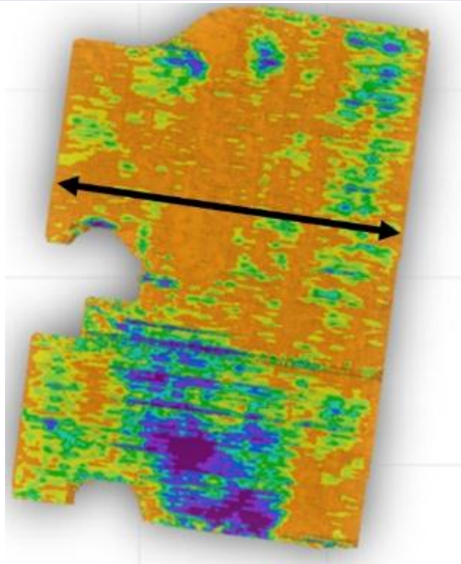
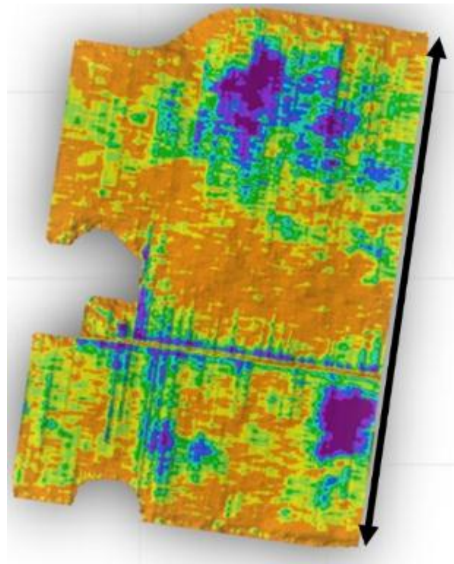
Precision agriculture technologies in vegetable production systems





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TIA is a joint venture of the University of Tasmania and the Tasmanian Government

Precision agriculture mindset

- Do you **want** to be **precise**?
  - PA management won't fix problems caused by ignoring the fundamentals
- What is your **purpose**?
  - improved profit, reduce off-site effects, more uniform harvest
- What are your **priorities**?
  - irrigation, nutrition, drainage

Know your **WHY**

Site Specific Crop Management - SSCM

Practices and inputs applied to better match soil and crop requirements as they vary within the field

- the **right amount**
- in the **right place**
- at the **right time**

Knowing exactly where you are on the planet, and knowing exactly what you should be doing when you are there.

Why use SSCM?

Natural within-field variability due to soil type/texture, structure, moisture content, nutrients, drainage…

Is it the right choice?

Differential treatment is based on:

- type of variation – spatial or temporal?
- degree of variation – is it economically important?
- cause(s) of variation – do you know the cause?
- suitability for management intervention – can you define management zones?

