

Yield monitoring in vegetables using load cells

Department of Agriculture and Fisheries



ADOPTION READINESS



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What is yield monitoring?

Yield monitoring (YM) in horticulture is increasing in use, but is still far from common practice.

The most successful yield monitoring approaches to date in horticulture are load cell based systems, used either in-line to continuously measure the mass of product moving over a conveyor, or retro-fitted under a bin to measure the incremental increase in load as the bin fills.

Commercially available yield monitors

Most yield monitors in vegetables are retro-fitted after market due to limited manufacturer options. There are two dominant systems in use in vegetable systems.

1. The ATV system originally developed for grape harvesters (<http://www.atv.net.au/>).
2. Greentronics™ (<https://greentronics.com/products/yield-monitor/>)

Both of these systems have been used for yield monitoring on potato, sweet potato and carrot

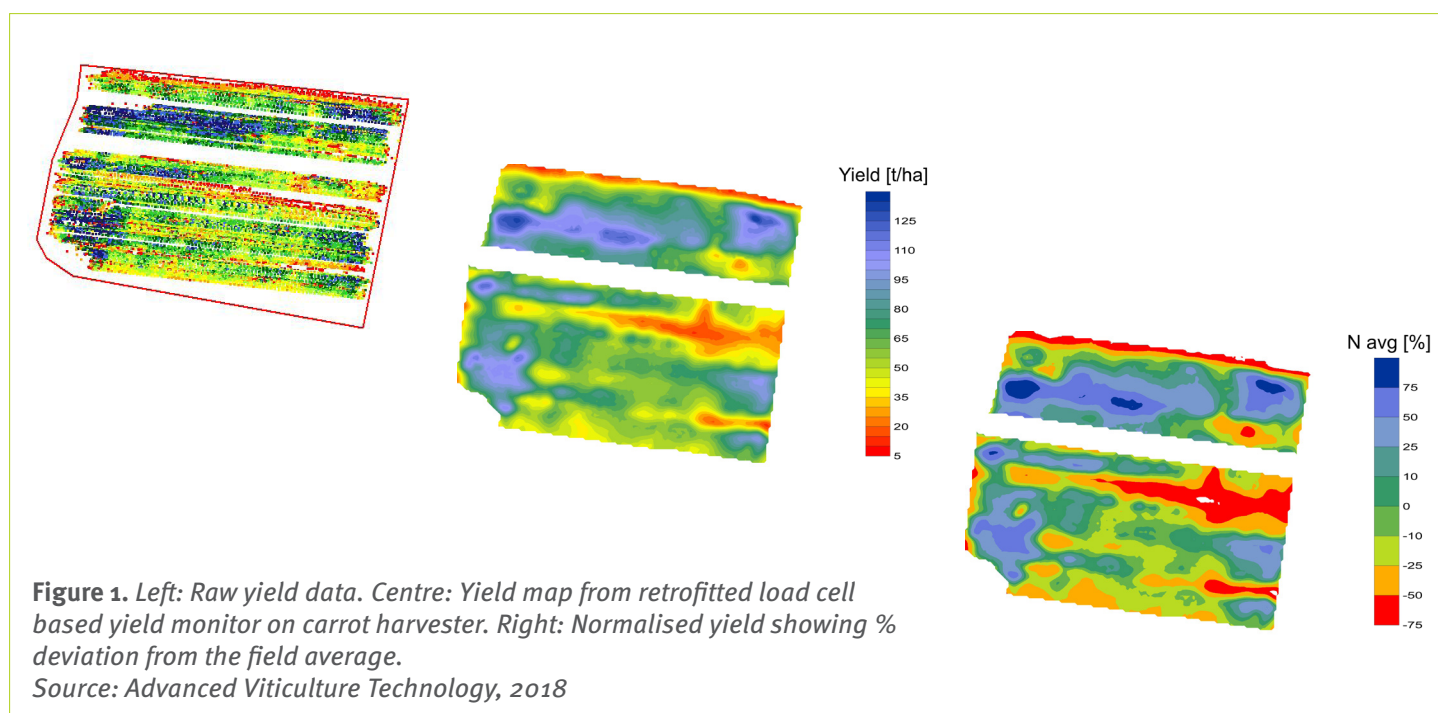
harvesters and offer connection to GPS systems to generate yield maps. The ATV system allows real-time, wireless data transfer and vehicle monitoring as at December 2018.

Why monitor yield?

'If you can't measure it, you can't manage it.'

Understanding variability in crop yield, and its impact on profitability, is a powerful motivator to investigate the underlying causes of variability and options to address it. This allows for measurement of block level variability, performance and trends.

Based on the yield map in Figure 1, yield within this field varies from approximately 20t/ha up to 100t/ha. Presenting this data as normalised yield i.e. the percentage by which yield deviates from the average yield, allows growers to easily see how much some areas may be underperforming. These yield maps can also easily be converted into profit-loss maps by applying standard input costs and price information.





Yield monitor calibration

Calibration of the yield monitor is one of the most important steps to ensure accurate data collection. The calibration method will depend on whether the packing shed records all packout data including waste and/or how product is harvested (i.e. into bins, trailers or a bunker).

In the example calibration below, the yield monitor was recording weights 20% above actual measured weights. The YM was then adjusted to account for this difference. Though once established, data post processing can also account for this variation. While absolute accuracy isn't possible variations of less than 10% have been achieved.

Benefits of yield monitoring

Yield monitoring provides:

- an indication of spatial variability and the extent of variability,
- the possibility of creating profit-loss maps to determine the cost of under-performing areas,
- ability to undertake cost benefit analysis of any management undertaken to reduce variability,
- comparison of yield variability with other spatial layers,
- comparison of yield data for individual fields over time.

Table 1. Calibration data for carrot harvester yield monitor, comparing actual bin weights with yield monitor readings for the same bins.

Measured yield (bins) (kg)	YM weight (kg)	Accuracy* (%)
4042.8	5110	79
4160.6	5280	79
4074.2	5490	74
4202	5270	80

*YM recording approximately 20% over measured bin weights.

Limitations to yield monitoring

Many vegetable crops that are machinery harvested are grown in rotation of up to 3-5 years, which means there will be no year-on-year data for the same crop in the same field

It is predominantly root crops that have implemented YM technologies to date which will inadvertently include some soil and will also mean that additional taring will be required as soil builds up on the harvester where the load cell is located.

For more information about 'Adoption of precision systems technology in vegetable production (VG16009)', contact the team:

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