

Healthy Country

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FarmFLOW

growth through good practice

Controlled traffic farming in intensive vegetables: does it pay?

At a glance

A cost benefit analysis of a controlled traffic farming system (CTF) found potential gains for intensive vegetable businesses including:

- 40% fuel savings
- 344 kg/ha/year reduction in carbon emissions
- gross margin increase of \$19 540/year without a yield gain
- potential for up to 4% yield gain through improved soil quality
- many small gains that together give significant savings.

Tillage and land preparation operations to correct soil compaction are a significant cost to intensive vegetable growers in south-east Queensland. Previous research has estimated that 20% of tractor power is used compacting the soil and another 25% breaking it up.

DEEDI has been working with Lockyer and Bremer growers implementing a CTF system to model the economics of CTF in vegetable production systems. The study identified how CTF can improve 'the bottom line' for vegetable growers.

Why change?

This case study was based on an 80 ha family-owned vegetable enterprise in the Lockyer Valley. The grower co-operator was interested in a CTF system due to:

- concern about damage to his soil caused by machinery traffic
- a desire to improve soil quality
- an opportunity to reduce operations and inputs.
- the availability of GPS guidance technology providing other precision opportunities such as aligning drip tape with the planting line and elimination of marker operations.

The cost benefit analysis

An initial investment of \$71 000 was made to install precision GPS guidance systems in two tractors. The analysis then looked at what

What is Controlled Traffic Farming (CTF)?

CTF refers to maintaining machinery traffic in the same wheel tracks over consecutive crops. Soil and productivity improve as crops are not growing in compacted areas and machinery efficiencies are improved by trafficking permanently compacted wheel tracks.

GPS guidance can be used in CTF systems to manage farm traffic and achieve accuracy in the alignment of wheel tracks.

practical changes to the farming system were possible using CTF, and the economic benefit over the conventional farming system.

The economic analysis involved two stages:

1. An analysis of machinery operations with and without CTF:
 - A range of tractor options (5 tractors of 24–82.4 pto kW, 4 work rates of 50–80% total available power, standard rates of repairs and maintenance, fuel consumption rate of 0.34 L/pto kW hr).
 - Implement details (tractor and work rate for each implement).
 - Harvest operation details.
2. An analysis of crop gross margins with and without CTF.

Gross margins were calculated for a range of intensive vegetable crops (broccoli, potatoes, celery, carrots, pumpkin, and watermelon) with and without CTF. To simulate the variability and risk associated with growing these crops each gross margin was recalculated hundreds of times using a range of values (for price, yield, different markets, number of operations, irrigation).

Machinery operating costs and associated labour

Changing to a CTF system resulted in differences in the number, type and power requirements of machinery operations. There were significant savings in machinery operating costs (incl. fuel and labour).

Table 1. Reductions in machinery operating costs with CTF

	Reduction in \$/ha with CTF	Total saved with CTF/80 ha farm	Average value of investment over life	% ROI on average investment
FORM incl. tractor & labour \$/ha	\$216.80	\$17344	\$46150	37.58%
Total cost of tractor & labour \$/ha	\$153.21	\$12257	\$46150	26.56%



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- Total machinery savings with CTF on an 80 ha farm include:
 - savings of \$216.80/ha in fuel, oil, repairs, maintenance and labour
 - savings of \$153.21/ha in total costs.
- Simple return on investment in GPS guidance was estimated to be 37.6% of variable costs and 26% of total costs.

Reduced fuel consumption due to changes in machinery operations is a key benefit of a CTF system.

Table 2. Reduction in fuel and carbon dioxide (CO₂) emissions.

Tractor	Reduction in tractor hours per year with CTF (hours)	Fuel savings per year with CTF for each tractor (Litres)
Tractor 1 (82.4 pto kW)	184	5299
Tractor 2 (57.6 pto kW)	86	3798
Tractor 4 (29.6 pto kW)	92	580
Tractor 5 (24 pto kW)	71	501
Total reduction in carbon emission (kg/ ha/ yr)		344 kg CO ₂
Total fuel saving as a percentage		40.42%

- The biggest tractor has reduced 184 hours per year and saved 5000 litres per year.
- Fuel consumption reduced by approximately 40% across the fleet.
- Estimated reduction in carbon dioxide emissions by 344 kg/ha/year or 27 tonne/80 ha/year.

Machinery operation savings are due to many small gains including:

- reduced power requirements for machinery operations (CTF reduces area of compaction and tillage requirements)
- greater machinery efficiencies
- replacing some operations with GPS guidance technology.

Gross margins

The co-operating grower identified the possibility of up to a 4% yield gain with a CTF system due to soil quality improvements. The analysis identified possible gross margin gains with a CTF system even without any yield increase.

Table 3. Gross margin gains with CTF.

Yield gain	0%	1%	2%	3%	4%
Average gain per crop (\$/ha)	\$122	\$318	\$498	\$725	\$926
Allow for double crop (\$/ha)	\$244	\$636	\$995	\$1451	\$1853
Sum of CTF gain for 80 ha double cropped farm (\$/year)	\$19540	\$50904	\$79609	\$116050	\$148215

Practical implementation

This analysis suggests substantial cost savings with a CTF system. This is a result of lots of small gains in operating efficiencies and reduced input costs that add up to substantial savings.

Potential benefits from CTF and minimum till system include:

- improved machinery efficiencies with reduced input costs (e.g. fuel, labour) through fewer and lighter operations
- reduced power requirements
- reduced soil compaction and improved soil structure
- improved water holding capacity and infiltration with better use of rainfall, irrigation
- improved nutrient application efficiencies
- reduced erosion risk
- possible yield gains
- future downsizing of machinery requirements
- reduced carbon footprint that may become tradeable
- improved timeliness of operations, crop turnaround and opportunity
- greater precision in farm operations e.g. spraying, irrigation, fertilising.

Challenges of implementing a CTF system

- Harvest machinery options that are compatible with industry wheel spacings. Crops that are hand harvested using harvest aids are easily compatible with a CTF system as they usually operate on the same wheel spacings as other farm machinery
- Machinery widths and road rules for moving machinery
- Accuracy in guiding implements even with GPS guidance on the tractor. CTF vegetable production in Europe involves implement guidance as well.
- Time required implementing a CTF system.

Where to from here?

Results suggest that changing to a CTF system will pay returns even with significant cost outlays in technology and/or machinery modification. It is likely to have production as well as environmental benefits that may have a market value in the future. This cost benefit analysis will continue to be validated by grower co-operators as CTF systems in horticulture develop.

A CTF calculator is available from DEEDI to help growers to run simple comparisons using their own costs to see how CTF might affect their farming system.

More information

The figures presented in this document are current as at June 2010. Your own situation may vary. To develop a more accurate costing for your farm please contact Julie O'Halloran or Jim Page.

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