



The Virtual Irrigation Academy

The Virtual Irrigation Academy

- 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

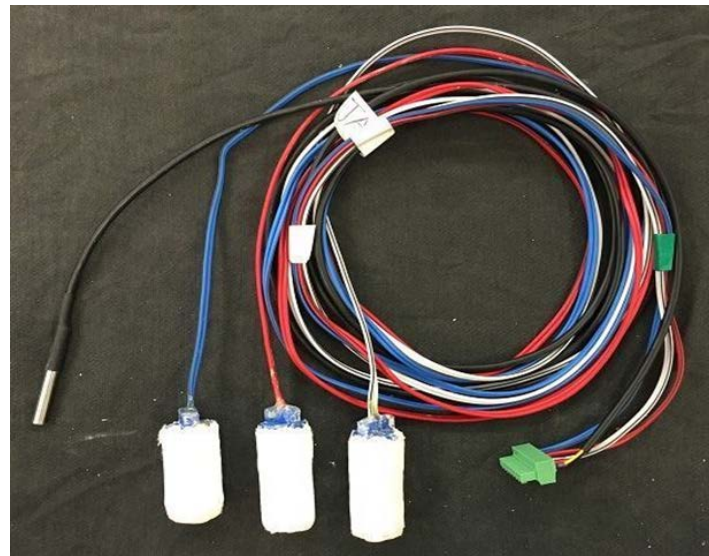
Red means that the soil layer is dry (> 50 kPa) – Need to consider irrigating