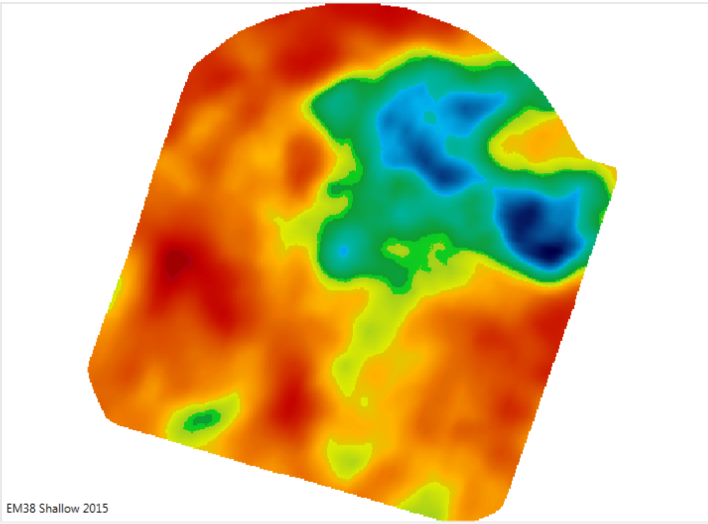
SSCM – the process

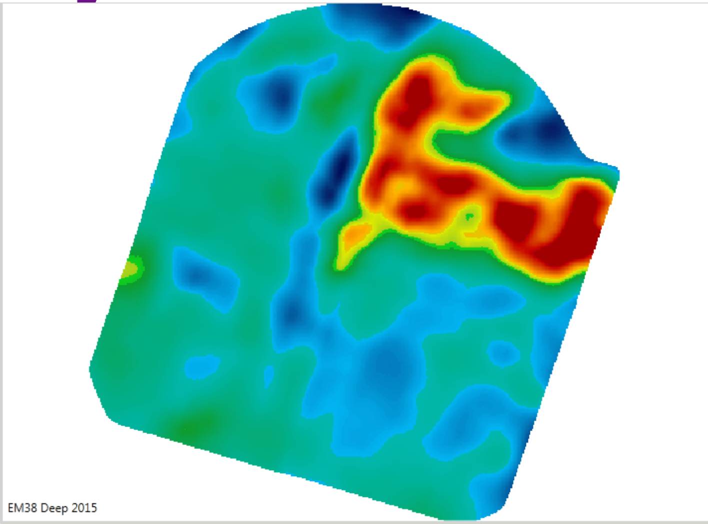
- **Observe variation** – imagery, soil and yield mapping
- **Assess cause(s)** – validation/ground-truthing
- **Provide timely and targeted treatment(s)** – vari-rate application (nutrients, irrigation etc.)

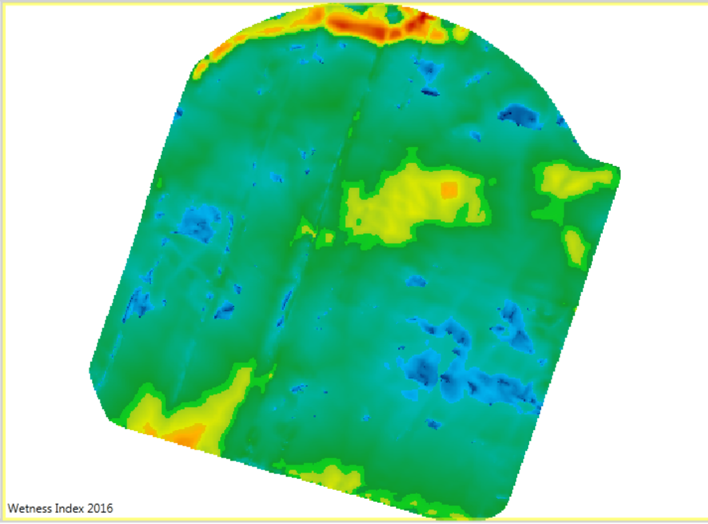
Tools used

- **GNSS** – geo-location and vehicle and implement guidance
- **Mapping** – exclusion zones, EM38, pH, nutrients, DEM, spectral imagery, yield
- **Imagery** – satellite, aircraft, UAV, ground-based
- **Vari-rate (VR) controllers** – irrigation, fertiliser, seed
- **Machine controllers** – drainage and land forming

