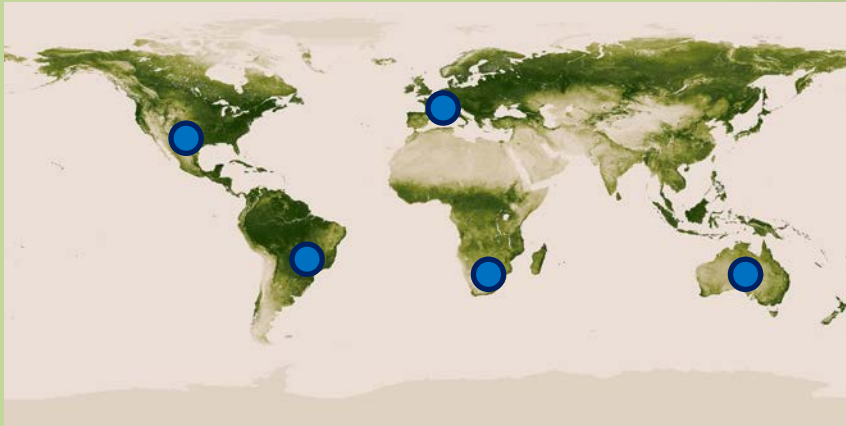


Aquacheck

- Company started in 1997 – South Africa
- Aquacheck products established in:
 - Africa, America, Europe, Australia
- Cropnuts - official dealer in Kenya & East Africa



Soil moisture sensing - Profiling:

1. Data Capturing – Probe (capacitance)
2. Data Logging + transfer – GPRS units
3. Data monitoring – Aquacheckweb

AquaCheck System

Data Capturing – Probes

- Each Probe permanently installed in ground (no disturbance to crop), connected via a cable to GPRS unit (logger);
- 6 sensors distributed every 10cm down to 60cm (can vary depending on probe length)



Data Logging + Transfer – GPRS Units

- One soil moisture reading logged per sensor every 30min;
- Data stored in logger & uploaded on an online server via cell phone network every 2 hrs: *“under ground eyes”*



Data Monitoring

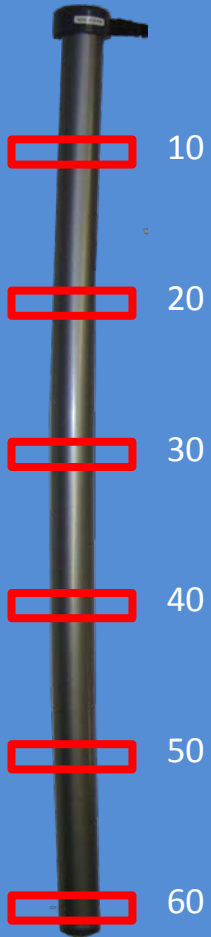
- Real Time Data visualized using an online ftp software (aquacheckweb) accessible from any laptop, tablet & phone

