The Virtual Irrigation Academy

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- An integrated system (sensor and cloud based platform) for improving irrigation management and governance

- Decision-making tools:
  - Chameleon
  - Wetting Front Detector

- Management Information System:
  - VIA platform (https://via.farm)

The decision-making tools

The Chameleon

Measures what the plant experiences (not soil water content)

Gives output as colours (not numbers):

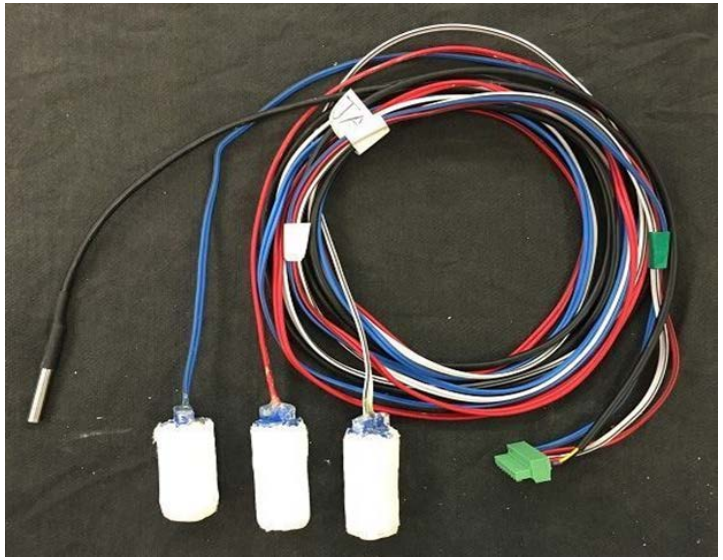
Green means that the soil layer is moist (20 to 50 kPa) – Ok for most crops

Red means that the soil layer is dry (> 50 kPa) – Need to consider irrigating

Blue means that the soil layer is wet (0-20 kPa) – Nutrients may be leached

The Chameleon reader and sensor array

- Reader connected to sensors buried at three depths typically; 20, 40 and 60 cm.
- ID chip identifies sensor array
- Temperature probe
- WiFi enabled reader
- Data stored on reader
- Long reader battery life
- Access point

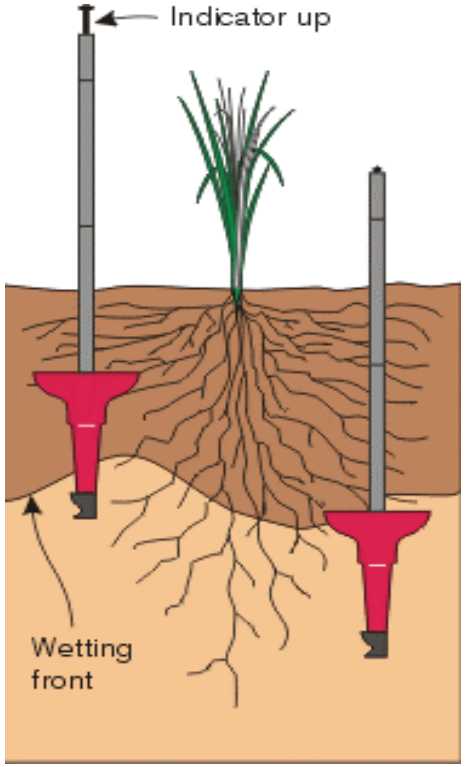


The advantages

- Affordable compared to other soil water monitoring tools
- Simplifies water measurement
- Easy to understand
- Immediate reading at three depths
- Accurate measurement of soil tension

The Wetting Front Detector

Captures a soil water sample by converging the downwards movement of water, and indicating with a mechanical float