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

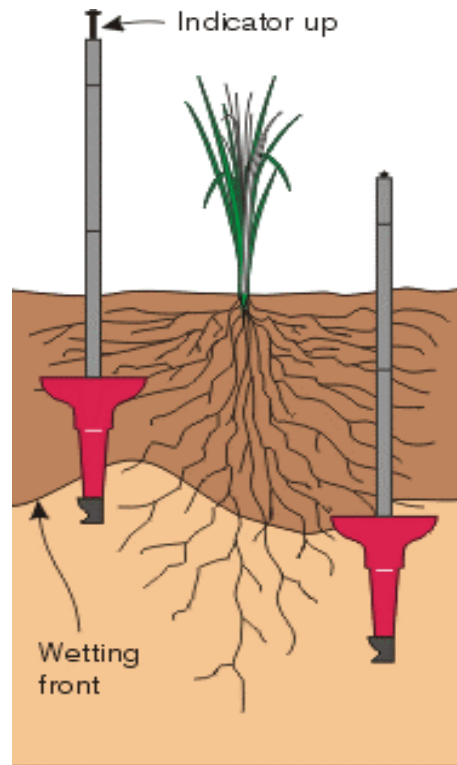


The advantages

- 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



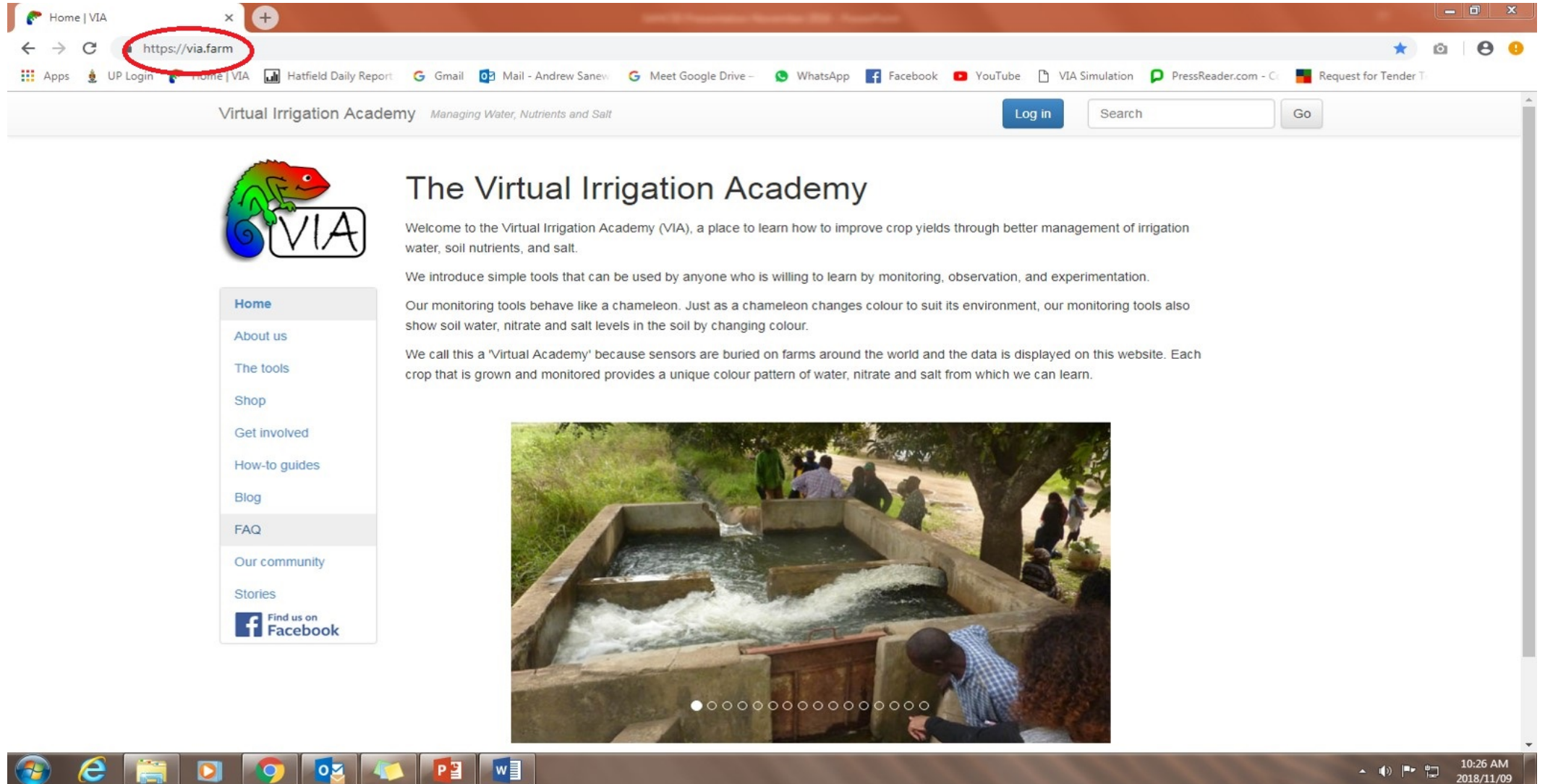
Measuring soil salinity



Measuring soil nitrate

Management information system

The VIA platform



The screenshot shows a web browser window displaying the Virtual Irrigation Academy (VIA) website. The browser's address bar shows the URL <https://via.farm>, which is circled in red. The website header includes the text "Virtual Irrigation Academy" and the tagline "Managing Water, Nutrients and Salt". A navigation menu on the left lists various sections: Home, About us, The tools, Shop, Get involved, How-to guides, Blog, FAQ, Our community, and Stories. Below the menu is a Facebook logo with the text "Find us on Facebook". The main content area features the VIA logo, which is a colorful chameleon on a sign that says "VIA". The text below the logo reads: "The Virtual Irrigation Academy", "Welcome to the Virtual Irrigation Academy (VIA), a place to learn how to improve crop yields through better management of irrigation water, soil nutrients, and salt.", "We introduce simple tools that can be used by anyone who is willing to learn by monitoring, observation, and experimentation.", "Our monitoring tools behave like a chameleon. Just as a chameleon changes colour to suit its environment, our monitoring tools also show soil water, nitrate and salt levels in the soil by changing colour.", and "We call this a 'Virtual Academy' because sensors are buried on farms around the world and the data is displayed on this website. Each crop that is grown and monitored provides a unique colour pattern of water, nitrate and salt from which we can learn." Below the text is a photograph of a concrete irrigation channel with water flowing through it, and several people are gathered around it, observing the water. The browser's taskbar at the bottom shows various application icons and the system clock indicating 10:26 AM on 2018/11/09.