Data layers





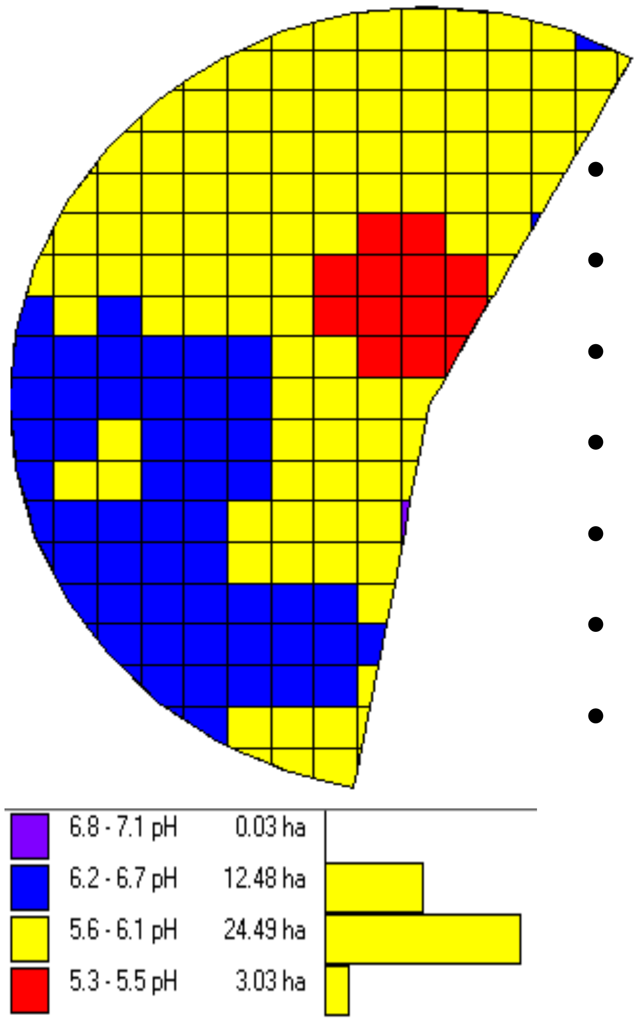


Precision drainage

- 140 ha, Inverleigh, Victoria.
- 36% (50 ha) suffered severe waterlogging, 75% yield reduction
- Tractor-generated RTK data used to produce contour map and develop drainage design
- Waterlogging damage reduced to 5% (7 ha)
- $70,860 gross margin increase
- $5,000 investment in drainage
- 14:1 ROI

precision agriculture Data and images from precisionagriculture.com

Vari-rate lime application



- 40 ha paddock, Hagley, Tasmania - target pH 6.0
- Traditional approach (3 t/ha lime blanket rate) = 120 t
- VR approach (average rate = 0.7t/ha) = 27 t
- Lime cost = $50/tonne (delivered & spread)
- Saving = 93 t or $4,650 (78%)
- Mapping cost = $600
- Total saving = $4,050 (6.75:1 ROI)

