

Reflections on five years in automation, robotics and sensing

Sue Heisswolf and David Carey
Department of Agriculture and Fisheries

2019 APEN conference

What we did and why we did it

Drivers:

- Media hype around the technology
- Increase industry productivity for greater global competitiveness

Aims:

- Better link up researchers with eventual end users:
Growers, agronomists, consultants, local machine developers → bring researchers into the regions
- Evaluate technology with growers and industry
- Focus on industry needs rather than technology

then

- Address several identified industry priorities → research on sensing technologies

and continue

- Regional industry forums, webinars, farm visits, one-on-one survey interviews, e-newsletters

Two projects – five years later.....

- The Technology – where is it at?
- Fit-for-Purpose and early end user involvement
- The Valley of Death in ‘Technology Transfer’

- Some general principles
- Get down to Specifics
- Social media as a technology

Bill Gates is supposed to have said

“We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten years.”



2017 Sydney Uni unleashes RIPPA the weed killer



2017 QUT's Agbot II weed slayer



2017 New SwarmFarm mini robotic sprayers to revolutionise farm machinery thinking



Horsepower circa 1915

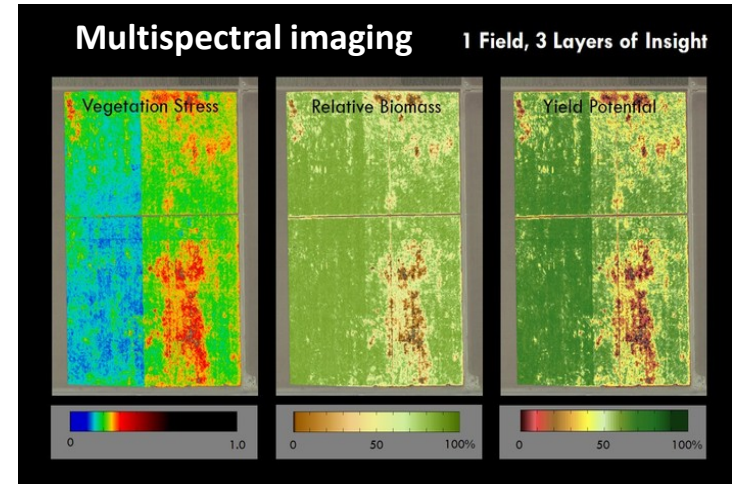


Self-driving old hat for tractors (GPS Global)

The World of Drones – remote sensing – satellite imagery

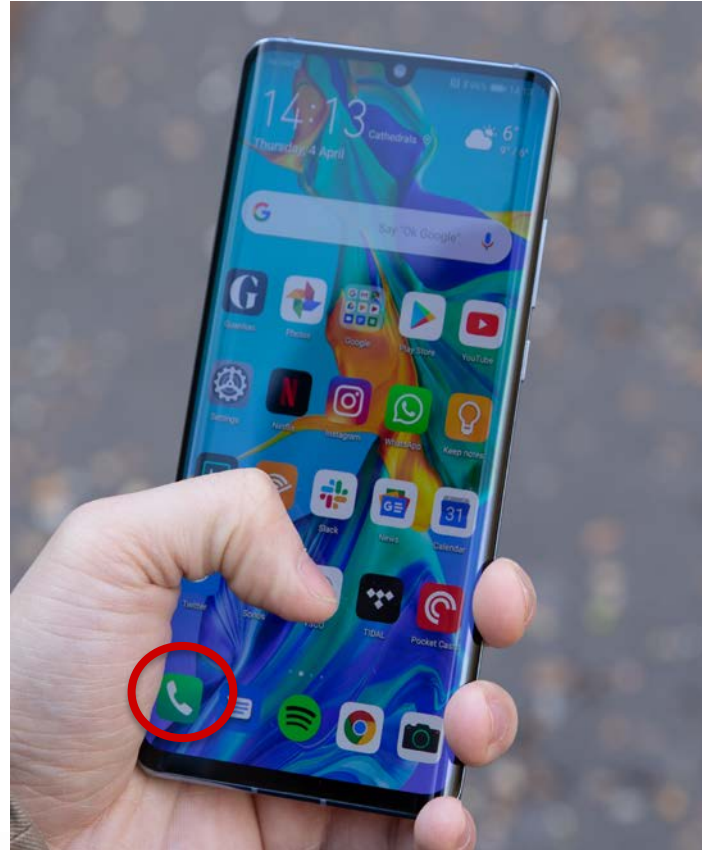


Hardware



Software output
per pixel

Communication tools – then and now



More
Faster
Better
Simpler

Next stop:
Telepathy?

