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Australian Plant Phenomics Network

Controlled climate growth capsules

Shipping container-based high-precision controlled environments with independent control of temperature, relative humidity, multispectral LED light and elevated CO_2 capability. The growth capsules can mimic diurnal and seasonal climate variations and simulate extreme climatic events such as heatwaves and drought. Plant growth can be monitored with two 3D canopy scanners.

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NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Australian National University

Controlled climate growth capsules

The APPN Node at the Australian National University (ANU) offers four shipping container-based growth capsules, with two walk-in controlled environment rooms in each capsule.

Capability highlights

- Eight walk-in rooms, all suitable for tall crops.
- Simulation of complex climate scenarios.
- Co-located with 3D canopy scanners.
- Elevated CO_2 capability.

These growth capsules provide a rare capability to grow tall plants to maturity (up to 2.1m) under high precision-controlled environment conditions.

Each room offers control over temperature and humidity, plus light quality and intensity, making it possible to simulate diurnal and seasonal changes as well as complex climate scenarios. Two rooms have high light capability and can be set to light intensities of approx. 1200 µmol/m²/s while another two rooms have multispectral lighting allowing for fine adjustments of light quality over six different channels.

Four of the eight rooms are fitted with CO_2 injection to provide elevated CO_2 conditions.

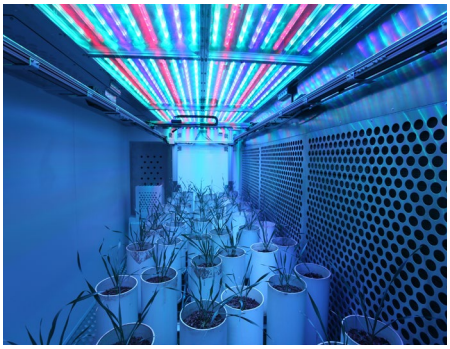
Co-located within the growth capsules are two 3D canopy scanners, which can be used to non-destructively monitor morphological and spectral plant traits during experiments. The growth capsules also offer ample space around the cultivation areas for accessing plants easily and accommodating measurements with other equipment, such as portable gas exchange systems.

Research benefits

As drought and climate change affect Australian crops, the ANU Node's growth capsules offer an ideal controlled environment for studying tall crops in different climate conditions.

The growth capsules can accurately simulate diurnal, seasonal, location-specific, historical and predicted climate conditions. The multispectral LED light lofts are thermally insulated from the plant growth area to enable experimental simulation of climatic scenarios that can be difficult to reproduce, such as low temperature conditions with high light or heat stress. Relative humidity is also controlled tightly with independent humidifiers and dehumidifiers.

Researchers can use the installed 3D canopy scanners to non-destructively monitor morphological responses to their selected conditions – including plant height, 3D leaf area and volume – along with multispectral indices such as Greenness, Normalized difference vegetation index (NDVI), Normalized Pigment Chlorophyll ratio index (NPCI), Plant Senescence Reflectance Index (PSRI) and Green Leaf Index (GLI).



Technical Details

Climate control

- Temperature range from 4 - 40°C
- Relative Humidity range from 40 - 80%
- High light capability up to 1200 µmol/m²/s (2 rooms)
- Multispectral LEDs with three bands (6 rooms) and six bands (2 rooms)
- CO_2 monitoring and injection (4 rooms)

Plant capacity

- 3.8m x 1.1m per room
- Modular, height-adjustable benches

Phenotyping

- 3D multispectral canopy scanners
- RGB monitoring in all rooms

Note: The Growth Capsules are not PC2 or quarantine certified. Please contact us for information on our PC2 and quarantine certified growth environments.

Unique expertise at ANU

The APPN team at the Australian National University (ANU) has acquired years of expertise in programming and monitoring the growth capsules and can advise which capsule is best suited for your needs.

The team can also support users with 3D phenotyping experiments through consultations, scanning support and data provision, and is experienced in scanning a range of different plant species from common crops like wheat and canola to smaller species such as alpine grasses.

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