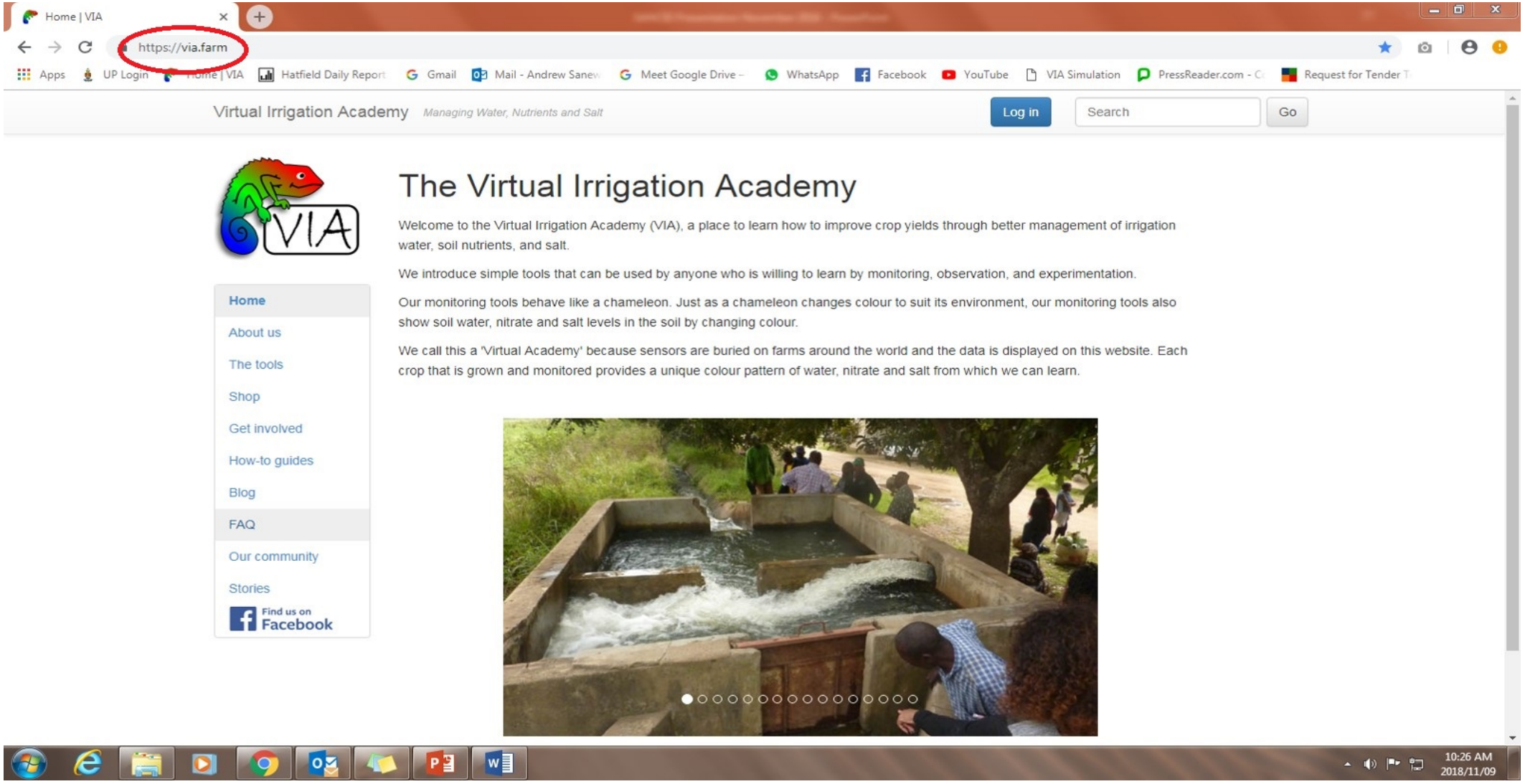


Measuring soil salinity

Measuring soil nitrate

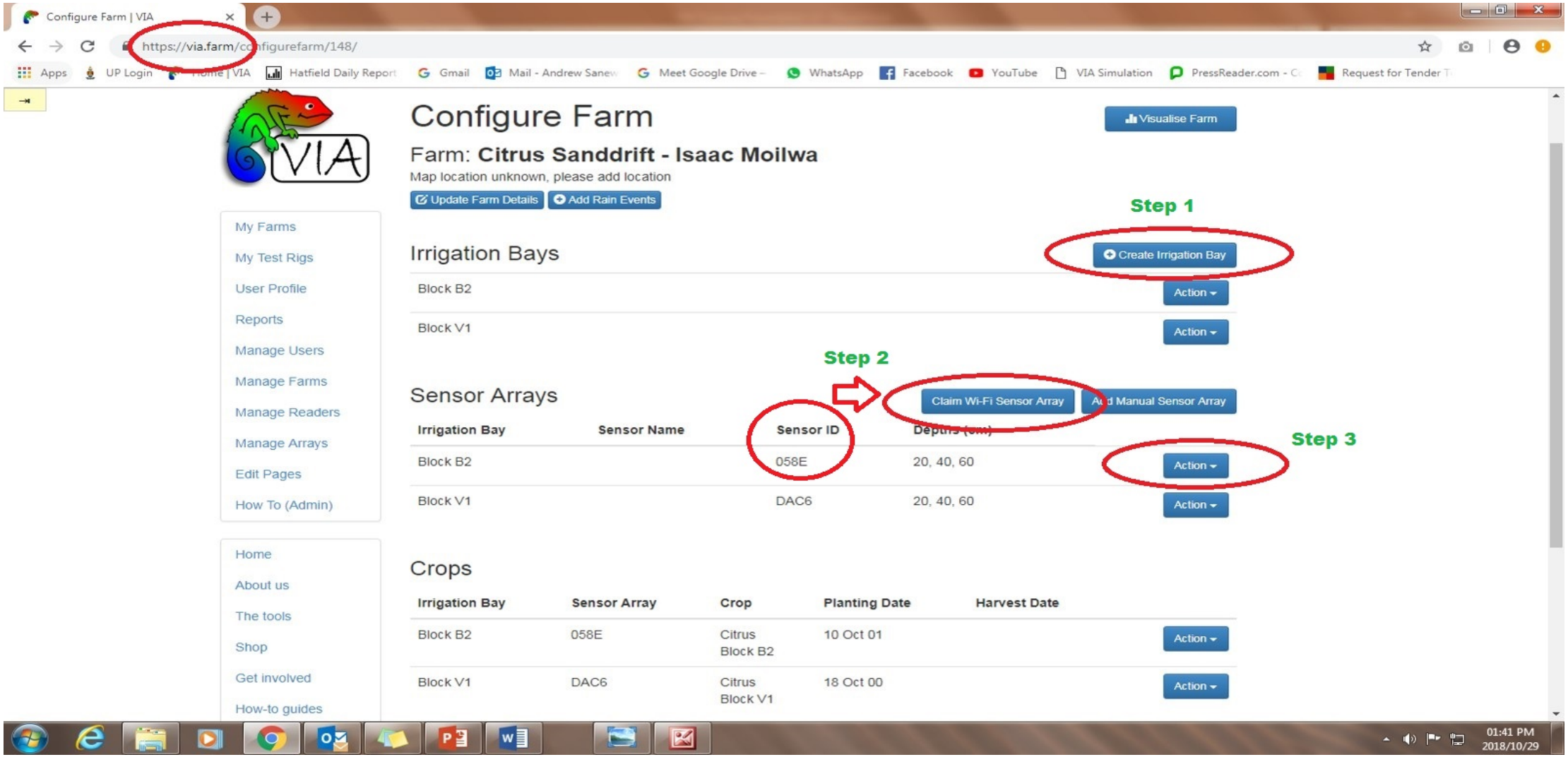
Management information system

The VIA platform



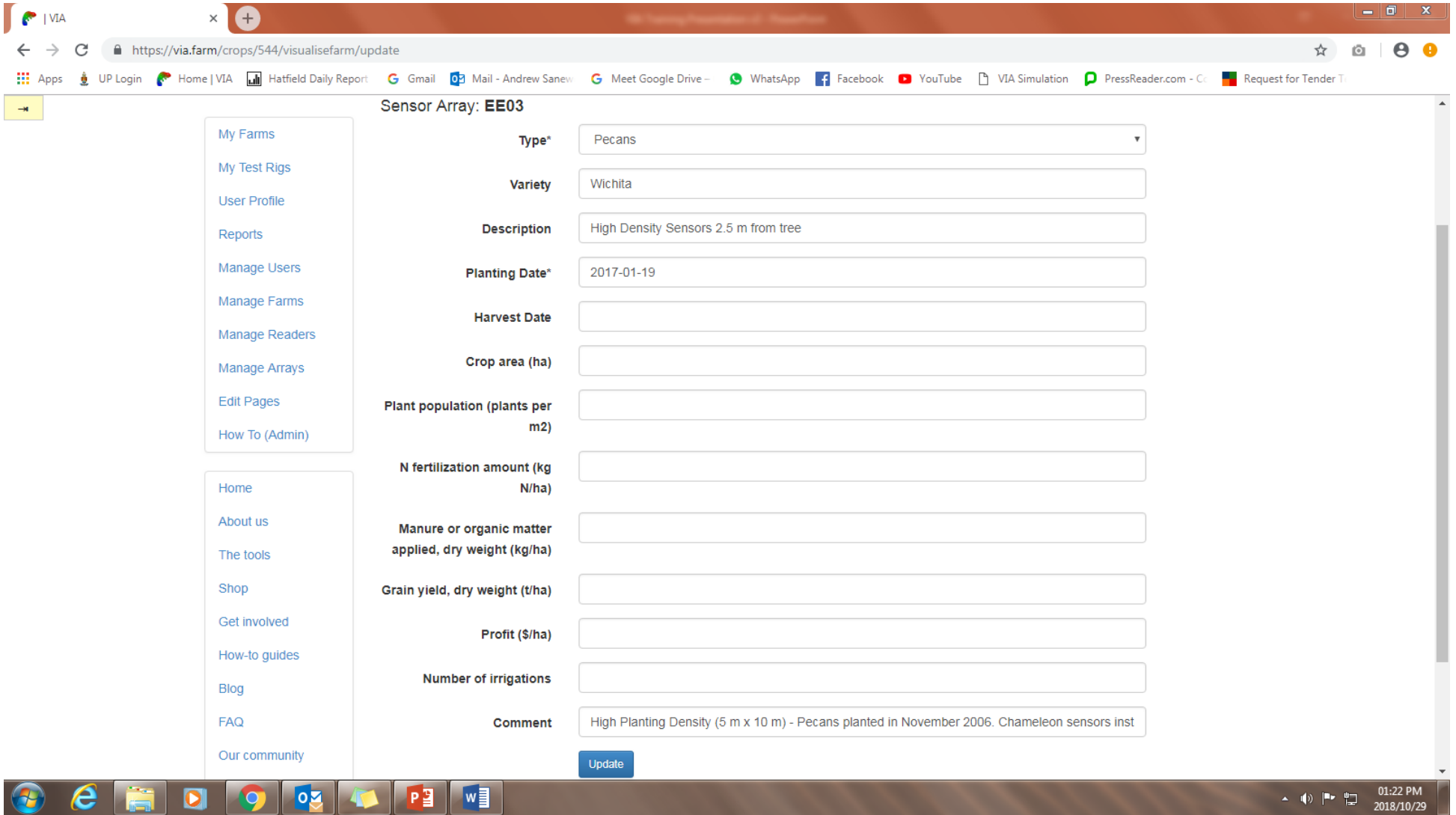
The VIA platform

Setting up a new farm



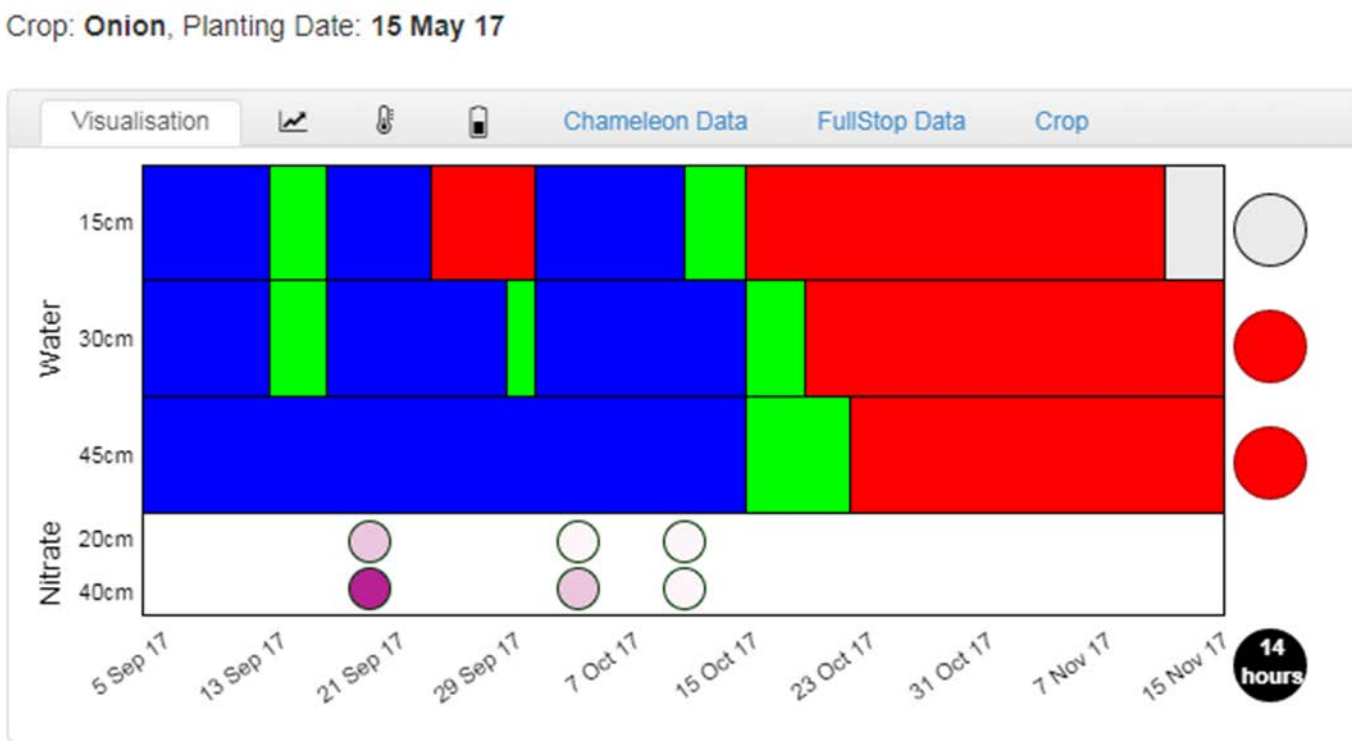
The VIA platform

Crop details



The VIA platform

- Shows the soil water by patterns (not graphs)
- Visualised on the VIA platform for decision making



The VIA platform

- VIA launched in 2016
- Over 1000 crops
- Different users from gardeners to commercial farmers
- Produced over 10,000 sensors in 18 months
- Active in 16 countries
- In SADC – Zimbabwe, Mozambique, Malawi, Tanzania and South Africa