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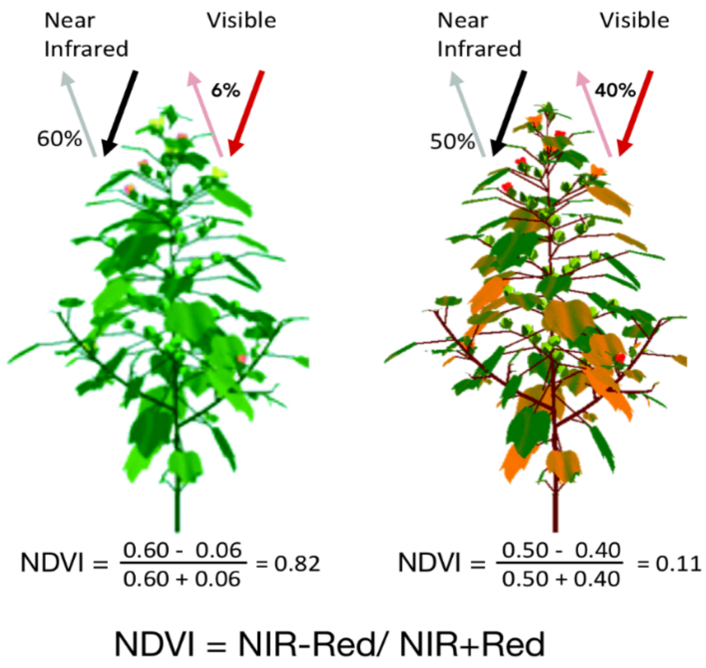
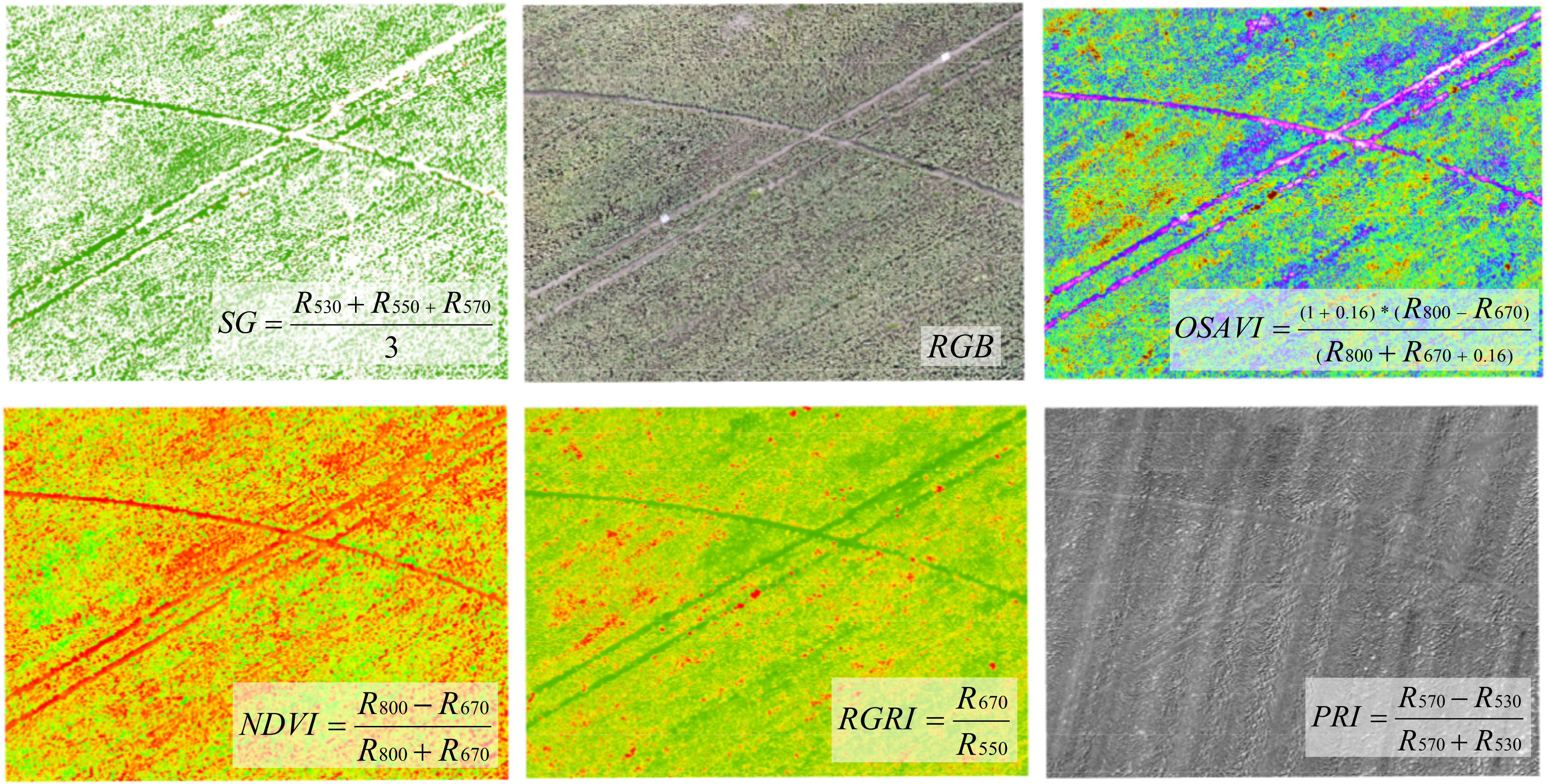
What is crop sensing

- Sensors measure Visible (Vis) and Near Infrared (NIR) light reflected by plants
- The amount reflected depends on the health of the plant
- Reflectance values are used to calculate vegetation indices such as Normalised Difference Vegetation Index (NDVI)



Spectral imagery – which index to use?