The VIA platform

Setting up a new farm

Configure Farm | VIA

https://via.farm/configurefarm/148/

Configure Farm

Farm: **Citrus Sanddrift - Isaac Moilwa**
Map location unknown, please add location

[Update Farm Details](#) [Add Rain Events](#) [Visualise Farm](#)

Irrigation Bays

Block B2 [Action](#)

Block V1 [Action](#)

[+ Create Irrigation Bay](#) (Step 1)

Sensor Arrays

Irrigation Bay	Sensor Name	Sensor ID	Depths (cm)	
Block B2		058E	20, 40, 60	Claim Wi-Fi Sensor Array Add Manual Sensor Array Action (Step 3)
Block V1		DAC6	20, 40, 60	Action

(Step 2 arrow points to 'Claim Wi-Fi Sensor Array')

Crops

Irrigation Bay	Sensor Array	Crop	Planting Date	Harvest Date	
Block B2	058E	Citrus Block B2	10 Oct 01		Action
Block V1	DAC6	Citrus Block V1	18 Oct 00		Action

My Farms
My Test Rigs
User Profile
Reports
Manage Users
Manage Farms
Manage Readers
Manage Arrays
Edit Pages
How To (Admin)

Home
About us
The tools
Shop
Get involved
How-to guides

01:41 PM
2018/10/29

The VIA platform

Crop details

Browser: VIA | VIA
URL: https://via.farm/crops/544/visualisefarm/update

Sensor Array: **EE03**

Type*: Pecans

Variety: Wichita

Description: High Density Sensors 2.5 m from tree

Planting Date*: 2017-01-19

Harvest Date:

Crop area (ha):

Plant population (plants per m2):

N fertilization amount (kg N/ha):

Manure or organic matter applied, dry weight (kg/ha):

Grain yield, dry weight (t/ha):

Profit (\$/ha):

Number of irrigations:

Comment: High Planting Density (5 m x 10 m) - Pecans planted in November 2006. Chameleon sensors inst

[Update](#)

Navigation Menu:

- My Farms
- My Test Rigs
- User Profile
- Reports
- Manage Users
- Manage Farms
- Manage Readers
- Manage Arrays
- Edit Pages
- How To (Admin)
- Home
- About us
- The tools
- Shop
- Get involved
- How-to guides
- Blog
- FAQ
- Our community

Windows Taskbar: 01:22 PM 2018/10/29

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 Reaitlthoma	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)