South Africa	Nkomazi Walda TSGro	Farm	—	Yes
South Africa	Nova Farm Molati village	Farm	-23.944406, 30.412684	
South Africa	Pecandale Cullinan	Farm	—	Yes
South Africa	Pecans (Experimental farm - Aubrey)	Farm	—	Yes
South Africa	Pieter 1	Farm	-31.671416, 18.51494	
South Africa	Pieter 2	Farm	-31.668613, 18.516245	
South Africa	Pretoria Lab	Farm	-25.750392, 28.259699	
South Africa	Pretoria Research Hub	Farm	—	Yes
South Africa	RIEng	Farm	-25.730823, 28.276272	Yes
South Africa	Ramotswa IWMI	Farm	—	
South Africa	Ripplemead Farm	Farm	—	Yes
South Africa	SABBI	Farm	—	
South Africa	SSLI	Farm	—	Yes
South Africa	Sabie River Farmers	Scheme	—	
South Africa	Sandput (Mossie)	Farm	—	
South Africa	Sandveld Potatoes	Farm	—	
South Africa	Schoeman Blaauwfontein	Scheme	—	
South Africa	Schoeman boerdery	Farm	—	Yes
South Africa	Taung Bosele	Farm	—	Yes
South Africa	Taung Ipelegeng	Farm	—	Yes
South Africa	Taung Pudimoe	Farm	—	Yes
South Africa	Taung Reaitlhoma	Farm	—	Yes
South Africa	Taung Rethuseng	Farm	—	Yes
South Africa	Taung Tshidiso	Farm	—	Yes
South Africa	Waterberg Berries	Farm	-24.0, 28.0	
South Africa	Wellington	Farm	—	
South Africa	ZZ2-Dikgale	Farm	—	

Taung Irrigation Scheme

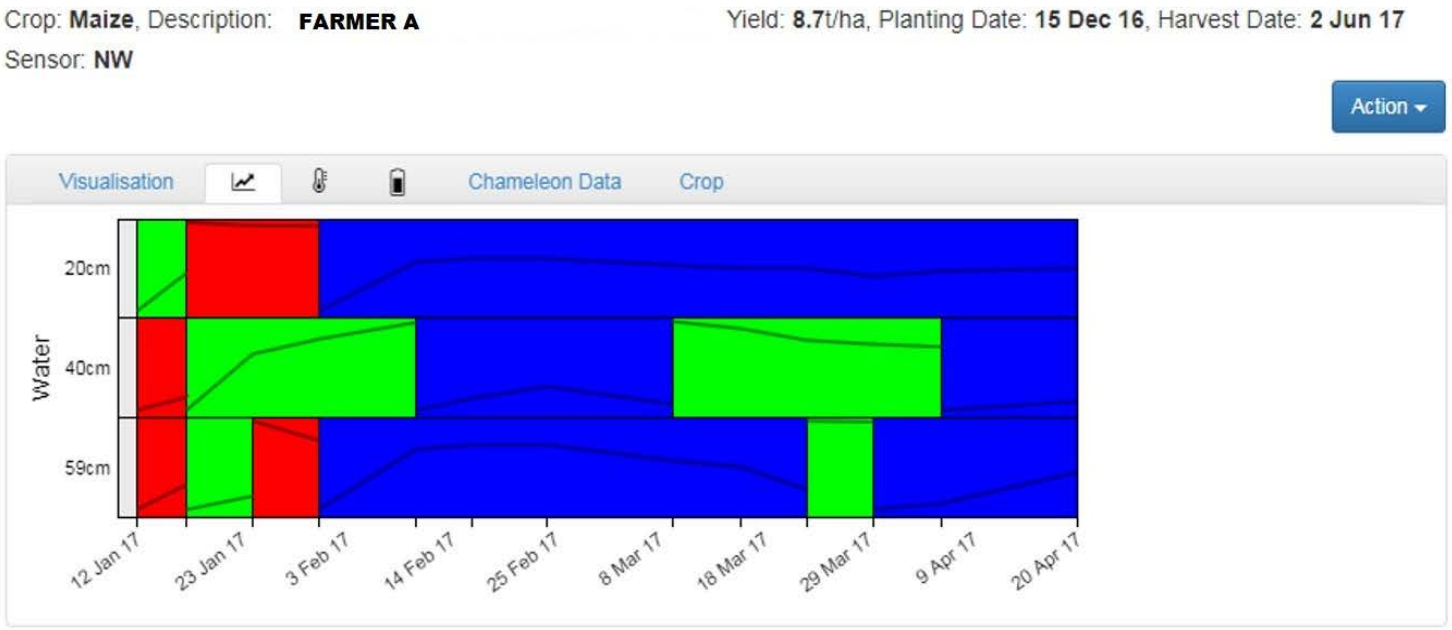
- Situated in North West province
- Established in 1939
- 411 barley farmers on 3764 ha
- Centre pivots on 2756 ha and sprinklers on 1008 ha
- Farmers contracted to supply barley to SA Breweries
- Barley/Maize or Barley/Groundnuts rotation
- One centre pivot covers 40 ha (Each farmer has >10 ha)
- Taung has 5 different cooperatives
- Tshidiso cooperative – 14 centre pivots on 560 ha

Taung irrigation scheme

Anheuser Busch InBev (SAB Miller)