Images from Arko Lucieer, TerraLuma, UTAS

Crop sensing

Crop sensing platforms

Satellite

- High resolution 0.3m - 0.5m pixels
- Limited by cloud cover and imagery delivery time

UAV

- Resolution can vary
- Can mount different sensor types
- On-line processing
- Be aware of geo-location requirements for spatial accuracy

Ground-based

- Real-time display in the cab
- Data capture whenever in the field

Yield mapping

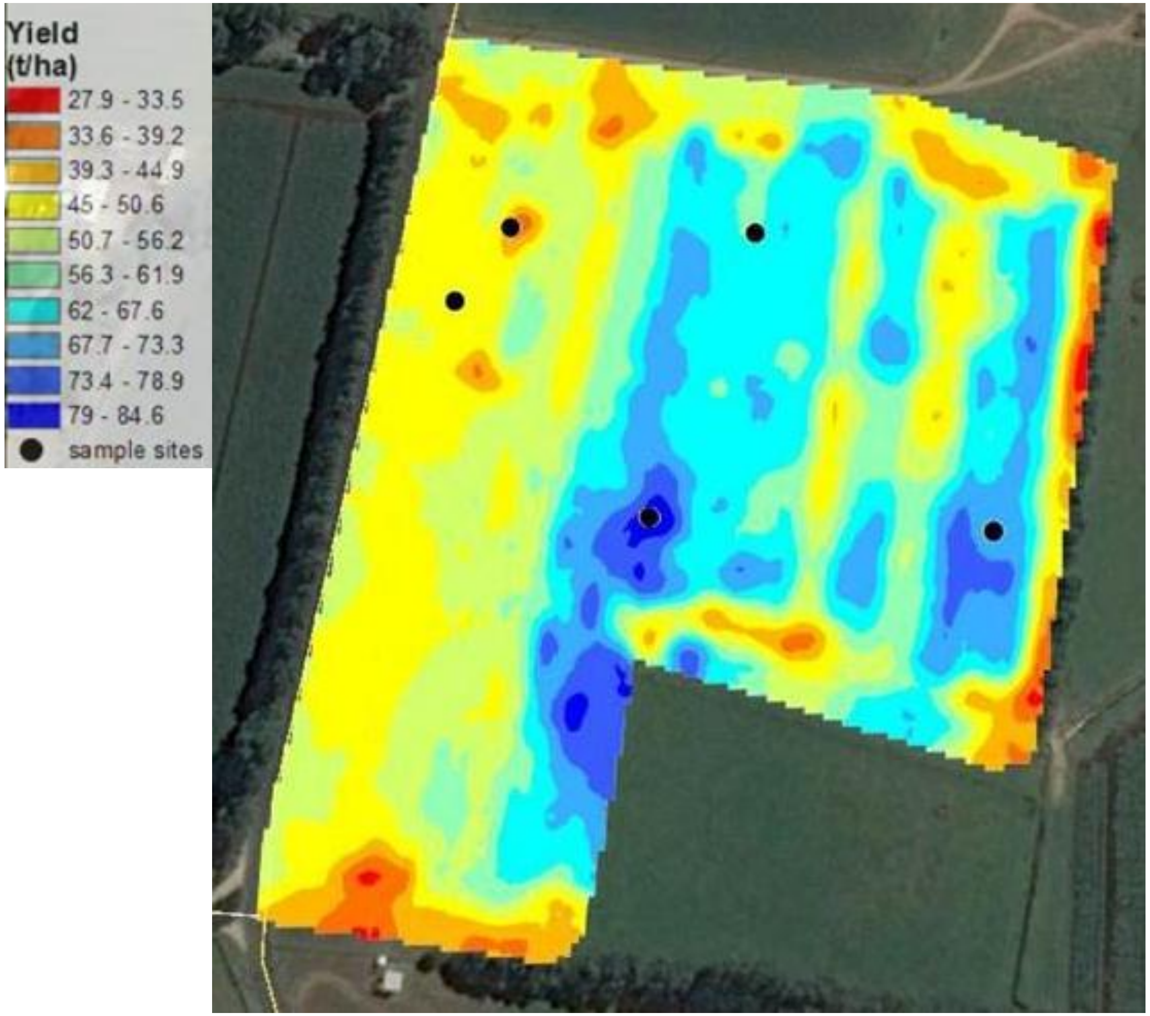


Image from Simplot Australia

Yield mapping

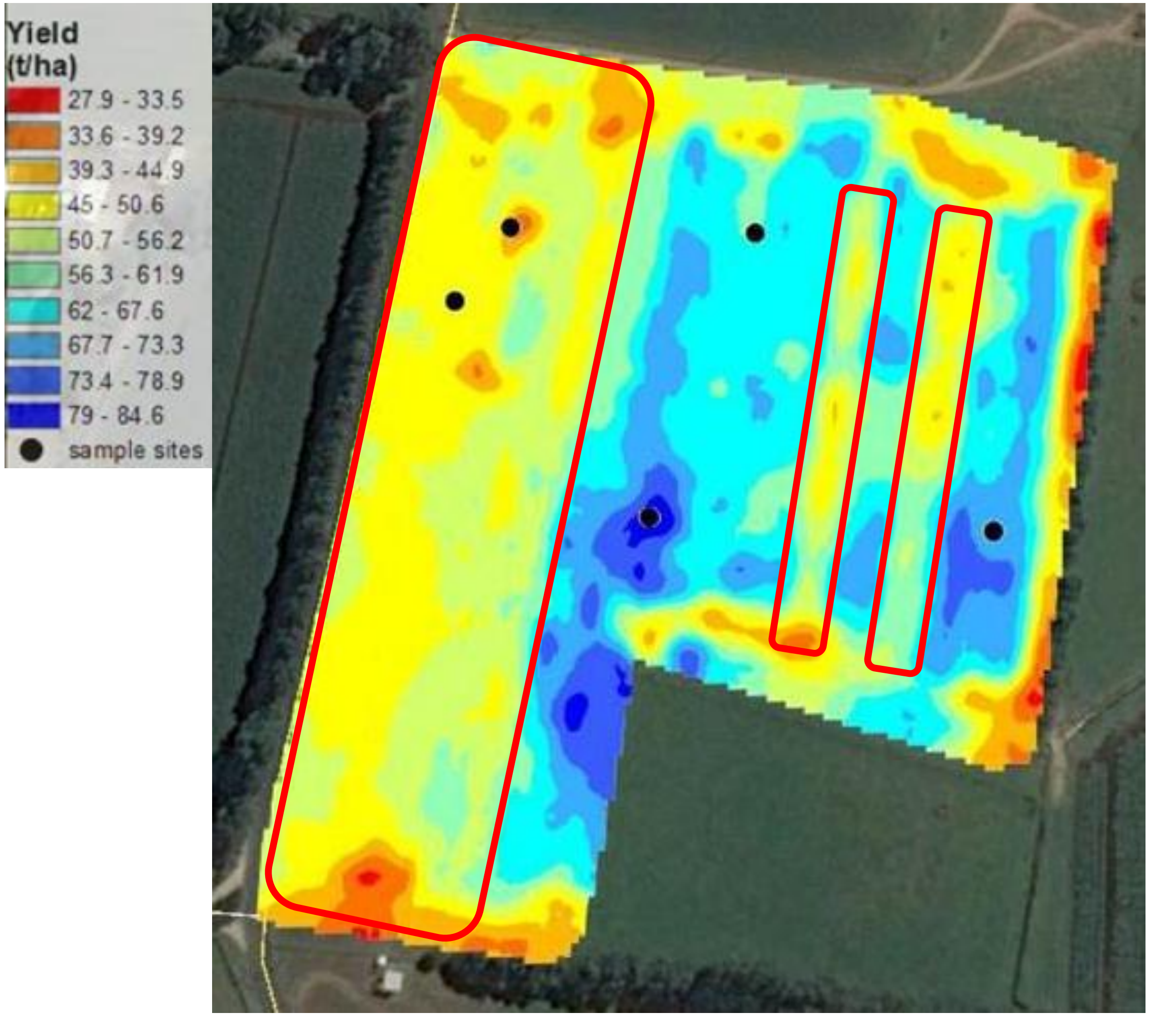
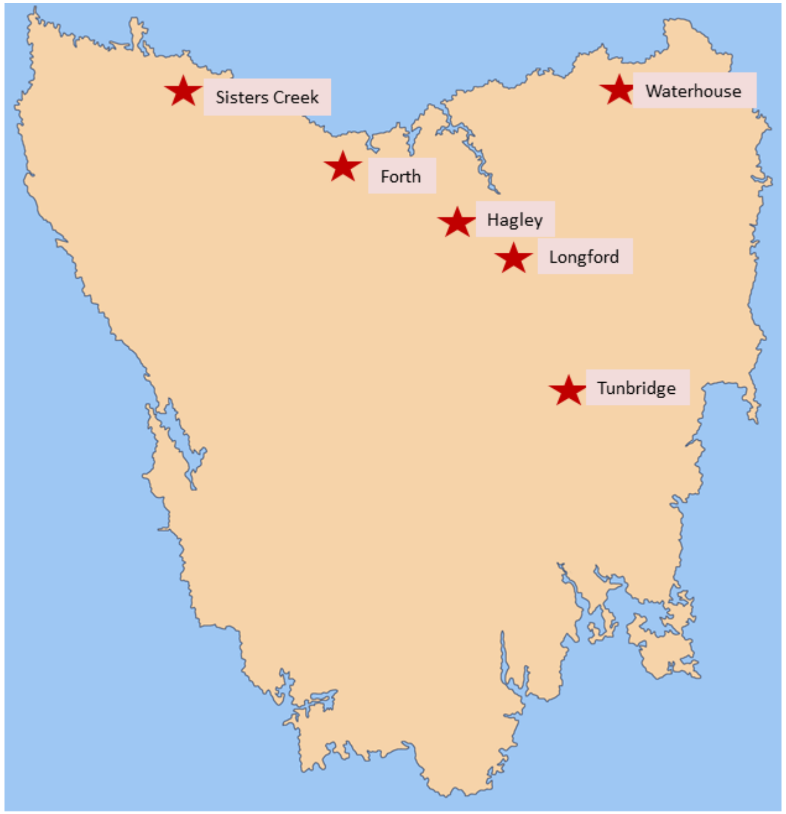