Rain Gauge

- Rain gauge allows to monitor irrigation system efficiency

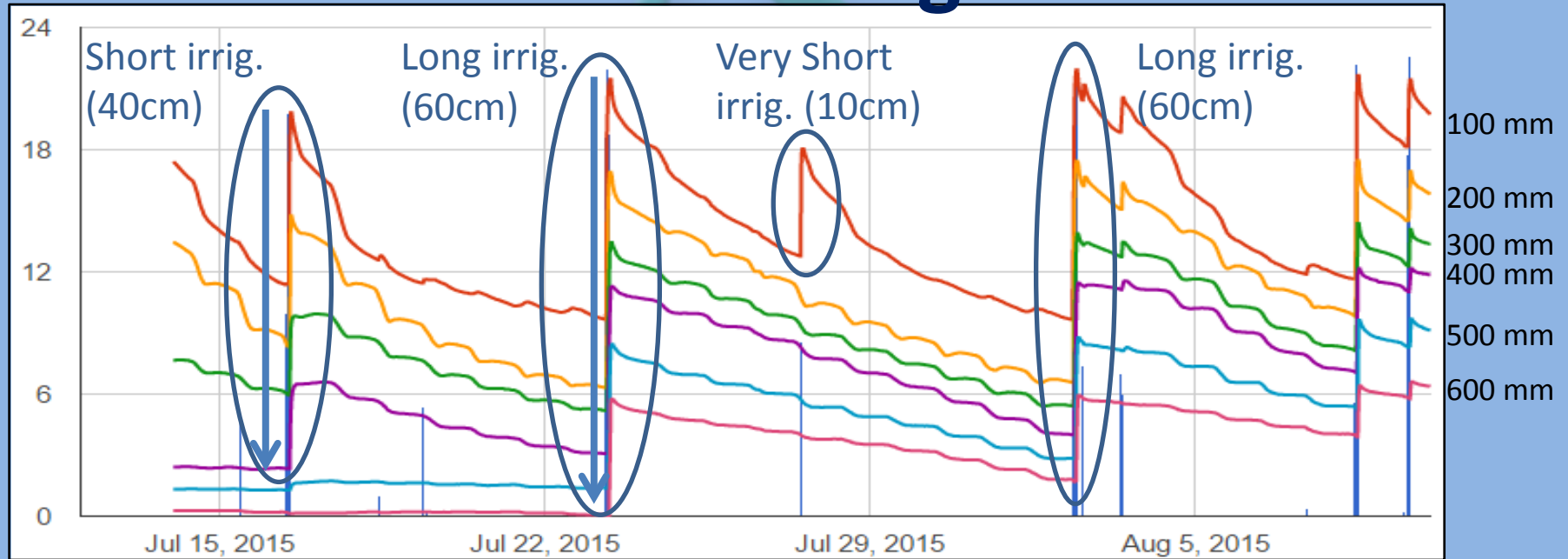


Typical Probe



- Capacitance sensors placed at 100, 200, 300, 400, 500 & 600mm levels
- Each sensor measures “*Dielectric constant*” in surrounding soil (and *soil temperature*)
 - Moisture impacts dielectric constant more than air or soil
 - Surrounding soil does not change only soil/air ratio
 - Continuous Measurement
 - Provides range of “Plant available water” (PAW) at each sensor
 - Provides depth of active root zone utilizing moisture
 - Provides irrigation/rainfall depth of penetration
- Probe lengths: 20cm; 40cm; 60cm; 80cm; 100cm; 120cm – can vary as can sensor spacing

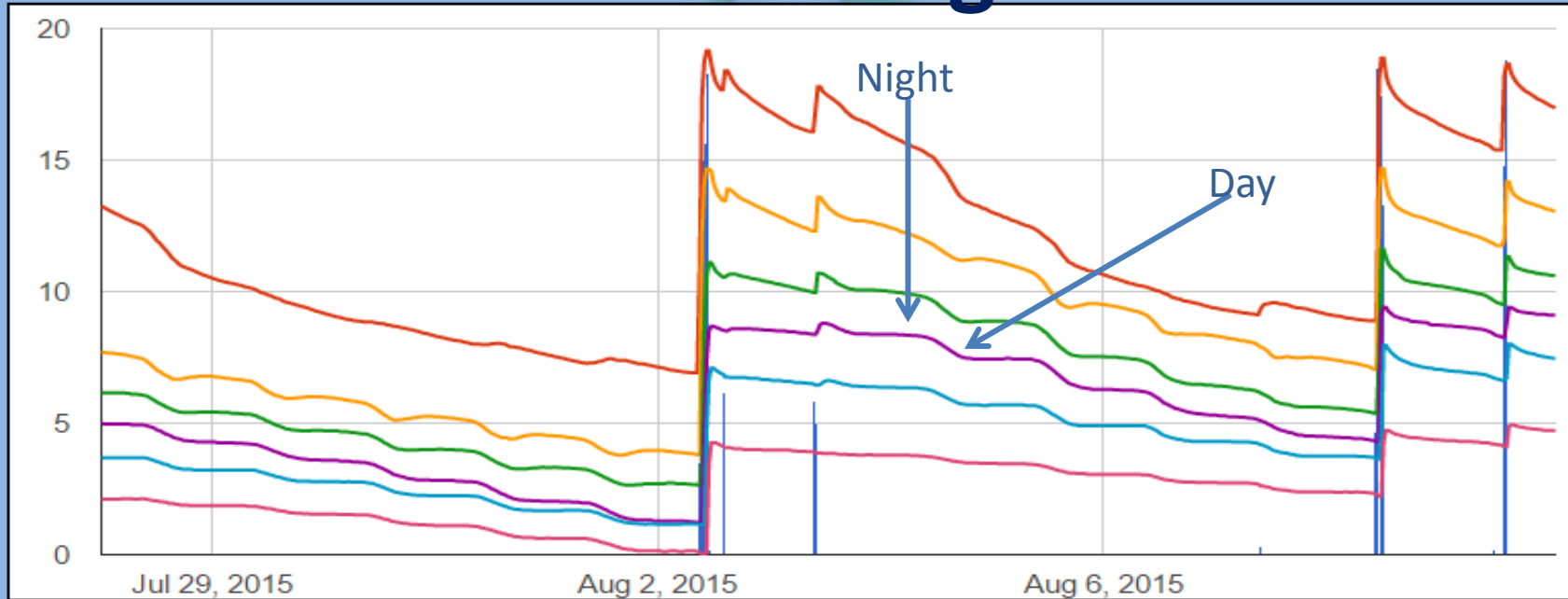
1. How deep does the water penetrate with each irrigation