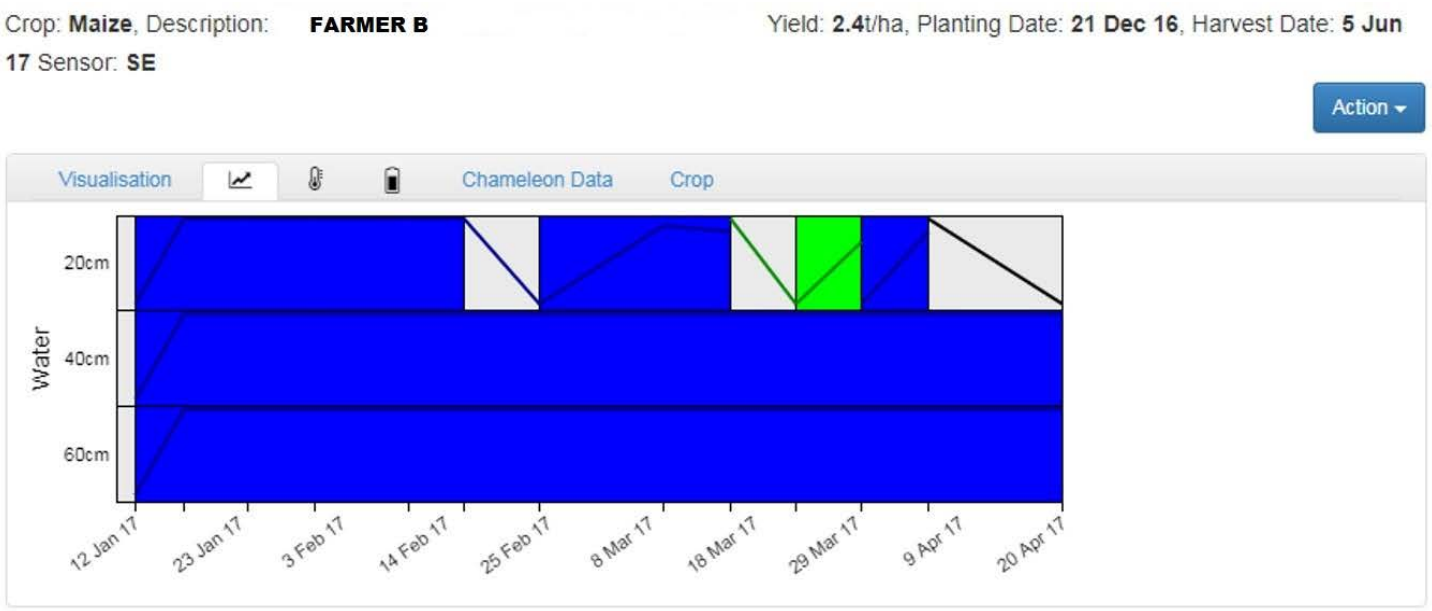
Taung – Tshidiso Cooperative

- Farmer A
- Non GM maize
- Centre pivot JS2
- Plant pop'n - 80 000 plants/ha
- Fertiliser - 125 kg N/ha
- Plot size - 10 ha
- Good yield – 8.7 t/ha
- Soil water pattern: 65% blue, 24% green and 11% red



Taung – Tshidiso Cooperative

- Farmer B
- Non GM maize
- Centre pivot JM6
- Plant pop'n - 80,000 plants/ha
- Fertiliser - 125 kg N/ha
- Plot size - 10 ha
- Poor yield – 2.4 t/ha
- Over irrigation & nutrient leaching
- Soil water pattern: 88% blue, 2% green and 10% red

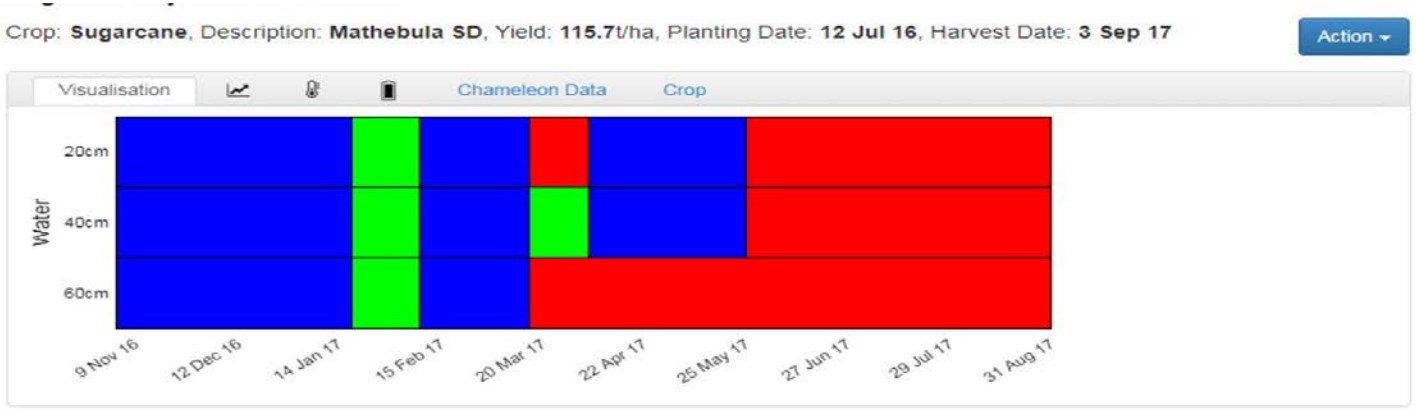


Nkomazi sugarcane growers 2017

Farmer A:

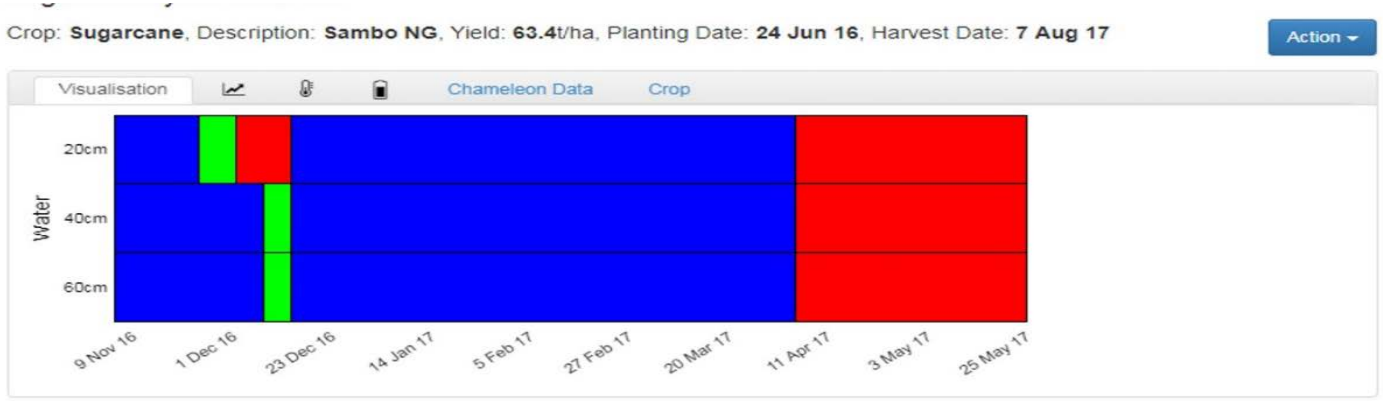
- 7 ha sugarcane (N19)
- Irrigation system: drip
- Soil water pattern: 49% blue; 10% green and 41% red

