decreased when the current system changed to controlled traffic. This is mainly due to less tillage operations. However, variable costs increased in the zero tillage and the combined zero tillage and controlled traffic because there was more wheat grown and the cost of controlling weeds by chemicals was higher than mechanical weed control.

Ownership costs are the costs that are incurred whether the machinery is used or not. They include interest, depreciation, insurance and shelter (Anon, 1985).

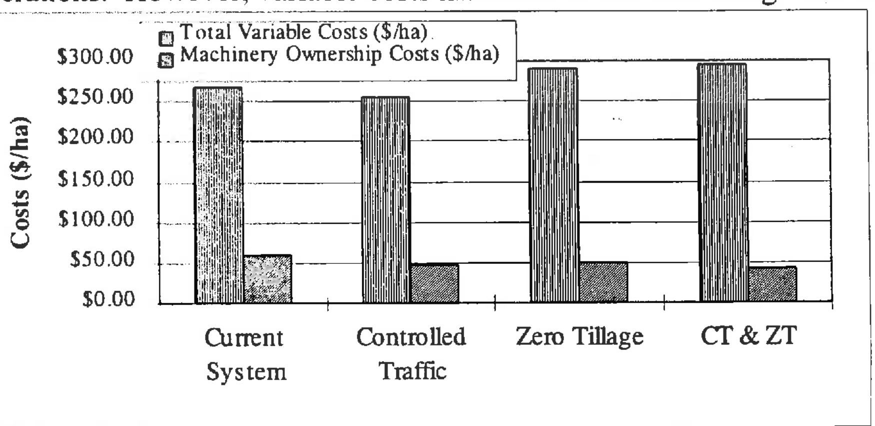

Figure 2 Variable and fixed costs for the case study property under four tillage systems.

Ownership costs are calculated for each operation and are allocated to each paddock. Machinery ownership costs are the lowest in the combined controlled traffic and zero tillage option, but because we assumed that no machinery would be sold (even if it was not used) they are not significantly less than the current system.

Changes in Profit

The total farm gross margin has been calculated by subtracting the variable costs from the gross income. The net margin is the gross margin less the fixed machinery costs. The highest net margin was achieved with the combination of controlled traffic and zero tillage. By implementing controlled traffic with the current system the landholder could expect a significant increase in returns.

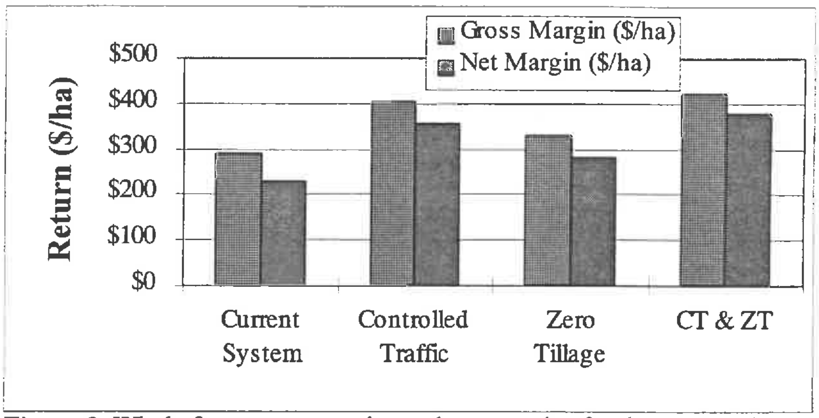

Figure 3 Whole farm gross margins and net margins for the case study property under four tillage systems.

These returns do not take into account other increases in production that could be expected with improved timeliness. This could be through planting crops closer to the optimum time or more opportunities for double cropping (McPhee, et.al., 1995). In many seasons planting operations are restricted because of planting into hard soil or are delayed due to wet soil. If hard soil was confined to the wheel tracks more and extended planting opportunities would be available.

Changes in the machinery investment

Investment in machinery is the current replacement value (in the case of tractors this is the new value) for the machinery used in each cropping system (Figure 4). This graph shows the long-term benefit of changing from the current system. On this property reducing the size of one tractor had a larger impact than not using any tillage equipment. The greatest reduction in capital required for working machinery was achieved when both the size of the tractor was reduced and the tillage equipment was not used. This occurred in the combined controlled traffic and zero tillage option.