- **Things to consider**

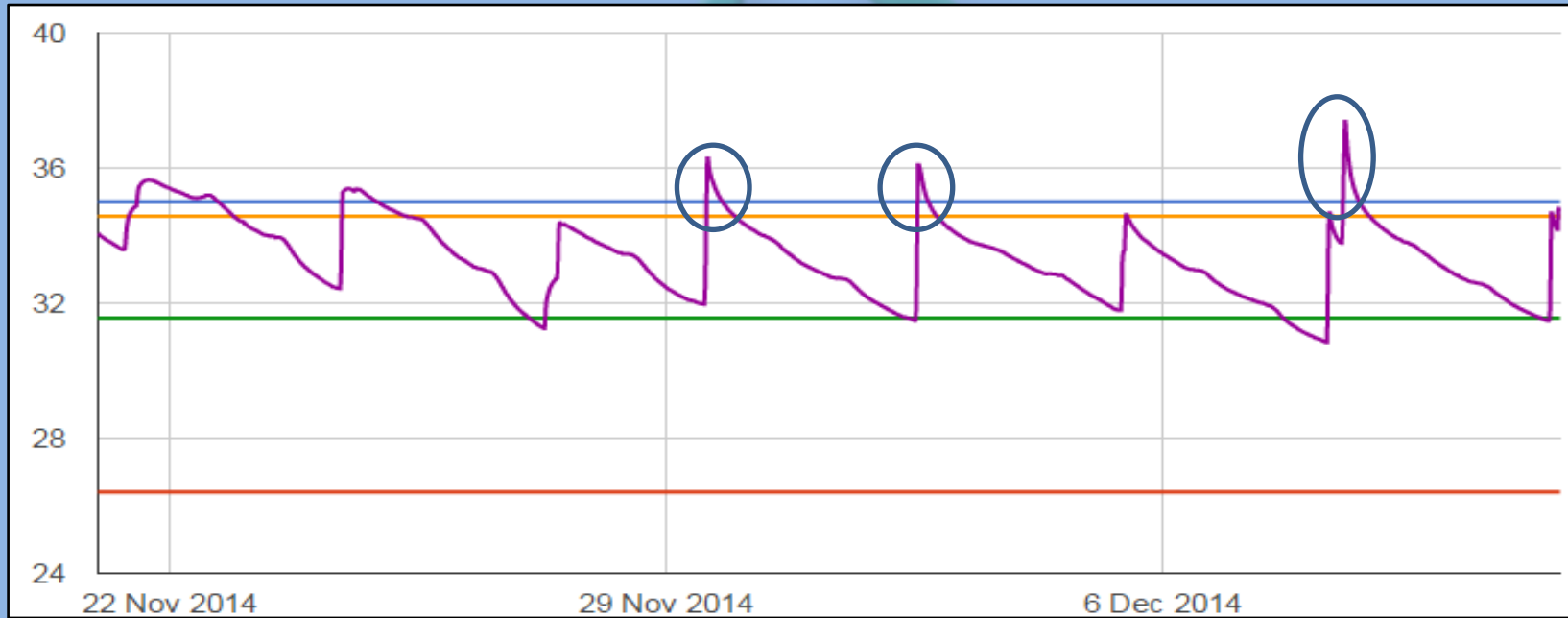
- Length of irrigation: longer = deeper (fills the topsoil first)
- Where do you need to irrigate to? (see next slide)
- Leaching requirement (wash salts out of root zone)