- Yield: 115.7t/ha

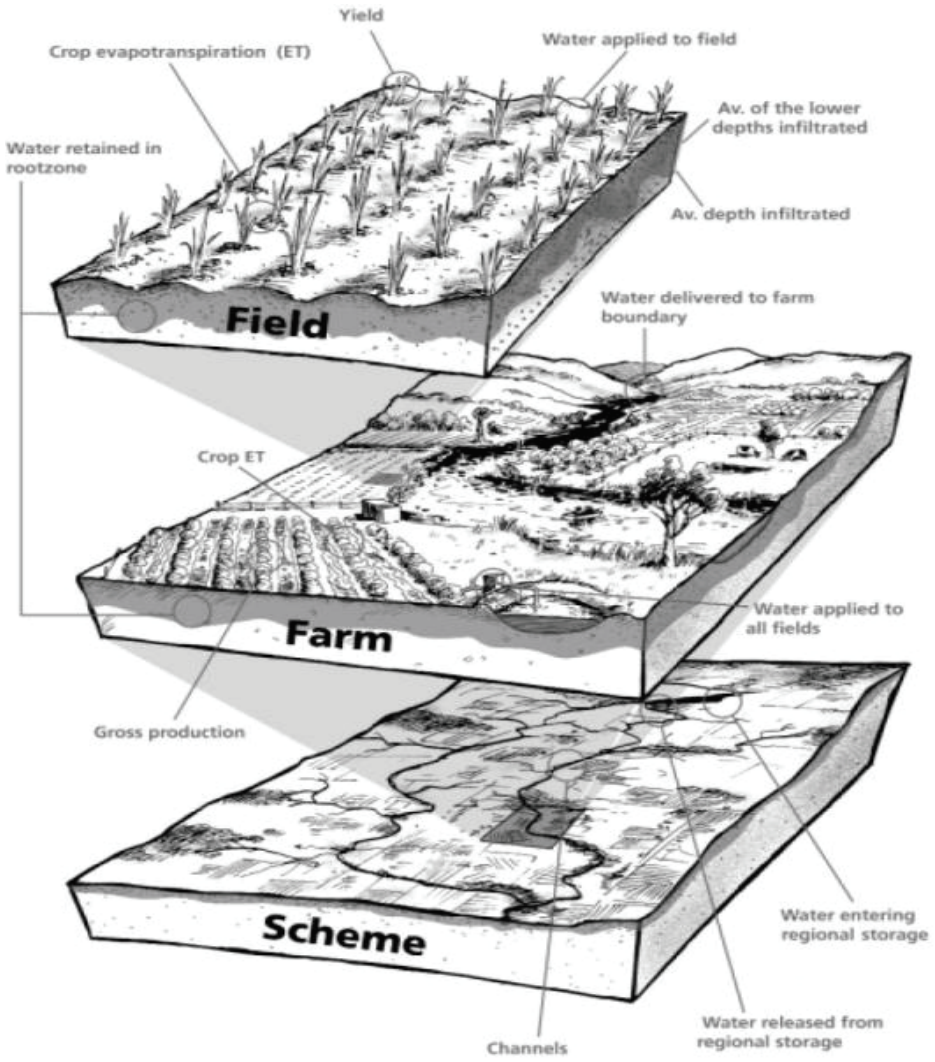


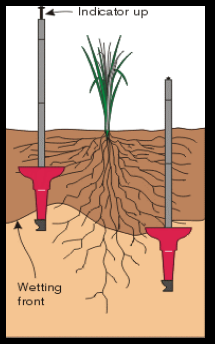
Farmer B:

- 7 ha sugarcane (N19)
- Irrigation system: drip
- Soil water pattern: 69% blue, 3% green and 28% red
- Yield: 63t/ha



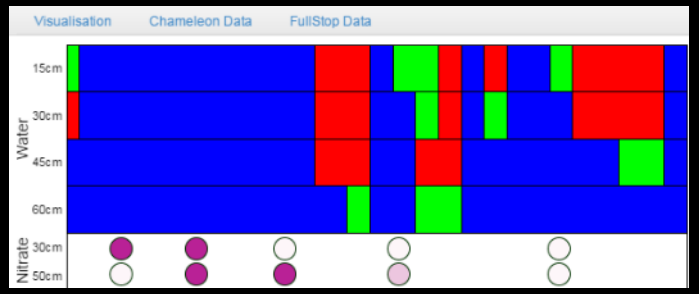
Levels of agricultural water management systems





Database

Farmer learning



Management
Governance

Country: **Tanzania**

Past crops

Farm	Crop Type	Year	Number of crops	Number with yield data	Min Yield	Max Yield	Avg Yield	Avg Uploads per week	Detail
Kiwere Irrigation Scheme (ANU)	Tomato	2014	13	13	8.6	23.6	15.8	0.5	
Kiwere Irrigation Scheme (ANU)	Tomato	2015	3	3	9.2	22.5	14.9	0.9	
Kiwere Irrigation Scheme (ANU)	Tomato	2016	1	0	–	–	–	2.0	
Kiwere Irrigation Scheme (VIA)	Tomato	2016	1	1	0.5	0.5	0.5	0.4	
World Vegetable Centre Arusha	Tomato	2016	1	0	–	–	–	0.0	
Kiwere Irrigation Scheme (VIA)	Tomato	2017	4	3	1.1	3.1	2.1	1.3	
Msolwa Irrigation Scheme	Rice	2017	8	8	5.2	8.4	6.7	0.1	
Kiwere Irrigation Scheme (ANU)	Onion	2015	2	1	6.3	6.3	6.3	1.6	
Kiwere Irrigation Scheme (ANU)	Onion	2016	3	0	–	–	–	1.9	
Kiwere Irrigation Scheme (VIA)	Onion	2016	5	5	1.2	3.6	2.3	1.4	

Reports to authorities for management, marketing, equity, governance, investments, interventions

On-going
Innovation

Farmer to farmer learning
Farmer to expert
Farmer to government

The VIA platform

Irrigation management and governance

- **Farmers:** Learn by comparing their Chameleon colours with their own crop performance.
- **Scheme management:** Groups will learn by comparing colour patterns and yields across the scheme.
- **Government:** Provide data on irrigation scheme performance across a country.
- **Development partners:** Provide automated reporting to development partners to track performance of their water investments.