PUDIEMOE FSU

16 x 40Ha

640 Ha



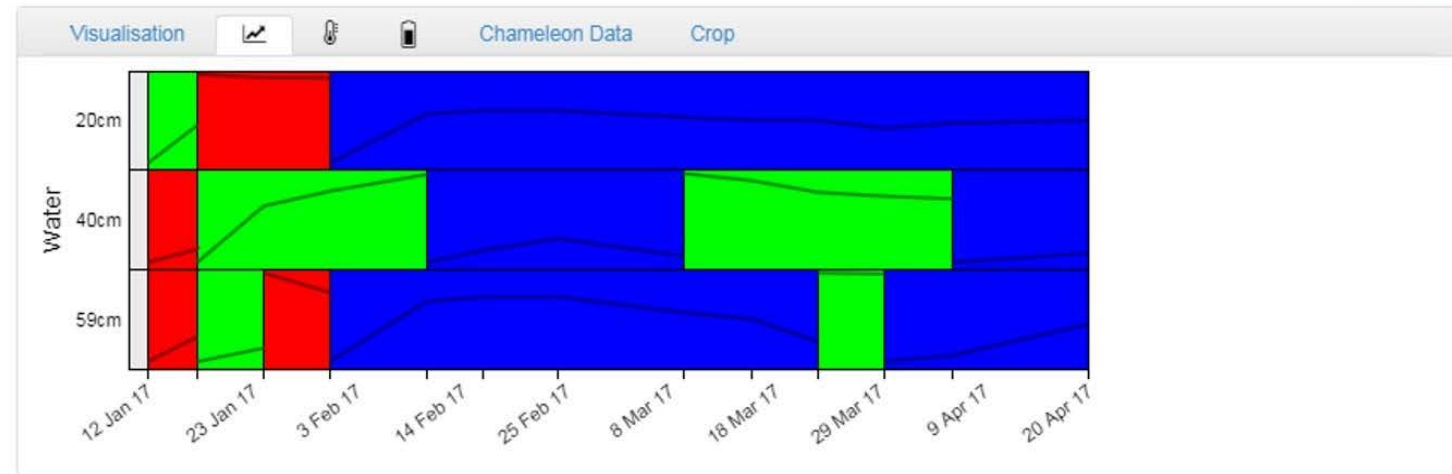
Taung – Tshidiso Cooperative

- 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

Crop: **Maize**, Description: **FARMER A**
Sensor: **NW**

Yield: **8.7t/ha**, Planting Date: **15 Dec 16**, Harvest Date: **2 Jun 17**

Action ▾

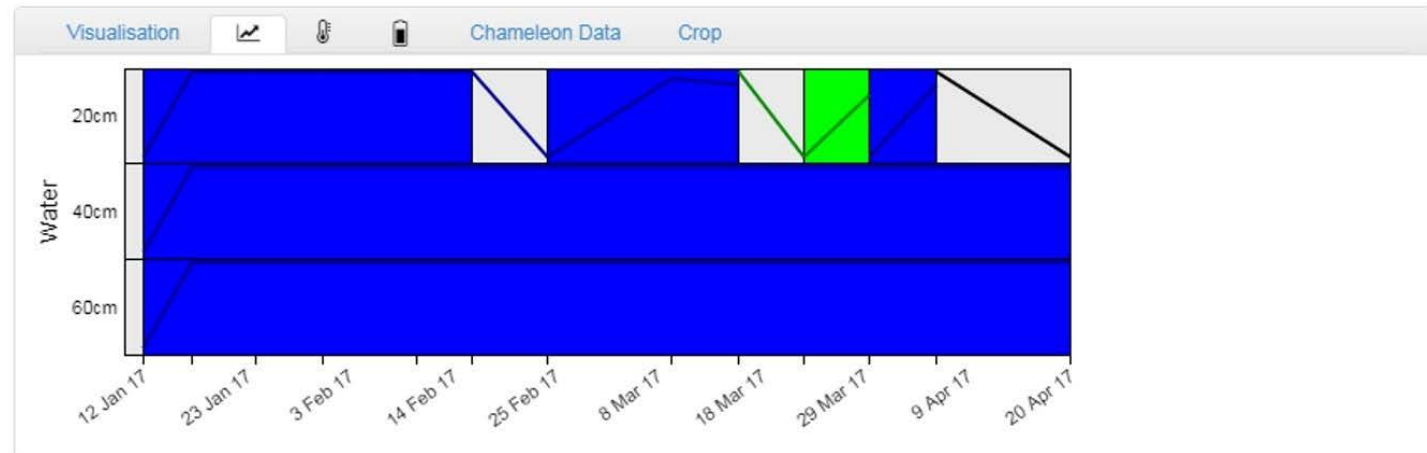


Taung – Tshidiso Cooperative

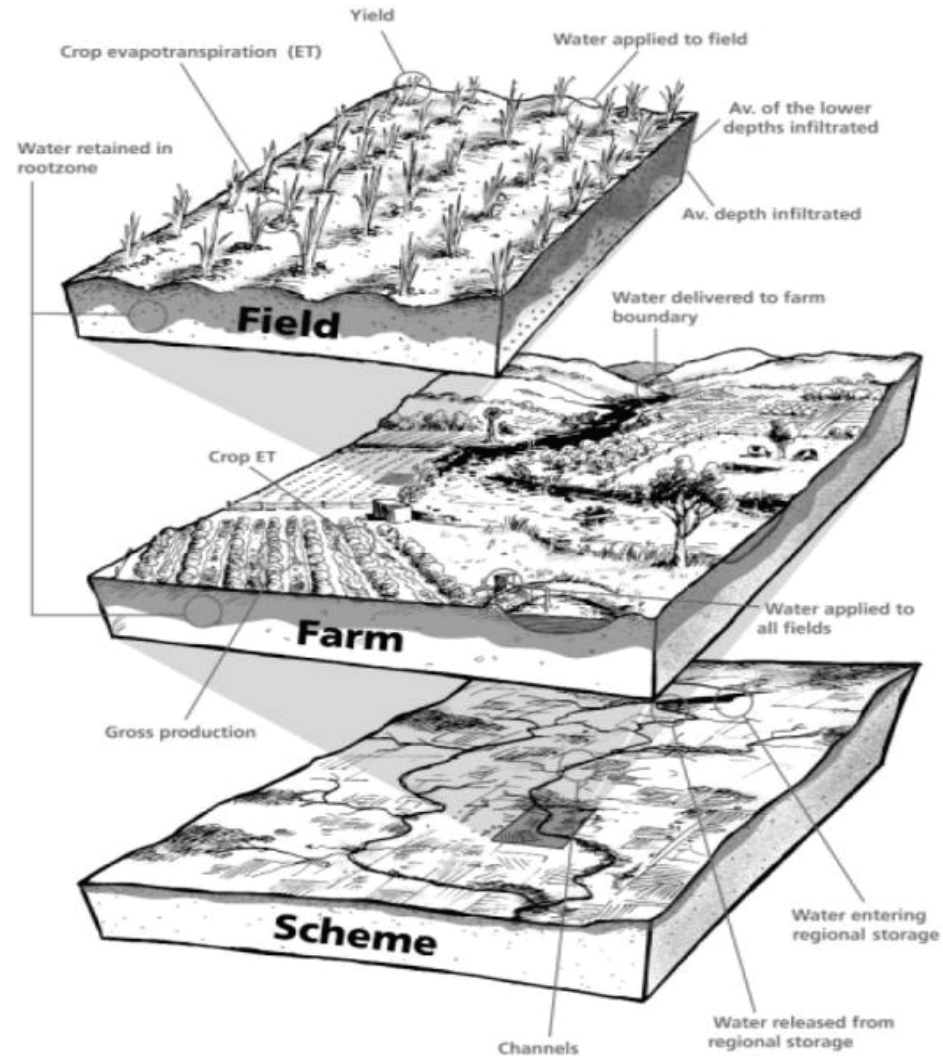
- Farmer B
- Non GM maize
- Centre pivot JM6
- Plant pop'n - 80,000 plants/ha
- Fertiliser - 125 kg N/ha
- Plot size - 10 ha
- Poor yield – 2.4 t/ha
- Over irrigation & nutrient leaching
- Soil water pattern: 88% blue, 2% green and 10% red

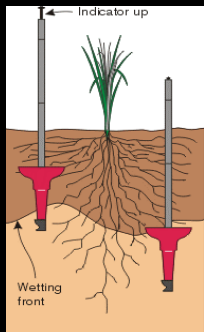
Crop: **Maize**, Description: **FARMER B** Yield: **2.4t/ha**, Planting Date: **21 Dec 16**, Harvest Date: **5 Jun**
17 Sensor: **SE**