2. Where/how deep are your roots working?



- “**Day–Night**” steps indicate root activity
 - Day: evapotranspiration (ETP) = soil water decreases
 - Night: no ETP = soil water remains constant (no change)
- Where to irrigate?

3. Do you have absolute confidence that you are not leaching nutrients



- Root zone graph (weighed average of all sensors in roots)
- Irrigating above URAW (FC) = Leaching below root zone
- Peaks indicate water is not held by soil

4. How big (in mm) is your Rooting Reservoir

Agronomy

Upper RAW	30.40	← Field Capacity	Irrigation Unit	mm
Lower RAW	22.30	← Refill Point	Approach	Manual
Crop	Flowers		Normalised Irrigation	16.00
Soil Type	Generic		Normalised Reaction	4.79
	<input type="button" value="Recalibrate Data"/>		Ratio	3.34
Graph Type	Weighted Average		RAW Length	8.10
Sensors Stacked	<input checked="" type="checkbox"/>		WHC	27.06

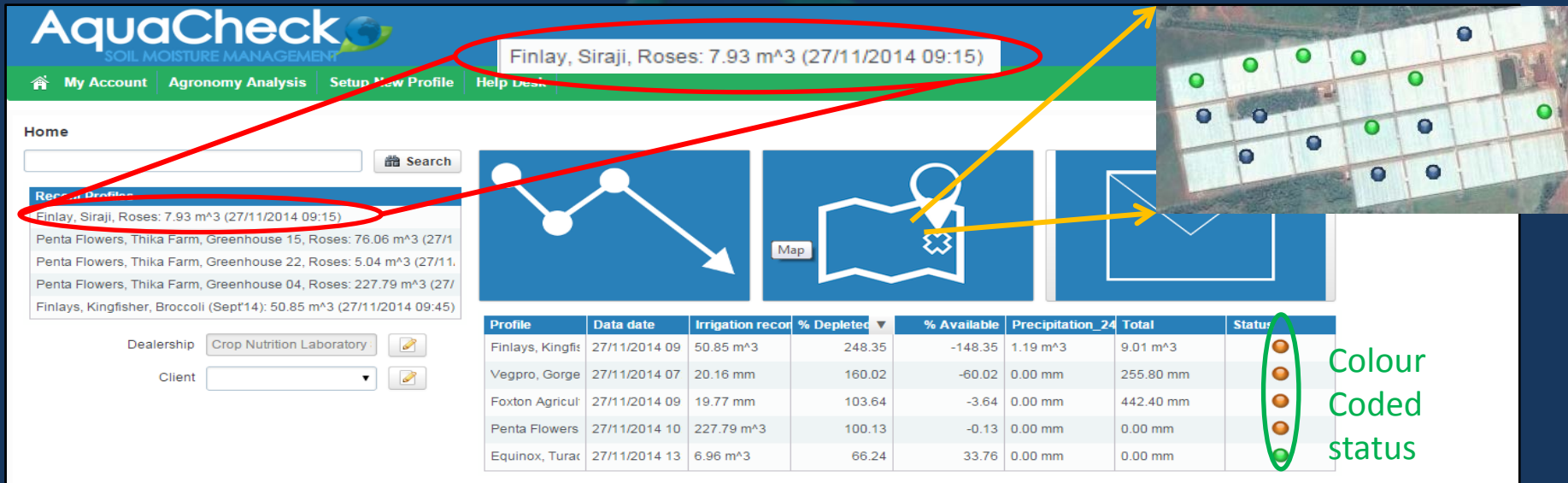
- We calibrate the soil's Full point and its Refill point based on graph behaviour (Water Holding Capacity).
 - Soil type allows us to determine “reservoir size”
 - How big is the bucket my roots are growing in?