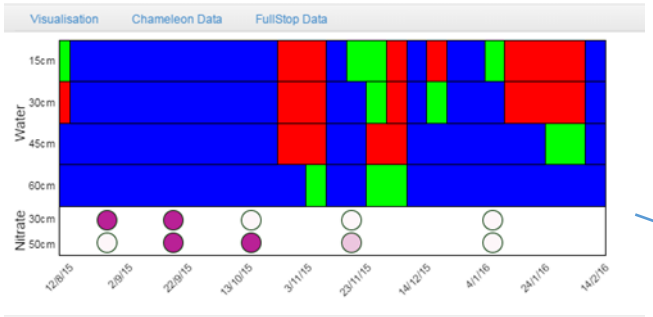
Examples of VIA data analytics

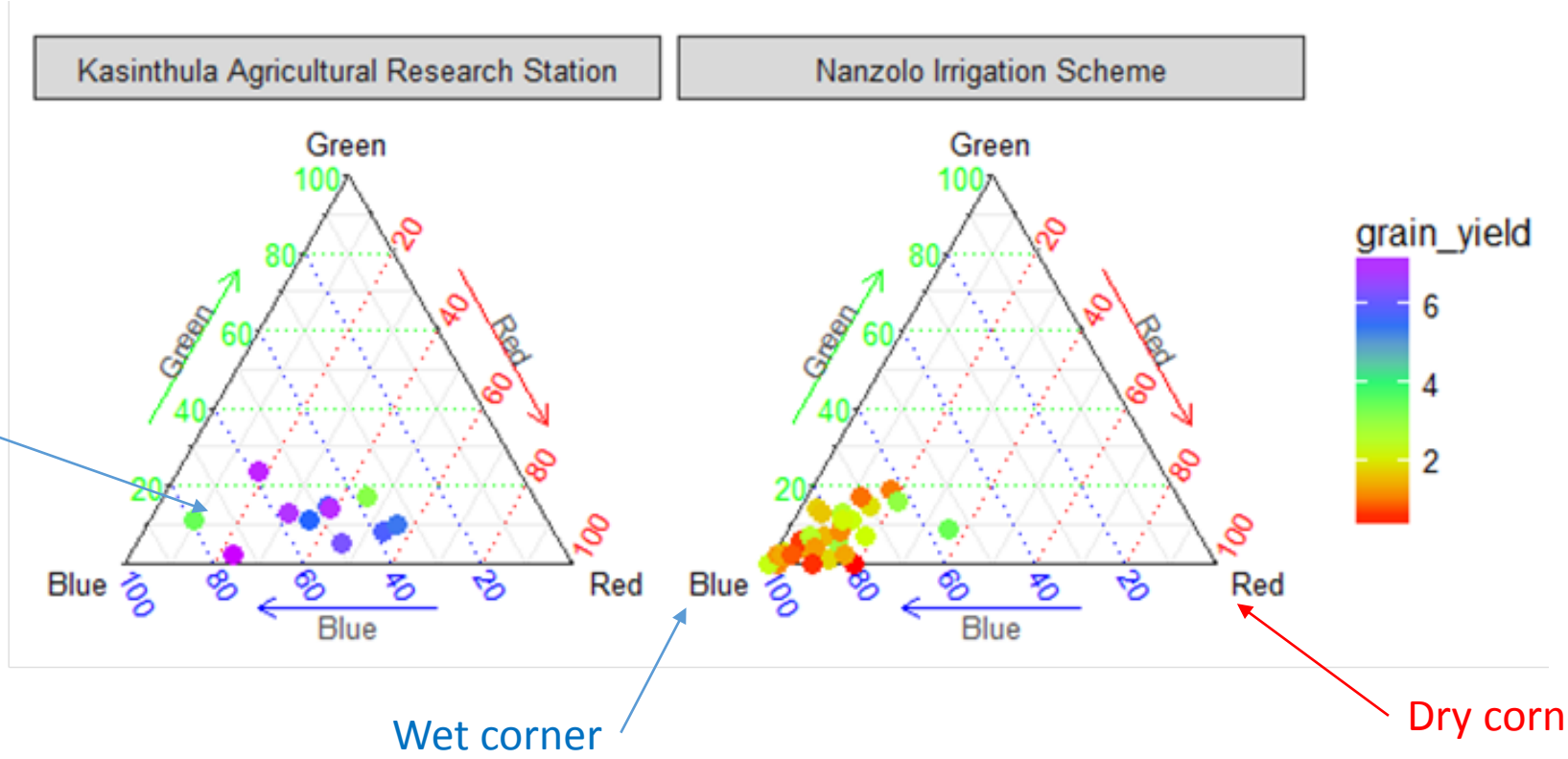
The VIA produces a colour pattern for each crop.
When the basic agronomic data is added (variety, fertiliser, yield), the data can be aggregated by crop or scheme

This gives us the ability to understand:

- Relationships between yield and water management
- Yield gaps within schemes
- Yield gaps among schemes
- Relationships between yield and fertiliser
- Relationships between yield and varieties

