

QLD Veg Automation News

September 2017

As reported in the January 2017 update, the initial Veg Automation project VG13113 finished at the end of 2016. The final report is available through InfoVeg <https://ausveg.com.au/app/data/technical-insights/docs/VG13113.PDF>

QLD Veg Automation News will continue to provide updates on the levy funded project VG15024 *Vision systems, sensing and sensor networks for managing risks and increasing productivity in vegetable crops.*

Rapid yield assessment with vision systems

This work uses two cameras to capture colour images and 3D scans of capsicum fruit to 'train' and evaluate vision-based algorithms. After scanning the crop, all fruit is picked and assessed manually for size, colour, weight and marketability – first or second grade according to defects – to ground truth machine generated data.

Protected cropping trials at Giru

QUT and DAF completed two trials in a greenhouse capsicum crop at Giru in North Queensland during July and August 2016. This work seeks to develop tools for automatically assessing fruit quantity and quality in vegetable crops.

Rapid yield assessment results so far:

The system achieved an accuracy of 94% green, 70% mixed colour and 91% red capsicum. That is an impressive result for this initial system and something on which we can build.



Example detections indicated by a red rectangle

Field trials at Gatton



Chris McCool from QUT 'scanning' a field grown capsicum crop for fruit numbers and quality

QUT has also completed two lots of trials in field-grown capsicum at the Gatton Research Facility.

The first series was completed in December 2016, the second in May 2017. Results will be ready later this year in time for the next project update.

Early problem detection with hyperspectral imaging

This area of research has proved challenging, however results from two greenhouse pot trials in late 2016 confirm that this is a technology worth pursuing.

Late 2016 pot trials

We grew capsicum plants in pots, inoculated half of the plants with Tomato Spotted Wilt Virus (TSWV) then took 133 infected and 103 healthy leaves and scanned these under controlled lighting conditions with two sophisticated hyperspectral cameras to develop algorithms to spot the difference.

The trials gave a better than expected result. The technology was able to discriminate between infected and healthy leaves with 90% accuracy.

Early trial results suggest that hyperspectral imaging could be useful for early problem detection in vegetable crops.

A third pot trial to confirm results from last year's work was completed recently and CSIRO are crunching the numbers now.

For this trial, we adjusted the leaf imaging schedule to see if the hyperspectral technology could pick up TSWV symptoms before DAF virologists could pick them up with the naked eye.



The DAF/CSIRO third pot trial at EcoSciences Precinct in Brisbane

We also increased the number of leaves sampled to give greater confidence in the 'automated learning model' that CSIRO are developing. During May 2017, we imaged 240 leaves on the first sampling date and 360 leaves on the second sampling date.

**Hyperspectral vs Multi-spectral vs NDVI
What's the difference?**

Simply put, *hyperspectral imaging* operates across the full electromagnetic spectrum from 400 nm to 2500 nm. The objective of the pot trials is to develop a '*hyperspectral signature*' for TSWV in capsicum from which software for early plant disease detection could be developed.

Multi-spectral imaging uses several bands along the electromagnetic spectrum, for example, *NDVI* technology (Greenseeker, etc) is based on the red and infra-red bands of the electromagnetic spectrum.

If results from pot trial 3 confirm results from late last year, the next step is to image whole capsicum plants grown in pots for TSWV later this year.

Once we are confident that the algorithms have 'learned' to reliably detect virus symptoms in whole plants, we will be taking the work out to the field.

Regional industry forums

In June 2017, DAF held a series of 'Veg Automation' forums across Queensland in Gatton, Bundaberg and Bowen

The aim was to update growers and industry on new developments in automation, robotics and sensing R&D for vegetable crops.

The following speakers presented as part of the forum program:

Chris McCool, Chris Lehnert and Tristan Perez from QUT outlined progress with AgBot 2, Harvey and the rapid yield assessment work in capsicum.

Peyman Moghadam and Phil Valencia from CSIRO gave an update on trial work with hyperspectral imaging and wireless sensor networks.

Salah Sukkarieh from ACFR at the University of Sydney gave an overview of progress with the Ladybird and RIPPA robots and the levy funded project VG15003.

The forums used the very successful 'virtual meeting' format from last year with researchers linking in via webinar for Q&A sessions. Twenty-seven people participated in discussions.

In an effort to make the forums more accessible to busy growers and their service providers, they were made available to industry via webinar link. Ten people took us up on this offer and it is certainly something worth following up in the future.

For more information on any of these topics please contact the project team:

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