5. How much water is required to fill the profile with each irrigation event

Profile	Data date	Irrigation recommendation	% Depleted	% Available	Precipitation_24H	Total	Status
Lolomarik, Marania Ltd, Bo	09/08/2015 22:00	11.86 m ³	526.40	426.40	0.00 mm	0.00 mm	●
Finlays Ibis, Block U64, Lili	09/08/2015 20:30	14.47 m ³	492.12	-392.12	0.00 mm	0.00 mm	●
Finlays Siraji, Greenhouse	10/08/2015 00:30	25.22 m ³	168.14	-68.14	0.00 mm	0.00 mm	●
Kakuzi, Ndera, Avocado Dē	10/08/2015 13:00	30.2 m ³	152.98	-52.98	0.00 mm	1377.20 mm	●
RFK, Greenhouse 10, Rose	10/08/2015 00:00	24.06 m ³	133.64	-33.64	0.00 mm	0.00 mm	●
Penta Thika, GH5, Roses v	05/08/2015 08:30	6.46 m ³	107.70	-7.70	0.00 mm	0.00 mm	●
Primarosa Flowers, Athi Riv	10/08/2015 00:00	8.39 m ³	107.57	-7.57	0.00 mm	0.00 mm	●
Penta Thika, GH15, Roses	10/08/2015 11:00	104.95 m ³	87.51	12.49	0.00 mm	25.20 mm	●
Uhuru Flowers Ltd, Alpha 0	10/08/2015 00:30	4.88 mm	60.16	39.84	0.00 mm	12487.80 mm	●
Harvest Flowers, Top Harv	09/08/2015 23:30	11.04 m ³	60.08	39.92	0.00 mm	0.00 mm	●
Zuri Farm, Greenhouse 18,	10/08/2015 00:30	1.49 m ³	50.59	49.41	0.00 mm	0.00 mm	●
Equinox, Turaco, Greenhol	09/08/2015 20:30	0.73 m ³	41.30	58.70	0.00 mm	0.00 mm	●
Equinox, Turaco, Greenhol	09/08/2015 22:00	1.14 m ³	39.24	60.76	0.00 mm	0.00 mm	●
Hamwe Ltd, Kudenga, Bloc	09/08/2015 23:30	32.13 m ³	38.04	61.96	0.00 mm	0.00 mm	●
New Holland Flowers, Laur	06/07/2015 22:30	25.38 m ³	35.22	64.78	0.00 mm	0.00 mm	●

- We know size of soil water reservoir:
 1. How empty/full is the reservoir at any one time?
 2. How much water is required to fill it up to 100%?

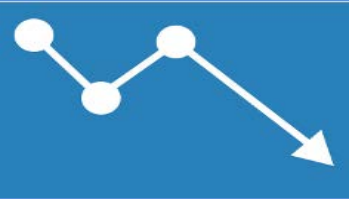
Aquacheckweb - Data Monitoring



The screenshot displays the AquaCheck web interface. The top navigation bar includes 'My Account', 'Agronomy Analysis', 'Setup New Profile', and 'Help Desk'. The main content area features a 'Home' section with a search bar and a 'Recommendations' section. The 'Recommendations' section lists several profiles with their respective irrigation recommendations and status. A table below the recommendations provides detailed data for each profile, including data date, irrigation record, percentage depleted, percentage available, precipitation, and total water available. The 'Status' column in the table is color-coded, with a legend indicating that green represents a 'Colour Coded status'.

