CTF in vegetables – great potential, challenged by incompatible machinery

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INTRODUCTION

Vegetable production in Tasmania is characterized by diverse crop rotations, frequent cropping schedules and intensive use of machinery for incorporation of crop residue, seedbed preparation and harvest. Intensive random traffic, as used in vegetable production, requires excessive tillage in an effort to remediate soil compaction. Controlled traffic farming (CTF), with traffic isolated to permanent wheel tracks, provides a number of farming system benefits including improved energy efficiency, soil health, crop yield, timeliness and economics. Research has shown that the implementation of controlled traffic leads to a change in tillage management, resulting in fewer, less energy intense, operations, and rapid improvements in soil structural condition. However, the adoption of controlled traffic in the Tasmanian vegetable industry is challenged by a diversity of machinery, making it difficult to achieve track and working width compatibility. Topography, ranging from flat to steeply undulating, poses further constraints.

SOIL AND TILLAGE BENEFITS OBSERVED IN TASMANIA

At one research site, soil structure, assessed by a visual soil structure score, improved considerably after only one season of controlled traffic practices (Fig. 1).

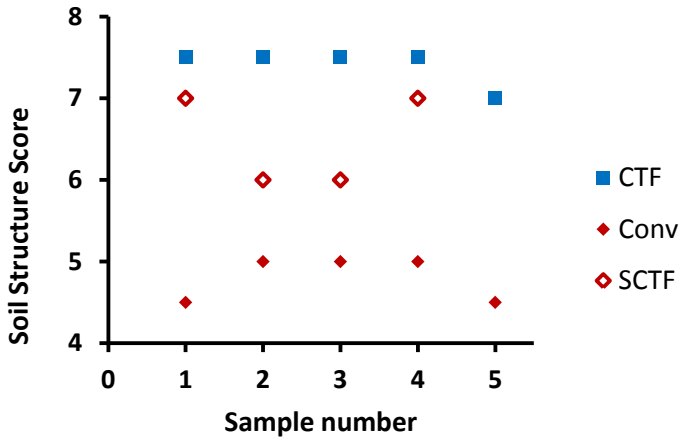

Fig 1. Soil structure score for controlled traffic, seasonal controlled traffic and conventional traffic systems in vegetable production. Score: 10 = excellent, 1 = very poor.

At another site, after one cropping season of controlled traffic, infiltration was measured in mid-winter, when the soil moisture content was high due to rainfall. The results (Table 1) show that the CTF site exhibited no run off, despite the same rate of water application lasting three times longer than on the conventional treatment. A later test at a drier time of year showed no difference in infiltration between treatments.

Table 1. Data from two infiltration tests under CTF and Conventional traffic conditions.

	Broccoli (Jul 2010)		**Fallow** (Aug 2011)	
	Conv	**CTF**	**Conv**	**CTF**
Duration of test (min)	30	90	90	90
Infiltration rate (mm/h)	3	exceeded application	exceeded application	exceeded application
Time to initial run-off (min)	2.2	not reached	not reached	not reached
Time to steady state run-off (min)	6	not reached	not reached	not reached

At three sites on two different soil types, tillage operations under CTF were reduced by 20 – 57% compared to the conventional system.

MACHINERY CHALLENGES

Table 2 shows the wide range of dimensions associated with machinery, particularly harvesters, used in the Tasmanian vegetable industry. Since many harvest machines are specialized for specific crops, it is difficult to achieve the dimensional compatibility required for controlled traffic over a wide range of crops. For this reason, seasonal controlled traffic (SCTF) is the preferred approach under current mechanization constraints.

Table 2. Dimensions of machinery (in mm) used in the Tasmanian vegetable industry.

	Track gauge	**Tyre section width**	**Working width**
Tractors	1625 – 2500	350 – 650	
Single row potato, carrot, onion harvesters	2000 – 2500	300 – 600	800 – 900
Tricycle carrot, potato, onion harvesters	1100 – 2600	600 – 750	750 – 1600
Pea, bean harvesters	2200 – 2600	400 – 750	2950 – 3330
Cereal, pyrethrum, poppy harvesters	3000 – 3300	300 – 800	4550 – 8000

The development of a prototype wide span tractor in Denmark (Fig. 2) provides an opportunity to reconsider and re-imagine mechanization in a way that would permit adoption of a fully integrated controlled traffic system for vegetable production. While this would be a transformational change in vegetable mechanization, most current mechanization could be adapted to suit the wide span more simply than trying to modify existing harvest equipment to fit a tractor-based system.

Fig. 2. Prototype wide span tractor configured for onion harvest.