Controlled traffic for vegetable production

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Mechanised vegetable production relies on intensive tillage, for two main reasons:

- Management of crop residue – there is a lack of zero-till seeders for many small seeded vegetable crops (e.g. carrot, onion, lettuce), and there is low tolerance of old crop residue in fresh harvested crops (e.g. beans, salad leaf etc.). Consequently, tillage is used to incorporate and manage crop residues to provide a seedbed with minimal surface residue.
- Remediation of harvest-induced soil compaction – this is particularly the case for crops that are mechanically harvested (e.g. most root crops, beans, peas etc.). Traffic compaction is difficult to avoid during vegetable harvest due to the lack of integration of track gauge and working width, both in individual machines, and between harvest technologies used for different crops. Further, as few vegetable crops are grown to dry maturity, and supply schedules are very demanding, harvest usually occurs when soil moisture conditions are ideal for compaction. An additional factor is the intensity of traffic during vegetable harvest, with 300 $t.km.ha^{-1}$ and wheel track coverage of 300 – 500 % being common for many root crop production cycles (compared to 20 – 30 $t.km.ha^{-1}$ and ~10% tracked area for CTF grain production). About half of the vegetable traffic load occurs during harvest.

Some sectors of the vegetable industry more easily lend themselves to the use of controlled traffic techniques. The production of hand-harvested crops (e.g. lettuce, melons etc.) is well suited to the use of permanent bed, controlled traffic production systems. In such circumstances, the main issues to address are the dimensional integration of machinery, which will already be in place in many bed production systems, the redesign of bed working and maintenance equipment to maintain the integrity of wheel tracks and beds, and farm layout to ensure adequate drainage and improve paddock access in wet conditions. Recent NZ experience indicates 40% greater production costs associated with random traffic in a bed production system.

Although vegetable and mixed farming enterprises may be mechanically complex, some benefits can be gained by transitioning to seasonal controlled traffic farming (SCTF). This requires that machinery used for tillage, seeding and crop management operations is matched for working width and track gauge, but the incompatibility of harvest equipment is accepted as being too difficult to overcome at this stage. The impacts of random traffic of harvest are "repaired" with post-harvest tillage, in much the same way as in a conventional production system. With the use of guidance and matched equipment, the production system can be reinstated on pre-existing traffic lanes for the next season. Research and commercial experience indicate improved soil conditions, reduced tillage requirements, lower fuel use and improved yield over time.

Machinery incompatibility is a barrier to CTF adoption in vegetables. Wide-span tractors (WS) offer a new mechanisation pathway for the vegetable industry, allowing many conventional implements to be mounted within the span. A prototype Danish WS tractor shows that mounting an onion harvester on a WS platform is no more complex than traditional tractor-driven or self-propelled harvest machines. Wide, non-trafficked crop beds would allow altered crop spatial arrangements, providing yield increases of up to 20% in some crops, purely by reducing the area required for wheel tracks.