Profile	Data date	Irrigation recor	% Depleted	% Available	Precipitation_24	Total	Status
Finlays, Kingf	27/11/2014 09	50.85 m ³	248.35	-148.35	1.19 m ³	9.01 m ³	
Vegpro, Gorge	27/11/2014 07	20.16 mm	160.02	-60.02	0.00 mm	255.80 mm	
Foxtan Agricult	27/11/2014 09	19.77 mm	103.64	-3.64	0.00 mm	442.40 mm	
Penta Flowers	27/11/2014 10	227.79 m ³	100.13	-0.13	0.00 mm	0.00 mm	
Equinox, Turac	27/11/2014 13	6.96 m ³	66.24	33.76	0.00 mm	0.00 mm	

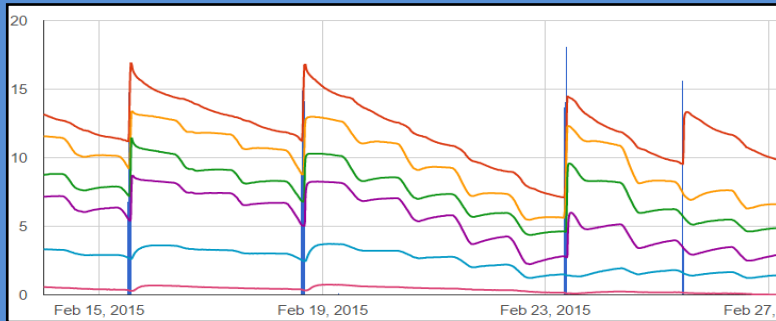
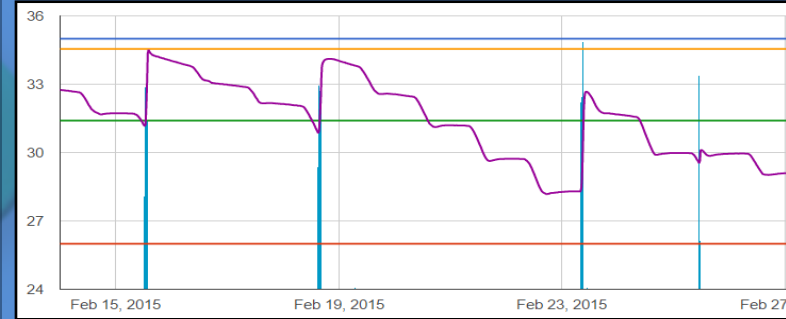
- Home Page gives quick status on all probes
 - Recommendations: amount to irrigate (mm/litres/m³)
 - Map view: quick glance at status of all probes in farm via colour codes (“warning” signs on how wet/dry each profile is)



Aquacheckweb - Report

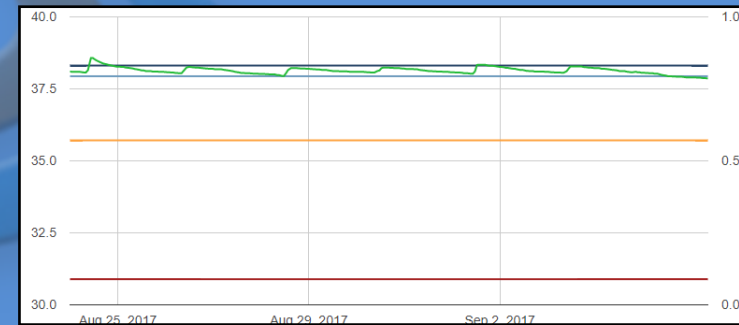
Each profile represented by 3 graphs:

- **Summary graph:** weighed average graph of moisture in the root zone = soil water in the root zone