Action ▾



Levels of agricultural water management systems



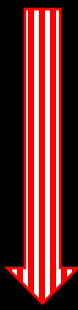


Database

Farmer learning



Management
Governance



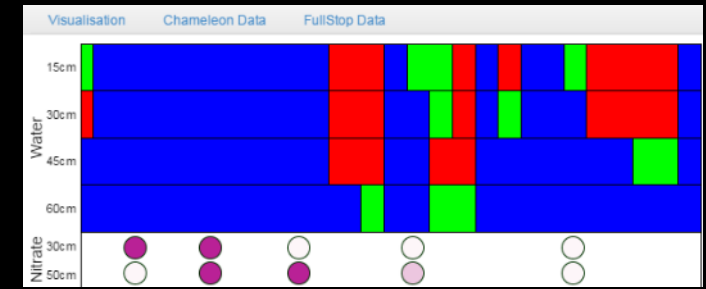
Country: Tanzania

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

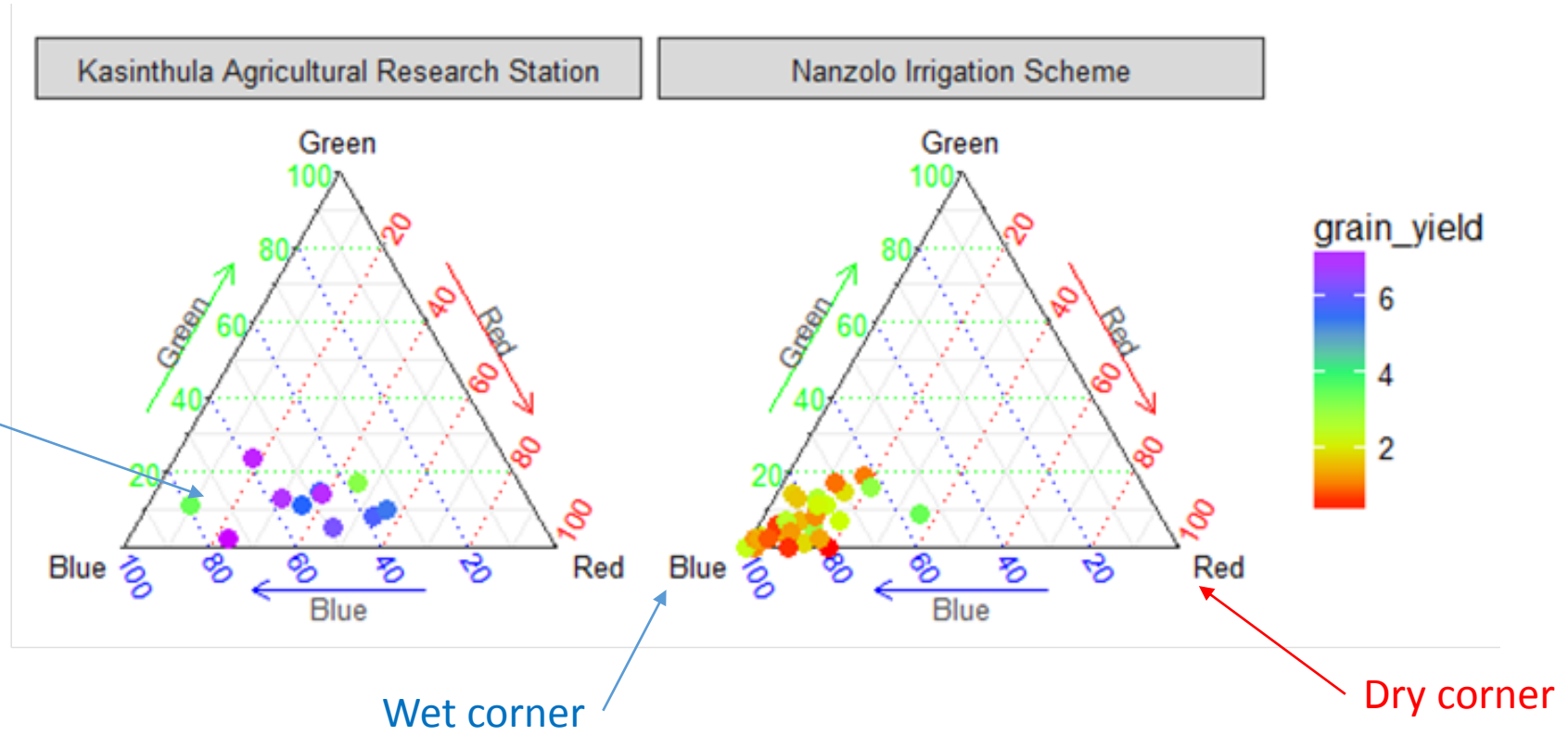
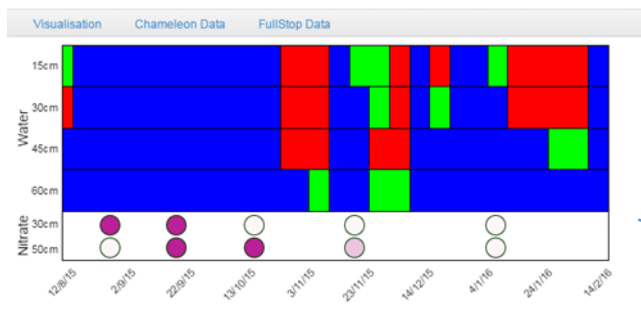
The VIA produces a colour pattern for each crop.