The digital revolution, sensing and wireless technology

- Turn on irrigation by mobile phone
- Recalibrate colour graders/defect sorters in house

The Yield Technology Solutions Sensing+ for Agriculture

long-term *transformation* over short-term *disruption*

Don't blame end users for poor adoption
Know your customer



<https://www.theyield.com/post/transformation-over-disruption-four-lessons-from-an-unconventional-startup-founder>

Sensing technologies and machine learning

DAF/QUT/CSIRO collaboration – proof of concept research in capsicum

- Needs massive amounts of digital data and large human input to ground truth
- Provided a core around which to wrap industry engagement
- Response to identified industry priorities
- Modular to complement/not compete with existing R&D on robots
- Not aiming for practice change
- Aiming for early end user involvement → fit-for-purpose technologies

QUT/DAF:

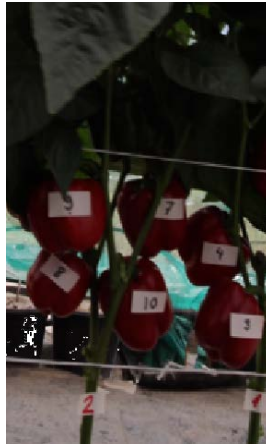
Can vision systems rapidly and accurately assess crop yields in fruiting vegetable crops?

- Optimised on field-grown capsicum crops
- Could find fruit in camera imagery at 75% accuracy
- Ready for prototype testing on farm

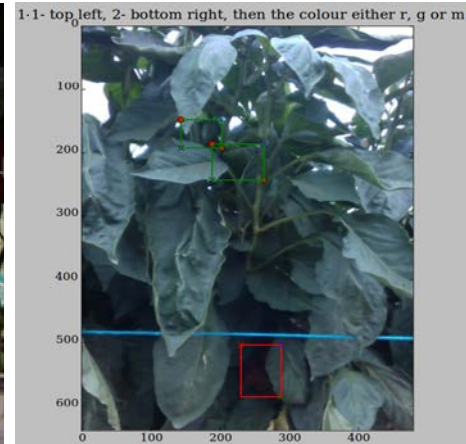
1. Scan crop



2. Label fruit & film



3. Manually annotate fruit in video



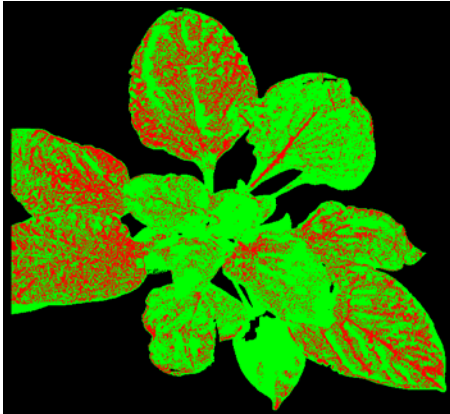
4. Harvest & grade



CSIRO/DAF: Can hyperspectral imaging & machine learning detect crop problems early before the human eye can?

- Tomato spotted wilt virus in capsicum
- CSIRO model detected infected plants at better than 90% accuracy
- Could detect infected plants at least 5 days before symptoms were visible to a plant pathologist
- Some way to go.....

Plant disease prediction per pixel



Under
controlled
lighting
conditions

What impact did we have?

- Initially engaged a broad cross section of industry
- Gradual drop off in people participating

Those that continued to be involved:

- Increased awareness, knowledge, understanding of automation, robotics and sensing
- Increased capacity for better decision-making about these technologies

In general:

- People remained very positive about the future of AgTech in their business
- Frustrated by the slow pace of progress
- In part a reaction to expectations raised by the media hype

Fit-for-Purpose technologies

Almost unanimous support for involving end users early in the R&D process but time is a real constraint to this aspiration for growers, industry and also researchers.....

Commercial
market

Research & invention

Co- Innovation

The Valley of Death in 'Technology Transfer'

Focus on industry needs rather than technology

Involving end users early in R&D

.....co-innovate, participatory action learning, farmer first research.....

It's about an approach, attitude, worldview – people and problems as well as technology

About specifics at the operational level as well as principles, strategies or generalities

The specifics are what is tested, improved, adapted, integrated into the farming system

Working out “how to” takes time, effort, courage, money and productive relationships

How might social media technology assist with all of this?

What can a smart phone do?

Social media as the new “word of mouth”

- We are all time poor – make it easy – simplify don’t complicate
- Keep it flexible – able to adjust and refocus in response to new input
- Managing/sharing data & information: provenance, filtering, value adding
- Communication – relationships – trust – respect

How can social media technology **improve end user participation?**

- Which tool – in what context – for what specific aim?

For example:

Webinars – link city researchers with regional end users – updates, Q&A, feedback, minimum travel time, easier to coordinate, scope for on-demand

Our thanks to all participants

DAF: Steve Ginns, Denis Persley and Fiona Giblin

CSIRO Data61: Peyman Moghadam, Phil Valencia and team

QUT: Chris McCool, Clinton Fookes and team

A broad cross section of Queensland's vegetable (& fruit) industry:

- Owners, managers and staff from 40+ grower enterprises, 6 consultancy firms, 5 engineering firms and 20+ other service providers
- Industry organisations in Bowen, Bundaberg and Gatton



Queensland
Government

**Hort
Innovation**
Strategic levy investment

**VEGETABLE
FUND**

This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

<https://www.freshplaza.com/article/9136908/there-is-a-breakdown-between-growers-and-technology-companies/>