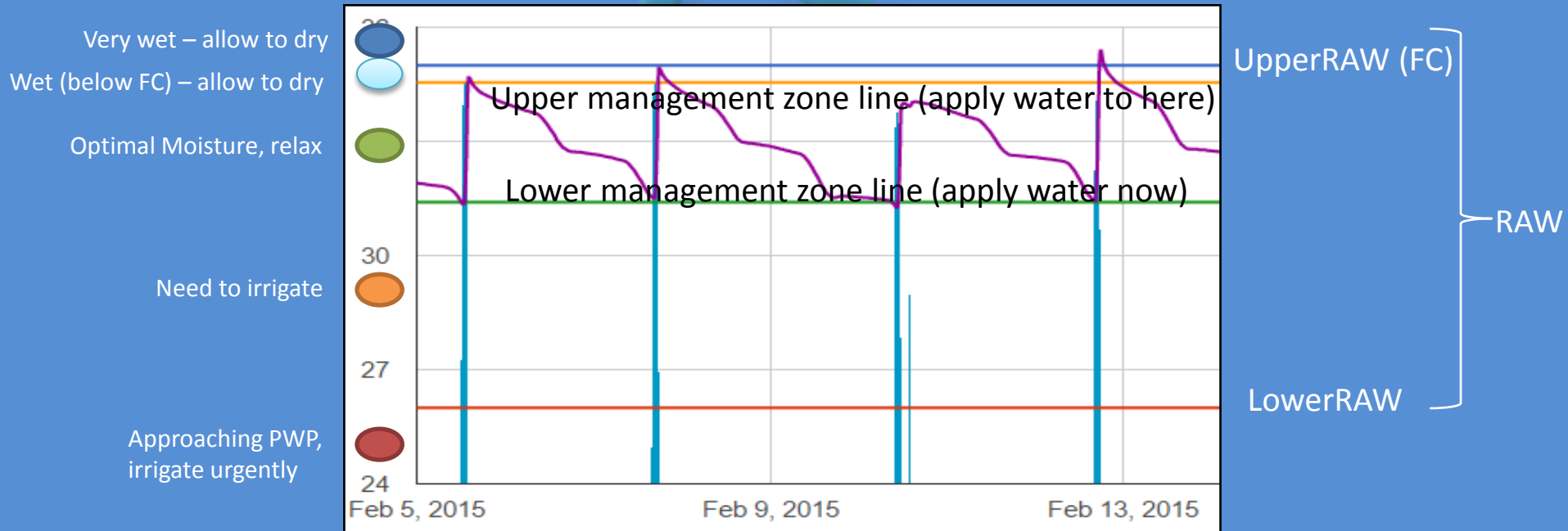


- **Separate sensors:** single sensor data stacked per depth

- **Buffer zone graph:** water content in deep soil to monitor and reduce leaching losses



Aquacheckweb – Graphs



- Readily Available Water (RAW) = 60% of total Available Water Content (AWC)
- AWC = Field Capacity (FC) – Permanent Wilting Point (PWP)
- Color codes based on soil moisture

Moisture Profiling Advantages

- Precise irrigation management: WHEN, WHERE, HOW MUCH water is not guess work
- No more over-irrigation:
 - Reduce water use by 30% (linked energy costs);
 - Reduce fertilizer leaching (savings of up to 40%);
 - Reduce pollution of water sources (“greener” agricultural practices);
 - Reduced stress on irrigation system;
 - Soil structure improvement (compaction effect from wet soil);
 - Increased soil aeration for healthier, deeper, roots

Moisture Profiling Advantages



- Improved root development and depth:
 - Superior crop quality & quantity (healthy roots = healthy crop = more fruits/buds, longer stems, bigger fruits)
 - Enhanced general crop health (hardiness of crop, resistance to disease – disease will prey on weaker)
- Leaching Requirements:
 - Salt accumulation
- Reduced soil surface humidity:
 - Reduced incidents of disease (botrytis and downy down by 80%)

In Conclusion

Precision Irrigation:

Save Water and Energy While Increasing Crop Yield
because

- Decreasing water availability, increasing fertilizer costs and environmental impacts of agriculture demand that our sector uses resources sustainably.
- Modern-day technology gives no excuse for inefficient soil moisture management.