APPF
Australian Plant Phenomics Facility

High-throughput Smarthouses

Fully automated, high-throughput phenotyping of up to 2,400 plants per day with RGB, fluorescence and hyperspectral imaging.
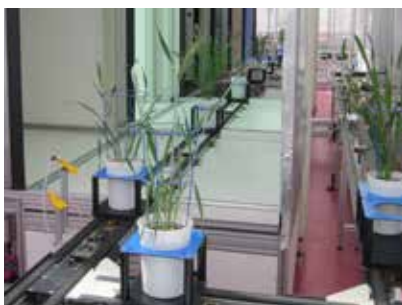
plantphenomics.org.au

The largest high-throughput plant phenotyping facility in the southern hemisphere

HIGH-THROUGHPUT SMARTHOUSES

Capability highlights

- Four conveyer-based, automated greenhouses (Smarthouses).
- Non-destructive measurement of shoot growth and physiology using RGB, fluorescence and hyperspectral imaging.
- Programmable watering to weight.
- Quarantine approved capacity for 1,200 plants.
- Suitable for all plants ranging in size from 10cm through to 1m in height.

The Plant Accelerator contains four large greenhouses, referred to as Smarthouses, fitted with conveyor systems and imaging stations (LemnaTec Scanalyzer 3D) for the non-destructive phenotyping of plants. This system consists of conveyors with a total capacity of up to 2,400 plants in radio-tagged carts. These are delivered automatically to digital imaging and watering stations on a daily basis.

Visible light images (RGB) allow the measurement of shoot area, estimated biomass, plant height and width, canopy density, other morphometric data and leaf colour.

Specim VNIR and SWIR hyperspectral cameras capture the spectral reflectance of plants from 400-2500nm. The hyperspectral reflectance data can be used to non-destructively measure a whole range of plant constituents, including nutrients, water or other aspects of plant physiology as long as a distinct spectral signature can be analysed and calibrated.

Steady-state fluorescence imaging with blue light large field excitation (<500 nm) allows quantification of plant senescence, chlorosis and necrosis.

Programmable watering to weight of plants to enable large scale experiments requiring controlled watering levels.

Research benefits

Research projects facilitated by this technology vary from large scale screening of early growth, salinity tolerance to water and nutrient use efficiency. Possible applications are diverse with respect to the measured traits and plant species studied.

Technical specifications

Platform
- LemnaTec Scanalyzer 3D

Imaging
- RGB and steady state fluorescence cameras
- A WIWAM hyperspectral imaging chamber (based on Specim high-resolution cameras 400-2500nm) allowing top and side view imaging of plants

Growth conditions
- Two Smarthouses with natural lighting, two with supplemental LED lighting
- Temperature control in all Smarthouses with additional humidity available
- Monitoring of light, temperature and humidity at multiple locations within each Smarthouse

Plant capacity
- Four greenhouses, each with 600 plant capacity (@ 2.5kg pot weight), total plant capacity 2,400
- Individual pot capacity up to 4.5kg

Location
- The Plant Accelerator®, Adelaide

Expertise at The Plant Accelerator® (TPA)

The TPA is a true service facility, with the team focused on delivering high quality customer support, from initial consultation through to analysis of results. TPA researchers, with a background in plant physiology and biometry, will provide advice on experimental design and optimal use of technology, backed by a cross-disciplinary team including experts in horticulture, data analysis, mechatronics, software engineering, and statistics.

TPA is certified to undertake quarantine and GMO research, and the team can assist with the necessary applications.

Discover more: plantphenomics.org.au

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