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:

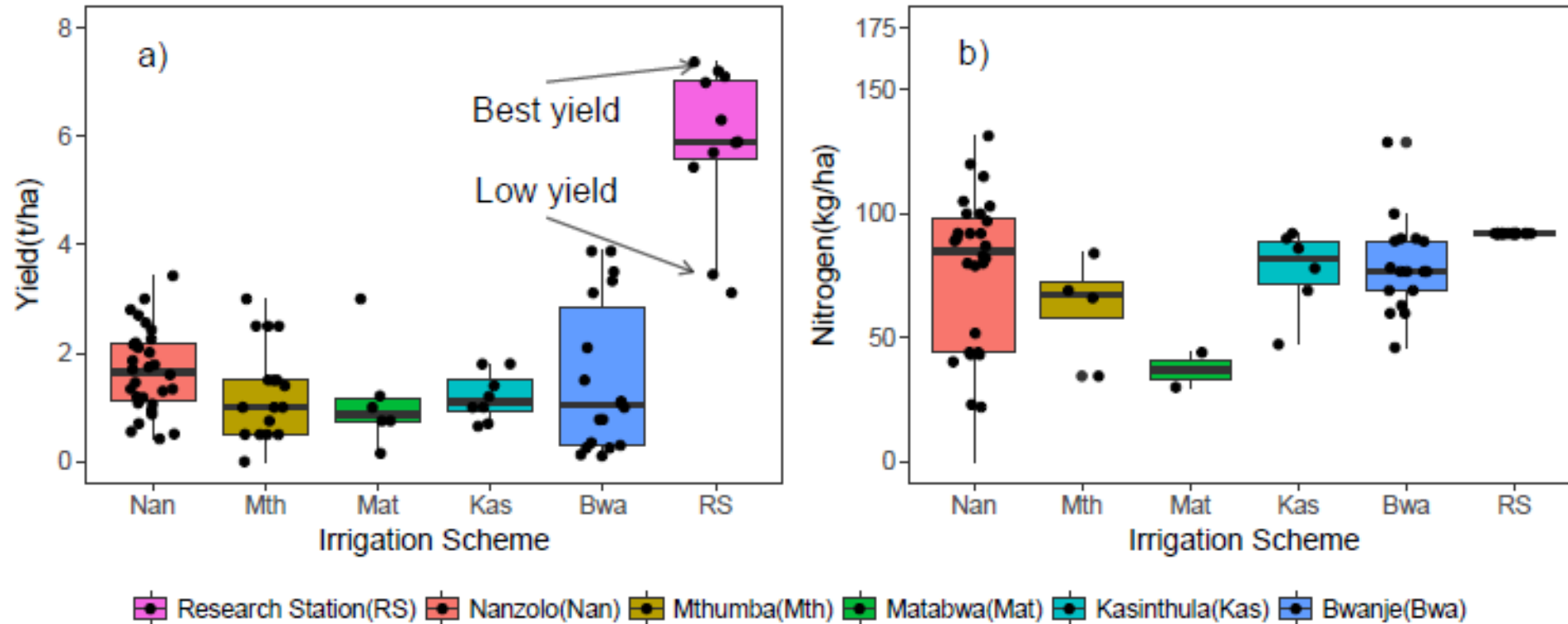
- Relationships between yield and water management
- Yield gaps within schemes
- Yield gaps among schemes
- Relationships between yield and fertiliser
- Relationships between yield and varieties

