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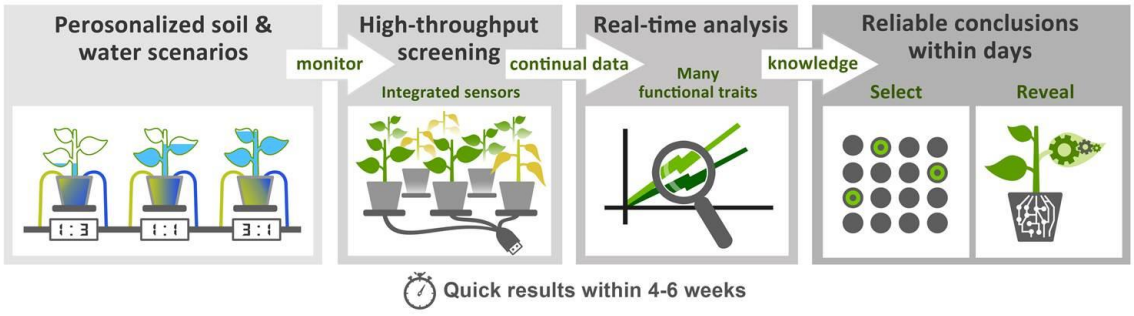
functional phenotyping

The PlantArray System

The PlantArray system is a high-throughput whole-plant functional digital diagnostics platform which delivers fast & trustable functional phenotyping results. It is the first to measure continuously and simultaneously the whole plant shoot and root functional (physiological) growth and productivity parameters under different ambient conditions. With the help of the SPAC Analytics software, the data is then transformed into valuable knowledge to better predict plant performance and speed up the discovery of new plant mechanisms, growth enhancers, and tolerant plants.



Source: Wageningen University, NPEC advanced phenotyping center, Wageningen NL

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The PlantArray sets come in two sizes:

- Small unit suitable fit 1.5– 8 L pots; 12-16 cm (4.7-6.3 in) bottom pot diameter
- Large unit suitable fit 10–40L pots; 27- 31 cm (10.6-12.2in) bottom pot diameter

Dimensions: one square meter can contain up to 6 small units or 2 large units.

The PlantArray system includes:

- **PFC (PlantArray FeedbackControl)** controls a unique irrigation system which enables different irrigation "cocktails" to each plant in the array and flexible application: by time, by weight, by own plant transpiration, by sensor. Regulates two separate solutions (and possibly more) for each pot. Performs auto daily washes to prevent salinity built up. Collects data from the sensors; Extract to CSV Excel file + graphic display).

- **PlantArray HighControl units, including dual irrigation units per pot**– receives its irrigation orders from the local control software and regulates dual irrigation valves, providing apersonalized "cocktail" for each pot by time/ weight/transpiration/ sensor. As it is for each pot, it enables a fully randomized experiment structure.

- **PlantArray WaterManage** container sets: WaterManage containers per pot for automated drainage to prevent salinity build up, manage the water-balance and prevent water leaks from the pot for high precision transpiration measurements.

- **Special Pot covers** to prevent evaporation from the soil.

- **Precision weights/ lysimeters** per pot which combine: plates made of steel for high stability, highly accurate load cells for any load the customer needs and plates covered with a plastic cover to keep the temperature down, and allow any water drop to slide off of the surface and by that ensures high precision of transpiration measurements. Load cells can be supplied at any required load weight (normal size small- 12kg; large-50kg)

- **Central meteorological station** and probes - Atmosphere- Relative humidity; Temperature; Radiation; Barometric pressure; This enables the calculation of VPD and normalizing the plant parameters to the VPD conditions.

- **Peripheral components** (drip irrigation pipes, power supply and electrical cables, metal stands…)

- **Set of pots**

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Add on Sensors

All sensors are integrated with the PlantArray system and the SPAC Analytics, enable simultaneous measurements of all plants and the environment on a momentarily basis **https://www.plant-ditech.com/products/sensors**

Catalog#	Model	Measure	In	Manufactorer
SEN507	TEROS 11	Moisture, Temperature	Soil	Meter
SEN506	TEROS 12	Moisture, Temperature, EC	Soil	Meter
SEN510	SO-411	Oxygen	Soil	Apogee
SEN503	ATMOS 14	Temperature, RH, Pressure	Atmosphere	Meter
SEN509	ATMOS 22	Wind velocity and direction	Atmosphere	Meter
SEN511	SQ-521-SS	PAR	Atmosphere	Apogee
SEN513	SRS	PRI	Plant	Meter
SEN514	SRS	NDVI	Plant	Meter
SEN512	SI-431-SS	IR Radiometer	Plant	Apogee
SEN508	ES-2	EC/Temperature	Water Solution	Meter
SEN504	HYDROS 21	Water depth/EC/ Temperature	Water Solution	Meter
SEN516	TEROS 21	Water potential	Soil	Meter
SEN517	TEROS 32	Tensiometer 40cm	Soil	Meter
SEN515	PHEHT	Water PH	Water Solution	Ponsel

More sensors can be integrated upon request

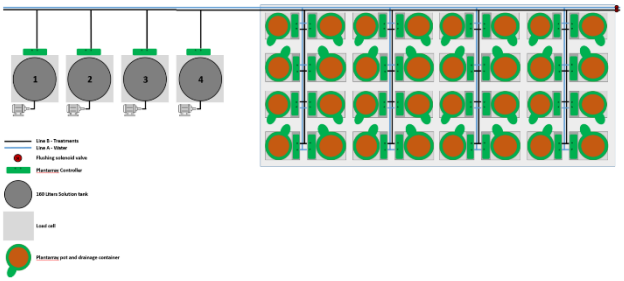
Add on Smart Fertigation System

For more than two solutions, then fixed solutions using submersible or self-priming pumps will be the best solution.