Image from Simplot Australia

Locations

- **Sisters Ck –** vegetables; linear
- **Forth –** vegetables, poppies; linear
- **Hagley –** grass seed, vegetables; pivot

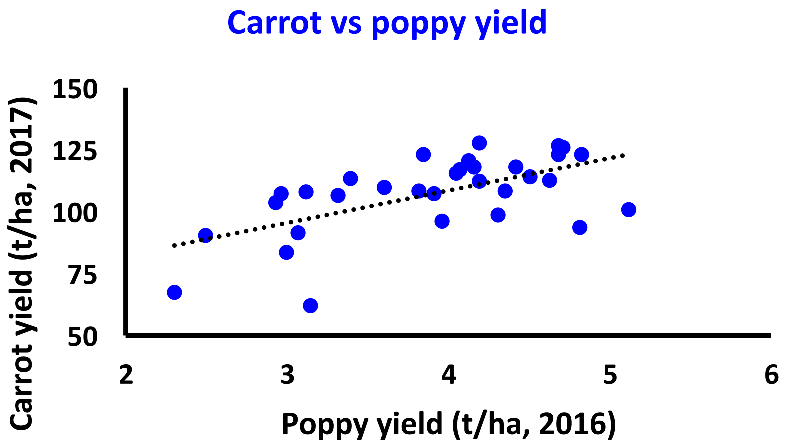


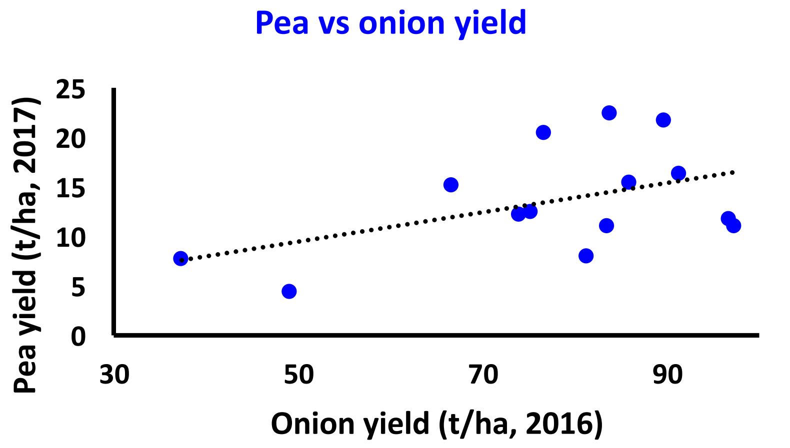
- **Longford –** vegetables, cereal, poppies; pivot
- **Waterhouse –** seed potatoes, cereal, pasture; VR pivot
- **Tunbridge –** poppies, garlic, cereal; pivot

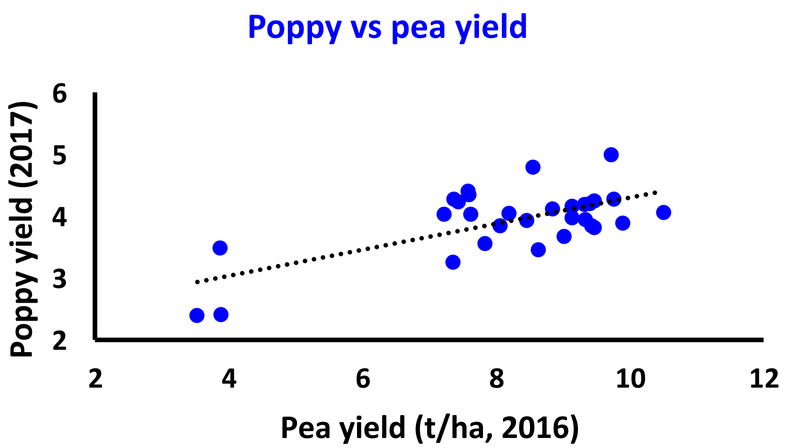
Yield variability

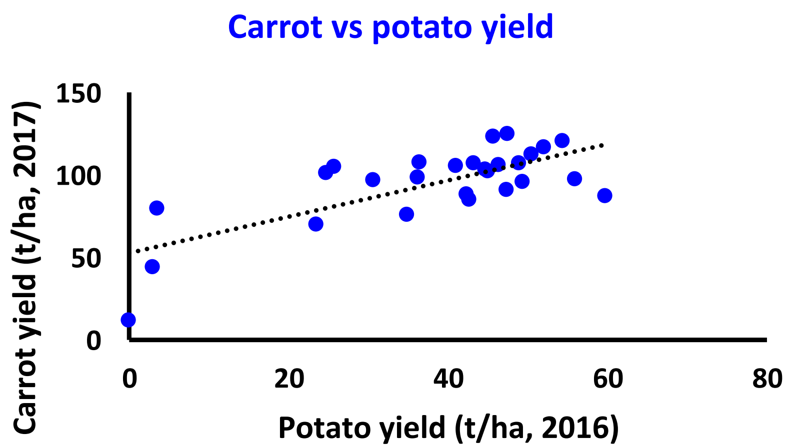
Crop	Avg (t/ha)	Min (t/ha)	Max (t/ha)	Variation
Carrots	95	12	125	10.5 x
Potatoes	38	3	60	20 x
Seed potatoes	33	11	51	5 x
Seed potatoes	29	12	43	3.5 x
Peas	10	1	18	18 x
Onions	73	37	97	2.5 x
Poppies	4	2.5	5	2 x
Peas	8	3.5	10.5	3 x
Peas	8	3.5	10.5	3 x
Seed potatoes	49	10	75	7.5 x
Carrots	107	62	128	2 x
Poppies	4	2	5	2.5 x
Seed potatoes	29	4	47	11 x
Poppies	3	2	4.5	2.3 x

Yield across seasons and crops









PA Expo