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

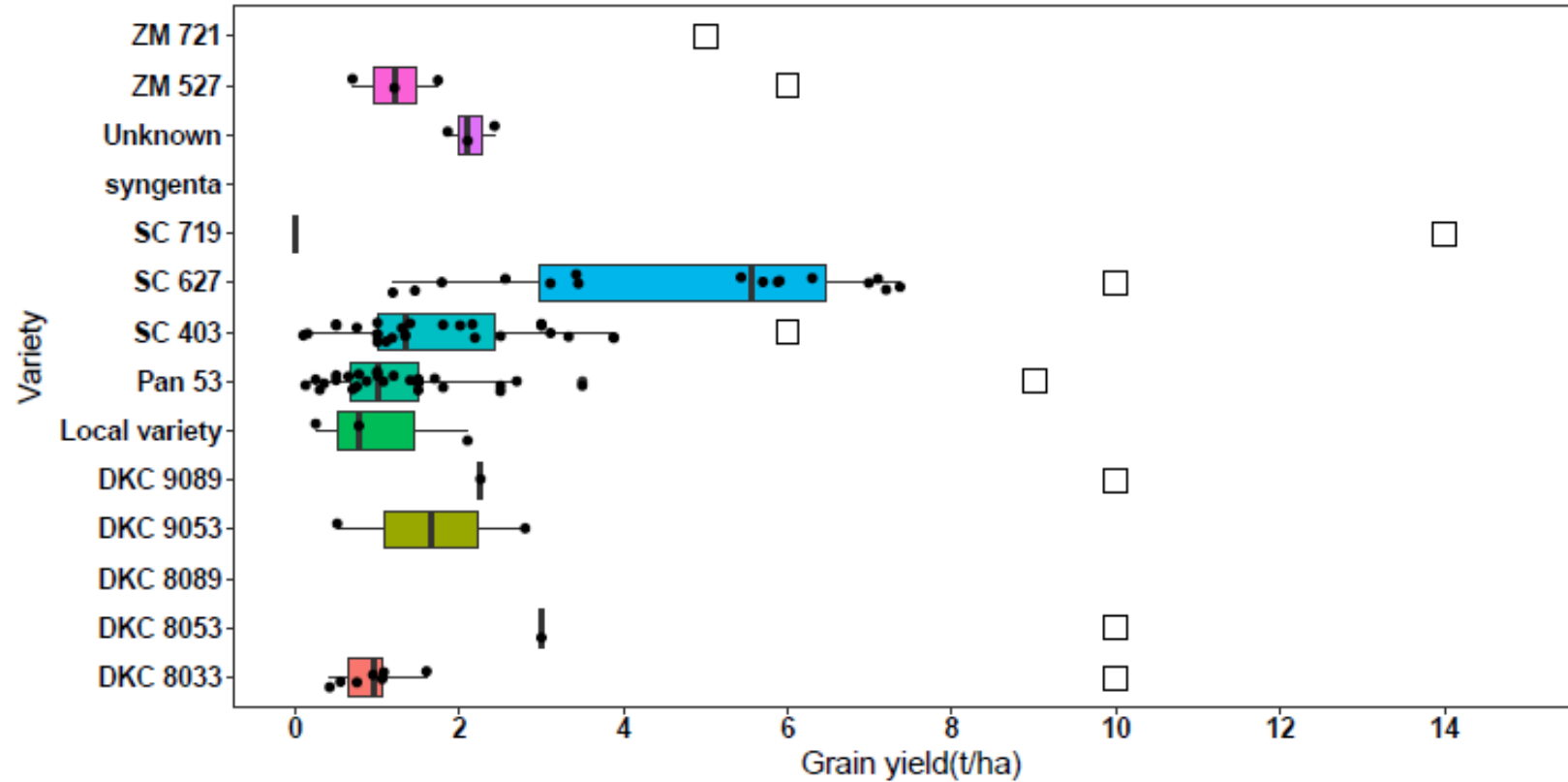
Yield gaps by scheme and fertiliser



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.