Each pump is connected and activated by the PlantArray controller, and synchronized with the plants irrigation regime.

The system can include more than one fertilizer pump of this type, one pump for each solution, according to different fertilization treatment/different crops/growth stages etc.

The design could be simple or complex, depends on the specific needs.



Complex design could include pipe-flushing procedure in order to replace between treatments/solutions. This will need to be discussed with Plant-Ditech's technical team.

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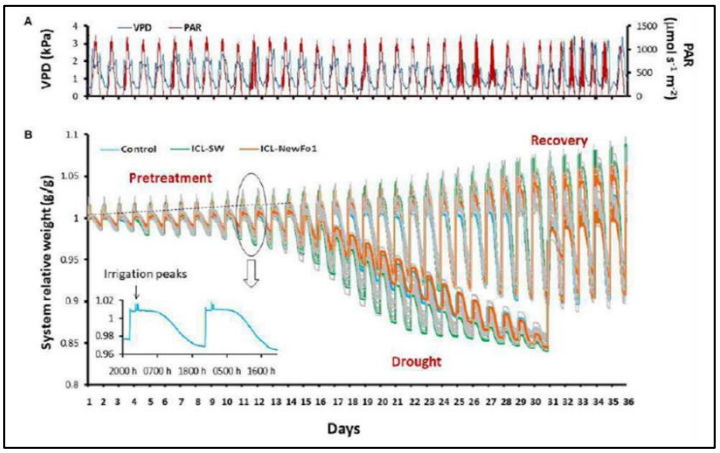
SPAC Analytics Software:

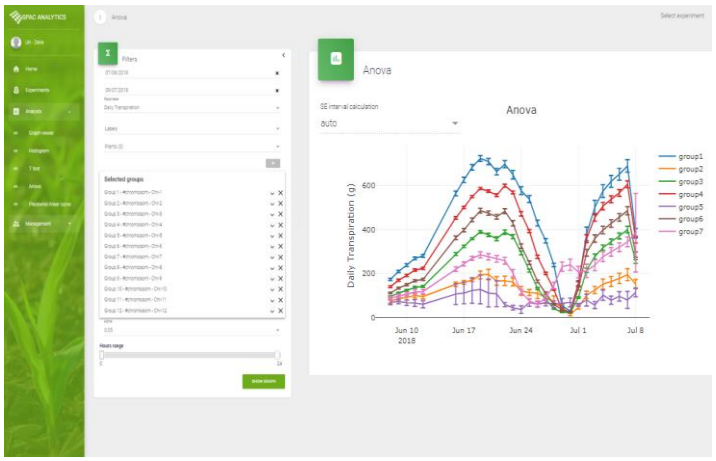
Real-time Histograms, graphs, T-Test, ANOVA test, boxplot
Open - easy import and export of data



Parameters list:

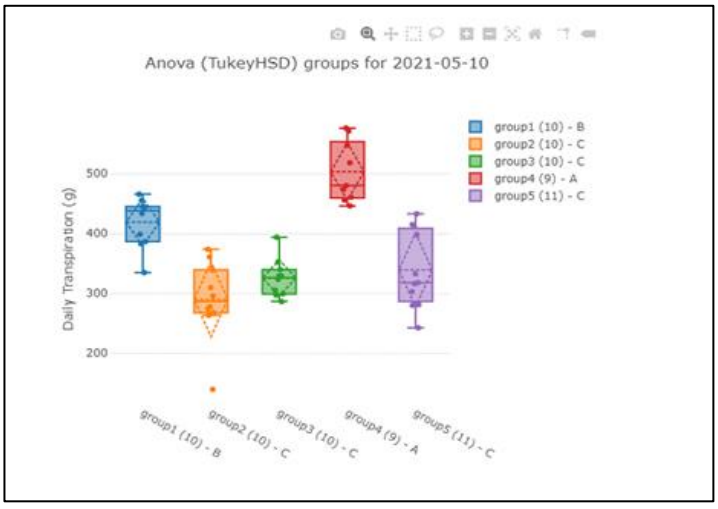
Continuously

Gross raw weight
% changes in gross raw weight
Whole plant transpiration rate
Whole plant normalized transpiration to weight (E)
Whole plant canopy stomatal conductance (Gs Canopy)
Whole plant canopy stomatal conductance per weight (Gs Canopy per weight)
Calculated soil VWC (without soil sensor)
Root influx *
Soil Volumetric Water Content *
Whole plant water balance *
Vapor Pressure Deficit (VPD)
Weather station Par light, RH, Temperature
All optional sensors readings



Daily

Whole plant net weight (fresh biomass)
Whole plant daily biomass gain (plant growth) **
Whole plant daily transpiration
Whole plant normalized daily transpiration
Calculated whole-plant weight
Daily water influx *
Plant water recharge (absorption)



Over days

Whole-plant Water-Use-Efficiency (WUE)
Whole plant mass gain rate
Drought Critical Point (θcrit)

Whole-plant resilience rate (in beta)
Whole-plant stress degree (in beta)

*Require soil sensor ** During drought- extracted from the WUE