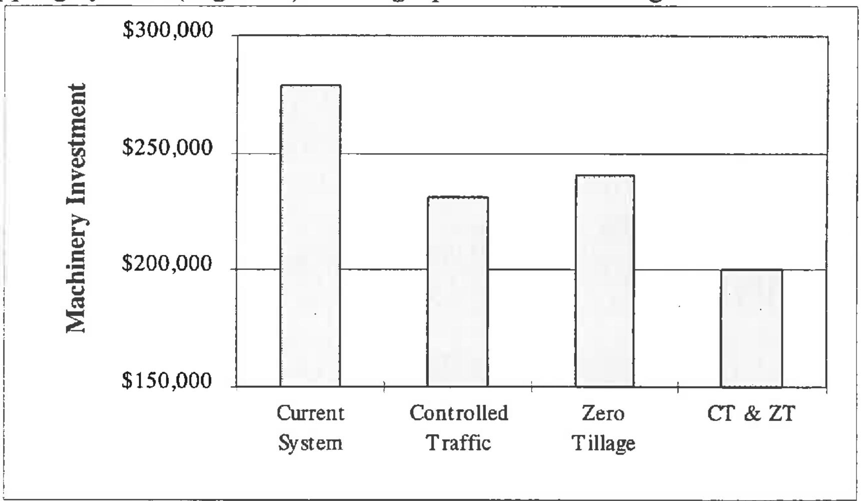

Figure 4 The value of the machinery used under the different cropping systems.

Discussion

Controlled traffic should be viewed as a further refinement for the conservation farming systems promoted to landholders over the past 20 years. Unfortunately, until now, only some elements of the recommended conservation farming system has been adopted (reduction in the number of cultivations, retention of stubble and the use of tined rather than disked implements). Failure to widely adopt these elements suggest that producers are not convinced they will be better off even though there are significant benefits for the soil resource. The change to conservation cropping is perceived by landholders as being too complex, too costly, too difficult to implement and for some landholders there is an underlying fear of chemicals (Glanville, Day, 1994).

In light of the low adoption rate of the conservation farming system, it would seem a change in approach is required before the "average" landholder will implement more sustainable practices. Controlled traffic may be the link between what the current farming practices are and the conservation farming approach. Controlled traffic allows the landholder to gradually change from the current system to a tillage system that reduces energy and labour requirements, increases infiltration rates (Ziebarth and Tullberg, 1995), and improves timeliness and the chance of double cropping. Many benefits can be obtained with minimal change to the current cropping system. In time, it would be envisaged that under a controlled traffic system the reason for tillage would change from one of creating a deep seedbed to that of digging out weeds in situations where chemical control is not suitable.

This case study shows that there are strong financial and labour reasons why the combination of controlled traffic and zero tillage should be adopted as standard management practice in the South Burnett. Although this should be the medium term aim of landholders, there are immediate benefits to be gained from changing to controlled traffic using the current tillage system. Under the most sustainable system of controlled traffic and zero tillage, labour requirements will almost halve (Figure 1), variable costs will increase (Figure 2) and profitability (both gross and net margin) will increase by more than $100/ha or around 30%. Added to this the total capital tied up in machinery will fall by $78 000. On properties that had higher investment in machinery the savings would be even greater.

Some questions that remain are:

1. Is the increase in profitability reported here achievable?
2. Is the increase in profitability, when combined with the soil benefits and increased sustainability of the cropping system a compelling reason to change?
3. Is the increase in profit and flexibility, combined with the reduction in capital invested in machinery enough to compensate landholders for the increase in the complexity of the controlled traffic / zero-tillage system?

It is unlikely that landholders will read this paper and make a simple decision to either ignore or adopt controlled traffic or zero tillage technology. However, this case study, and the spreadsheet (PADCOST) developed for the evaluations will allow landholders to explore these questions for their own situation. As a result, they may be encouraged to explore other options in addition to controlled traffic and or zero tillage. These other option can also be evaluated with PADCOST and compared with their current cropping system. In the medium-term improvements on individual properties will collectively add to the international competitiveness of Australian agriculture and also contribute to the continued prosperity of rural communities.

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