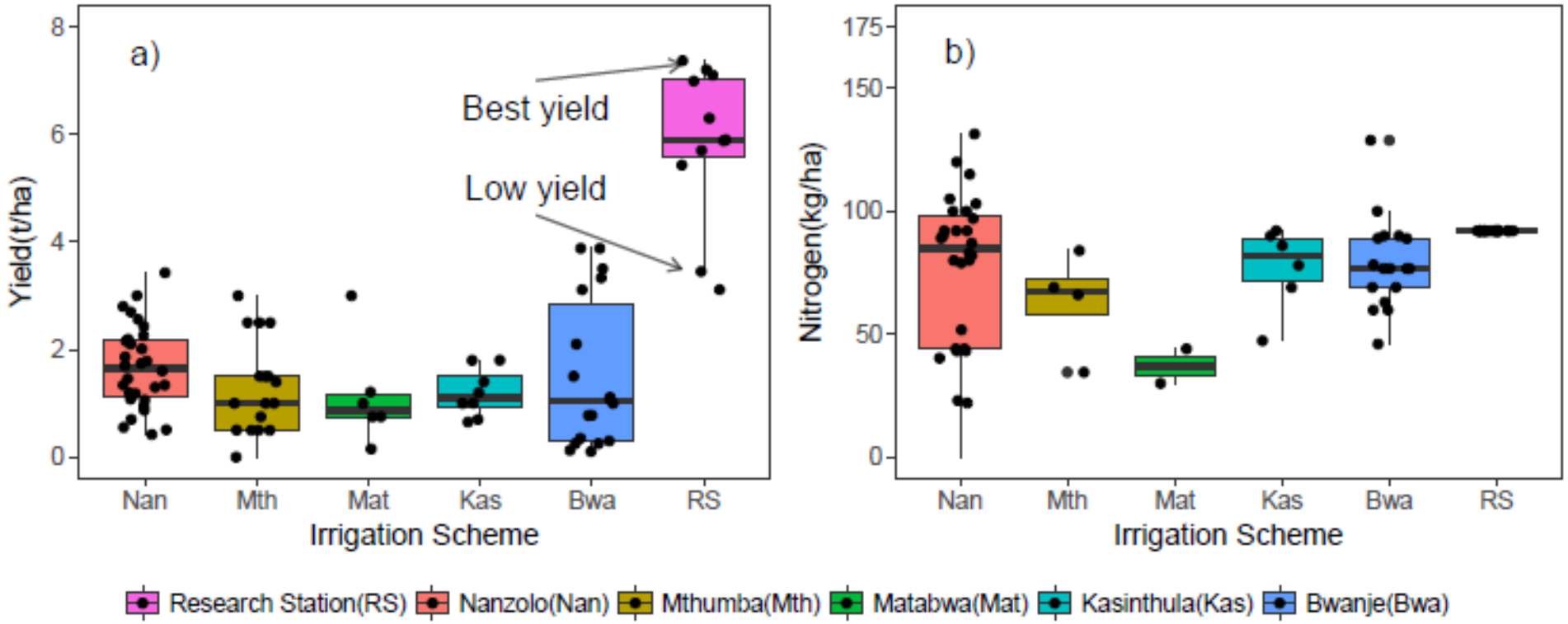
Yield and Water management





Each point on the triad represents a single crop, by integrating the Chameleon pattern to give percentage blue, green and red colour
The colour of the point shows the yield (purple is high, red is low)
We see lower yields at Nanzolo scheme compared to the Kasinthula Research Station.
Lower yields associate with points clustered into the blue (wet) corner of the triad

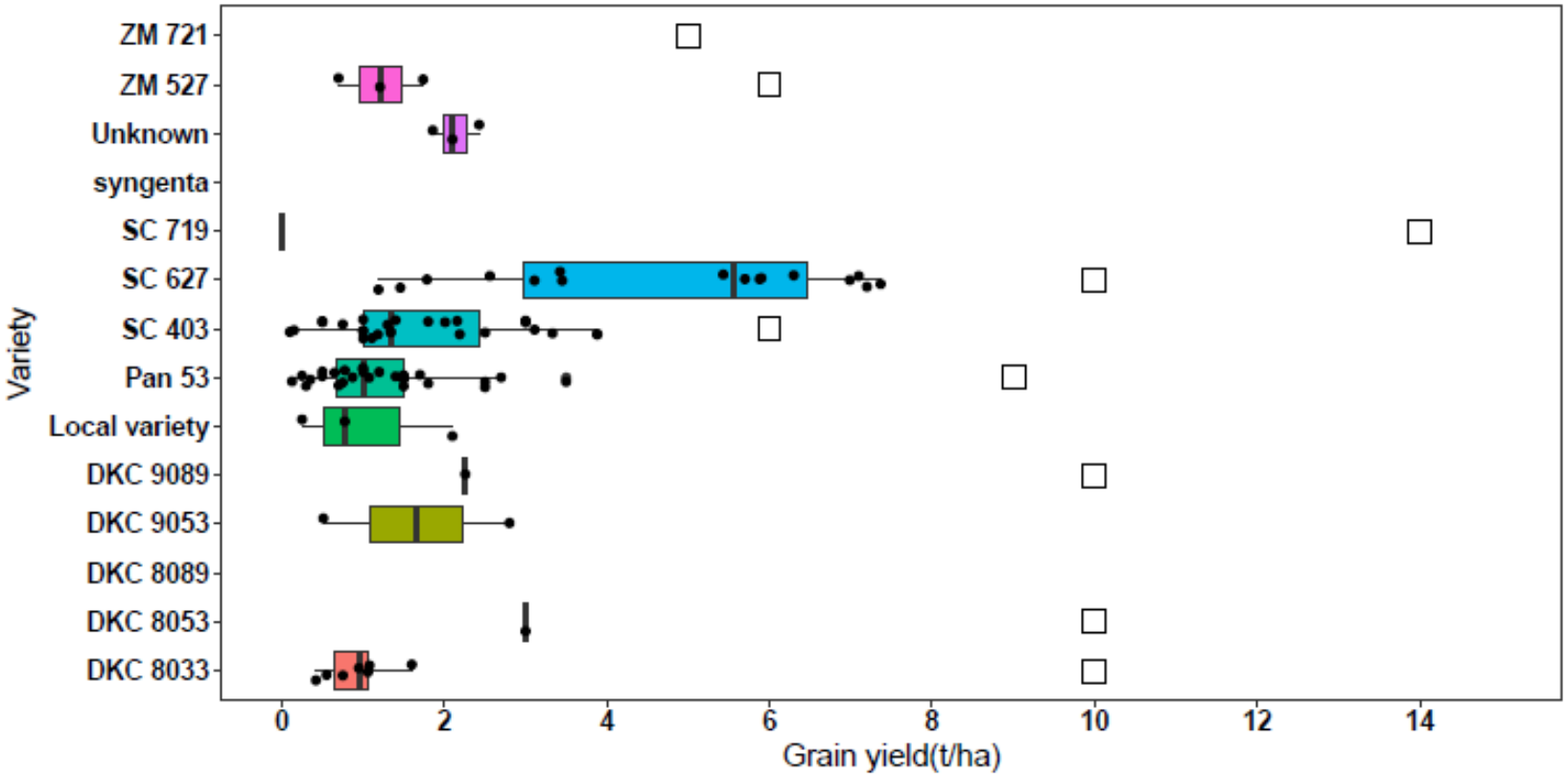
Yield gaps by scheme and fertiliser



Left: Grain yield of over 100 maize crops grown in five different irrigation schemes and a nearby research station. The box plots divide the farmers into quartiles, with the horizontal line as the median yield

Right: Nitrogen fertiliser use by the farmers. The median fertiliser used on the schemes is similar to the research station but the yields are much lower on the schemes

Yield gaps: actual vs potential by cultivar



Grain yield of over 100 maize crops grown in five different irrigation schemes and a nearby research station plotted by cultivar. The open box shows the potential yield. Cultivar SC 627 got the highest yields but falls short of the potential.